Quantifiable Performance Information, the road to winning tenders?

A research into the optimisation of the application of QPI by vendors

The bitterness of low quality remains long after the sweetness of low price is forgotten ~ Benjamin Franklin

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Master programme: Construction Management and Engineering
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Preface

This thesis is the final result of my graduation research and the conclusion of my time as a student at Delft University of Technology. During the past nine months I worked hard and with great pleasure on this research.

I could not have performed this research without a lot of persons. First I would like to thank my thesis committee. Marcel, for his enthusiasm, his open mind about my research and for always looking at the bigger picture. Sicco, also for his open mind, his BVP knowledge and for challenging me to be critical. And Cigdem, for her insights on practical research matters. Without the support of Grontmij my graduation research would not have been the same. They gave me the room to develop my own plan and encouraged me to make the most of it. Furthermore, they gave me unlimited access and insight in their internal practises. Therefore, I would like to thank them.

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Jella Jongerius
Delft, May 2014
Summary

In the Dutch construction industry a few years ago a new procurement method was introduced. This new procurement method is called: Best Value Procurement (BVP). The incentive to start using a new way of procuring started to occur when a committee started to investigate the construction fraud in 2002. To be able to make a change from awarding on lowest price to awarding on a good quality versus price ratio BVP was introduced in the Netherlands. However, BVP is not only a way of procuring. It is an extended method, which is also used in the execution of projects. Because of this and the focus on quality this method is changing the industry. Rijkswaterstaat and a lot of other clients are already using BVP and plan to use it extensively in the future. Therefore, vendors need to follow this line and make themselves capable of winning BV tenders.

However, in BV tenders other things are requested. The vendors do not need to deliver an extensive action plan, but only need to deliver three qualitative documents: a risk file, a value added file and a performance substantiation. Within these documents the vendors need to proof their expertise by substantiating the documents with Quantifiable Performance Information (QPI). This information is factual, dominant information that can show the expertise of a vendor on this specific project. Although engineering companies often are aware of their strengths it seems to be difficult for them to translate this to QPI and substantiate in a dominant way that they are the expert for a certain project. A problem becomes visible between the use of QPI at this time by vendors and the standard of QPI that is expected by the clients to be able to successfully participate in tenders. This gap needs to be explored and closed.

Therefore, the main objective of this research is: to develop a model for engineering companies to improve the way they measure and apply QPI in BV tenders.

To be able to achieve this objective a main research question for this research is stated. This question is:

**How can engineering companies improve the application of Quantifiable Performance Information in tenders?**

Theoretical Background

To be able to answer this research question three research phases are needed. The first phase is the Theoretical Background. In this phase three subjects are explored based on a literature study. These subjects all come forward as crucial to be able to gather and apply good QPI.

First, a good information system (IS) is necessary. Such a system allows to balance the amount of information and makes sure that the information is understandable and clear for everyone. Here also comes forward what is needed for information to be dominant. In the IS performance information is gathered and assessed in a proper way.

Secondly, a Performance Measurement System (PMS) is necessary to measure critical performances. The performance measures that are stated in the PMS are needed to measure the performances of an organisation based on their expertise. The outcome of this system is performance information, which is the base for QPI.

The final and third subject that is studied are Key Performance Indicators (KPI’s). These KPI’s are variables that are quantifiable, which make it possible to relate a performance to a pre-set standard. KPI’s are the input for the PMS, because they enable performance measurement.
The IS comprises both the PMS and the set of KPIs, where the KPI’s are the input for the PMS. What, furthermore, comes forward from the literature study is that the environment in which the IS, PMS and QPI operate is formed by an organisations proposition or strategy. All three aspects are directly linked to the proposition of an organisation. This is the case, because to be able to show your expertise in QPI the performance information that is the output of the PMS should be linked to the expertise or proposition of a client. Furthermore, to be able to measure the right performances the KPI’s should directly be linked to the proposition. Also the IS should be linked to the proposition, this gives the data within the IS a certain context, which makes the information easier to understand.

Furthermore, a proposition should be used in a consistent way. Consistency is crucial. All actions and decisions that are taken need to be directed by the proposition, therefore, the three aspects: IS, PMS and KPI’s all fall within the environment of an organisations proposition.

**Practical Comparison**

The next step in this research is the Practical Comparison. In this section the findings from the literature study are verified and new findings are done. The first step in this section is performing an extensive case study analysis. In this analysis 13 BV tenders are analysed on different aspects.

After this two employees of Grontmij are interviewed to be able to get an insight of the current state of performance measurement, KPI’s and propositions within the organisation. This helps to establish where they stand and what is necessary to improve QPI.

The final step in this section is interviewing seven employees of three different clients and one BVP expert. In these interviews the findings from the case study analysis and the literature study are verified by the clients. This is needed because according to the literature and the practice of an engineering company itself a good view is gained on how the application of QPI is improved, but in the end the clients are reviewing and scoring the qualitative documents and the QPI. So, if they have a different view on QPI this should be known. Therefore, these interviews and, thus, this step of verification are necessary to get a good overall insight on QPI.

From this section in general comes forward that a proposition is indeed important for improving the application of QPI. This proposition needs to be stated based on an organisations own strengths and capabilities in combination with the markets demand. To be able to do this a format called: the Business Canvas, should be used. As also comes forward from the literature study this proposition is the base for the PMS, KPI’s and, thus, QPI. Furthermore, it gives direction to making choices in which tenders an organisation should participate.

A good start of a PMS is made by starting to measure performances based on the most common client objectives from the request for tenders. These two types are: planning and budget related objectives. For these two categories KPI’s and performance measures should be stated. The overall distribution of the different kinds of objectives is shown in figure 1.
Furthermore, the clients and expert state that performance measurement is solely a task of the vendors. They need to be creative with measuring their own performances to be able to gather the right performance information and be able to state QPI. Ways of measuring performances are extending the use of the client surveys and the WRR. With a few alterations these two tools are ready to be used as a first step in performance measurement.

QPI is seen by the clients as hard and objective information. This information needs to be verifiable, simple and transparent. Another important aspect of QPI is that it needs to be linked to a specific project. According to the clients performance information also needs to be dominant.

Performance information is seen as dominant by clients if it is:

- Irrefutable (no discussion or interpretation possible)
- Measurable
- Verifiable
- Specific
- Realistic
- Show a high performance
- Translated to a specific tender
- Simple

It also comes forward that QPI consists of three different aspects. These aspects are: ‘stating experience’, and showing ‘the effect’ and ‘the success’ of a certain measure. These three aspects all need to be used to be able to state QPI. A prerequisite of QPI, and all qualitative documents in general, is that it needs to be formulated in a SMaRt way.

The letters A and T are small in this abbreviation, because the clients indicate that measures and QPI do not need to show ambition or time-boundness to be dominant. Therefore, only the aspects of Specific, Measurable and Realistic are taken into account or at least have the main focus of a vendor when stating their QPI and qualitative documents.

When a qualitative document is set up by vendors the following steps need to be taken:
1. State the risk or value added option
2. Make your claim (what will the measure to control the risk or execute the value added option)
3. State your project specific experience (base of QPI)
4. Substantiate this experience with the success and effect on the client objectives (substantiation of QPI)

If these steps are taken into account the set-up of the qualitative documents is good in the view of the clients.

**Design Phase**

In the next and final phase of the research all findings from the previous sections are combined, this phase is called: Design. The main outcome of all findings is a roadmap, which is shown in figure 2. This roadmap helps to answer the main research question and will, thus, help to improve the application of QPI by engineering companies. This roadmap consists of four different steps that need to be taken on a strategic, tactical and operational organisational level. First, a *proposition* needs to be formulated. This proposition is the base of QPI and should be stated based on an engineering company's own strengths in combination with the market demand. It gives direction to in which tenders an engineering company participates and it is leading in stating KPI's.

Setting up a *set of KPI's* is the second step in the roadmap to improve the application of QPI. A set of KPI's should consist of a diverse set of KPI's of both qualitative and quantitative KPI's. Furthermore, these KPI's should be: measurable, relevant (link to proposition) and accountable. A good set of KPI's will enable performance measurement.

The third step in the roadmap is, therefore, *setting up a PMS*. In this PMS performance measures are stated that actually enable the measurement of the KPI's. These performance measures need to measure internal, external, financial and non-financial aspects to give a good and complete insight in the performances of an organisation. This insight on the performances of an organisation challenges the proposition to keep improving. Therefore, a learning loop is visible between the PMS and the proposition. Furthermore, it becomes clear that these aspects all evolve over time.

The final step within the roadmap to improve QPI is *stating QPI*. The input for this QPI is the performance information that comes forward from the PMS. With this information QPI is stated. QPI consists of three different aspects. As a base previous ‘experiences’ are stated, which are substantiated by making the ‘effect’ and ‘success’ of the measures and experience for the specific tender visible. Furthermore, the QPI needs to be stated in a SMaRt way.

If all four steps of the roadmap are completed then QPI is formulated, which can be applied in a tender. A learning loop is visible between the application of QPI in a tender, winning the tender and measuring the performances of the tender that is won in the PMS. Because when QPI is applied in a tender the quality of the offer rises, so more tenders are won. When a tender is won, more performances can be measured, which will lead to the gathering of more performance information and, thus, more application of QPI. Than the learning loop can start again. QPI will, thus, keep on improving in this loop.

When this roadmap is used this will improve the application and gathering of QPI by engineering companies.
The changes that need to be made within the roadmap need to happen on both a strategic, tactical and an operational organisational level. This will take some time. To be able to already make some changes that will, for now, improve the use of QPI for every step in the roadmap quick wins are indicated.

To be able to start improving not only the QPI in tenders, but also improve the qualitative documents in general a checklist is set up that is used during the writing of the qualitative documents to see if the aspects that diminish the scores stated earlier are not incorporated. This checklist leads not directly to an improvement of the application of QPI. But it will improve the quality of the tenders overall, because it can be used to predict if and prevent that mistakes are made. Especially the general and risk file related aspects are predicted and prevented by using the checklist. This, thus, supports the application of QPI in the overall qualitative documents.

Also some quick wins come forward to be able to improve the qualitative documents in general on a shorter term.

**Overall conclusion**

With the roadmap engineering companies are able to improve their application of QPI. The roadmap indicates a good process for improving QPI. It allows engineering companies to gain more insight in what is needed for QPI and also gives insight on how the QPI can be applied. The quick wins that are formulated in the roadmap also helps engineering companies to make improvements on the gathering and application of QPI on a short term. Therefore, there is concluded that the roadmap and the quick wins are the answer to the main research question.
Furthermore, the outcomes that are related to the qualitative documents, the general quick wins and the checklist, maybe do not directly contribute to improving the application of QPI, but it does support, complement and improve the offers, in which the QPI is used, in general. Therefore, this research helps engineering companies not only to improve their application of QPI, but also to improve their tenders in general.

**Scientific relevance**
The contribution of this research to science is the roadmap. There is, nowadays, no literature available that focuses on QPI combined with the way this could be gathered and applied. This research fills this scientific knowledge gap. It gives new insights on which processes are needed within an organisation to be able to gather and apply QPI in an effective way.

**Practical relevance**
The practical relevance of the research is large. The outcomes of the research can be applied by engineering companies or other vendors in the forms of the roadmap, the quick wins in the roadmap, the quick wins in general and the checklist. The roadmap and the quick wins within the roadmap give insights and direction to be able to improve the gathering and application of QPI. The general quick wins and the checklist do not directly contribute to improving the application of QPI. However, these two outcomes do contribute to the improvement of the qualitative documents and offers in general, which supports and complements the application of QPI. Altogether this will, hopefully, result in winning more tenders.
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Section I: Introduction
1 Introduction

1.1 Background Information

The construction industry in the Netherlands is a very traditional and rigid industry. Things are done in a certain way and that is hard to change. However, some changes were, and still are, necessary. (De Ridder, 2011b)

An incentive to change the way of working in the construction industry came forward when in 2002 a committee started a research on the construction fraud in the Netherlands. During the nineties pricing agreements were systematically made within cartels. This led to unfair competition and left little room for innovation or making profit. At that time the attitude and structure of the industry and market shaped the perfect environment for this fraud. (Tweede kamer, 2003)

Changes are being made in several ways. There is, for example, a change visible in the contracts that are being used. There is a growing use of innovative integrated contracts. Changes are also made in the way of thinking, flow thinking is a new trend, which influences chain management. Furthermore, new types of procurement procedures are introduced and their use is increasing at a rapid pace. (Rydell, Verheul, & Santema, 2013).

CROW (2007) states that: "Changing an industry starts by changing the request for tender." This indicates that changing the way of procuring is a good start of changing the construction industry as a whole. However, there must be kept in mind that this is a first step in a long process. A closer look is taken at these new ways of procuring in this introduction. But to be able to do that first the traditional way of procuring is introduced.

1.2 Traditional procuring

The traditional way of procuring is still used nowadays. In this method the client specifies very precisely what he wants. Vendors are chosen on who can deliver the project, according to the specifications, for the lowest price. The main award criterion on which the decision for a vendor is made is, therefore, the lowest price. (Van Duren, & Dorée, 2008)

Due to this focus on price the vendors are forced to make an offer with a very low price, which is often close or similar to cost price. The vendors are, therefore, not able to make a profit and can only meet the minimum requirements of the client. To be able to make a profit they try to find loopholes in the contract or the specifications of the client to make additional works necessary. For these extra efforts extra payments are received. Only with this additional work the vendors are able to make a reasonable profit. (Van Duren, & Dorée, 2008)

This situation is illustrated in a transaction model of the value, price and costs of a project in figure 3. In this figure it is shown that the difference between the value and the price is the benefit for the client in the form of added value. When a vendor delivers more quality the value of the project becomes larger. The difference between the price and the costs is the benefit for the vendor. This benefit comes forward in the form of profit. (CROW, 2007)(De Ridder, 2011a)
This traditional attitude and way of procuring often leads to cost and planning overruns and a lower quality (and thus value) of the delivered works. This is also made visible within the model. The vendors are not challenged to deliver their best work and cannot think in favour of the client’s needs, because their own benefits are also very small. Therefore, they are forced to do exactly what is asked, nothing more, nothing less. Offering something extra to add quality is almost not possible, because this will almost certainly cost extra money and raise the price. In this way no tenders can be won, so delivering extra’s are a disadvantage. (Bossink, & Crucq, 2011) (Van Duren, & Dorée, 2008)

This way of procuring and working does not seem to be a very logical and healthy way of working and doing business. But in 2008 still 80% of the tenders were procured with this method. This indicates that the construction industry is still using a procurement method that does not contribute to a healthy industry, therefore, changes need to be made. (De Ridder, 2011b) (Van Duren, & Dorée, 2008)

### 1.3 Economically Most Advantageous Tender

A big step forward in improving the way of procuring was made in April 2013, when a new procurement law, ‘Aanbestedingswet 2012’, was introduced in the Netherlands. An important change in this law is that all clients are obliged to award on a criterion called Economically Most Advantageous Tender (EMAT). Only when the reasons for tendering solely on a price criterion is clearly motivated an exception is made and there is deviated from using EMAT. (Pianoo, 2013)

In the EMAT method vendors are selected on a combination of price and quality. The quality is measured in criteria, which are set in advance. With this method a client is able to find the economically most advantageous tender. (Van de Rijt, & Santema, 2013)

The scores on the EMAT criteria are translated into monetary values with the method ‘Gunnen op waarde’. In this way, both price and quality have the same unit and therefore they can easily be compared. (Rijkswaterstaat, n.d.a) (Van de Rijt, & Santema, 2013)

When the score on a criteria is sufficient, the monetary values of each criteria are subtracted from the offered price. When the score is insufficient, the monetary value is added to the offered price. The monetary value that remains is called the fictive price. Based on this fictive price a ranking is made. The vendor with the lowest fictive price wins the tender, because he offered the best quality versus price ratio. (Bossink, & Crucq, 2011).
Because of this ranking offering a higher quality, and thus more value, is rewarded with a lower fictive price, which improves the ranking of a vendor. Therefore, the criteria is used to stimulate the offering of extra quality. The vendor is more likely inclined to anticipate to the clients desires. (Bossink, & Crucq, 2011)

For EMAT tenders also a value, price and cost model exists. This model is shown in figure 4. In this figure there is shown that in EMAT tenders the value that is delivered is higher, because the delivered quality is higher. The total value that is added is also larger. The price is higher than in a traditional tender, because the price is more realistic. And because the vendors are not solely evaluated on the offered price. It is also shown that in this tender procedure it is more common that profit is made, because of the realistic price no additional work is necessary to make a profit. This makes the benefit for both the client and the vendor larger. (CROW, 2007)(De Ridder, 2011a)

![Figure 4: Value, price, costs model in an EMAT tender (Based on (De Ridder, 2011a) and (CROW, 2007, intermezzo p. 12))](image)

There are different variants of EMAT tenders that are used in the Netherlands. One of these variants is Best Value Procurement, this variant is introduced in the next paragraph.

### 1.4 Best Value Procurement/Best Value Sales

One of the latest developments within EMAT in the Netherlands is the usage of a new American procurement strategy: Best Value Procurement (BVP). (Rydell et al., 2013)

In 1993 Dean Kashiwagi, a professor at Arizona State University, created a procurement process named Best Value Performance Information Procurement System (BV PIPS). In this research this process is referred to as Best Value Procurement. The underlying theory of BVP is the Information Measurement Theory (IMT) that was also developed by Dean Kashiwagi. (PBSRG, n.d.) (Van de Rijt, & Santema, 2013)

The Best Value (BV) method has already been tested for 1583 times for a total amount of $3.8 Billion in the construction industry. The projects have a success rate of 98%. BVP lifts the original EMAT procedure to another level, which makes the focus on quality even greater. This seems to pay off in this very high success rate. (PBSRG, n.d.) (Van de Rijt & Santema, 2013)

BVP is not only a way of procuring although the name seems to suggests this, it is an extended method, a philosophy, which is also used in the design and execution of projects. This makes BVP a very extensive method that covers not only the procurement phase, but the execution phase as well.
BVP is not based on finding the vendor who offers the lowest price, but on finding the vendor who offers the most value for the lowest price. In this way the client tries to find an expert to execute his project. (Van de Rijt, & Santema, 2013)

In BVP quality and, therefore, value are a large part of the tender. This is reflected in the weights that are used in reviewing BV tenders. Generally, in BVP, quality has a weight of 75%, while the price has a weight of only 25%. The method is, thus, value based. (Van de Rijt, & Santema, 2013)

To be able to successfully use BVP a different mindset from both the client and the vendor is required. In traditional procurements, for example, the client is used to manage, control and specify everything the vendor does. In this way a non-expert is telling the expert what to do. This is no logical way of working. (Rydell et al., 2013)

In BVP this is turned around. The client specifies only a global question based on some carefully stated objectives and a maximum price limit, which is called the upper limit price. These client objectives are the key element and the base of the request for tenders, because it is the only way a client can give direction to the offers of the vendors. This leaves room for the vendors to be innovative and decide themselves what the best way to address the project is, within the given budget and taking the objectives into account. In this way the vendors can show what they are capable of and are stimulated to perform on the top of their game. Furthermore, it is crucial that the offers of the vendors contribute to these client objectives. (Rydell et al., 2013)

For the vendors it is important that they know what they are capable of and are aware of their expertise. It is also important for them to be able to show the client their expertise, because by showing their expertise in a dominant way the vendors can proof their expertise. Showing this expertise happens mainly with Quantifiable Performance Information (QPI). This is factual data about performances which makes clear if parties are capable of executing a certain project. With this information it is made dominantly clear who the best vendor is. If no vendor can distinguish them self on quality by the use of QPI, then the vendor that offers the lowest price is chosen. (Rydell et al., 2013)(Van de Rijt, & Santema, 2013)

Another difference with more traditional tenders is that after awarding the project to a vendor it is important that the client keeps its distance in order to create space and freedom for the expert to turn his offer into reality. The vendor is the expert, so no control by the client should be necessary. (Van de Rijt, & Santema, 2013)

There are two important parties that are involved in this method, the client and the vendor. The method is two sided. On the side of the client this method is called BVP, because they try to purchase something and try to find vendors for their project. The other side of this method is viewed from the vendors perspective. This method is called Best Value Sales (BVS), because the vendor tries to sell their product to the client. (Rydell et al., 2013)(Van de Rijt, & Santema, 2013)

Both sides of the method have different phases which, ideally, need to be executed to successfully finish a project. These phases run parallel to each other and are shown in figure 5.
BVP starts with a preparation phase. During this phase the client prepares the request for tender, formulates his objectives carefully and brings his question to the market. After the offers of the vendors are submitted the selection phase can start. During this phase the tenders are reviewed, a ranking is made and a winner is chosen. The scoring of the offers happens on a scale of dominance. Only dominantly good, dominantly bad or neutral scores are achieved. There are no scores in between these scores, which ensures a clear review with large differences instead of small irrelevant differences. In the pre-award phase that follows the chosen vendor gets time to plan the entire project in detail. When the product of this phase is acceptable for the client the award becomes final and the real work can start in the execution phase. (Van de Rijt, & Santema, 2013)

In BVS the vendor's first task is to have a good vision on their qualities and focus within their work field. This is stated in a proposition. When this proposition is clear a vendor can open up to the market and participate in tenders that are in line with this proposition. During the tender/proposal phase all tender documents are delivered and the vendor is interviewed. After this phase the choice for one vendor is made by the client. Only one party goes on through the next and final phase, the realisation phase. In this phase the project is finally prepared and executed. (Rydell et al., 2013)

Since 2008 BVP is used in the Netherlands by Rijkswaterstaat. Rijkswaterstaat procured half of the 'Spoedanpak Wegen' with BVP. Nowadays the procedure is expanding quickly. Rijkswaterstaat has already finished about 20 projects with this method and is planning to procure many more projects with this method in the coming years. Also other public clients, such as: Provinces, Municipalities and Water Boards, are working with BVP. There is, therefore, a big sense of urgency for vendors and clients in the Netherlands to get familiar with this new approach. (Rijkswaterstaat, n.d.b)

1.5 Problem analysis

As mentioned in the previous paragraph BVP requires a completely different attitude from the vendors and the client. At the beginning of the tender process the vendors do not need to deliver an extensive action plan as is usual in traditional tenders, but instead they have to deliver three written documents, the qualitative documents: a performance substantiation, a risk file and a value added file. (Van de Rijt, & Santema, 2013)

Furthermore, the vendors are interviewed by the client. During these interviews, and in the documents as well, the vendors can show their expertise by substantiating the documents and answers with QPI. Furthermore, all documents need to be formulated in a SMART way. This stands for Specific, Measurable, Ambitious, Realistic and Time-bound. (Van de Rijt, & Santema, 2013)

However, engineering companies seem to have difficulties with proving their expertise by substantiating every document with QPI. In practice these companies work from project to project, without a proper evaluation of finished projects. This is caused by the attitude of most organisations that there can only be worked on a project when the budget for that project is still open. When a project is delivered this budget is often closed immediately, therefore, there is no budget for a proper project evaluation. This indicates that there is almost no attention for the evaluation of the quality of the product that was delivered, so there is no room for performance measurement.
Because of this, no information is gathered that is used as a substantiation in the form of QPI in following tenders. Therefore, in new tender procedures no expertise is proven with factual data on the performance of earlier projects and vendors cannot dominantly proof their expertise. This is a missed opportunity, because a lot of data that could form QPI is lost. This is a problem. Therefore, engineering firms need to pay more attention to this crucial part of BVP and need to improve application of QPI. This can make the difference between winning or losing a tender. (Rydell et al., 2013)

Another part of the problem is that engineering companies have an idea of what their expertise is and in what part of their work field they excel. But they cannot properly express their expertise in QPI and therefore, once again, they cannot dominantly proof their expertise to win tenders. So they need to learn how to translate their strengths and expertise into QPI to be able to make dominantly clear to the client what they are capable of. (Rydell et al., 2013)

Therefore, QPI is crucial in BV tenders. It seems to be a catalyst when it comes to winning tenders. When a tender is won, the performances of this project are measured. This results in QPI, which can then be used in the documents that are delivered in a new tender. So, when more tenders are won, more QPI is gathered and more tenders are won. The circle is then complete. Therefore, it is very important that vendors understand how they can gather and apply QPI.

1.6 Problem formulation

Engineering companies are often aware of their strengths and skills. However, they are not able to express their expertise in QPI and do not evaluate projects properly. What QPI exactly is, how it can be measured and how it can be used in new tenders in an effective way is not clear for engineering companies.

In BV tenders QPI plays a crucial role, because with this information the different vendors can show their expertise. Rijkswaterstaat and other public clients have the intention to increase the use of BVP, therefore, engineering companies are forced to embrace this way of procuring and adapt their way of approaching tenders.

The problem becomes visible as a gap between the application of QPI at this time and the standard of QPI that is needed to be able to participate successfully in BV tenders according to the clients. This gap needs to be closed to be able to win tenders.

1.7 Research objective

The main objective of the research is: to develop a roadmap for engineering companies to improve the way they gather and apply QPI in BV tenders.

To be able to reach the main objective first a sub objective needs to be achieved. This objective is: to gain insight in what QPI is and how it is gathered.

1.8 Research questions

To be able to reach the research objective in an effective and structured way a main research question is formulated. When this question is answered the research objective is obtained. To be able to answer this main research question, several sub questions are formulated. These sub questions contribute to the answering of the main question and a few also provide the
information to achieve the sub objective that is stated in the previous paragraph. In this way the research is divided into different parts. This makes the research more manageable and easier to oversee.

There are three sub questions that each belong to a different phase of the research. In that phase this specific sub question is answered. In the next chapter the phases of this research are explained.

The main research question is:

*How can engineering companies improve the application of Quantifiable Performance Information in tenders?*

The sub questions are:

1. **Theoretical Background**
   - What is needed for QPI to make it suitable for tenders according to the existing literature?
     - Information Systems
     - Performance measurement
     - Key Performance Indicators

   The outcome of this phase is a conceptual model. This represents the ideal situation that is extracted from the literature on what is needed for engineering companies to gather QPI.

2. **Practical Comparison**
   - How is the current application of QPI compared to the use of QPI as stated in the conceptual model and what new insights can be discovered in practice?

3. **Design phase**
   - How can the results of the theoretical background and practical comparison help engineering companies to improve their application of QPI in tenders?
2 Research Methodology

In this chapter the methodology that is used in this researched is explored. But first two aspects need to be made clear.

The viewpoint from which this research is performed is the point of view of the client. This might seem strange, because the research is performed for a vendor and the research question is formulated for engineering companies. But the client is the party that reviews the tenders and, therefore, it is most valuable for vendors to know what the clients view is on QPI and how that influences the evaluation of tenders.

Furthermore, the scientific field in which this research takes place is process management. The research takes a closer look at the processes of gathering and applying QPI in tenders to be able to improve the application of QPI.

2.1 Methodology

The research methodology is made visible in figure 6 in the next paragraph. The research is executed in three different phases.

Phase 1) Theoretical Background
The first phase of the research is called the 'Theoretical Background'. In the pyramid shaped research framework it is shown that this phase forms the base for the rest of the research. The first phase is an overall exploration of the subject of the research. Several subjects such as: BVP, Information Systems, Performance Measurement and Key Performance Indicators are explored by performing a literature study. From this first phase a conceptual model of all literature combined comes forward. This is a framework of how the literature describes the content of these different subjects. The model is focused on bringing all the literature subjects together on how, in an ideal situation, QPI is gathered and improved according to the literature.

Phase 2) Practical Comparison
When this conceptual model is known, this literature based model is used to analyse practical cases and it is verified by several clients and a vendor. To be able to do this a case study analysis is performed for 13 BV tenders that Grontmij participated in. This analysis gives an insight in several aspects of BV tenders and the use of QPI in specific. Seven employees of three different clients of these case studies are also interviewed to be able to determine what their view is on QPI and the other findings of the case study analysis and the conceptual model from the previous phase. In this way the findings are verified by the clients. Verification also happens by interviewing a BVP expert. Another part of this phase is looking at the way an engineering company (Grontmij) already uses performance measurement in projects and in what way projects are evaluated at this time. A look is also taken at the proposition of Grontmij. By getting insight in these subjects it becomes clear what the current state of the use of QPI, performance measurement and the way of tendering is in practice. These insights are gained by keeping interviews with two employees of Grontmij.

This phase will give an overall insight on what is important for QPI and BV tenders in general in the view of a vendor, which is verified by the clients and an expert.
Phase 3)  Design Phase

In the design phase all results and insights from the two previous phases are combined and a roadmap is made that will help to obtain the main objective and answer the main research question. The roadmap will be able to help engineering companies to improve their application of QPI.

All additional findings that do not directly contribute to improving QPI, but do support the improvement of BV tenders in general will also be brought together in a model, a checklist, to be able to improve tenders overall. To be able to see if this checklist will contribute to eliminating common mistakes from the qualitative documents a validation is performed.

After the design phase is completed conclusions and recommendations of the overall research are made. Here the research question is answered and recommendations are made for further research.

2.2 Research Framework

![Figure 6: Research framework (based on (Verschuren, & Doorewaard, 2010))](image-url)
Section II: Theoretical Background
3 Introduction

In this section the literary background of this research is presented. This section exist of three chapters that all work together to answer the sub question that is linked to this phase of the research. This question is:

- What is needed for QPI to make it suitable for tenders according to the existing literature?

To be able to answer this question a literature study is performed. Three subjects are explored. These subjects are: Information Theory, Performance Measurement and Key Performance Indicators. When these three subjects are combined the relationship of these subjects and what is needed for gathering QPI becomes visible. The result of this section is a model that shows these relations to each other and how a combination of these subjects will result in QPI.

First the three subjects are explored separately in three different chapters, which all end with a conceptual sub model of that specific subject. In the final conclusion all three subjects and sub models are merged into one conceptual model that reflects the relationship of the subjects with QPI. This model in combination with the sub models is a base for improving the gathering and application of QPI in engineering companies.

4 Information Systems

In 1991 the Information Measurement Theory (IMT) was formulated at the Arizona State University. This theory is the base for BVP and is a structure that optimises information systems. The theory considers different concepts, for example, it uses the laws of physics and deductive logic (common sense) to give an explanation of the structure of an event. It can show the relationship between factors when statistical analysis techniques cannot be used, because of insufficient data. (Kashiwagi, 2002)

In this theory information is seen as: "the combination of laws and data which represents the existing conditions that are used to accurately predict a future outcome. Information is not what an individual may perceive, but an explanation of what actually exists." (Kashiwagi, 2002)

To be able to win BV tenders and most likely also other EMAT tenders it is important for engineering companies to have an optimised Information System (IS). QPI is the ultimate output of an optimised IS. Therefore, in this chapter IS’s are explored based on IMT.

4.1 Construction Industry Structure

According to the IMT the construction industry is defined by two major components (Kashiwagi et al., 2002):

- Performance
- Competition

With these two components a representation of the construction industry is made. This representation is shown in figure 7 and is called the Construction Industry Structure analysis (CIS). The logic of this analysis identifies that the traditional management of the construction industry is mostly reactive, inefficient and ineffective. To be able to increase the efficiency and the quality the entire system must change. This can only happen when dominant performance
information is available. In the CIS performance can, therefore, be replaced by the level of use of performance information. (Kashiwagi et al., 2009)

In CIS the two major components, performance (information) and competition, form the axes of the figure. This results in a figure with four quadrants.

**High**

- **Quadrant III: “Negotiated Bid”**
- **Quadrant II: “Best Value”**

**Low**

- **Quadrant IV: “Unstable”**
- **Quadrant I: “Low Price”**

*Figure 7: Construction Industry Structure (CIS) (Kashiwagi et al., 2002)*

Quadrant I is the lower right quadrant. In quadrant I the competition is high and the performance of the industry is lower than what it could be. Vendors are not forced to deliver their best possible performance. Furthermore, the use of performance information is low. (Kashiwagi et al., 2002) This quadrant represents the situation in the traditional way of procuring, where the dominant factor in procuring is the lowest price. In this environment the client expects the highest performance, while the vendor offers the lowest possible performance. This is caused by price pressure and price based awarding. (Van Duren, & Dorée, 2008)

Because of this contradicting expectations and behaviour there is tension in the relationship between the vendor and the client. In this price based awarding situation vendors are hesitant to offer a high performance, because according to the literature most of the time this will drive the price up. Vendors cannot afford to raise the price, because of the high competition on offering the lowest price, therefore no higher performance is offered. (Kashiwagi et al., 2002)(Kashiwagi et al., 2009)(Van Duren, & Dorée, 2008)

However, a remark should be made here. From the practical experience of BVP in the Netherlands it has come forward that offering a high quality and a low price often accompany each other. On this specific subject the theory does not comply with the practical experience. (De Wilde, 2013)

Quadrant II is the quadrant that represents the situation when BVP is used and which is, according to IMT, the desirable quadrant to be in. Here, there is not only a high level of competition, but also a high level of performance and, therefore, a high level of the use of
performance information. In a study by Kashiwagi and Massner (2002) it is stated that the industry can move to this quadrant when during the award process value is also taken into account. In this quadrant the price pressure decreases in comparison to quadrant I, because of the focus on both value and price. The price in this quadrant is then the competitive price. Furthermore, the use of performance information is of great importance and is needed on a high level, because with this information the value of a tender is made clear and a vendor can show his expertise. (Kashiwagi & Massner, 2002)

In quadrant III at the upper left side of the CIS there is a low level of competition, whilst the level of performance, and use of performance information, is high. In this quadrant the level of competition is so low that sometimes only one vendor offers to execute the project. There is no real competition, so vendors are not forced to offer the best performance they can offer. In this quadrant there is also price pressure, because of the lack of competition the focus will remain on the price that the vendor offers instead of the value. This quadrant is called the ‘Negotiated Bid’. For a healthy industry with a good market this is not a good quadrant to be in, because of the lack of competition. (Kashiwagi & Massner, 2002)

The lower left quadrant, Quadrant IV, is the quadrant where both competition and the use of performance information are low. This seems to be a combination that causes the industry to be instable, because vendors cannot maintain themselves and are not able to remain in business for a very long time. Therefore, an industry needs performance, competition or both to be able to maintain itself. This quadrant is therefore not taken into account. (Kashiwagi & Massner, 2002)

Nowadays, a movement from Quadrant I and III is visible towards Quadrant II. Clients that are in an industry which is in quadrant I are forced to find vendors that focus on performance, because of the increased request to move the focus from price to value. Therefore, Quadrant I moves towards quadrant II. The other movement from quadrant III to quadrant II is caused by the price pressure that results from the low level of competition. Clients are forced to move towards a more competitive quadrant, because of the price pressure. This movement is based on the assumption that a higher level of competition will lower the price and at the same time the level of performance will be maintained or improved. (CROW, 2007)(De Ridder, 2011a) (Kashiwagi et al., 2002)

Furthermore, an important remark is that the use of performance information is crucial for the movement towards Quadrant II. Without such information the real performance of a vendor cannot be made dominantly clear and, therefore, the vendor that offers the highest performance cannot be found. This indicates that it is important for engineering companies to have an insight in their performance by means of performance information to be able to win BV tenders. (Kashiwagi et al., 2002)

4.2 Rate of Change

That performance information is necessary in a value based industry also comes forward from another part of IMT. This part is shown in a figure that is called the Rate of Change (RoC), see figure 8. In this figure the relationship of the perception of information over time by an individual is made visible. (Kashiwagi & Massner, 2002)

In the graph two different points are indicated with a letter, these points both represent a certain type of person, either type A or type C. On the one side the level of information that a
type A person perceives, uses and passes is high. On the other side of the graph it is indicated that a type C person perceives, uses and passes a low level of information. (Kashiwagi, 2002)

This graph is related to the change process of persons. When a person receives new information, this causes change. This change causes the person to be able to perceive more information. This means that over time persons get better in perceiving information. This is shown in the lines on which the points of a type A and C person lie in the RoC graph. This means that a person or an organisation can get better at processing and perceiving information over time. This is convenient for performance information, because this will get interpreted in a better way when time goes by. (Kashiwagi, 2002)

![Rate of Change graph + KSM](Kashiwagi et al., 2002)

The right side of the graph is called the Kashiwagi Solutions Model (KSM), here there is shown that also other components are influenced by the information level. For example, when there is a high level of information no decisions have to be made. This is the case, because when there is full information, the information can make the performance dominantly clear. When something is dominantly clear no decisions have to be made, because the decision has been made by itself. (Kashiwagi, 2002)

A type C person which has a low level of information represents the price based award process, and, therefore, Quadrant I in the CIS. The low level of information forces the use of minimum standards, control by rules and inspection. Because of the low information these measures are necessary for a client to make sure the minimum standards are met and to ensure the outcome of the decisions is favourable and according to the specifications and wishes of the client. (Kashiwagi, 2002)

On the other side of the figure, the type A person represents the value based award process and, therefore, Quadrant II in the CIS. From the KSM comes forward that when there is a high level of information no rules and standards need to be set and no decisions have to be made. Also no inspections have to take place and still the performances are maximised. Having full information
is, therefore, needed to be able to move to a value based environment. Engineering companies need to have full information on their performances in the form of QPI to be able to win value based tenders. (Kashiwagi, 2002)

4.3 Quantifiable Performance Information

The previous paragraph revealed that having full information and, thus, (quantifiable) performance information is crucial for a value based environment and award process. Therefore, in this paragraph information and QPI are explored.

Information is a driving power for organisations, because information helps to think logical and take logical actions. It is, therefore, important for organisations to have a solid information system to be able to keep improving and keep moving forward. (Sullivan et al., 2006)

In the last decades the gathering and sharing of information has increased tremendously, because of the enhanced use of computers and the internet information has never been so accessible as today. On the one hand this is convenient for the IS's in organisations, but on the other hand there is a large risk of overabundance of information. When there is too much information available it gets harder to focus on the relevant information. (Sullivan et al., 2006)

According to Sullivan et al. (2006) the performance in the construction industry is low, because the overabundance of information reduces the accountability of engineering companies. Therefore, the level of information has to be chosen carefully at a balancing point where the information still allows for complete understanding and accountability. A proper IS is required.

However, finding the balance in an IS seems to be contradicting to the KSM. In the KSM it was stated that full information is necessary for easy decision making and improving performances, the more information the better. Because of the insight that too much information can also make an IS less effective the perspective in which full information is seen becomes different. In this new perspective full information does not mean that an organisation needs all possible information, but they need all relevant and necessary information to be able to understand and oversee the big picture. (Kashiwagi, 2002) (Sullivan et al., 2006)

If an organisation wants to ensure an efficient IS the following steps need to be taken:

1. Eliminate data and capture information
2. Identify the important information
3. Simplify the information
4. Translate the information into measurements
5. Minimise communication

According to the first step data is something different than information. Information is able to clarify things and is unambiguous, it reduces uncertainty and makes things understandable. If it does not contribute to these goals it is data and not information. Information is data that is organised and set into a context. Data has no context and are mere facts. Data, therefore, leads to reduced accountability and has to be eliminated from the IS. An important remark that has to be made is that what is information for one person is maybe data for another. Information has to make sense to a person, when it does not, it is no information, but data. (Sullivan et al., 2006)

Furthermore, it is important that information is understandable for everyone, for an entire organisation. Therefore, information needs to be simplified, here also a balance needs to be found. Too simple information has no proper context and is, therefore, not useful (it is data). Too
complex information distracts from and conceals what is actually important. Therefore, making information simple and consistent is difficult. Only critical information may remain. To be able to make information simple and consistent the information needs to be linked to the organisations proposition or strategy. This is an important aspect of information that needs to be kept in mind in the IS. (Sullivan et al., 2006)

A special kind of information, that is the key of this research, is performance information or more specifically QPI. QPI is information about the performance of an organisation. With this information an organisation is able to get a better insight in his performances and it can act on this. QPI is performance information that is quantifiable and is displayed as digits. They are measurable facts in a context. (Van de Rijt, & Santema, 2013)

QPI is dominant information, this means that the QPI should make it dominantly clear if (in the scope of this research) a vendor is capable of executing a certain project. Therefore, as already shown in the KSM no real decision has to be made. However, the concept of dominant information not very clear. It seems to be very hard to show performances in a real dominant way. (Van de Rijt, & Santema, 2013)

Van de Rijt and Santema (2013) identified six characteristics that QPI should have to make the performance information dominant. According to them dominant performance information should be:

- Irrefutable
- Verifiable
- Accurate
- Quantifiable
- Show a high performance
- Translated to the current project

Another perspective on QPI is that it should be formulated in a SMART way. This also brings along characteristics for performance information to be dominant, some characteristics occur in both perspectives. The SMART characteristics for performance information are:

- Specific
- Measurable
- Ambitious
- Realistic
- Time bound

When QPI is formulated these two groups of characteristics of dominant information have to be taken into account. In this way QPI is displayed in an effective way that is useable in BV and other EMAT tenders. (Van de Rijt, & Santema, 2013)

### 4.4 Conclusion

In this paragraph a conclusion is drawn from the information in this chapter. In figure 9 an overview of the information in this chapter is shown.

The IMT is a structure that optimises IS’s. The output of an optimised IS is QPI. This information and, therefore, this optimised system is necessary to be able to win tenders.

According to IMT the construction industry is based on two components: competition and performance. To be able to move to a value based industry there must be both competition and a
high performance. Also a high level of performance information is required. According to KSM there must be full information in a value based industry.
However, it is important to remark that the amount of information has to be balanced. Otherwise, it loses its effectiveness. Furthermore, five steps need to be taken to be able to set up an optimised IS:

1. Eliminate data and capture information
2. Identify the important information
3. Simplify the information
4. Translate the information into measurements
5. Minimise communication

Step one indicates that data is not the same as information. Information is data that is set within a context.

An important point of performance information and, thus, the entire IS is that it needs to be linked to the organisations proposition.

To be able to use QPI in a tender it is necessary that performance information is represented in a dominant way. There are a few characteristics that dominant performance information needs to have to be dominant, these are:

- Irrefutable
- Verifiable
- Accurate
- Show a high performance
- Translated to the current project
- Specific
- Measurable/Quantifiable
- Ambitious
- Realistic
- Time bound

The results from this chapter are combined in a sub model. This model is shown and explained in the next paragraph.

4.5 Explanation of model

In figure 9 the sub model of the IS that is explored in this chapter is shown. In this paragraph this model is explained.

From the literature it comes forward that the IS is based on the IMT/KSM theory of Dean Kashiwagi. Therefore, these theories are the input for the IS. According to these two theories it is essential for an IS to have a high level of competition within the market and a high level of performance. This is indicated with the two squares that are output of the IMT/KSM block. This high level of performance can also be seen as a high level of performance information. This is shown in the model as the use of performance information.

From the literature it comes forward that when using performance information the level of performance information should be balanced. Too much performance information will lead to chaos, which makes it hard to differentiate the important information from the unimportant information. However, also too little performance information is not favourable, because than the effectiveness of the information is lost.
Furthermore, information is data that is put in a context, this is also applicable for performance information. If the facts of past performances are not put in a context the data is not interpretable. In the model it is also shown that for performance information it is important that it consists of dominant information and that there is full information.

For information to be dominant the information has to comply with a few characteristics, these are shown in the model at the bottom.

What overall is very important for an IS is that it is situated within an environment of an organisation's proposition. Therefore, the model is placed within this environment. This proposition gives guidance to the IS and if treated consistently it makes the IS more effective and clear.

**Figure 9: Sub model of Information System**

Now that it is clear what is important for an optimised IS and how balancing of full information and displaying it in a dominant way is possible a closer look needs to be taken at how performance information is obtained. This is explored in the next chapter.
Performance Measurement

As mentioned in the previous chapter it is necessary for vendors and, thus, engineering companies to make their expertise and capabilities explicitly and unambiguously clear in tenders. Therefore, performance information has to be obtained. This information has to meet the standards of information that are stated in the previous chapter. To be able to obtain this performance information organisations have to measure their performances in a controlled and explicit way. This is done by using performance measurement, which is explored in this chapter.

5.1 Performance measurement in general

Performance measurement is defined by Bourne, Neely, Mills and Platts (2003) as: "the process of quantifying the efficiency and effectiveness of an action." This indicates that performance measurement is a process in which the actions that an organisation undertakes determine the performance of this organisation in ways of the efficiency and effectiveness.

Performance measurement can take place by the use of performance measures. Bourne et al. (2003) define performance measures as: "a metric used to quantify the efficiency and/or effectiveness of an action." So, performance measures are used to quantify the efficiency and effectiveness of the actions that are undertaken by an organisation.

These two definitions come together in the definition of a Performance Measurement System (PMS), according to Bourne et al. (2003) a PMS is defined as: “the set of metrics used to quantify both the efficiency and the effectiveness of actions.” From this definition comes forward that a PMS consists of a set of performance measures, which try to quantify all actions of an organisation. The performance of an organisation is, therefore, a function of the efficiency and effectiveness of the actions it undertakes. To be able to gather QPI engineering companies have to implement a PMS. (Bourne et al., 2003)(Neely et al., 1995)

Performance measurement is a continuous process of monitoring/measuring, reporting and evaluating. It is used to measure past performances, but it can also be used to show progress in achieving certain objectives. (Aedes, 2013)

Ultimately the goal of performance measurement is that informed decisions are made based on the performance information that emerges from the measurements. When the QPI is dominant the decision making should be easy, because, as shown in the KSM in the previous chapter, when there is dominant and full information available no decisions have to be made. The decisions are so obvious they are made by them self. These decisions are, for example, a decision of a client for a certain vendor that is capable to execute a certain project, but it can also help to make internal decisions at the management level of an organisation to change certain processes or the way of working. (Aedes, 2013)

Performance measurement on itself is not a goal. It affects an organisation as a whole. It is, for example, helping to make the performance of an organisation transparent. More transparency helps to identify the strengths and weaknesses of an organisation. Therefore, the organisation can easily make decisions on what is going well, what can be improved and what needs to be changed. Because of this transparent view into the strengths and weaknesses it also becomes easier to choose their core business, which is based on an organisation strengths. Therefore, it also improves the focus of an organisation on achieving their objectives, which makes it easier to
evaluate and adjust the performance of an organisation. Because of the clear view adjustments are made with more conviction and precision. (Aedes, 2013)

Another effect of performance measurement is that it helps to compare performances not only internally between different segments of a company, but it also enables to compare an organisations performances with an external competitor.

Performance measurement also makes people more aware of their accountability. This motivates people and organisations to perform well, because when an organisations strength and performance is measured they want to get the best result possible. People are, therefore, motivated and more eager to strive for a better performance.

Furthermore, performance measurement also enhances communication. This is linked to the more open environment in the organisation which enables more specified and clear communication. (Aedes, 2013)

For performance measurements to be effective it is necessary to be performed against a reference framework. Against such a framework the measurements of actions are judged. This puts the performance measurements in a realistic perspective, which is important to be able to make well informed decisions based on QPI. (Bourne et al., 2003)

5.1.1. Link to organisation

The most important characteristic that performance measurement needs to take into account, and needs to incorporate, is that it should always be linked to and derived from a company’s proposition, therefore, it has to be completely integrated in an organisation. The management of the organisation must give their full support to it. This is important, because the measuring of the performances impacts the environment of the organisation, which must be accepted by the entire organisation

The key factor of a proposition is consistency. A proposition can only exist when there is a consistency in decisions and actions. (Bourne et al., 2000)(Bourne et al., 2003)(Neely et al., 1995)

However, it must also be taken into account that propositions evolve by the decisions that are made, this makes them complex. Therefore, it is important that the PMS is continuously aligned with the underlying proposition. This enables the system to improve the strategic management by challenging the proposition and to act in a consistent way. (Bourne et al., 2000)(Bourne et al., 2003)

Furthermore, the importance of strategic variables should be reinforced by the measurements. Measuring only the subjects that are critical for an organisation to achieve their proposition is important for an organisation to be able to have success and achieve their long term prospects. (Neely et al., 1995)

5.1.2 Pitfalls and difficulties

Measuring performances also brings some pitfalls and difficulties along. These have to be taken into consideration when a PMS is introduced in an organisation. In this way the organisation can cope with performance information in a better way, because it puts it in a wider context.

A pitfall is that only short term objectives are taken into account. This is, for example, the case when only financial and internal information is gathered. This is not desirable, because then no
real course is taken to improve performance on a long term base. This happens in traditional measures. (Aedes, 2013)

When using performance measurement it is important that managers make decisions based on the performance information that is delivered by the PMS. However, a pitfall is that managers keep making decisions based on their intuition instead of making a decision based on performance information. This eliminates all benefits of measuring performances at once and is, therefore, undesirable. (Aedes, 2013)

Another performance information related pitfall occurs when performance information is simplified too much. When this occurs performance information can lose its context and decisions are made based on wrong assumptions. Furthermore, when interpreting performance information that came forward from performance measurements one has to be careful, because persons and organisations always try to manipulate the outcomes in such a way that there performance looks better. This is called: gaming the numbers. Therefore, everyone who interprets performance information has to be aware of the fact that it only represents a model of reality. (Aedes, 2013)

One of the difficulties of performance measurement is finding the right balance in the amount of information that is collected. This also came forward in the previous chapter. The effectiveness of performance measurement is often greatly reduced when managers receive a data overload. This stands in the way of good decision making, because the vision of the decision making gets blurred. It is also possible that too little information is gathered. Then decision making cannot be effective as well. There is a possibility that essential information is missing and, therefore, the big picture is missing. Finding a good balance in the level of information that is gathered is crucial for effective performance measurement. (Aedes, 2013)(Neely, 1999)

### 5.2 Performance measures

In the previous paragraph the definition of performance measures is stated. In this paragraph performance measures are further explored.

Traditional performance measures only focus on financial and internal measures. These traditional measures have a few characteristics that make these measures not suitable for the market situation nowadays. For example, these measures encourage a short term perspective, are one dimensional and do not completely focus on an organisation's proposition. These characteristics cause problems on the long term and do not stimulate constant improvement. What is also a problem here is that these internally focused performance measures do not measure information that is relevant for clients. Therefore, measuring performances with only traditional measures does not contribute to gathering QPI. (Bourne et al., 2003)(Neely, 1999)

Furthermore, Bourne et al. (2003) state that more innovative sets of performance measures that are used nowadays consist of a multi-dimensional set of performance measures. This indicates that the set of performance measures do not only take financial and internal measures into account, but also include non-financial and external measures. Because of this external focus these measures are more useful for obtaining QPI. With these measures also the strategic focus is improved, because of this multi-dimensional perspective. These measures are called: current measures.

To be able to measure performances in a clear and unambiguous way performances need to be measured in numbers with an accompanying unit. In this way factual information about
performances comes forward, which is the base for QPI. To be able to set up performance measures that measure performances in numbers the measures need to be based on performance indicators. These indicators need to be linked to the organisations proposition, just like the measures and the IS. These indicators are called: Key Performance Indicators (KPI's). KPI's are explored in the next chapter, because they are crucial input for the performance measures. (Aedes, 2013)

According to Van de Rijt and Santema (2013) past performance is no longer a criterion on which vendors are reviewed in BVP. However, in my opinion performance measures, and eventually QPI, do focus, at least for a part, on measuring past performances and showing past performance results. Therefore, past performance is still part of the evaluation of BV tenders.

5.3 Performance measurement systems

As mentioned before a PMS consists of a set of performance measures. A PMS has to be able to give a complete picture of the performances of the entire organisation. These performances need to be linked to the proposition of the organisation. (Bourne et al., 2003)

Neely, Gregory and Platts (1995) state that a PMS consists of three different levels on which it is examined. These levels are:

1. The individual performance measures
2. The set of performance measures, which form the PMS
3. The relationship of the PMS with the environment

A representation of these three levels is shown in figure 10. PMS's contain different individual performance measures, which together form the system. All these individual measures need to be set into a strategic context to be able to reach the objectives and support the proposition of the organisation. The measurement of the individual measures stimulates action. Only by consistency of the organisations actions the organisations proposition is realised. (Neely et al., 1995)

Figure 10: Visualisation of Performance Measures in a PMS (Based on (Neely et al., 1995))
During the implementation of the PMS the interaction with the environment has to be taken into account, this environment can also be seen as the proposition of an organisation. There are two dimensions in the environment, namely the internal and the external environment. The internal environment is the organisation itself, the external environment is the market in which the organisation competes. (Neely et al., 1995)

The external environment, or the market, seems to consist of two parties. On the one side the clients and on the other side the competitors. To be able to perform on a top level both sides need to be taken into account. (Neely et al., 1995)

According to Bourne, Mills, Wilcox, Neely and Platts (2000) the development of a PMS is performed in three phases.

*Phase 1:* Design phase, in this phase the performance measures are designed in two sub phases. One sub phase is identifying the proposition that needs to be measured and the other is designing the actual measures.

*Phase 2:* Implementation phase, in this phase the information is collected, processed and sorted.

*Phase 3:* Use phase, in this phase the measures should be used to measure the success of the proposition, challenge assumptions and test the validity of the proposition. A review is performed and then actions are undertaken according to the measures outcome.

### 5.4 Conclusion

A representation of this chapter is presented in figure 11 at the end of the next paragraph. In this paragraph the conclusions of this chapter are drawn.

Performance measurement quantifies the efficiency and effectiveness of actions. Performance measurement is necessary to be able to measure the performances of organisations in a quantifiable way. It obtains performance information that will form QPI.

Performance measurement has multiple effects on an organisation. These effects are:

- Transparency
- Focus
- Evaluate and adjust
- Comparison
- Accountability
- Motivation
- Communication

The PMS exists of multiple performance measures that measure performances, which are set against a reference framework. This framework enables an organisation to judge the outcomes. There are two types of performance measures: traditional and current measures. Traditional measures use financial and internal measures. Current measures use the traditional measures and adds non-financial and external measures to them.

An important aspect is that the performance measures and PMS are linked to the proposition of the organisation to be able to measure the right aspects of their performances.

From the literature a few characteristics of a PMS come forward.
Characteristics of a PMS are:
- Integrated in an organisation
- Full support by management
- Measure only critical subjects
- Focus on long-term prospects
- Continually align with proposition
- Balance information

The development of a PMS happens in three different phases. These phases are:
1. Design phase
2. Implementation phase
3. Use phase

All the findings from this chapter are combined in figure 11, in a sub model. This model is explored in the next paragraph.

5.5 Explanation of model

The findings from the literature study in this chapter are shown in figure 11 at the end of this paragraph. In this figure there is shown at the top that a certain performance has a certain efficiency and effectiveness. These two aspects of a performance are quantified by a Performance Measurement System. To be able to measure the performances and do this quantification several performance measures are used. This is represented in the figure, because the performance is the input for the performance measures, which are in their turn the input for the PMS.

There are two categories of performance measures. The first category exist of traditional measures. In these measures only financial and internal measures are performed. While with the current measures also non-financial and external measures are performed.

The PMS is set against a reference framework. This provides a context for an organisation to be able to judge the performance measurements.

Furthermore, several characteristics to which a PMS should comply are incorporated in the model on the bottom right.

The development of a PMS happens in three different phases. These phases are:
1. Design phase
2. Implementation phase
3. Use phase

An important aspect of the entire PMS model is that the performance measures and PMS need to be linked to the proposition of the organisation. This proposition can give direction to which performances are measured. This is shown by the environment in which the model is placed.
To be able to make the measurements quantifiable and to be able to measure aspects that are understandable and easy to interpret the performances have to be measured based on Key Performance Indicators. This subject is explored in the next chapter.
6 Key Performance Indicators

Key Performance Indicators (KPI's) are necessary in performance measurement to make sure that in a PMS the correct variables are measured. The choice of these performance indicators is very important, because they have to give a complete and good representation of the overall performances, otherwise the PMS delivers incorrect QPI and wrong decisions are made based on this information. To be able to get a good insight in what KPI’s are they are explored in this chapter.

6.1 KPI’s in general

KPI's are defined as: “quantifiable variables that make it possible to relate a performance to a pre-set standard.” KPIs are quantifiable, therefore, the indicators are expressed in a number with a unit. Each indicator has a unit that corresponds to that specific indicator. In this way performance indicators are able to show dominant information in a verifiable and transparent way. (Aedes, 2013) (Van de Rijt & Santema, 2013)

In the construction industry the goal of KPI's is to enable the measurement of the performances of a project or organisation. Just like the IS and PMS also for KPI's the link to the organisation's proposition is very important. KPI’s are needed to indicate the effectiveness of the proposition of an organisation. (Rydell et al., 2013)

The performances of an organisation on its objectives cannot be measured by only one performance indicator. A set of indicators is required that covers the performances of the entire proposition. If the KPI’s in the set are chosen and formulated in a correct way the entire set of KPI's and, therefore, also the PMS and QPI is linked to the proposition of the organisation. In this way an organisation can ensure that the proposition gets achieved. (Aedes, 2013)(Nicis Institute, 2010)

According to A.P.C. Chan and A.P.L. Chan (2004) in the PMS the following factors need to be taken into account for the development of KPI’s:

- The number of KPI's that is required should be balanced and be manageable, otherwise the PMS becomes either too complex, or the proposition is not entirely represented
- KPI's need to be used in a systematic and consistent way over multiple projects
- Data collection must be simple
- A large sample size is needed for KPI’s to be effective, they need to be applicable to every project
- The entire organisation must approve and support the PMS and the corresponding KPI’s
- KPI's change over time, because the proposition and objectives of the organisations are subject to continuous changes. The KPI's need to follow this move and must evolve.

When an organisation decides that it wants to measure its performances, first it is important that it is decided what performances are going to be measured. When this is clear these subjects need to be translated into KPI's. When, for example, the performances of a certain subject depend on a specific group of stakeholders it is convenient to have a KPI that takes the needs of these stakeholders into account. (Aedes, 2013)
6.2 Categories and characteristics of KPI's

According to Lin, Shen, Sun and Kelly (2011) KPI's are divided into three groups of indicators that all focus on a different kind of indicator. These three groups are:

- Predicting Indicators
- Process-related Indicators
- Outcome-related Indicators

To be able to have a complete PMS all three indicators should be represented in the PMS.

In a research of the Nicis Institute (2010) three criteria came forward that need to be taken into account when performance indicators are chosen and formulated. These three criteria are:

- Measurable
- Relevant
- Accountable

A KPI is measurable when an indicator is measured in an unambiguous an explicit way. The KPI needs to be expressed in a number with an accompanying unit. When an indicator contributes to the objectives and proposition of an organisation the KPI is relevant. The relevancy of a KPI is important for an organisation, because then a KPI contributes to achieving the objectives of an organisation. The last criterion indicates if a KPI is accountable. For KPI’s it is important that the organisation is completely accountable for the performances that a KPI reflects. Because when an organisation is accountable for a specific performance measured by the KPI the organisation can influence the performance on this KPI and, thus, the performance of this KPI is in their own control. (Nicis institute, 2010)

According to the literature the perfect KPI combines all of these three criteria. However, the KPI's that consist of all three criteria are very rare. It is, therefore, hard to find solid criteria that comply with all of these criteria. Often KPI’s are based on only two of these three criteria, which is a risk because the third criterion is not involved. Then a KPI can, for example, be accountable and measurable, but when it is not relevant for the organisation it is useless. Therefore, a KPI that misses the link with one of these three criteria has to be perceived with the knowledge that a criterion is missing in mind. When this is done the outcomes of the KPI is assessed in a correct context and this puts the result in the right perspective. (Nicis institute, 2010)

From these KPI's dominant performance information comes forward, or at least the base for dominant performance information has to come forward. Therefore, the characteristics of dominant information in paragraph 4.4 also have to be kept in mind when KPI's are set up.

Performance indicators are expressed in a one dimensional or a multi-dimensional way. Multi-dimensional performance indicators are expressed as ratios of two different units, while one dimensional performance indicators express one measured unit. If multi-dimensional values are used this makes the performances comparable with other companies. (Aedes, 2013)

Cox, Issa and Ahrens (2003) make a differentiation between quantitative and qualitative KPI's. Quantitative indicators are physically measured and are often the most obvious indicators. Qualitative indicators are often not immediately visible as possible KPI's, because they are difficult to assess and measure.

Another distinction between two kinds of KPI's is made by Chan et al. (2004) who looks at KPI's as both subjective and objective indicators. Objective indicators are similar to the quantitative
KPI’s, they are quantifiable and are expressed quite easily in hard digits and numbers. These KPI’s are based on hard information and are calculated with mathematical formulas. Subjective KPIs are similar to qualitative KPIs. These KPI’s are harder to quantify. Eventually they are expressed in numbers, but these numbers are based on soft information, for example, opinions and personal judgements. (Neely, 1999) (Nicis institute, 2010) In a complete set of KPI’s both objective and subjective KPI’s are required. Because the hard information that comes forward from the objectives are viewed in a better context when subjective KPI’s are also added. This helps to give more insight in the overall results of the indicators. Therefore, it is important to combine these two kinds of indicators. (Nicis institute, 2010)

6.3 Scores on KPI’s

When an organisation uses performance measurement and gets a score on a certain KPI, this score is either positive or negative. This score causes an incentive for the organisation to make changes and improve. Such an incentive is either powerful or very low. A too powerful incentive makes an organisation desperate to achieve a good performance and, therefore, they will do anything to accomplish this. The way this is done is mostly not favourable for the organisations performance. However, a too low incentive brings along the risk that the incentive is not observed or is ignored by an organisation. Therefore, a balance is also important when it comes to the strength of incentives from the KPI’s in the PMS. (Nicis institute, 2010)

As comes forward from the definition of KPI’s it is necessary that KPI’s relate to a pre-set standard. This is similar to the reference framework against which the PMS is set in the previous chapter. In this way KPI’s are set in a certain context and performances are compared to these standards. In other words, standards make KPI’s functional. (Aedes, 2013) Standards are set in different ways, for example, as:

- Norms
- Benchmarks
- Historical data

Norms are formulated by an organisation and can reflect a certain level of performance that at least must be achieved. When a performance scores above this norm, the performance is decent. But when the performance stays below the norm the organisation has to change and improve to be able to achieve the objectives. The norms are, therefore, a good reference to keep track of performances. (Aedes, 2013)

Another type of standard to which performances are compared is benchmarking. In benchmarking the performances of an organisation are compared to the performances of other organisations that perform in the same market and work in the same processes. In this way the standard becomes the performance of the market. (Aedes, 2013)

The last standard that is identified is historical data. In this way of assessing performance information the performance of a current project or process is compared to earlier results on similar projects or processes. In this way the company sets its own standards by its past performance. A remark here must be made that when an organisations performances in the past are low, the standard to which the current performances are compared is also low. Therefore, an organisation is not forced to improve its performances, because from the standard it seems that
what was good enough in the past is still good enough in the current market. This is no good reference for improvement. (Aedes, 2013)

### 6.4 Examples of KPI’s

In this paragraph examples are given of possible categories of KPI’s. Within these categories different examples of actual KPI’s are given. When reading this paragraph one thing that has to be kept in mind is that the categories and examples of KPI’s are all based on literature for the construction industry, which mainly focuses on the actual execution of construction works. Therefore, these KPI’s and categories are a good example of how KPI’s for contractors are categorised and formulated. But most likely these are less useful for engineering companies, because their works often are focused on the work before the execution starts. Therefore, this paragraph must give an idea of what categories and KPI’s can look like, but must not be interpreted as readily applicable for engineering companies.

The basic criteria that determine project success and, thus, a good performance are according to Neely (1999):

- Time
- Cost
- Quality

These three criteria are named the ‘Iron Triangle’ by Atkinson (1999). According to him the Iron Triangle is the base for project success, and thus, a good performance. These criteria are, therefore, seen as the base for a PMS and KPI’s.

Time and costs are measurable criteria and have units that are simply defined. But according to Atkinson (1999) these two criteria are only based on best guesses. Quality is an even more difficult criterion, because it depends on people’s perspectives and beliefs. It changes over time and it is different for every person. Therefore, it is hard to capture in a KPI. Furthermore, quality is seen as a neutral criterion by public clients. This means that it does not determine project success for clients. This is taken into account when formulating KPI’s by vendors. (Van Loenhout, 2013)

Because of these difficulties of measuring the criteria, the Iron Triangle on its own is not enough to capture the complete performances on projects of an organisation. Therefore, additional criteria on which KPI’s are based are necessary. The Iron Triangle on its own is too restricted. (Atkinson, 1999) (Van Loenhout, 2013)

In literature on KPI’s a lot of different examples of KPI’s and categories are given. In table 1 an overview of different identified categories and examples of KPI’s are given to give an example of what KPI’s can look like.
Table 1: Examples of KPIs in the construction industry (Atkinson, 1999; Egan, 1998; BRE, 2013; Chan et al., 2004; DETR, 2000; Cox et al., 2003)

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<td>- Speed of Construction</td>
<td>-Time Variation</td>
<td>-Time predictability</td>
<td>-Lost time accounting</td>
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<td>- Cost predictability</td>
<td>- Unit Cost</td>
<td>-Percentage net variation over final cost</td>
<td>-Cost predictability</td>
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<td>-Quality</td>
<td>Qualifications &amp; Skills</td>
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<td>-Environment Impact</td>
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<td>Staff</td>
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<td>-Rework</td>
<td>-Percent complete</td>
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<td>-Motivation</td>
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6.5 Conclusion

KPI’s are important for measuring the correct variables in a PMS. These KPI’s have to give a good representation of overall performances and have to be linked to an organisations proposition. One KPI is not enough to cover the entire proposition and performances, therefore, a set of indicators is required.

KPI’s are quantifiable variables and exist of a number with a corresponding unit. This unit can either be one or multi-dimensional. KPI’s, furthermore, reflect dominant information and are, therefore, important to be able to obtain QPI.
Criteria that are necessary to formulate a good set of KPI's are:

- Balanced number of KPI’s
- Used in consistent and systematic way
- Data collection must be simple
- Large sample size is needed
- Approved and supported by organisation
- Evolves over time with a changing proposition

Furthermore, there are three kinds of KPI’s:

- Predicting indicators
- Process-related indicators
- Outcome related indicators

When it comes to KPI's there are three criteria that all KPI's should possess. These criteria are:

- Measurable
- Relevant
- Accountable

An ideal KPI combines all three of these criteria, but mostly two criteria are combined in one KPI. Then it is important that the missing criterion is kept in mind, this gives the KPI a better perspective.

Furthermore, KPI’s are either objective/quantitative or subjective/qualitative. Objective KPI's are based on hard information, facts, and are measured by formulas. Subjective KPI’s are based on soft information, such as opinions.

Finally, a set of KPI's is set against a reference framework. This framework exists of pre-set standards, such as: norms, benchmarks or historical data. These give KPI's a framework to which they are compared. This makes them easier to assess.

6.6 Explanation of model

In figure 12 a representation of the information in this chapter is shown. In this paragraph this visualisation of the literature is explained.

KPI's are important for measuring the correct variables in a PMS. One KPI is not enough to cover the entire proposition and performances, therefore, a set of KPI's is required. This is shown in the large square in the model. This set of KPI's consists of multiple KPIs. These indicators are outcome related, process related or predicting. All KPI’s have to comply with three criteria. They should be: measurable, relevant and accountable.

On the right side of the model there is shown that the KPI’s can either be objective/quantitative or subjective/qualitative. These two types of KPI's are both needed within a set of KPI’s to give a good overview of the performances that are being measured.

The set of KPI’s is set against a reference framework. Just like the PMS here as well this reference framework sets the KPI's in a certain perspective to be able to judge the outcomes.

Another important aspect for the set of KPI’s is, just like the IS and PMS, that it is linked to the proposition of an organisation. When an organisation knows what it wants to achieve and be good at for this particular performance KPI’s are stated. Therefore, here as well the environment of the model is the proposition of the organisation.
In this chapter an overall conclusion of this section is given. This conclusion is based on the previous three chapters about IS, PMS and KPI’s and is focused on how these three subjects contribute to optimising the gathering and application of QPI.

In figure 13 a representation is shown of the links between the subjects of the previous chapters. In this model there is shown that the proposition of an organisation is the environment in which the entire model takes place. All aspects within this environment of the proposition and objectives are linked to them. For example, for performance information it is important that the entire IS is linked to the proposition. This also counts for the PMS and the KPI’s.

The proposition of an organisation is complex. It evolves over time with all decisions that are made. However, despite these changes it is necessary for an organisation to have a consistent proposition that is reflected in all actions that are taken. Therefore, the proposition of an organisation is the base and environment of the entire model.

Another important aspect that is needed to be able to gather and apply QPI is the IS. This system represents an optimised IS in which performance information is gathered and assessed in a proper way. The IS comprises both the PMS and set of KPI’s, because performance measurement happens within the IS and KPIs are the input for the PMS.

The PMS consists of a number of performance measures. These measures are all linked with the proposition and occur within the IS. Performance measurements need to be performed in such a way that the outcome is used as the base of QPI. Therefore, only the critical subjects are measured in a quantifiable way. To be able to do this KPI’s are necessary. These KPI’s are within the IS, the input for the PMS and are also linked to the proposition of an organisation.
In the end when an organisation’s IS is optimised, an effective PMS is implemented that measures KPI’s in a quantifiable way. The outcome of the KPI’s, PMS and IS together is a base for QPI. This information is used to win BV and other EMAT tenders that also lie in the scope of the proposition of the organisation.

The insights that are given in this section all come together within this conceptual model. When within this model all different sub models are taken into account an organisation is able to optimise his IS, implement a PMS and introduce KPI’s into his organisation to be able to generate QPI and eventually win tenders.

Figure 13: Conceptual model based on literature background

The insights from this section on how QPI is gathered and applied based on the literature are now used in a practical comparison. At first thirteen different tenders that Grontmij participated in are analysed. Furthermore, the results of this section are verified by client and expert interviews and it is used to get an insight in the current practice at Grontmij. The results of these analyses can be found in the next section.
Section III: Practical Comparison
8 Introduction

In the exploration of the problem, BVP and the literature study a lot of information comes forward. This information forms the base of this research as is explained in the research methodology that is shown in the methodology pyramid in figure 6.

Now the base of the research is finished a next step is taken, which is called the 'Practical Comparison'. As shown in the research methodology pyramid this next step consists of three separate sub steps.

Together these three sub steps will give an insight in the current practice of Grontmij, in BV tenders in general, and in what is needed and important, for example, in the opinion of clients to be able to win BV tenders.

9 Case study analysis

To be able to get a good insight in BV tenders and to be able to answer the main research question 13 BV tenders are analysed in a case study analysis. The results of this analysis are explored in this chapter.

9.1 Introduction

In the introduction of this research an insight is given in the BV philosophy and method. Here the insight is gained that the client objectives are the key element of BV request for tenders. These objectives give the offers of the vendors direction. All qualitative documents need to be linked to these objectives, otherwise these documents cannot be scored and are not taken into account. This indicates that the client objectives are crucial for the tenders. Therefore, the different types of client objectives are analysed. In paragraph 9.3 the results of this analysis are shown. (Rydell et al., 2013)

In the introduction it also comes forward that the way of scoring qualitative documents also happens in line with the BV approach. Only dominant scores or a neutral score are given. Based on this knowledge it is interesting to see how the scores of Grontmij are on this scale of dominance. In this way there is seen what their actual performances are in these 13 tenders. And it will indicate if improving the qualitative documents is really necessary or if certain documents are already scoring well. Therefore, the results of the analysis of the scores and which documents need to be improved is shown in paragraph 9.4. (Van de Rijt, & Santema, 2013)

In the literature study there is shown that having a proper IS and being able to use dominant information is necessary to be able to apply good QPI. In the conceptual model there is shown what is necessary for good QPI. Now this is looked at in practice.

9.2 Cases

As mentioned above in this chapter the results of the case study analysis that is performed are discussed. For a good insight in the BV tenders in general and in the offers of Grontmij in specific 13 BV tenders that Grontmij participated in are analysed. The complete analysis of all 13 case studies can be found in Appendix A.
The 13 cases that are analysed are stated in table 2.

### 9.3 Objectives

A large part of the analysis of the case studies focuses on the different objectives that are set by the clients. These objectives are set to give direction to the vendor within the request for tender and are, therefore, crucial in BV tenders. Because of this importance the clients put a lot of effort and thought into the objectives of their request for tenders. (Rydell et al., 2013)

In BV request for tenders the vendors are supposed to link all their qualitative documents (risk- and value added files) to the client objectives. Thus, if it is known which objectives are common or generally important for clients a vendor can take this into account in its QPI. This can give direction to the PMS on what performances should be measured to deliver proper QPI and, thus, good qualitative documents. Therefore, a closer look is taken at these different client objectives.

#### Objective categories

In the next part of the objectives analysis a closer look is taken at the different client objectives. In a lot of the cases a distinction is made between the overall objectives of a client and the objectives that are specifically focussed on the works that needs to be performed for the specific tender. These different objectives are called respectively the general objectives and the works objectives. The general objectives mainly come forward when the assignment for this particular tender is only a small part of a larger project or when a client has some main ambitions.

This paragraph focuses on these two kinds of objectives. All objectives are analysed and divided into a specific objective category, which gives insight into the most common objective categories. An example of a request for tender with the two different kinds of objectives that are divided into categories is shown in figure 14.

![Request for Tender](image)

**Figure 14: Example of objective categories in request for tenders**

In the analysis 19 objective categories are observed in 13 request for tenders. These categories are explained in table 3.

#### Table 3: Explanation different objective categories

<table>
<thead>
<tr>
<th>Objective category</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Works planning</strong></td>
<td>Achieving the planning for the specific works of the tender.</td>
</tr>
<tr>
<td>2. <strong>Realisation</strong></td>
<td>Contributing to achieving the planning for the entire realisation of</td>
</tr>
</tbody>
</table>
| planning | the project.
|---------|----------------|
| 3. **Works budget** | Delivering the works within the upper set limit price, or as low as possible.
| 4. **Realisation budget** | Contributing to staying within the budget of the entire realisation of the project.
| 5. **Quality** | Delivering a solution with a high standard of quality.
| 6. **Project Specific** | These objectives are very specifically oriented at the projects/works that are requested.
| 7. **Unburdening** | Unburdening the client as much as possible by efficiently involving the client or by taking responsibility and having a proactive attitude.
| 8. **Safety** | The safety of a solution needs to be guaranteed.
| 9. **Image** | Contributing to or not damaging the clients image.
| 10. **Sustainability** | Offering a sustainable solution.
| 11. **Comply with law** | The solution should comply with the Dutch law.
| 12. **Support** | There should be strived for as much support as possible for the offered solution.
| 13. **Collaboration** | The use of knowledge and cooperation needs to be maximised.
| 14. **Client satisfaction** | The client needs to be satisfied as much as possible.
| 15. **No appeal** | The offered solution should be set-up in such a way that there is as little appeal as possible against it.
| 16. **Additional work** | Include as much extra functionalities as possible in the solution.
| 17. **Nature** | The solution that is offered should make a contribution to nature.
| 18. **Flexibility** | There must be a lot of flexibility and freedom in the design of the solution.
| 19. **Hindrance** | Reducing the hindrance of the environment as much as possible.

What is striking in table 3 is that there is made a difference between two kinds of planning and budget, because there is a division visible within the categories of planning and budget. At first there are two objective categories stated for planning and budget, which focuses on the entire realisation planning and budget of the project. Because the focus of these two objective categories is on the entire project, the performance of the vendor in respect to this objective needs to be so clever that the planning and budget are positively affected for the entire project. When this is shown a good impression is made by the vendor. These objective categories are called the realisation budget and realisation planning. The other kind of planning and budget objectives focuses on achieving only the works of the specific request for tender within time and budget. The works planning objective often focuses on achieving certain milestones within the specific works. The works budget objective, however, is somewhat different. The objectives in this category often state that the offer of the vendor for the tender should be below the set upper limit price or as far below this amount as possible. This seems to be a strange objective within the BV approach, because this objective category seems to ask vendors to give the lowest price. Which is not in line with the BV approach. Another thing that is striking and contradicting in this objective category is that staying within the upper limit price is actually a requirement, because when a vendor offers his works at a higher price than
the upper limit price he is immediately excluded from the tender. Therefore, this objective category seems to be quite strange and contradicting compared to the other objective categories. This seems to be no category where a vendor needs to start measuring his performances. He just has to make sure that he stays below the requirement of the upper limit price.

**Overall view on the objectives**

In the analysis of the objectives at first the two different kinds of objectives (general and works) are analysed separately. These separate analyses are shown in Appendix B. What is remarkable about the works objectives is that in the planning category more than 82% of the objectives fall within the works planning objective category, while the rest of the planning related objectives are realisation planning related objectives. In the budget related objectives, however, it shows that the objectives are divided evenly over the realisation budget and the works budget category. Furthermore, there are no clear outstanding differences visible in the two kinds of objectives. Therefore, in this paragraph there is focused on the two kinds of objectives combined, this is called the overall view on the objectives.

According to the findings about BVP in the introduction section the qualitative documents that need to be delivered by the client, almost always, need to be linked to both the general objectives of a client and the works related objectives. Therefore, this analysis of the overall objectives is important.

During the analysis every objective has been granted a certain objective category. In figure 15 an overview is given on the distribution of the different objective categories in all objectives. All 101 objectives are divided into the earlier mentioned 19 detected objective categories. The three categories that really stand out from this graph are: the planning, budget and project specific objectives. 24,75% of the objectives are project specific, 21,8% of the objectives are planning related, 14,9% are budget related and 7,9% of all objectives are quality related and also unburdening and safety related objectives occur in 5% of the objectives.

This analysis indicates that almost a quarter of the objectives is focused very specifically on the specific project or works that are requested in a tender. These objectives focus on performances that are hard for vendors to measure, because they specifically focus on one project. However, when a project falls within a very specific expertise of a vendor this can work in a vendors favour. Because then, maybe, a vendor is able to gather and apply performance information on this specific objective.

However, in most of the tenders it is good to know for vendors that this many objectives are focused on the specific project or works. But most of the time no real action for, for example, performance measurement is undertaken by the vendor based on this knowledge.

From the six objective categories that occur most frequently, both the planning and budget related performance information consist of hard data, as appeared in paragraph 6.2. These two categories are based on facts, which should make them fairly simple to measure according to the insights about KPI's and performance measurement in the 'Theoretical Background'. Certainly compared to the soft data objectives that are related to quality, safety and unburdening. These objectives are soft, because they rely on the view of a certain client and, therefore, cannot be measured as factual data. (Neely, 1999)

With this insight in the objectives in the request for tenders compared to the information that came forward in chapter 6 about KPI's it would be wise for engineering companies to develop KPI's for at least the two hard data objective categories: planning and budget. When the
performances of vendors on these two aspects are measured already. 36.7% of the objectives are covered and proven with QPI. Together with quality, the planning and budget related objectives form the Iron Triangle as is mentioned in paragraph 6.4. However, according to Van Loenhout (2013) the quality related objectives do not need to be measured, because in the clients perceive the quality criterion as neutral when it comes to proving project success. Starting by measuring the planning and budget related objectives is, therefore, sufficient.

Figure 15: Overview of all objective categories

This analysis also indicates that if there is a standard project evaluation available that is always conducted with KPI’s of achieving the clients budget and planning objectives already a lot of effective information for QPI is gathered for future request for tenders.

9.4 Scores

The clients of the different tenders reviewed and scored the 13 tenders that Grontmij participated in. In this paragraph the scores of the qualitative documents that were delivered by Grontmij are analysed, because according to the literature on BVP the scale and way of scoring BV tender is very different from the scoring of other tenders.

Scoring scale

As is also stated in the introduction section in the BV approach a special scale is used to be able to score the qualitative documents and interviews of the vendors. The 12 analysed cases are mostly scored on this specific scale, which is shown in figure 16. However, there must be noted that some projects also awarded scores in between the numbers on this scale. This is not favourable, because this does not make the scoring procedure transparent. For a clear procurement procedure it is important that this scale is used in its original form to be able to find the best vendor in a clear, dominant and convincing way. (Van de Rijt, & Santema, 2013)
Figure 16: Assessment scale of the BV approach (Based on (Van de Rijt, & Santema, 2013))

The scale runs from the numbers 2, 4, 6, and 8 up to 10. The scale is constructed based on dominance. Therefore, scoring a 6 on this scale represents scoring a neutral score. To be able to get a score higher or lower than a 6, a vendor must show that he can perform dominantly better or worse than just doing what is asked. Because the scale is based on dominance a vendor is only able to achieve a higher score when he can make explicitly clear that he can perform and bring something of extra value to the project. When this is not dominantly clear and the offer needs to be interpreted or a discussion is necessary to decide on a grade the score becomes neutral. To be able to score lower than a neutral score a vendor must make it dominantly clear that his offer does not contribute to the client objectives for the project or even harms the objectives. (Van de Rijt, & Santema, 2013)

In this paragraph the results of 12 tenders that clients reviewed are analysed. The analysis of every separate qualitative document and the interviews on their scores can be found in Appendix C. In this paragraph the focus lies on the overall scores, the quality versus price ratio and the ranking of the different tenders.

**Overall scores**

After the analysis of all the scores on the qualitative documents and the interviews in Appendix C, now these scores are analysed together. In figure 17 all scores of the documents and interviews are combined. All scores above 6 are divided into the category dominantly good and all scores below 6 are divided into the category dominantly bad. All scores of a 6 are seen as neutral.

All three types of scores occur almost the same amount of times. This indicates that Grontmij is able to really score dominantly good and make their expertise clear, but is also able to make a negative or neutral impression with their expertise.

To be able to win BV tenders only dominantly good scores are necessary. The other two types of scores are not good enough to be able to win tenders in a dominant way. A vendor must, therefore, be able to proof their expertise with QPI. Therefore, still about two third of the scores and, thus, the offers need to be improved. This can, partially, be achieved by applying QPI in the qualitative documents and interviews. But this indicates that there is still a long way to go before all scores are on the desired level of dominantly good.
Figure 17: Overview of all scores

**Quality versus price ratio**

Another part of the scores that is interesting to take into account is the quality versus price ratio that the client uses while calculating the fictive tender prices of all vendors. Therefore, a closer look is taken at the different quality versus price ratios of the cases in Appendix A.

The average quality versus price ratio is: 79.4%. This means that the upper limit price is taken into account at a 100% and that (on average) 79.4% of this amount is diminished by offering quality. Scoring well on the qualitative documents and interviews is very important. Only by achieving perfect dominant scores (of a 10) the entire quality percentage is subtracted. Winning by just offering a low price is no longer possible, because of this high percentage that is given to quality aspects.

The quality versus price ratio is built up from the different values that are awarded to the qualitative documents and interviews. In the request for tender all qualitative documents are awarded with a percentage of the upper limit price that is set on beforehand. This means that if a document is awarded with a percentage of 20% of the upper limit price and a vendor scores the maximum score (10) on this document, the vendors subscription price is diminished with 20% of the upper limit price that was set on beforehand. When all percentages of the different qualitative documents and interviews add up to 100% of the entire upper limit price this is distracted from the subscription price. Which can lead to a negative fictive price, because the subscription price is often lower than the upper limit price.

The weight percentages also show how important a client finds every qualitative document and interview. Therefore, an analysis is performed on these percentages. The results of this analysis are shown in figure 18. The interviews are, in general, most important according to the clients. On average the interviews are taken into account for 35% of the upper limit price, when a maximum score is achieved. Often this percentage is divided over two or even three interviews. Then every individual interview is scored half or a third of this percentage.

But to be able to even participate in the interviews first sufficient scores have to be gained on the qualitative documents. The risk file of the client and the value added files are taken into account for respectively 18% and 16%. This indicates that these two documents are seen by the client as
half as important as the interviews, but together they are seen as evenly important. Good scores on these two documents are, therefore, essential for a good ranking and for participating in the interviews.

The last document that often occurred in the cases is the risk file of the vendor risks, this risk file is on average seen by the client as the least important document. The average percentage that is subtracted from the upper limit price when scoring a maximum score is 8%. This is half of the percentage of the value added file and the risk file of the client. And only a quarter of the percentage that is awarded to the interviews. This indicates that this is the least important document, which is in line with the notion that this document is not often requested anymore, because in the BV approach an expert should be perfectly able to control their own risks and these risks, therefore, should not be taken into account in the tender. (Van de Rijt, & Santema, 2013)

![Pie chart](image)

**Figure 18: Percentages of the upper limit price awarded for maximum scores**

### 9.7 QPI

From the literature study, paragraph 4.1, it comes forward that incorporating QPI in the risk and value added file is crucial for winning tenders. Different degrees become visible in the use of QPI. From this general analysis it comes forward that there are five degrees of QPI. A representation of these degrees is shown in figure 20.
The best application of QPI is the use where all four aspects that are found in the analysis; experience, success, effect and SMART, come forward. To be able to make QPI effective and really be able to substantiate the qualitative documents in a proper way all four aspects should be incorporated thoroughly. All vendors should be aware of these different aspects to improve their use of QPI.

9.8 Conclusion

Especially objectives related to planning and budget are common in BV tenders. The qualitative documents need to be linked to these objectives and also the effect of the measures on these objectives need to be made clear. Therefore, it is advisable to start performance measurement with these two most common subjects of client objectives. There can, for example, be set up a standard project evaluation with these two subjects. Although it has to be kept in mind that there are two kinds of planning and budget objectives, which makes the performance measurement harder and not as easy as it seems.

The project specific objectives are most common. These are hard to anticipate on when it comes to the use of QPI, but it is good for vendors to be aware of these most common objectives.

Overall the scores of Grontmij on the qualitative documents and interviews differ equally from dominantly good, neutral to dominantly bad. This indicates that Grontmij is capable of delivering good qualitative documents and interviews, but still two third of the scores need to be improved from neutral and dominantly bad to dominantly good. Because to be able to win tenders only dominantly good scores are needed. These scores are improved by using QPI in tenders.
It also seems that the interviews are taken into account the most in BV tenders. The scores on the interviews count for 35% of the quality scores. However, in order to participate in the interview the scores on the qualitative documents need to be sufficient. Furthermore, the value added file and the client risk file are taken into account for respectively 16% and 18% of the upper limit price. Therefore, these two documents are together equally important (34%) as the interviews. Without proper scores there cannot be participated in the interviews. Thus, a lot of effort has to be put into these documents.

There are four aspects that are important for the set-up of QPI. These four aspects are: experience, success, effect and SMART formulation. The most effective use of QPI is reached when all four aspects are combined. This means that at first the experience to related projects is mentioned, after that there is mentioned that this experience was successful, then there is stated what the effect of this measure is on the objectives of this specific project. And finally it is needed that all of this information is formulated in a SMART way.

10 Current practice

11 Client and expert view

To be able to verify the findings that are gathered by performing the literature study, exploring the 13 different case studies and keeping interviews with employees of Grontmij, interviews with different clients are held. This verification is important, because in the literature study an ideal picture is shown on how QPI should be gained an applied and in the case study analysis there is shown how the practice of BV tenders at Grontmij is at this time. These findings are either theoretically based or practically based on the vendor’s experience. However, in practice the clients are the parties that review the tenders, decide if the qualitative documents are sufficient and decide if QPI is used in an effective way or not. Therefore, it is important that the clients recognise these findings and to know what their view on these aspects is. Because when in literature and vendor practice QPI is seen in a certain way, but in practice clients review it in a very different way the view of QPI needs to be adapted to be able to win tenders in practice. Therefore, the interviews with the clients are a necessary step of verification.

Also an interview with an expert of BVP is held to gain more insight in the results from the literature study and to give insights from a clear BV point of view. To be able to get a good and diverse insight in the visions of clients of BV tenders in QPI and the related analysed subjects three cases of three different clients are selected from the 13 cases that are analysed in the case study analysis. From each of these three different clients two or three employees are interviewed. Most of the time these persons are the tender manager and someone that participated in the review committee of the tender. This entire chapter is based on the overall views of all interviewees, because of confidentiality no direct links to sources are made in this chapter.
11.1 QPI

At first the view that the clients have on QPI is important for vendors. In the opinion of the client QPI is crucial for vendors to be able to deliver a good offer for a BV tender. In their view QPI is hard information that is made as objective as possible. The information has to bring forward a performance that is related to the specific project of the tender. Furthermore, the information has to be verifiable, because in the pre-award phase the promised performances with the QPI are verified by the client. If a statement that is made in QPI then seems to be incorrect the award is withdrawn. It also has to be simple and transparent. Furthermore, all clients state that it is crucial that QPI is dominant.

**Dominant information**

In the view of the different clients dominant means that the QPI is so clear that there is no discussion possible about the meaning of the information and no interpretation of the information is necessary. What is stated is all that is needed and it says all. This corresponds with the criterion of dominance in the literature study that dominant information is irrefutable. According to the client this is the most important criterion which makes information dominant. Furthermore, what makes information dominant is that it is measurable in numbers, which are verifiable. Numbers are seen by the clients as hard data or facts, this makes information very clear and, therefore, dominant. That the numbers and information need to be verifiable in order to be dominant is also an important aspect according to the clients, because this possibility of verification gives meaning and certainty about the information that is given. These two criteria also come forward as important in chapter 4 of the literature study.

The criteria that come forward in the literature study on dominant performance information that are part of the SMART abbreviation are not all seen as equally important by the different clients. For example, the clients state that dominant information has to be specific, measurable and realistic. But, in their opinion, dominant information does not necessarily has to be ambitious or time-bound. This is the case, because a performance can also be very generic and still be effective, not every project is unique or very complex and in need of ambitious solutions. So, when it is a quite standard project the QPI does not have to be ambitious to be dominant. However, often ambitious is even mentioned in the selection criteria as important and this indicates that clients do review the qualitative documents on being ambitious. One client states that indeed they used the selection criterion of showing ambition in the past, but they recognised that this is no good criterion to review a project on, therefore, this aspect is not taken into account in their new BV tenders.

The clients also state that performance information does not always have to be time-bound to be dominant, because it depends on the objective to which the QPI is related if the time aspect is an important aspect of the QPI. Therefore, QPI only needs to be time-bound when this is relevant for the client objectives, but it is no criterion to make QPI dominant. With this knowledge the abbreviation of SMART changes to SMaRt, where the aspects: SMR are seen as the most important. When stating QPI vendors should take these three aspects into account.

Other criteria that came forward in the literature study as important, such as: showing a high performance and translating the information to the specific tender, are also seen by the clients as important. According to the clients and expert QPI is not solely based on past performances. It is not only a way for vendors on showing earlier experiences, but it also needs to focus on what the
approach that is suggested will bring for this specific project. The effect of the measures on the objectives of the client is most important.

**Set-up of QPI**

From the case study analysis it comes forward that QPI ideally needs to consist of four different aspects. These aspects are: experience, effect, success and SMART formulation. These aspects are verified in the client interviews and also their own view on the set-up of QPI is asked. In this part the set-up of QPI in the view of the clients and expert is stated.

However, to be able to apply QPI first two other aspects need to be stated according to the clients and the expert. The first step to be able to deliver a proper qualitative document is the stating of a **risk or value added option.** This risk or value added option needs to be linked to the project and needs to be relevant for the client.

After this risk or value added option is stated a **claim** is made by the vendor. In this claim an approach is stated. This approach helps to mitigate the risk or helps to add extra value to the clients objectives, this is still no aspect of QPI but a necessary condition that needs to be stated to be able to apply QPI.

After this claim is made the claim needs to be substantiated with QPI. According to the case study analysis QPI, ideally, consists of four different aspects. These aspects are now verified by the clients and an expert. They all state that the aspect of the **experience** that a vendor has with this approach in comparable projects needs to be mentioned. This is the first aspect of QPI that they mention, which comes across with the aspect from the case study analysis. However, the clients all state that just showing experience cannot stand alone in QPI. The experience is what makes the information performance information, but the experience in itself says nothing. It is, thus, seen by them as the **base of QPI,** which needs to be complemented with other aspects.

After the experience is stated it is important, according to the clients and expert, that there is shown what this experience bring for this specific project, because the experience will only have value for a client when it has a positive **effect** on the client objectives. The link and effect on the objectives in the specific project is **most crucial for QPI** in the opinion of the clients, because with this aspect of QPI the earlier experiences of a vendor are translated to the specific project of the tender. With this aspect of the information a vendor can really show their contribution to the specific project.

Not all clients are of opinion that the vendors need to show that the experience they had was successful. That the experience was **successful** is something that the clients feel they can automatically assume, because if the experience was not successful a vendor would not use the performance information. However, in contradiction to this they also state that stating success is crucial not to only make a client assume that it was successful, but to make it dominantly clear that the experience indeed was successful and will bring success in this specific project. Therefore, it is seen as important that the success is made explicitly clear. However, what makes showing success difficult is that it is not generally clear what success is. Therefore, vendors need to state that the experience was successful, why this will help the new project to also be successful and explain what they see as success. From this it also comes forward that showing the effect on the objectives and showing success go hand in hand and strengthen each other. Showing the effect **combined** with success is, in the clients opinion, what makes the QPI dominant.
Furthermore, the clients state that the given information on experience, effect and success needs to be substantiated with measurable or quantifiable aspects that are shown in verifiable numbers. This corresponds with the aspect of QPI that comes forward from the case study analysis where it was stated that QPI needs to be formulated in a SMART way. However, here there needs to be taken into account that, as was stated earlier, in the abbreviation of SMART the letters A and T, that stand for ambitious and time-bound, must be made small, SMaRt. This is done, because as it seems from the explanation of dominant information it is stated by almost all clients that ambition and time-boundness is not necessary for QPI to be dominant. Therefore, these two letters are less important from now on and are written as small letters within the abbreviation.

There should also be noted that the clients are of opinion that in general all the qualitative documents and, therefore, also the QPI needs to be formulated in a SMaRt way. This is, therefore, not specifically seen by the clients as an aspect of QPI, but it is seen as a prerequisite for all delivered documents in general.

In figure 23 the view of the clients on the aspects of QPI is presented. In this figure it is shown that showing experience is the base of effective QPI, but that without the aspects of showing the effect on the objectives of the client and showing success this experience has no meaning. Furthermore, it is shown that showing the effect and showing success go hand in hand and strengthen each other. Together these three aspects are the key ingredients for stating effective QPI. These aspects are, furthermore, all subject to the prerequisite that all qualitative documents and, thus, QPI needs to be formulated in a SMaRt way.

![Figure 20: Aspects of QPI according to the clients](image)

**Set-up qualitative documents**

Not only the application of QPI seems to be difficult for vendors, but creating and writing the entire qualitative documents seems also to be difficult for vendors. Therefore, the steps that are mentioned in the text above for setting up an entire qualitative document are clustered and clarified.

There are actually five aspects required in qualitative documents. The first two aspects are necessary for vendors to make a statement on how they will control a risk or deliver a certain value added option. This base is at first formed by stating a risk or value added option that is seen
as important and that is linked to the clients objectives. The second step or aspect of the base of the document is **formulating the claim** which mitigates the risk or enhance the value added option. This step is seen as the claim that is made by the vendor.

After these two aspects are made clear this base needs to be substantiated by the three aspects of QPI, which are: *showing the experience, substantiated by the effect and the success* of the claim. These are the steps that every tender team of a vendor that is working on an offer in a BV tender should keep in mind when writing a risk or value added file. An overview of these steps is shown in figure 24.

**Figure 21: Steps of information in qualitative documents**

**QPI at this time**

The clients notice that delivering good qualitative documents with effective use of QPI is, currently, still difficult for vendors. This is not remarkable, because the introduction of BVP in the Netherlands went very fast. More and more clients are using BVP, because of this trend in procuring the vendors need to move along and make sure they are capable of producing effective QPI and good qualitative documents in general. Most of the vendors still need to make changes to be able to apply QPI. These changes mostly need to be made at several organisational levels, which takes some time. However, the clients do indicate that they can definitely see an improvement in the way vendors substantiate their qualitative documents and in the level of QPI that is used.

This visible change also means that vendors are beginning to understand the urgency to not begin with performance measurement and gathering QPI when a tender becomes available on the market. But to start measuring performances and stating a proposition before a tender is requested. In this way the vendors are able to apply QPI in tenders, without having to start from zero and being very creative to put together qualitative documents with some substantiation when a request for tender comes along.

### 11.2 Objectives

As mentioned before the client objectives that are stated in request for tenders are crucial to be able to award projects with the BV approach. According to the clients these objectives are the base of the tender, because the vendors must base their offer on these objectives. All the information that is delivered by the vendors that is not linked to the client objectives is not even taken into account by the client. The objectives, therefore, have the power to give direction to the vendors when making their offer and play a crucial role in BV tenders. Because of this importance a lot of time and effort is put into choosing and formulating the objectives by the client. The objectives need to be really clear and, therefore, also in the objectives a SMaRt formulation is desirable.

The most important lesson that is learned from the clients perspective on the client objectives is that the objectives of the clients differ per project. For each project they formulate new
objectives, which are project specific. This also is shown in the results from the case study analysis, where it is shown that almost a quarter of the client objectives are very project specific. Overall the objectives make or break the project and are most important, therefore, in general not one objective is more important than another.

Furthermore, an interesting insight is given by the clients into the overall view of the clients on the objectives. Clients believe that the objectives need to be strongly related to the specific project of the tender. Therefore, the works objectives are seen as more important than the general objectives. This needs to be taken into account by vendors in prioritising their risk and value added options and the QPI in their offers.

**Planning and budget**
From the case study analysis there comes forward that planning and budget are the most common client objectives that occur in BV tenders. The clients all state that budget and planning are always important, in every project. But if those two aspects are also the most important objectives is not that obvious for them. They all state that staying within the planning and budget are more conditions in projects that all vendors need to take into account, than that they are the most important objectives. However, they also think that for vendors these two hard data aspects that are always represented in every project are a good start for setting up performance measurement within an organisation.

The difference between the two different kinds of planning and budget objectives that is made in the case study analysis are recognised by the clients. Especially the realisation planning and budget are seen as important objectives, because in these objectives a vendor needs to show that they can do their own works in such a clever way that it diminishes the costs or time that is needed for the rest of the project. This shows insight in the entire project and shows expertise.

The works planning and budget objectives are seen by the clients as something that is necessary in every project, but are seen as less important.

However, an important remark should be made on the works budget objective. As is stated in the case study analysis this objective seems to be a strange objective, because often this objective is stated in such a way that it is focussed on the aspect that the vendors prices need to be beneath the upper limit price or as much below that level as possible. This seems to be an odd objective, because staying below the upper limit price is a hard requirement for participating in the tender. Therefore, I stated that this objective is not relevant. However, the expert states that this objective is mostly used not to keep the prices below the upper limit price, but to be able to score value added options that only have an effect on the costs of a project. Because value added options can only be scored when they contribute to a client objective, adding this type of a budget objective ensures a client of being able to benefit from value added options that saves them money. This means that the works budget objective is a valid client objective and does not only focus on the already hard requirement. But still gathering QPI for the objective should not be a main priority, because that is not what this objective is used for.

**Safety**
Safety is a frequently recurring objective. However, from the interviews there is gained a new insight that some clients feel that safety is more important for them than for other clients. However, almost all clients and the expert agree that safety should not be an objective, because safety should always be guaranteed. All clients believe that there must not be made any
commercial assessment on safety aspects. Therefore, there is concluded that safety aspects are seen as very important by clients, but are mostly seen as a hard requirement. Thus, safety objectives are not seen as very effective by the clients and expert.

**Unburdening**

Another common objective in request for tenders are objectives related to the unburdening of the client. According to the clients this objective is no good objective. Although they all used this objective in the past they now recognise the problems that can occur when using this objective and almost all state that it should not be used any more. This objective is interpreted in so many different ways by both the client and vendor that it is no good objective to give direction in a tender. It only leads to misunderstandings.

The different views that occur are that the client often sees unburdening as a promise for a high transparency in the cooperation with the vendor. They want to be aware of where the vendor is going, where they will end and want to be given some certainty about the outcome by the vendor. This shows that a client expects from being unburdened that there is an open communication and that they expect to be kept up to date with the process of the vendor.

However, the vendors feel that to unburden the client they should take (some) work out of the hands of the client and give them a free ride through the project. In this way they can do their work and at the end they can deliver it to the client. In this view the client is specifically not kept up to date, but only has to sign for the result.

These two completely different views on the same objective causes friction. This shows that it is, also for the objectives, important to be stated in a dominantly clear and SMaRt way. No interpretation by the vendor should be necessary, because this can lead to differences in vision on the objectives, which affects the works that are delivered. This indicates that unburdening is no good client objective.

Another aspect that also shows that unburdening is not seen as a good client objective is the fact that the clients wish to be unburdened is seen as contradictory to the BV philosophy. In BVP there is a small scope that is shaped by the objectives in which the vendors should do their offer. However, by stating unburdening as an objective this invites the vendor to pull as much tasks and responsibilities to themselves as possible, which widens this narrow scope.

**Quality**

Quality is, especially in BV tenders, important. However, the quality objective in request for tenders is not seen as very clear by the clients. The general client perspective on the quality objective is that quality most of the time comes forward in other objectives that, in the clients perspective, determine the quality of the project. Most of the time these objectives that relate indirectly to the quality are the project specific related objectives. An objective specifically related to quality is not very common according to the clients and they do not use it very often.

In the relatively short time that BVP is being used changes are already being made. Clients have already learned from some of their mistakes and are fine tuning their objectives in request for tenders. It is interesting to see that from the five most common client objectives already three are not seen by the clients as relevant or effective objectives any more. For vendors it is good to be aware of these new insights that clients have about their objectives, to keep anticipating on these objectives and to keep evolving.
11.3 Performance measurement

According to the clients performance measurement to gather performance information is solely a task of the vendors themselves. They need to decide what is important performance information that they can successfully use in BV tenders and start measuring that information. The clients should not directly be involved in this process.

However, the clients do have an opinion on how performances can best be measured. For example, they think that there are already some simple ways visible on how vendors can measure their performances or use other information as QPI. Some clients are measuring performances themselves. One client, for example, measures the vendors performances on being pro-active in the execution of projects. This is done by awarding a grade to the vendors for their pro-active attitude. This grade is also known by the vendor. This grade can, therefore, be used by the vendor as performance information in next tenders. Especially in tenders from this specific client this grade has a certain value.

Clients also give grades in general to vendors and in executing the projects clients also keep track of other aspects in the cooperation with the vendor. Therefore, a good start is to assess which clients measure what performances and put this performance information in a database. In that way when a new request for tender comes along there is viewed which of this information is useful in this specific tender.

Another way for vendors to start measuring their performances on, for example, planning is in the opinion of a few clients and the expert using the results of the Weekly Risk Report (WRR). This report is a part of the BV method. In this report the risks that occur in the project during the execution or are foreseen by the vendor are reported every week by the vendor to the client. In this report there is also stated who is responsible for the risk and what the effect of the risk is on, for example, the planning. This report is approved every week by the client. (Rydell et al., 2013)

Actually in this report every event that delayed the planning is stated and there is also stated who's responsibility this was. This information could be processed into performance information, because with this information there can be shown that a vendor stayed within planning when a vendor can prove with the report that all delays were either not avoidable or he can show that the delays were the responsibility of the client. In this way performance information is gathered on planning, which can also be easily verified, because the client has approved the information.

In the WRR also other KPI's can be stated which are tracked during the execution of the project. In that way the WRR is, according to the clients and expert, a good tool to gather performance information that is also verified by the client, because the clients grades the aspects in the WRR on a weekly base.

In the clients opinion to be able to gather more performance information in a shorter amount of time it is advisable for vendors to start introducing WRR also in projects that are won in traditional tenders. The WRR is both a good manner for clients and vendors to be transparent and manage a project in a good way, therefore, this WRR is useful in traditional tenders as well. Which enables a vendor to measure performances with a WRR also in other projects than BV projects.

The clients all state that there must be kept in mind by the vendors that, although performance measurement seems to be very difficult to set up, everything can be measured. You just have to
be creative. The metrics and KPI's have to be formulated in a very precise way, which allows all kinds of performances to be measured. What has to be kept in mind here is that the performance information that is gathered must be linked to the client objectives. But measurements can differ from just keeping track on things, such as keeping track of the amount of additional work that is needed in a project, but it can also be based on an opinion or grade that needs to be given by the client or a third party, such as measuring client satisfaction or the satisfaction of the environment.

11.4 EMAT

Within the main research question of this research there is stated that the possession and application of QPI by vendors cannot only improve the results on winning BV tenders, but might also improve the offers that are delivered by the vendors in all kinds of tenders. Therefore, the opinion on the use of QPI in all kinds of tenders is verified by the clients. The clients and the expert agree that when a vendor possesses QPI this can be used in all kinds of EMAT tenders. In their opinion this dominant information cannot hurt the offer in other EMAT tenders. But if it will be scored and taken into account depends on the selection and reviewing criteria that are used.

When such dominant performance information is used in, for example, an action plan, this will at least give a more positive impression of the expertise of the vendor, which will not diminish the score. And because of the dominance of the information it will help to improve the SMaRtness of the documents.

Furthermore, the clients state that when a vendor possesses QPI this means that he knows what his strengths and skills are. This knowledge is crucial for a vendor to be able to perform at a high level. Therefore, possessing this QPI is also positive for the performances of vendors and, thus, just having this information is already beneficial for all kinds of tenders.

11.5 WRR in execution

For the BV approach and effective procurement of these tenders it is important that not only during the procurement phase, but also during the execution of the project the BV approach is used. This means that, according to the literature, in the execution phase there should be a minimum of management and control by the client. One of the tools that should be used during the execution phase is, as earlier mentioned, the WRR. Although this is part of the BV approach it seems that in many tenders the BV approach is only seen as a procurement method. This is partially caused by the misleading name of BVP, but in practice it is more than just a procurement method.

The clients that are interviewed state that they all acknowledge that BVP is more than just a procurement method and that it is an approach for the entire project. They also state that in the projects that they represent from the analysed case studies the WRR is used or will be used during execution. One client, however, mentions that it still is a difficult and unfamiliar way of working during the execution phase. During the project that is being executed they at first started with using the WRR, this went well and shaped an environment of open communication and transparency. However, when there were a few bumps in the road that damaged the cooperation for a moment immediately the use of the WRR’s was stopped by the client and both the vendor and client fell back in their traditional roles. Which meant managing and controlling
the process of the vendor by the client. After a while both the vendor and client came to the conclusion that they had fallen back in old behaviour which did not seem to help the project, therefore, the relationship was recovered and the WRR and BV approach are embraced again. This example shows that clients (and vendors as well) really have the intention to embrace the entire BV approach, but that when the process becomes difficult or some problems arise it is in the nature of the client and vendor to get back to their old ways. Therefore, the use of the BV approach still is a learning process for both parties. But when a vendor and client realise this and are aware of this instinctive behaviour that is occurring, that is the first step forward towards embracing the BV approach. Being aware of your pitfalls is step one to making sure that it does not happen again.

11.7 Conclusion

According to the clients and expert QPI is hard, objective, verifiable, simple, transparent information that is related to a specific project. It also has to be dominant. Performance information is seen as dominant by clients if it is:

- Irrefutable (no discussion or interpretation possible)
- Measurable
- Verifiable
- Specific
- Realistic
- Show a high performance
- Translated to a specific tender
- Simple

The set-up of QPI and the aspects of QPI that result from the case study analysis are recognised by the clients and the expert. They are of opinion that the aspect experience is the base of QPI. In itself this experience means nothing, but by adding the aspects of ‘success’ and ‘effect’ good QPI is gained. Especially the effect of the previous experience and the proposed measure on the objectives of this specific project is crucial for good QPI. SMaRt formulation of QPI is seen by the expert and clients as a prerequisite for all qualitative documents and the offer in general. This is not specifically seen as an aspect of QPI.

When a qualitative document is set up by vendors the following steps need to be taken:

1. State the risk or value added option
2. Make your claim (what will the measure to control the risk or execute the value added option)
3. State your project specific experience
4. Substantiate this experience with the success and effect on the client objectives

The clients state that they put a lot of time and effort in the objectives of every BV tender, because in BV tenders these objectives provide the entire direction of the request for tender. The link to the specific project in these objectives is very important, therefore, often the works objectives are seen as more important than the general client objectives.

The clients do recognise that planning and budget, both the works and realisation related objectives are common and important objectives. However, they do feel that these aspects are important in every project and, therefore, should always be taken into account. Because of this
importance and the frequent occurrence as client objectives the clients agree that starting performance measurement based on planning and budget is a good start of gathering QPI. The safety objective is seen by the clients as a prerequisite. There should not be made commercial considerations on safety is the general view of the clients. The unburdening objective, is in the clients view no good objective. Although all clients used this objective in the past, they all state they will not do this again. Because of the different perceptions that exist on this objective it is not able to give good direction to the tender. The quality objective is also not seen as very common or important, because the quality aspects often return in many different objectives that together decide the quality of a project.

According to the clients and expert performance measurement is solely a task of the vendor itself. They need to decide their capabilities and decide what message they want to get across. The client should not primarily be involved in this process. However, clients also measure performances and often these performances are vendor performances. This information is often public and therefore vendors should gather and use this information as QPI. Easy ways to start performance measurements are according to several clients and the expert, the WRR and the client survey. When these two tools are extended and adjusted to be able to measure performances and get a verification by the client on these performances, this is a good base for QPI and a solid beginning of the PMS. Furthermore, they state that everything can be measured, vendors just have to be creative.

All clients and the expert state that having QPI is also beneficial for offers that are made in other kinds of EMAT tenders. They believe that having such dominant information on your own expertise and knowing what you are capable of certainly helps to make offers in other tenders better. So, improving the application QPI has multiple benefits for vendors.

### 12 Conclusion

According to the literature study the base for improving QPI and, thus, improving the offers for BV tenders is an organisation’s proposition. This proposition has to be stated at a relatively low level in an organisation to be able to make a specific proposition. The proposition should be stated in the format of the Business Canvas that is based on an organisation’s own strengths and capabilities in combination with the market demands.

Based on this proposition choices for participating in specific tenders are made. This diminishes the amount of tenders that there is participated in, but improves the winning rate. Also because the proposition gives direction to the PMS, KPI’s and thus QPI.

Within the request for tenders the client objectives are most important for clients to give direction to the tenders. There are two types of objectives works objectives and general objectives. The works objectives are often more important to the clients.

A start of a PMS is made by starting to measure the performances of two of the most common overall client objectives. These objectives are planning and budget related objectives. These objectives can both be separated into two types: realisation and works related objectives. Furthermore, performance measurement is seen as solely a task for the vendors themselves. They have to start measuring performances based on their proposition. This is harder than it seems, but there has to be kept in mind that everything can be measured as long as you are creative.
Simple measures that can be used to measure performances by making small alterations are the WRR and the client survey. When these two tools are adapted in such a way that performance information is gathered this can simply be used in every project, which enables fast gathering of performance information. What also has to be kept in mind is that clients also measure performances. This information can also be used by vendors as performance information. QPI is seen as hard, objective, verifiable, simple, transparent information that is related to a specific project. It also has to be dominant.

Performance information is seen as dominant by clients if it is:

- Irrefutable (no discussion or interpretation possible)
- Measurable
- Verifiable
- Specific
- Realistic
- Show a high performance
- Translated to a specific tender
- Simple

With these characteristics of dominant performance information there is shown that within the aspects of the SMART abbreviation only the S, M and R aspects are seen as important. Showing ambition and time-boundness are not seen as important by the clients to make QPI dominant. Therefore, from now on the abbreviation of SMART is stated as SMaRt, because these two aspects are seen as not important.

When QPI is gathered and applied it is interesting to know that good QPI consists of three different aspects. The base of QPI is ‘experience’, which is substantiated by a combination of the ‘effect’ and the ‘success’. These three aspects all need to be incorporated to apply good QPI and all need to be stated in a SMaRt way. This SMaRt formulation is seen as a requirement for not only QPI, but the entire offer.

Good QPI can also be used in other EMAT tenders. This makes these tenders also more dominant, which will at least not diminish the quality of the offer.

When a qualitative document is set up by vendors the following steps need to be taken:

1. State the risk or value added option
2. Make your claim (what will the measure to control the risk or execute the value added option)
3. State your project specific experience (base of QPI)
4. Substantiate this experience with the success and effect on the client objectives (substantiation of QPI)

If these steps are taken into account the set-up of the qualitative documents is good in the view of the clients.
Section IV: Design
13 Introduction

In this chapter the outcome of this research is presented. In this section the information from the introduction and the results from the literature background and the practical comparison are combined to be able to answer the main research question, which is:

*How can engineering companies improve the application of Quantifiable Performance Information in tenders?*

14 Roadmap

To be able to make the results from this research usable for engineering companies all results are combined in such a way that it is clear for engineering companies how they can start to improve their application of QPI. Therefore, a roadmap is made to show engineering companies which steps they need to take and which challenges they need to overcome to be able to improve their application of QPI.

The four steps that need to be set on different organisational levels to improve the application of QPI and especially the gathering of QPI are, in the end, combined in an overall roadmap. This roadmap gives an insight in how the different steps are linked to each other.

The separate steps of the roadmap are explored in the different paragraphs. At the end of each paragraph a visualisation of the findings within a sub model is presented. In these sub models also the other steps of the overall roadmap are shown to give insight on the position of each sub step within the overall roadmap.

Because the different steps of the roadmap need to be taken on different organisational levels, from a strategic and tactical to an operational level, these changes take a while. They cannot happen overnight, because processes throughout the entire organisation must be changed. However, engineering companies are participating in BV tenders at this time as well. Therefore, it is also good for organisations to know what, besides these big steps indicated in the roadmap, can be done at this time, to make improvements now. In this way the application of QPI can, immediately, be improved.

These short term improvements are called ‘quick wins’, which are achieved on a shorter notice than the big steps in the roadmap that need to be taken. When these are achieved the use of QPI is improved immediately. In every step of the roadmap quick wins are indicated.

However, there must be kept in mind that to make proper changes and improve the level of QPI to the desired level the entire steps in the roadmap need to be taken on different organisational levels to really make a change.

14.1 1. Proposition

The first step that is taken to be able to improve the application of QPI in tenders comes forward from the literature background and the practical comparison. This first step is the **formulation of a proposition**.

This is an important step and is the base of the changes that need to be made at a **strategic organisational level** to be able to improve the gathering and application of QPI.
In the conceptual model it comes forward that the proposition of an organisation is the environment in which all performance measurement and the entire process of gaining QPI takes place. This indicates that a proposition is crucial for gaining QPI. Furthermore, from the steps of BVS that are mentioned in the introduction of this research it already appeared that having an understanding of your qualities in the form of a proposition is the first phase of BVS. And, therefore, the base of every tender from the vendors point of view. (Rydell et al., 2013)

However, nowadays it seems that engineering companies do not have clear propositions and only start thinking about their expertise and how they can show their expertise when they have a specific request for tender where they can participate in. This missing step in BVS is made visible in figure 25.

Figure 22: Overview missing step BVS (Bases on (Rydell et al., 2013))

For an organisation to be able to show their expertise and what they are capable of it is necessary that they are aware of their expertise and qualities. When there is no insight in the strengths of an organisation they are not able to show their expertise in a dominant way to clients. This indicates that knowing the strengths and qualities of an organisation is the base for using QPI and, thus, for being able to dominantly show expertise. Therefore, engineering companies must fill in the gap in the BVS phase model to be able to win tenders by using QPI. (Rydell et al., 2013)

As comes forward in chapter 10 a proposition is stated by using the Business Canvas, which is shown in figure 20. A proposition is based on both the internal and the external environment of an organisation. The base and most important aspect of the proposition is the internal environment. This internal environment exists of the vendors own strengths, capabilities and qualities. When these are known the external environment is analysed. The external environment is based on the markets position and demand. The internal environment is, therefore, compared to the markets position to see if the qualities of an organisation are relevant for the market. After these two environments are known the proposition is stated. (Rydell et al., 2013)(Neely et al., 1995)

A second requirement to set up a proposition is that it is necessary that the proposition is stated on a strategic organisational level. This is important, because it needs to be supported on management level, so it can become completely integrated within the organisations working procedures and is able to put the organisation into the same mindset. It is, therefore, important that an entire organisation acts on the proposition in a consistent way. This shapes a clear and consistent environment in which it is clear what is important and what is not. (Bourne et al., 2000)(Bourne et al., 2003)(Neely et al., 1995)

A proposition helps to make information more understandable and simple, because of the clear focus of the proposition. One could see a proposition as the context in which data becomes information. It becomes logical and understandable for everyone. Although a proposition needs to be consistent it must also be noted that a proposition evolves over time. This is caused by all
the decisions that are being made and by the changing market demands. Therefore, continually the proposition has to be aligned with the changing internal and external environments. (Bourne et al., 2000) (Bourne et al., 2003)

The proposition is leading for two aspects. In first instance a proposition decides the focus of an organisation and, therefore, decides in which tenders a vendor should participate. This focus can, for example, lie on certain projects where an organisation knows they can excel in. When this is clear, for every tender there is decided if it fits within the proposition. If it does, there is participated in this tender. If it does not fall within the proposition, there should not be participated in this tender. When an organisation only participates in tenders where they can excel in the winning rate rises. (Rydell et al., 2013)

Another aspect that is lead by the proposition is that it decides which aspects of an organisation’s performances need to be measured. When a vendor only wants to participate in tenders that fit within its proposition it is important to have performance information based on this proposition. In that way performance information specifically focused on these tenders is used in their offers. Therefore, the proposition is the base for developing KPI’s. This is the next step in the roadmap for gaining QPI. (Rydell et al., 2013) (Bourne et al., 2000) (Bourne et al., 2003)

An overview of the proposition and its important aspects is presented in figure 26.

**Figure 23: Roadmap step 1, Proposition**

**14.2 2. KPI’s**

As mentioned in the previous phase the next step on the roadmap to QPI is stating KPI’s that are based on the proposition. According to the literature study a set of KPI’s is necessary for QPI, because only by measuring performances linked to the proposition an organisation is able to
gather QPI and apply this QPI to make their expertise dominantly clear. (Aedes, 2013)(Nicis Institute, 2010)
Therefore, the KPI’s need to be set up at a tactical organisational level and need to be based on the proposition. The KPI’s need to be selected and formulated in a very careful way, because the entire set of KPI’s has to give a good representation of the performances on the entire proposition.

It is good for an organisation to be aware that the KPI’s must be able to show information in a dominant, verifiable and transparent way and that it must enable the measurement of performances. Therefore, the set of KPI’s needs to comply with several characteristics that came forward in the literature study and conceptual model. For example, there must be taken into account that the data collection of a certain KPI is simple and that the set of KPI’s is consistent with the proposition. (Chan & Chan, 2004)
Furthermore, for the set of KPI’s there must be kept in mind that there is a mix needed of both qualitative and quantitative KPI’s, as comes forward in the literature study. This indicates that some KPI’s are based on hard data, which are facts. And that other KPI’s are based on softer data, such as opinions. This mix provides the most effective set of KPI’s that represents the entire proposition in an effective way. (Cox et al., 2003) (Neely, 1999) (Nicis Institute, 2010)
As stated in the literature study the KPI’s itself should ideally consist of three characteristics. A KPI should be measurable. Quantitative KPI’s are often seen as easier to measure than qualitative KPI’s. However, when an organisation is creative with stating its KPI’s both kinds of KPI’s can be made measurable. Another characteristic is that KPI’s should be relevant. This means that every KPI needs to be in line with an organisation’s proposition and must contribute to the insight on the performances of the proposition. The final characteristic is accountable. For every performance that is measured by a KPI someone should be accountable. This is important, because when a performance falls short someone can take responsibility and improve the performance. Otherwise there is a risk that no action is undertaken based on the performance information. (Nicis Institute, 2010)
Another important remark about KPI’s is that the set of KPI’s is dynamic, because it is based on the proposition that changes and evolves over time. Therefore, also the set of KPI’s evolves and changes over time. However, this must always happen in line with the proposition. (Chan & Chan, 2004)

An overview of what is needed and is important for a set of KPI’s in this step of the roadmap is shown in figure 27.
Figure 24: Roadmap step 2, KPI's

14.3 3. PMS

After a set of KPI’s is stated the next step in the roadmap can be taken. This step consists of setting up a PMS, this needs to happen on a tactical organisational level. This system enables an organisation to quantify the efficiency and effectiveness of actions undertaken by an organisation. The performances of an organisation linked to the proposition are actually measured within this PMS with the use of the already stated set of KPI’s. To be able to measure these performances and, thus, the KPI’s, performance measures are stated. (Bourne et al., 2003) The information that is used and is the output of the PMS needs to be balanced. This is necessary to be able to make the information understandable and make persons accountable for the outcomes. When there is an overflow of information in a non-structured way coming from the PMS a large part of the information is lost and the purpose of the measurements is also lost. Therefore, it is extremely important that also the PMS is in line with the proposition. Because the KPI’s are all formulated based on the proposition this will almost automatically be the case if these KPI’s and the proposition are used in a consistent way within the PMS. Within the PMS there needs to be a continuous process of monitoring, measuring, reporting and evaluating of the performances. This all needs to be done in a consistent way, so the outcome is understandable and linked to the proposition. (Aedes, 2013)(Neely, 1999) Both traditional and current measures need to be used. This means that not only financial and internally focussed performances are measured, but also non-financial and externally focussed aspects are used. Especially these externally focused aspects are important for QPI, because the
QPI is based on performance information that is important for the clients of an organisation, an external party. (Bourne et al., 2003)(Neely, 1999)
As comes forward in paragraph 6.3 a reference framework is needed for every PMS to be able to judge the outcome of the PMS. This reference framework consists of standards for every measure and KPI. In this way there is seen if the objectives of an organisation on their performances are met. (Aedes, 2013)
The factual information that comes forward from the performance measures are the base for QPI. Therefore, the next step in the roadmap is developing QPI with this performance information. In figure 28 the step in the roadmap of the PMS is shown.

Figure 25: Roadmap step 3, PMS

14.4 4. QPI

When the foundation for developing QPI is finished by having successfully completed the previous steps the next and final step in developing QPI is taken, namely stating the QPI. This application of QPI takes place on an operational organisational level.
The performance information that comes forward from the PMS is the base for this QPI. To be able to form QPI it is necessary that the performance information from the PMS is saved in a clear and transparent way, so for new tenders it can easily be gathered and used. For QPI it is important that the factual information about performances is shown in a dominant way. In this way there has to be no discussion about the substantiation of a certain measure and it is immediately clear if the expected performance is good. QPI gives insight in the value of an offer. QPI is, therefore, necessary for vendors to distinguish themselves on quality instead of price, and thus, to show their expertise. (Van de Rijt, & Santema, 2013)
For QPI to be dominant it has to comply with a few characteristics. One of the most important characteristics is that the information needs to be *irrefutable* to be dominant. This means that there must be no discussion or interpretation possible about the content of the QPI. It must be very clear. Other important characteristics are that it should be *verifiable, linked to the specific tender and that it shows a high performance*. (Van de Rijt, & Santema, 2013)

Furthermore, all qualitative documents that need to be delivered in a vendors offer need to be *substantiated with QPI*. One prerequisite where all these documents need to comply to is that all information in the qualitative documents and certainly the QPI needs to be formulated in a *SMaRt way*.

After the performance information is gained as the output of the PMS it has to be transformed to QPI. According to the findings of the case study analysis and the interviews there is concluded that the base of QPI is *the experience* that a vendor has with similar projects. This experience should be stated first as *the base of the QPI*. After that *the effect and the success* of the experience need to be shown. With the effect there is meant what the experience in previous projects will specifically bring for this tender and what the effect of this experience will be on the clients objectives. Furthermore, it is important to state that the experience was a success and to show that the effect on this project will also be beneficial for the client objectives. This must be made explicitly clear.

An overview of what is needed to be able to apply QPI is shown in the final step of the roadmap in figure 29.
As comes forward in the previous paragraphs four steps need to be taken to be able to improve the application of QPI by engineering companies. In the previous paragraphs these four steps are explored separately. In this paragraph the entire roadmap and, thus, all steps in relation to each other are explored. A representation of this is shown in the roadmap in figure 30.

As mentioned in paragraph 14.1 the first step to improve the use of QPI is stating a proposition. This proposition is the base on which QPI is formulated. It gives direction to decide in which tenders there needs to be participated and it gives direction for stating a set of KPI's. Stating a set of KPI's is the second step that needs to be taken within this roadmap. The set of KPI's has to be very diverse and should consist of both qualitative and quantitative KPI's. With these KPI's performance measurement is enabled.

Therefore, the next step in this roadmap is setting up a PMS in which the KPI's can actually be formed into measures that will measure actual performances. Within these measures it is important that not only internal and financial performances are measured, but also external and non-financial measures are taken. These measures will give a good insight in the actual
performances of an organisation. This performance information is the base for setting up and applying QPI.

The next, and final, step in the roadmap is actually stating the QPI. With the performance information that comes forward from the PMS, the QPI that is used is improved. What also helps to improve the application of QPI is the insight that QPI needs to consist of three different aspects. The base of QPI is stating experience. This needs to be substantiated and followed by stating the effect of the experience for this project on the client objectives and stating that this was and, therefore, will be successful. Furthermore, it is good to keep in mind that this QPI is formulated in a SMArt way.

**Learning loops**

Within the overall roadmap there are several loops incorporated that are focussed on giving feedback between the different steps. These loops are seen as learning loops, because with the insights that are given throughout the roadmap things are continuously evaluated, learned and adjusted.

The first learning loop that is important within the roadmap is made visible within the overall roadmap in figure 30. This loop runs from the PMS back to the proposition. As mentioned in paragraph 5.1 the PMS helps to evaluate and adjust performances. This means that the PMS gives a good insight in the performances of an organisation, because these performances are measured and set against a reference framework. Therefore, the performances are evaluated and can adjust the proposition. It is, for example, possible that from the measurements it appears that what is seen by the organisation as a strength is not a real strength of the organisation, because the performance measurements show no good results on the performances of this strength. But maybe it also gives insight in some aspects that an organisation excels in which are, until then, not seen as an expertise of the organisation. These insights create an incentive to change the proposition. Therefore, the PMS can challenge the proposition. It enables an organisation to give feedback to their own proposition and to adjust and improve this proposition based on the actual performances of the organisation. It provides a learning experience about the proposition and the actual performances of an organisation.

Within this first loop also the step of setting up a set of KPI’s is involved, because when a proposition is adapted the KPI’s will change with the proposition, which will influence the PMS. As already seemed in paragraph 6.3 the outcomes of the KPI’s from the PMS are seen as incentives to make changes. In this loop these changes are made.

The second learning loop that is also directly visible within the roadmap in figure 30 becomes visible between the stating and applying of QPI in a tender, winning a tender and the PMS. When an organisation is able to formulate QPI this can be applied in offers for BV tenders. This is also shown in the model. When QPI is used this makes an offer dominantly better, which leads to higher scores and a higher winning rate of tenders.

When a tender is won and a project is executed this leads to more input for the PMS, because these performances are also measured. The performances of these projects that are measured lead to more performance information and, thus, more QPI. With this QPI again more tenders are won. Therefore, it seems that improving the application of QPI will work as a catalyst for winning more tenders, which will work as a learning experience over every tender that is participated in with QPI and every new tender that is won. This loop, thus, keeps on improving the application of QPI over time. It is a continuous process.
What, furthermore, is interesting to notice is that in paragraph 4.2 it is shown that a person gets better in perceiving information over time. The good thing about this is that over time the clients also get better in perceiving the QPI, therefore, the information becomes more clear to them. Which will, over time, help to bring across an organisations expertise to clients.

The vendors themselves also seem to get better in perceiving and applying the performance information.

When an engineering company completes all four steps and keeps on evolving these steps the application of QPI will keep on improving over time.

![Diagram](image)

**Figure 27: Roadmap to improve application of QPI**
To be able to improve the use of QPI in tenders by engineering companies four steps need to be taken on a strategic, tactical and operational organisational level. These four steps are combined within a roadmap.

The first step of this roadmap isformulating a proposition. This needs to be stated on a strategic level and should be based on the strengths of an organisation in combination with the market demand. Therefore, the proposition should be stated based on the Business Canvas.

The proposition, furthermore, gives direction to the choice of tenders in which an organisation should participate. It is also leading for the KPI’s that are stated, this is the next step of the roadmap to improve QPI.

Creating a diverse set of KPI’s is the following step in the roadmap that needs to be set up on a tactical level. The KPI’s are based on the proposition that is formulated in the previous step. The characteristics that a KPI needs to have are: Measurable, Relevant and Accountable. These KPI’s are needed to enable performance measurement. The next step of the roadmap is setting up a PMS.

A PMS is needed to be able to gather performance information and also needs to be set up on a tactical level. The KPI’s are the input of this PMS. To be able to measure the KPI’s performance measures are needed. These measures need to measure the past performance of an organisation based on the proposition. The results of the PMS is performance information.

In the next and final step of the roadmap the performance information that comes forward from the PMS is used and transformed into QPI on an operational level. This QPI needs to be dominant and SMaRt. QPI consists of three different aspects. The base of QPI is the experience that an organisation has, this experience needs to be substantiated with the effect and success. The effect and success need to make clear what this experience means for this specific project.

To be able to improve QPI with this roadmap changes need to be made on a strategic, tactical and operational level.

Furthermore, two learning loops are visible within the roadmap. The first loop runs from the PMS to the proposition. In the PMS the performance information gives insight in the actual performances of an organisation. This information challenges the proposition. The proposition evolves, because of this information. Which also affects the KPI’s that change along with the proposition.

There is a second learning loop visible in the roadmap between the stating and application of QPI in tenders, winning tenders and the PMS. When QPI is used in tenders, more tenders are won. Then more performances are measured by the PMS. This leads to more and better QPI, which in the end will lead to winning more tenders again. QPI is, thus, a catalyst for winning tenders. It is a continuous process that keeps on improving the application of QPI.
These changes in the roadmap will not happen overnight, time is needed to make them. Therefore, also some quick wins for every step in the roadmap are mentioned. These quick wins are things that engineering companies can start changing right away. In that way improving QPI can start immediately. Overall there is concluded that the roadmap is a good first step for engineering companies to change their organisation on a strategic, tactical and operational level to be able to improve their application of QPI. Furthermore, this research contributes to the overall improvement of the BV offers by vendors by improving their qualitative documents in general.
Section V: Conclusions
Conclusion

This research is an exploratory research on how engineering companies and vendors in general can improve their application of QPI within tenders. The urgency for this research comes forward from the gap that is visible in the current application of QPI by vendors and the expected level of QPI by the clients. The main objective for this research is, therefore, to develop a model that helps engineering companies to improve the way they measure, formulate and apply QPI.

The main research question that is answered is:

How can engineering companies improve the application of Quantifiable Performance Information in tenders?

Important aspects from literature study

In the research three steps are taken to be able to answer this question. At first a close look is taken at the currently available literature about BVP and tenders in general. After that the currently available literature is explored on aspects that are linked to QPI.

From the literature study there is concluded that there are three important subjects that are needed to be able to gather and apply QPI. These three subjects are: an Information System (IS), a Performance Measurement System (PMS) and a set of Key Performance Indicators (KPI’s).

Furthermore, these three linked aspects all need to be set in the environment of an organisations proposition. A PMS is a system that consists of several performance measures, which use a set of KPI’s as an input. When all performances are measured in line with the proposition and its corresponding KPI’s the outcome of the PMS is performance information. This performance information is transformed to QPI. This QPI can then be used in new tenders that are also in line with the organisations proposition.

A conceptual model gives an overview of the three different aspects and the environment of the proposition in relation to improving the application of QPI.

Insights from practical comparison

After this literature background is completed a practical comparison is performed, which verifies the findings from the literature study and gives new insights on the current practice.

Proposition

A proposition can best be stated based on an organisations strengths in combination with the markets demand. The Business Canvas is used for stating the proposition. This proposition is leading for the tenders that are participated in.

Performance measurement

Performance measurement is seen as solely a task for vendors. Therefore, vendors need to start measuring performances. A good start can, for example, be made by measuring aspects of two of the most common client objective categories: planning and budget. But there must also be kept in mind that almost a quarter of the client objectives is focused on project specific aspects. These are hard to measure. However, when a tender falls within an organisations specific expertise maybe there is performance information available for these project specific objectives.
**Qualitative documents in general**

According to the clients not all 5 aspects in the SMART formulation are seen as important. According to the clients the offer of a vendor does not necessarily need to be ambitious or time-bound. Therefore, these letters are made small in the abbreviation and the focus will lie on the Specific, Measurable and Realistic aspects.

When a qualitative document is set up by vendors the following steps need to be taken:

1. State the risk or value added option
2. Make your claim (what will the measure to control the risk or execute the value added option)
3. State your project specific experience (base of QPI)
4. Substantiate this experience with the success and effect on the client objectives (substantiation of QPI)

If these steps are taken into account the set-up of the qualitative documents is good in the view of the clients.

**QPI**

QPI is seen by the clients as hard and objective information. This information is verifiable, simple and transparent. Another important aspect of QPI is that it is linked to a specific project. According to the clients performance information also is dominant.

Performance information is dominant when it is:

- Irrefutable (no discussion or interpretation possible)
- Measurable
- Verifiable
- Specific
- Realistic
- Show a high performance
- Translated to a specific tender
- Simple

Furthermore, QPI consists of three different aspects. The first aspect is ‘experience’. This aspect is the base of QPI, in which vendors can show they have relevant experience in related projects. This experience is substantiated with the following two aspects. These aspects are the ‘effect’ and ‘success’. The effect aspect consists of showing what the effect of the measure is on this specific project. The success aspect consists of stating that the previous experience and, thus, the proposed measure is successful. This aspect goes hand in hand with the effect, but they are mentioned separately to make the success also dominantly clear.

QPI is formulated in a SMaRt way. This is a prerequisite for all QPI and the entire qualitative documents.

**Design**

All the previous findings are needed to come to a roadmap that engineering companies can use to improve their application of QPI and, thus, answer the main research question. Therefore, all findings are combined. There is concluded from the findings in the previous sections that there are four aspects visible that are needed to be able to improve the application of QPI. These four aspects are:

1. Proposition
2. KPI’s
3. PMS
4. QPI

Based on these four aspects a roadmap is made that is used to make necessary changes on a strategic, tactical and operational organisational level to be able to improve the application of QPI.

The first step that needs to be taken is stating a proposition. This is the base on which QPI is built. This proposition gives direction to two different aspects. First of all it gives direction to the tenders in which an organisation participates. It helps to make actions and decisions within an organisation consistent. Secondly, it is leading for developing a set of KPI’s. The proposition is based on the Business Canvas, with a base that focuses on an organisation’s own strengths. This is combined with the markets demand. It also has to be taken into account that a proposition develops over time.

The second step in the roadmap to QPI is that a set of KPI’s is developed. A set of KPI’s evolves with the proposition and consists of diverse KPI’s. There should, for example, be incorporated both qualitative and quantitative KPI’s. Furthermore, a set of KPI’s enables performance measurement in line with the proposition. Therefore, the next step to improve the use of QPI is setting up a PMS. In the PMS for all KPI’s performance measures are stated to enable performance measurement. Within these measures it is important that not only internal and financial performances are measured, but also external and non-financial measures are taken. The outcome of the PMS is performance information of an organisation that is in line with the proposition. This information gives insight in an organisation’s performances, which is compared to a reference framework. This insight in the performances challenges the proposition. Therefore, a learning loop in the roadmap is visible between the PMS and the proposition. This is a continuous learning process.

From the performance information that is the output of the PMS QPI is made. This the next, and final, step in the roadmap. For stating QPI the three aspects of QPI are used. The base of the QPI is ‘experience’, which is substantiated with stating the ‘effect’ and the ‘success’. Furthermore, the QPI is formulated in a SMaRt way.

When this QPI is stated it is applied in tenders. The use of QPI improves the quality of an offer. Therefore, more tenders are won and in the execution of these projects, again, performances are measured. Therefore, QPI leads to winning more tenders, more performance measurement and more QPI. This is the second learning loop that is visible within the roadmap. Within this loop QPI keeps on improving over time.

This roadmap is, therefore, on a strategic, tactical and operational level the base for engineering companies to improve their application of QPI.

**Quick wins and the checklist**

Changing an organisation’s way of working on a strategic, tactical and operational level will take some time. However, from this research also several aspects come forward that fall within the roadmap, but can make changes on a shorter term. These changes improve the application of QPI and are a good start for engineering companies to make changes now. These changes are called: quick wins.

Also a checklist is made for engineering companies to check their offers on several aspects that come forward as flaws in the qualitative documents according to the clients. This checklist leads
not directly to an improvement of the application of QPI. But it will improve the quality of the tenders overall, because it can be used to predict if and prevent that mistakes are made. Especially the general and risk file related aspects are predicted and prevented by using the checklist. Therefore, it will support the quality of the tenders in general and the application of QPI.

**Overall conclusion**
With the roadmap engineering companies are able to improve their application of QPI. The roadmap indicates a good process for improving QPI. It allows engineering companies to gain more insight in what is needed for QPI and also gives insight on how the QPI can be applied. The quick wins that are formulated in the roadmap also helps engineering companies to make improvements on the gathering and application of QPI on a short term. Therefore, there is concluded that the roadmap and the quick wins are the answer to the main research question. Furthermore, the outcomes that are related to the qualitative documents, the general quick wins and the checklist, maybe do not directly contribute to improving the application of QPI, but it does support, complement and improve the offers, in which the QPI is used, in general. Therefore, this research helps engineering companies not only to improve their application of QPI, but also to improve their tenders in general.

**Scientific relevance**
The contribution of this research to science is the roadmap. There is, nowadays, no literature available that focuses on QPI combined with the way this could be gathered and applied. This research fills this scientific knowledge gap. It gives new insights on which processes are needed within an organisation to be able to gather and apply QPI in an effective way. The scientific relevance is enlarged, because not only the view of the vendor is taken into account, but also the clients perspective is analysed. Because of these insights the research objective is met and the research question is answered.

**Practical relevance**
The practical relevance of the research is large. The outcomes of the research can be applied by engineering companies or other vendors. The first contribution to the engineering companies is the roadmap. This roadmap gives direction for the engineering companies to set up their proposition, KPI’s and PMS to be able to gather QPI and apply it in tenders. When QPI is available and used in the way as described in the roadmap the quality of the qualitative document will improve and more tenders are won. Also because the roadmap ensures that engineering companies only subscribe in tenders within their expertise the winning rate gets higher. Another outcome of the research that also contributes to the practice of engineering companies and application of QPI are the quick wins. The quick wins within the roadmap are of relevance, because they provide fast ways for engineering companies to improve the gathering and application of QPI. This is needed, because it will take a while before all steps in the roadmap are taken. With these quick wins improvements of QPI can be made now. Furthermore, the general quick wins and the checklist do not directly contribute to improving the application of QPI. The open minded attitude that is kept within this research contributed in gaining these extra insights. With the quick wins and the checklist not only the QPI, but the
entire quality of the qualitative documents is improved. This gives engineering companies direction, guidance and support during the setting up of the qualitative documents. Which will support and complement the improvements that are made within the gathering and application of QPI and make the offers overall better. This will, hopefully, result in winning more tenders.

19 Recommendations

After performing this research a few recommendations are made for further research. In this research a certain amount of time is available, therefore, there are still some aspects visible that can be made clear with further research. Here the recommendations for further research are explored.

- Firstly, I would recommend that further research is performed about the implementation of the roadmap to improve the application of QPI. The steps in the roadmap are stated to all together help to improve the application of QPI. But implementing this roadmap and making changes within an organisation on a strategic, tactical and operational level is worth an entirely new research. Therefore, further research should be performed on how these changes can be made and the roadmap can actually be implemented.

- It is interesting to see if the changes that I propose within my roadmap and the quick wins will really lead to the improvement of QPI and, thus, better scores from the clients. Because these changes will not happen overnight it is interesting to make a new analysis two years from now to see if the evaluations of clients have improved and if this is also visible in the scores and winning rate. This would be a good validation of the roadmap and the quick wins.

- A step of the roadmap that can also be researched to a further extend is the PMS. From this research and specifically the interviews with the clients and employees of Grontmij it appeared that performance measurement is very hard for engineering companies. It seems to be logical and simple, but developing a PMS that extracts exactly the right performance information is really difficult. Therefore, it is advisable to do some extra research specifically on performance measurement and how this can actually happen in an effective way to really make sure that the performance information can be used in QPI.

- Another recommendation to further research is linked to the previous recommendation. What is also a difficulty in the road to QPI is making the performance information available and applicable for QPI. There is a system or database necessary where all performance information can be saved, sorted and categorised in such a way that it can easily be found and re-used in BV tenders. When this is the case and a database is available it will become more easy to find relevant performance information for different tenders. This will save time and money that is spend on setting up offers for tenders. Therefore, further research should be performed on setting up such a database.

- An aspect of BV tenders that has been under exposed in this research is another qualitative document that also needs to be delivered in BV tenders. This document is called the performance substantiation. In this research this document is not taken into account, because in the BV tenders that are researched no performance substantiations are requested. But in new BV tenders this file is requested. Therefore, it is interesting to research what the common mistakes or pitfalls within this document are, how QPI can be incorporated within this document and what the clients perspective is on this document.
According to the view of the clients in this research the aspects of ambition and time-boundness are not very important for QPI. However, in the SMART assessment tool analysis compared to the clients opinions I did incorporate these two aspects. It is also interesting to see in a new analysis what the outcome of the analysis of the SMART assessment tool would be when only the SMR aspects are taken into account. According to the clients these are the aspects where they review SMARTness on. So, one would assume that the clients scores come across with the scores of the SMaRt tool.

My final recommendation for further research is based on all different kinds of BV tenders that are being used. Because of the growing publicity on BVP more clients are using BVP. However, there are a lot of clients that do not use the BVP philosophy entirely. Therefore, there are several tenders that only use a part of the BV method or only use it as a procurement procedure. For example, some clients only use the interviews or the risk file in other tender procedures. These different variants of BVP do not contribute to the transparency that the BV tenders normally offer. When a client only asks a client risk file as an addition to the action plan the vendors do not know if this risk file is reviewed based on the BV philosophy. Therefore, these different variants lead to less transparency and more vagueness about the review of the tenders. Additional research to these tenders that only use a part of the BV philosophy is necessary to make clear how vendors can cope with these tenders.
Discussion

An interesting insight was given in an interview with a client. This insight is that the BV philosophy can also be seen as a method that makes it more clear and predictable which vendor will win a certain tender. This is the case, because if vendors follow the BV philosophy they only participate in the tenders that fit within their proposition. Therefore, only real experts participate in tenders. This eliminates a lot of vendors from participating on forehand. This lowers the amount of vendors that subscribe in every tender. Which is a start of making the winner of a tender more predictable.

Another insight here is that there is also a shift visible from 'the client chooses the best vendor' towards 'the vendor chooses their client of choice'. Instead of always having a lot of vendors that participate in all tenders and the clients choosing the winning vendor from that large group a shift is visible to a situation where the vendors choose their client. In the ideal situation a vendor only participates in tenders they can excel in, because they are in line with their proposition. Therefore, they only participate in tenders they know they can win. This indicates that the vendors actually choose the clients that they want to work for. This is an interesting shift, because this changes the vision of procuring entirely.

A positive effect that comes forward from using BVP is the fact that vendors are being forced to analyse their performances. Therefore, vendors gain new insights about their actual performances, are forced to think about what their performances mean to a client, they reconsider their performances and think about how they can transfer their performances to the client. These insights and moments of reflection of an organisation on its performances will improve their performances over time. Which will benefit the construction industry, the clients and the vendor itself. In this view BVP as a procurement method contributes to better performances and a better construction industry in general.

However, if nowadays the real experts are found with this procurement method I am not sure. I think that all vendors first need to improve their proposition, PMS and QPI to really be able to dominantly proof their expertise. I expect that in two years most vendors have gathered performance information and can really proof their expertise. From then BV as a procurement method can really start working.

According to the BV theory and methodology BVP seems to be a very logical way of procuring and working. However, after performing this research I think that, although it sounds logical and easy, for almost every vendor and client BVP is still difficult and a real challenge.

For clients it seems to be a challenge to change their normal ways of working. This starts by setting up entirely different request for tenders. Where especially the objectives that they state are crucial and leading for the rest of the project. Stating good and clear objectives seems to be hard according to several clients. They have to put a lot of thought and effort into them and need to make sure that they also consist of dominant and SMaRt information. This is needed, because the objectives need to be very clear and no discussion or interpretation should be possible about them. Otherwise the result of the tender will not match with the desired outcome.

However, what is the most difficult and crucial part of the BV method is the actual cooperation during the phases that follow on the pre-award of the assignment. What is especially difficult is letting go of the old ways of cooperation. The clients need to let go their ways of management
and control. To be able to do this they must be completely convinced by their choice for a specific expert. Because when they can have faith in a good result, letting go is easier. This indicates that procuring with BVP is not, yet, enough to ensure a client that he has found the best party for the project. Otherwise these doubts would not exist.

An important aspect to overcome these doubts in the execution phase is that the vendor must give transparency in its way of working to be able to assure to the client that they know what they are doing and that the project is going in the right direction.

It all seems to revolve about cooperation. It is important that the teams of both the vendor and the client give each other their room, while also giving insight in each other’s work. Only in that way they are both be able to let go.

These challenges and difficulties that clients and vendors have indicate that the BV methodology is not as easy as it seems. In the coming years the vendors need to step up their game to be able to really become an expert in a certain area of expertise and to show that in tenders, this research can contribute to make these improvements. The coming years will show if clients and vendors are able to overcome these challenges.

If both clients and vendors can settle in cooperating in a completely different way, without falling back to all kinds of controlling measures and needs to ask for additional work the BV method will be able to prevail. Because only when a client can truly find the best expert this ideal form of cooperation that BV promises will be possible.

But if they can overcome these challenges I believe that this will change the industry for the better and that BVP will be used more frequently. However, if both the client and vendor are not able to close the gap to use the BV methodology in the correct way, especially if the cooperation with each other does not improve, I do not know if BV will still be used in the future. Then I think it will evolve or will be replaced by another quality focused method.

For now, however, I think that BVP has set a good first step to make a change in the construction industry away from the focus on price.
References


Booij, A. (2013). Towards the Best Value vendor. 
http://repository.tudelft.nl/view/ir/uuid%3A0f388691-ff19-4a09-9fd9-ec3f144f5f8b/ Last visit: 10 March 2014.


Grontmij (2013f). Risicodossier Opdrachtgever definitief, NWO. 
http://www.emeraldinsight.com/journals.htm?articleid=849266&show=abstract


Loenhout, C. Van (2013). Public project manager's perspective on project success. http://repository.tudelft.nl/view/ir/uuid%3Af1dced58-3da5-466a-b74a-7a5034460aff/ Last visit: 16 April 2014.


Rijkswaterstaat (n.d.b). *Resultaten*.


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