Performance Indicators in the Best Value Approach

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One of the distinctive aspects of the Best Value approach compared to traditional approaches is the use of dominant information: simple, non-disputable information. It enables experts to explain complex situations to non-experts in a clear way. This leads to increased transparency in the supply chain and to mitigation of risks. Rijkswaterstaat, as one of the worldwide leading clients using the Best Value approach, pays increasing attention to performance information in their Best Value projects. However, both client and contractor encounter several problems, such as a lack of support for and performance measuring, difficulties in collecting data and a lack of knowledge regarding the development and use of performance indicators. This paper describes the problems encountered based on interviews with practitioners of both client and contractor. Suggestions are made to resolve these problems. Furthermore, a process model for the development and use of performance indicators in infrastructural Best Value projects is proposed. This model is based on theory and validated in practice.

Keywords: Best Value approach, performance indicators, risk management, infrastructural projects, Rijkswaterstaat

Introduction

An emerging procurement and project management method is the Best Value approach. Key aspects of the Best Value approach are a win-win situation for both client and contractor, a high value for a low price, less management, direction and control of the client, and giving contractors the space to show their expertise (Kashiwagi, D. T. 2013). Over the years, the Best Value approach has evolved from a procurement method to a combination of procurement method, project management method, and risk management method. Increasing attention is paid to the use of simplistic measurements in all three phases of the process (i.e. selection, clarification and execution). Performance indicators are used to put these measurements into context by defining a target value and thus a qualification if the performance is sufficient or not.

The use of Best Value at Rijkswaterstaat started in 2008, when more than half of the Spoedaanpak program (i.e. 16 of 30 projects concerning resolving major bottlenecks on the Dutch highway network) was delivered using the Best Value approach (Rijt, van de et al. 2011). Because of the success of the approach in this program, Rijkswaterstaat decided to test the approach in other pilot projects.

Rijkswaterstaat did not prescribe the use of performance indicators by contractors in their first pilot projects, because the approach was new to market parties and therefore the focus was mainly on the procurement and the risk management by using Weekly Risk Reports. The increasing attention in the Best Value approach for performance information (Kashiwagi, D. T. 2013), however, made Rijkswaterstaat decide to pay more attention to developing and using performance indicators. Contractors were asked to develop and deliver a set of performance
indicators at the end of the clarification phase and to measure on these indicators during the execution of the project.

During the project, however, both contractors and Rijkswaterstaat encountered that the attention for the indicators decreased as the project progressed and that project teams of both client and contractor were critical about the need to use the indicators. Moreover, some of the indicators developed were not measured because they turned out to be impractical and too time and resource consuming. Because the use of performance indicators was a novelty to contractors, they found it hard to collect data. Scientific relevance for research on the area of performance indicators in Best Value projects is earlier mentioned by Kashiwagi et al. (2013): “further research (...) is needed in (...) the impact of the BV approach on performance metrics”.

Concluding, both client and contractor require help with developing and using performance indicators in Best Value projects. We highlight one specific problem – the lack of knowledge regarding the development and use of performance indicators – and for this problem, we propose a process for developing and using performance indicators in Best Value construction projects. This leads to the following research objective: to propose a step-by-step model for contractors and Rijkswaterstaat, for the process of developing and using performance indicators in Best Value projects.

**Literature: Performance Indicators**

Before the problem analysis in the field, we will first take a closer look at the role of performance indicators in the Best Value approach. Next, we will summarize the findings from literature on performance indicators in construction projects. To conclude this section we will confront the findings from our literature study on performance indicators in construction project with the literature on the Best Value approach.

**Performance Indicators in the Best Value Approach**

Figure 1 schematically shows how performance information is used in the approach. During the selection phase, verifiable performance information of risk measures, value-added plans and the capability of the contractor are used to support the submittals and the interviews. The client verifies the information of the prospective contractor in the clarification phase. During the clarification phase, the contractor develops a project management plan and a list of risks, including mitigation measures. The project management plan and list of risks are also supported by verifiable performance information.
Besides the project management plan, the list of risks including mitigation measures and other deliverables (e.g. a scope list and detailed planning), the contractor is required to provide a list of performance indicators at the end of the clarification phase. These performance indicators should be related to the most important project goals and top risks of the project. During the execution, the contractor measures the performance and takes action on the indicators. The indicators are communicated to the client in the Weekly Risk Report.

In future tenders, the contractor can use the measurements done in the current project, in order to support the several submittals and the interviews. Therefore, the contractor has an incentive to deliver a high performance in the current project.

From a theoretical perspective, performance indicators also play an important role in Best Value projects. The Information Measurement Theory of Kashiwagi, D. T. (2013) stresses the importance of transparency in the supply chain. As a form of dominant information (i.e. non-disputable, verifiable, accurate information), performance indicators increase transparency. Kashiwagi states that, in the end, risk is mitigated through transparency. This is contrary to traditional projects, where management, direction and control are used by the client, leading to non-transparency and a win-lose situation. Practical research showed that dominant information is unique for the approach, according to 84% of the practitioners. The practitioners agree that dominant information and not management, direction and control increases value on the projects (Kashiwagi, J. S. 2013).

From the perspective of New Institutional Economics, the need for performance measurements is also confirmed. Van Duren (2013) researched the several aspects of the Best Value process and concluded that seen from this perspective, performance management to less uncertainty, that it takes bounded rationality into account, and that it leads to lessened tendency for opportunistic behavior.
Performance Indicators in Construction Projects

The construction industry is known for its low performance compared to other industries (Vrijhoef, 2011). The main reasons stated in the literature for this low performance are the complex nature of building projects, the existence of many disciplines and stakeholders, the fragmented processes in the project, and the uniqueness of each project. In the last years, this has led to several attempts for improvement. One of these attempts is the use of performance indicators. However, the construction-specific characteristics require a slightly different way of using performance indicators, which is described below.

Complexity

Knowledge from various disciplines is needed to finish the projects. Moreover, many stakeholders have an interest in the project. These stakeholders include not only the client, the contractor, and his subcontractors, but also other governments, end-users, local residents, NGOs, etc. The number and kind of disciplines and stakeholders vary however per project. Since all disciplines and stakeholders are part of the project, the indicators have to represent somehow these disciplines and stakeholders, in order to be supported. Therefore, a common, generic set of indicators can only be applied partly in construction projects.

Fragmentation

A construction project is a process that consists of various phases. These phases, such as the pre-project phase, design phase, and construction phase, are interdependent but also very different in nature. Therefore, the performance indicators have to be tailored to each phase, instead of using one set of indicators during the whole project.

Uniqueness

Although many construction projects are in some way similar, they all have certain uniqueness, because of for instance unique ground and weather conditions, specific user requirements and special stakeholders. This uniqueness means that a generic set of indicators that can be used in every project are partly applicable; project-specific indicators are also needed.

Types and Examples of Indicators in Construction Industry

Traditionally, performance indicators in organizations are mainly about financial aspects, although many studies show that these aspects are no longer sufficient, as they do not stimulate continuous improvement and innovation. Kaplan & Norton (1992) address the need for a mix of financial and operational indicators. They come with four perspectives for goals on which the indicators should be linked, namely a customer perspective, an internal perspective, an innovation and learning perspective, and a financial perspective.

Atkinson (1999) calls the financial criteria, together with time and quality, the “iron triangle”, and concludes that these three criteria alone should not be the only project management criteria that have to be measured. Neely (1999) argues that financial indicators encourage short-termism,
lack strategic focus, and fail to provide data on quality, responsiveness and flexibility, encourage local optimization, and do not encourage continuous improvement. Toor & Ogunlana (2010) conclude that construction projects are slowly moving away from traditional indicators towards a mix of qualitative and quantitative indicators.

Ghalayini & Noble (1996) as well as Kagioglou et al. (2001) make a distinction between lagging and leading indicators. Lagging indicators are indicators that indicate results in the past. These indicators give little possibility to improve the performance. This is contrary to leading indicators; these indicators give an opportunity to steer. This is agreed by Haponava & Al-Jibouri (2009), who urge the need for process-based indicators. Examples of lagging indicators are financial indicators such as total costs, which only tell something about the outcome; an example of a leading indicator is client satisfaction, since this indicates the quality of a process and changing the process can influence the indicator.

Cox et al. (2003) see two types of indicators: qualitative and quantitative. Quantitative indicators are indicators that can be physically measured and that do not place a heavy burden on the field personnel. Examples of quantitative indicators are percent complete and total rework. Qualitative indicators are indicators that are less easy to measure. Examples of qualitative indicators are safety or absenteeism.

Beatham et al. (2004) make a distinction between three types of indicators: Key Performance Indicators (KPIs), Key Performance Outcomes (KPOs), and perception measures. In their research, they see KPIs as performance measures that indicate the performance of an associated process. This indication provides an opportunity to change and to take corrective action. An example of a KPI is the number of complaints of road users, which may indicate a low performance in limiting the nuisance of the work. On the other hand, KPOs are considered as the results of a completed process, which means that they do not offer the opportunity to change. They can be used to change the next process, but the results of the current process cannot be changed. An example is total overrun in days, which quantifies the outcome of the performance. The third type of indicators is perception measures. They are measures that measure the perception of people and they are carried out by direct question or survey. Perception measures can be used both during the project and at the end of the project. An example of a perception measure is client satisfaction.

Finally, Chan & Chan (2004) make a distinction between objective and subjective indicators. The first type can be calculated using mathematical formulas. The second type is based on subjective opinions and personal judgment of the stakeholders. Objective indicators include construction time, net present value, and accident rate, whilst subjective indicators include quality, client satisfaction, and end-user satisfaction.

Concluding from the overview above, other indicators than time, cost, and quality are of importance. Moreover, several scholars advocate performance indicators that enable to steer during the process.
Impact of the Best Value approach Best Value Indicators

The last section showed a wide range of indicators, mostly generic indicators that can be used in every project. However, the specific characteristics of construction projects (i.e. complex, fragmented, and unique) showed also the need for partly using project-specific indicators, in addition to generic indicators. Generic indicators can be used for company-wide and industry-wide comparison, which is less possible with project-specific indicators. Meanwhile, project-specific indicators can be more effective when closely steering on specific, important aspects of a project.

Best Value has an influence on the use of performance indicators in general infrastructural construction projects: the contractor is responsible for developing and measuring the indicators. The goal of these indicators is to show the performance of important aspects of the project in a dominant, transparent way to the client. These important aspects are the project goals and the risks that threaten the achievement of these project goals. To a certain extent, these project goals are generic. Examples of such project goals are finishing the project within time and budget and satisfying the client. These indicators are also measured in the Weekly Risk Reports, but other generic indicators may exist.

However, a part of the project goals is unique for the project itself or unique for the phase of the project. Moreover, the risks of a project are mainly project-specific. Because Best Value stresses the need to measure the performance on the project goals and to measure the performance of mitigating the top risks of the project (risk is mitigated through transparency and thus with performance indicators), performance indicators in Best Value projects are much more project-specific. For example in a project of building a tunnel, the generic indicator profitability is important for the contractor to measure, but is not directly connected to a project goal or top risk and is therefore less important to communicate according to the Best Value approach. However, a top risk of the project (as indicated by the expert contractor) can relate to the integration of the safety system in the tunnel. An indicator that measures the performance of this integration gives transparency regarding this top risk and enables the contractor to steer closely on this risk and hence mitigate the risk.

The Weekly Risk Report, the expert role of the contractor, the measurements he conducts, and the focus on transparency and risk mitigation are unique for Best Value and therefore, project-specific indicators play a bigger role in Best Value projects compared to general infrastructural construction projects. Therefore, we develop a model to help in the development and use of performance indicators in Best Value projects.

Research Methodology

Considering the developing character of this research, the framework chosen for this research is based on the design science framework of Hevner et al. (2004; 2007). Figure 2 shows the model as adapted for this research.
The primary components of forming a model are the environment and the knowledge base, which are therefore studied first. The left side of the model shows the environment. In this research, this environment consists of the Best Value projects of Rijkswaterstaat. A thorough analysis of these Best Value projects, especially on the problems encountered with performance indicators, is needed, as this defines the relevance for this research and the input for the model. This problem analysis is done by holding semi-structured interviews with experts from both the client and the contractor side. The aim of these interviews is to find out what problems are encountered by client and contractor using performance indicators in practice. Ten interviews were held, of which four with contract managers of Rijkswaterstaat and six with contract managers of engineering firms and general contractors. The contract managers work in six different projects that are currently executed: one exploration study, two planning studies, two Design and Construct (D&C) contracts and one performance contract. In total, eight different firms or contractors execute the projects. A broad selection of contract managers, from both the perspective of client and contractor, and analyzing very different projects helps in creating a broad view of the problems regarding the use of performance indicators (resource triangulation). The description of the environment will lead to a business need. The business need is one part of the input for the model.

The right side of the framework shows the knowledge base, which consists firstly of an extensive literature study on Best Value and on performance indicators in construction and secondly of a data analysis of previous Best Value projects at Rijkswaterstaat. In the literature study on
performance indicators, the focus is on their use in common construction projects, because no literature is available on performance indicators in Best Value projects. Therefore, a literature study on the Best Value approach is performed to find out to which extent the use of performance indicators in the Best Value approach is different from the use in common construction projects. These possible unique aspects of Best Value are an important base for the model. In addition to theory, data analysis is executed on previous Best Value projects of Rijkswaterstaat. This is done because a first view on the Best Value approach showed that there is a strong relationship between performance indicators and risk management. To find out what and why risks occurred, weekly reports of previous projects are analyzed. The literature studies and data analysis are the applicable knowledge. The quality of this applicable knowledge is called the degree of rigor of this research. The applicable knowledge is the other part of the input for the model.

Next, the model can be developed using the input of the business need and the applicable knowledge. A step-by-step guide for both client and contractor, containing characteristics for the development and use of performance indicators, is chosen as kind of model. The model is based on the process of developing and using performance indicators in the Best Value approach — based on the theory of the approach. The characteristics in the model are derived from the literature study on performance indicators. The step-by-step model is validated by testing the model in practice through interviews with experts from both the client side and the contractor side. The remarks of the expert — contract manager of current Best Value projects working with performance indicators — are used to refine the step-by-step model towards the final model.

The refined step-by-step model is the output of this research. It can then be applied in the environment and can be added to the knowledge base for further research. The application in the environment is done by doing recommendations to Rijkswaterstaat. The model is validated by testing the step-by-step model in two cases during the clarification phase of projects. The additions to the knowledge base are done by writing this paper.

Business Needs: Problem Analysis

The first component of the framework that is worked out is the business need. As described, Rijkswaterstaat and contractors encounter several problems regarding performance indicators. 10 semi-structured interviews are held with both contract managers of client and contractor of current Best Value projects, in order to find out the state of the current use of performance indicators in Rijkswaterstaat’s Best Value projects in a qualitative manner. Three major problems are identified.

1. Lack of support for the indicators developed

In almost all projects studied, the indicators were developed and agreed upon by only a few people. For example, in one project, the client is not involved at all in the development. In another project, only the project manager and contract manager of the contractor and the contract manager of the client developed the indicators, which caused a lack of support for the indicators. Therefore, one interviewee said that the indicators should be developed with both projects teams
in order to create support for measuring and taking action. The indicators will be of increasing importance when the whole project team owns the indicators.

2. **Difficulties in collecting data and a lack of benchmark data on the client and contractor side**

Because performance indicators are new to Best Value projects and performance indicators are hardly used in other projects, contractors find it hard to collect data at various departments of their organizations. The interviews showed a difference in engineering services and design and construct contracts on the one hand, and performance-based maintenance contracts on the other hand. The contractors of the performance-based maintenance contracts were already more used to measure performance and therefore they are already able to collect data easier.

Both client and contractor agree that an ambitious target value for indicators should be agreed. Moreover, a bandwidth has to be determined to define when immediate action should be taken on an indicator. However, client and contractor hardly use performance indicators on their projects and therefore they do not know what value is ambitious and what value should be the minimum. In other words, a lack of benchmark data exists. This lack of data exists both on the client and contractor side.

3. **Lack of knowledge regarding the development and use of performance indicators**

Because performance measuring is new to most contractors, they lack the knowledge to develop performance indicators, which caused difficulty in developing them during the clarification phase. Interviewees indicate that it is both hard to determine what to measure and how to make indicators measurable. During the execution, this leads to ignoring the indicators because they are either not relevant or hard to measure. Moreover, client and contractors do not always take action upon indicators when this should be required by the value of the indicator.

The next sections suggest improvements for respectively these three major problems. The last problem (i.e. a lack of knowledge regarding the development and use) is worked out the furthest, which in the end leads to the step-by-step model, according to the Hevner model.

**Solution for problem 1: Lack of support for the indicators developed**

During the projects, project teams were not able to keep the indicators lively because of a lack of motivation. This is caused by the agreement of the indicators by only a few people. As already suggested by one interviewee, a collaborative session of both the project teams of client and contractor prior to the execution is expected to increase this motivation. When the both project teams develop indicators together, they are owned by both parties. The contractor is still in lead for developing and measuring the indicators and taking action, but a joint commitment to the indicators arises.

To even more increase the support for the indicators, contractors can suggest performance indicators in the selection phase as part of the claims made in the submittals. The process of developing the indicators – as shown in Figure 2 – then shifts from the clarification phase to the
selection phase. During the clarification phase, the indicators can be further refined in a collaborative meeting with client and the intended contractor. By suggesting performance indicators in an early phase, both client and contractor already think about measuring, which is expected to increase motivation for measuring during the execution.

**Problem 2: Difficulties in collecting data and a lack of benchmark data on the client and contractor side**

The development and use of performance indicators in Rijkswaterstaat’s Best Value projects is still in an early phase, causing difficulties in collecting data and establishing benchmarks. The collection of data by contractors is expected to become easier as the project continues and as experience with more Best Value project is gained, which is already seen at the contractor of the maintenance contract. As a client, Rijkswaterstaat can only indirectly contribute to this advancement by practically stressing the importance of collecting data in their explanations both prior to projects and their general explanations to market parties about the approach. These explanations are expected to increase the awareness of market parties for measuring and thus to reduce the difficulties in collecting data.

More data collection also decreases the lack of benchmark data, because it enables contractors to compare the current project with earlier projects. Industry-wide benchmark data is at this moment not available in The Netherlands. The benchmarking initiatives in for instance the UK (Constructing Excellence 2006; CCI 2010) could serve as an example for performance comparison between contractors and therefore as a base for continuous improvement.

**Problem 3: lack of knowledge regarding the development and use of performance indicators**

The third problem found by the interviews is the lack of knowledge regarding the development and use of indicators. This is the problem we focus on in this research, and therefore this problem is further worked out, according to the Hevner framework.

**Applicable Knowledge: Characteristics of Performance Indicators in Best Value**

The current problems with performance indicators (see for instance Beatham et al. (2003)), together with an extensive literature review, are to base of a list of characteristics that should be kept in mind while developing and using performance indicators. The sources all relate to either project management literature or literature on performance indicators in construction projects. Some characteristics found in the literature are left out, because they are less applicable in either the construction industry or Best Value projects; this is motivated below. Table 1 shows the characteristics, which are further explained below.
Table 1

*Characteristics divided by reference*

| Characteristics                        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|-----------------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|
| Few in number                           | ● | ● | ● | ● | ● | ● | ● | ● | ● |    |    |    |
| Balanced and cover the project          | ● |   |   | ● |   | ● |   |   |   |    |    |    |
| Focus on improvement                    | ● | ● | ● | ● |   |   | ● |   |   |    |    |    |
| Standardized                            |   |   |   |   |   |   |   |   |   | ●  |    |    |
| Reinforced with incentives              |   |   |   |   |   |   |   |   |   |    | ●  |    |
| Simple                                  | ● | ● | ● | ● |   |   |●  |   |   |    |    |    |
| Specific                                |   |   |   |   |   |   |   |   | ● |    |    |    |
| Measurable                              | ● | ● |   |   |   |   |   |   |   |    |    |    |
| Context driven, target and bandwidth    | ● |   | ● | ● |   |   |   |   |   |    |    |    |
| Aligned with goals / relevant           | ● | ● | ● |   |   |   |●  |   |   |    |    |    |
| Time-bound                              |   |   |   |   |   |●  |   |●  |●  |    |    |    |
| Verifiable                              |   |   |   |   |●  |●  |   |●  |●  |    |    |    |
| Owned by someone accountable            | ● | ● |   |   |   |   |●  |●  |●  |    |    |    |
| Actionable                              | ● |●  |●  |   |   |   |●  |●  |●  |    |    |    |
| Visual communication                    |   |●  |●  |   |   |   |   |   |   |    |●  |    |
| Evaluation                              |   |   |●  |●  |●  |●  |   |   |   |    |    |●  |

For a successful implementation of a performance measurement system, the number of indicators should be kept low (Yuan et al. 2009). Kaplan & Norton (1992) speak of a handful, most critical performance indicators, Atkinson (1999) states no more than fifteen and Collin (2002) says that in order to keep the indicators maintainable and not too time- and resource-consuming, a limited, manageable amount should be used.

**Few in Number**

A balanced, holistic set of indicators has to be developed, which covers the project goals (Beatham et al. 2004). There has to be a good mix of client and contractor indicators, a good mix of indicators related to project performance and risk performance, and the indicators should not undermine each other (Eckerson 2006).

1. Eckerson (2006, p. 201), 2. Kerzner (2011, p. 104), 3. Haponava (2009, p. 168), 4. Constructing Excellence (2006), 5. Yuan et al. (2009), 6. Kaplan & Norton (1992), 7. Atkinson (1999), 8. Collin (2002), 9. Beatham et al. (2004), 10. Neely et al. (1997), 11. Cox et al. (2003), 12. Chan & Chan (2004)
Focus on Improvement

Indicators should be predictive and leading, i.e. they have to give the opportunity to steer, instead of only telling something afterwards (Haponava 2009). This way, the indicators are the base for improvement. By using leading indicators, they “can be used to give an early warning, identify a potential problem and highlight the need for further investigation” (Beatham et al. 2004, p. 106).

Standardized

Eckerson (2006, p. 201) states that performance indicators have to be standardized, so “they can be integrated across dashboards throughout the organization”. However, as stated before, project-specific indicators are more common in Best Value projects and the model focuses on developing and using these project-specific indicators. Standardized indicators, such as the deviation from planning and budget are already included in the Weekly Risk Reports. Therefore, this aspect is left out in this part of the research.

Reinforced with Incentive

Performance indicators can be reinforced with incentives, such as payments when an indicator is at the target value. However, Eckerson (2006, p. 201) warns that this should only be done to well-understood and stable performance indicators. In Best Value, the only incentive of the indicators is that a contractor may use the measurements in a future tender, to distinguish himself amongst his competitors and therefore this characteristic is left out.

Simple

A simple, easy-to-understand indicator is important to increase transparency, reduce discussion about the indicator and keeping the resources needed to measure low. Kerzner (2011 p. 104) states that indicators “should be straightforward and easy to understand”. Cox et al. (2003) stress that indicators should be easy to gather, should be easy to apply, and should not place a heavy burden on field personnel. The KPI Handbook of Constructing Excellence (2006) advocates simplicity and no bureaucracy.

Specific

Indicators should describe clearly what is measured and how this is calculated. This reduces discussion. Neely et al. (1997, p. 1136) describe the title of the indicator as “one that explains what the measure is and why it is important. It should be self-explanatory and not include functionally specific jargon”.

Measurable

A measurable indicator makes it possible to compare the indicators over time and with others. Moreover, using a formula keeps the indicator objective and verifiable. A simple formula increases transparency. Neely et al. (1997) state that a measurable indicator with a clear formula
is one of the most challenging elements to specify, because it affects how people behave: making an indicator measurable in a certain way may create an unwanted incentive.

**Context Driven**

Context driven is described as having a target, bandwidth, or benchmark. Kerzner (2011) addresses the need for a target and bandwidth. Cox et al. (2003) say that a historical baseline can be used as a change for improvement. Kaplan & Norton (1992, p. 74) describe a benchmark as a “technique to compare their performance against competitor’s best practice”. Beatham et al. (2004) state that benchmarking is key to adding value to performance measurements. Experience is required to know the benchmark. When using project-specific indicators, benchmarking is harder and decision are more based on intuition (Chan & Chan, 2004).

**Aligned with Goal**

In order to make sure that performance measurements are not meaningless, they have to be part of a performance management system. This system consists of reviewing the performance, deciding on actions, and changing the way in which the organization operates (Beatham et al., 2004). According to Bititci et al. (1997), the performance management process is a closed loop control system, schematically shown in the left side of Figure 3.

The organization’s vision is on top of the triangle. This vision is deployed into the organization through business objectives, strategic goals, critical success factors, and, at the operational level, performance indicators. These indicators provide feedback to the various levels of the organization. In this system, performance indicators are “of critical importance to the effective and efficient functioning of the performance management” (Bititci et al. 1997, p. 46). This system can be translated to a project (the right side of Figure 4), where, instead of a vision and business objectives, project goals are deployed via critical project success factors to performance indicators. These performance indicators give feedback of the extent to which the project goals are achieved. Therefore, in a project, performance indicators need to be somehow related to project goals in order to be relevant. This is also agreed by others (e.g. Kerzner (2011), Eckerson (2006), Haponava (2009), Neely et al. (1997)).
Time-bound

This is also one of the SMART requirements. In practice, this means an indicator should have a frequency of measuring. Neely et al. (1997) make a distinction between the frequency of measuring and the frequency of reviewing. Eckerson (2006) stresses the need for timely data, so that it is possible to improve the performance before it is too late.

Verifiable

One of the problems found by Beatham et al. (2004) regarding performance indicators in construction included a lack of verifiability. Unclear indicators with different interpretations made it not possible to compare the indicators mutually. Neely et al. (1997) states that the source of data and the formula of calculating an indicator should be clear.

Owned by Someone Accountable

Collin (2002) concludes that effective performance indicators have to be owned by the organization. This is agreed by Eckerson (2006) who says that the performance indicator has to be owned by an individual or group who is accountable for its outcome.

Actionable

A performance indicator should trigger changes. It is the action that makes the indicators add value (Constructing Excellence 2006). Neely et al. (1997) state that the action cannot always be specified upfront, because the action may depend on the context. However, it has to be clear upfront what management process will be followed when the performance is either acceptable or unacceptable.

Visual Communication

The communication of indicators has to be clear; it has to give a quick but good view on the key processes. Collin (2002) states that graphic displays need to be simple in design, easy to update, and accessible. The graphic displays are also known as a dashboard, which “convey the most critical information to the stakeholders the fastest way” (Kerzner 2011, p. 197). Using dashboards is also advised in the KPI Handbook of Constructing Excellence (2006), which advises results and trends to be displayed. Kerzner (2011) suggests the use of so-called traffic light reporting, because this can convey simply critical performance information.

Evaluation

Identifying the indicators is done not only when starting at the start of the project, but also after a certain time period or a change of phase in a project, since the set of indicators will need to evolve and it is likely that they will change and be refined (Collin 2002). As mentioned earlier, the fragmented nature of construction projects also insists on specific indicators tailored to each phase of the project. Moreover, evaluation at the end of the project is important to check whether the indicators contributed to the success of the project.
Development and Validation

In this section, we describe the four phases of building a model for the development and use of performance indicators. First, a draft model is designed. After that, the draft model is evaluated by means of interviews with experts that use performance indicators in Rijkswaterstaat’s Best Value projects at this moment. Subsequently, a final model is built. Finally, the model is tested at two Best Value projects of Rijkswaterstaat.

A model is made based upon the fourteen characteristics that are found in the literature and that are regarded applicable to Best Value construction projects. In several steps, a six-step model is designed for the development and use of performance indicators. The six steps of the model include choosing the set of indicators, choosing indicators, development of the indicators, incorporate in the Weekly Risk Report, use during execution in the project, and the end of the project.

All the characteristics from the literature are put in these six steps and after that, the step-by-step model is validated by means of interviews with experts. Analysis is done using the ‘word table’ method of Yin (2009), which is a type of cross-case analysis. This method is chosen because it makes it possible to compare different cases in a uniform framework: the draft model based on the characteristics from the literature. The qualitative analysis of the remarks from each interviewee on each characteristic leads to the conclusion of removal or alteration. Additionally, interviewees were able to suggest characteristics that are forgotten in their opinion. When these suggestions or similar suggestions are done several times, and when they are in line with the theory already found, they are considered useful for the model and therefore added. A quantitative analysis is hard because of the early phase the use of performance indicators in Rijkswaterstaat’s Best Value projects is in. Therefore, the interviewees are not all aware of the usefulness of each characteristic.

All interviewees agreed with the six steps. Most of the characteristics are agreed; characteristics that were not agreed or that had to be changed are respectively left out or improved. Moreover, several characteristics are added based on the expert input. As shown in Figure 4, the final model consists of twenty characteristics in total.
The model is validated in two different cases. One case included the use of the model in a session with client and contractor; the other case included the use of the model as a checklist for the performance indicators drawn by the contractor. In the first case, the model supported the session, which led to eight draft indicators complying. A qualitative, concise analysis of these indicators showed that more characteristics of the model could be found in the indicators, compared to the indicators from the problem analysis. In the last case, it led to fifteen potential improvements for five indicators, of which thirteen were agreed and used by the contractor. This test is therefore considered as a success; however, the influence on the rest of the project is due to time limitations not researched further.

**Conclusion**

Since Rijkswaterstaat started to ask for the development and use of performance indicators by contractors, problems were encountered by both client and contractor. These problems related to the lack of support for the indicators developed, the difficulties in collecting data and establishing benchmarks and the lack of knowledge regarding the development and use of performance indicators in Best Value.

*A Collaborative Session with Both the Project Team of Client and Contractor*

To increase motivation for measuring early in the process, a joint meeting should be arranged during the clarification phase, to develop or refine performance indicators.
Suggest Indicators in the Selection Phase

To come to an even earlier attention for performance indicators, contractors should suggest performance indicators as a part of their plans in their tender. Contractors should explain how the claims made in their bid are measured during the execution of the project. Client and contractor can together refine the indicators during the clarification phase.

Stress the Importance of Collecting Data

To increase the awareness of market parties to measure and collect data, Rijkswaterstaat should practically explain why it is important to measure performance. Explanations prior to the project and in general should decrease the difficulties in collecting data.

Consider Industry-wide Benchmarking

Although benchmark data will become available after several projects in which they measured performance, industry-wide performance comparison should be considered in order to serve as a base for continuous improvement. In the absence of industry-wide benchmarks, contractors are encouraged to start measuring their own project portfolio.

Use the Characteristics when Developing and Using Performance Indicators

The model as proposed in this research shows the most important characteristics of developing and using performance indicators in Best Value projects. These characteristics should be kept in both client and contractor’s mind in all phases of the Best Value process.

Discussion and Suggestions for Further Research

The decisions made during the design of this research as well as decisions made while executing the research imposed several limitations. Most of these limitations are related to the early stage of performance indicators in Best Value projects, which means a lack of quantitative data exists. Below, some suggestions for further research are done.

Research on Performance Indicators in Other Projects

The interviews were done at six current Best Value projects at Rijkswaterstaat. Although this number of projects is high compared to other clients, it is still not enough to draw profound conclusions. The projects are chosen because of their diversity, but this also led to only one or two project per type. More research has to be done on other projects, also from other clients to see whether all problems with performance indicators in Best Value are covered with this research.
Research on the Course of the Clarification Phase

The Best Value theory states the clarification phase is the most important phase. This research showed this also applies to the use of performance indicators. A ‘performance indicator’ session with the project teams of both client and the prospective contractor is suggested, but another way of paying attention of performance indicators in the clarification phase may exist. Moreover, the model as suggested in this paper is only tested concisely in two cases. Therefore, further research on characteristics for performance indicators on more projects is required.

Research on the Effect of Performance Indicators on the Success Rijkswaterstaat’s Best Value Project

The Best Value approach, and especially the use of performance indicators in Best Value projects, is in an early phase in general and so at Rijkswaterstaat. The success of using performance indicators and measurements done by the contractor is not yet quantified. Theory states that it leads to transparency and thus risk mitigation, reduces discussion and communication, performance improvements, less uncertainty, taking bounded rationality into account, and less opportunistic behavior. More research is needed to give insight into the effect on these aspects and on the effect of performance indicators on Best Value project success.

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