Creating line-of-sight in performance management

A search for and application of a practical method for brownfield asset management organisations

Graduation Thesis

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Preface

This is my thesis on line-of-sight in performance management at asset management organisations. It is the final product of my Master of Science Construction Management and Engineering at the faculty of Civil Engineering and Geosciences, Delft University of Technology.

Infrastructure networks have always been of great interest to me, and even though large construction projects were the hot topic during the master CME, it were the lectures of Rob in particular that motivated to me to do further research on asset management. It was the "NASA anecdote" that defined the topic for my thesis: line-of-sight.

I would like to thank my graduation committee for their patience, commitment and encouragement, even when the process of graduation went less smoothly. I also would like to thank them for their assistance and inspiration. From Rijkswaterstaat specifically, I would like to thank Frank for providing me the platform to get this project started and for our discussions on Rijkswaterstaat and the state of asset management and for all the information and contacts. Furthermore I would like to thank the participants to the workshop sessions at Rijkswaterstaat for their time, expertise and enthusiasm.

Finally I would like to thank my parents and girlfriend for spurring me on. It might never have been finished without your support dad!

Jasper Meijsen

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Summary

Infrastructure asset networks form a vital part of all economies worldwide. Although failure of road, rail or water infrastructures can have a huge impact on society, governments are under constant pressure to reduce, account for, and justify expenses. So too for the costs of the construction and maintenance of the infrastructures networks. The effective and efficient management of the performance of these infrastructure assets is therefore an important topic for (governmental) asset management organisations.

Recent developments in the field of asset management, such as the introduction of the ISO55000 for Asset Management, show an increased interest in an integral approach to asset management (The Institute of Asset Management, 2014) and having a clear alignment of strategic mission, vision and goals and operational activities – line-of-sight – is promoted as an essential part of the performance management for asset management organisations. "Brownfield" asset management organisations, i.e. pre-existing organisations with already some forms of performance management systems and a history in asset management, are now increasingly looking to professionalize their systems, similar to the suggested developments in literature.

In literature it is observed, however, that the linking of the organisational objectives to its operational activities and performance is seldom fully understood or well communicated within organisations (Wijnia & Herder, 2009). In research on performance management practices in Europe Van der Lei, Schoenmaker and Vleugel (2013) found that some countries do show a clear line-of-sight with the help of a hierarchy of goals and objectives and that in the Netherlands a Hierarchical Performance Management should be considered as well to create a clearer line-of-sight.

Therefore, the goal of this research is to provide more insight in what line-of-sight means and how it can be implemented by asset management organisations in order to manage performance. The second goal is to present a model that can help organisations improve their line-of-sight.

To research the line-of-sight for performance management in asset management organisations and ways for such organisations to improve that line-of-sight, the following research question is presented. After the main research question the sub questions are presents, which will help answer the main research question:

> *How can line-of-sight in performance management be achieved in brownfield asset management organisations?*

The first set of guiding sub-questions are:

1. *What are the reasons for line-of-sight in performance management systems of infrastructure asset management organisations?*
2. *What are the relevant elements of line-of-sight performance that brownfield asset management organisations should include?*
3. *What method can be applied to achieve line-of-sight in performance management?*

The second set of questions are answered by doing a case study:

4. *What is the current situation of performance management and the state of line-of-sight at the asset management organisation Rijkswaterstaat?*
5. *What is the impact of applying line-of-sight to performance management for the asset management organisation?*

To answer these questions this research project has been divided into three phases. The first phase is the literature study, which sets the basis for the answers to the first three sub-questions. The second phase consists of a case study, based on a method that resulted from the first phase, at an asset management organisation and consists of desk research part followed by a workshop session at the case study subject Rijkswaterstaat. This will set the answers to the second set of sub-questions. Finally, in the third phase the results and data from the previous phase is analysed and through that analysis the main research question is answered, ending with recommendations for (brownfield) asset management organisation looking to improve the line-of-sight in their performance management.

1. What are the reasons for line-of-sight in performance management systems of infrastructure asset management organisations?

The literature review phase looks at the fields of asset management, performance management and line-of-sight, and aims to answer the first sub-question. In general it can be noted that the term asset management has evolved over time. We now see that the term is used for the integral approach of management of all the organisation's assets. This is reflected by how the ISO55000 defines asset management as the: "Coordinated activity of an organisation to realize value from assets." This is much broader than just maintenance. It further states that asset management involves the "balancing over time of costs, opportunities and risks against the desired performance of assets, to achieve the organisational objectives". From this definition the relation to performance and performance management clear. But also the relation to line-of-sight can be seen, in that an organisation should manage their assets in such a way that it helps achieve the organisational objectives.

Line-of-sight (of performance management) is increasingly recognized as an important aspect of asset management. Part of any organisation is the translation and alignment of vision, mission and goals with operational activities. And asset management literature now also recognizes the importance of an integral approach, where all aspects of the organisation performance are represented. A system that presents this information and aids in the line-of-sight and decision-making can increase the effectiveness of an organisation.

2. What are the relevant elements of line-of-sight performance that brownfield asset management organisations should include?

The following list presents the essential elements for an asset management line-of-sight performance management system, and is the answer to the second sub-question:

- Have an integral approach, inclusion of information from the entire organisation.
- Use and generate information on risks, costs and performances.
- Include information on all timeframes (short, medium and long).
- Measures should be balanced, including not only financial measures.
- Measures should provide information on past *and* future performance.
- The framework should help the organisation in creating transparency and other benefits whilst preventing the potential perverse effects of PM.
- In the case of asset management organisation it should allow for technical (RAM) measures.

- Incorporate mission, vision and goals.
- Allow employees to know *how* they contribute to goals and to be involved.

3. What method can be applied to achieve line-of-sight in performance management?

Many authors have developed frameworks, methods and systems for performance and asset management. Three methods fulfil various of the required elements and can be considered for implementation to achieve line-of-sight, these are: the Balanced Scorecard (BSC), the Performance Prism and the Service Framework. Of these three the Service Framework fulfils most of the required elements. It particularly scores well on the elements regarding asset management compared to the other available methods.

This concluded the first phase of this thesis, and the next phase was a case study at an asset management organisation, where the Service Framework method from the previous phase is implemented. The organisation where this case study is performed is Rijkswaterstaat, in the Netherlands. This second phase provides the answers to the second set of sub-questions.

4. What is the current situation of performance management and the state of line-of-sight at the asset management organisation Rijkswaterstaat?

A desk research study revealed a series of observations concerning the current situation of asset and performance management at Rijkswaterstaat. A critical finding is that asset management is still largely seen as a separate process rather than an integral part of all processes within the organisation. This can be explained by a couple of things:

1. The ambiguity of the term asset management within the organisation.
2. The existence of the term *prestatiemanagement*, performance management.
3. A separate process (and process owner) for asset management.
4. Separate units or clusters concerned with asset management and/or performance management at both strategic and tactical levels.

To make a statement concerning the line-of-sight at Rijkswaterstaat the planning documents of Rijkswaterstaat (and Ministry) were examined. It is concluded that: (i) the increasing amount of planning documents at the various levels within the organisation form an implicit line-of-sight of objectives from top to bottom; and (ii) the reporting on the performance of these objectives is well behind and is not logically done at the right level. There are only two levels where performance is explicitly reported: between the Director of RWS and the Minister, via the SLA; and between the Director of (Regional) Departments and the Director of RWS, via the management contract. It can be concluded that Rijkswaterstaat does not score positively on all elements presented under sub-question 2 and that applying the method from sub-question 3 likely provides some improvements in line-of-sight for the organisation.

5. What is the impact of applying line-of-sight to performance management for the asset management organisation?

After the desk research, the case study continued with the implementation of the Service Framework method via workshop sessions. The conclusion from these workshops is that the Service Framework is a suitable method to increase the line-of-sight at the organisation. The fact that employees from various departments together discus the elements of the performance system and objectives, was considered really valuable. The employees stated that this approach also really added to their personal understanding of their work in relation to the mission and goals of the organisation.

It should be noted, however, that the method is best applied as cyclical process rather than a linear one-time project. Because in order to paint a complete picture of the organisation the method should be applied as an iterative process that can be applied at all the many (sub-)departments of the organisation. Applying the method as a cyclical process also allows for implementing improvements to the current asset management system.

The output from the application is a framework that organises all the metrics and objectives from the different planning documents in to one single framework, of which the employees found the alignment to be much clearer than the original situation. Although the scope of this thesis was limited to a specific part of the organisation, it is safe to assume that the method could also work for the rest of the organisation.

Conclusion

All the sub-questions have been answered. This leads us to the conclusion to the main research question.

> "How can line-of-sight of performance management be achieved in brownfield asset management organisations? "

This research substantiates that it is important for asset management organisations to have clear line-of-sight of the performance measures from strategic objectives all the way to operational activities. There are quite a few ways to achieve this according to state-of-the-art research on this subject.

For brownfield asset management organisation, where some form of performance management is already in place, a successful method for achieving line-of-sight is by organising workshop sessions via a modified version of the Service Framework method of Hatcher and Sivorn.

This method uses information and knowledge already produced by the organisation and presents it in easy to read service framework where clear relationships between performance measures have been established. Another advantage is that the method is scalable. Meaning that it is possible for instance to just roll out the method at certain levels or (sub-)departments if the internal organisational resistance is too high at first.

The participants have rated the workshops as both fun and interesting. They also commented that the method was not only useful for the organisational management of performance but that is was also very useful for their own understanding of their position within in the organisation and in what way they individually contribute to the organisational mission, increasing their satisfaction and engagement to organisation mission.

This method has now been applied at two different cases, Rijkswaterstaat and previously the Highways Agency in the UK. At both cases the results were positive and the approach can be applied at other asset management organisations, like *Waterschappen,* provinces or municipalities in order to increase the line-of-sight of their performance management and align strategic goals with operational activities.

Recommendations

The goal of this research is to provide more insight in what line-of-sight means and how it can be implemented by asset management organisations in order to manage performance. This was achieved through the first phase of this thesis. The second goal is to present a model that can help organisations improve their line-of-sight. This was also done and tested in the second phase of this thesis. Based on the research done several recommendations are made, for asset management organisations looking to improve line-of-sight, for Rijkswaterstaat, and regarding the method Service Framework itself.

General recommendations for asset management organisation:

- Involve everyone in the process;
- Invest time and effort in formulating the mission, vision and goals of the organisation and departments;
- Check for balance and improve if necessary.

Specific recommendations for Rijkswaterstaat:

- Create more balance in the metric used;
- Be clearer in the organisation's core message;
- Continue the development and integration of asset management plans;
- Maintain room for individual expertise;
- Separate asset performance and organisational performance.

Specific recommendations for the Service Framework method used:

- Selection criteria for participants;
- Apply the method as a cyclical process rather than a linear project by adding more iterative steps and implementing improvements based on evaluation of the workshop sessions.

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1 Introduction

1.1 The performance of infrastructures

The performance of infrastructures has always been very important to society. We see that all modern economies are supported by a vast infrastructure of roads, waterways and other transport systems, by fresh water supply, and availability of energy and telecommunications. The quality of life and the very fabric of modern society is hugely influenced by the infrastructure assets of a nation, which is taken for granted until something fails or no longer provides the expected services.

However, the infrastructures as we know them are under pressure from multiple sources, as Wijnia & Herder (2009) show in Figure 1. Therefore it seems logical that the performance of infrastructure assets is of high priority for governments and asset management organisations.
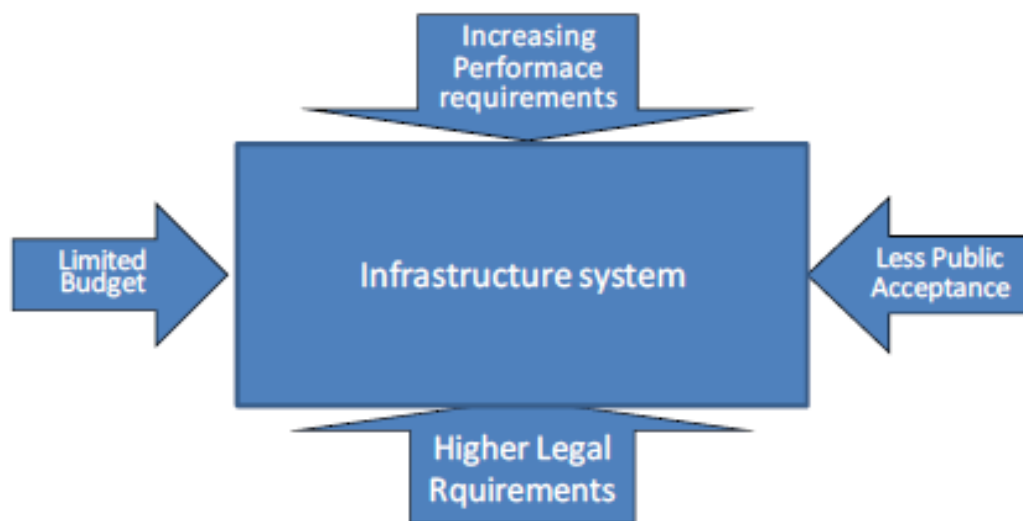
Figure 1 The pressures on infrastructures systems (Wijnia & Herder, 2009)

Partly due to recent economic developments, governments want to spend less on infrastructure assets and require more control on maintenance expenditures. This has resulted in the (re)privatization of infrastructures—for example in the Netherlands, this happened for rail (in 1993) and electricity (1999)—and governments have limited their budgets for agencies responsible for infrastructure (Schraven, Hartmann, Bosveld, & Dewuld, 2012; Wijnia & Herder, 2009).

At the same time, the performance requirements of infrastructure are increasing; ever increasing traffic numbers and longer lifetimes are requited. The public demand availability of infrastructure. Any incidents that limit this availability are frequently and extensively covered in the media; there is less public acceptance for failing infrastructure assets.

Besides that, there is the issue of the ageing infrastructure (see for instance (De Leeuw & Pries, 2014)). Where in the past fifty to sixty years – roughly since the end of World War II – western countries, including the Netherlands, have invested heavily in the development of infrastructure assets—such as roads, bridges, electricity—we now see a steady increase in maintenance expenditure which clashes with the need to control governmental spending (Volker, Altamirano, Herder, & Van der Lei, 2011).

Parallel to all these pressures was the rise of New Public Management in western governments to improve their efficiency and performance. At the core of these reforms are the development of

performance indicators and benchmarking and placing executive bodies at arms' length from ministries (Pollitt, Van Thiel, & Homburg, 2007).

1.2   Performance management for infrastructure assets

In the Netherlands this resulted in performance-based management systems and the Result-Oriented Management Control initiative in central government (De Bruijn & Van Helden, 2006) and the restructuring of the Dutch infrastructure asset management organisation, the Rijkswaterstaat as the executive agency of the Dutch Ministry of Infrastructure and the Environment.

Similar trends occurred worldwide, leading to the further development and professionalization of the knowledge field of asset management in infrastructure, across the world. This, in turn, has led to the desire for international standardization.

The International Standard on Asset Management defines asset management as the: "Coordinated activity of an organisation to realize value from assets" (2014). According to (International Standards Organization, 2013) asset management involves the balancing over time of costs, opportunities and risks against the desired performance of assets, to achieve the organisational objectives. It is therefore no surprise that asset management is so interesting to infrastructure organisations.

Too (2010) mentions that the growing recognition by infrastructure organisations of the need to improve effectiveness and overall operating performance requires clear understanding of how to manage infrastructure assets in a way that allow their current performance to improve and be competitive, while ensuring they are planning and re-investing for the future. Consequently, organisations that manage infrastructure assets are driven to adopt a formal and holistic approach to the management of infrastructure assets in order to provide services in the most cost effective manner, and to demonstrate this to customers and stakeholders. The shift in perspective is in sync with the concepts of performance management and asset management (Too, 2010).

1.3   Scope of research

The introduction of New Public Management has led to the development of performance indicators and performance-based management initiatives within government agencies in the belief that it would lead to transparent organisations and accountability (De Bruijn, 2002). However, in the absence of regulations and norms or standards, this sometimes led to haphazardly introducing the tools and concepts of performance management – and in some cases within different "silos" – of an organisation (Anderson, Henriksen, & Aarseth, 2006). Given the importance of well-defined attributes, unfortunately, insufficient thought typically is given to the choice of attributes (Keeney & Gregory, 2005).

The recent introduction of the ISO 55001 (2013) standard has stimulated asset management organisations to rethink the approach to performance management. One of the main points of the ISO 55001 is the concept of line-of-sight. A clear line-of-sight of (performance) attributes should provide the decision maker with the right kind of information to make informed decisions. The foundation for any decision is a clear statement of objectives. Attributes clarify the meaning of each objective and are required to measure the consequences of different alternatives.

It is observed that linking of the organisational objectives to its operational activities and performance is seldom fully understood or well communicated within organisations (Wijnia & Herder, 2009). Therefore, the alignment between organisational goals and the operational performance criteria is weak.

The advancements in the scientific field of asset management has led to the development of asset performance management systems by theoretical researchers that appear to fulfil the need for integral solutions of performance management problems. A problem of line-of-sight in performance management is that it is mostly approached from a practical, case oriented point-of-view in literature. Many methods that try to provide the desired line-of-sight are either tailor-made to a specific case or are based on "greenfield" situations. However good these solutions may work in greenfield situations, where one could start from scratch, the implementation of these problems in complicated long-existing "brownfield" asset management organisations is something that is much harder and something that as of now has not often been tested. The terms greenfield and brownfield used here are borrowed from development projects. Greenfield refers to developments on vacant sites where a new system can be developed with maximal design flexibility, whereas brownfield refers to developments within existing buildings with all their restraints and pre-existing infrastructure and history, which will require some compromises for the new development.

1.3.1 Research objective

The goal is to allow for a high quality line-of-sight within existing "brownfield" asset management organisations.

Therefore , in this light, the research objective of this thesis is to test whether the use of state-of-the-art knowledge on, and best-practices of, performance management can achieve the desired line-of-sight as prescribed by the ISO 55001, and subsequently aims to make recommendations for creating line-of-sight for brownfield asset management organisations.

1.3.2 Research subject

In line with the research objective the requirements for the research subject is an asset management organisation with a pre-existing performance management structure in place (thus "brownfield"). In the Netherlands there are a number of potential research subjects. Waterschappen, provinces, large municipalities all manage assets and most, but not all, can be considered brownfield with regards to performance management.

However, Rijkswaterstaat - the national agency responsible for highways, waterways and water safety – can be considered the largest asset management organisation in the Netherlands and also already has performance management in place. In fact, in a study by Van der Lei, Schoenmaker, & Vleugel (2013) one of the recommendations was for Rijkswaterstaat to consider the use of Hierarchical Performance Management. This is very much in line with what has been introduced in this chapter – and emphasized by the recent introduction of the ISO 55001 standard.

Therefore, the choice for Rijkswaterstaat as the subject of this research is seen as good opportunity to try and achieve the research objective.

1.4 Research question

Asset management organisations, both governmental, semi-governmental and private organisations, are more and more seeking to get in control of the performance of their infrastructure assets.

To achieve the research objective, as previously stated in 3.3.1, the following main research question has been formulated:

How can line-of-sight in performance management be achieved in brownfield asset management organisations?

In order to answer this main research question two sets of research sub-questions need to be answered. First the theoretical perspectives are researched. For this part the following questions are formulated:

1. *What are the reasons for line-of-sight in performance management systems of infrastructure asset management organisations?*
2. *What are the relevant elements of line-of-sight performance that brownfield asset management organisations should include?*
3. *What methods can be applied to achieve line-of-sight in performance management?*

The second set of questions are answered by doing a case study:

4. *What is the current situation of performance management and the state of line-of-sight at the asset management organisation Rijkswaterstaat?*
5. *What is the impact of applying line-of-sight to performance management for the asset management organisation?*

1.5   Outline of this research report

The central theme of chapter 2 of this thesis is the exploration and understanding of different topics. The core topics of the research questions are: *line-of-sight, performance* and *asset management.* What is performance management and what is asset management? Or are they actually two sides of the same coin? More insight is presented by discussing the increased focus of the integral approach and that of the so-called line-of-sight.

In chapter 3, based on the theoretical research on line-of-sight, performance and asset management, the requirements for potential methods are distilled. Based on these requirements several methods are reviewed and one method is chosen as the one with the highest potential to be applied on a brownfield situation.

In chapter 4 the decision for performing a case study is explained. Also the case subject, Rijkswaterstaat is introduced. The case study entails two parts, a desk research in to the existing situation of Rijkswaterstaat and a workshop session part in which the previously selected method is applied and tested at the Rijkswaterstaat situation.

Based on the case study approach as described in the previous chapter, the results and analysis of the desk research and the results and analysis of the workshop sessions are presented in chapter 5, and the connection between the theoretical perspectives and the results are made.

The final step is answering the research questions. This will be done in the first parts of chapter 6. In the following parts the implications of these answers and this research are presented and recommendations are made for both Rijkswaterstaat, the authors of the original method as used in the case study, other asset management organisations looking for a way to improve their performance management systems and finally for further research.

2 Literature review "Asset and performance management"

There is approximately 2.500 km of highways, 18.000 km of dikes, 5.000 km of waterways, and almost 7.000 km of railways in the Netherlands. The government yearly spends over €600 million on maintenance, renovation and operation (asset management) of the highways, over €1.2 billion for the railways and over €2.5 billion for dikes and flood protection (Ministry of Infrastructure and the Environment, 2015). For that money the government has certain ambitions for those networks, and wants to be sure that their networks perform the tasks they are intended to perform. It has to deliver a certain performance.

The first section of this chapter will introduce asset management (maintenance and operation). It will not so much focus on the specific technical aspects of maintenance, but on the organisation of the maintenance operation. The second section introduces the term performance management, its history and use in organisations. Aligning ambitions – such as those that the government has for its infrastructure networks – with the operational activities that need to be performed in order to fulfil those ambitions is called line-of-sight. That is the topic of the third section of this chapter.

2.1 What is asset management?

Asset management in itself is a very old phenomenon. Although the term asset management in the context of infrastructure management has only been in the centre of attention for the past few years, its ideas have been practiced for as long as there have been humans. It just wasn't necessarily called asset management back then. However, when we talk about infrastructure asset management nowadays, it is important to know the why, what and how of the management of infrastructure assets.

Please note: although the term asset management made its first appearance in the financial sector, our scope does not include financial assets and wealth management, which in the financial world is often times also called asset management. There is, however, a similarity with asset management in infrastructure management; financial asset managers, i.e., investors, use asset management techniques to achieve the best balance of capital security/growth and interest rates/yields within their investment portfolio for a predetermined acceptable risk (Woodhouse, 2003). When we look at our definition for asset management the parallel can be quickly drawn.

Defining asset management

There are many definitions of the terms assets and asset management, especially in professional documentation. In this paper the definitions by the Institute of Asset Management are presented as they represent most other definitions quite nicely. The International Standard on Asset Management (International Standards Organization, 2013) defines asset management as the:

"Coordinated activity of an organisation to realize value from assets."

It further states that asset management involves the "balancing over time of costs, opportunities and risks against the desired performance of assets, to achieve the organisational objectives". The balancing might need to be considered over different timeframes.

This definition already clearly shows the connection with the other topics of this chapter, i.e., the performance of assets (performance management) and the connecting of these performance with

the organisational objectives (line-of-sight). The picture below illustrates the three most important aspects of what asset management is about.

Figure 2: Asset management is the balancing of risks, costs and performance

Infrastructure asset management is essentially the set of processes that need to be in place to ensure that the infrastructure assets perform corresponding to service targets over time, that the risk are adequately managed, and that the corresponding costs, in a lifetime cost perspective, are as low as possible (Alegre & Coelho, 2012).

In comparison to other disciplines such as project management, financial engineering, maintenance engineering or construction, asset management is a relatively new discipline. In 2003 a Google search on asset management revealed around 450.000 hits. Type in "asset management" in Google now, and it returns over 8 million hits. It is safe to say that asset management is a very contemporary topic.

Defining assets

And, when talking about managing assets, we should also define what assets are. In literature assets are usually defined as objects that generate value. See for instance the following definition by the Institute of Asset Management (2013):

"An asset is an item, thing or entity that has potential or actual value to an organisation"

Where they note that; (i) Value may be tangible or intangible, financial or non-financial, (ii) value includes consideration of risks and liabilities, and therefore may be positive or negative at different stages of the asset's life cycle, and (iii) an organisation may have partial responsibility for an asset, with limited or indirect influence upon the value obtained or generated (International Standards Organization, 2013).

Typical infrastructure assets may include (but are not limited to) for instance:

- Transportation networks (roads, rail, ports, airports);
- Energy supply systems (gas/electricity/oil production, transmission and distribution);
- Parks and recreation facilities;
- Water utilities (water supply, waste water and storm water systems);

- Flood protection and land drainage systems;
- Solid waste facilities; and
- Telecommunication networks.

Networked infrastructure assets

There is an important distinction between the management of singular asset or a networked infrastructure consisting of a collection of assets. There is a system behaviour, i.e., individual assets are dependent on other assets and their environment (e.g. culture, standards, laws, etc.), and it can't be replaced as a whole, but rather is renewed piece by piece of the individual components of the infrastructure system (Wijnia & Herder, 2009; Burns, Hope, & Roorde, 1999; Alegre & Coelho, 2012). In this regard, the management of a singular asset is more or less akin to more traditional maintenance and operation activities, whereas the scope of this research is that of networked infrastructure networks.

Organizing an asset management organisation

Asset management frameworks adopted by infrastructure organisations usually have a life cycle process approach. The processes range from asset planning, creation, operation, maintenance to performance measurement and incorporate risk, quality and environmental management to form a total asset management framework (Too, 2010).

However, (Too, 2010) observed two main barriers that prevent further advancement and development of asset management in the context of infrastructure organisations. The first being that the adoption of asset management is found in the 'step child' status left to dedicated asset management groups within an organisation, whereas prestige is commonly attributed to investment activities regarding new construction and development. Additionally asset management is often associated with only maintenance, asset inventory and its related services and therefore to be considered of less importance.

The second barrier he defined is the almost ambiguous state of asset management. There are many contesting definitions (and frameworks derived from those definitions) that relate to what constitutes asset management to the different organisations.

Besides these two barriers, a third barrier can be added (Too, 2012): increasing complexity. The changing political landscapes, customer demands, and linkages among countries place an increased emphasis on a more performance-focused, customer-oriented, and proactive asset management strategy.

Too (2012) continues to say that to remove these first two barriers asset management needs to be viewed from an integrated strategic approach in order to create value for the organisation and that there is a need for a clear understanding of what asset management is about. A closer examination of the definitions provided by the various professional bodies of knowledge – such as the one already presented by the IAM – reveal four unifying themes that form the heart of asset management: (1) alignment of assets and operations with corporate objectives; (2) it links decision-making and action with information; (3) Life-cycle costing is a key concept; and (4) asset management is a process. Particularly items (1) & (2) are important with regards to line-of-sight, discussed later in this chapter.

The cube in Figure 3 symbolizes an example of an integrated infrastructure asset management approach as developed by (Alegre & Coelho, 2012). It reflects the ideas that infrastructure asset management decisions need to be analysed in terms of performance, risks and costs. Further it promotes the idea that asset management should be addressed at different planning and decisional levels: a strategic level, focused on organisational and long-term views; a tactical level, where the

intermediate managers in charge of the infrastructures need to select the best mid-term intervention solutions; and the operational level, where the short-term actions are planned and implemented. A final notion is that asset management requires the knowledge and competences from the three pillars management, engineering and information (Alegre & Coelho, 2012).
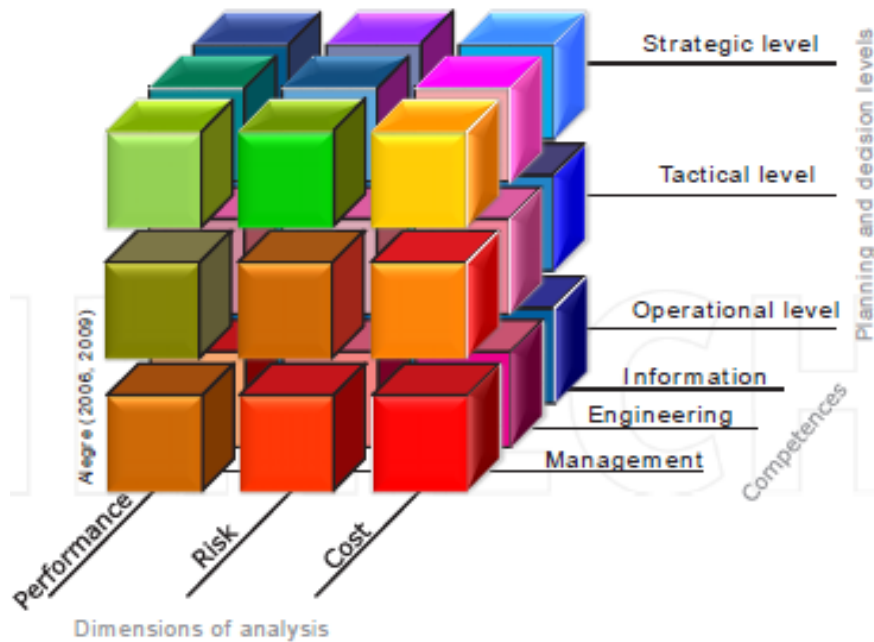
Figure 3 General infrastructure asset management approach
(Alegre & Coelho, 2012)

In accordance with the strategic approach to infrastructure asset management proposed by Too (2012), most professional literature incorporate this strategic approach to their guidelines (The Institute of Asset Management, 2014; British Standard Institute, 2008; International Standards Organization, 2013)

According to the PAS-55 (British Standard Institute, 2008) this strategic approach to asset management is done with an asset management system (AMS). The PAS-55 AMS consists of six elements: (1) general requirements; (2) asset management policy and strategy; (3) asset management information, risk assessment and planning; (4) implementation and operation; (5) checking and corrective action; and (6) management review and continual improvement.

The AMS as proposed by ISO 55000 (International Standards Organization, 2013) considers somewhat similar elements: (1) the context of the organisation; (2) leadership; (3) planning; (4) support; (5) operation; (6) performance evaluation; and (7) improvement.

To further illustrate, the (The Institute of Asset Management, 2014) argues that there is not one perfect model but instead uses a conceptual model (Figure 4) to describe the overall scope of asset management and the high-level groups of activities included within. The model highlights the fact that asset management is about the integration of these groups of activity and not just the activities in isolation.

Figure 4 The IAM Conceptual Model (Institute of Asset Management, 2014)

To highlight one activity group, consider for example "Strategy & Planning". This group contains the core asset management activities to develop, implement and improve asset management within an organisation, taking into account business and organisational objectives and the effect of changing demand over time on the asset portfolio (The Institute of Asset Management, 2014). It covers the following subjects: asset management policy; strategy & objectives; demand analysis; strategic planning; and asset management planning. This follows the theme set out by the PAS-55 and the ISO 55000.

Policy, planning and decision-making

It is by now clear that asset management is not just about maintenance and operation, a context in which it used to be (and in some cases still is) seen (Too, 2010; Wijnia & Herder, 2009). Instead, it is about making decisions related to infrastructure management that are based on policy goals and objectives. Decision-making implies that there are, or should be, alternatives to choose from. Thus asset management is about creating alternatives and choosing one alternative that fit the organisational objectives best.

Infrastructure organisations often have to deal with performance criteria that are imposed by external bodies. However many of these criteria are at a top level and do not directly apply to day-to-day activities. It is therefore the task of an asset management organisation to translate infrastructure performance criteria into asset performance criteria and internal targets, based on policy goals and objectives (Wijnia & Herder, 2009). These internal targets and translations present additional levels of decision-making, and although they need different inputs, all these levels are highly interconnected. It is at these levels decisions need to be made, for example on where to invest or

works prioritization, such that the investments contribute best to the overall organisational goals and objectives.

In order to do so it is important to know how certain investment options, such as the activities and processes that the organisation executes, contribute to the higher strategic goals. This can be a complex endeavour, where decisions are concerning conflicting planning horizons (long term strategic versus short term operational) and stakeholders with different requirements. This is where line of sight between strategic objectives through to operational activities is very important; this topic will be discussed in section 2.3.

2.2   What is performance management?

The second subject of this chapter is performance management and how performance management relates to infrastructure asset management. Therefore, first the terminology relating to *performance management* are defined. After that follows a brief history of performance management and how performance management is used in organisations nowadays. Finally we distil the important and relevant components and elements of performance management for use in the infrastructure asset management.

Defining performance

A quick review reveals that there is no uniform definition of the term *performance* in literature. Even the Oxford English Dictionary provides multiple definitions for performance: *"(1) An act of presenting a play, concert, or other form of entertainment; […] (2) The action or process of performing a task or function; (2.1) A task or operation seen in terms of how successfully it is performed; (2.2) The capabilities of a machine, product, or vehicle."* It provides varying synonyms such as: carrying out, execution, discharge, conducting, functioning, working, operation, running, behaviour, capabilities, etc.

There are also many different definitions of *performance* in scientific literature, and different fields of study hold different definitions in different contexts. For example, in the field of production management the aspect of *the activity* is accentuated; in the organisational context the focus lies on *fast and optimal cost processes*; economics looks at performance as *productivity*; in business studies performance is often translated into *monetary value*; and management accounting view performance as *an output of a company in financial terms* (Samsonowa, 2012).

A common notion among all definitions and views on performance is that they are mostly in terms of *efficiency* and *effectiveness*. For instance Neely, Gregory, & Platts (1995) define performance as the "efficiency and effectiveness of purposeful action". Efficiency refers to doing things right, while effectiveness refers to doing the right things. Performance should therefore not be seen as an absolute but rather as a relative measure of success (Lebas, 1995). In most cases performance is measured against predefined goals, a set of objectives or for comparison to other time periods or competitors.

Metrics, measures and performance indicators

There are different names for the measures of performance. Some call them measures, metrics, performance indicators (PI's), and/or key performance indicators (KPI's), and in literature many more can be found. The difference is the increasing importance of the context and additional information needed for each respective *term*.

A *measure* is mostly just "a quantifying value", while a *metric* embodies additional information about the measure and puts it into a certain context (Samsonowa, 2012), e.g., the total distance in kilometres of highway with video-surveillance within an observed system.

However *measures* and *metrics* do not directly determine or reflect the actual performance of organisation. Besides the systematic and orderly collection of quantitative data, i.e., *metrics*, performance indicators are used to quantify the efficiency and/or effectiveness of an action, process or (sub-)system when compared to reference values (Neely, Gregory, & Platts, 1995). Therefore, a performance indicator is not an absolute but a relative value, just like concluded previously that performance should be seen as a relative measure.

Ultimately Key Performance Indicators (KPI's) can be seen as the final step and are a set of performance indicators that are selected upfront and agreed on by management or stakeholders to be the most representative and/or critical performance indicators (Samsonowa, 2012). A key performance indicator is an element of this set. They are used because it can be argued that reporting to upper management is done in a reduced form and therefore several performance indicators are consolidated into KPI's (Samsonowa, 2012).

Performance measurement

It might seem that performance measurement is an essential part of a "larger" performance management, but this might not be the whole story. While some authors argue that you cannot manage what you cannot measure (Sink & Tuttle, 1989), the counterargument focusses on the danger of choosing the wrong metrics (Rolstadås, 1995; Neely, Adams, & Crowe, 2001). The danger and main weakness of traditional performance measurement systems is that they focused on a narrow and incomplete part of an organisations business. This focus was usually on costs and cost-effectiveness. These figures were viewed as synonymous with the performance of an organisation, which might be true in a stable industrial environment, but should be questioned in periods of rapid change (Rolstadås, 1995) in the context of the organisation. Think for example of changing political landscapes, innovation and changing stakeholders.

Why should we measure performance?

Now we know what performance is, and what measures are, we could ask ourselves the question why we want to measure the performances of organisations. Generally there are five reasons why management would want to measure performance (Lebas, 1995), to answer the following questions:

Where have we been? Score card about the past: how did we get to where we are. Such measures support the reward system - rewards are based, most of the time, on the past, not on the likelihood of future success - and serves to build the archives that will help forecast the parameter values used in decision analysis models.

Where are we now? What is the status of the processes that define the organisation and what is their potential for achievement in the future - for example: the car-engine oil-level and the ignition timing are coherent with the manufacturer's recommendations; the spark plugs are new; etc

Where do we want to go? We want the measures to provide support to the definition of objectives and targets, and support to the design of action plans.

How are we going to get there? The measures must support the budgeting and planning activities, and support continuous improvement.

How will we know we got there? Measures cannot be separated from the feedback loop about whether or not objectives or targets have been achieved. They feed into the reward system, and serve to reinitialize the cycle again.

Creating line-of-sight in performance management

Hans de Bruijn and Jan van Helden (2006) have another way of looking at it is, and state the following functions that performance measurement usually fulfils:

Creating transparency. Performance measurement leads to transparency and can thus play a role in accountability processes. An organisation can make clear what products it provides and – by means of an input–output analysis – what costs are involved.

Learning. An organisation takes a step further when it uses performance measurement to learn. Thanks to the transparency created, an organisation can learn what it does well and where improvements are possible.

Appraising. A performance-based appraisal may now be given (by the management of the organisation, by third parties) about an organisation's performance.

Sanctioning. Finally, appraisal may be followed by a positive sanction when performance is good, or by a negative sanction when performance is insufficient. The sanction may be a financial one, but other types of sanction are possible.

Performance management

Of course, only measuring how you perform in itself does very little to improve an organisations performance. It is what one does with the information where improvements can be made. Although there is generally no clear differential between performance *measurement* and performance *management*, one could argue that when organisations make strategic or tactical decisions based on measured performance information in order to improve those performances you can speak of performance management.

A brief history of performance metrics

Going back to 1900-1910 many of the basic methods to manage big businesses were already in place (Neely, Gregory, & Platts, Performance measurement system design: a literature review and research agenda, 1995). And performance measurement was amongst those methods. Traditionally performance were measured in relation to cost-effectiveness. Common measures for instance were return on investment, profit margin, and cashflow, many of these are still used today (Tangen, 2003). Other important measures, especially in factories, were productivity measures e.g. output per labour hour.

During the 80's and 90's we saw the introduction of performance measurement in public organisations during the time of New Public Management (NPM). In order to improve efficiency and performance of government agencies reform was needed. Public accountability of taxpayer money was an important part of that change and was to be achieved through performance measurement (Brignall & Modell, 2000; Pollitt, Van Thiel, & Homburg, 2007). Examples of organisations where these reforms occurred are the National Healthcare System (NHS) in England (Brignall & Modell, 2000) and the introduction of *agentschappen* in the Netherlands was also heavily influenced by NPM (Smullen, Van Thiel, & Pollitt, 2001).

However the traditional performance measures from the 50'and 60's were criticized because they encouraged short-termism (Neely, Gregory, & Platts, 1995), lacked strategic focus and were subject to perverse effects and failed to include in the needs of stakeholders and customers (Kaplan & Norton, 1992). They were outdated and unfit for use for more complex public organisations. The danger and key weakness of traditional performance measurement systems is that they focused on a narrow and incomplete part of an organisations business. This focus was usually on costs and cost-effectiveness. These figures were viewed as synonymous with the performance of an organisation,

which might be true in a stable industrial environment, such as factories, but should be questioned in periods of rapid change (Rolstadås, 1995) in the context of the organisation. Think for example of changing political landscapes, innovation and changing stakeholders.

Since the 1990's many authors have come up with performance measurement frameworks with an additional and more balanced set of measures that try to overcome the problem of a narrow and incomplete focus. Kaplan and Norton's (1996) Balanced Scorecard (BSC) is probably the best known example of these new performance measurement frameworks and was intended to provide top managers a quick but comprehensive view of the business.

Are performance metrics for asset management organisations different?

While there have been many measures and metrics for organisational performance for decades, the development of measures and metrics for the performance of maintenance activities and asset management is more of a recent development. Previously maintenance was thought of as a necessary evil, whereas it is now considered key to improving the cost-effectiveness of an operation and creating additional value for stakeholders (Kumar, Galar, Parida, Stenström, & Berges, 2013).

With the management of assets, and maintaining them, becoming an important strategic activity for organisations, especially with increased amount of outsourcing due to the separation of asset owner, asset manager, and service provider (Schoenmaker, 2011; Van der Velde, Klatter, & Bakker, 2013), so also increases the importance of measurement and control of asset maintenance performance. In the past, with the advancement of technology, many maintenance strategies have evolved, for example condition-based maintenance or corrective maintenance, predictive maintenance, and preventive maintenance, etc. (Kumar, Galar, Parida, Stenström, & Berges, 2013). Nowadays the effectiveness and efficiency of these strategies is an important decider for organisations faced with operationalizing their assets. Usually related to in terms of reliability, availability, maintainability (RAM), etc.

A state-of-the-art maintenance performance measurement system should include the following characteristics (Kutucuolglu, Hamali, Irani, & Sharp, 2001; Kumar, Galar, Parida, Stenström, & Berges, 2013):

- Appropriateness of the performance indicators in relation to the strategic objectives of an organisation. (Selection criteria): each performance measure should have an organisational goal or objective to feed back;
- Vertical alignment of performance indicators to translate the strategic objectives into different levels of hierarchy. (Deployment criteria): Recognition of different hierarchies;
- It can assess the contribution of the maintenance function to the strategic business objectives;
- It can identify the strengths and weaknesses of the implemented maintenance strategy;
- It can establish a sound foundation for a comprehensive maintenance improvement strategy using qualitative and quantitative data; and
- It can re-evaluate the criteria used for benchmarking.

Potential perverse effects of performance management

Performance management can also have negative effects on an organisation. This can occur in situations where measured performances are only used as to punish or reward individuals or departments. This behaviour is usually found at the managerial echelons of an organisation. Resulting in managers only aiming to turn their indicators "green". Either by solely focusing on them

and neglecting other important aspects of the business or "cooking the books" by presenting their performances in a way that doesn't truly reflect the true performance. This can result in reduced learning and growth of an organisation.

Although reward and punishment can be one of the effective uses of performance management, is this form on its own a poor and ineffective application of performance management.

Hans de Bruijn expands further on the topic of perverse effects of performance management in his book *Managing performance in the public sector* (2007).

2.3   What is line-of-sight

Introduction

During the early 60s, amidst the so-called space race, the John F. Kennedy, the president of the United States of America visited the NASA space-centre. This event was of course covered by the media, and a group of reporters noticed a janitor working towards them with a broom in hand. When the president asked the janitor what his job was at NASA, he said straight on, "It's my job to help put a man on the moon."

This anecdote tells us something interesting about NASA. It tells us that at they are very capable of committing all employees to a greater purpose. The employee has sight on the higher objective of the organisation and that his work contributes to that. This is an example of line-of-sight.

The "why"

Line of sight is defined as employee understanding of organisational objectives and how to contribute to those objectives. Although it is difficult to measure line of sight within an organisation (Boswell & Boudreau, 2001) the idea is that an organisation is better able to achieve its goals by achieving alignment through shared vision. In a study by Terry Cooke-Davies (2002) on the real success factors on projects it was concluded that one factor that leads to consistently successful projects is a suite of project, programme and portfolio metrics that provide direct line of sight feedback on project performance, so that project, portfolio and corporate decisions can be aligned.

In this section we will discuss the concept of line of sight. Line of sight, also known as alignment, refers to importance of "the big picture" and how activities contribute to organisational objectives, strategy, direction and purpose, the "why" of it all (Boswell & Boudreau, 2001).

Any organisation should be able to answer the question of its purpose, of why it exists. A strategic planning hierarchy should be able to help answer that question. Sink and Tuttle define the planning hierarch as follows (as cited by Rolstadas (1995) p91):

- Vision
- Mission (purpose)
- Guiding principles (values and beliefs)
- Superordinate goals
- Goals
- Objectives
- Activities.

Figure 5 shows a typical model of the traditional planning hierarchy, characterized by a decomposition of objectives as plans (top half of the image) and the aggregation of measures as the feedback (bottom half of the image).
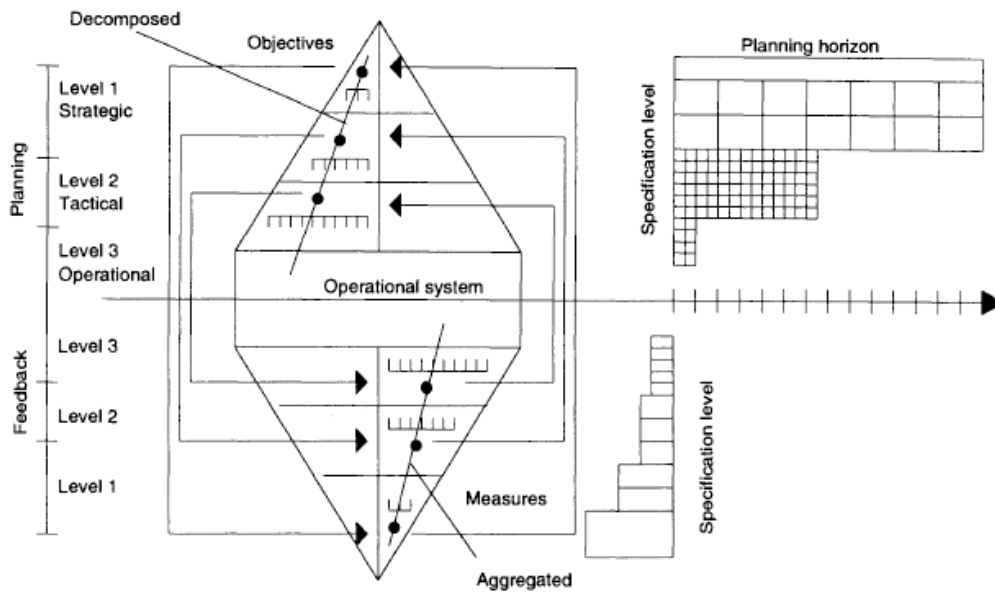
Figure 5 The planning hierarchy with major information flows (Rolstadås, 1995)

The high level strategic plans should have a long planning horizon and a less detailed specification level but should encompass most (if not all) of the organisations activities. It would be logical for these plans to at least contain the vision, mission, guiding principles and superordinate goals of the organisation. The strategic plans are then decomposed in tactical plans with a medium planning horizon and a slightly higher degree of specification, usually these are formulated at a departmental level and contain tactical goals and objectives. Finally the operational plans have a short planning horizon and the highest detail of specification and should focus only on a select few aspects and activities and contain the goals, objectives and activities at the operational level..

Information feedback (reporting) moves the other way. Detailed information on performance at the operational level is measured and reported to the tactical level. On this tactical level the information of different operational units is combined and aggregated to report to the strategic level of the organisation. Normally it is expected that the higher in the organisation you are the lower the amount of details are reported. The availability of integrative information is a key dimension in assisting managers to deliver positive strategic outcomes (Chenhall, 2005).

Enhancing employee line of sight

It must be noted though, that the strategic planning hierarchy is of little value if the employees do not comprehend organisational strategic objectives, let alone know how to contribute to them (Boswell, Bingham, & Colvin, 2006). So in order to enhance the employee line of sight communication is key. The strategic management levels should have a clear vision of where the organisation should be headed, as mentioned above. However, once this is achieved the vision must be shared with the employees. Boswell et al. (2006) suggest that direct one-one communication aimed at specifically linking employee roles to the organisational goals is key. In fact, involving employees in this process, bottom-up, it is expected to yield even better results, because the more employees personally believe in the goals, the greater the chance that they will contribute to them.

The "human resource management aspect" of line of sight was discussed further by Buller & McEvoy (2012), who argue that aligning the organisation's strategic goals with organisational capabilities and culture, group competencies and norms, and employee skills, motivation and opportunity enhances organisational performance. This was confirmed by Ouakouak & Ouedraogo (2013) who showed evidence that employee strategic alignment is indeed a full mediator in the relationship between

strategic planning and organisational performance: rational strategic planning positively influences organisational performance through employee strategic alignment, i.e. line of sight. Line of sight is especially critical when employees are relatively new to the organisation (Joshi, Kathuria, & Porth, 2003) or for instance after large reorganisations, and when there is a larger differentiation of responsibilities.

2.4   Concluding thoughts

This concludes the introduction to the central themes of this thesis. Asset management, performance management and line-of-sight. Important takeaways with regards to an infrastructure asset performance management framework are:

On the introduction to asset management;

- Asset management (AM) is not just about maintenance or operation;
- AM is about balancing performance, risk, and costs of a network of assets;
- AM requires knowledge on management, information and engineering;
- AM is about making strategic decisions on different levels (strategic, tactical, and operational) in the organisation to achieve the organisational goals and objectives.

On the introduction to performance management;

- Performance management can be used to increase the effectiveness and efficiency of an organisation by allowing an organisation to monitor the performance on certain indicators.
- There are several benefits to performance management, e.g. if you can link the performance on a particular indicator to certain activities or processes, you can learn to improve those processes and activities.

On the introduction to 'line of sight';

- Line of sight relates to the alignment of mission, goals and performance metrics.
- Purpose of work increases the performance of employees and contribution towards the organisations mission.

Over all we can conclude that all three themes are closely intertwined and share quite a lot of elements:

- Line-of-sight is an element in both asset management and performance management. Connecting the strategic goals of an organisation with the tactical and operational levels is essential for a well performing organisation.
- Asset management is about the balancing the performance of the assets in relation to the costs and risks associated with the assets. Therefore any asset management organisation should have at least some sort of performance management system in place that communicates this information to decision makers.

This is also the answer to our first sub-question:

1. *What are the reasons for line-of-sight in performance management systems of infrastructure asset management organisations?*

Line-of-sight (of performance management) is increasingly recognized as an important aspect of asset management. Part of any organisation is the translation and alignment of vision, mission and

goals with operational activities. And asset management literature now also recognize the importance of an integral approach, where all aspects of the organisation are represented in this line-of-sight and with decision making.

The next chapter will delve further into the criteria that a management system, or framework must meet in order to achieve line of sight with regards to performance management within an asset management organisation.

3 Theoretical framework for line-of-sight

The focus of this thesis is improving the line line-of-sight of asset management organisations with regards to their performance management. The aim is not necessarily to create a new framework or performance management system, but instead the interest lies in existing knowledge and state-of-the-art systems that may help in the goal.

The previous chapter introduced the three main themes: performance management, asset management and line-of-sight. This chapter first presents the elements, or requirements, that are essential to a system according to these three theories. Secondly several state-of-the-art methods, frameworks, and performance management systems are presented. Finally is examined how well these methods fulfil the elements/requirements as prescribed by the theory and the context of this research. The method that "performs" best will provide the theoretical perspective for the case study of the rest of this thesis.

3.1 Requirements for asset/performance management systems

This section will provide the elements and requirements on to which we will judge the appropriateness of the state-of-the-art asset/performance management systems. We will look at frameworks, methods and approaches because they can provide an organisation with a control system.

3.1.1 From the perspective of asset management

First, contemporary and state-of-the-art literature on asset management all state the importance of approaching asset management systems as an integral part of the entire organisation. A system should allow for as many parts of the organisation to be included in the performance framework. This means that not only technical or asset information metrics should be included, but also information on supporting business activities (e.g. organisation & people) and organisational strategical information, see also Figure 4, the IAM conceptual model on page 23. The first requirement is thus the focus on information from the entire organisation; from engineering, management and supporting departments.

Secondly, asset management is balancing of risks, costs and performance Figure 2, page 20. Therefore the second requirement from an asset management point of view is that the system should allow for the inclusion of information on these three aspects.

Finally, Alegre & Coelho add the third requirement that the system should include information about all time-frames; the short-term operational level, the mid-term tactical level and the long-term strategic level.

3.1.2 From the perspective of performance management

The first requirement from the performance management perspective is the notion of balance, as described by Kaplan & Norton. Balance means that information should not only focus on one particular aspect of the business (usually financial performance) but also on stakeholder satisfaction, internal processes and organisational and employee learning and growth.

A second requirement is having both leading and lagging performance indicators. Lagging indicators only give you information on past performances, while leading indicators can present an indication of future performance and allows management to adjust before performance drops below expectations.

The third requirement from a performance management point of view is that the system can be used for: creating transparency, learning, appraising and sanctioning, according to Hans de Bruijn (page 17). Related to this is the avoidance of the perverse effects that can be witnessed when performances are measured.

A final requirement is specific for asset management organisations. On the "lowest" level of the organisation are the assets themselves. The maintenance and operation of assets require specific set of measures, usually related to RAM (reliability, availability, maintainability), are to be included. They should be appropriate to the strategic objectives, and deployed at the right level of the hierarchy (Kutucuolglu, Hamali, Irani, & Sharp, 2001).

3.1.3   From the perspective of line-of-sight

Regarding line of sight and strategic hierarchy planning the first important requirement is that the system should incorporate the vision, mission, guiding principles (values and beliefs), (superordinate) goals, objectives, activities, from strategic to operational levels. Also the feedback loop of information going the other direction (operational, tactical, strategic) should be incorporated.

The second requirement from this perspective is the importance of employee understanding of the strategic objectives, and perhaps more importantly *how* the employees can contribute to them within his role (Boswell, Bingham, & Colvin, 2006). The system would be more effective if employees from the different levels and departments of the organisation are involved in the process.

3.2   The available methods aimed at improving line of sight

In state of the art literature there are several frameworks, methods, and performance management systems available. This study is interested in methods that are applicable to brown field asset management organisations. This section presents the methods available while in the next section they are reviewed against the requirements presented in the previous section.

3.2.1   The Balanced Scorecard

The balanced scorecard (BSC), created by Robert Kaplan and David Norton in 1992, is perhaps one of the best known and most influential concepts within the field of performance management. The BSC was developed with the goal to combine traditional financial measures with non-financial measures to provide decision-makers with better and more detailed information (Perkins, Grey, & Remmers, 2014). The perspectives of the non-financial measures are customers, internal business process, and learning and growth, it was not intended as a replacement but as complement to traditional financial measures. The following figure show how Kaplan and Norton envisioned the BSC.
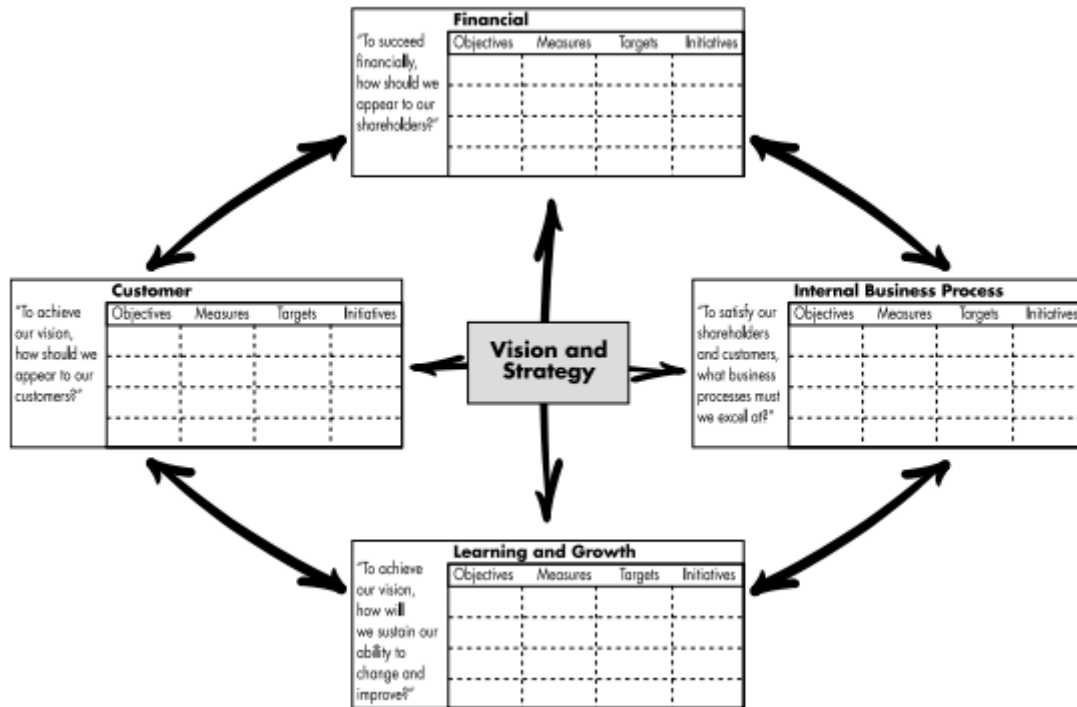
Figure 6 "Translating Vision and Strategy: Four Perspectives" (Kaplan & Norton, 1996). How Kaplan and Norton first envisioned the BSC. d the BSC

Since its first introduction the method has evolved over time and has been adapted to be used by corporations or government organisations. This was done by Kaplan and Norton themselves in the period from 1992 until 2006 as they grew the Balanced Scorecard from performance measurement tool in to a comprehensive performance management system. In this period it also became more and more tool to involving the management of the organisation, rather than the controllers, and as such putting the strategy and vision at the heart of the system (Perkins, Grey, & Remmers, 2014).

While Kaplan and Norton claim that the implementation of the BSC in an organisation leads to increased performance there is no empirical evidence of that, however some research suggests indirect support to the conclusion that organisations that implement BSC are more likely to take advantage of the benefits expected by Kaplan and Norton from adopting the BSC, since the characteristics of comparison between the BSC and non-BSC firms are very likely correlated with success (Soderberg, Kalagnanam, Sheehan, & Vaidyanathan, 2011).

The latest iteration of the BSC has seen the introduction of "Strategic Mapping" (Kaplan & Norton, 2008). It is aimed at solving the problem of companies underperforming because of a disconnection between strategy and operations. The strategy map is a tool for visualizing the alignment (as cause-and-effect relationships) between strategic objectives. Large organisations typically have one overall strategic map linked to separate strategy maps per sub-division.

3.2.2 The performance prism
The Performance Prism is a measurement framework introduced by Professor Andy Neely and his colleagues Chris Adams and Mike Kennerley (2002). It is a comprehensive measurement framework that addresses the most important business issues on which various organisations, both profit and non-profit, can rely. The framework was based on recommendations they had found in literature and tested through a series of studies and supposedly addresses the shortcomings of many of the traditional measurement frameworks and (Neely, Adams, & Crowe, The performance prism in

practice, 2001) call it a second generation framework. As a prism should, it is built out of five interrelated facets.

The main distinctive feature of the Performance Prism is that it uses the organisation's stakeholders as the basis, rather than its strategy. The primary facet of the prism is Stakeholder Satisfaction. Where the stakeholders in the Balanced Scorecard (originally) only include shareholders and customers, Neely et al. (2002) include all stakeholders, such as employees, suppliers, partners, local communities, etc, they explicitly ask "Who are the important stakeholders in the organisation, and what do they want and need?". The complete list of the five facets of the Performance Prism and their respective key questions are:

- **Stakeholder Satisfaction** – "'Who are the stakeholders and what do they want and need?'';
- **Strategies** - ''What are the strategies we require to ensure the wants and needs of our stakeholders are satisfied?'';
- **Processes** - ''What are the processes we have to put in place in order to allow our strategies to be delivered?'';
- **Capabilities** - ''What are the capabilities we require to operate our processes?'';
- **Stakeholder Contribution** – "What do we want and need from our stakeholders if we are to develop and maintain these capabilities?"

Although the nature of a prism being a 3d object that translates awkwardly to 2d representations, it would look something like the figure below.
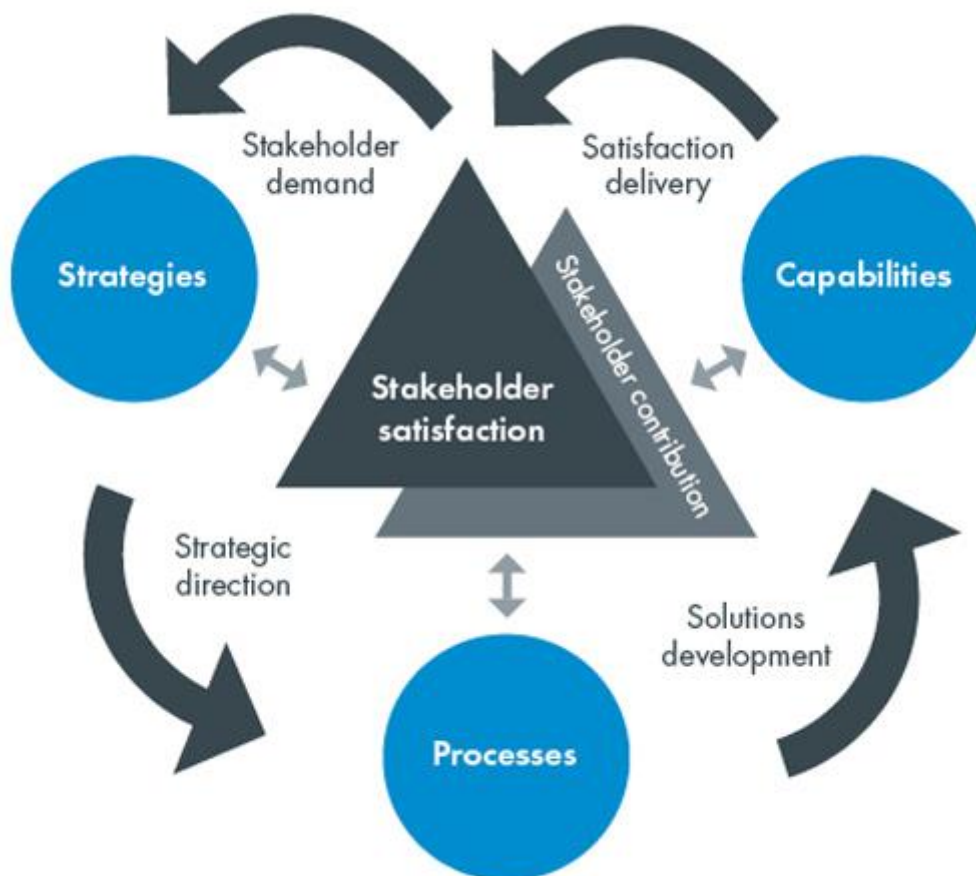
Figure 7 The Performance Prism (Cranfield School of Management, 2018)

The Performance Prism has been applied in numerous real-life situations and has "proved itself to be malleable to the various needs of a wide variety of different organisations" (Neely, Adams, & Kennerley, 2002) and its strength lies in the way it questions the organisations existing strategy first before the measures are selected, therefore ensuring that the performance measures are well aligned and are well founded (Najmi, Etebari, & Emami, 2012).

3.2.3   A Service Framework for Highway Asset Management

The third framework discussed is the service framework by Hatcher, Whittlestone, Sivorn, & Arrowsmith (2012). Where the previous two can be considered as more theoretical, scientific approaches, the Service Framework by Hatcher et al. can be considered as a more practical approach. It was created as part of the ongoing improvements of asset management at the UK's Highways Agency.

The authors recognised the importance of line-of-sight – as described by the new ISO standard 55000 – and that linking organisation strategic goals with operational activities a challenge is that asset management organisations face worldwide. Primary goal of the service framework was to develop a better understanding of the organisation's operation and to achieve alignment of strategic objectives and operational activities (Hatcher, Whittlestone, Sivorn, & Arrowsmith, 2012).

In contrast to the previous two described methods, Balanced Scorecard and Performance Prism which originally were designed for 'regular' private companies, the Service Framework is more pragmatically designed and is more geared to organisations in asset management, infrastructure in particular. The Service Framework method aims for an appropriate contribution of assets to the organisation's strategic goals. Schematically the relationship is shown in the figure below. The service framework boasts several benefits for asset management organisations:

- It should offer structure to operational activities towards high-level goals by providing line-of-sight.
- It combines both customer service measures as well as technical measures from multiple sources within the organisation in one single hierarchy.
- It allows communication on organisational strategy within a single system, allowing processes to be revaluated when certain performance measures are not at the expected level.
- When the impact on performance of service levels is expressed as a consequence of varying investments, varying regimes can be assessed.
- The objectives and services can be expressed in a way that associates risks of non-performance to decision making.
- It helps visualizing goals and activities within the organisation that lack effective measurements.
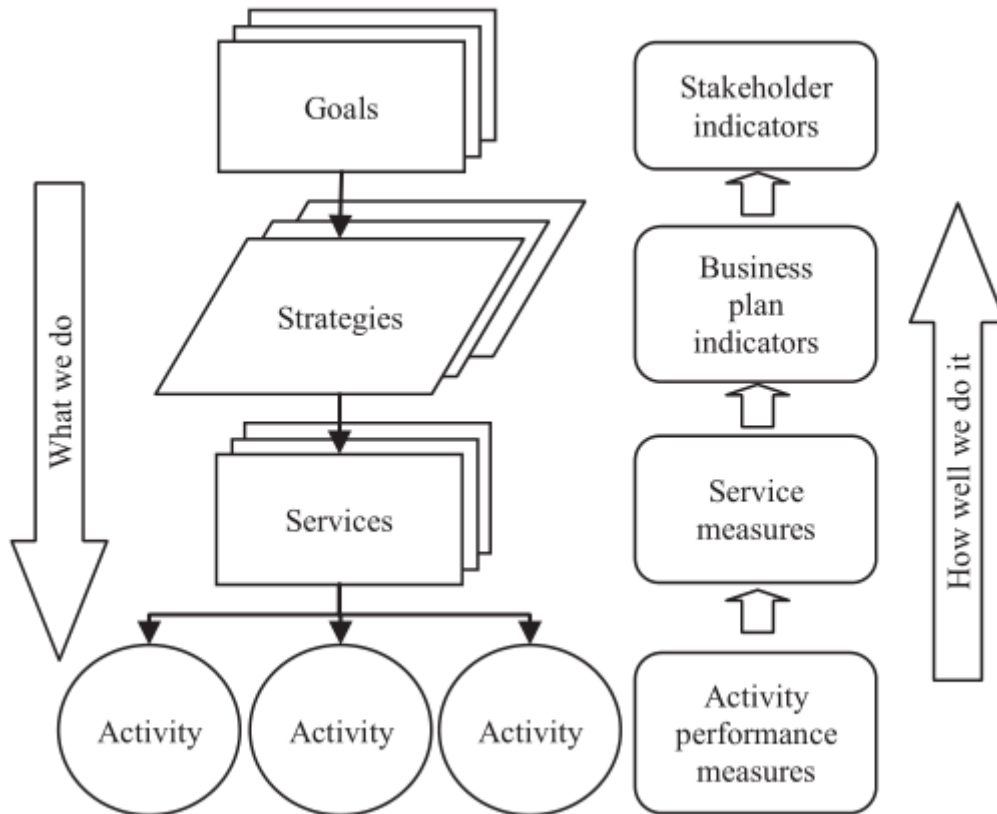
Figure 8 Application of the service framework (Hatcher, Whittlestone, Sivorn, & Arrowsmith, 2012)

The method uses existing management plans and information and also measures already in place in the organisation and employs a workshop approach to rearrange them systematically in a new single service framework. The beauty of this workshop approach is that employees from within different departments and backgrounds of the organisation can contribute to the framework.

3.2.4   Other systems and frameworks

Besides the three frameworks mentioned in the previous sections, many more can be found in literature. However, many of those are either designed specifically for for-profit organisations and manufacturing businesses or are aimed for "green-field" application. The following are some of the more well-known but not relevant for this particular research study, based on extensive study of performance management systems by David Otley (1999):

- Sink and Tuttle (1989) introduced one of the first frameworks for performance measurement in the planning phase.
- European Foundation for Quality Management (2018) is a not-for-profit membership foundation in Brussels, established in 1989 to increase the competitiveness of the European economy and their Excellence Model is, in summary, based on the question: "What determines the success of organisations that focus on excellence?"
- Economic Value Added by the Stern Stewart Corporation is at its core relatively simple. The complexity is that the concept must be applied to every business decision at all levels of a particular company to realize the desired long-run effects (Grant, 2003).

3.3 The conclusion and selection of frameworks to obtain line of sight of performance management for asset management organisations

In this section one method is selected based on the research on performance management, asset management and line of sight. In section 3.1 the following criteria were established:

AM 1) Have an integral approach, inclusion of information from the entire organisation.
AM 2) Use and generate information on risks, costs and performances.
AM 3) Include information on all timeframes (short, medium and long).
PM 1) Measures should be balanced, including not only financial measures.
PM 2) Measures should provide information on past *and* future performance.
PM 3) The framework should help the organisation in creating transparency and other benefits whilst preventing the potential perverse effects of PM.
PM 4) In the case of asset management organisation should allow for technical (RAM) measures.
LOS 1) Incorporate mission, vision and goals.
LOS 2) Allow employees to know *how* they contribute to goals and to be involved.

And due to the scope of this research the final criteria is that the method can be easily applied to a *brownfield* asset management organisation (BF 1).

In the table below the different methods are scored for how well they fulfil these criteria. A "+"-sign meaning high fulfilment of the criteria, a "o"-sign medium fulfilment and the "-"-sign minimal fulfilment of the criteria.

	Balanced scorecard	Performance prism	Service framework
AM 1	+	+	+
AM 2	-	-	+
AM 3	-	0	+
PM 1	+	+	+
PM 2	0	0	0
PM 3	0	-	+
PM 4	-	0	+
LOS 1	+	+	0
LOS 2	0	0	+
BF 1	-	-	+

Based on these results the Service framework by Hatchet et al. seems most appropriate for applying in a case study to achieve line of sight in performance management at a brownfield asset management organisation. In the next chapter the second part of this research introduced, i.e. the case study and the approach in which the Service Framework is applied at the case study are described.

4 Research design and introduction to case

In the previous chapter we've seen a couple of methods that should lead to line-of-sight of performance management within asset management organisations. One of those methods, the Service Framework by Hatcher and Sivorn was determined to be most successful when applied at a "brownfield" organisation. The following chapter describes how this thesis uses a case study to test this method in practice.

4.1 Case study

To acquire the empirical data required for this research qualitative procedures are used, namely a case study with workshops. As a research strategy, the case study is used in many situations to contribute to our knowledge of individual, group, organisational, social, political, and related phenomena (Yin, 2012). The use of case studies are used for intensive data gathering, with onsite observations when studying a small number of research units within their context (Verschuren & Doorewaard, 2010).

Screening and selection of the case and scope

There have been three criteria for the selection of the case subject:

1. It had to be an asset management organisation within the Netherlands.
2. It should have some form of performance management system in place, but with room and a desire for improvement.
3. It should be open to the researcher and be open for the intervention with workshops as described.

Rijkswaterstaat, being the largest infrastructure asset management organisation in The Netherlands – and one of the oldest existing ones in the world – offers great support for graduation research and as such was the obvious choice for the subject for this research. Relatively recently before the start of this research, an external audit by the consultancy firm Twynstra Gudde (2014) confirmed that, although performance management within Rijkswaterstaat is already a theme with many connotations, there is need to improve both the instruments used for performance management as well as the connection between asset and organisational performance and the employees operational activities within the entire chain.

So Rijkswaterstaat presents us a brownfield situation, with performance management in place with a need for further integration in the organisation, and is open to graduation students. The perfect combination.

During the first stages of the research it became clear that it was essential to continually narrow the scope in order to get the required depth. Therefore the first choice was to narrow the scope to main roads network that Rijkswaterstaat maintains. And to leave the water systems out of scope whenever possible. The main reason being that RWS was already working on this aspect the most with regards to performance management. A second narrowing of scope was regional. It turned out that it was best to go more in depth in one region of the Netherlands (the regional division of RWS called West Nederland Zuid), this was mostly a practical consideration.

4.2 The case study approach

The case study approach follows the service framework approach proposed by Hatcher, et al. (2012) and consists of three parts. The first parts consists of a desk research; acquiring and reviewing existing Rijkswaterstaat strategic and planning documents to determine organisational links between goals and activities.

The second part consists of a mapping exercise. This is done via workshop sessions at Rijkswaterstaat. After identifying and extracting all relevant aspects relating to objectives and services they are collated independently from the source. The various measures are then subjected to workshops attended by an expert panel involving representatives from various managerial and organisational levels. The goal of the workshops is to allocate the various measures to the service framework. Also the determination of goals, strategies and services are debated to create clarity on how outputs contribute to those services and goals.

The third and final part consists of a reiteration. The results from the workshops will be aggregated and recirculated to the expert panel and feedback will be integrated in the final analysis.

Protocols for the desk research

The desk research part of this case study is mostly a document study. The host organisation has provided access to all relevant planning and strategic documents. A selection was made of all available documents to stay within scope, this meant that – where necessary – documents relating to regional divisions other than *West Nederland Zuid* (Western Netherlands South) were not taken into account.

Besides the document study an unstructured observation approach is applied at the host organisation. The researcher has temporarily joined the organisation in a relevant organisation unit (Prestatie Netwerken - WVL) and has taken part in a series of meetings and informal unstructured interviews with Rijkswaterstaat employees. The results of this unstructured approach are not to be explicitly shared but are implicitly part of the analysis of the rest of this study.

Protocols for workshops

The workshops are the second stage of the case study. After the completion of the first stage of this case study (the desk research) the workshop sessions are conducted with the following rules:

- Workshops should have participants from different departments of the organisation.
- Only use the (during desk research extracted) already existing metrics.
- The author of this thesis was also the moderator/facilitator but was not intrinsically involved in the results of the workshops.

Having participants from different department it is intended to increase the likeliness of a more balanced result representative of the entire organisation. The intention of using only existing metrics is to increase the quality of the result and decrease the (valuable) time spent on thinking of new metrics. Although an "independent" moderator might be better, due to the knowledge of the method itself it was determined that it was best if the researcher is also the moderator.

The workshop sessions had the following participants:

Role/title	Department
Adviseur Intern opdrachtgever	WNZ
Adviseur System Engineering	GPO (WKI)
Adviseur Transport	WVL (Policy)
Regisseur Asset Management	WNZ
Adviseur Technisch Management	GPO (Project)
Asset Manager Industriele Automatisering	WNZ
Adviseur Beleid	BS

Table 1 Roles within the organisation of participants of the workshops.

4.3   The method to create line-of-sight

The case study approach used in this graduation thesis can be schematically represented as in the following figure. This approach is based on the Service Framework (Hatcher, Whittlestone, Sivorn, & Arrowsmith, 2012). Three separate phase are identified. As previously mentioned a desk research phase (or document study), a workshop session and an evaluation.

Phase 1

- **Review available asset management planning documents.**
  - Extract and document relevant mission, goals and performance measures.

Phase 2

- **Workshop session: Mapping exercise**
  - Define promises: "We will.."
  - Define service statements
  - Determine the rationale for existing organisational activities "Why do we do what we do?"
  - Create the hierarchy, or line-of-sight.
    Arrange the mission, goals and performance measures in a service framework, irrespective of source.

Phase 3

- **Evaluate the result:**
  - Are there any glaring gaps in performance measures?
  - Are the measures balanced?
  - Do all top mission/goals have relevant underlying performance measures?
- **Suggestions for improvements to the source material and performance measures.**
  - Suggestions for adding/removing/replacing performance measures.
  - Suggestions for improvements of the performance management reporting documents.

Figure 9 Creating the Line-of-Sight

The first phase of the approach consists of a desk research. Brownfield asset management organisation will already have a mission, goals, and most likely performance measures formulated. These are written down in asset management plans. The goal is to extract all the relevant goals, mission and performance measures from the current performance asset management planning documents within the organisation, so that in the next phase these can be shaken up and rearranged in a way that a clear line-of-sight is possible.

The second phase is a mapping exercise wherein all the extracted measures are rearranged in a service framework. The framework has 5 levels:

1. Strategic goals
2. Promises
3. Service statements
4. Operational activities
5. Performance measures

This second phase is done in a workshop in a workshop format, in which the promises of the organisation are defined, service statements are formulated and the rationale behind the organisational activities is determined ("Why do we do what we do"). At the top are the organisational strategic goals. This is all based on the information that was extracted from the existing asset management plans, no new measures are formulated. To simplify the framework and aggregation, all the elements are connected one-to-one. In appendix C the agenda for the first workshop session for this case study is included.

The figure below gives an example of the result of such a framework for an asset management organisation where the line-of-sight of the activity "maintain lighting" is linked with the organisational strategic goal "Our roads are the safest in the world".
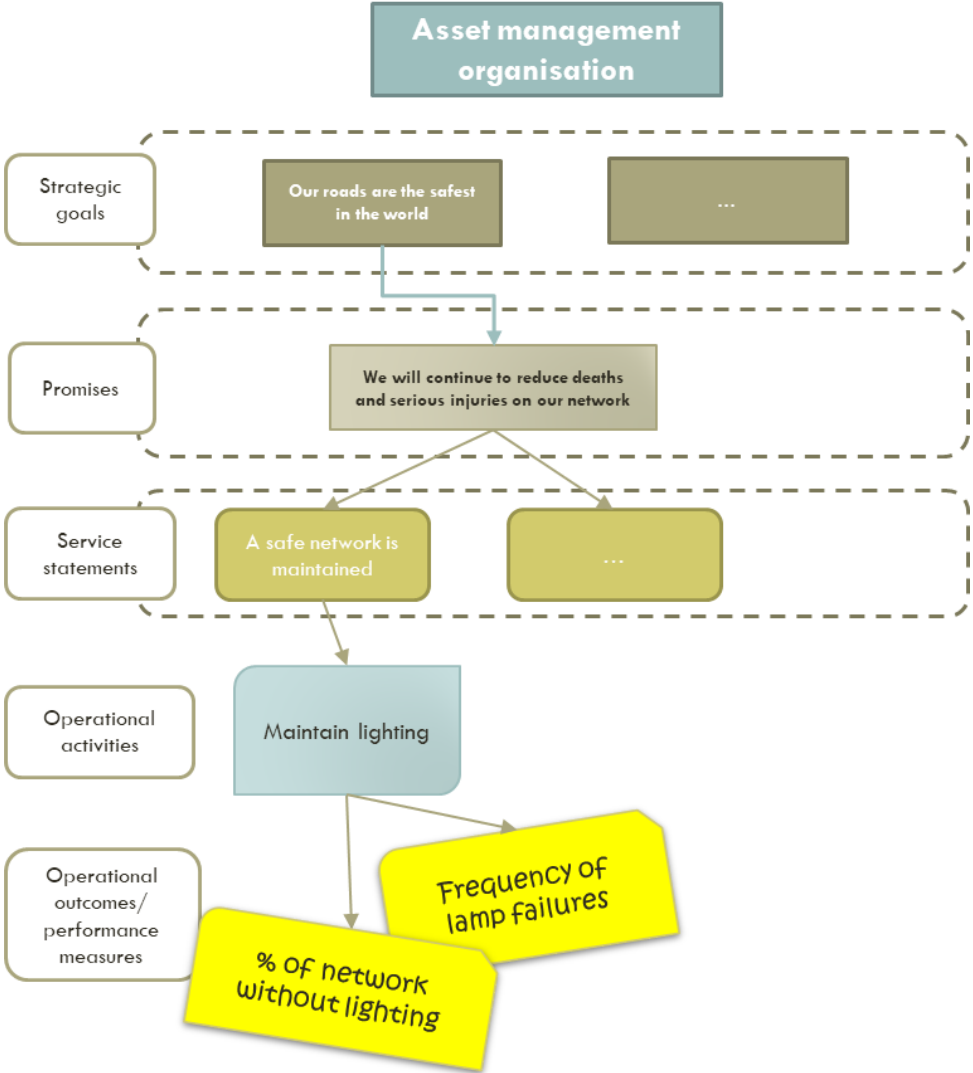
Figure 10 Line-of-sight Service Framework

After the mapping exercise is done, the third part is the evaluation. The results from the workshop session (the framework above) are then send to the participants of the workshop for feedback. And the result is analysed. An example of questions that should be asked are, for example:

- Are the strategic goals balanced enough and do they encompass the entire organisation? See the Balanced Scorecard (Kaplan & Norton, 1992) and section 3.2.1.
- Are there gaps in the framework?
- Are there activities for which no outcomes or measures are being recorded?
- Do the measures form a mix of leading and lagging indicators?

Based on these findings suggestions for improvements to the existing structure can be made. It might become evident that certain measures are currently reported on at the wrong level within the organisation and that maybe a more appropriate measure is possible at that level. It might also be that the organisational strategic goals do not include all aspects of the organisation and recommendations can be made for reconsideration.

4.4   Introduction to the case subject: Rijkswaterstaat

Rijkswaterstaat was founded in 1798 when a major plan was adopted to take control of public works and water management in the Batavian Republic. From that moment on all matters concerning public works and water management were dealt with in a centralized way. Christiaan Brunings was appointed president to control dikes, dunes, public works and water management in the Batavian Republic, and is therefore considered to be the first director of Rijkswaterstaat.

Rijkswaterstaat is the executive organisation of the ministry of Infrastructure and the Environment. It maintains and develops national roads, waterways and open waters, and supports a sustainable environment. In collaboration with others Rijkswaterstaat commits itself to a country that is protected against floods. With sufficient nature and sufficient clean water. Where the public can travel fluently and safely from A to B. Rijkswaterstaat aims, in collaboration with others, to make the Netherlands safe, sustainable and accessible.

The mission of Rijkswaterstaat is to ensure that the Dutch inhabitants have;

- protection against floods,
- sufficient and clean water,
- a smooth and safe flow of transport on the national highways and the main waterways,
- reliable and useful information, and
- a sustainable environment.

To achieve its mission, Rijkswaterstaat fulfils three societal roles: it wants to be a customer-oriented network manager, a leading project manager, and a decisive manager in times of crisis.

Rijkswaterstaat in a nutshell

In 2015 roughly 8800 people are employed by Rijkswaterstaat nationwide. Spread out over 7 regional departments, 16 districts, 4 process departments, 1 department for scope and 1 corporate department. Rijkswaterstaat is regionally organized but centrally governed. It has been the executive agency to the ministry of Infrastructure and the Environment since 2006.

It is responsible for the construction, management and maintenance of the main infrastructure facilities in the Netherlands including the main road network, the main waterway network and the

main water-systems and flood protection. It is responsible not only for the technical condition of the infrastructure, but also its user-friendliness. The approximately 8000 people working for Rijkswaterstaat are divided in national and regional divisions divided over more than 200 locations nationwide displayed in Figure 11 Organisational structure RWS .

A few relevant units are briefly described. Rijkswaterstaat Water, Traffic and Environment (WVL) develops the vision on the main infrastructure networks and the living environment. It tries to give direction on how the main infrastructure networks should develop and improve, which quality it should deliver to its end-users, and what care should be given to the environment.

The division Prestaties Netwerken – Performances Networks (PN) – is part of WVL and is concerned with the required performances of the three RWS networks, now and in the future, to meet with the changing demands, desires, and legislations. PN aims for a coherent network vision, suited for a changing environment. The section PN directs and facilitates the trade-offs between desired and achievable network performance for the short and long term, taking into account developments in functionality. The department stands for transparency, continuous improvement, and connecting. Performance Networks department initiates the creation of balanced and achievable performance agreements (1) and provides the necessary current frameworks (2) and knowledge (3). The department carries a chain management role regarding performance management in the RWS organisation, analyzes the current developments of all three infrastructure networks, and advises (4).
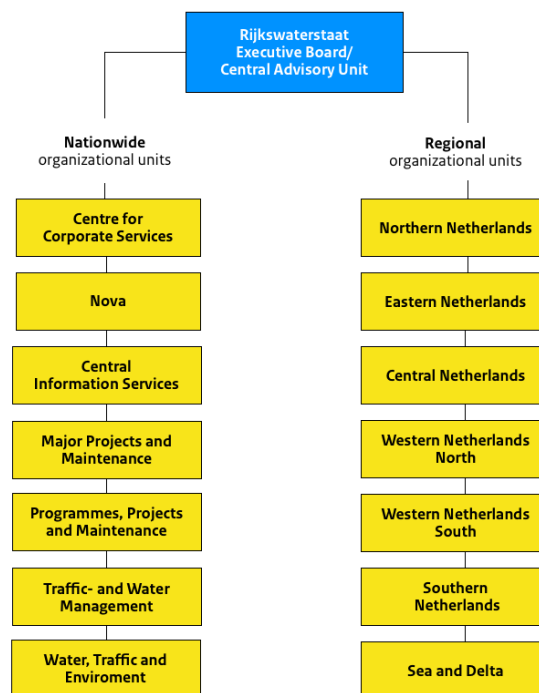
Figure 11 Organisational structure RWS (Rijkswaterstaat, 2018)

Rijkswaterstaat Programmes, Projects and Maintenance (PPO) is, together with Major Projects and Maintenance (GPO), the executive organisational unit for construction and maintenance projects. PPO and GPO are jointly responsible for portraying Rijkswaterstaat as a reliable partner, which meets the required production of construction and maintenance within agreed boundaries. PPO and GPO execute the production goals of Rijkswaterstaat on behalf of the regional divisions. PPO does this for programmes, Design & Construct-projects smaller than 65 million euro, performance contracts and other maintenance projects, while GPO is responsible for larger projects and programmes, including

large-scale DBFM projects. Within these division most of the employees spend most of their time as part of project organisations rather than the line management.

The division of Western Netherlands South (WNZ) is the regional division of the region that roughly can be described as the province South Holland of the Netherlands. WNZ is responsible for the operational objectives within the region. In addition, it is the pivot point in relation to the local parties in the area. WNZ consists of the departments network development (netwerkontwikkeling), network management and operational management (bedrijfsvoering). The network development department includes, among other things, the unit Asset Management (werkwijze omgevingsmanagement en assetmanagement). It is this regional department that can be considered the true asset management division of the organisation. They manage all the assets within their region and are responsible for keeping those assets performing at the required level.

5   Results and Analysis

In this chapter the results and analysis from the case study are presented and analysed. This includes the desk research results in the first section and the results from the workshop session in the second section.

5.1   Results from the desk study

The first part of the case study consisted of a desk research. The goal was to research the current situation of performance asset management within Rijkswaterstaat. This meant collecting and examining all relevant asset and performance management planning documents of Rijkswaterstaat and the Ministry of Infrastructure and the Environment. The following table presents the documents that have been reviewed for this thesis.

Table 2 Overview of I&M and RWS documents reviewed

Author	Title	Content
I&M	Rijksbegroting	The Departmental Budget for the Ministry of Infrastructure and Environment
I&M	Infrastructure Fund 2016	Contains the budget of the long-term Infrastructure Fund.
RWS	Ondernemingsplan 2015	Businessplan of Rijkswaterstaat
RWS	Koers 2020	Vision on the future and business plan
RWS (GPO)	Netwerkbeheervisie	A vision on how to manage the networks of RWS.
RWS (WNZ)	Managementcontract	(Performance) agreements between the director (HID) of the regional department WNZ and the director-general (DG) of Rijkswaterstaat.
RWS (WVL)	Other	Relative documents as provided by the host department.

First, in order to present some context, the rise of asset management at Rijkswaterstaat is presented. Some of this information is the result of the unstructured observations at *Prestatie Netwerken* and comes from internal publications of Rijkswaterstaat.

Secondly, after the context is presented, the all metrics, goals, ambitions, indicators, etc. that are presented in these documents were extracted. All this information is collected in the tables found in Appendix A and is used as input for the workshop sessions.

5.1.1   The rise of asset management within Rijkswaterstaat

In the wake of 'good' corporate governance in the business sector, New Public Management (NPM) was the movement to introduce 'good governance' to public organisations. This largely meant bringing management concepts from private business into the public realm (e.g. performance measurement, customer orientation, restructuring and bottom line focus) as well as the conditions that would facilitate this, such as deregulation, outsourcing, tendering out and privatization (Van Kersbergen & Van Waarden, 2004).

As a result, Rijkswaterstaat has been subject to several changes in the past few years. First of all, in 2004 it became an Agency in service of - what is now - the Ministry of Infrastructure and Water Management. This meant a clear separation between policy and execution. The government, i.e., the Ministry, is owner of all the assets and is responsible for policy making. The agency, i.e., Rijkswaterstaat is responsible for the execution of this policy. One of the results of this change is that Rijkswaterstaat, since becoming an agency, has become a more professional organisation

(Rijkswaterstaat, 2011). It was no longer freely in control of budgets and had to report on how much and on what money was spent.

A second change was the rise of public-oriented operations. As a public agency, the work of Rijkswaterstaat is under constant scrutiny of the tax-payers. They, the public, have become more vocal about their needs and demand a certain minimum quality of services. This means that it important to make the right and well formulated decisions on allocating funds and recourses.

A third change is the reorganisation of Rijkswaterstaat. Since 2004 Rijkswaterstaat has been reduced from over 11000 fte in 2004 to less than 9300 fte in 2013. This number is expected to drop even further to 7800 fte in 2018 (Rijksbegroting, 2014). This with the aim of being a modern government with the goal: less employees and more use of the market. The foundation of this thought is that the market is able to deliver higher quality at lower prices than the government. An important condition for this is that Rijkswaterstaat, as a client, directs it contractors, the market, in a uniform, efficient, and clear matter. This mean that it should know exactly what assets it has, and what it demands from its contractors.

The traditional method of operation was mostly concerned with maintaining assets in proper condition, when a bridge needed a new lick of paint, someone was sent out to do just that. This method of operating, however, had an ad hoc character. When Rijkswaterstaat was still largely responsible for policy, this was not a real issue, as it was always able to shift some recourses around. That freedom however is now gone. Both the Ministry, the public and the market demand a long-term forecast of actual maintenance needs and expenditure.

Contemporary asset management at Rijkswaterstaat

Therefore, we nowadays see a more integrated form of asset management employed at Rijkswaterstaat. One in which where ambitions on the performance of Rijkswaterstaat and its assets are described in several different vision/planning documents. These documents are formulated at different units within the organisation. A few examples of these documents are:

The **Koers 2020**, which is, essentially, the business plan for Rijkswaterstaat with goals and ambitions over the period 2015-2020.

The **Netwerkbeheervisie**, a vision document describing how the different networks should be managed.

The **Netwerkschakelplannen** describe per chain of assets *(netwerkschakel)* the required performance and management strategy, e.g. the A20 chain; including bridges, viaducts, highways, on- and off ramps between point A and point B.

The **ObjectBeheerRegimes**, loosely translated: object maintenance protocols, is a protocol per asset on how frequently certain operational maintenance activities should be performed, e.g. lubrication of moving friction parts of a bridge.

5.1.2   Mission and vision statements

The previous section provided a brief overview of asset management within the organisation of Rijkswaterstaat. This section expands that overview by analysing a broad spectrum of asset management plans and documents. First the data is collected from documents by the Ministry of

Infrastructure and Environment[1]. After that the data from Rijkswaterstaat was collected. A more detailed collection of data is collated in appendix A.

Ministry of Infrastructure and Environment

The policy agenda in The Departmental Budget for the Ministry of Infrastructure and Environment describes the main focus points for the ministry in 2016: Within the scope of this research, i.e. main roads network, the following (mission, vision) statements are relevant:

- To keep the Netherlands accessible and liveable in the future, the Cabinet is focusing on three solutions:
    - Improving rail and road networks,
    - Stimulating smart travel solutions
    - And experimenting with intelligent transport systems.
- The Minister is responsible for a robust mobility system of strong connections, strong modalities, predictable travel times and good accessibility.
- The Minister is responsible for the design and partly for the implementation of the road and traffic safety policy, including the supervision of the implementation of the legislation and regulations.

The agenda for infrastructure[2] (a chapter in the budget for the Infrastructure Fund) presents the milestones that have the main focus for the ministry of IenM in 2016:

- Traffic management, including:
    - Deployment of road inspectors in the event of incidents;
    - The collection of reliable journey and route information on all road sections.
    - This information is delivered to the NDW in time.
    - Realization of interventions to improve the utilization of networks and "connecting (smart) mobility".
- Management and maintenance, including:
    - Paving maintenance, maintenance of constructions and maintenance of Dynamic Traffic management (DVM) systems.
- Implementation of the renovation program "Replacements and Renovations", including the Steel Bridges program.
- The completion of a set of construction projects of new road sections.

Rijkswaterstaat

Rijkswaterstaat is the executive agency for the Ministry of Infrastructure and the Environment. Examining the business plans of Rijkswaterstaat and its departments from top to bottom presents the following set of statements regarding mission, vision and goals relevant to the scope of this thesis. A more detailed collection of data is collated in Appendix A.

The *Koers2020* (Rijkswaterstaat, 2016) is the business plan for Rijkswaterstaat for the period 2016-2020. It is a document for both internal and external communication and contains the vision for the future of Rijkswaterstaat , ambitions, and the mission statement.

- Mission statement for Rijkswaterstaat:

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[1] Please note that the Ministry of Infrastructure and the Environment has recently changed its name to Ministry of Infrastructure and Water Management, throughout this thesis these names are used interchangeably.
[2] In Dutch: Infrastructuuragenda

> *"Rijkswaterstaat operates at the heart of society and works to ensure that the Netherlands is safe, livable and accessible. Together with each other and with our partners, we work hard day and night:*
> - *A sustainable environment*
> - *Dry feet*
> - *Sufficient and clean water*
> - *Fluid and safe road and water traffic*
> - *Reliable and useful information"*

- With regards to mobility the following vision is formulated:
  - We focus on operational traffic management, management and maintenance, replacement and renovation and implementation of the Multiannual Programme for Infrastructure, Spatial Planning and Transport (MIRT).
  - Rijkswaterstaat will continue the program "better use of its resources". IT and data are becoming increasingly important in this area.
  - We are paying more attention to sustainability and mobility in and around cities. Many cities are now working on the quality of life, the conditions for establishment, growth and the sustainability of the economy. This leads to different needs in terms of accessibility: more sustainable, cleaner and healthier.

The Koers2020 is the business plan for the entire organisation. Subsequently, each department (GPO, WNZ, WVL, etc.) has formulated their own specific mission and ambition statements. For the regional department WNZ and the implementing department GPO the following statements have been formulated:

- Mission statement WNZ:
  - RWS West Netherlands South and its employees are proud to carry out their work in this region. We are committed to Rijkswaterstaat's mission: dry feet, clean water and smooth and safe traffic on water and roads. Right from the start after the reorganisation, we want to achieve the operational objectives as a single RWS.
  - Our mission has been translated into two operational goals: Availability of the networks and being a reliable partner.
- Mission statement GPO:
  - Within one RWS, GPO contributes to available and safe networks in the Netherlands. We are responsible for the construction and maintenance of large projects, within the set scope, budget, time and quality and with minimum inconvenience to the environment.

5.1.3   Goals and performance metrics

Here we first look at the relevant measures, metrics and indicators found in the documents by the department of Infrastructure and the Environment of the Dutch Government. After that we look at planning and management documents by the agency Rijkswaterstaat. Below is only a selection of the relevant information for analysis. For a more comprehensive overview of targets please refer to appendix B.

Rijksbegroting (State Budget) 2016 and Infrastructure Fund 2016

In the State Budget (chapter xii: Infrastructure and Environment) and the Infrastructure Fund several indicators are mentioned and reported on. These indicators are selected based on mainly political

motivations and the policies the current Government has prioritized. Relevant indicators in the State Budget:

- (Acceptable) travel times
- Local air quality
- Trend of traffic related casualties
- Efficiency indicators of Rijkswaterstaat, further specified in:
  - Agency costs per unit area (per infrastructure network)
  - % Agency costs compared to turnover
  - Costs per FTE
  - Turnover (per infrastructure network)
  - Organisation size in FTE
  - Percentage of overhead
  - Stakeholders: User satisfaction (per network)
  - Development of the PIN values (performance indicator values)

Relevant indicators in the Infrastructure Fund 2016:

- Reliable route and travel information is recorded on all measured road sections and shared with service providers.
- The share of disruptions to traffic flow caused by construction, renovation, maintenance relative to the total disruption to traffic flow.
- Amount of time (%) that the road is safely available, without lanes closed for construction or maintenance works, failure of assets or failure of traffic management.
- Complying to the norm for pavements (skid resistance and rut formation) and to the norm for ice prevention (preventative spreading of salt)
- Performance indicators for Rijkswaterstaat:
  - Technical availability of the road
  - Traffic jams as a result of roadworks
  - Complying to the norm for pavements (skid resistance and rut formation) and to the norm for ice prevention (preventative spreading of salt)
  - Availability of data for third parties
  - Up-to-date data for third parties

Service Level Agreement 2013-2016 and 2017

The Service Level Agreement (SLA) concerning the asset management of roads, waterways and watersystems was signed in 2012 by the then Secretary-General (SG) of the Ministry of I&M and then Director-General (DG) of Rijkswaterstaat for the period 2013-2016 and was later extended for 2017 as well. This SLA sets out the performance of Rijkswaterstaat in relation to the Ministry and the amount of resources available to deliver the agreed performances. Every trimesters the DG reports on the performances of the SLA targets to SG with a SLA progress report.

The SLA has different chapters relating to the different networks, in accordance with the scope of this study only the indicators related to the main roads network are mentioned here. The HWN indicators are:

- Availability
  - Technical availability of the road in % of time
  - Duration of disruptions due to roadworks compared to total disruptions
  - Availability of the road during rush hours

- o Calculated sum of lost hours of traffic on the main roads network
- Safety
  - o Complying to the norm for pavements (skid resistance and rut formation)
  - o Preventative spreading of salt
  - o Number of deaths on the main roads network
  - o Number of injuries due to traffic accidents on the main roads network
- Information services and predictability
  - o Availability and correctness of information data to third parties
  - o Predictable journey times on national trajectories
- Sustainability
  - o In 2016 sustainability was no longer part of the general SLA. Instead, a separate dashboard was being prepared for a set of interventions for 2017.

Management Contract WNZ 2015-2018

The management cycle is the process in which the DG makes agreements with the Head-Engineer-Director (HID) of the organisational unit (in this case WNZ) concerning the long-term production tasks and finances, the measures to be taken for process improvements and other organisation-related aspects. These multi-year agreements are laid down in a management contract. For the period 2015-2018 the following indicators were agreed upon:

- SLA indicators: The regional performance on the indicators mentioned, slightly differently formulated:
  - o Technical availability of the road
  - o Traffic jams as a result of roadworks
  - o Traffic jams as a result of failing infrastructure assets
  - o Response to unsafe traffic situations in a timely manner
  - o Availability and correctness of information data to third parties
  - o Noise nuisance along roads network
  - o Complying to the norm for pavements
  - o Response times in case of incidents
  - o Useful content of traffic messages to road users for traffic management
- Additionally WNZ has an operational goal, Reliable Partner, defined by indicators;
  - o Percentage (MIRT) milestones achieved
  - o Percentage payments made on time
- Production indicators:
  - o External production costs (EPK) for construction and maintenance projects
  - o Percentage of maintenance/construction tasks scoped for contract management
- Internal process improvement goals:
  - o WNZ has several specific goals to improve internal processes according to LEAN
- Employment and organisation goals:
  - o Time between job vacancy and job interviews
  - o Amount of job vacancies
  - o Internal mobility
  - o Rejuvenation of the workforce
  - o Absenteeism and sick leave
  - o (Reduction of) internal employment costs
- Pro-active safety culture
- Sustainable living environment indicators:

- o Energy reduction plan
- o Regional customer (or citizen) satisfaction regarding the networks
- o Regional customer (or citizen) satisfaction regarding Rijkswaterstaat reputation

5.2 Analysis of the desk research phase

5.2.1 Unstructured observations regarding the rise of asset management at Rijkswaterstaat

A few critical observations can be made related to the fact that asset management is still largely seen as a separate process rather than an integral part of the all processes within the organisation. This can be explained by a number of things:

1. The ambiguity of the term asset management within the organisation.
2. The existence of the term *prestatiemanagement*, performance management.
3. A separate process (and process owner) for asset management.
4. Separate units or clusters concerned with asset management and/or performance management at both strategic and tactical levels.

First, the ambiguity of the term asset management. There is still a large group of people that purely think of the maintenance of objects when they hear the term asset management. This appears to be especially evident at the operational level within the regional divisions of Rijkswaterstaat and is propagated by the job-title *assetmanager* for functional asset specialists that are primarily concerned with operational maintenance of certain asset-types within their specific region. This reinforces the idea of "asset management = maintenance". At the other side of this medallion is a growing sense that Rijkswaterstaat as a whole is an asset management organisation, however it is not entirely evident wat this means and how this translates into the day-to-day activities for the employees.

Secondly, within Rijkswaterstaat the term *prestatiemanagement*, performance management, exists. Theoretically this is a complicated term with regards to asset management. Because, as presented in the literature review part of this study, asset management is the act balancing of risks, costs and performance. Thus performance management is part of asset management. However, at Rijkswaterstaat the activities and results of "performance management" are almost exactly what the goals of asset management are according to literature. This juxtaposition of these two terms within the organisation with different *owners* only bolstered the position of asset management as maintenance management.

Thirdly, the existence of the separate main organisational process *"Omgevings en Assetmanagement (OAM)"* which are technically two main processes: *omgevingsmanagement*[3] and the for this thesis relevant process asset management. This process is assigned to the regional divisions, such as WNZ. To put this in to context, the other main processes defined by Rijkswaterstaat are: (i) "Construction and Maintenance projects" assigned to the construction divisions GPO and PPO; (ii) "Traffic and Water Management" assigned to the division VWM; (iii) "Information service", mainly assigned to the CIV; (iv) "Executive Management" (Bedrijfsvoering) assigned to management and control; (v) "Knowledge and Network quality" assigned to WVL; and (vi) "Crisis Management" assigned to various units.

The problem with this is that asset management is being worked on at several levels and within different processes, but not always under that explicit denominator. In the "asset management"

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[3] Omgevingsmanagement translates difficultly in to English, the process focus is not only on managing the environment (omgeving), but also on good relationship management and customer contact with the partners in the region (stakeholder management).

process, for example, it is mainly object-related operational tasks that are carried out, whereas the focus on performance is a task within the "Knowledge and Network Quality" process. Perhaps in an ideal situation asset management should be the core process for an asset management organisation. And all other processes should provide information to or result from the asset management decision-making process.

Finally, the fact that there are several organisational units (Prestatienetwerken – WVL; Netwerkmanagement – WNZ; System Engineering – GPO) working on their own products does not necessarily help the integration of asset management in the organisation. Although there are positive signs that these parties are increasingly looking to involve each other in their activities.

5.2.2   Line of sight of Rijkswaterstaat business plan and asset management documents

In order to complement the analysis of the ist-situation, the current line-of-sight at the case subject will be discussed in this section.

Within this analysis the policy documents of the Ministry of Infrastructure and the Environment are also considered, as they are very closely interwoven with the goals and mission of the agency Rijkswaterstaat. Both the Ministry of Infrastructure and Water Management and Rijkswaterstaat have documents in which they have formulated mission statements and ambitions. The diagram on page 54 shows all the documents that were reviewed in this process and the relation their relative position in the overall situation (the grey boxes are context, out of the scope of this research and were *not* reviewed).

What is interesting to see is that a relatively logical ordering of documents is possible. But, when looking at the documents in isolation they hardly ever mention the other relevant documents or how the document fits within the larger picture. Therefore there is no real line of sight established between the documents. This was also mentioned during the discussions in the workshop phase in this study, some of these documents were known to the employees, but most did not know how the documents related to each other and if there was a hierarchy between them. To establish a line of sight in these documents (at least those within the Rijkswaterstaat organisation) it could be beneficial to define one framework company-wide and present that framework in each of the documents as the backbone and context to that document.

Although the documents of Rijkswaterstaat definitely have an increasing concretization of asset management this is not reflected in performance targets. When comparing this to the literature review we see that top part of the Planning Hierarchy (Rolstadås, 1995), page 29, is well established within the organisation, however the feedback loop and aggregation of information and reporting is well behind. The objectives are not SMART and measurable and therefore it is hard to determine how well the objectives mentioned in the planning documents are performed.

Essentially, there are only two levels at which reporting to higher echelons is done. This is via the Service Level Agreement between the Ministry of I&E and the Director-General of Rijkswaterstaat and the Management Contract's between the Head-Engineer Director of the Departments and the Director-General of Rijkswaterstaat. Again, the performance targets mentioned in those two "contracts" definitely fall far behind in concreteness to the level of detail of the asset management plans formulated throughout the organisation. A possible explanation for this discrepancy is the history of Rijkswaterstaat as a governmental body and the negative connotation with targets and fear for the perverse effects associated with them. Regardless of the reason, the fact that there is such a discrepancy also hampers the realization of a true line of sight of objectives.

Creating line-of-sight in performance management

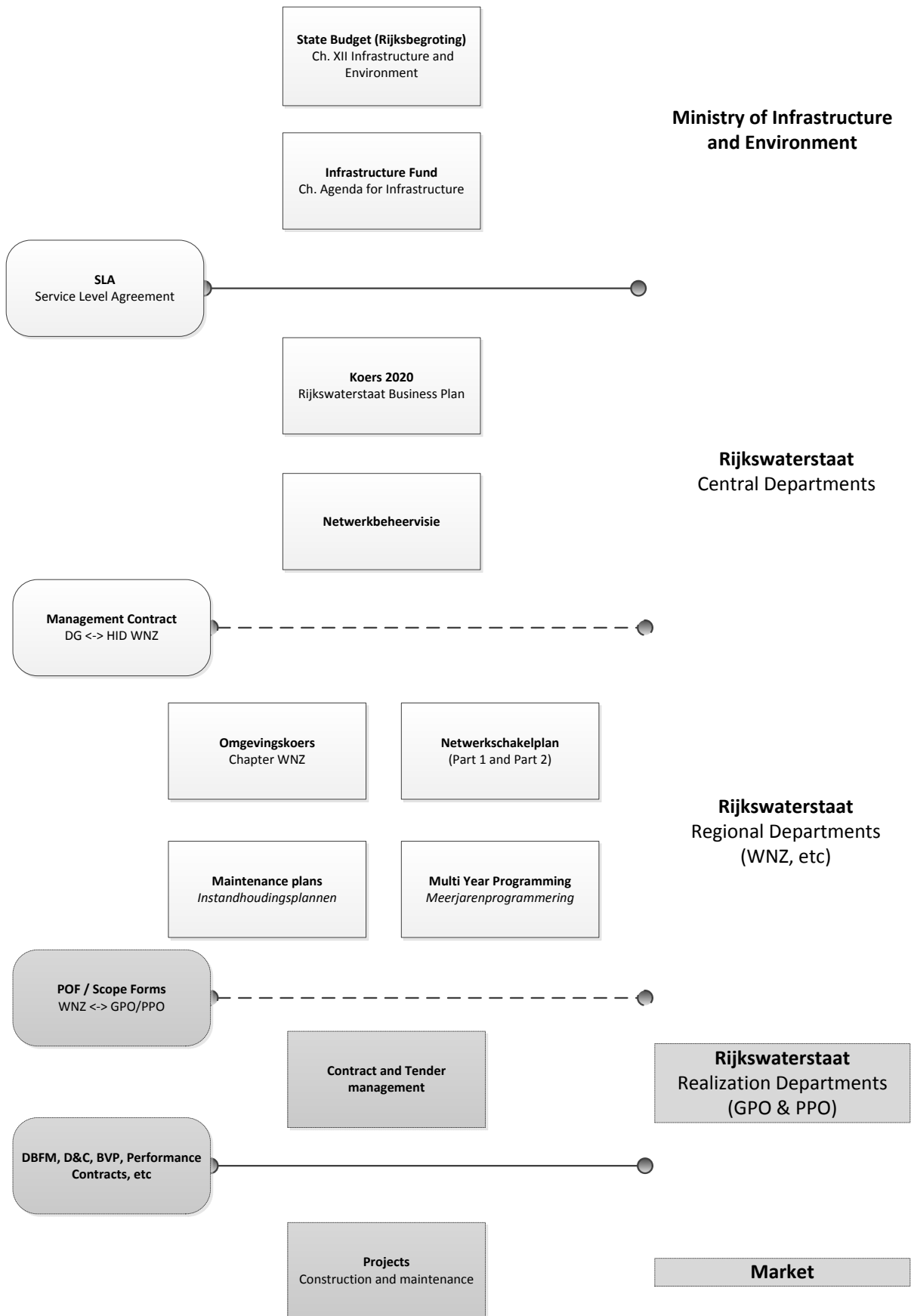|	
State Budget (Rijksbegroting) Ch. XII Infrastructure and Environment	**Ministry of Infrastructure and Environment**
Infrastructure Fund Ch. Agenda for Infrastructure	
SLA Service Level Agreement	
Koers 2020 Rijkswaterstaat Business Plan	**Rijkswaterstaat** Central Departments
Netwerkbeheervisie	
Management Contract DG <-> HID WNZ	
Omgevingskoers Chapter WNZ **Netwerkschakelplan** (Part 1 and Part 2)	**Rijkswaterstaat** Regional Departments (WNZ, etc)
Maintenance plans *Instandhoudingsplannen* **Multi Year Programming** *Meerjarenprogrammering*	
POF / Scope Forms WNZ <-> GPO/PPO	**Rijkswaterstaat** Realization Departments (GPO & PPO)
Contract and Tender management	
DBFM, D&C, BVP, Performance Contracts, etc	
Projects Construction and maintenance	**Market**

Figure 12 Documents reviewed and their position relative to each other

One would expect a very strong relationship between on the one hand the State Budget and Infrastructure Fund and on the other hand the Service Level Agreement. This SLA sets out the performance of Rijkswaterstaat in relation to the Ministry and the amount of resources available to deliver the agreed performances. In terms of indicators this indeed seems to be the case. A few observations can be made.

First, not all indicators selected are directly the result of the performance of Rijkswaterstaat. E.g., "Calculated sum of lost hours of traffic on the main roads network" is highly dependable on external factors, such as economic growth the weather and even changing social aspects of road users (think: increased mobile phone usage of drivers). It is understandable that the Ministry needs the information for policy making purposes, but their inclusion in performance targets for Rijkswaterstaat seem out of place.

Secondly, the State Budget mentions a set efficiency targets for Rijkswaterstaat, that are surprisingly not part of the SLA agreement. Although the efficiency indicators can be considered "old-school" financial measures, they still have a place in a balanced performance system (Kaplan & Norton, Using the Balanced Scorecard as a strategic management system, 1996). It is also interesting to note that although they are not part of the SLA between the Ministry's SG and Rijkswaterstaat's DG, they do reappear, albeit in slightly altered state, in the management contract between DG and HID of the regional department. There is obviously a link missing here.

Thirdly, changing political landscapes and changes in top management positions significantly influence the various documents due to the disparate time frames and release dates of the documents. On the one hand this works as intended; the multi-year agreements prevent overly turbulent changes to the management of one of the nation's most important infrastructures. On the other hand, however, there will always be a discrepancy and therefore lack of proper line of sight.

Fourth, the asset management plans such as the *Netwerkbeheervisie, Omgevingskoers* and *Netwerkschakelplannen* have very much a descriptive nature. The *Netwerkbeheervisie* is developed at the central departments of Rijkswaterstaat WVL. It sets out the long-term vision for developing and managing the networks, with the sustainable living environment as the foundation and the provision of information as the connecting link. The vision brings coherence between the different visions on our work processes. It sets out what is important now and in the future, what the ambitions are but not under what conditions they can be considered to be achieved.

The *Omgevingskoers* describes which developments can be expected in the mid-term in the various regions and the networks of Rijkswaterstaat and its main stakeholders. It is a product of the regional departments, such as WNZ. Again it describes what the ambitions are for the management and development of the networks, and adds activities should be done in relationship to those ambitions and it describes the hotspots in region. Just like the *Netwerkbeheervisie* there are no measurable targets included.

Netwerkschakelplan part 1 (NWSP-1) is the translation of the regional *Omgevingskoers* into a vision at the level of a network link of assets, for instance a stretch of the highway network including all the bridges, tunnels, on and off ramps in that corridor. An exploration is made of the long-term developments in the functionality of that link, the performance requirements, ambitions and choices that arise in that link. These performance requirements are a precondition for drawing up Performance Based Conservation Plans (PIHPs) for all the single assets. The NWSP-1 provides input for *Netwerkschakelplan part 2* (NWSP-2): which contain the mutually considered measures, resulting

from the underlying conservation plans, that are necessary to allow the network link in question and the assets within it to perform. Together with the (P)IHPs, NWSP-2 forms the basis for the (operational) programming. Both the NWSP-1 and the NWSP-2 contain information on the performance of the assets on certain measures, as such these documents form a connection between the SLA and the programming of operational activities, e.g. a specific maintenance measure at viaduct. The *Netwerkschakelplan 1* and *2* are still in their early stages and have not yet completed landed everywhere in the organisation.

When looking at the mission, ambition and goal statements throughout all the mentioned documents they seem rather repetitive. There are many places where the missions are shared and the main goals as well. There is quite some repetition, not always substantiating, and even when the same goal is mentioned in two separate document they can sometimes be formulated differently, e.g. the goal "dry feet", which is also frequently called "protection against floods". This, alongside the descriptive rather than prescriptive nature of the documents, undermines their potential value, at least in terms of performance management. The only direct visible line of sight is that between the NWSP-1 and 2 and the SLA.

5.2.3 Does the IST-situation meet the preconditions set out in the literature?

In chapter 3.1 a set of preconditions were set out to which an asset and performance management system within an organisation should comply according to the literature review. These were:

1. Information on performance of the entire organisation should be included as much as possible, including engineering, management and supporting departments.

When looking at the information used at Rijkswaterstaat it should be concluded that this is not the case. The performance management system is almost entirely focused on engineering and technical performance information from the assets from the regions. There is only very little information on, e.g., human resources, internal growth and learning in the Management Contract between WNZ and the DG.

2. Any asset management system should include information on: costs, risks and performance.

Rijkswaterstaat is increasingly able to collect and structure information on costs and performances, e.g., in the NWSP and the programming, and there is information on costs and performances in the SLA. However, the associated risks are only anecdotally mentioned in the various plans, mostly in terms of visions of the future. They do not yet have a quantified position in any of these plans.

3. Information on all time-frames (short, mid, and long term) should be part of the asset management system.

There is definitely a strong structure in the system at Rijkswaterstaat regarding the different time-frames. The strategical document *Netwerkbeheervisie* has long-term focus, the *Omgevingskoers* a mid-term focus, the *Netwerkschakelplan*'s have a mid to short-term focus and the resulting (multi-year) programming have short term vision.

4. Like the first requirement, the metrics and measures used should be *balanced* and not just focused on one aspect of the organisations business.

Rijkswaterstaat and the Ministry applies measures mainly on functional aspects (availability) and costs. Obviously availability should be considered a measure aimed at stakeholder satisfaction. But what is missing, according to the Balanced Scorecard (Kaplan & Norton, 1996), are top level indicators on internal processes and organisational and employee learning and growth.

5. When performance indicators are used, there should be a mix of lagging and leading indicators.

Almost all of the indicators used in the SLA and Management Contract are lagging indicators, meaning they report on past performances and have little predictive value for expected future performances. Therefore they offer little assistance to management for preventative steering. One example of a leading indicator is "Percentage of maintenance/construction tasks scoped for contract management" in the Management Contract; because if too little tasks are scoped in time for the contract management teams (GPO/PPO) the work will most likely not be executed in time, resulting in poorer future performance of the assets.

6. The system should help the organisation in creating transparency and other benefits whilst preventing the potential perverse effects of PM.

The current system creates some transparency, but only for a limited part of the organisation. Because most of the information used is focused on engineering performance there is limited transparency on risks, costs, or internal processes. This also limits the other potential benefits, such as learning from previous performances or that of other regional departments. Perverse effects of performance management is not observed and does not seem very prevalent at Rijkswaterstaat. Only instance of possible perverse effects is a discussion witnessed where a certain metric had some "play" where management decided to put a traffic light on orange instead of green, to denote a point of interest and to start a discussion.

7. Asset management organisations should allow for technical measures to be reported.

Rijkswaterstaat and the Ministry of I&E both report quite a lot on technical measures already, as discussed earlier, arguably even too much. It does so generally using the RAMS aspects, i.e. measures of Reliability, Availability, Maintainability, and Safety of the assets, derived from the System Engineering approach.

8. The mission, vision and goals should be the foundation for the performance measures selected.

This relation between measures and mission is neither explicitly nor implicitly clear. In none of the planning documents such a clear relation is formed. Secondly the relation of mission and goals statements between the different documents is not very consistent.

9. Employees should know how they can contribute to goals and be involved in formulating goals.

The current situation of selection measures is very top-down. Goals and measures are selected by an expert group for the management. It is not immediately clear what an employee can do to improve the performance on certain measures. In the management contracts the director of the regional division decides in consultation with the director of RWS the goals for their division, but involvement from lower echelons in this process is not common.

The conclusion of this segment is that the desk research at Rijkswaterstaat shows that there some essential elements of performance management for asset management organisations is in place, but that also a lot of requirements as found in the literature are unfulfilled. This makes it a good subject for the case study approach as presented in section 4.2, i.e. the Service Framework approach to see if the situation can be improved and more of the requirements can be fulfilled.

5.3   Input for the workshop sessions

The results from the desk research in the previous section form the input for the workshop sessions, the second part of this case study approach. All the elements (measures, goals, etc.) that are extracted from the various management plans are collated independent from their source to be used in the mapping exercise during the workshop session. These are the elements in appendix A and B.

5.4   Results from the workshop sessions

The second part of the case study were the workshops. Here the results from the desk research were used as input. This section presents the results, what was the output and outcome of the workshops.

5.4.1   Output from the workshop sessions

The direct result were framework where measures and metrics were realigned according to create a logical line-of-sight. An impression of the workshop is presented in a framework in Appendix D.

The output from the workshops were gathered and digitally presented in a new framework. This was shared with the participants for feedback and the resulting framework is presented in Appendix D. The figure below gives an indication of the result.
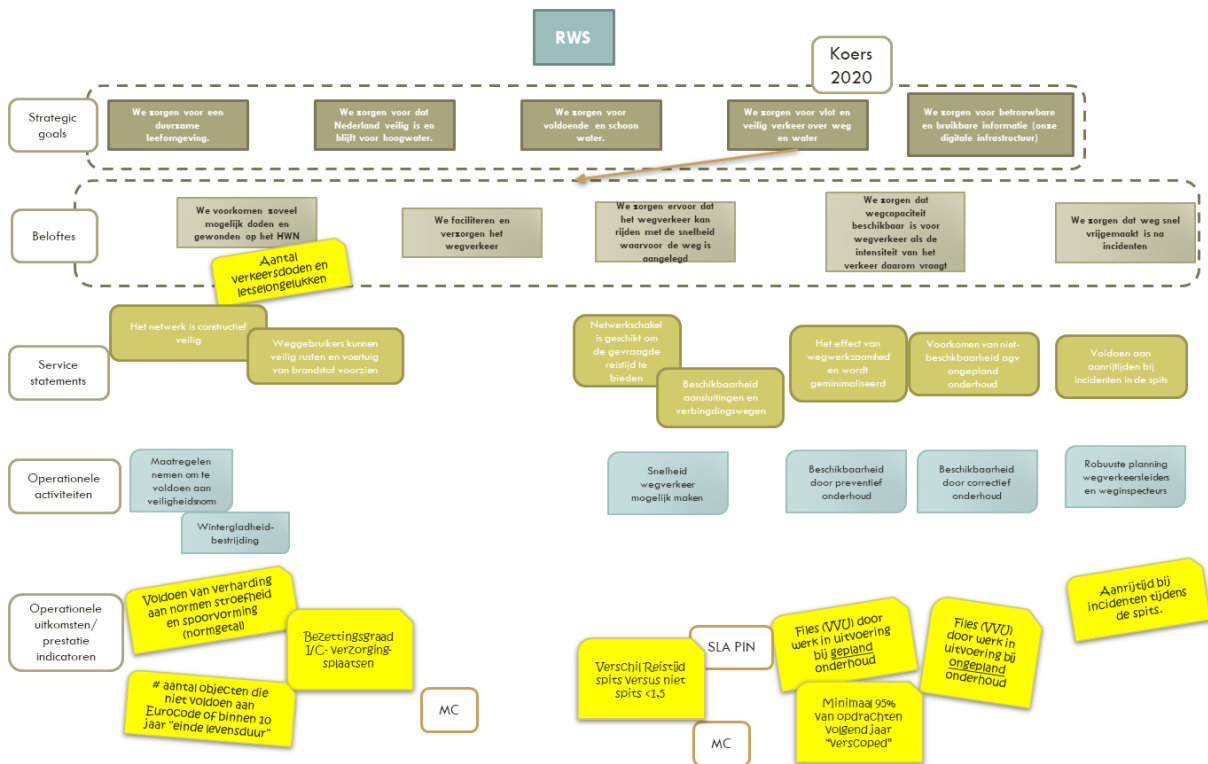
Figure 13 Output of the workshop session

5.5   Analysis of the workshop session and approach

The previous section presented the tangible output of the workshop session. In section 3.1 a set of nine requirements were formulated to which a proper performance management system for an asset management system should conform, in this section we will discuss the "intangible" results from the workshop sessions and how well the new situation conforms to the nine requirements; the "soll"-situation.

5.5.1 A new framework for Rijkswaterstaat?

The workshop sessions were limited in their approach because only existing measures and information was taken in to consideration. However, this was by design in order to speed up the process.

During the first workshop session it became clear that starting with all the information extracted from all the planning documents was to ambitious. There were too many unknowns for the participants which slowed down the progress. A preselection of information is something that should be considered in future applications of the workshop session approach.

What was positive was that the participants were quite easily able to (re-)arrange the information available from the different sources into a new structure according to the Service Framework method. Most effort was put in the areas of the framework that related most to the area of expertise of the participants. But, due to diversity of the group this enabled really interesting discussion on how certain metrics or goals should be interpreted and where they should be placed in relation to the other metrics.

When compared to the situation before applying the method and workshop we can now identify how well the end result complies with the requirements set out in section 3.1.

1. Information on performance of the entire organisation should be included as much as possible, including engineering, management and supporting departments.

Although this has not improved in this iteration, due to the limitation set out that no new metrics should be added, it does uncover where metrics are lacking. For instance, metrics regarding supporting departments, such as HR and Corporate Services can now quite easily be added to the new framework.

2. Any asset management system should include information on: costs, risks and performance.

No improvements were found on this aspect. Information on costs and performance are included but risks are still not (yet) part of the system.

3. Information on all time-frames (short, mid, and long term) should be part of the asset management system.

This is included in this framework. And is now part of one overview, rather than separate documents as before.

4. Like the first requirement, the metrics and measures used should be *balanced* and not just focused on one aspect of the organisations business.

Here to, the limitation of the Service Framework where no new metrics are added prevented improvement on this aspect. However, the single overview does allow for identification of gaps in the metrics, such as metrics concerning employee satisfaction, internal processes and learning & growth.

5. When performance indicators are used, there should be a mix of lagging and leading indicators.

It is possible to have both leading and lagging indicators in this framework. In the end result, mainly lagging indicators are used, but in subsequent iterations leading indicators could be added to the framework.

6. The system should help the organisation in creating transparency and other benefits whilst preventing the potential perverse effects of PM.

Having the information presented in an open format such as the Service Framework increases the transparency and allows for comparing between (regional) departments and enables learning opportunities. The system itself does not necessarily promote any perverse effects, as long as there are no penalties or rewards based solely on the scores on the metrics.

7. Asset management organisations should allow for technical measures to be reported.

Within the Service Framework there is definitely room for technical aspects and measures to be incorporated and reported upon. The system also places the technical/functional on a lower level in the organisation, closer to the operational level, where most influence on the performance on these measures can be had.

8. The mission, vision and goals should be the foundation for the performance measures selected.

The Service Framework starts with the Mission and Vision at the top of the document and the goals are aligned with those in one framework. Anything in lower parts of the framework is aligned with those top organisational goals and mission. No longer are there any "dead ends" in separate asset management plans.

9. Employees should know how they can contribute to goals and be involved in formulating goals.

Here the biggest improvement is found. The fact that employees themselves are participants in the workshops and are enabled to formulate the goals and metrics and see them in relation to the organisational mission and vision greatly improves the employee understanding of their day-t-day activities in relation to achieving the Rijkswaterstaat mission.

It can be concluded that the implementation of the Service Framework has increased the (perception) of line-of-sight at the organisation. Most benefit had is the single overview, which also reveals where there are still gaps in the information reported on. However, the biggest improvement can be had if the method is implemented in an iterative process where in the next phase metrics and goals can be replaced and added to the framework.

5.5.2 Evaluation of the method by the participants

A questionnaire was discussed with the participants, this questionnaire is included in Appendix D. The questions could be answered on a 5-point scale. The first set of questions regarded to their familiarity with the theories of asset and performance management. The second set of questions regarded the familiarity with the asset management plans at Rijkswaterstaat, and the third set of questions on how much goals, objectives and metrics in these plans are known. is part of their day-to-day activities. The fifth set of questions regarded the method (the Service Framework by Sivorn and Hatcher) used. The sixth set regarded their opinion on the line-of-sight at RWS before and after the workshop. Below a summary of results.

1. On average, the participants had a medium to low familiarity with the theories of asset and performance management (average 2,1).
2. Only a few of the asset management planning documents of Rijkswaterstaat were known, on average the SLA was unknown and Koers2020 was well-known. (Average familiarity of 2.6)

3. On average the RWS top missions is well known (4,5), however the lower objectives as formulated in lower asset management plans are fairly unknown (average 2.2).
4. Nobody in their day-to-day activities is consciously working towards the top-RWS mission and goals (average of 1.8), however their respective (sub-)department goals were more relevant to their day-to-day activities (average 3.0).
5. On average the participants really liked the approach (workshop) (4.0) and think that the approach is repeatable within their division (on average 3.7). The factual outcome however was on average rated mediocre (2.8).
6. The participants opinion on the line-of-sight increased on average from 1.8 before to 3.8 after participating in the workshop-session. .

5.5.3 Observations during and after the workshops

The conversations and discussions during the workshops were an indirect output from the workshop.

Discussions during and after the workshop

During the workshop-session many thoughts were shared and discussions were had. Although no complete transcription is available, the topics discussed are listed below:

- The Rijkswaterstaat mission is very "technical" there is no mention of employee satisfaction.
- The different management plans seem repetitive and their relation is unclear.
- They are fairly vague in their objectives, they are not SMART or measurable and reporting on the performance on them is difficult.
- Presenting all the information in this way is useful for increasing understanding of the relationship between operational work and projects and Rijkswaterstaat's mission.
- Although the overall experience was positive, and the outcome was an increase in line-of-sight, the outcome was not yet strong enough and it was recognized that this approach needs various sessions like this in iterative format, with various expert-groups to produce an effective and useable end-result.

Indirect secondary outcome

According to the evaluation and informal interviews after the workshops some of the participants mentioned that they have shared the experiences of the workshop with their colleagues of their respective organisation division. This resulted in an additional effect where in one case they have re-evaluated the goals of that division in relation to the goals of their department and Rijkswaterstaat in general, they used a similar but simplified version of the Service Framework for this.

5.5.4 Applicability of the chosen method for asset management organisations

The results show that (a modified version of) the Service Framework method can definitely be applied at the case Rijkswaterstaat. Although this appears to only have been the second time this method has been applied at asset management organisations (previously at the Highways Agency in England and thus now also Rijkswaterstaat in the Netherlands) it has yielded positive results at both instances. Although not necessarily part of the scope of this research, it is worth considering the cultural differences between these two countries; England is generally considered part of the Anglo-Saxon model versus the Netherlands which is generally considered part of Rhineland model. The fact that the Service Framework method (Hatcher, Whittlestone, Sivorn, & Arrowsmith, 2012) provides positive results at both agencies seems promising for other asset management organisations looking for a way to increase the line of sight of their asset and performance management goals.

The conclusion regarding the Service Framework method, is that some modification should be considered when applying the Service Framework method to make it more successful at creating

line-of-sight for the entire asset management organisation. These modification are explained in section 6.2.3 Recommendations for the Service Framework Method.

It should be noted though that this method is rather labour-intensive. Both the preparation phase (the desk research) and the workshop phase can take a lot of time. Especially the workshop phase can take numerous workshops. In this case study the scope is limited to only predefined section of all of the work of the organisation, and still it took substantial effort to organize all the necessary meetings. Part of this difficulty can be attributed to the timing of this particular case study. The connation of the subject asset and performance management at the time of the case study within the organisation was sensitive, due to multiple actors within the organisation developing views on those topics at the time. This made it harder to engage employees as they might have already been involved in similar discussions from other sources within the organisation with different contexts. Another element that contributed to the increased efforts in organizing workshops were the requirements on the participants; the workshops required attendance by employees from various departments of the organisation and from various locations.

The beauty of the method is that it can be applied both small, within a (sub-)department or workunit, but also big, i.e. for an entire organisation. The employees react really positive to being involved in this process and it really enables them to be involved in envisioning and formulating the goals of their individual work, that of their department, and that of the organisation as whole. In doing so it enables them to see the line of sight of their work in relation to organisations mission. In fact it might even be better to perform this method iteratively with different scopes to yield the best results where employees from all divisions are involved in the process as it creates a platform for discussion about the goals. An iterative approach also adds the possibility of filling gaps in the framework that were uncovered in a previous workshop. When applying a method such as the Service Framework it appears to be important that it is not an exercise to be done by just one group of experts within a "silo".

6 Conclusion and recommendations

This research provides insight in the methods for creating line-of-sight in performance management for "brownfield" asset management organisations. The fundamental goal for performance management is to measurably improve the overall performance of the organisation over time.

Performance management and asset management has evolved over time. Systems developed by organisations in the past are no longer adequately sufficient when compared to state-of-the-art theory, best practices and international standards and norms on performance and asset management.

Many scientific methods have been developed to create or improve performance management systems for organisations. Most of these are geared towards greenfield situations, organisations starting with a blank canvas. Only few are applicable for brownfield situations, organisations with forms of performance management already in place. One such method was potentially deemed most successful for application within a large scale asset management organisation; the Service Framework by Hatcher et al (2012).

The case study conducted at Rijkswaterstaat showed that the Service Framework by Hatcher et al. can be successful, but some recommendations should be considered. The case study shows that – although it can be quite difficult for an organisation that already has forms of performance management in place to restructure their indicators and metrics in order to form a line-of-sight from top to bottom and vice versa – that improvements in the line-of-sight definitely can be made.

In chapter 1.4 the research question and sub-questions were formulated. In the following section we will conclude this research with the answers to these questions. The last section of this research contains recommendations; first of all for Rijkswaterstaat on how to continue improvements on their performance management system, secondly for other organisations looking to improve their line-of-sight by using the method presented in this thesis and finally some recommendations for future research.

6.1 Conclusions

The main research question formulated in the first chapter was:

> *"How can line-of-sight of performance management be achieved
> in brownfield asset management organisations? "*

In order to answer the main research questions we will first have to answer the sub-questions. The answer to both the sub-questions as well as the main research question are underpinned by the content of this report, i.e., the literature research, case study desk research and observations and case study workshops and the analysis thereof.

6.1.1 Answers to the research sub-questions

Answering the main research questions is done via two groups of research questions, the first three questions from a theoretical perspective and the final two from the perspective of a case study.

Creating line-of-sight in performance management

Q1: Why should asset management organisations want to have line-of-sight in their performance management system?

The end goal of performance management is to continuously improve the performance of an organisation. Especially government agencies are increasingly under pressure to "achieve more and cost less". However, large asset management organisations usually have multiple management layers between the top strategic goals formulated by the government or top management and day-to-day operational activities "out in the field". Without a clear line-of-sight between strategic goals and tactical decisions and operational activities the performance of the organisation as a whole can not be linked with the performances of assets or activities thereon. See also Chapter 2.

Q2: What are the relevant elements of line-of-sight performance that brownfield asset management organisations should include?

The following list presents the essential elements for an asset management line-of-sight performance management system, and is the answer to the second sub-question:

- Have an integral approach, inclusion of information from the entire organisation.
- Use and generate information on risks, costs and performances.
- Include information on all timeframes (short, medium and long).
- Measures should be balanced, including not only financial measures.
- Measures should provide information on past *and* future performance.
- The framework should help the organisation in creating transparency and other benefits whilst preventing the potential perverse effects of PM.
- In the case of asset management organisation it should allow for technical (RAM) measures.
- Incorporate mission, vision and goals.
- Allow employees to know *how* they contribute to goals and to be involved.

Q3: What is the preferred method to achieve line-of-sight in performance management?

With these core elements identified a selection of available (state-of-the-art) methods for creating line-of-sight for performance management were examined that provide tools to create line-of-sight, that have been presented in chapter 3: the Balanced Scorecard, the Performance Prism, and the Service Framework.

Out of the methods selected, and considering the essential elements and considering the scope of the research, the method of Hatcher et al. called Service Framework is the preferred method, because:

- This approach makes use of the performance measures already in place,
- It results in connections of each measure with one measure higher in the hierarchy
- It takes the mission and vision of the organisation as the starting point
- Allows for all sorts of measures to be implemented
- It can be applied in the form of workshops as a case study

In order to make sure that it also qualifies the elements for balance and leading and lagging the results will be checked on the basis of the Balanced Scorecard approach.

Q4: What is the current situation of performance management and the
state of line-of-sight at asset management organisations?

A case study was conducted to answer this question. Essentially, this question consists of two components, first how is performance management done, and second how good is the line-of-sight of that approach. Rijkswaterstaat was selected as the case study subject, as it is a very important asset management organisation in the Netherlands. To determine the *ist* situation a desk research was conducted first. The case study approach and subject are introduced in chapter 4 and the results of the case study research is presented in chapter 5 and discussed in chapter 6. The main conclusions on the current state of affairs are:

-   A long and slow introduction of – elements of – performance management within Rijkswaterstaat has resulted in a disjointed collection of performance measures at different hierarchical levels of the organisation.
-   Many of the top-level performance measures are actually quite specific and not very well balanced, mainly focussed on financial measures or technical/functional (RAM) measures. But no internal processes, learning and growth measures.
-   There are many planning documents within the organisation, and most of them describe goals, but their relative hierarchical alignment is seldom clear.
-   Between the strategic level and the more tactical levels "management contracts" are used wherein certain goals and performances measures and targets are agreed upon. However, the alignment with other planning documents is never explicitly mentioned.
-   Performances of assets are already increasingly being aligned through hierarchical asset-networks.

During the workshop sessions it became clear that the 5 main goals mentioned in the Rijkswaterstaat mission are – although recognizable – not universally known as such amongst all the employees. The five main goals of Rijkswaterstaat are: (i) sustainable environment, (ii) dry feet, (iii) sufficient and clean water, (iv) fluid and safe road and water traffic, (v) reliable and useful information. Although these participant were relatively new to the organisation it is evidence of a lack of line-of-sight; to what goals do my day-to-day activities contribute?

The fact that this organisation is producing more and more asset management planning document at different levels within the organisation shows that this particular asset management organisation is already moving towards the situation that is advocated for by contemporary research and state-of-the-art international standards. But there is still plenty room for improvements, particularly in the area of aligning the measures in a way that creates a clear line-of-sight between these planning documents.

Q5: What is the situation after the preferred method
is applied at the case study?

The preferred method selected from literature for obtaining line-of-sight in performance management consists of several phases that provide several results, of which the service framework is the main focal point.

But what was equally interesting were the secondary results that were generated during the process. The participants of the workshop sessions did not always knew all the main goals of the organisation or their department. This resulted in good discussions amongst the different employees, and the results of the workshops and the approach itself were also used by these employees with their own departments to re-evaluate their department goals. It really raised the awareness of the

performance management approach and how the employees could contribute to the main organisational goals.

The service framework itself provided additional line-of-sight for the organisation. Where before the main goals, and performance indicators were scattered throughout several different management plans they are now collected in one easy-to-understand framework. As a side-effect it also showed in what areas the organisation was not really having any indicators and in what area they were putting too much measuring, so the method also helps making the performance management more balanced.

6.1.2   Answer to the main research question

"How can line-of-sight of performance management be achieved
in brownfield asset management organisations? "

This research substantiates that it is important for asset management organisations to have clear line-of-sight of the performance measures from strategic objectives all the way to operational activities. There are quite a few ways to achieve this according to state-of-the-art research on this subject.

For brownfield asset management organisation, where some form of performance management is already in place, a successful method for achieving line-of-sight is by organising workshop sessions via a modified version of the Service Framework method of Hatcher and Sivorn.

This method uses information and knowledge already produced by the organisation and presents it in easy to read service framework where clear relationships between performance measures have been established. The method is also reliant on the employees themselves, increasing their satisfaction and engagement to organisation mission.

One modification is recommended however, instead of applying the method as a linear process it is recommended to apply it in the form of cyclical process, where evaluation and improvements to the asset management plans are part of the process. Another advantage of that approach is that the method is scalable. Meaning that it is possible to roll out at certain levels only if the internal organisational resistance is too high at first. See section 6.2.3 Recommendations for the Service Framework Method.

The participants have rated the workshops as both fun and interesting. They also commented that the method was not only useful for the organisational management of performance but that is was also very useful for their own understanding of their position within in the organisation and in what way they individually contribute to the organisational mission.

6.2   Recommendations

Based on the results, analysis and conclusions of this research a number of recommendations are derived. This sections presents these recommendations. Making recommendations is an objective of this research.

6.2.1   General recommendations for asset management organisations

First the more general recommendations for asset management organisations looking to improve their line-of-sight will be presented.

Enable employee participation

The method used in this research is most effective when employees responsible for operational outcomes and performances are represented in the process. Having workshop sessions like in this research where a wide range of employees with different backgrounds have input contributes greatly to the quality, balance, of the results. Too often performance measured are defined top-down or by one expert group for the entire organisation, this reduces the effectiveness and is a missed opportunity. Having discussions between employees from different management levels, different departments increases mutual understanding and increases understanding and interpretation of the metrics and their use. In this study, having those employees that in their day-to-day job contribute to the performance metrics involved in the creation of the framework was really well received.

For example for Rijkswaterstaat, the so-called RAM'er[4] and asset-specific experts have a lot of knowledge on what operational activities are most relevant to asset and network performance and should always be consulted.

Invest effort in mission, vision and goals

The method uses the organisations mission and vision as starting points of the workshop sessions. It is therefore important that these should be well thought out and have wide support within the organisation. On the other hand the method allows the mission to be shared among employees that may be haven't been familiar with them before. Therefore it could also be used as a method to increase employee awareness and increase their commitment to that mission.

Check for balance and improve if necessary

As mentioned before, the Service Framework method does not introduce new metrics. Therefore it is necessary to evaluate the results to see if the metrics are balanced and represent the entire organisation. The Balanced Scorecard is a great tool for this evaluation.

6.2.2   Specific recommendations for Rijkswaterstaat

Secondly recommendations will be made specific for Rijkswaterstaat, the host organisation for the case study.

Create more balance in the metrics used

One of the main findings regarding the metrics currently used at RWS is that they are not very balanced. Rijkswaterstaat is at its core an engineering organisation with a big focus on technology. This shows in the metrics used of the current performance measurements. Especially the aspects regarding the human aspects, learning and growth, are underrepresented. RWS has an extensive

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[4] The job-title RAM stands for: Regisseur Asset Management

internal corporate learning centre providing employees with a wide range of training options and employees also have the possibility to increase their knowledge with training and lectures. Although not researched in this thesis, it is reasonable to assume that the education and development of employees can be a predictive "leading" indicator for the performance of certain aspects of the organisation. It is therefore recommended to include this information as a metric in the performance framework of the organisation. A strategic goal for Rijkswaterstaat could be "RWS is a healthy organisation"[5], with promises such as "Rijkswaterstaat is a learning organisation" or "our employees are happy to work for Rijkswaterstaat". Service statements related to these goals and promises then might be "Relevant and state-of-the-art learning opportunities are provided" and performance measures might be "90% have followed the asset management E-learning module".

Be clearer in the organisation's core message

Rijkswaterstaat has had several top management plans in the recent past and Koers2020 has already been a big step in the right direction by inviting the employees in the creation of the plan. During a workshop session some of the participants had to confess that they did not know the Rijkswaterstaat vision and mission by heart. And even the strategic goals of their individual departments were not known by all. The performance framework that resulted from the workshop sessions in this research can help management in the communication of these goals, and also the promotion of the several asset management plans and their position in the organisation could be better. Besides that, it would help if upper and lower management could emphasise the core message of the organisation more.

Continue the development and integration of asset management plans

Rijkswaterstaat has a fairly advanced knowledge of and vision on its network. This is represented by a series of tactical asset management plans such as the *Netwerkbeheervisie, Omgevingskoers* and *Netwerkschakelplannen.* This was a great starting point for this research and provided a lot of input, in that sense the RWS organization is already quite mature as an asset management organization.

However, there is gap noticeable in performance management between the strategic goals at the level of the Ministry and operational level. This is unfortunate because at the tactical level there is actually a lot of knowledge and a lot of developments are going at this level with asset management plans such as the *Netwerkbeheervisie, Omgevingskoers* and *Netwerkschakelplannen.* These plans could form a much stronger link between the strategic and operational level if they had more of prescriptive element to them rather than a descriptive element. If the goals, ambitions and vision elements in these documents were to be more directly linked and integrated in their respective business processes and departments and coupled with performance metrics the concrete and practical use on an asset management level would certainly increase.

Maintain room for individual expertise and employee participation

Within any organisation the balance between (top-down) uniformization and the (bottom-up) individual expert approach is a difficult one. The same applies to Rijkswaterstaat and also to performance management. Prescribing all the performance metrics in one big framework in too much detail might make employees feel placed in a straitjacket. It is important that that Rijkswaterstaat involves employees and departments in setting their own goals. The method used in the workshops sessions in this research are a great tool for this. The room for individual expertise is already given to its employees by Rijkswaterstaat, by allowing employee input in the Koers2020, which is a good example of employee participation.

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[5] Rijkswaterstaat has a program "Vitale organisatie" referring to a mental and physical vitality, or healthiness.

Separating asset performance and organisation performance

It is really difficult to combine the performance metrics of real world assets and the performance of the organisation in to one performance framework. Theoretically it can be done, however it is advisable to measure the performance of assets separately from the performance of the organisation because it adds a complexity that diminishes the practicality. Rijkswaterstaat is on the right track with the creation of an asset performance management system. The value of the performance framework resulting from the workshop approach from this research as a separate entity lies in the ability to increase the effectiveness and efficiency of the organisation, whereas the value of the asset performance framework lies in the ability to make investment options in infrastructure more transparent and effective.

The biggest dilemma here is data management. Where is the data on performance collected, recorded and shared. Is one single data-system possible that is inclusive to all sorts of performance (organisational and asset) data but optimized for neither, or are two separate optimized data-systems needed with lesser integration. A solution could be found in developments in BIM software.

6.2.3   Specific recommendations for the Service Framework method used

Thirdly recommendations specific for the method used in the workshop session sessions of this research are made.

Selection criteria for participants

The method uses workshop sessions. Therefore the participants of the workshop sessions have a big influence on the outcome and final results of the Service Framework. This study has found that having a well-balanced heterogenous group of participants is preferable over a homogenous group from a single department. This is something the method itself does not explicitly state.

Iterative and cyclical process and introducing new metrics

The limitation to only use existing metrics is a very useful one, in order to speed-up the process and not to side-track too much. However the participants generate a lot of good ideas that can't be used if you follow the rule of only existing metrics strictly. Therefore it is recommended to add an extra phase in the process where between the aligning phases new metrics can be introduced and old ones that are obsolete can be removed.

Figure 8 in section 4.3 showed the approach for creating line-of-sight as linear process. During the workshops and the analysis it became clear that a cyclical process at the different levels would be more successful in creating an even better integral line-of-sight framework. In Figure 14 below an improved process is presented, where the cyclical nature is better represented. The recommendation is to do phase 2 and 3 of the process iterative at the different levels of the organisation.

The main focus for the strategic level should be the "strategic goals" and formulating the "promises" for the organisation. At the tactical level the main focus should be on the "service statements" and the relation to the "promises". And on the operational level the main focus should be on the "operational activities" in relation to the "service statements". At all levels there should also be a focus on the performance measures related to that level. The evaluation phase at all levels should also include a check on balance, see Balanced Scorecard, section 3.2.1.

An additional fourth phase after one or two cycles would be an overall evaluation and the implementation of suggestions and improvements to the asset management plans, like adding/removing/replacing measures. This would then be again be the input for a new cycle, starting at phase 1 again.

Creating line-of-sight in performance management

The cyclical nature would allow all aspects from the organisation, from technical to supportive departments to be reviewed and represented in the line-of-sight performance service framework of the organisation. In the end every operational activity should be aligned with a strategic goals and the performance should be measurable by a relevant indicator.
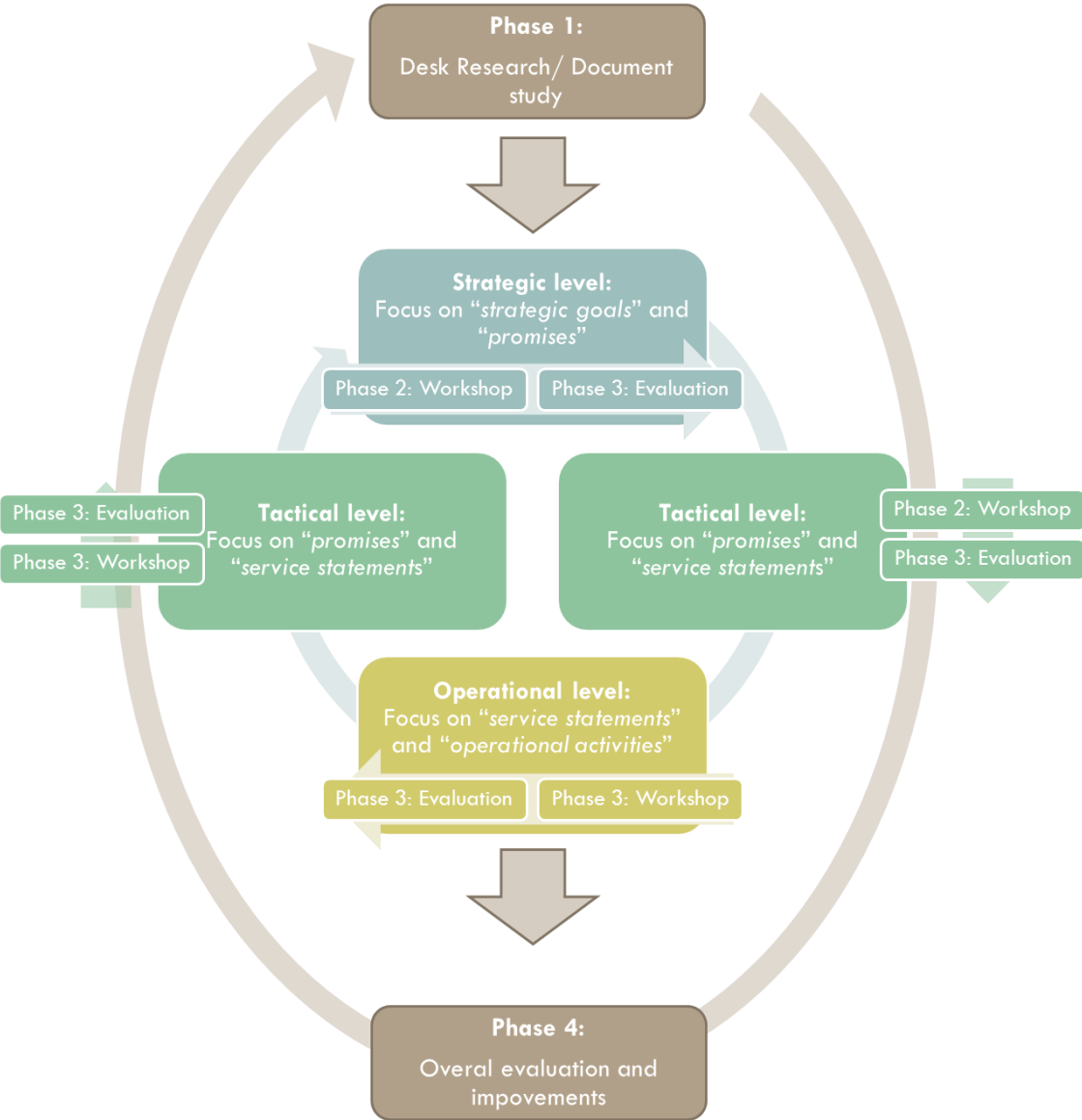
Figure 14 Improved (cyclical) process for creating line-of-sight

6.2.4   General recommendations for further research on this topic

The final recommendation are geared towards further research. For instance other graduate students interested in the topics of asset management or performance management.

From static to dynamic and using ICT-systems

This research attempted to increase the line-of-sight with an aim of improving and has resulted in a static graphical framework. A next step would be to move from a static representation of data to a dynamic one. Is it possible to create a sort of (ICT) dashboard based on this information that shows real-time the performance of the organisation of divisions.

In line with this, further research in how current developments in BIM (Building Information Model) can help asset management decision making. In the past information on the state of assets were scattered over different departments which was also an issue encountered in this case study. Now, with more sophisticated ICT-systems it is possible to integrate all that data in to one model, along with information on the state of maintenance, the performances, associated risks and even planning of construction projects.

Further integration with other processes

Performance measurement has its value. However, integrating the information generated with the methods presented in this research with other processes in organisations (HRM, portfolio management, risk management, etc.) may provide even further benefits and could be a topic for further research. Asset management is about making trade-offs against performance based on risks and costs.

A "Risks Framework" where a line-of-sight of risks and "risk indicators" can be visualised from operational to strategic level could be an instrument to increase the maturity of risk management in an organisation and provide further, alongside the Service Framework, information for asset management decision-making.

From qualitative towards quantitative

This research has shown qualitatively that the line-of-sight of performance management for asset management can be increased. A quantitative research of the added value-for-tax-money could strengthen these results.

Other infrastructure

The Service Framework applied in this research originated in England, at the Highways Agency. This research has shown that that method also provides benefits outside the Anglo-sphere at a company in a country with a more Rhineland culture. But still within the context of a roads network. In other kind of infrastructure projects, for instance in rail projects from ProRail and in decentralised governmental projects (Waterschappen, Provinces, Municipalities), parties are curious about the applicability of performance and asset management as well. Therefore, this research can be used as a starting point for further research in this field.

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Appendix A: Relevant goals, mission and vision statements found in management and planning documents

Ministry of Infrastructure and the Environment

The policy agenda in The Departmental Budget for the Ministry of Infrastructure and Environment describes the main focus points for the ministry in 2016 (within the scope of this research, i.e. main roads network).

Theme	Goal, mission, statement
Accessibility, or ability to travel[6]	To keep the Netherlands accessible and liveable in the future, the Cabinet is focusing on three solutions: - Improving rail and road networks, - Stimulating smart travel solutions - And experimenting with intelligent transport systems.
Climate	With regard to mobility and transport, the Netherlands is implementing the Energy Agreement for sustainable growth with a view to saving 15 to 20 PJ of energy in 2020 and maximizing CO_2 emissions to 25 Mton in 2030
Policy Article 14: Roads and traffic safety	The Minister is responsible for a robust mobility system of strong connections, strong modalities, predictable travel times and good accessibility.
	The Minister is responsible for the design and partly for the implementation of the road and traffic safety policy, including the supervision of the implementation of the legislation and regulations.

The agenda for infrastructure[7] (in the budget for the Infrastructure Fund) presents the milestones that have the main focus for the ministry of IenM in 2016.

Theme	Goal, mission, statement
Management, maintenance and renovation on the main roads network	Traffic management including deployment of road inspectors in the event of incidents, the collection of reliable journey and route information on all road sections. This information is delivered to the NDW in time. Realization of measures to improve utilization of networks and "connecting mobility".
	Management and maintenance including paving maintenance, maintenance of constructions and maintenance of Dynamic Traffic management (DVM) systems.
	Implementation of the program "Replacements and Renovations", including the Steel Bridges program.
Construction of new roads on the main roads network	Completion of: A2 Passage Maastricht N50 Ens – Emmeloord A12 Ede – Grijsoord

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[6] In Dutch: Bereikbaarheid
[7] In Dutch: Infrastructuuragenda

	Start construction:
	N18 Varsseveld – Enschede
	A1 Apeldoorn Zuid – Beekbergen

Rijkswaterstaat

The *Koers2020* (Rijkswaterstaat, 2016) is the business plan for Rijkswaterstaat for the period 2016-2020. It is a document for both internal and external communication and contains the vision for the future of Rijkswaterstaat , ambitions, and the mission statement.

- Mission statement for Rijkswaterstaat:

"Rijkswaterstaat operates at the heart of society and works to ensure that the Netherlands is safe, livable and accessible. Together with each other and with our partners, we work hard day and night:
- A sustainable environment
- Dry feet
- Sufficient and clean water
- Fluid and safe road and water traffic
- Reliable and useful information"

- This mission statement is accompanied by the following ambition statement:
  - What we want to be: An agile organisation of committed and independent people who enjoy working together on the basis of craftsmanship and trust.
  - What we aim for: Our work contributes to the quality of the living environment and prosperity of the nation. In doing so, we bring technological innovations in practice, for example in the field of Smart mobility and sustainability.
  - What is the result: A safe and clean delta to live in, good accessibility and a sustainable living environment that is created together with our partner public authorities, businesses and the citizens.
- With regards to mobility the following vision is formulated:
  - We focus on operational traffic management, management and maintenance, replacement and renovation and implementation of the Multiannual Programme for Infrastructure, Spatial Planning and Transport (MIRT).
  - Rijkswaterstaat will continue the program "better use of its resources". IT and data are becoming increasingly important in this area.
  - We are paying more attention to sustainability and mobility in and around cities. Many cities are now working on the quality of life, the conditions for establishment, growth and the sustainability of the economy. This leads to different needs in terms of accessibility: more sustainable, cleaner and healthier.

Appendix B: Relevant performance metrics found in management and planning documents

Ministry of Infrastructure and the Environment

Here we first look at the relevant measures, metrics and indicators found in the documents by the department of Infrastructure and the Environment of the Dutch Government. After that we look at planning and management documents by the agency Rijkswaterstaat.

Rijksbegroting (State Budget) chapter xii Infrastucture and Environment 2016

Theme	Indicator or measure
Indicator: Acceptable travel time	Percentage of routes where the target value (during rush hour no more than 1.5 times as long as outside of rush hour) is reached.
Indicator: Local air quality NO2	Amount of locations where the threshold for local air quality NO2 is exceeded.
	Problem areas for noise along highways for which a remediation plan has yet to be established.
Indicator: Development of traffic casualties	Number of road fatalities
	Severe road injuries
Overview of efficiency indicators Rijkswaterstaat	Agency costs per unit area (per infrastructure network)
	% Agency costs compared to turnover
	Costs per FTE
	Turnover (per infrastructure network)
	Organisation size in FTE
	Percentage of overhead
	Stakeholders: User satisfaction (per network)
	Development of the PIN values (performance indicator values)

Infrastructuurfonds 2016

Theme	Indicator or measure
Indicator traffic management	Reliable route and travel information is recorded on all measured road sections and shared with service providers.
Asset management	The share of disruptions to traffic flow caused by construction, renovation, maintenance relative to the total disruption to traffic flow.
	Amount of time (%) that the road is safely available, without lanes closed for construction or maintenance works, failure of assets or failure of traffic management.
	Complying to the norm for pavements (skid resistance and rut formation) and to the norm for ice prevention (preventative spreading of salt)
Performance indicators RWS	Technical availability of the road
	Traffic jams as a result of roadworks
	Complying to the norm for pavements (skid resistance and rut formation) and to the norm for ice prevention (preventative spreading of salt)
	Availability of data for third parties
	Up-to-date data for third parties

Rijkswaterstaat

Rijkswaterstaat performance metrics SLA (Service Level Agreement)

Theme	Indicator or measure
Technical availability	Deel van het jaar (%) dat de weg veilig beschikbaar is, zonder dat rijstroken zijn afgesloten of een snelheidsbeperking is ingesteld als gevolg van aanlegwerkzaamheden, onderhoudswerkzaamheden of falen van infra of verkeersmanagementsystemen.
Traffic jams as a result of road maintenance	Het aandeel van de filezwaarte als gevolg van werk aan de weg, in de totale filezwaarte, bedraagt maximaal X %.
Traffic jams as a result of road maintenance, failure of infrastructure and failure of dynamic traffic management.	Het aandeel van de filezwaarte als gevolg van werk aan de weg, falen van infra en falen DVM, in de totale filezwaarte, bedraagt maximaal Y %.
Road and traffic safety	Voldoen van verhardingen aan normen op het vlak van stroefheid en spoorvorming (% van oppervlak).
	Indien het areaal preventief gestrooid dient te worden, wordt dit binnen 2 uur uitgevoerd (% van situaties).
Supply of traffic and route information	Beschikbaarheid: Van X % van de meetlocaties van RWS zijn op minuutniveau de intensiteits- en snelheidsgegevens beschikbaar voor levering aan de Nationale Databank Wegverkeersgegevens (NDW).
	Actualiteit: Y % van de op minuutniveau beschikbare intensiteits- en snelheidsgegevens is binnen 75 seconden na afsluiting van de meetminuut gereed voor verzending naar NDW.
Noice reduction	Het 'Nalevingsverslag Geluidproductieplafonds (GPP'S) HWN', over het afgelopen jaar, wordt voor 1 september in concept opgeleverd door RWS aan DG-B en wordt voor 1 oktober definitief opgeleverd. De kwaliteit van het verslag dient te voldoen aan de eisen die in de Wet milieubeheer en het Besluit Geluid Milieubeheer zijn op-genomen.
Road conditions	X % van de verhardingen voldoet aan de normen.
Network objects (bridges, tunnels, etc.)	X % van de kunstwerken voldoet aan de BON-normen.
Response times	In X% van de gevallen is de aanrijtijd bij incidenten in de spits ten hoogste 15 minuten op IM-plus-trajecten en 30 minuten op niet-IM-plus-trajecten.
Dynamic Route Information Display	Het tonen van inhoudelijke verkeerskundige boodschappen op de DRIPs is in X% van de tijd mogelijk.

Internal management contracts of Rijkswaterstaat departments

Theme	Indicator or measure
Organisation and employee	Cruciale vacatures worden snel ingevuld.
Internal processes	Elk team heeft einde jaar tenminste 1 procesverbetering doorgevoerd.
Performance and products	Uitelijk oktober moet voor volgend jaar 95% van de beheer & onderhoudsprojecten "verscoped" zijn.
Stakeholders	Relatie met stakeholders aantoonbaar verbeterd (maturity check)
Asset: Maeslantkering	Voldoen aan faalkans
Multi-year programming	Er is met PPO&GPO een gedeeld beeld over de haalbaarheid van de actuele meerjarige referentielijst.

Smart & Sustainable City	Pilot-project Schiedam afronden en geleerde lessen formuleren voor WNZ.
Availability HWN	Filezwaarte per week als gevolg van werkzaamheden, falen en incidenten/ongelukken – Ambitie 24.000
Reliable (business) Partner	% mijlpalen bereikt % op tijd betaald % lineaire uitputting
SLA PINS	In het management contract zijn verder dezelfde PINs opgenomen als in de SLA en regionaal gespecificeerd.

Appendix C: Workshop agenda

Participants: 6-8 people
Names: Jasper Meijsen (TU Delft), --- (WNZ), --- (WNZ), --- (WVL), --- (WVL), --- (VWM), --- (GPO)
(names redacted)

Program:

Item	Time	Length	Description	Tool / how
Welcome and agenda	09u15	10 min	Participants are welcomed and a short introduction round The agenda for the afternoon is presented	PPT PPT
Intro research and theories	09u25	20 min	Brief introduction of my research and the contemporary theory and literature on asset management & performance management	PPT
Intro in today's workshop approach	09u45	15 min	What will we be doing today, What is the expected outcome? Presentation of the input for the day. Individually study the different sheets on the walls and familiarize with the structure.	PPT PPT + A0's on the wall A0's on the wall
Extract promises	10u00	10 min	Extract promises from Strategic Plan (Koers2020) description of goals: "We will…" Input: Koers2020 Strategic plan Output: Strategic goals as promises	In pairs Post-it's A0's
Coffee break	*10u10*	*5 min*	*Discuss what you have just learned and observed with you colleagues*	*Coffee*
Determine Service Statements	10u15	20 min	What are our ambitions, what services do we want to deliver? Input: Netwerkbeheervisie: Ambities Output: Service Statements (which are the outcomes that link Strategy to Operational Activities)	In pairs Post-its A0's
Determine rationale for existing activities	10u35	20 min	Why do we do what we do? Link organisational activities/processes to goals and service statements. Input: Omgevingskoers, Organogram and Process-structure Output: Operational activities	In pairs Post-its A0's
Determine rationale for existing measures	10u55	20 min	Why do we measure what we measure? Input: Existing measures from SLA/MC's and Netwerkschakelplan Output: Service Measures (which form the basis for the level a service provides and performance measurement)	In pairs Post-its A0's

Coffee break	*11u15*	*15 min*	*Discuss what you have just learned and observed with you colleagues*	*Coffee*
Create hierarchy	11u30	30 min	Put together the outputs from before the break in a hierarchy. Input: Strategic goals as promises, Service statements, Operational activities, Service Measures. Output: Service Framework	Post-its A0's
Discuss the result	12u00	15 min	What do you like about the framework? What do you think is missing? Where can it be improved? Where do you think the organisation is lacking effort? Output: Comments and suggestions.	In pairs and in group-discussion.
Coffee break	*12u15*	*15 min*	*Discuss what you have just learned and observed with you colleagues*	*Coffee*
Evaluation of the workshop-approach	12u30	10 min	Individual evaluation of the process of the day. What did you think of the workshop? Did it bring new insights? Do you expect this to help you in your work? Is this helpful for the organisation? Output: Comments and suggestions.	Evaluation-form

Appendix D: Result workshops

Impressions of the workshops

Service Framework

On the following pages the Service Framework resulting from the first two iterations of the workshop sessions can be found.

RWS

Koers 2020

Strategic goals
- We zorgen voor betrouwbare en bruikbare informatie (onze digitale infrastructuur)
- We zorgen voor vlot en veilig verkeer over weg en water.
- We zorgen voor voldoende en schoon water.
- We zorgen voor dat Nederland veilig is en blijft voor hoogwater.
- We zorgen voor een duurzame leefomgeving.

Beloftes
- We zorgen dat weg snel vrijgemaakt is na incidenten
- We zorgen dat wegcapaciteit beschikbaar is voor wegverkeer als de intensiteit van het verkeer daarom vraagt
- We zorgen ervoor dat het wegverkeer kan rijden met de snelheid waarvoor de weg is aangelegd
- We faciliteren en verzorgen het wegverkeer
- We voorkomen zoveel mogelijk doden en gewonden op het HWN

Service statements
- Voldoen aan aanrijtijden bij incidenten in de spits
- Voorkomen van niet-beschikbaarheid agv ongepland onderhoud
- Het effect van wegwerkzaamheid en wordt geminimaliseerd
- Beschikbaarheid aansluitingen en verbindingswegen
- Netwerkschakel is geschikt om de gevraagde reistijd te bieden
- Snelheid wegverkeer mogelijk maken
- Weggebruikers kunnen veilig rusten en voertuig van brandstof voorzien
- Het netwerk is constructief veilig

Operationele activiteiten
- Robuuste planning wegverkeersleiders en weginspecteurs
- Beschikbaarheid door correctief onderhoud
- Beschikbaarheid door preventief onderhoud
- Maatregelen nemen om te voldoen aan veiligheidsnorm
- Winterglaaheid-bestrijding

Operationele uitkomsten / prestatie indicatoren
- Aanrijtijd bij incidenten tijdens de spits.
- Files (VVU) door werk in uitvoering bij *ongepland* onderhoud
- Files (VVU) door werk in uitvoering bij gepland onderhoud
- Minimaal 95% van opdrachten volgend jaar "VerSCoped"
- Verschil Reistijd spits versus niet spits <1,5
- Aantal verkeersdoden en letselongelukken
- Bezettingsgraad I/C-verzorging-splaatsen
- Voldoen van verharding aan normen stroefheid en spoorvorming (normgetal)
- # aantal objecten die niet voldoen aan Eurocode of binnen 10 jaar "einde levensduur"

SLA PIN

MC

MC

Creating line-of-sight in performance management

RWS

Koers 2020

Strategic goals

- We zorgen voor een duurzame leefomgeving.
- We zorgen voor dat Nederland veilig is en blijft voor hoogwater.
- We zorgen voor voldoende en schoon water.
- We zorgen voor vlot en veilig verkeer over weg en water
- We zorgen voor betrouwbare en bruikbare informatie (onze digitale infrastructuur)

Beloftes

- Welzijn en gezondheid wordt verbeterd
- We dragen bij aan een prettige leefomgeving
- We dragen bij aan een positieve verandering van energie en klimaat

Service statements

- De stand van het geluids-niveau voldoet aan Nalevingsrapportage
- De Wet Milieubeheer wordt nageleefd
- Barrières voor fietsverkeer worden voorkomen en verholpen
- De leefomgeving nodigt uit tot fysieke beweging
- Potentie energieopwekking in beeld
- Energieneutrale netwerken in 2030

Operationele activiteiten

- Maatregelen nemen om te voldoen aan geluidsnorm.
- Maatregelen nemen om te voldoen aan luchtkwaliteit.
- Kansen en intitiatieven uit de omgeving laten meewegen in scope
- Landschapsplan en Esthetisch programma van Eisen opstellen
- Energiebesparingsplan en besparingmaatregelen worden uitgevoerd

Operationele uitkomsten / prestatie indicatoren

- Aantal overtredingen GPP
- Aantal knelpunten NSL
- Waarde 20ppm
- Aantal knelpunten geluid
- Relatie met omgeving aantoonbaar beter
- Pilot project Schiedam afgerond en lessons learned geformuleerd voor WNZ
- Energieopwekking op areaal RWS (in MW)
- % van materialen zijn biobased
- % van verlichting is LED

NWSP

MC

NWSP

NWSP

Appendix D: Questionnaire for participants

Vragenlijst naar aanleiding van de prestatie management workshop

Beste deelnemer, bedankt voor je deelname en inbreng tijdens de workshopsessie voor mijn onderzoek naar prestatiemanagement bij Rijkswaterstaat. Om naast de discussies en resultaten tijdens de dag input te hebben voor het onderzoek, wil ik je ook vragen de volgende vragenlijst te beantwoorden. De vragenlijst is te beantwoorden aan de hand van een 5-punt schaal, waar minimaal 1 negatief is en maximaal 5 positief beantwoording is. Alvast hartelijk bedankt voor je reactie!

Deel 1: Inhoudelijk prestatiemanagement

Eerst wil ik graag weten in hoeverre je van tevoren bekend was met de theorie omtrent asset management en prestatie management, aan de hand van de volgende vragen:

1. Bekendheid met het vakgebied asset management
2. Bekendheid met de definitie van asset management
3. Bekendheid met het vakgebied prestatie management
4. Bekendheid met prestatie management methodes (bijvoorbeeld de Balanced Scorecard)

Deel 2: Prestatie en assetmanagement bij RWS en in jouw dagelijkse werk

Nu wil ik graag een paar vragen stellen over in hoeverre jij voor de workshop bekend was met de verschillende RWS plandocumenten en de doelen die daar in beschreven staan.

5. In hoeverre was jij bekend met de SLA (Service Level Agreement) tussen Min I&M en RWS
6. In hoeverre was jij bekend met de Managementcontracten tussen DG en HID's
7. In hoeverre was jij bekend met de Koers 2020
8. In hoeverre was jij bekend met de Netwerkbeheervisie
9. In hoeverre was jij bekend met de Omgevingskoers
10. In hoeverre was jij bekend met de Netwerkschakelplannen
11. In hoeverre was jij bekend met overige documenten, zoals Objectbeheerregimes (OBR), Netwerkschakelplannen en of Prestatie Instandhoudingsplannen?

Deel 3: Bekendheid met de missie, visie en doelstellingen van RWS

Tijdens de workshop zijn de verschillende doelstellingen uit de asset management plannen gepresenteerd;

12. In hoeverre was je bekend met de 5 top-RWS doelstellingen?
13. In hoeverre was je bekend met de overige doelstellingen en taken van RWS?

Deel 4: Prestatie en assetmanagement bij RWS en in jouw dagelijkse werk

Ook wil ik graag weten in hoeverre jij in jouw (dagelijkse) werkzaamheden je bewust bezig houdt met asset en/of prestatiemanagement en doelstellingen?

14. In hoeverre ben jij bewust bezig met bijdragen aan doelstellingen van RWS?
15. In hoeverre hou jij bewust bezig met (meetbare) afdelingsdoelen?

Deel 5: Wat vond je ervan om op deze manier bezig te zijn met de doelstellingen van Rijkswaterstaat?

16. Wat vond je ervan om op deze manier bezig te zijn met de doelstellingen van Rijkswaterstaat?
17. Zou je deze methode ook (periodiek) binnen jouw afdeling met collega's willen toepassen?
18. Wat vind je van de uitkomst van de workshop-sessie?

Deel 6: Wat vind je van de line-of-sight bij Rijkswaterstaat?

19. Hoe beoordeel jij de line-of-sight van de doelstellingen binnen RWS vóór de workshopsessie?
20. Hoe beoordeel jij de line-of-sight ná het doen van de workshopsessie?

The results of the questionnaire:

	Questions	P#1	P#1	P#1	P#1	P#1	P#1	Average
	Participants							
1	Bekendheid met het vakgebied asset management	2	2	5	3	1	4	**2,8**
2	Bekendheid met de definitie van asset management	1	1	3	3	1	3	**2,0**
3	Bekendheid met het vakgebied prestatie management	1	2	3	2	1	3	**2,0**
4	Bekendheid met prestatie management methodes (bijvoorbeeld de Balanced Scorecard)	1	1	3	2	1	2	**1,7**
5	In hoeverre was jij bekend met de SLA (Service Level Agreement) tussen Min I&M en RWS	1	1	3	2	1	3	**1,8**
6	In hoeverre was jij bekend met de Managementcontracten tussen DG en HID's	2	4	3	2	1	3	**2,5**
7	In hoeverre was jij bekend met de Koers 2020	4	5	4	4	5	4	**4,3**
8	In hoeverre was jij bekend met de Netwerkbeheervisie	2	2	4	3	1	3	**2,5**
9	In hoeverre was jij bekend met de Omgevingskoers	3	4	3	3	2	1	**2,7**
10	In hoeverre was jij bekend met de Netwerkschakelplannen	1	4	4	2	1	3	**2,5**
11	In hoeverre was jij bekend met overige documenten, zoals Objectbeheerregimes (OBR), en of Prestatie Instandhoudingsplannen?	1	3	2	1	1	4	**2,0**
12	In hoeverre was je bekend met de 5 top-RWS doelstellingen?	4	4	4	5	5	5	**4,5**
13	In hoeverre was je bekend met de overige doelstellingen en taken van RWS?	1	3	3	2	1	3	**2,2**
14	In hoeverre ben jij bewust bezig met bijdragen aan doelstellingen van RWS?	1	3	2	1	1	3	**1,8**
15	In hoeverre hou jij bewust bezig met (meetbare) afdelingsdoelen?	2	4	3	2	2	5	**3,0**
16	Wat vond je ervan om op deze manier bezig te zijn met de doelstellingen van Rijkswaterstaat?	4	5	3	4	4	4	**4,0**
17	Zou je deze methode ook (periodiek) binnen jouw afdeling met collega's willen toepassen?	3	5	4	3	3	4	**3,7**
18	Wat vind je van de uitkomst van de workshop-sessie?	2	3	3	2	3	4	**2,8**
19	Hoe beoordeel jij de line-of-sight van de doelstellingen binnen RWS vóór de workshopsessie?	2	2	1	2	1	3	**1,8**
20	Hoe beoordeel jij de line-of-sight ná het doen van de workshopsessie?	4	4	3	4	4	4	**3,8**

TUDelft

Master Construction Management and Engineering

Creating line-of-sight in performance management

Jasper Meijsen

2018

Creating line-of-sight in performance management

Jasper Meijsen

2018