

# TENSIONS IN INTERNAL PERFORMANCE AGREEMENTS

a multiple-case study on the process of making internal performance agreements at infrastructure management organisations



Mark Marijnissen  
Master Thesis  
Delft University of Technology

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# PREFACE

This thesis is the result of the graduation research I conducted to complete my Master Construction Management & Engineering at the Technical University of Delft.

First, I would like to thank my graduation committee for their guidance and support throughout this research. Hans, thank you for being the chair of my graduation committee and the sharp and constructive feedback you provided at several stages of my research. Rob, thank you for getting me in touch with your contacts at Schiphol and for the supportive feedback you provided during the meetings. Mark, as my first supervisor you've invested quite some time and effort in getting me on track after a rather problematic start of this research. With your extensive knowledge on the subject and on the process of conducting research you have set and kept me on the right track to successfully finish this thesis. Also I would like to thank you for giving me the opportunity to present my intermediate results at a meeting of Next Generation Infrastructures and to publish these results in their magazine. Last but certainly not least, Jos, I sincerely want to thank you for being my company supervisor at Schiphol. You were always willing to make time to sit down with me and provide me with much appreciated guidance and advice throughout my research. I really hope you'll supervise more graduate interns at Schiphol in the future, as they'll definitely benefit from your knowledge and support.

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Finally, I want to thank all my friends and family for their support and help throughout this challenging process. You cheered me up when I was down because the research wasn't going as I'd initially planned and helped me to put things in perspective. Furthermore I would like to thank everyone who contributed to this report by reviewing various chapters of this report.

I hope you'll enjoy reading this report.

Mark Marijnissen

Den Haag, February 2017

## SUMMARY

Infrastructure management organisations use internal performance agreements to define the performance its asset management departments need to achieve in order to meet the organisations' objectives. Preliminary research at Amsterdam Airport Schiphol indicates that there are inherent tensions in the process of making these internal performance agreements, which can have positive but also negative effects on making internal performance agreements and integral trade-offs. The first tension concerns the agreement process itself, in which actors with different perspectives need to agree on a common perspective. The use of performance agreements implies the use of performance measurement, which introduces the second tension, as performance measurement may have positive as well as negative effects. The third tension is related to the infrastructure sector, in which a tension arises between short term and long term, or more specifically: dynamic client demands versus the long term maintenance requirements of the infrastructure. This research aims to provide insight in the process of making internal performance agreements at different infrastructure management organisations and to identify how these organisations cope with the inherent tensions associated to the process. This research indicates how the organisations make use of the positive effects of the tensions and limit the negative effects. Hence the research questions is:

*How do infrastructure management organisations' asset management departments cope with the inherent tensions in the process of making internal performance agreements, to support integral trade-offs on performance, risk and cost?*

In a qualitative multiple-case study the process of making internal performance agreements is researched at Amsterdam Airport Schiphol and the Port Authority Rotterdam. The results from both cases are compared and interpreted by means of a theoretical framework in a cross-case analysis. The results of this cross-case analysis indicate that the tensions in the process of making performance agreements and integral trade-offs are similar at Amsterdam Airport Schiphol and at the Port Authority Rotterdam. However, due to different ways of organising the asset management department and the process of making internal performance agreements, the effects of these tensions differ in some situations as far as the interaction between the sub departments is concerned.

*Different organisations, different processes, similar tensions*

Amsterdam Airport Schiphol has organised its Asset Management department process-based and has split the department into a number of sub departments, which act as a network. Three of these sub departments are involved in the annual process of making internal performance agreements. These departments have different roles and responsibilities, based on the process they are responsible for. This creates a tension of having different perspectives in the Asset Management department, while a common perspective has to be found in the process of making internal performance agreements and integral trade-offs. The Port Authority Rotterdam has a classic separation of Asset Owner and Asset Manager in the organisation. The Asset Management department is organised on asset types, with each sub department being responsible for a cluster of interrelated asset types and headed by an Asset Manager. In an annual process between Asset Owner and Asset Manager the asset management goals are determined. This process is characterised by searching for a balance between the organisation's ambitions and what is feasible from an asset perspective.

*Joint process leads to new insights and better integral trade-offs...*

Both organisations use the positive effect of the tension of having different perspectives while a common perspective needs to be established to make the internal performance agreements. The joint process brings out the contrast of the different perspectives of the sub departments at Schiphol and of the Asset Owner and Asset Manager at the Port Authority, leading to new insights and thereby enabling better integral trade-offs. Furthermore the joint process and the interdependence of the sub departments to achieve their targets at Schiphol creates the positive effect of *checks and balances* in the organisation, prohibiting one of the perspectives becoming predominant.

*...but also requires control mechanisms and monitoring*

This process however also introduces an *agency relation*, which concerns a relation in which one party (the principal) delegates work to another party (the agent), who then performs that work. With this delegation of work, also some decision making authority is transferred to the party which will perform the work. Due to *goal incongruence* (predominant factor at Schiphol) and *information asymmetry* (predominant factor at the Port Authority) the agent does not necessarily act in the principal's interest. Both organisations attempt to limit the perverting behaviour of the agent by incorporating control mechanisms in the performance agreements and monitoring of the performance.

*Actors may focus on achieving own targets instead of making integral trade-offs...*

Performance measurement may have the perverting effect that actors focus on achieving their own targets instead of making integral trade-offs. While this principle applies to both organisations, the effects are different due to the organisational differences. At Schiphol the agreement process requires the collaboration of three sub departments. The pitfall is that these sub departments shirk from the process of making internal performance agreements and integral trade-offs and focus on their own projects and goals. Furthermore lacking insight in each other's processes hinders understanding each other's perspectives. At the Port Authority the sub departments are less interdependent due to the organisational structure and therefore the sub departments tend to form organisational silos, which hampers making integral trade-offs.

*...but generating new insights and internal benchmarking help in breaking down silos*

The Port Authority has implemented two mechanisms to cope with this tension and overcome the silos. The first mechanism is a visual tool (*PortMaps*) which combines geographical and asset information to obtain new insights, enabling better integral trade-offs and stimulating discussion between the departments. The second mechanism is a combination of specific roles (belonging to a quality organisation), tooling (to compare the execution of processes of the different sub departments) and management support to stimulate sharing of knowledge between the sub departments.

*Process model makes tension of different perspectives manageable for Schiphol*

While the lack of insight and collaboration is acknowledged at Schiphol, no mechanism has been identified in the case study to cope with the tension of different perspectives and make it manageable. Therefore it is recommended that Schiphol designs and implements a process model concerning the making of internal performance agreements and integral trade-offs, specifying how the sub departments should interact and collaborate. In line with the coping mechanisms applied at the Port Authority, Schiphol is recommended to appoint a process owner, who stimulates and controls use of the process model. This process owner should have a staff function and should not be part of one of the sub

departments in which the processes are executed, to prevent the pitfall that this person may also focus on the perspective of this sub department instead of the entire Asset Management department. Furthermore it is recommended Schiphol implements a tool which visualises the processes of the different departments, in which the process steps can be traced and deliverables of these process steps are provided. Insight in each other's processes and in the deliverables of the process steps makes it easier to understand someone else's motivation. Improved understanding of each other's perspectives may help in finding a common perspective. To further stimulate the interdepartmental collaboration and to generate extra support, the management of Schiphol's Asset Management department should make this one of their focus point.

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# 1. INTRODUCTION

Management of infrastructures is often in the hands of large organisations. Due to their size these infrastructure management organisations tend to organise themselves by making a division between front- and back-office. The front-office makes agreements with the organisation's clients and the back-office is where the actual processes take place to live up to the agreements made. While both sides are part of the same organisation, there are a lot of differences between a front- and back-office (as illustrated in Figure 1), e.g. a short term mindset of the front office versus the long term projects the back office needs to deal with. These differences may lead to obstacles between the front- and back-office, for instance having different objectives.

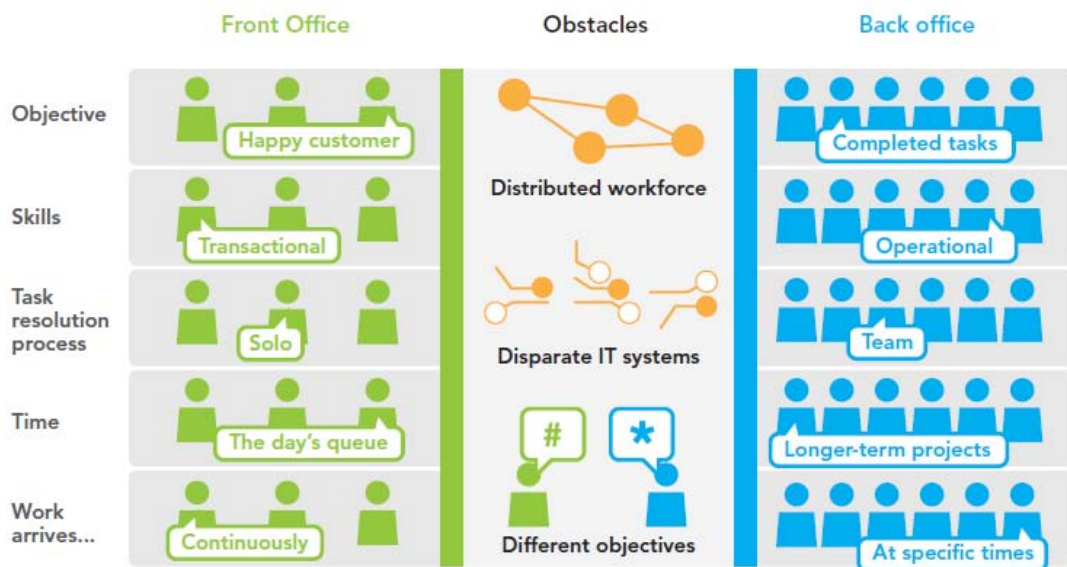


Figure 1 - 'The Great Divide Between Front and Back Office'(Aspect Software Inc., 2014)

## 1.1 Asset management

The question is how does an organisation make the connection between its front- and back-office. At the meeting point between business and technical interest asset management has emerged (Hastings, 2015, p. 7). Asset management aims at effectively and efficiently meeting the asset-related needs of the organisation by providing the organisation with the appropriate assets and support services to these assets. To achieve this asset managers need to balance performance (asset performance and quality of service), risk and cost (financial, environmental and social) (Hastings, 2015, pp. 7,11). One can make this balance for each individual asset, but an organisation can create more value from its assets by balancing these aspects over the entire organisation i.e. making integral trade-offs.

Asset management activities predominantly take shape in the back-office, but a solid connection needs to be made with the front-office of the organisation. One way of making this connection is through internal performance agreements, in which the performance is documented the asset management department has to provide in order to meet the organisation's objectives.

## 1.2 Tensions at Amsterdam Airport Schiphol

Preliminary research<sup>1</sup> at a large infrastructure management organisation, Amsterdam Airport Schiphol, indicates that there are inherent tensions in the process of making internal performance agreements. These tensions are caused by the way in which organisations like Schiphol are set-up and may have positive as well as hampering effects in the process of making internal performance agreements. The first tension is the result of the way in which Schiphol is organised, with various departments which have different objectives. For the internal performance agreements these departments need to find a common ground, despite their differing objectives. However having different objectives can influence the way departments act in the process of making performance agreements and to which goals they aspire. The second tension concerns the use of performance measurement, which has positive effects, but can also result in undesired and perverse effects. The third tension is more related to the infrastructure sector, than to the way infrastructure management organisations are organised. Organisations like Schiphol have to deal with a tension between the dynamic demands of the client versus managing and maintaining the asset base which is developed for long-term usage. These tensions influence the making of integral trade-offs between performance, risk and cost.

## 1.3 Problem statement

The tensions identified at Schiphol are far from unique; other large infrastructure management organisations likely have to deal with these same issues. Due to their size these organisations seem to have organized themselves similarly and have some sort of division between front-office, where the agreements with clients are made, and back-office, where the actual processes take place to live up to the agreements made. Organisations which are in the business of transporting people and cargo like Schiphol, but also other organizations in e.g. telecommunications, energy networks and railway transportation are confronted with a tension between (increasingly) dynamic demands and an asset base which is developed and maintained for long-term usage. This leads to the following problem statement:

*Infrastructure management organisations are confronted with several inherent tensions, which may have positive as well as hampering effects in the process of making internal performance agreements and making integral trade-offs between performance, risk and cost.*

## 1.4 Research objective

Infrastructure management organisations are organised in such a way that the process of making internal performance agreements supports integral trade-offs. Hence the objective of this research is to provide insight in the processes of making internal performance agreements and to indicate how organisations cope with the inherent tensions encountered in this process. Therefore the research objective is formulated as:

*The objective of this research is to provide insights in how processes of making internal performance agreements are organised at infrastructure management organisations and how these organisations cope with the inherent tensions in this process, to support integral trade-offs between performance, risk and cost.*

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<sup>1</sup> Part of the results of the preliminary research are incorporated in the main body of this report. Appendix A features sections which are left out of the main body of this report for reasons of focus, clarity and readability. Chapter 3 provides information on how this preliminary research has been conducted.

## 1.5 Research questions

From the above stated research objective, the following research question is derived to collect the desired insights:

*How do infrastructure management organisations' asset management departments cope with the inherent tensions in the process of making internal performance agreements, to support integral trade-offs on performance, risk and cost?*

In order to answer the main research question the following sub-questions have to be answered:

1. *How is the process of making internal performance agreements organised at infrastructure management organisations?*

By conducting a qualitative multiple-case study a description of the process of making internal performance agreements at different infrastructure management organisations is generated. This provides a the base for the rest of the research.

2. *Which positive and negative effects and accompanying questions concerning the process of making internal performance agreements arise at infrastructure management organisations as a result of the inherent tensions?*

The data gathered in the multiple-case study and the interpretation of this data with concepts of the theoretical framework developed in this research provides a set of positive and negative effects resulting from the inherent tensions in the process of making internal performance agreements. The organisations will be faced with questions on how to prevent or overcome these negative effects.

3. *What are the similarities and differences in the positive and negative effects and questions the different organisations face and how can these be explained?*

By means of a cross case analysis the findings resulting from the previous sub question are confronted with each other and the theoretical framework. From this confrontation the similarities and differences between the situations at the researched organisations become clear. The confrontation of the empirical findings with the theoretical framework results in explanations concerning why these effects emerge at the organisations.

4. *Which mechanisms do the organisations' asset management departments apply to cope with the inherent tensions and how do they value these mechanisms?*

Now the effects of the inherent tensions have been identified and explained, the mechanisms by which the organisations try to cope with the tensions are elaborated. This information is derived from the multiple-case study. To assess the value of these mechanisms it's important to investigate how valuable these mechanisms are in the opinion of the actors who apply them. Hence this assessment is based on qualitative data.

## 1.6 Structure of the report

This report continues with a literature review in Chapter 2, in which theoretical concepts are discussed which are applicable to the process of making internal performance agreements. The literature review results in a theoretical framework. Chapter 3 discusses the research methodology for the multiple-case study and how the results are analysed. The case study results are presented in Chapters 4 and 5. Chapter 6 contains the cross-case analysis. The conclusions of the research are stated in Chapter 7, followed by

the recommendations in Chapter 8. Chapter 9 contains the discussion on the conclusions and recommendations, contribution to literature and academic research, the limitations and recommendations on further research. A combination of the report structure and research approach is depicted in Figure 2. On the left side the subsequent chapters are listed, with the output of these chapters on the right side. The two cases provide information to answer sub questions 1, 2 and 4 and the cross-case analysis is used to answer sub question 3. The answers to this sub questions are combined in the conclusion, in which the research question is answered.

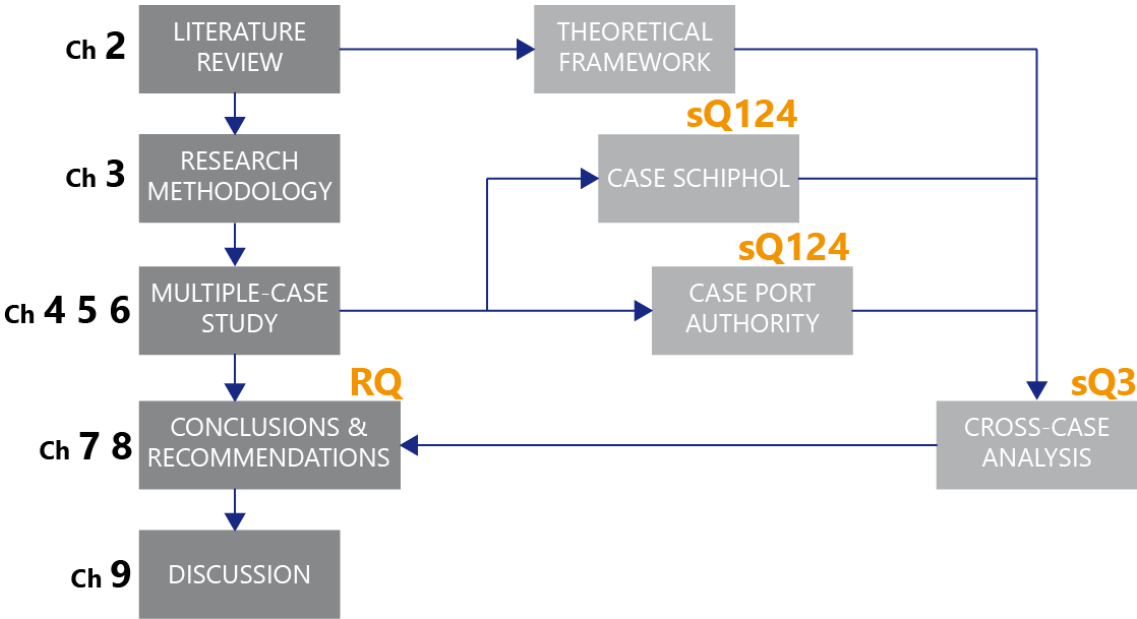


Figure 2 - Visualisation of report structure and research approach

## 2. LITERATURE REVIEW

This chapter provides insight in the process of making internal performance agreements by presenting literature on multi-actor decision making, agency relations, performance measurement and strategic behaviour. Each concept describes phenomena which affect the process of making internal performance agreements and discusses complicating factors to this process. Concepts from the discussed theories form a theoretical framework, which is used to analyse the empirical findings of this research.

The first topic is multi-actor decision making, in which inter alia the differences between networks and hierarchies are discussed. This topic is elaborated first, because the way an organisation is organised has consequences for the resulting agency relations in the organisation. The internal performance agreements between the actors in these relations are based on performance measurement, which can have positive as well as negative effects. Agency relations and performance measurement may lead to strategic behaviour, which is the last topic of this literature review.

### 2.1 Multi-actor decision making

Infrastructure management organisations may opt for different ways to organise themselves. As discussed in the previous chapter, Amsterdam Airport Schiphol has various Asset Management sub departments involved in the process of making internal performance agreements and integral trade-offs. These sub departments have different responsibilities and objectives, although part of the same Asset Management department. De Bruijn and Ten Heuvelhof (2008, p. 1) refer to such a configuration of actors as a *network*:

*A network can be defined as (1) a number of actors with (2) different goals and interests and (3) different resources, (4) who depend on each other for the realization of their goals.*

Networks are characterised by variety, mutual dependencies and a dynamic nature. Networks possess variety in e.g. actors involved, interests and products. The various actors are dependent on each other and these relations may be complex due to the following aspects of the dependencies:

- multi-value - dependencies cannot be expressed in one value
- multilateral – more than two actors are dependent on each other
- asynchronous – actors need each other at different times
- simultaneous – actors are dependent on simultaneous actions

Furthermore opinions and attitudes of actors may change, which indicates the dynamic nature of networks (De Bruijn & Ten Heuvelhof, 2008, pp. 10-12). These characteristics have implications for the decision-making process. Due to the interdependent relations actors need to work together to achieve their goals, therefore only a joint decision making process will be effective. Joint decision making however is possibly hampered by variety in and the dynamic nature of networks. As a result decision-making processes in networks are often capricious and unstructured (De Bruijn & Ten Heuvelhof, 2008, p. 23). To illustrate the capricious and unstructured nature of decision-making processes in networks, De Bruijn and Ten Heuvelhof (2008, pp. 26-31) have contrasted it with making decisions in a hierarchy<sup>2</sup>, as depicted in Table 1 on the next page.

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<sup>2</sup> In a hierarchy, there is a leading actor, who is at the top of the hierarchy and steers its subordinates. This superior, it is assumed, has both the information and power that are needed for effective decision making (De Bruijn & Ten Heuvelhof, 2008, p. 8).

<i>Hierarchy</i>	<i>Network</i>
Regular and sequential	Irregular and no clear sequence of activities
Phases	Rounds
Actors are stable	Actors join and withdraw and behave strategically
One arena, process has a clear starting point and end point	Several arenas, no isolated starting point and end point
Content of the problem is stable	Content of the problem shifts
Incentive to regard problems as structured	Incentive to regard problems as unstructured
Consistency and predictability	Flexibility and unpredictability

*Table 1 - Decision making in hierarchies and networks (De Bruijn & Ten Heuvelhof, 2008, p.26, Table 2.3)*

Decision-making processes in networks are irregular as a result of the strategic behaviour of the actors involved, who are more concerned with maximizing their own interests than with making decisions through an orderly process. In networks, the process is not organised in sequential phases, but in rounds. Due to new insights or developments actors may feel the need to redefine problems, adjust solutions or revoke decisions. The capriciousness of the process is further increased by actors joining and leaving the decision making process. Actors may for example enter the process when it's in a decisive stage. Decision-making processes in networks are often multiple and the process regarding one topic may interfere with the decision-making process on another topic. Furthermore the topic of the process may shift when for example a problem seems unsolvable and solutions for other problems pop up. Problems can be structured (i.e. there is only one solution) or unstructured. In unstructured problems there is no consensus about facts, which are debatable, or norms, which are the result of normative trade-offs. In networks therefore there is an incentive to regard problems unstructured, as this offers room for negotiation. The dynamic nature of networks results in unpredictability and flexibility in the decision-making process (De Bruijn & Ten Heuvelhof, 2008, pp. 26-31).

### *Application*

Networks and hierarchies as described above are considered ideal forms; in reality organisations will often be somewhere in between of the two extremes and have more characteristics of a network or a hierarchy. It will be valuable to look if the organisations have more network or hierarchy characteristics, as this will affect their decision-making processes. According to De Bruijn and Ten Heuvelhof only joint decision making is effective in networks, although this is hampered by some of the characteristics of networks. This may prove part of the explanation to why some of the current problems have arisen at the organisations. Furthermore the discussed concepts provide a base for the rest of this literature review.

## **2.2 Agency theory**

Agency theory concerns relations in which one party (the principal) delegates work to another party (the agent), who then performs that work. With this delegation of work, also some decision making authority is transferred to the party which will perform the work. This agency relation, or principal-agent relation, is laid down in a contract (Eisenhardt, 1989, p. 58; Jensen & Meckling, 1976, p. 308; Schoenmaker, 2011, p. 67). With the contract being the unit of analysis of the agency theory, Eisenhardt (1989, p. 58) reasons:

*"The focus of the theory is on determining the most efficient contract governing the principal-agent relationship given assumptions about people (e.g., self-interest, bounded rationality, risk aversion),*

*organisations (e.g. goal conflict among members), and information (e.g., information is a commodity which can be purchased)."*

These assumptions are of importance because they can cause problems to occur in principal-agent relations. As a result of *goal incongruence* and *information asymmetry* (the agent often possesses more information about his behaviour than the principal), the agent in question doesn't necessarily act in the principal's best interest. The agent may behave opportunistic, which is a problem for the principal. Furthermore there is the problem of risk sharing, resulting from the fact that the principal and the agent may have differing attitudes towards risk. The agency theory assumes that an agent is relatively risk averse, while a principal is risk neutral. Due to these different risk preferences, both parties may opt for different actions in dealing with risk (Eisenhardt, 1989, pp. 58-61; Schoenmaker, 2011, p. 67).

The principal can limit the negative effects of the above phenomena by taking some directed actions. He can provide the agent with appropriate incentives and limit the actions of the agent which are not in his interest by means of monitoring. Monitoring is not limited to measuring and observing the agent's behaviour, but also encompasses 'controlling' mechanisms of the principal like rules and guidelines or budget restrictions. Some situations call for the agent to incur *bonding cost*; expenditures to ensure that he acts in the principal's interest (e.g. ISO certification or a quality plan). Still there will almost always be a discrepancy between the action taken by the agent and the actions that would lead to welfare maximization of the principal. This discrepancy is also considered to be a cost of the principal-agent relationship and is referred to as *residual loss* (Jensen & Meckling, 1976, p. 308; Schoenmaker, 2011, pp. 67-68). Jensen and Meckling (1976, p. 308) therefore define *agency costs* as the sum of:

1. the monitoring expenditures by the principal,
2. the bonding expenditures by the agent,
3. the residual loss.

Agency theory focuses on the most efficient contract, being an outcome-oriented or a behaviour-oriented contract (Eisenhardt, 1989, p. 58). Schoenmaker (2011, p. 66) states this dichotomy doesn't reflect the reality of nowadays and refers to Turner (2004) who describes contracts being a mix between input (behaviour-oriented) and output (outcome-oriented) control mechanisms. Thus the question becomes what the right mix between input and output control mechanism is.

Agency theory has developed in two complementary schools: positive agency theory and traditional principal-agent theory. The focus in positive agency theory is on identifying various contract options and describing governance mechanisms which limit the agent in acting in his own interest. This school indicates that the agent is more likely to act in the principal's interest when the contract is outcome-based and the principal possess information to verify the behaviour of the agent. Traditional principal-agent theory focuses on determining the optimal contract, based on variables (e.g. information, outcome uncertainty and risk aversion) which plea for behaviour-oriented or outcome-oriented contracts. When the principal has complete information, thereby knowing what the agent's actions have been and the outcome of these actions is also easily measured, the most efficient contract is one based on behaviour. Generally though, the agent's behaviour is unobservable to some extent. This leaves the principal with two options: invest in monitoring to eliminate the information asymmetry or a contract oriented on outcome (Eisenhardt, 1989, pp. 59-63; Schoenmaker, 2011, p. 69).

### *Decision making processes*

Schoenmaker (2011, p. 73) argues that in case of outcome-oriented contracts concerning maintenance works, performance agreements will be in play; the agent has to achieve a certain performance requirement. As previously mentioned, with the delegation of work in a principal-agent relationship, also some decision making authority is transferred to the agent. The agent then has the decision making authority to decide how to achieve these performance requirements (within any boundaries set in the agreement with the principal). Agents are rewarded by either a fixed payoff or an incentive payoff tied to the measured performance. The principal bears the risk of the discrepancy between these promised payoffs and the revenues on the assets, which is referred to by Fama and Jensen (1983, p. 303) as *residual risk*. As a result of goal incongruence between the principal and agent, the agent may decide to behave strategically, which leads to inefficiencies and sub-optimisation for the principal. Phrased differently, the strategic actions of the agent increase the residual risk (Schoenmaker, 2011, p. 74). Fama and Jensen (1983, p. 303) argue that separating the different phases in the decision making process provides a solution to the agency problem. They distinguish four steps in the decision process:

1. *initiation* – generation of proposals for resource utilization and structuring of contracts
2. *ratification* – choice of the decision initiatives to be implemented
3. *implementation* – execution of the ratified decisions
4. *monitoring* – measurement of the performance of decision agents and implementation of rewards

When an actor who initiates and implements significant decisions is not the bearer of the residual risk, control of the principal-agent problem in decision making processes is required to protect the interests of the principal. In absence of effective control mechanisms such an actor is more inclined to make decisions that are not in the best interest of the residual risk bearer. *Decision control* (ratification and monitoring) should therefore be separated from *decision management* (initiation and implementation). This way the principal can decide on which initiatives proposed by the agent should be implemented and after implementation he can monitor if the agent did his job sufficiently (Fama & Jensen, 1983, p. 304).

The following example illustrates the concept Fama & Jensen propose. In an infrastructure management organisation, the principal incurs a certain cost for delegating work to the agent, for example the budget assigned to an asset management department to perform maintenance work. The principal carries the risk of the discrepancy between the cost it took to maintain an asset and the revenues from that asset. To maintain control of this risk to a certain extent, the principal should make decision concerning *ratification* and *monitoring*. The asset management department may generate proposals for maintenance works and execute these, but only after the principals has decided which works he deems necessary. Furthermore the monitoring on how the asset management department has performed, which may lead to changes in the assigned budget.

### *Information asymmetry between actors increases with number of actors*

So far the relation between a single principal and a single agent has been discussed. Principal-agent relations are not only possible between two actors, but also in networks; here one can identify multiple principals and multiple agents. Furthermore actors may adopt the role of principal in one relation in the network and that of agent in another relation (Ten Heuvelhof, 2016, pp. 58-59). A greater number of actors involved increases the information asymmetry among the actors (Schoenmaker, 2011, p. 76).

Therefore an increasing number of actors will increase agency problems, in quantitative terms as well as in the weight of the problems.

#### *Application*

Internal agency relations develop in infrastructure management organisations as a result of the delegation of work. First step will be to assess which actors in the organisation assume which role. The agent doesn't necessarily act in the interest of the principal due to *goal incongruence* and *information asymmetry*, which will increase with the number of actors. Therefore it needs to be explored to what extent these concepts are distinguishable in the organisations, as it may lead to agency problems, which may affect the process of making internal performance agreements. Furthermore different attitudes towards risk may hamper the making of internal performance agreements and integral trade-offs.

In attempt to limit the agent's behaviour which are not in his interest, the principal can apply monitoring through measurements and observations of the agent's behaviour and controlling mechanisms like budget restrictions. It will be investigated if the principals in the organisations have applied such instruments. Finally the separation of *decision management* and *decision control* is an interesting concept for this research, as it provides the principal with means to keep the agent's actions in his interest.

### **2.3 Performance measurement**

Actors have numerous options for contracting and making agreements. As stated before in the section on agency theory, in case of outcome-oriented contracts and maintenance actors often opt for performance agreements. Infrastructure management organisations may apply performance agreements on different interfaces, internally as well as with external parties, to capture the required performance.

In order to make performance agreements one needs to implement performance measurement; without measurements the actors cannot know if the agreed performance is actually met. According to Neely, Gregory, and Platts (1995, p. 80), "*performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action*".<sup>3</sup> De Bruijn (2002, p. 7) argues that there is a simple thought behind performance measurement: an organisation states its performance aim and defines performance indicators by which the performance can be measured. With these measurements an organisation can see if the actions it took have resulted in meeting the performance aim and what the cost of these actions has been. According to Waggoner, Neely, and Kennerley (1999, p. 54) performance measurement is often implemented to monitor performance, identify areas that need attention, increase motivation, improve communications and strengthen accountability. Andersen & Fagerhaug (as cited in Vilanova, Filho, & Balestieri, 2015, p. 2) add that performance measurement is also used to support decision making, prioritise actions and verify the effectiveness of implemented interventions.

De Bruijn (2002) sheds a different light on the subject and takes a more critical stand towards performance measurement. De Bruijn (2002, p. 8) differentiates between four functions of performance measurement, with an increasing level of compulsion:

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<sup>3</sup> Effectiveness refers to the extent to which customer requirements are met, while efficiency is a measure of how economically the firm's resources are utilized when proving a given level of customer satisfaction (Neely et al., 1995, p. 80).

- *Transparency*: Organizations can analyse and concretise what has been produced and what the related costs were.
- *Learning*: Organizations can learn which processes go well and which can be improved.
- *Appraising*: The performance of organizations can be appraised by management or third parties.
- *Sanctions*: Sanctions, positive as well as negative, can be imposed in line with an organization's performance.

De Bruijn (2002, pp. 9-11) identifies three beneficial effects of performance measurement. The first effect refers to the function of performance measurement mentioned above: it leads to transparency. Transparency is an incentive for improving performance and innovation, as discussions may arise inside an organisation as a result of the transparency. The second effect has been discussed in the section on agency theory: performance measurement is a type of output steering and therefore an incentive for performance. The result is rewarded in performance measurement, not good intentions (in case of input steering) or effort (in case of throughput steering). The third beneficial effect of performance measurement is that it improves the quality of policy and decision making. As a result of the determination of goals by an organisation and the measurements to assess if the performance is met, the organisation ends up with a lot of quantitative information about performance. This available information may aid an organisation in making decisions and designing policies.

#### *Conditions which problematise performance measurement*

Performance measurement is however not always easy to implement. De Bruijn (2002, p. 13) identifies conditions which problematise the use of performance measurement for organisations. These conditions are set out in Table 2.

<i>Performance measurement possible</i>	<i>Performance measurement problematic</i>
An organization has products	An organization has obligations and is highly value-oriented
Products are simple	Products are multiple
An organization is product-oriented	An organization is process-oriented
Autonomous production	Co-production: products are generated together with others
Products are isolated	Products are interwoven
Causalities are known	Causalities are unknown
Quality definable in performance indicators	Quality not definable in performance indicators
Uniform products	Variety of products
Environment is stable	Environment is dynamic

*Table 2 - Conditions under which performance measurement is possible and problematic (De Bruijn, 2002, p. 13, Table 1.1)*

#### *Perverting effects performance measurement*

Performance measurement has positive effects as described above, although this is not the complete picture. De Bruijn (2002, pp. 21-29) argues that performance measurement also creates numerous perverse effects. First, performance measurement is an incentive for strategic behaviour (which is further elaborated in the next paragraph). Previously it was stated that performance measurement may lead to innovation through transparency. Although this is true, performance measurement may also block innovation and ambitions. Innovation means exploring the unknown, which can turn out well but also lead to failure and harm production. Performance measurement is an incentive for producing the existing, especially when it's coupled to a financial reward. Organisations may also enhance their performance by

optimizing their input, which is known as *cherry picking*. This type of strategic behaviour happens at the expense of ambitions. Third, performance measurement may veil actual performance, especially when information is aggregated and therefore further distanced from the primary process. Furthermore performance measurement may kill a professional attitude. Services are always the result of a trade-off. The professional attitude may be harmed when the focus shifts from constantly making integral trade-offs to scoring on performance indicators. In a situation of competing actors, performance measurement may block cooperation (like sharing best-practices) and lead to compartmentalisation. Finally performance measurement may lead to rewarding, but also to penalising performance. When a department manages to improve performance on a given budget, management may reason that it can also maintain performance on a lower budget. If another department does not manage to improve performance, management does not cut budget. This may lead to a situation in which a better performing department is punished by getting a lower budget than the less performing department.

De Bruijn (2002, pp. 32-38) elaborates on why these perverse effects of performance measurement arise, however his focus is on public organisations. Since infrastructure management organisations, not public organisations, are the topic of this research, the question is if these explanations also apply for this type of organisation. Some infrastructure management organisations are public organisations, while others are not, as depicted in Figure 2. Infrastructure management organisations are on the boundary of the group of organisations which De Bruijn describes. Therefore his concepts are to a greater or a lesser extent applicable in this research, to what extent exactly will vary per situation.

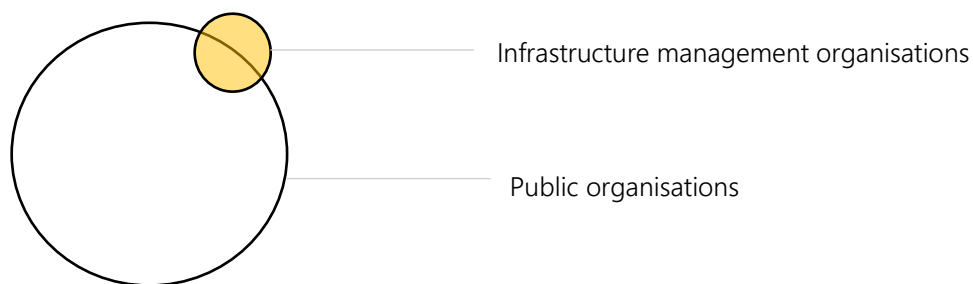


Figure 3 - Place of infrastructure management organisations relative to public organisations (own ill.)

De Bruijn (2002, pp. 32-38) argues that several developments within public organisations are inconsistent with performance measurement. The first development is that public organisations are transforming into professional organisations, in which the primary process is complex and knowledge-intensive. Performance measurement is poor because it does not do justice to these aspects, as this kind of performance is hard to standardize in performance indicators. The second development involves intertwining: performance is achieved in a network of dependencies. Performance measurement does not take this aspect in consideration and therefore it can be experienced as unfair. Increasing compulsion of performance measurement enhances this experience and leads to increased perverting behaviour. (De Bruijn, 2002, p. 36) sketches a paradoxical picture: *"the more management wants to steer with the help of performance measurement, the stronger the incentive for the members of the organisation to show perverse behaviour"*. Looking back at Table 2, it shows that the above characteristics of infrastructure management organisations make performance measurement problematic. An increasing complexity of a product or service leads to increasing dynamic, due to the fact that there are more actors involved and more values have to be assessed. Increasing dynamic is the third development and is problematic because performance measurement tends to be static, instead of *'lively'*. Simply coping with this dynamic by

increasing the number of products and performance indicators (known as mushrooming) does not provide a viable solution as the performance measurement systems loses its function. This leads to a conflict in an organisation: a professional wants performance measurement to be dynamic, while management needs stability.

*Possibilities to prevent perverse effects*

Now the perverse effects of performance measurement and their explanations have been discussed, the obvious question is how these effects can be minimised as far as possible. De Bruijn (2002, p. 56) has come up with a few design principles which can aid in designing performance measurement. Application of these principles influences certain values in order for performance measurement not to induce perverse effects. This relation is depicted in Table 3.

<i>Explanation for perverse effects</i>	<i>Value</i>	<i>Matching design principle</i>
Performance measurement is unfair	Trust, fairness	Interaction
Performance measurement is poor	Content	Variety and redundancy
Performance measurement is not lively	Liveliness	Dynamic: both product and process management

*Table 3 - Three design principles for performance measurement (adapted from De Bruijn, 2002, p. 56, Table 4.1)*

Trust is an important value in performance measurement and in order for it to exist, it has to be recognised that performance is realised in a network of dependencies. Therefore performance measurement has to be based on interaction between the actors involved. Management and professionals have to interact during the design of the performance measurement system as well as when the system is in use. This increases the support for the system, which leads to more meaningful performance measurement (De Bruijn, 2002, pp. 56-57). Content is another important value. In order to do justice to the complexity and multiplicity of services, performance measurement should incorporate variety and redundancy (which is a step further than just variety). It should be noted that variety and redundancy only have to be incorporated to a certain extent, as a performance measurement system needs a certain consistency and stability to fulfil its functions. Therefore these concepts have to be balanced in a system (De Bruijn, 2002, pp. 57-58). The third value of importance in performance measurement is liveliness. Products and services are created in a dynamic environment and performance measurement has to recognize and deal with this aspect. Dynamic can be identified at a product level as well as on a process level and a performance measurement system has to include both (De Bruijn, 2002, p. 59). This is consistent with what was stated earlier in the section on agency theory: in the reality of nowadays contracts have to be a mix between behaviour-oriented and outcome-oriented control mechanisms.

*Application*

Infrastructure management organisations choose to use performance measurement because of the positive effects it can bring to an organisation. However, as Table 2 indicates, there are conditions which make the use of performance measurement problematic. The existence of such conditions at infrastructure management organisations may provide a partial explanation about why these organisations have difficulties concerning performance measurement.

Performance measurement may lead to perverse effects, being inter alia serving as an incentive for strategic behaviour, blocking innovation, veiling actual performance and harming the professional attitude. Manifestations of these effects may be identified during the case study, which implies the

organisations have not been able to prevent these perverse effects from emerging in the organisation. De Bruijn's design principles may then offer a possible solution to minimise the perverse effects. De Bruijn argues that positively contributing to the values trust, content and liveliness by incorporating respectively interaction, variety and redundancy and product as well as process management hinders the creation of perverse effects.

## 2.4 Strategic behaviour in networks

The previous sections of this chapter argued that actors who are involved in networks and principal-agent relations, may behave strategically to maximize their own interest. Subsequently the question emerges how strategic behaviour can be defined.

Ten Heuvelhof (2016, p. 27) provides a quite narrow definition of strategic behaviour and identifies three conditions for behaviour to be considered strategic behaviour. First, an actor who behaves strategically must act to serve his own interest, while knowing it may harm the interests of others. Second, an actor has to act intentionally, meaning he has considered his behaviour and has come to the conclusion that it will serve his interest and may possibly hurt the interest of others. Third, the actor who behaves strategically will camouflage his behaviour, his intentions and/or the consequences of this behaviour. He is aware that being completely open about it will diminish the effectiveness of this strategic behaviour, while also knowing the risk of damage to his reputation.

Ten Heuvelhof's definition is clear and precise, however in this research it is assumed that there are also forms of behaviour which do not check each of this criteria but can still be labelled as strategic. Ten Heuvelhof states that a strategic actor acts intentionally, accepting that he may hurt the interest of others. This research assumes that there are various gradations, of which Ten Heuvelhof's is the most extreme. This is based on the reasoning that the complete opposite of what Ten Heuvelhof describes is not realistic: a situation in which everybody just blindly follows the rules and serves everybody's interests. People have different goals and objectives and to achieve these they may sometimes hurt the interests of others, whether this may be intentional or not.

As explained previously in the section on networks, actors are dependent on each other to achieve their objectives, which leads to the forming of dependency relations. Ten Heuvelhof (2016, p. 26) argues that these dependency relations enable the development of strategic behaviour. Strategic behaviour manifests in many different ways, however it often develops through *sources* and *strategic possibilities*. Regarding sources Ten Heuvelhof (2016, pp. 57-58) distinguishes *information*, *time* and *language*. *Patterns* and *biases* form strategic possibilities to influence decision-making processes. Strategic behaviour is usually supported by a combination of both, although it's also possible that only one of these aspects is the driving factor (Ten Heuvelhof, 2016, pp. 56-57).

### *Application*

Due to goal-incongruence actors may behave strategically to serve their own interest i.e. achieve their own goal. Perverse effects of performance measurement and agency relations further fuel strategic behaviour, which hampers organisations in making integral trade-offs. Since camouflage is one of the characteristics of strategic behaviour, it's not plausible that clear examples are identifiable in the case studies. This is also due to the fact that actors will deny that they behave strategically when asked about it (Ten Heuvelhof, 2016, p.13). Therefore this research project has no intention of identifying specific strategic behaviour in organisations, but it is important to note that certain phenomena in the process of

making internal performance agreements may induce this kind of behaviour which is harmful to organisations.

**2.5 Theoretical framework**

For the purpose of analysing and interpreting the empirical findings of this research a number of concepts from the above discussed theories are selected. The majority of these concepts affect the process of making internal performance agreements and help explain the complex situations encountered at the researched organisations. The other concepts include management strategies offered by literature on how to counter negative effects which may arise in the agreement-making processes. These concepts may offer theoretical explanation and support for the strategies used in the researched organisations. The theoretical framework in Table 4 captures all concepts.

<b>Relevant concepts from multi-actor decision making</b>	
<i>Concepts which affect the agreement making process</i>	
Hierarchical relation	
Network relation	
Joint decision-making	
<b>Relevant concepts from agency theory</b>	
<i>Concepts which affect the agreement making process</i>	<i>Management strategies</i>
Agency relation	Monitoring
Agency problems	Separation of decision management and control
Number of actors involved	
Goal incongruence	
Information asymmetry	
Risk distribution	
Decision management (initiation and implementation)	
Decision control (ratification and monitoring)	
<b>Relevant concepts from performance measurement</b>	
<i>Concepts which affect the agreement making process</i>	<i>Management strategies</i>
Conditions which make performance measurement problematic (see Table 2)	'Interaction' as a design principle
Perverse effects: incentive for strategic behaviour, blocking innovation, veiling actual performance and harming the professional attitude	'Variety and redundancy' as design principle
	'Product and process management' as design principle

Table 4 - Theoretical framework

## 3. RESEARCH METHODOLOGY

The previous chapters treated the problem, the research question, relevant theories and which concepts from these theories will be used to analyse the problem. This chapter elaborates on *how* the research is conducted in terms of literature study, research strategy, data collection, analysis and focus of the research.

### 3.1 Literature study

The preliminary research has pointed out several potential tensions in the process of making internal performance agreements at infrastructure management organisations. In order to develop a better understanding of the factors at play in this particular situation, a literature study is undertaken. Based on this study a theoretical framework has been developed, which gives direction to what the researcher has to look for while conducting the research. Furthermore it puts the information obtained during the research in perspective as it enables to compare the (empirical) results with theory. The role of theory in this study is not predominantly to find solutions to the identified problem, but rather to clarify the empirical complexity encountered in the cases. It helps in understanding the behaviour of actors and the evolution of certain behaviour and effects as a result of how processes are organised.

The literature study includes scientific articles, papers and books. Applicable literature is searched through scientific search engines: *Scopus*, *Google Scholar*, *Web of Science* and *Science Direct*. Another method which is used in this research is to look up the documents which are referenced in the literature found. Furthermore the supervisors of this graduation thesis are consulted in the search for useful literature.

### 3.2 Research strategy

The research question, as stated in Chapter 1, is:

*How do infrastructure management organisations' asset management departments cope with the inherent tensions in the process of making internal performance agreements, to support integral trade-offs on performance, risk and cost?*

While the theory discussed in the previous chapter provides information about how the tensions may develop, it does not indicate how asset management departments cope with these tensions. Empirical descriptions of how the processes are organised and evolve in organisations can provide valuable insights. Therefore this research has an *explorative* nature.

In order to answer the research question, a thorough understanding of the process of making internal performance agreements at infrastructure management organisations is required. *Case study* research is a suitable strategy because, as described by Verschuren and Doorewaard (2010, p. 178), it is a research strategy in which the researcher attempts to obtain an in-depth insight into one or several processes which are confined in space and time. Case study research is especially applicable when (Hutjes & van Buuren and Swanborn as cited in Schoenmaker, 2011, pp. 105-106; Steward, 2012, p. 80)

- it is impossible to isolate the subject of research from its environment;
- research concerns relations between organisational structures, management processes and outcomes;
- research concerns gaining insight in interactions between actors;

- profound data collection is required to enable understanding of the way in which processes actually take shape; and
- research concerns gaining insight in problems experienced by the actors involved and solutions to these problems that have already been found.

These aspects are all very much applicable to the research at hand and therefore it is legitimate to assume that the decision to opt for case study research is the right choice. Choosing for case study research has some implications for the characteristics of the study (Verschuren & Doorewaard, 2010, pp. 178-180). The research consists of a relatively small number of cases, in this research that number is two. Ideally there would be a few more cases, however this is not possible due to time constraints. The selection of these cases is strategic, based on a set of criteria. Furthermore case study research is characterized by the use of multiple and intensive methods for generating in-depth data. How data collection is organised in this research is elaborated on the next page. Case study research concerns creating a holistic, integrated image of an object or process. This implies a qualitative, unstructured and open way of data collection and use of qualitative research methods. Finally, engaging in case study research implies that the case is not isolated, but studied in its natural context. Therefore both organisations which are subject to the case studies are visited and interviews are conducted at these organisations.

Yin (2003, p. 39) distinguishes between single-case and multiple-case studies and between holistic of embedded units of analysis, as depicted in Figure 3. The case study in this research is done according to the embedded multiple-case design.

As previously mentioned, this research contains two cases. This research has an explorative nature and covers a rather big subject. Hence it will take a lot time to get a thorough understanding of the process of making internal performance agreements at an infrastructure management organisation in all its facets. Therefore the first case is used to get such understanding, after which the second case can be executed much more focussed. The researcher's access to the research material of both cases also differs in time. Consequently a sequential order of studying both cases is necessary. A selection of the issues identified in the first case, is subject of research in the second case. In this way a comparison can be made between mechanisms applied by the research organisations that address certain aspects of the process of making of internal performance agreements. This research does not provide an all-solving strategy for the entire process. The focus is rather on identifying aspects in the process, that may benefit from the implementation of certain mechanisms to steer the process in the right direction. Looking back at Figure 3 and applying this research on its terminology, the concepts can be made explicit:

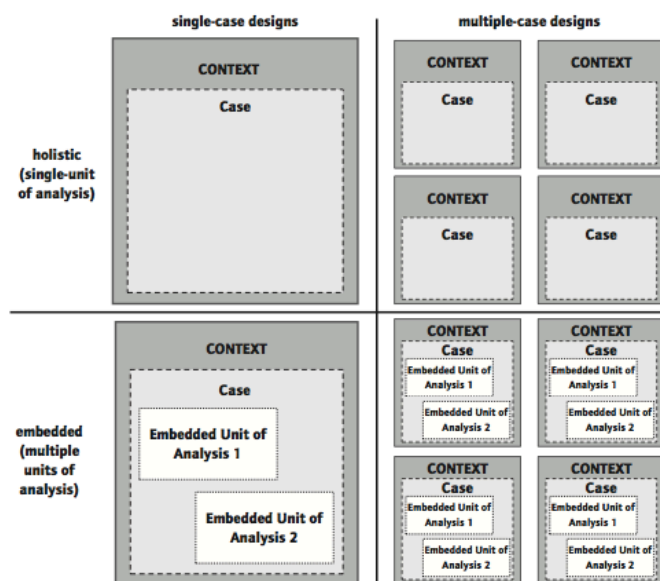


Figure 4 - Basic types of designs for case studies (Yin, 2003, p. 40)

- Context: The infrastructure management organisation under investigation
- Case: The process of making internal performance agreements concerning a particular asset system of this organisation
- Embedded unit of analysis *no. x*: selected issue *y*

### 3.3 Case selection

Verschuren and Doorewaard (2010, p. 180) argue that in case of explanatory research the researcher should select cases that have a lot of similarities. When there is a large variation between the cases it is difficult to link up the various phenomena and to obtain generally descriptive assertions. The choice for the first case follows logically from the preliminary research: the process of making internal performance agreements concerning the aircraft stands at Amsterdam Airport Schiphol. For the second case an infrastructure management organisation is selected which shows a lot of similarities: Port Authority Rotterdam. The selected cases have the following in common: they are large infrastructure management organisations with similar asset management challenges, inter alia to cope with a dynamic demand versus an asset base which is developed for long-term purposes. At Schiphol the case study is about the internal performance agreements concerning the aircraft stands. The internal performance agreements about quays, land infrastructure and fairways at the Port of Rotterdam offers a good possibility for comparison, as these are the asset systems which are used by the commercial client (just like the airlines at Amsterdam Airport Schiphol). While the aircraft stands are in function best compared to the berths on the quays, they don't compare when it comes to complexity of the asset system. Therefore the *chain of assets* of the above stated assets is used in this research. Both organisations have a front-office in which the agreements with the clients are made and a back-office in which the asset management department has to realise these agreements.

### 3.4 Data collection

For achieving in-depth results, researchers who conduct case studies use various and intensive methods of generating data (Verschuren & Doorewaard, 2010, p. 179). Applicable research methods are for example conducting interviews, content analysis of textual material and participant observations. Researchers do not only use different methods, but also multiple sources of data: e.g. available documents and interviews with several informants (Swanborn, 2010, p. 13). Using multiple sources of information and different research methods is considered *triangulation*, which is a means to contribute to the reliability and validity of the study (Van Thiel, 2007, p. 62). This research will predominantly consist of analysing available documents and interviews with actors who are involved in or who's processes have interfaces with the process of making internal performance agreements. Also less formal ways of acquiring information, like *coffee-corner-chatter*, are used as input, as this creates a more lively picture of how the processes which are laid down in documents actually turn out.

#### *Documents*

In the preliminary study as well as in the case studies a lot of (mostly internal) documents are studied. First of all these are documents which have a direct connection with the subject of study: documents containing the internal performance agreements and documents in which the process of making these agreements is described. The process of making internal performance agreements is however not an isolated process; it has interfaces with numerous other processes, for instance processes concerning maintenance management. Documents related to these intertwined processes are also of interest to this research. Furthermore making the internal performance agreements is not the only task of the actors

involved. What are the roles and responsibilities of these actors in the organisation and how does this connect to the internal performance agreements? It is important to keep focus and not get lost in the multitude of available documents, therefore it is essential to keep asking the question whether the document is relevant for this research.

### *Interviews*

The case studies also include a number of interviews, which help to gain a profound understanding of how processes really take place in the organisations. Interviews provide context around the documents and create a rich image. There are various ways to conduct interviews, which fit different kinds of studies. In this explorative research open, semi-structured interviews are used. In this type of interviews, the topics are fixed, but the questions and answers are not. The order in which the topics are addressed is also not fixed (Baarda, Van der Hulst, & De Goede, 2012, p. 19). Semi-structured interviews therefore provide the researcher with quite some freedom, which is preferable in a situation in which prior knowledge is limited. For each interview a checklist with topics is drafted, with possible follow-up questions. The freedom of order has the advantage that the researcher enables the interviewee to get his or her story across more fluently, whereas a strict order can interrupt the interviewee's story. However each topic from the checklist should be addressed eventually. While the *embedded units of analysis* are covered in the checklist, these should also always be kept in mind by the researcher in order to notice possibilities for valuable follow-up questions.

The largest part of the interviews conducted in this research are individual face-to-face interviews, however some interviews are held in small groups. Group interviews are conducted only in case this adds value in terms of getting a complete story, e.g. when the group exists of employees which have the same function and role in the organisation and therefore may be seen as a single actor in the process. Individual interviews are preferred as the interviewees are more inclined to tell their side of the story, not influenced by other actors in the room. For this reason the interviews take place in an enclosed room or office. To protect the interviewees they are anonymised in the final report.

As mentioned before, the two cases differ in time assigned to each study, which has implications for the way the interviews are processed. During the first, extensive case study the researcher makes notes during the interviews, which are developed into an interview report short after the interview to prevent loss of valuable information. Due to the fact that the researcher spends an extensive amount of time at the organisation where the first case study takes place, it is fairly simple to address the interviewee with some follow-up questions or to verify statements after the interview. The researcher however only spends a relatively short period of two weeks at the organisations of the second case study. Therefore the interviews at the second organisation are recorded, after which transcripts are drafted. This is a time-consuming process, but necessary as the researcher does not have an easy way of approaching the interviewees after these two weeks.

### **3.5 Analysis methodology**

From the collected data the researcher develops a rich image on how both organisations have organised the process of making internal performance agreements and integral trade-offs. Three phases can be distinguished in which the acquired data is analysed, of which the third is the most comprehensive.

The first phase belongs to the preliminary research, in which tensions were identified which affect the process of making internal performance agreements at Amsterdam Airport Schiphol. From internal documents and interviews with twelve employees of Schiphol an overview was created of the

characteristics and issues of three types of performance agreements: internal, external with the client and external with the contractor. By contrasting these different characteristics, tensions in the internal process, which has interfaces with both external processes, were derived. These findings, which are the result of the preliminary research, provided the starting point for the main research. From this point on, the scope of the research narrowed down to the process of making the internal performance agreements.

The second phase of analysis is conducted during the first case study, before starting on the second case study. As argued in paragraph 2.3, the chosen strategy and access to the case study material makes a sequential order of studying both cases necessary. The aim of this phase is to derive a number of characterising findings from the first case study, to serve as focal points for the second case study. This way the second case study can be executed much more focussed. The second phase of analysis therefore does not concern interpreting the case study results, but is focussed on determining what kind of data has to be searched in the second case. While the concepts from the theoretical framework are not yet applied to analyse findings of the case study, the framework does provide a reference for what to look for in the cases. The collected data during the first case study is analysed by looking for similarities in the information presented in the interviews: which aspects are mentioned frequently and which are regarded as important by several actors? In this process passages from the interviews are coded and put under specific headers, e.g. 'interdepartmental communication'. From this pooled information the essence of the issue is derived. These issues and the derived focal points for the second case study are provided in the next paragraph.

The third and most comprehensive analysis phase is the cross case analysis, in which the actual research results are developed. Prior to this phase, the data from documents, interviews (two additional interviewees in case of Schiphol and five interviewees in case of the Port Authority) and *coffee-corner-chatter* (in case of Schiphol) is combined into one comprehensive image for each case study. In this process of developing the case descriptions already a separation is made between primary and secondary issues by considering which information does actually affect the process of making internal performance agreements and integral trade-offs and which information is also interesting, but out of scope. The cross case analysis starts with searching for common elements in both case descriptions, e.g. organisational structuring principles or issues concerning an imbalanced trade-off. The next step is to search for consequences, positive as well as negative, of for example the way of organising. Besides reasoning from the findings of the case studies, it may also be helpful to reason from the theoretical framework. In the beginning of the research these concepts were deemed applicable and important to interpret the complex reality. In what way are these concepts reflected in the case study results? What makes that these concepts are indeed applicable? Next step is to link various findings and theoretical concepts, e.g. consequences of the organisational structure which can be explained from agency theory. While the literature review particularly discusses negative effects, there are of course also positive aspects to how the organisations and processes are organised, otherwise they would not have decided to do it this way. It's important to discuss these positive effects to get a complete picture. Maybe these effects are not explicitly reflected in the interviews due to the fact that the interviews were more focussed on negative effects, but the positive effects can also be argued with logical thinking. The cross case analysis as described above can be characterised as an iterative process of going back and forth between the case study results, the theoretical framework and insights gained from the confrontation of these inputs.

### 3.6 Research focus

As mentioned previously, a selection of issues which resulted from the first case study (Amsterdam Airport Schiphol) is analysed in the second case study (Port Authority Rotterdam). These issues serve as the *embedded units of analysis* and enable a comparison between Schiphol and the Port Authority. In the case study on Amsterdam Airport Schiphol four issues are identified which complicate the process of making internal performance agreements:

1. Sub-departments are primarily focussed on achieving their own targets
2. Roles and responsibilities are laid down in regulations, but in reality there is a lack of clarity on how these are translated to the processes concerning the performance agreements
3. Lack of clarity regarding the processes executed by other sub-departments
4. Time dimension: dynamic client demands for long-term purpose assets and asynchronous (sub) processes

The question is whether these issues also influence the process of making internal performance agreements at Port Authority Rotterdam. Therefore Yin's research design is applied on this research, resulting in *Table 5*. This research identifies the similarities and differences between the two organisations and interprets these with the concepts from the theoretical framework. From these interpretations and comparisons it is shown what both organisations can learn from each other and what lessons can be learned in terms of mechanisms which can be applied by infrastructure management organisation in general.

<i>Context</i>	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
Case	Process of making internal performance agreements regarding the aircraft stands	Process of making internal performance agreements regarding the quays, fairways and land infrastructure
<i>Embedded units of analysis</i>	<ol style="list-style-type: none"> <li>1. Focus of the involved sub-departments</li> <li>2. Allocation of roles and responsibilities on paper and clarity in reality</li> <li>3. Clarity about processes executed by other sub-departments</li> <li>4. Time dimension</li> </ol>	

*Table 5 - Case study design*

# 4. CASE STUDY: AMSTERDAM AIRPORT SCHIPHOL

## 4.1 Context

Amsterdam Airport Schiphol is the main airport of the Netherlands and one of the biggest airports in Europe. The airport is operated by Schiphol Group, which also owns and operates Rotterdam The Hague Airport and Lelystad Airport and holds a majority share in Eindhoven Airport. Amsterdam Airport Schiphol has the ambition to be Europe’s Preferred Airport for passengers, airlines and logistics services providers. To achieve this ambition investments are made in infrastructure as well as facilities. The main revenue stream comes from the airlines, which are obliged to pay port dues in order to make use of Schiphol’s infrastructure. Passenger number and flight movements are increasing each year at Schiphol. To accommodate this strong growth a new pier and terminal are developed (Schiphol Nederland B.V., 2016b, 2017a, 2017c).

Schiphol Group is organised in four business areas and two support units, which are directed by the Management Board. The four business areas are Aviation, Consumer Products & Services, Real Estate and Alliances & Participations. Aviation is responsible for all aviation related activities and processes at Amsterdam Airport Schiphol. It provides airlines and handling agents with the means to ensure an efficient and high-quality handling process of passengers and cargo. Furthermore it offers the appropriate facilities and services to the airport’s passengers. Consequently Aviation has a broad range of responsibilities: inter alia development and maintenance of the airport’s infrastructure, management of the airside processes and ensuring safety (Schiphol Nederland B.V., 2017b). Aviation is divided into a number of departments, of which two are important for this research: Airport Operations and Asset Management. Both are accountable to the COO. The organisational structure of Schiphol is illustrated in Figure 4.

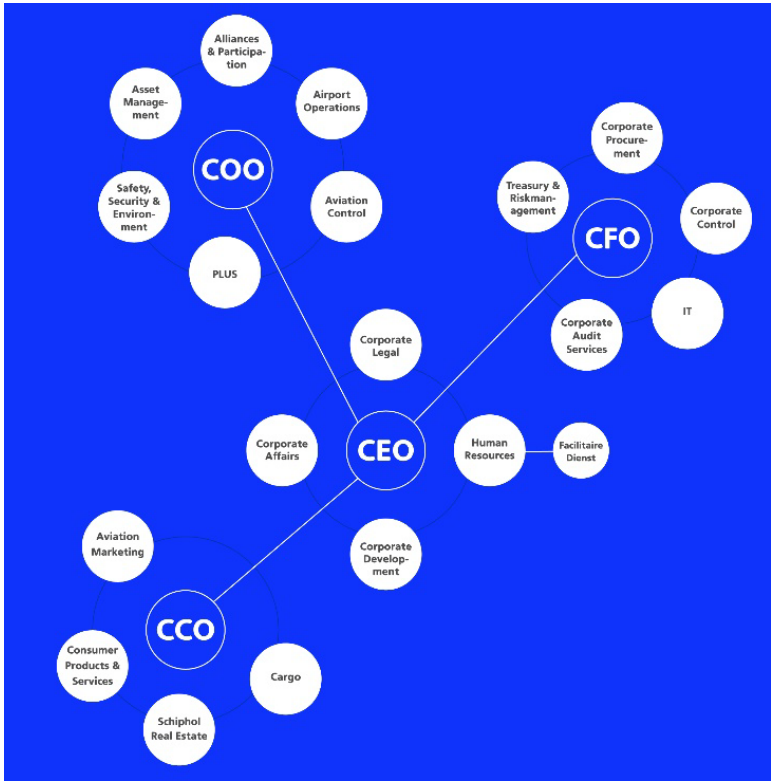


Figure 5 - Organisational structure Schiphol (Schiphol Nederland B.V., n.d.)

## 4.2 Asset management

To achieve its ambition of becoming and staying Europe's Preferred Airport, Schiphol is making big investments to increase quality and capacity at the airport. Schiphol deems it necessary to improve its competitiveness due to the increased competition among airports worldwide. To become more competitive Schiphol has to provide appropriate quality to its clients, for a more competitive price. As more than fifty percent of its costs are related to assets, Schiphol considers improving its asset management a necessity. The aim is to retain a level of quality which suits Europe's Preferred Airport accompanied by better long-term asset related cost control (Schiphol Nederland B.V., 2015b, p. 4).

Schiphol deems it essential to align asset management with operations and commerce in order to increase value from assets and become more competitive. Operations needs to ensure quality for passengers and airlines, whereas commerce focuses on optimising revenues and ensuring desired services and experience. Providing infrastructure of appropriate quality for a competitive price is up to asset management. Hence the implementation of the program 'Asset Wise!' at Schiphol, striving for three main objectives: increase value from assets, structural reduction of assets' life cycle cost and creating a mindset to achieve the previous two objectives (Schiphol Nederland B.V., 2015b, p. 5).

Asset management at Schiphol is conducted following five principles, which should ensure alignment with the organisational goals. These five principles are (Schiphol Nederland B.V., 2015b, p. 7):

1. Each asset has to effectively create value in realising Schiphol's mission and strategy. This is done for the client.
2. Effective asset management decisions are based on a trade-off between function, risk and euro's over the entire life cycle.
3. An explicit and integral mainly top-down decision-making process is implemented from a strategic to an operational level.
4. Asset management decisions are made based on facts and numbers.
5. Ownership in the asset management process: all responsibilities are explicitly assigned to owners, rolls are appointed, and all actors show commitment and take responsibility on their level (internal and external) and are able to do so.

## 4.3 Strategic, tactical & operational plan process

Schiphol's asset management activities are included in the corporate plan process, which consists of a strategic, tactical and operational phase. Determination of costs and output is the focus of the first two phases, whereas the operational plan process revolves around managing control and output. The strategic plan process take place once every three years. During this process Schiphol's strategy is determined for the next five years. From this strategy the integral goals for the organisation are derived, aligned with the functional long-term requirements of the airlines. The decision making authority on these goals lies with the managing board (Schiphol Nederland B.V., 2015b, pp. 9-10).

The tactical plan process concerns the translation of goals and user requirements into solution spaces and eventually into a project portfolio for Schiphol for the upcoming four years and for Aviation specifically for the upcoming five years. During this yearly process possible solutions are developed to meet the goals and fulfil the clients demands. Different scenarios and their effects are established based on Total Cost of Ownership (TCO) . The possible solutions are asset as well as non-asset solutions. Non-asset solutions are developed by operational units and concern adjusting and stretching the current operation. Asset solutions can take the form of adjustments or expansions of the infrastructure, or adjustment of

management and maintenance concepts by the Asset Management department. The decision on which solutions (asset, non-asset or a combination) will be applied is based on business cases, in which it is important to note that decisions may have impact on management and maintenance concepts and costs. Based on the business cases and a trade-off between performance, risk and cost the most effective project portfolio on realising the solutions is established (Schiphol Nederland B.V., 2015b, pp. 11-12).

Realisation, adjustment and operation of assets belong to the operational plan process. The definitive business cases per project are established as well as the effects of the agreed project portfolio on the management and maintenance of the current asset base. Before assets are taken into service, agreements between user and owner are made. These agreements are translated into required asset performance and maintenance strategies and plans, depending on an asset's function and criticality. Based on these plans maintenance works are conducted when the asset is in service. During the operation of assets the performance as well as the cost are continually measured, to determine if the asset still has a valuable contribution to the operational processes. When this is not the case or when a better solution presents itself, the asset's life cycle may come to an end (Schiphol Nederland B.V., 2015b, p. 13).

#### **4.4 Integral approach in decision making**

Schiphol has the ambition to make decisions integrally and based on a trade-off between performance, risk and cost. For the tactical plan process this means that it does not only want an integral plan, but also an integral process. Furthermore it wants to make integral assessments concerning investments, meaning that these assessments are not focussed on one department but are made considering all departments at once (Schiphol Nederland B.V., 2015b, p. 12).

#### **4.5 Performance, risk & cost**

In the 'Asset management policy statement – Amsterdam Airport Schiphol' (Schiphol Nederland B.V., 2015a, pp. 10-11) the managing board of Schiphol argues that Schiphol has to be operated efficiently. Asset related decisions need to be based on explicit trade-offs between performance, risk and life cycle cost. The '*Blueprint Asset Management*' (Schiphol Nederland B.V., 2015b, p. 17) elaborates further on the trade-off, although here it is referred to as the function-risk-euro trade-off. This document describes that the trade-off is made throughout the plan process, although the influence on the final result is greatest in the strategic plan process. On this strategic level the trade-off is used in determining and prioritising the integral vision and goals of Schiphol. During the tactical plan process the trade-off is made when solution directions are assessed and when the final project portfolio is decided upon. During the operational plan process the trade-off is made in two separate phases. The first phase is the realisation phase, in which the trade-off is used to make decisions in the design and execution of a project. The trade-off is continually made in the exploitation phase, to evaluate whether the current management and maintenance concepts still ensure the desired function and whether this is according to the right costs and risks (Schiphol Nederland B.V., 2015b, pp. 17-19).

#### **4.6 Asset management department**

The Asset Management department (ASM) has recently been reorganised, switching from a organisation based on assets to one based on processes. The department is divided in five sub departments and two staff departments (Control and Secretariat). The split into five sub departments is based on processes which enables optimizing these Asset Management processes. The five sub departments are (Schiphol Nederland B.V., 2015c, p. 25):

- Technical Expert Center (TC)
- Planning & Portfolio Management (P&P)
- Development (DV)
- Maintenance & Operations (M&O)
- Strategy Office (SO)

The Development and Strategy Office sub departments are not involved in the internal performance agreements process and therefore will not be discussed in this report. The goals and responsibilities of the other three sub departments are elaborated below.

#### *Maintenance & Operations*

The goal of M&O is to guarantee the continuity of the airport processes by managing and maintaining assets in a cost-effective way with minimal nuisance for the operation. M&O manages and maintains Schiphol's assets according to the maintenance programs for these assets and is obliged to do this in an effective manner. The programs are the result of an interactive process with the Technical Expert Center (TC), whose maintenance concepts form the basis for this process. M&O provides input for the maintenance concepts by measuring, securing and reporting asset performance data. Also P&P needs data on performance, in order to establish whether the agreed performance is actually achieved (Schiphol Nederland B.V., 2015c, p. 37).

#### *Planning & Portfolio Management*

P&P is responsible for the return on the assets in terms of function, risk and cost. Their goal is to contribute to the strategy of Schiphol Group by prioritizing and planning the construction, maintenance and divestment of assets in such a way that their contribution is maximized. It does so by developing, composing and adjusting the portfolio for the upcoming 5 years, based on function, risks and cost. They are evaluated on the satisfaction of the client, which is in this case the Process Management Airside department. P&P has to respond to their needs by translating their functional demands to development orders or performance agreements (Schiphol Nederland B.V., 2015c, p. 33). P&P initiates and coordinates the tactical plan process of Aviation and ensures continuous attunement with the other Business Areas and the IT department. Managing the established project portfolio is also the responsibility of P&P (Schiphol Nederland B.V., 2015b, p. 11).

#### *Technical Expert Center*

TEC's goal is to guarantee that the Asset Management department meets the agreed asset performance by providing guidance and advice to sub-departments of ASM and other internal clients about technical standards, asset data and asset information. TEC needs to contribute to the strategy of ASM and Schiphol Group by developing asset policies and maintenance concepts (Schiphol Nederland B.V., 2015c, p. 30). These products, based on the trade-off between the aspects function, risks and cost, enable the organisation meet the agreed asset performance.

### **4.7 Asset system: aircraft stands**

The internal performance agreements used in this research concern the aircraft stands. Amsterdam Airport Schiphol has four types of aircraft stands: gate connected, remote, buffer and cargo. The connected aircraft stands are the most complex assets systems as these comprise of all aircraft stand assets, while the other types only have a few of these assets. Therefore the gate connected aircraft stand

is elaborated. Figure 5 depicts the signage at a gate connected aircraft stand, while at the same time indicating the location of some of the system's assets.

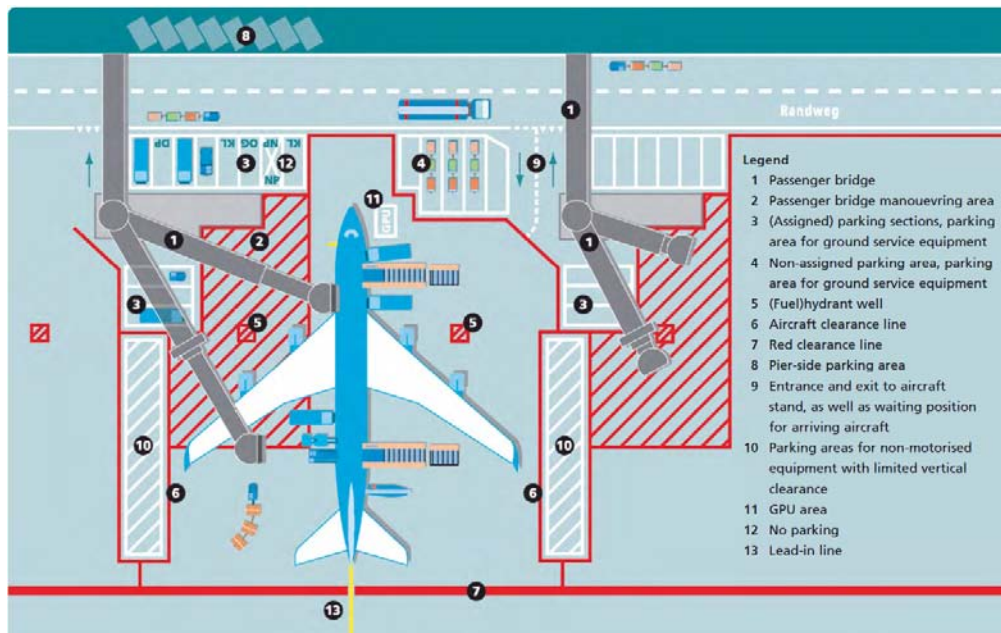


Figure 6 - Aircraft stand (Schiphol Nederland B.V., 2015d, pp. 86-87)

Besides the signage, the asset system of a gate connected aircraft stand is composed of a number of other assets (Schiphol Nederland B.V., 2014, p. 4; 2016a, p. 8):

- Pavements
- Drainage
- Lighting
- Gate identification
- Guidance system for parking (VDGS)\*
- Passenger bridge (connected\* and movable for back-up)
- Fuel hydrant wells
- Ground Power/400Hz Unit (GPU)\*
- PreConditioned Air Unit (PCA)\*
- Fire extinguishers
- Storm-warming system

\*(KPI's for technical performance are only set for these specific assets in the current internal SLA)

Aircraft stands enable a number of processes: boarding, de-boarding and servicing. Gate identification and the VDGS ensure the pilot parks the aircraft at the right place, after which de-boarding can take place. Passengers and crew will leave the airplane by making use of the passengers bridge, which is connected to the gatehouse. In order to prepare the aircraft for the next flight the aircraft is cleaned, fuelled with use of the hydrants and the air is refreshed with the use of the PCA. Due to environmental regulations aircrafts are not allowed to be powered by fuel when they are parked at a stand, so a ground power unit feeds the plane with electricity. The other assets from the list above (pavements, drainage, lighting, fire extinguishers, storm warning system) make sure the processes can be executed in a proper and safe way.

#### 4.8 Internal performance agreement part of service level agreement

The internal performance agreement concerning the aircraft stands are put down in a Service Level Agreement (SLA). According to this document *"the goal of a Service Level Agreement (SLA) is to concretize expectations, agreements and goals in such a way that it can be used as a two-way steering tool. By using a SLA actors can gain insight in complying with agreements and performance and achieving long-term goals"*. The SLA document contains several agreements and norms. First the scope of the SLA is mentioned by differentiating between gate connected aircraft stands and remote aircraft stands and stating the functional areas (pier/buffer/platform) and functional components (assets) of both types of aircraft stands. Next the 'work agreements' are mentioned, stating when a product (maintenance year plan/demand specification/maintenance report/SLA report) should be presented, assessed or approved and by whom. The subsequent set of agreements are the 'functional agreements' which specify the technical and functional requirements and the limit values per asset (Schiphol Nederland B.V., 2014, pp. 4-5).

Then the internal performance agreements are elaborated. The performance agreements are agreements concerning maintenance. Schiphol recognizes that it needs to perform maintenance works on its assets to comply with client requirements and laws and regulations. The requirement maintenance is captured in a capacity planning. The performance agreements concern two aspects: availability and reliability. Availability is subdivided into three aspects, for which a key performance indicator (KPI), norm and review interval are specified (see Table 6) (Schiphol Nederland B.V., 2014, pp. 5,8).

Aspects	KPI	Norm	Review interval
Not available due to planned maintenance	Compliance with agreed maintenance periods per functional area	X % of maintenance executed according to plan	Each quartile
Not available due to delays of planned maintenance	Delay time of planned maintenance per functional area	Max. Y% more time than planned	Each quartile
Not available due to unscheduled downtime	Recovery time due to failures per functional area	Differs per located: captured in Appendix Z	Each month

Table 6 - Performance agreement availability (Schiphol Nederland B.V., 2014, p. 8)

The norms concerning unscheduled downtime are stated in one of the SLA's appendices. These norms are specified as 'total allowed loss of usability in unplanned hours' per cluster of aircraft stands (Schiphol Nederland B.V., 2014, p. 11).

The performance agreements concerning reliability are expressed in a similar fashion, as displayed in Table 7, although there are no norms for the first two aspects (SLA, p.8). In the appendix the norm for the number of failures is provided as the allowed number of failures per asset per pier, based on a the average number of movements per aircraft stand (Schiphol Nederland B.V., 2014, p. 10).

Aspects	KPI	Norm	Review interval
Unreliable due to the number of changes in the capacity planning	The number of deviations on the agreed capacity planning	--	Each quartile
Unreliable due to the number of delays of maintenance	The number of delays concerning planned maintenance per functional area	--	Each quartile
Unreliable due to the number of failures	The number of failures per functional area	Differs per located: captured in Appendix Z	Each month

Table 7 - Performance agreement reliability (Schiphol Nederland B.V., 2014, p. 8)

The document continues with agreements regarding reports (planning report, SLA report, SLA annual report (evaluation) and management report) and consultations (tactical account consultation, SLA evaluation consultation and planning consultation), which can be found in Appendix B. These agreements concern the monitoring of progress and evaluations. The SLA's appendices further state reaction and response time in case of failures and the prioritisation of the aircraft stands (Schiphol Nederland B.V., 2014, pp. 8-15).

#### 4.9 Process of making internal performance agreements and integral trade-offs

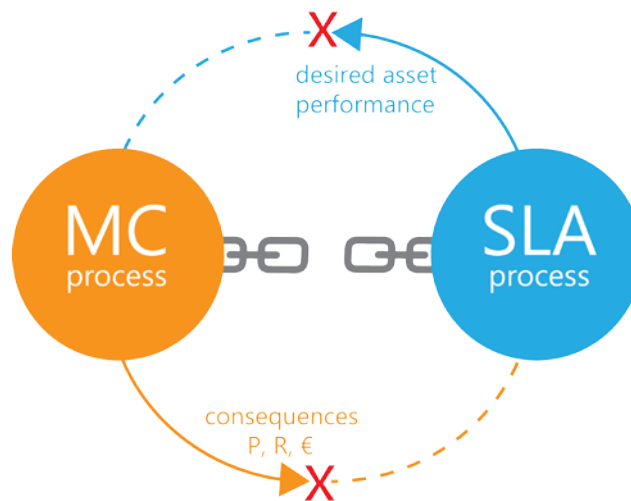
The internal Service Level Agreement regarding the aircraft stands is the result of an annually interaction between Process Management Airside (PMA, a sub department of Airport Operations) and the Asset Management department (ASM) (Schiphol Nederland B.V., 2014, p. 2). PMA has certain demands concerning the aircraft stands in order to run their operations and fulfil the airlines' needs. ASM has to come up with solutions to meet PMA's demands. These solutions can be asset as well as non-asset solutions, of which the latter is the responsibility of P&P. Technical expertise for the asset solutions is brought into the process by the ASM sub-department Technical Expert Center (TC), while Maintenance & Operations (M&O), another ASM sub-department, provides information on the financial consequences of the possible solutions (Person C). As described in the section on the tactical plan process, agreements between user and owner are made when the assets are taken into operation. In this case performance agreements are made to ensure the required performance is met, as agreed upon in the SLA between PMA and ASM. In the process of making the internal performance agreements three Asset Management sub departments are involved, as depicted in Figure 6, which provides an simplified illustration of the organisation and the agreement process.



Figure 7 - Simplified organisation of AM department and agreement process at Schiphol (own ill.)

### *Integral trade-off hampered due to incomplete input*

Trade-offs between performance, risk and cost need to be made in the process of providing asset solutions and during the operational phase, to evaluate whether the current management and maintenance concepts still ensure the desired asset performance and whether this is according to the appropriate costs and risks. The Technical Expert Center is responsible for the development of the maintenance concepts, however these are currently not completely available for all assets. Person D indicates "We do have maintenance concepts, and trade-offs are made implicitly, but none of this secured". Person D states that there is currently no clear process for the development of the maintenance concepts. According to Person F there is no link between the process of developing maintenance concepts and the process of making performance agreements, which hampers making integral trade-offs, as illustrated in Figure 7. As a result of this missing link between the two processes, each process misses input. TC doesn't know the asset performance which is desired by the client i.e. the performance which needs to be ensured through the maintenance concepts. In the SLA process it's not possible to establish all the consequences that a client's changed demand will have on maintenance in terms of asset performance, risks and maintenance cost. Consequently it is not possible to make integral trade-offs.



*Figure 8 - Trade-off not possible due to missing link (own ill.)*

Besides missing input concerning the desired asset performance, TC also misses input on actual asset performance. M&O is responsible for reporting on asset performance to TC and P&P, but is currently not able to do so due to missing data. P&P therefore does not know whether they live up to the agreements with its client. Moreover not knowing the current asset performance makes it impossible to make a complete trade-off on performance, risk and cost.

P&P's problem is that the airlines' demands, communicated through the Airport Operations department, are often not functionally specified, but specific demands. This is partly due to negotiations in the past, when the airlines were used to getting what they asked for (Person C). This indicates that the Airport Operations department does not challenge the client's demands properly, which is illustrated by Person C with the following example: "The Process Management Airside department should challenge the demands of the airlines to their abilities (it is not possible to challenge them on e.g. technical aspects because they do not possess that knowledge). This is however not always done properly, for example quite recently with LVNL (Air Traffic Control the Netherlands). LVNL is struggling with a ground capacity problem which they addressed to PMA. Agreeing on the urgency of the problem, they together worked on a plan with a number

of asset as well as non-asset solutions, without involvement from P&P. The plan contains inter alia an extra entry to one of Schiphol's runways, to improve aircraft flow. P&P has its doubts whether this is the best solution to LVNL's problems, but nevertheless the project is transferred to Schiphol's development department. Not long after, PMA tells P&P that LVNL has changed its priorities; the new priority was an extra exit on another runway. A better challenge of PMA at the start could have prevented problems resulting from a shift in priorities (author's note: think for example of cost overruns and delays due to a scope change). PMA should place not make plans with asset and non-asset solutions, since this is the job of the ASM department". This anecdote also illustrates another problem indicated by Person C: airlines just put in demands, but do not always know what they really need. The problem with specific instead of functional demands is that the Asset Management department is not able to search for optimal solutions through integral trade-offs, as aspects of the trade-off are fixed instead of open for discussion. This limits the number of opportunities for the Asset Management department to contribute to the department's as well as the company's targets.

#### *Collaboration between the ASM sub departments*

While the various sub-departments of ASM should work together to achieve department (and in the end company) targets, they are often focussed on their own processes and targets. The internal SLA concerning the aircraft stands was supposed to be renewed before 2016, but currently the old SLA for 2015 is still in use. One of the reasons why the SLA has not been renewed is that P&P has been busy with other projects. Even though they acknowledge the necessity for a new SLA for developing a process in which this internal SLA needs to be made, no progress has been made due to the fact that they are too busy with these other projects (Person C). This focus on achieving other targets also affects the communication between the sub-departments. Person C argues that due to the focus on the vast amount of ongoing projects, improving interdepartmental interactions does not get the attention it deserves. An example of lacking interdepartmental communication concerns one of TC's new ideas on how to design their maintenance. TC has the ambition to incorporate differentiation in their maintenance concepts to provide different price options to the airlines, according to the level of agreed availability of assets on an aircraft stand (Person A & D). This concept however has not been communicated to P&P, which feels slightly indignant because TC's plan of using differentiation has to be incorporated in the yet to be developed process of making the SLA (Person C). When asked if and when TC was planning on involving P&P Person D responded: *"We should first get our own things sorted out, we are still in an early phase and don't know yet how the differentiation will take shape"*. Lacking interdepartmental communication may thus lead to inefficiencies, although this is not always realised by the involved actors.

In spite of the fact that the roles and responsibilities of the different ASM sub-departments are documented, e.g. in *"Blueprint Asset Management"*, including RACI charts, there are some doubts about the roles and responsibilities and the accompanying processes. P&P is formally the single point of contact for the client. According to Person C it is however not forbidden for M&O's asset managers to talk directly to the client in case of asset related questions, while these asset managers think every form of client contact should go through P&P. Person C also indicates that opinions are divided concerning the collection of information from the different disciplines of TC. P&P would like to see this collection of technical input organised within TC to provide an integral answer to P&P. P&P thinks that the different disciplines of TC don't cooperate and only focus on their own expertise. Person F however has a different opinion on this topic: this person feels that other departments just ask TC anything (even some things these departments should be able to answer themselves) and expect TC to be able to provide an answer, even when the question does not cover their expertise. Another example concerning the lack of clarity

about responsibilities is provided by Person B, to whom it's not clear who is responsible for challenging TC's maintenance concepts. Person A feels the confusion about on roles and responsibilities between what's on paper and reality is due to the top-down way Schiphol is organized. Management may think the roles and responsibilities are documented and clear to the organisation, but they lack knowledge about how processes are executed.

Furthermore it seems that the processes which take place in the sub departments are not always clear to the rest of the organisation. To illustrate this some examples are provided which indicate a lack of insight in challenge processes executed by other sub departments. Person C mentions its doubts about PMA challenging the demands of the airlines, while Person D feels TC is not always involved in the challenge processes of P&P. Person B doubts whether the multiannual maintenance programs of TC as well as the main contractors' input for these programs are challenged at all. This uncertainty may lead to extra work, as indicated by Person E: *"The first thing I do when I receive a work request is check the entire document. Have they taken everything into account?"*

#### *Use of internal performance agreements*

As mentioned before P&P has not updated the SLA for 2016 and therefore the 2015 version is still in use. Although M&O cannot provide complete data, Person C indicates that they do inform P&P weekly on issues which have occurred, to warn them for possible complaints of the client. Person C acknowledges a possible risk: *"This way of informing indicates we are not measuring and managing on the KPIs which are mentioned in the SLA, but on intuition"*. Hence this way of monitoring does not clearly indicate whether P&P is living up to the agreements concerning reliability and availability of the assets. Despite the occurred problems, the agreements may still be met. Person C continues: *"It's important to be cautious and not act on emotions"*.

#### **4.10 Concluding: main findings case Amsterdam Airport Schiphol**

Amsterdam Airport Schiphol is confronted with sustained growth in passenger numbers and flight movements, which results in a necessity to increase the airport's capacity. To achieve their ambition of becoming and staying Europe's Preferred Airport they also need to become more competitive by delivering quality requested by the client for a more competitive price. These objectives are to be realised by Schiphol's Asset Management department.

The Asset Management department is organised based on processes and divided into a number a sub departments. Three Asset Management sub departments are involved in the process of making internal performance agreements: Planning & Portfolio Management, Maintenance & Operations and Technical Expert Center. These sub departments have different roles and responsibilities, according to corresponding processes. This creates a tension of having different perspectives, while a common perspective has to be found in the process of making internal performance agreements and integral trade-offs. A hypothetical example: P&P desires maintenance works to be executed one hour every week outside of peak hours because this would be most beneficial in terms of operational availability, M&O wants to do all maintenance in one week straight because this would be cost efficient, while TC prefers half a day every month because this fits the long-term asset strategy best. The internal performance agreements concerning the aircraft stands are stated in an internal Service Level Agreement. This document describes the required availability and reliability of the aircraft stands' assets, in terms of acceptable deviations from the maintenance included in the capacity planning.

Schiphol wants to make decisions integrally and based on a trade-off between performance, risk and cost. Currently this integral trade-off is hampered by inter alia incomplete input and issues concerning the collaboration of the Asset Management sub departments. The processes for making the internal performance agreements and the maintenance concepts, by which the agreed performance should be ensured, are however not clear to the people involved and not linked to each other, which leads to missing input for making integral trade-offs. The agreed performance is also not adequately measured. A strong focus on own perspectives and insufficient insight in each other's processes are issues which further hamper the department in making internal performance agreements and integral trade-offs.

## 5. CASE STUDY: PORT AUTHORITY ROTTERDAM

### 5.1 Context

The Port of Rotterdam is Europe’s largest sea port, which is managed, operated and developed together with Rotterdam’s industrial area by the Port Authority Rotterdam. The Port Authority is responsible for ensuring a safe and smooth handling of all shipping (Port Authority Rotterdam, n.d.-a). Its ambition is to further develop the port of Rotterdam as a European world-class port and to maintain and enhance this position in the future (Jurgens, 2014, p. 3). To achieve this ambition, the Port Authority invests in the development of the existing port area as well as in new port sites, in public (e.g. roads) and customer-specific (e.g. quay walls) infrastructure and in effective handling of shipping (e.g. emergency control and a traffic management system). The key revenues streams which support these developments consist of rental income and port dues. The first stream of revenues comes from storage and transshipment companies and (petro)chemical industries, which rent port sites from the Port Authority. Ships that make use of the port are obliged to pay port dues (Port Authority Rotterdam, n.d.-a). While there is a decrease in the volume of some goods, the total volume of goods shipped and handled at the port grows every year (Port Authority Rotterdam, 2016). To accommodate this growth, a huge expansion, the *Maasvlakte II*, has been developed in the recent years.

The organisational structure of the Port of Rotterdam Authority consists of various departments which fulfil a unique role in the organisation. The department of Infrastructure & Maritime Affairs is responsible for developing and maintaining Rotterdam’s port and industrial area. The department, which is headed by the Chief Operating Officer (COO), is divided into three subsections: Port Development, Asset Management and Environmental Management. The Port Authority has two commercial departments: Containers, Break Bulk & Logistics and Process Industry & Bulk Goods. These departments are responsible for retaining, finding and identifying customers. Furthermore there is the Finance & Information Management department, which is responsible for finance and funding, information management, risk management and decision-making concerning investments. A special department is the Harbour Master’s Division, which performs public duties assigned by the government or Rotterdam’s or neighbouring municipality (Port Authority Rotterdam, n.d.-b). The organisational chart in Figure 6 depicts the organisational structure at the Port of Rotterdam Authority.

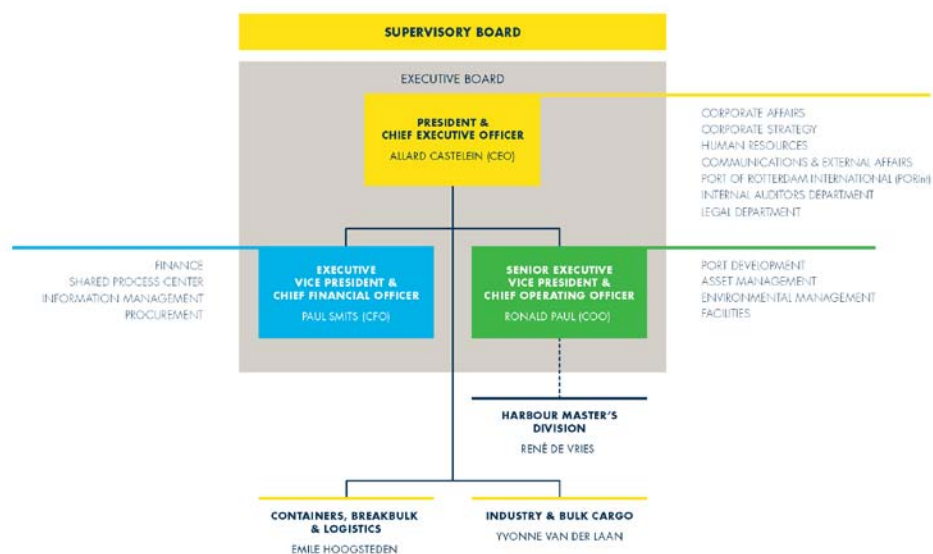


Figure 9 - Organisational chart Port of Rotterdam Authority (Port Authority Rotterdam, n.d.-b)

## 5.2 Asset management

Future developments influence asset management at the Port of Rotterdam Authority. The Asset Management department (Jurgens, 2014, p. 3) argues that the requirements of the physical assets will increase as a result of an increase in transhipments and traffic movements. Intensified use and aging of the port's assets demands increased management and maintenance of the port's asset base. In addition, existing assets will be expanded and new assets will be developed and constructed.

The Port Authority acknowledges that asset management involves striving for an optimum between performance, risks and costs. In its asset management approach the Port Authority aims at two objectives. First, the approach is aimed at decreasing the life cycle costs of physical assets. The decrease of life cycle costs is however limited by performance and risks: the required performance should be achieved at an acceptable risk level. met and the risks need to remain acceptable. Second, the approach aims at setting up a decision making process concerning asset management activities which provides insight for the Managing Board into the long-term consequences of decisions (Jurgens, 2014, p. 3).

The Port Authority is organised by a standard asset management distribution of roles: Asset Owner, Asset Manager, Service Provider. The Port Authority indicates this creates a healthy tension in the business operations. Actors and responsibilities are assigned to each of the three roles (Jurgens, 2014, p. 5).

- The Asset Owner is responsible for determining the asset management policy, strategy and goals. Agreements with clients and other stakeholders serve as a base for defining the asset management goals, which are expressed in asset performance, costs and accepted risks. The role of Asset Owner is assigned to the COO, who is supported and advised by the Assistant Asset Owner. The overall decision making authority lies with the Managing Board.
- The Asset Manager translates the goals set by the Asset Owner into implementation plans for the Service Provider. This translation is executed through structured processes in which risks are taken into account according to the Port Authority's risk management process. The plans need to be approved by the Asset Owner. Making sure that the execution of the implementation plans by the Service Provider takes place at a competitive price is also a responsibility of the Asset Manager. The role of Asset Manager is assigned to the Asset Management department for the management phase of infrastructure, while Port Development takes on this role in the phases of development, construction and demolition.
- The Service Provider is responsible for an effective, efficient and safe execution of the plans made by the Asset Manager. The role of Service Provider is assigned to external actors, who are controlled by various departments of the Port Authority. For maintenance works the controlling role is assigned to Asset Management, whereas for construction works it is Port Development who takes on this role.

## 5.3 Relation policy, strategy, goals & plans

The policy regarding asset management at the Port Authority, which is laid down in the document 'Asset Management Policy and Strategy', is interconnected to other policy of the Port Authority. The policies interact with each other and information from one policy serves as input for other policies and vice versa (Jurgens, 2014, pp. 8-9).

The asset management system implemented at the Port Authority is based on PAS 55, an international standard for asset management (nowadays replaced by ISO 55000). This standard advocates a line of sight between asset management policy, strategy, goals and plans. Policy and strategy, which are

combined at the Port Authority, give direction to the asset management process and system. Organisation, scope, (strategic) principles and overarching goals are included in the policy and strategy. As mentioned above, the asset management policy and strategy are translated into concrete asset management goals per asset in terms of performance, risks and costs. A further translation from these goals into plans results in activities belonging to the various life cycle phases. To ensure that policy is executed in the field and activities can, in their turn, be traced back to policy, the various levels are interconnected. There is a top-down translation to the execution level and a bottom-up feedback loop to policy, in which all intermediate levels are included (Jurgens, 2014, p. 9). The relations between the different asset management levels is depicted in Figure 7.

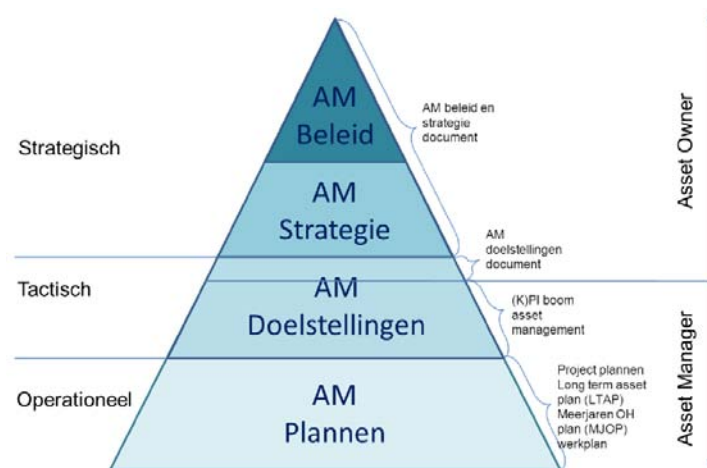


Figure 10 - 'Line of sight' (Jurgens, 2014, p. 10)

The documents 'Asset Management Policy & Strategy' and 'Asset Management Goals' are regarded as the 'formal' agreement between Asset Owner and Asset Manager, who meet every quartile to discuss progress on all relevant aspects (Jurgens, 2014, p. 20).

#### 5.4 Integral approach in decision making

The Port Authority assesses investment initiatives by means of portfolio management, which means that the initiatives are not only compared financial aspects, but also on e.g. sustainability and contribution to the Port Authority's goals. The Port Authority has the ambition to make a wider use of this approach so all asset management activities can be assessed in this integral manner (Jurgens, 2014, p. 13).

The asset management activities are focussed on achieving all asset management goals. A trade-off needs to be made between the agreed or desired performance of the assets, the risks that are acceptable to the Port Authority and the involved costs (Jurgens, 2014, p. 9).

#### 5.5 Assets management department

The asset base of the Port Authority is divided into six categories, which are subdivided into asset types. The main asset categories are:

- Asset Management Constructions
- Asset Management Infrastructures
- Asset Management Data Management
- Asset Management Ports & Fairways
- Facilities Equipment
- Facilities Systems & Real Estate

The organisational structure of the Asset Management department is based on these categories; a sub department has been created for each asset category. In the case selection section of the research methodology it was already stated that the focus of this research is on quay walls, the waterbed and land infrastructure, which pertains to the sub departments Constructions, Ports & Fairways and Infrastructures. The internal performance agreements regarding these and all other physical assets are laid down in the asset management goals.

**5.6 Asset management goals**

The 'Asset Management Goals' document lists the goals for each asset type, expressed in performance, risk and cost. These goals are established once a year and approved by the Chief Operating Officer (COO). Each quartile the progress is discussed between Asset Owner and Asset Manager and a progress update is provided to the COO. The asset types which are part of this research have their performance-related goal stated as a percentage 'technical availability' or 'availability upon request'. The cost-related goal states that the cost should remain within budget, with a five percent tolerance. Concerning risk there are three goals: '100% risk analyses complete', 'cost effectiveness'<sup>4</sup> and 'risk appetite'<sup>5</sup>. The risk analyses are based on the asset management company value risk matrix (Jurgens, 2016).

**5.7 Process of making internal performance agreements and integral trade-off**

The internal performance agreements at the Port Authority are the result of an annual interaction process between Asset Owner<sup>6</sup> and Asset Manager, in which the asset management goals in terms of performance, risks and costs are determined (Person Z). The asset management goals are derived from the company goals (Person W). Starting point for the Asset Owner, who is in the end responsible for determining the goals, is the current performance, measured by a set of performance indicators. An assessment is done to establish whether the agreed performance is actually achieved and whether the performance indicators are indeed the aspects which should be measured. Subsequently the Asset Owner sits down with the Asset Manager. The asset management goals are determined per asset category. Therefore the Asset Owner talks to each head of the various sub departments, which are responsible for the Asset Manager role in the agreement making process. The goals are derived from the company goals Person Z: "We ask ourselves questions like: what can we improve, should we set tighter norms, can we think of better performance indicators? There is an internal drive to enhance the attractiveness of the port."

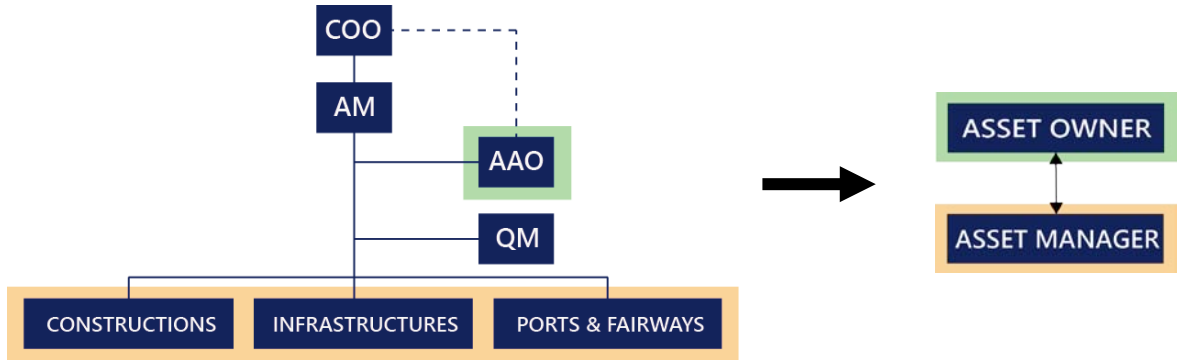


Figure 11 - Simplified organisation AM department and agreement process at Port Authority (own ill.)

<sup>4</sup> Cost effectiveness' is defined as that no mitigation activity may be more expensive than the reduction in risk as effect of this activity.

<sup>5</sup> 'Risk appetite': no risk is in the red and black parts of the company values matrix.

<sup>6</sup> While the COO is the statutory Asset Owner, the Assistant Asset Owner is involved in the agreement process

While the *'Asset Management Policy & Strategy'* indicates that the asset management plans are derived from the goals, the interviews do not support this. Person X states that the goals are suggested by the sub departments itself and then discussed with the Asset Owner. He adds: *"It's predetermined how we are going to achieve the goals. We do not propose goals which we cannot achieve. There may be certain ambitions, but if it's not possible, I won't put it forward"*. This may give the impression that only easily achievable goals are considered, but Person Z as well as Person W indicate it is about striking a balance between *challenging* and *feasible* in determining the goals. The goals need to be challenging to provide an incentive for the Asset Manager to enhance performance. Striking a balance between these aspects is however not easy. Person Z recognizes the balance may be off in some situations, but then again the organisation may learn from these failures. Therefore it is important to have an open dialogue between the Asset Owner and Asset Manager. The fact that this may elicit strategic behaviour of the Asset Manager is inherent to the process, according to Person Z.

#### *Determining goals and performance indicators*

Determining asset management goals is not a straightforward process for all asset types. Maintenance management reasons from primary functions of assets. The question is how one should express these primary functions in terms of performance. Embankments for instance are assets for which the Port Authority has not yet established a performance indicator (Person Z; Jurgens, 2016, p. 13). For quay walls the Port Authority has set a performance indicator *'availability upon request'*, which is an ambiguous indicator. *"We have a quay wall of one thousand meters long, at which two four hundred meters long ships can moor. Is it just to say that the quay wall is available in its entirety when maintenance works are executed on the remaining two hundred meter? There is no consensus on this topic."*, according to Person Z. Besides the fact that the indicator is ambiguous, it is also measured improperly. Person W explains: *"We are not going to check if every ship that needs to dock in our port is actually able to do so. We practice 'management by exception': we determine the achieved availability by measuring the alerts we receive of ships not able to moor."*

The difficulty in establishing valuable performance indicators is also encountered in the department of Ports & Fairways. The performance of the waterbed is measured by the percentage of the area that is in compliance with the *dredging atlas*. The *dredging atlas* states the depth contracted by the clients, also known as the nautical guaranteed depth. Historically the area which is not in compliance with the nautical guaranteed depth is about eleven percent. It is however not a problem when these areas are located in the inside and outside bend of the rivers or canals. The real problem is that a percentage of the total area does not indicate where the inconsistencies with the dredging atlas are located. The total percentage is an aggregation of the percentages of all individual regions in the port. If the non-compliant areas are in the bends of a river or canal it's not a problem, but if these are located at e.g. the berths, the Port Authority will instantly receive a financial claim by the client (Person Z & Y). The problem concerning the performance indicator is acknowledged by Person Z: *"The current norm is maybe not the best option. It is currently the subject of debate in our organisation. The current indicator provides us with a general idea how we are performing, but not whether our actions lead to client satisfaction."* Due to its ambiguity the performance indicator is not used as a steering tool inside the Port & Fairways sub department. They use area maps which reflect which parts are in compliance with the dredging atlas. Yellow areas indicate that the depth is in the maintenance buffer, red areas indicate non-compliance with the atlas. This way the department can clearly see where the non-compliant areas are located and which areas are on the edge of becoming non-compliant. The performance indicator does fulfil a function, according to Person Y: *"The area maps are used as our steering tool, not the norm set in the performance indicator. However the*

*performance indicator may provide an explanation why certain activities have been undertaken (i.e. to comply with the norm) for our managing board.*" One of the possible solutions is to differentiate between the areas where it is crucial that the depth is in accordance with the atlas and areas where it is of lesser importance.

#### *Integral performance, risk, cost trade-off*

The Port Authority Rotterdam once started as a municipal service, where money was not abundant but certainly not a problem (Person Z). According to Person Z, it is in an asset manager's nature to take good care of his assets, striving for technical perfection and keeping them clean and tidy. However, this is not how it works nowadays. Money is a bigger issue now than in the past and asset managers have to change their way of thinking. Instead of doing what is best for a single asset, asset managers have to align their actions with what is best for the organisation and what is demanded by the client. Therefore making integral trade-offs across assets is getting increasingly important for organisations.

While the Port Authority strives for making integral trade-offs, it recognizes that it is not yet possible to make these trade-off integrally for all asset types (Jurgens, 2014, p. 14). According to Person Z trade-offs are currently often made on intuition and experience instead of based on data. Person Y, W and X feel that the Asset Owner and the Port Authority's managing board do not make decisions based on a balanced trade-off, but primarily based on cost. Person W argues that the management board is reluctant to accept more risk as a consequence of their budget cuts. Person Y feels the trade-off is not well-balanced and focuses on short-term financial gains: *"Delaying maintenance works saves money this month, but it is accompanied by unwanted high risk levels. In the end you still need to do maintenance, which may even be more expensive due to the extra capacity you need to do such quantities at once instead of evenly spread over time in the case of preventive maintenance"*. The trade-off process is currently not executed correctly according to Person X, who states that the Asset Owner's involvement is lacking: *"There are no questions asked about which performance may be lowered or which higher risks may be accepted. It is simply: we need to cut costs"*.

Although they feel the trade-off is not sufficiently made, Person X and P have a clear image on how they should cut cost. Person W indicates that it is not possible to do all maintenance works within the assigned budget. Therefore it is necessary to take an integral view on all assets and look for the activities which have the least value for the organization. By using the company values matrix this value can be expressed in monetary terms. In combination with the organisation's risk prioritisation, decisions can be made on where to cut cost.

The difference in degradation processes between asset types induces the focus on short terms consequences in the trade-off process. When maintenance works concerning dredging are not executed, the effects will show in three weeks. If extra money is required for the continuity of the operation, this money is provided by the organisation. Constructions like the quays however have long-term degradation processes and the effects of cancelling maintenance will only be noticeable after a much longer period. Therefore these assets will not have extra budget assigned if the maintenance works exceed budget (Person W & Y).

The Port Authority acknowledges that it is not yet possible to make this trade-off integrally for all asset types. Therefore it has set up a list of improvements to make this trade-off possible (Jurgens, 2014, p. 14). The Port Authority also developed a visual tool, called *'PortMaps'*, which supports making asset management decisions. This tool combines geographical data with asset data. Through a multi criteria

analysis, performed by the various Asset Management sub departments, each asset has a business value assigned to it. By multiplying an asset's business value with a value according to its risk prioritisation, the criticality value of an asset can be determined. The assets are prioritised according to these criticality values. This way different asset types are made comparable to each other, which helps in integral decision making (Person Z).

Through the combination of geographical and asset data in a visual tool, new insights are generated. Person Z provides an example concerning maintenance works: *"Let's take a Π-shaped quay, in which a relatively short quay wall connects the two larger, parallel quay walls. The waterbed surrounding these quays is deemed important, as it needs to be deep enough to facilitate large ships which make use of the large quays. However, because of its limited length, no large ships will moor at the short quay wall. This provides opportunities to differentiate in maintenance and decrease maintenance costs. The water bed adjacent to this quay wall doesn't need to be at the same depth as the water bed adjacent to the other quays and the fairways, because it doesn't facilitate large ships"*. Person V recognises the value of *PortMaps* as it stimulates thinking in chains of assets instead of individual assets, an aspect which Person A is trying to improve in the Asset Management organisation. Person V feels the new insights *PortMaps* generates stimulate interdepartmental consultations. Person Z concludes that *PortMaps*, though in use, is not an end product and needs further developments, however he feels that the discussions it induces are sometimes more important than the results.

#### *Involvement actors in trade-off process*

Both Person Z and X feel that the trade-off between performance, risk and cost is not something you want to propose to the client. They argue that a client will always ask for 'golden taps', i.e. the maximum. Person Z prefers an internal discussion between the Asset Management department and the commercial departments. The commercial departments have business managers and account managers, who are in close contact with the clients and therefore know what the key demands of the clients are. If the Asset Management department knows which performance it can deliver at which cost, they can propose various options to the commercial departments and discuss these options. The commercial departments are not responsible for integral decision-making and will therefore tend to choose the option which is best for the client instead of which is best for the organisation. To enable a fruitful discussion, Person Z feels the Asset Management department should make their commercial colleagues more aware of the trade-off between performance, risks and costs. The head of the asset management department has recently been in contact with the commercial directors to discuss the consequences of the budget cuts, as cancelling activities will directly influence clients. This creates awareness with the commercial department about the trade-off, which is a step forward in the process toward making integral trade-offs. Person W adds that the awareness is further increased due to the fact that the budget cuts are already affecting the clients, which have reported this to the Port Authority.

Even though the awareness may increase, it is hard for the commercial departments to not reason from the viewpoint of the clients and focus on performance. In the end the one who has an integral viewpoint should take the decisions on trade-offs, which is the CEO (Person Z). However the Asset Owner role is currently assigned to the COO. According to Person Z this is not correct, as the COO does not have the commercial interest clear in mind. The Asset Management department has a supporting role in the decision making process, providing advice to the decision maker by means of substantiated propositions.

Person Z feels it is the responsibility of the Assistant Asset Owner to involve the other stakeholders in the integral trade-off process. In the first place the Asset Management department should have consensus on

the prioritisation of assets, based on their criticality. Subsequently the commercial departments and the Harbour Master have to be consulted on the proposals of the Asset Management department. Hence this process has to be approached from an asset perspective, according to Person Z. The alternative is an approach from a user point of view. Person Z has had bad experiences with the latter approach, as each commercial manager thinks his particular market (e.g. containers, bulk, etc.) is the most important.

Person Z would also like to see more input from stakeholders in the process of setting the asset management goals, to improve attunement with the other departments. Such a process does however require maturity of the organisation in terms of having complete data and knowing the need for information, Person Z argues. These are important conditions for making trade-offs, as incomplete information influences balancing the trade-off. This shows for example in the increase in maintenance cost for dredging at the *Botlek*. To increase accessibility to the port, an underwater dam which supported the natural flow of the river was demolished. As a consequence of lacking sedimentation studies, the increase in sediment was underestimated, leading to a more than expected increase in dredging cost. In subsequent projects sedimentation studies were executed, leading to a more complete input which supports making better trade-offs (Person Y). In the '*Asset Management Policy & Strategy*' document a list of improvements is provided which are foremost focussed on improving available data and knowledge on the port's assets (Jurgens, 2014, p. 14).

To achieve the asset management goals, the sub departments make asset management plans. These plans contain activities which contribute to achieving the targets. For each asset a risk analysis is conducted, in which risks and possible mitigations are identified. If the monetary value of the mitigated risk is higher than the cost of the mitigation action, it is worth undertaking. When all risks are identified, a set of measures is composed which feeds into the asset management plan. This is not only the result of trade-offs, but also influenced by e.g. regulations and agreements which have to be fulfilled. Currently the asset management plans are strictly the end product and do not contain reasoning behind the set of measures. Person Z feels it would be valuable if the underlying considerations were also included in the future plans. Person Z recommends discussions concerning cost with the financial department and the management board: if you can provide them with several options, the decision makers become part of your dilemma.

Next to involving other departments, there is also a lot to gain in the Asset Management department itself. Due to the diversity of asset types they are responsible for, the Asset Management department strives for uniformity in its processes. This is partly because of the ISO certification and despite the differences between the sub departments. An internal quality organisation has been implemented to achieve and preserve this uniformity. Part of this organisation is the quality team or '*QA-team*', which is composed of a fulltime Quality Manager and one decentralised manager in each of the sub departments. The quality organisation also involves a number of task forces, which are more focussed on specialist expertise like risk management or maintenance management. The *QA-team* coordinates the activities that result from the task forces and adjust the asset management processes if necessary (Person V). Person V indicates it is not easy to achieve uniformity in processes along the sub departments: "*Due to the variety of assets it's quite hard. The process of maintaining the waterbed is all-in-all quite different from that of maintaining a quay wall. As a result the process model that we implemented ten years ago has diverged significantly in the various sub departments*".

The Port Authority has acquired a process model, '*Value Driven Maintenance XL*', and has implemented it in the Asset Management department after making some adjustments to make it suitable for the organisation. Person V: "*Every sub department works on its own assets, but it's the responsibility of the*

Quality Manager to ensure uniformity in processes. Furthermore he has to ensure sharing of knowledge between sub departments so they can learn from each other and to prevent each sub departments from individually re-inventing the wheel". The process model includes a control panel which indicates the KPI scores of the various processes along with the explanation of these scores. This makes it possible to compare between sub departments based on these scores, which may lead to internal benchmarks and interactions between sub departments to learn why they perform better or worse compared to other sub departments (Person V). Person V deems it important to get rid of the silos in the organisation and feels this will lead to improved efficiency at the Asset Management department, which may offer a solution to cope with the recent budget cuts.

The implementation of roles and tooling in the organisation is however not enough, as Person V argues: "Before I got my current position, I was away for seven years. Since the moment I left we obtained PAS certification and uniform processes were implemented throughout the Asset Management department, but when I came back I noticed few had actually changed: the sub department still formed silos in the organisation". The recent appointed head of the Asset Management department has made it one of her focal point to stimulate the sharing of knowledge between the sub departments. "It's a big cultural challenge for the organisation, but it definitely helps if management supports it. Having support is a prerequisite for successfully breaking down the organisational silos", thus Person V.

#### *Short term demands versus long term asset requirements*

The Port Authority does not only look to the current demand of their clients, but also to the future in developing their infrastructure. This principle is illustrated by the construction of a new quay. Person W indicates that they design their quays not only on the client demands, but also on the developments in the shipping industry. Ships are getting bigger and bigger each year, demanding more from the quays at which they moor. To respond to this development, quay walls are constructed deeper than initially needed. This extra depth can be utilized by dredging to deeper levels to facilitate ships with a larger gauge. This approach has worked out well at for instance the 'Euromax' terminal, although not in the way they planned. It was expected that ships would increase in gauge, but instead ships became broader. This demanded bigger cranes, which could be supported by the quays because of the higher negative moment due to the deeper quay walls.

## **5.8 Concluding: main findings case Port Authority Rotterdam**

The total volume of goods shipped and handled at the Port of Rotterdam increases every year, although there is a decline in some of these goods. To accommodate this growth, a huge expansion, the *Maasvlakte II*, has been developed in recent years, requiring an evenly huge investment.

The Port Authority Rotterdam has a classic separation of Asset Owner and Asset Manager in the organisation. The Asset Management department is organised on asset types, with each sub department being responsible for a cluster of interrelated asset types and headed by an Asset Manager. In an annual process between Asset Owner and Asset Manager the asset management goals are determined, expressed in performance (asset availability), cost (assigned budget) and risk (completeness risk analyses, cost effectiveness and risk appetite). In this process a balance between *ambitious* and *feasible* has to be struck, in order to make the performance agreements. Every quarter an update of the progress on these goals is provided and discussed between Asset Owner and Asset Manager.

The Port Authority faces a number of issues in the process of making internal performance agreements and integral trade-offs. For some asset types (e.g. the waterbed) the Port Authority has difficulties in

determining meaningful goals and performance indicators. It is the ambition of the Port Authority to make integral trade-offs, but it acknowledges that this is currently not possible for all assets. Furthermore various interviewees indicate that the trade-offs are not well-balanced at the moment and decisions are made predominantly on cost. This focus on cost is partly due to the investment in the *Maasvlakte II*.

The Port Authority has developed a visual tool to support the making of asset management decisions and integral trade-offs, called '*PortMaps*'. This tool combines geographical data with asset data and makes comparison and prioritisation of assets possible through multi-criteria analyses. This combination of data leads to new insights, which stimulates interaction between the sub departments.

The sub departments tend to act as organisational silos, which inhibits the sharing of knowledge from in the organisation. The Asset Management department has its own quality organisation, which strives for uniformity in processes throughout the department and sharing of knowledge between the sub departments. Part of this organisation is the quality team or '*QA-team*', which is composed of a fulltime Quality Manager and one decentralised manager in each of the sub departments. Next to these specific roles, also a tool is implemented to stimulate the sharing of knowledge between the sub departments. This tool is part of the process model (VDMXL) and enables comparing the execution of the processes of the sub departments and consequently enables internal benchmarking. Sharing knowledge between the sub departments is also one of the focal points of the head of the Asset Management department. Management support is crucial to break down the silos, according to one of the interviewees.

## 6. CROSS-CASE ANALYSIS

In this chapter the two cases are compared, by indicating the similarities and differences between the organisations. The theoretical framework from Chapter 2 is used to provide an explanation for these similarities and differences, if applicable. The cross-case analysis is presented in six tables, which each capture different aspects of and perspectives on the process of making internal performance agreements at Amsterdam Airport Schiphol and at the Port Authority Rotterdam. Each table is presented on a different page. For reasons of clarity the tables are individually readable, with the consequence that some statements are captured in various tables and thus displayed as comparison multiple times. Each table is presented with the title above it and a explanation directly below it. In the tables paragraph and page numbers are added to refer to passages from the case studies and literature study. The six tables concern the following topics:

1. Influence of organisational perspectives on the performance, risk, cost trade-off
2. Positive and possible negative effects as a result of the organisation of the process of making internal performance agreements, considered from agency theory and a multi actor perspective
3. Extent to which the principal can restrain the agent's behaviour
4. Positive effects and possible pitfalls of the organisational structure, considered from perverse effects of performance measurement, and applied mechanisms to prevent pitfalls
5. Positive effects and possible pitfalls of the organisational structure, considered from the perspective of knowledge sharing, and applied mechanisms to prevent pitfalls
6. Perverting effect of performance measurement concerning veiling actual performance

The first table is presented on the next page.

## 1. Influence of organisational perspectives on the performance, risk, cost trade-off

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Organisational structure</i>	Processes (§4.6)	Asset types (§5.5)
<i>Situation</i>	Strong growth, which makes an increase in capacity of Schiphol's infrastructure necessary (§4.2)	Overall growth, although decrease in some goods. Recently did a huge investment in the development of the 'Maasvlakte II' (§5.1)
<i>Consequence</i>	Pressure on the required asset performance: increasing asset performance efficiency (§4.2)	Pressure on cost: budget cuts during the past few years, no budget to perform all maintenance works (§5.7)
<i>Focus</i>	Performance aspect	Cost aspect
<i>Reflection of focus in performance agreements</i>	The internal performance agreements only contain agreements concerning performance (§4.8)	Budget and allowed deviation included in the internal performance agreements. (§5.6)
	Agreements concerning risk and cost are missing	Agreements on performance and risks are also included, which shows the ambition to make trade-offs as all aspects are included
<i>Influence on short vs. long term tension</i>	Focus on meeting the short term client demands may conflict with long term maintenance requirements to achieve asset strategy and goals	Focus on cutting costs can be accompanied by accepting unwanted high risks and may result in higher long term maintenance cost

*Table 8 – Influence of organisational perspectives on the performance, risk, cost trade-off*

Amsterdam Airport Schiphol and Port Authority Rotterdam are both faced with growth of its (air)port, although there is a decrease in some streams of goods in Rotterdam. The strong growth forces Schiphol to increase the capacity of its infrastructure, leading to a focus on asset performance. This strong focus on performance is illustrated by the fact that the other aspects from the trade-off, risk and cost, are missing from its internal performance agreements concerning the aircraft stands.

The Port Authority has recently done a huge investment in the development of the 'Maasvlakte II', which in combination with the decrease in a number of goods has led to pressure on costs, which has resulted in budget cuts in its Asset Management department. Similar to Schiphol, although to lesser extent, the researched internal performance agreements illustrate the organisation's focus as the agreement includes the available budget and allowed deviations.

At both organisations the organisational perspectives lead to a focus on one of the trade-off's aspects, which influences the tension between short and long term, although in a different way at each organisation. The focus on cost influences the tension between short and long term, as cutting cost on maintenance works now may be accompanied by unwanted high risks (as a result of non-executed maintenance) and may result in higher long term maintenance costs. Strong growth and the resulting necessity to increase infrastructure capacity at Schiphol may affect the short versus long term tension, as meeting short term client demands to accommodate and further stimulate the growth may conflict with long term maintenance requirements to achieve asset strategy and goals.

2. Positive and possible negative effects as a result of the organisation of the process of making internal performance agreements, considered from agency theory and a multi actor perspective

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Organisational structure</i>	Processes (§4.6)	Asset types (§5.5)
<i>Involved actors</i>	Agreements are made between P&P, TC and M&O (§4.9)	Agreements are made between Asset Owner and Asset Manager (§5.6)
<i>Relation actors (§2.1)</i>	Has relatively more characteristics of a network relation: multiple actors, different goals and resources, interdependent for realisation of goals	Has relatively more characteristics of a hierarchical relation: The Asset Owner is higher in the hierarchy than the Asset Manager and has decision making power
<i>Consequences regarding the making of performance agreements</i>	For performance agreements concerning one type of asset various sub departments have to be involved, resulting in an increased number of moments where information has to be transferred along these departments and increased interdepartmental interactions, i.e. a larger coordination issue  Due to the organisational structure the various sub departments have different perspectives (§4.6, p. ), while a common perspective has to be established in order to make internal performance agreements: this creates tension in the organisation regarding the asset performance which has to be achieved	For performance agreements concerning one type of asset only the Asset Owner and Asset Manager of the concerned sub department are required (§5.6)  Tension in jointly determining the asset management goals: searching for a balance between <i>ambitious</i> and <i>feasible</i> (§5.7)
<i>Positive effect</i>	The separation of responsibilities concerning the agreement process among the various sub departments, which are interdependent on each other for achieving their targets, creates checks and balances in the organisation. These checks and balances prohibit one of the perspectives becoming predominant. The joint process brings out the contrasting perspectives of the sub departments, which contributes to making better integral trade-offs because from this confrontation new insights emerge	There are only two actors involved in the process of making internal performance agreements concerning one asset type, which reduces complexity and leads to less extensive information asymmetry. The tension created by the joint process brings out contrasting views on what's required from an organisational perspective and from an individual asset's perspective and between <i>ambitious</i> and <i>feasible</i>
<i>Agency relation (§2.2)</i>	No distinctive agency relation between the actors in the governance, according to the organisational structure the actors are equal (§4.6, p. ). However in the processes there is a agency relation distinguishable with P&P as principal and TC/M&O as agent: achieving the performance which P&P agreed with its client is the responsibility of TC/M&O	Distinctive agency relation between the Asset Owner as principal and the Asset Manager as agent, whom jointly determine the asset management goals (§5.2; §5.6)
<i>Driving factor agency problem (§2.2)</i>	Goal incongruence (between P&P, TC and M&O) (§4.6)	Information asymmetry (between Asset Owner and Asset Manager)
<i>Consequences from agency theory (negative effect) (§2.2)</i>	The agent (TC/M&O) does not necessarily act in the principal's (P&P) interest due to the fact that he may strive for other goals as a result of a differing perspective	The agent (Asset Manager) may influence the balance between <i>ambitious</i> and <i>feasible</i> to his advantage as a result of the information asymmetry

Table 9 – Positive and possible negative effects as a result of the organisation of the process of making internal performance agreements, considered from agency theory and a multi actor perspective

The Asset Management departments at Amsterdam Airport Schiphol and Port Authority Rotterdam are organised differently, which creates different tensions in both organisations concerning the process of making internal performance agreements. These tensions have positive as well as possible negative effects. Schiphol's Asset Management department is organised on processes and the actors involved in the process of making internal performance agreements have a network relation. The sub departments have different perspectives, while a common perspective has to be established, which creates a tension regarding the asset performance to be achieved. The positive effect of this way of organising is that it creates checks and balances in the organisation, prohibiting one of the perspectives to become predominant. Due to the joint process of finding a common perspective the contrasting perspectives are put forward, which leads to new insights and therefore contributes to a better integral trade-off process.

The Asset Management department at the Port Authority is organised on asset types and the process of making internal performance agreements involves a hierarchical relation between Asset Owner and Asset Manager. The tension here is in the joint process between these two actors, in which a balance between *ambitious* and *feasible* is sought. This process is less complex than at Schiphol and due to the fact that only two actors are involved the information asymmetry is less extensive. The positive effect of the tension is that it contrasts views on what's best from an organisational perspective and what's best from an asset point of view, which may lead to meaningful discussions.

The way of organising at both organisations however also creates an agency relation, which may lead to negative effects. The driving factor for the agency problems is different for each organisation. At Schiphol the agency problem is predominantly the result of goal incongruence between the actors due to the different perspectives. As a result TC and M&O may not act in P&P's interest. Information asymmetry between Asset Owner and Asset Manager is the driving factor behind the agency problem at the Port Authority. The latter may use the information asymmetry to influence the balance between *feasible* and *ambitious* to his advantage.

### 3. Extent to which the principal can restrain the agent's behaviour

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Organisational structure</i>	Processes (§4.6)	Asset types (§5.5)
<i>Involved actors</i>	Agreements are made between P&P, TC and M&O (§4.9)	Agreements are made between Asset Owner and Asset Manager (§5.6)
<i>Interaction as a design principle for performance measurement (§2.3)</i>	Interaction between the departments increases support for the performance measurement system, which leads to more meaningful performance measurement	Interaction between Asset Owner and Asset Manager increases support for the performance measurement system, which leads to more meaningful performance measurement
<i>Agency relation (§2.2)</i>	No distinctive agency relation between the actors in the governance, according to the organisational structure the actors are equal (§4.6). However in the processes there is an agency relation distinguishable with P&P as principal and TC/M&O as agent. Achieving the performance which P&P agreed with its client is the responsibility of TC/M&O	Distinctive agency relation between the Asset Owner as principal and the Asset Manager as agent, whom jointly determine the asset management goals (§5.2; §5.6)
<i>Driving factor agency problem (§2.2)</i>	Goal incongruence (between P&P, TC and M&O) (§4.6)	Information asymmetry (between Asset Owner and Asset Manager)
<i>Consequences from agency theory (negative effect) (§2.2)</i>	The agent (TC/M&O) does not necessarily act in the principal's (P&P) interest due to the fact that he may strive for other goals as a result of a differing perspective	The agent (Asset Manager) may influence the balance between <i>ambitious</i> and <i>feasible</i> to his advantage as a result of the information asymmetry
<i>Aspects in performance agreements</i>	Only performance. Risk and cost are not yet included (§4.8)	Performance, risk and cost (§5.6)
<i>Control mechanisms for principal (§2.2)</i>	Limited control mechanisms included in the internal performance agreements (§4.8)	More control mechanisms (budget, acceptable risks) included in the internal performance agreements by the principal, thereby creating more limiting measures to keep the actions of the agent in his interest (§5.6)
<i>Monitoring included in the agreements</i>	Monitoring through monthly reports and meetings concerning the performance on the agreed norms. Evaluation at the end of every yearly cycle. (§4.8)	Monitoring through progress reports and meetings on the agreed norms each quartile. Evaluation at the end of every yearly cycle. (§5.3)
<i>Reality</i>	Inadequate measurement of performance specified in KPIs and norms hampers meaningful monitoring (§4.8)	Monitoring takes place in the way described in the performance agreement

Table 10 - Extent to which the principal can restrain the agent's behaviour

The internal performance agreements create an agency relation at both organisations, which may lead to the negative effect that the internal agent doesn't necessarily act in the interest of the principal. At Schiphol this behaviour is predominantly fuelled by goal incongruence between the different sub departments, while at the Port Authority information asymmetry between the Asset Owner and Asset Manager is the influential factor. The principal at the Port Authority has introduced ways of keeping the agent's action in his interest by incorporating control mechanisms in the internal performance agreement and performing monitoring conform to the agreement. At Schiphol only limited control mechanisms are included as risk and cost are not included. Furthermore inadequate measurement of performance hampers meaningful monitoring. Therefore the principal has less means to keep the agent's actions in his interest. As a result Schiphol faces a larger risk of M&O and TC not acting in P&P's interest than the risk of the Asset Manager influencing the balance to his advantage at the Port Authority.

4. Positive effects and possible pitfalls of the organisational structure, considered from perverse effects of performance measurement, and applied mechanisms to prevent pitfalls

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Organisational structure</i>	Processes (§4.6)	Asset types (§5.5)
<i>Consequences regarding the making of performance agreements</i>	Due to the organisational structure the various sub departments have different perspectives (§4.6), while a common perspective has to be established in order to make internal performance agreements: this creates tension in the organisation regarding the asset performance which has to be achieved	Integral trade-offs require the involvement of the various sub departments
<i>Positive effect</i>	The separation of responsibilities concerning the agreement process among the various sub departments, which are interdependent on each other for achieving their targets, creates checks and balances in the organisation. These checks and balances prohibit one of the perspectives becoming predominant. The joint process brings out the contrasting perspectives of the sub departments, which contributes to making better integral trade-offs because from this confrontation new insights emerge	The knowledge for making trade-offs concerning an individual asset types is concentrated in one sub department
<i>Possible perverse effects performance measurement (§2.3)</i>	Sub departments focus on their perspective and what they are judged on. This may hamper making integral trade-offs and searching for a common perspective	Sub departments focus on scoring on performance indicators and achieving their own targets, instead of continually making integral trade-offs
<i>Pitfall</i>	Actors shirk from the process of making integral trade-offs, because they are judged on other factors	Optimisations and best practices remain in the sub departments  Trade-offs are not made integrally
<i>Question</i>	How does one make the tension regarding the asset performance which has to be achieved manageable?	How does one stimulate sharing knowledge across the various sub departments?  How does one make integral trade-offs between the different asset types?
<i>Currently applied mechanisms</i>	Has not been clearly identified in the case study	A combination of specific roles, tooling and management support. An internal quality organisation, including a <i>QA-team</i> , which involves a Quality Manager and decentralized managers in each sub department, has to ensure uniformity in processes and stimulate sharing of knowledge between the sub departments. A process model (VDMXL) is used for the entire Asset Management department, which includes a tool to compare how well the sub departments execute their processes to perform internal benchmarks. Finally there is support from the management, which has sharing knowledge as one of its focal points. (§4.7)

		A visual tool, 'PortMaps', helps in making integral trade-offs by combining geographical data with asset data, leading to new insights which stimulates interaction between the sub departments. Different assets are made comparable through a multi criteria analysis, by which the assets' business value and criticality value can be determined. (§4.7)
<i>Situation</i>	Lack of process agreements makes pitfall very real	Instruments are implemented and first results are promising, but need further iterations and refinement (§4.7)

*Table 11 – Positive effects and possible pitfalls of the organisational structure, considered from perverse effects of performance measurement, and applied mechanisms to prevent pitfalls*

Schiphol and the Port Authority have organised themselves differently, resulting in different positive effects and also different pitfalls.

The organisation of Schiphol's Asset Management department has the positive effects that it creates *checks and balances* and leads to new insights by confronting different perspectives, which contributes to making better integral trade-offs (see Comparison 2 for a more extensive explanation). However their way of organising also has a pitfall as a result of the perverting effects of performance measurement: the sub departments may shirk from the process of making integral trade-offs, as they are judged on other factors. This is for instance applicable to P&P, who have not taken responsibility in renewing the Service Level Agreement of the aircraft stands for 2016, as they were busy with other projects to satisfy their internal client (§4.9). P&P is evaluated on the satisfaction of PMA (§4.6). The question Schiphol faces is how to make the tension they created by introducing different perspectives manageable? In the case study no clear answer has been found on how Schiphol tries to make this tension manageable. The lack of process agreements to manage this tension therefore makes the pitfall very real.

The Port Authority's way of organising has the advantage that the knowledge for making trade-offs concerning one type of asset is concentrated in one sub department. However making integral trade-offs is possibly hampered by the same perverting effect Schiphol may face: sub departments focussing on scoring on performance indicators instead of continually making integral trade-offs. Their way of organising has two pitfalls: optimisations remain in the sub departments and trade-offs are not made integrally. However the Port Authority has implemented two instruments to prevent these pitfalls. Through a combination of specific roles, tooling and management support they strive for uniformity in processes, comparing how the sub departments perform in these processes and sharing knowledge on these processes between the sub departments. To help making integral trade-offs between the sub departments the Port Authority has developed a visual tool, 'PortMaps', which makes different assets comparable and leads to new insights by combining geographical data with asset data. These new insights stimulate interaction between sub departments, thereby overcoming the organisational silos.

5. Positive effects and possible pitfalls of the organisational structure, considered from the perspective of knowledge sharing, and applied mechanisms to prevent pitfalls

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Organisational structure</i>	Processes (§4.6)	Asset types (§5.5)
<i>Consequences regarding the making of performance agreements</i>	<p>For performance agreements concerning one type of asset various sub departments have to be involved, resulting in an increased number of moments where information has to be transferred along these departments and increased interdepartmental interactions, i.e. a larger coordination issue</p> <p>Due to the organisational structure the various sub departments have different perspectives (§4.6, p. ), while a common perspective has to be established in order to make internal performance agreements: this creates tension in the organisation regarding the asset performance which has to be achieved</p> <p>In order to find a common perspective it is necessary to understand each other's perspective and trust each other's work. Therefore insight into other actor's processes is to some extent necessary</p>	<p>For performance agreements concerning one type of asset only the Asset Owner and Asset Manager of the concerned sub department are required (§5.6)</p> <p>The knowledge for making trade-offs concerning an individual asset types is concentrated in one sub department</p> <p>Integral trade-offs require the involvement of the various sub departments</p>
<i>Positive effect</i>	<p>The separation of responsibilities concerning the agreement process among the various sub departments, which are interdependent on each other for achieving their targets, creates checks and balances in the organisation. These checks and balances prohibit one of the perspectives becoming predominant. The joint process brings out the contrasting perspectives of the sub departments, which contributes to making better integral trade-offs because from this confrontation new insights emerge</p>	<p>Knowledge and processes concerning one asset type are concentrated in one sub department, which is advantageous for optimisations concerning that asset</p>
<i>Pitfall</i>	<p>Poor insight in each other's processes does not contribute to mutual trust and understanding each other's perspective, which hampers making performance agreements and may lead to inefficiencies</p>	<p>When the sub departments become organisational silos knowledge (inter alia concerning best practices) is not shared across the departments and optimisation opportunities remain unexploited</p>
<i>Current strategy</i>	<p>Has not been clearly identified in the case study</p>	<p>A combination of specific roles, tooling and management support. An internal quality organisation, including a <i>QA-team</i>, which involves a Quality Manager and decentralized managers in each sub department, has to ensure uniformity in processes and stimulate sharing of knowledge between the sub departments. A process model (VDMXL) is used for the entire Asset Management department, which includes a tool to compare how well the sub departments execute their processes to perform internal benchmarks. Finally there is support from the management, which has sharing knowledge</p>

<i>Situation</i>	Insight in each other's processes (and correspondingly mutual trust) is sometimes lacking (§4.9). Without a mechanism to improve this, the pitfall that it hampers the making of performance agreements becomes very real	as one of its focal points (§4.7). Room for improvement on sharing knowledge between departments, it's one of the focal points of the manager of the Asset Management department. However there are mechanisms applied to improve this (§4.7).
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*Table 12 – Positive effects and possible pitfalls of the organisational structure, considered from the perspective of knowledge sharing, and applied mechanisms to prevent pitfalls*

The organisational structure of both organisations has consequences for the making of internal performance agreements. From the perspective of the sharing of knowledge, positive effects as well as pitfalls can be identified.

Schiphol has created a tension of having different perspectives. The process of finding a common perspective brings forward the contrasting perspectives, which leads to new insights. However to achieve a common perspective, insight in each other's processes is to some extent necessary. This insight is missing on some levels, which is indicated by for instance the doubts about challenges performed by other sub departments (§4.9). The according pitfall is that poor insight hampers making performance agreements, which becomes very real due to the missing insight and the fact that there are no clear mechanisms identified that can improve this.

The Port Authority has organised its Asset Management department on asset types, which has the advantage that knowledge and processes concerning one asset are concentrated in one sub department, which provides good means to optimise in the sub department. This however may lead organisational silos, hampering the sharing of knowledge across the sub departments and thereby possibly missing process optimisations. However, through a combination of specific roles, tooling and management support sharing of knowledge between the sub departments is stimulated. A Quality Manager and decentralized managers in the sub departments need to stimulate sharing of knowledge, while a process model has been implemented with a tool to compare the processes in the sub departments and perform internal benchmarks. While the pitfall is real at the Port Authority, they are actively trying to improve the situation.

6. Perverting effect of performance measurement: veiling actual performance

	<b>Amsterdam Airport Schiphol</b>	<b>Port Authority Rotterdam</b>
<i>Perverting effect performance measurement (§2.3)</i>	Performance measurement may veil actual performance, especially when information is aggregated and therefore further distanced from the primary process	
<i>Example of where this is applicable</i>	The performance norms in the internal performance agreement are determined as accepted deviations from the maintenance planning (§4.8). The agreements therefore are not about the goal (availability of the asset system), but concern the means (maintenance)	The performance norm for the waterbed is expressed in a percentage of the total area that has to meet the agreed depth (Nautical Guaranteed Depth). This percentage is an aggregate of the percentages of all the port's regions. This percentage however doesn't indicate where inconsistencies with the NGD are located and therefore the Port Authority doesn't know if they have a problem (§4.7).
<i>Consequence</i>	Measuring the means instead of the goal may veil the actual performance of assets	Measuring performance in such a way may veil the actual performance

*Table 13 - Perverting effect of performance measurement: veiling actual performance*

Both organisations seem to struggle with a perverting effect of performance measurement: it may veil the actual performance. At the Port Authority this can clearly be identified in the norms for the waterbed. Due to the fact that the information is aggregated and expressed in a percentage, the Port Authority cannot know if they comply with the agreements when they only look at this performance indicator. At Schiphol the issue concerns the performance agreement as a whole: the means is measured instead of what Schiphol wants to achieve, the availability of the aircraft stands. This results in a ambiguous indication of the actual asset performance.

## 7. CONCLUSION

Infrastructure management organisations use internal performance agreements to define the performance its asset management departments need to achieve to meet the organisations' objectives. Preliminary research at Amsterdam Airport Schiphol indicates that there are inherent tensions in the process of making these internal performance agreements, which can have positive but also negative effects on making internal performance agreements and integral trade-offs. The first tension concerns the agreement process itself, in which actors with different perspectives need to find a common perspective. The use of performance agreements implies the use of performance measurement, which introduces the second tension, as performance measurement may have positive as well as negative effects. The third tension is related to the infrastructure sector, in which a tension arises between short term and long term, or more specifically: dynamic client demands versus the long term maintenance requirements of the infrastructure. This research aimed at providing insight in the process of making internal performance agreements at different infrastructure management organisations and at indentifying ways in which these organisations cope with the inherent tensions to make use of their positive effects and limit the negative effects. Hence the research question was:

*How do infrastructure management organisations' asset management departments cope with the inherent tensions in the process of making internal performance agreements, to support integral trade-offs on performance, risk and cost?*

A set of four sub questions was derived to answer the main research questions. The answers to the sub questions are listed below.

1. *How is the process of making internal performance agreements organised at infrastructure management organisations?*

The two researched organisations have a different way of organising the process of making internal performance agreements. This is partly due to the different organisational structure of the asset management departments.

The organisation of the Asset Management department at Amsterdam Airport Schiphol is based on processes and split into a number a sub departments. Three Asset Management sub departments are involved in the annual process of making internal performance agreements: Planning & Portfolio Management (P&P), Maintenance & Operations (M&O) and Technical Expert Center (TC). These sub departments have different roles and responsibilities, based on the processes they are responsible for. This creates a tension of having different perspectives in the Asset Management department, while a common perspective has to be found in the process of making internal performance agreements and integral trade-offs.

The Port Authority Rotterdam has a classic separation of Asset Owner and Asset Manager in the organisation. The organisational structure of the Asset Management department is based on asset types. Each sub department is responsible for a cluster of interrelated asset types and headed by an Asset Manager. In an annual process between Asset Owner and Asset Manager the asset management goals are determined. In this process a balance between *ambitious* and *feasible* has to be struck in order to make the performance agreements.

2. *Which positive and negative effects and accompanying question concerning the process of making internal performance agreements arise at infrastructure management organisations as a result of the inherent tensions?*

Due to the organisation of Schiphol's Asset Management department, the sub departments have different perspectives, while they are interdependent on each other for achieving their individual targets. This creates a tensions in the process of making internal performance agreements as a common perspective has to be established on which asset performance needs to be achieved by the department. This creates the positive effect of checks and balances in the organisation. These checks and balances prohibit one of the perspectives becoming predominant. Furthermore the joint process brings out the contrasting perspectives of the sub department. This contributes to making better integral trade-offs because from this confrontation new insights emerge. However their way of organising entails that for performance agreements concerning one type of asset, various sub departments have to be involved. This results in an increased number of moments where information has to be transferred along these departments and increased interdepartmental interactions, i.e. a larger coordination issue. While there is no distinctive agency relation between the actors in the governance, the process does involve an agency relation between the sub departments. This may lead to agency problems. As a result of goal incongruence due to the different perspectives of the sub departments, the agent (M&O/TC) does not necessarily act in the principal's (P&P) interest. Furthermore there is the tension of performance measurement, which can have positive but also perverse effects. Due to their unique perspectives, the sub departments are primarily focused on their own projects and goals. As a result, the sub departments shirk from the process of making integral trade-offs, which hampers making integral trade-offs and searching for a common perspective. Another perverse effect of performance measurement is that it may veil actual performance. The internal performance agreement which was studied for this research includes performance norms which measure the means (maintenance) instead of the actual goal (availability of the asset system). This may influence the process of making performance agreements and integral trade-offs, as they are then based on incomplete information. Last but not least there is tension between meeting short term client demands and meeting the long term asset strategy and goals. Due to strong growth in flight movements at Schiphol, increase in capacity of its infrastructure is required, which puts pressure on the required asset performance. As a result performance outweighs the other aspects in the trade-off. The focus on meeting short term client demands to accommodate the growth may conflict with the long term asset strategy and goals. The key question at Schiphol's Asset Management department is how does one make the tension of the different perspectives in the department manageable to make internal performance agreements?

The Port Authority Rotterdam introduces a tension in the joint process of determining the asset management goals between the Asset Owner and Asset Manager, because they need to balance between *ambitious* and *feasible*. This tension brings out the contrasting views of the Asset Owner and Asset Manager on what is required from an organisational perspective and from an individual asset's perspective. This confrontation leads to new insights, which contributes to making better integral trade-offs. However this process also creates an agency relation between the Asset Owner and Asset Manager. The Asset Manager (agent) may influence the balance between *ambitious* and *feasible* to his advantage as a result of the information asymmetry between him and the Asset Owner. Furthermore the use of performance measurement may have the perverse effect that the sub departments focus on scoring on performance indicators and achieving their own targets, instead of continually making integral trade-offs. Consequently there are two pitfalls at the Port Authority: optimisations and best practices remain in the

sub departments and trade-offs are not made integrally. Hence the Port Authority has to find a solution to the following questions: how to stimulate knowledge sharing across the sub departments and how to make integral trade-offs between the different asset types? Performance measurement also has the possibly perverting effect of veiling actual performance. The performance indicator for the waterbed is an example of this effect. The agreed depth of the waterbed differs per location and while at some locations (the inner and outer bends of rivers and canals) it is not a problem if this agreed depth isn't met, it is a big problem at other locations (e.g. the berths). Because the norm is an aggregate and a percentage of the total port area, the Port Authority does not know whether they have a problem or not. This may have a negative effect on making performance agreements and integral trade-offs, due to ambiguous input. The Port Authority also has to deal with a tension between short and long term. Cutting maintenance cost now may result in having to accept unwanted high risks and possibly higher long term maintenance cost. This is due to a focus on cost in the trade-off, as a result of the investment in the *Maasvlakte II* and a decrease in the volume of some types of goods.

3. *What are the similarities and differences in the positive and negative effects and questions the different organisations face and how can these be explained?*

At both organisations the organisational perspectives have an influence on the trade-off, although due to differing situations the resulting focus is on other aspects. The focus at Schiphol is on performance, as a result of the strong growth in flight movements, while at the Port Authority cost is the focus of the trade-off, due to a decrease in the volume of some types of goods and the investment in the *Maasvlakte II*. At both organisations this focus may lead to preferring short term wins to long term results.

The way the process of making internal performance agreements is organised has positive as well as possible negative effects at both organisations, which can be explained from agency theory and a multi actor perspective. The process at the Port Authority is simpler, due to the hierarchy relation and the involvement of just two actors. Schiphol has a more complex process due to the network relation and a higher number of actors involved in the process, which results in a larger coordination issue. However the implementation of different perspectives also results in checks and balances in the Asset Management department. Both organisations create a tension with the joint process of making agreements, in which different perspectives are contrasted. This leads to new insights and thus contributes to better integral trade-offs. Due to the organisation of the asset management departments, there is an agency relation at both organisations, although the driving factor for the agency problem is different (goal incongruence at Schiphol and information asymmetry at the Port Authority). The consequence, the agent not necessarily acting in the principal's interest, is similar at both organisations although it manifests itself on a different organisational level.

Besides agency problems, Schiphol and the Port Authority are also faced with the possible perverting effects of performance measurement. The first effect that performance measurement may veil actual performance is applicable to situations at both organisations. This influences making performance agreements and integral trade-offs, due to incomplete or ambiguous input. The second perverse effect is that actors may focus on performance indicators instead of continually making integral trade-offs, which may hamper integral trade-offs at both organisations and searching for a common perspective at Schiphol. However the pitfalls and subsequent questions vary due to different way of organising the asset management departments. At Schiphol, with its organisational structure based on processes and interdependent network of sub departments with different perspectives, it's about how to make the tension between the different perspectives manageable, in order to make integral trade-offs and

performance agreements. At the Port Authority the question is more focussed on how to make integral trade-offs between the different asset types and share knowledge across the sub departments. This is because to the organisational structure the sub departments are far less interdependent and may form silos in the organisation. Knowledge sharing, or rather the lack of it, is an important issue at both organisations. At the Port Authority it concerns process optimisations and best practices. At Schiphol another type of knowledge needs to be shared between the sub departments at Schiphol to establish find a common perspective. Here it is necessary for the sub departments to have (to some extent) insight in each other's processes, as they need to understand each others' perspectives and trust each others' work. Poor insight at Schiphol results in inefficiencies and hampers the making of performance agreements.

4. *Which mechanisms do the organisations' asset management departments apply to cope with the inherent tensions and how do they value these mechanisms?*

The process of making internal performance agreements requires actors with different perspectives to come to an agreement on the performance of assets. At Schiphol these different perspectives are the result of organising the Asset Management department based on processes, while at the Port Authority the different perspectives are due to the differences between Asset Owner and Asset Manager in role and hierarchy. Both organisations have created a joint process between the actors, in which the confrontation of different perspectives leads to new insights, which enables better integral trade-offs. Such a process meets the design principle of *interaction*. This helps minimising the development of perverse effects of performance measurement by increased support for the system, which enables to more meaningful performance measurement. At the Port Authority this mechanism does not always produce a well-balanced agreement, but they are aware of this issue and advocate learning by doing.

Making internal performance agreements involves an agency relation between the different parties in the agreement, which creates a tension as agency problems may arise. Both organisations try to limit the agency problem by incorporating control mechanisms in the internal performance agreements. The control mechanisms are more extensive at the Port Authority because the agreements include budget restrictions and risk. Through monitoring the principal tries to maintain the agent's actions in his interest. The design of the monitoring process is more or less the same at both organisations. They have progress updates on the agreements every month (Schiphol) or quartile (Port Authority) and an annual evaluation in after which the agreements are revised. While monitoring at the Port Authority is conducted according to the design, monitoring is not adequately executed at Schiphol, thereby losing its function.

The Asset Management sub departments at the Port Authority do not interact directly in the process of making internal performance agreements as these are made between the Asset Owner and the head of each separate sub department. The sub departments tend to act like organisational silos. To help make integral trade-offs, the Port Authority has developed a visual tool (*PortMaps*), which combines asset data with geographical data, resulting in new insights and thereby stimulating interaction between the sub departments. The value of the tool is recognised inside the organisation, as it stimulates thinking in integral trade-offs, interdepartmental interactions and discussions in the organisation. A combination of specific roles (belonging to an internal quality organisation), tooling (to compare how well sub departments execute their processes) and management support further stimulates the sharing of knowledge between sub departments.

*Ways to cope with inherent tensions in the process of making performance agreements*

The tensions in the process of making performance agreements and integral trade-offs are similar at Amsterdam Airport Schiphol and at the Port Authority Rotterdam. However, due to different ways of organising the asset management department and the process of making internal performance

agreements, the effects of these tensions differ in some situations as far as the interaction between the sub departments is concerned.

Both organisations use the positive effect of the tension of having different perspectives while a common perspective needs to be established to make the internal performance agreements. A joint process brings out the contrast of the different perspectives of the sub departments at Schiphol and of the Asset Owner and Asset Manager at the Port Authority, leading to new insights and thereby enabling better integral trade-offs. However this process also involves an agency relation with the possible negative effect that the agent does not necessarily act in the principal's interest. Both organisations attempt to limit the perverting behaviour of the agent by incorporating control mechanisms in the performance agreements and through monitoring of the performance.

Performance measurement may have the perverting effect that actors focus on achieving their own targets instead of making integral trade-offs. While this principle applies to both organisations, the effects are different due to the organisational differences. At Schiphol the agreement process requires the collaboration of three sub departments. The pitfall is that these sub departments shirk from the process of making internal performance agreements and integral trade-offs and focus on their own projects and goals. The lack of a process model makes the pitfall very real. Lacking insight in each other's processes hinders understanding each other's perspectives. While this lacking insight and collaboration is acknowledged in the organisation, no mechanism has been identified in the case study to cope with this tension.

The pitfall at the Port Authority is that the sub departments form organisational silos, which hampers making integral trade-offs. This is recognised by the organisation, which has implemented two mechanisms to cope with this tension and overcome the silos. The first mechanism is a visual tool (*PortMaps*) which combines geographical and asset information to obtain new insights, enabling better integral trade-offs and stimulating discussion between the departments. The second mechanism is a combination of specific roles (belonging to a quality organisation), tooling (to compare the execution of processes of the different sub departments) and management support to stimulate sharing of knowledge between the sub departments.

Amsterdam Airport Schiphol and the Port Authority Rotterdam implement a joint process to make use of the positive effects of the inherent tensions, while incorporating control mechanisms and monitoring to limit the negative effects. The Port Authority also applies a visual tool and a combination of roles, tooling and management support to overcome organisational silos. No coping mechanism has yet been identified at Schiphol to make the tension regarding finding a common perspective manageable.

## 8. RECOMMENDATIONS

In this chapter recommendations to Amsterdam Airport Schiphol (§8.1) and the Port Authority Rotterdam (§8.2) are provided, based on the theoretical framework and the findings from the multiple-case study.

### 8.1 Recommendations to Amsterdam Airport Schiphol

The process of making internal performance agreements at Schiphol requires collaboration between the Asset Management sub departments to find a common perspective. However, as a result of the perverting effects of performance measurement, the sub departments may focus on own perspectives and shirk from the process of making internal performance agreements and integral trade-offs. The absence of process agreements on how this process should take place and on how the sub departments should collaborate makes the pitfall very real. The interviews show that this is acknowledged by the organisation. It is mentioned that interdepartmental communication should be improved and the focus on own projects hampers renewing the internal performance agreements. This research has revealed that a coping mechanism is necessary to deal with the tension of the different perspectives and make the tension manageable.

Therefore it is recommended that Schiphol designs and implements a process model concerning the making of internal performance agreements and integral trade-offs, specifying how the sub departments should interact and collaborate. Which requirements should be met for process model to be successful? The case study at the Port Authority Rotterdam offers some input for the design and implementation of such a process model. The Port Authority stimulates the sharing of knowledge between their Asset Management sub departments with a combination of specific roles, tooling and management support. It is recommended that Schiphol implements a tool which visualises the processes of the different departments. By means of this tool process steps can be traced and deliverables of these process steps are provided. This would significantly improve insight of the sub departments in each other's processes, something which is currently lacking. Insight in each other's processes and in the deliverables of the process steps makes it easier to understand where someone else is coming from. Improved understanding of each other's perspectives will certainly help in finding a common perspective.

To ensure such a system is actually used, Schiphol is recommended to appoint a process owner, who's objective it is to ensure collaboration between the departments through this process model. Similar to the Port Authority's Quality Manager, this person should have a staff function and should not be part of one of the sub departments in which the processes are executed, to prevent the pitfall that this person may also focus on the perspective of this sub department instead of the entire Asset Management department. Similar to the Port Authority this process owner should have team members from each of the sub departments, to create support for the new process model and stimulate the use of the tool. As was indicated by the interview with Person V, only implementing a process model is not enough: management support is required. Therefore the management of Schiphol's Asset Management department is recommended to make 'improving the collaboration between the sub departments' one of its focal points.

The other mechanism used by the Port Authority, *PortMaps*, also possesses properties which could be of use in establishing a common perspective. Part of the input of *PortMaps* consists of the business value that the assets represent, which are derived from a multi criteria analysis performed by the various sub departments. While at the Port Authority these business values are used to compare between different

asset types, at Schiphol business values may be used in discussions and trade-offs concerning assets of the same asset type. Due to the fact that the organisation of the Asset Management department is process-based, multiple departments are involved in performance agreements concerning one asset. Determining the business value of these assets may be valuable in discussions on similar assets or asset systems, for example in case of the '*one hundred percent aircraft stands*'. These aircraft stands need to be available at any time, and therefore maintenance on these aircraft stands is problematic. An option would be not to plan any maintenance at these aircraft stands, but fully replace them every few years. Although this option is significantly more expensive, it might be worthwhile due to the high business value the aircraft stand represents. Business values may thus help to make trade-offs in which multiple sub departments are involved because it enables differentiation between similar assets.

Further it is recommended Schiphol deals with several issues that came up during the case study:

- Connect the process of making service level agreements to the process of developing maintenance concepts, as these processes require each other's input. In the interviews it is also acknowledged that this link should be made. This enables making better integral trade-offs (see Figure 8 on p. 29).
- Provide information in the Service Level Agreement on how the various sections are interconnected. For instance the availability norms for the aircraft stands seem to have no correlation at all with the prioritisation of the aircraft stands, whereas this correlation would be expected. The current document permits ambiguity which may hamper making integral trade-offs and renewed performance agreements.
- Comply with the process agreements that are stated in the Service Level Agreement concerning monitoring and evaluations. This will offer additional information, which enables making better integral trade-offs and performance agreements.

## **8.2 Recommendations to the Port Authority Rotterdam**

In line with the time spent on both cases in this research, the recommendations to the Port Authority are less extensive than those to Schiphol. It is recommended that the Port Authority deals with the following issues that came up during the case study:

- Various Asset Managers feel the trade-off between performance, risk and cost is not properly made by the Asset Owner. They indicate that they need to cut cost while there are no considerations about which performance may be lowered or which higher risk may be accepted. This may influence the making of the internal performance agreements, as the Asset Managers might use information asymmetry to their advantage. They might overestimate cost in the process of establishing the goals to anticipate on the budget cuts. The Asset Owner has to start making decisions on all aspects of the trade-off and communicate his considerations.
- The perverse effect of performance measurement concerning veiling actual performance is applicable on the waterbed, as is indicated in the case study. While this is acknowledged by Asset Owner and Asset Manager, the Port Authority does not have solution to this problem yet. It is recommended the Port Authority differentiates between the areas where inconsistencies with the nautical guaranteed depth lead to instant problems (in the form of fines they have to pay to the users of the Port) and areas where inconsistencies do not lead to instant problems.

## 9. DISCUSSION

This final chapter discusses the conclusions and recommendations (§9.1), the contribution to literature (§9.2) and academic research (§9.3) and the limitation of the conducted research (§9.4). It ends with a number of recommendations for further research (§9.5).

### 9.1 Discussion of conclusion and recommendations

The preliminary research and main research show that despite of the frequent use of internal performance agreements, the process of making these agreements is not an easy task due to the inherent tensions in the process. This research provides a partial explanation behind these tensions and their effects, reasoned from various theoretical concepts which are applicable to the process of making the internal performance agreements. It further provides insight in the possible implications of choosing a particular way to organise asset management departments and the process of making internal performance agreements, by making a comparison between two different approaches. As this research is explorative in nature, its value is predominantly in creating insight in how such a process is organised and which positive and possible hampering effects may result from the inherent tensions, which is in line with the predefined research objective.

While from this research it may seem that the approach of Schiphol automatically leads to more problems, this image needs to be nuanced. The Asset Management department of Schiphol recently has gone through an extensive reorganisation in which the organisational structure has changed from one based on asset types (similar to the Port Authority) to one based on processes. As a result of this recent change, it's hardly surprising that some affairs are not yet in order. With the new organisation a new game has developed in the Asset Management department and the employees still need some time to understand how this new game works and what their part in the play is.

Considering the more complex network situation at Schiphol, one would expect from a theoretical perspective that more control mechanisms would be implemented to restrain the behaviour of the agent in the principal-agent relation. The multiple-case study shows the opposite, with more restraining measures at the Port Authority. Perhaps Schiphol does have other types of mechanisms to restrain the agent's behaviour, but are these more complexly embedded in the organisation and out of the narrow scope of this research. The budgeting procedures for instance have not been researched.

Throughout the research the tension between short and long term has been mentioned several times, although no coping mechanisms have been identified for the process of making internal performance agreements (how to cope with this tension in designing new infrastructure has been discussed in the Port Authority case study). The coping mechanisms may however be already implemented by the joint process between actors with various perspectives. At Schiphol for example, P&P is more concerned with short term client demands, M&O with short term maintenance requirements and TC with long term maintenance requirements.

Moving on from the findings and conclusions to the recommendations, it's not surprising that the recommendations are greater in number and extensiveness for Schiphol. Schiphol has been researched more extensively and therefore more issues have been identified. Furthermore the process and organisation of the Asset Management department is recently implemented as stated before. This makes it less mature than the process at the Port Authority, which has evolved for a longer period of time.

Concerning the recommendations to Schiphol, it should be noted that these are not the only mechanisms possible. However, with the information gathered during this research, it's plausible to state that a combination of roles, tools and management support may help Schiphol in collaboration between the sub departments, because this approach led to positive results concerning the sharing of knowledge at the Port Authority.

Taking a step back and looking at this research from a broader perspective of infrastructure management organisations in general, the question emerges if the tensions and accompanying positive and hampering effects would be much different at other organisations. Presumably the answer to this question is in accordance with one of the conclusions of this research: in essence the tensions are the same, however due to other ways of organising asset management departments and processes of making internal performance agreements the effects may be different.

## **9.2 Contribution to literature**

In existing literature on asset management little research has been conducted on how asset management is actually executed in organisations. This research focuses on rather soft topics of asset management, on how the different actors involved in asset management interact in an organisation. Therefore this research applies theories on multi-actor systems, agency relations and performance measurement on a new field, that of asset management organisations.

## **9.3 Contribution to academic research**

Conducting this research project has not been a smooth process, as it turned out that it was hard to operationalise and map the subsequent steps which would lead to the research findings and outcome. As the purpose and scope of the research was blurry during the first half of this research, it was difficult to decide where it needed to go. In the end, with ups and downs, a solution was found how to conduct this research and therefore it may offer direction to academics who find themselves in the situation of having to execute a similar research, in which human interaction processes in different organisations have to be compared.

## **9.4 Limitations**

This research has several limitations in the way this research has been conducted, of which the most important are listed below:

- A simplified model has been used in the case study on Schiphol to limit the scope to the Asset Management department. In reality the process is even more complex, with more actors involved from other departments.
- Only two cases have been researched, in which a limited amount of people have been interviewed. This makes it impossible to generalise the outcomes.
- The people selected for the interviews at both organisations differ in rank. At Schiphol the interviews were conducted on specialist working in the various sub departments, while at the Port Authority only employees with management and staff functions were interviewed. This may have influenced the results of the research, as other problems may arise at different levels in the organisation. Moreover, managers are often more reluctant to talk about issues in the organisation than the employees of the departments they manage, as having issues may be interpreted as the manager not doing his job successfully. Employees will be more open to talk about changes the manager should make to improve processes in the department. Furthermore

it may be the case that managers have the idea that the organisation has all kinds of mechanisms to cope with the inherent tensions, while this is not obvious to the employees in the departments. All these aspects may have influenced the findings, including the identified coping mechanisms.

- It has not been identified what the actual effectiveness is of identified mechanisms for coping with the inherent tensions.
- The focus of this research has predominantly been on the negative and hampering effects of the inherent tensions, instead of on the positive effects the tensions may bring, especially in case of Schiphol. People also tend to speak more about the negative effects than the positive effects, which they may not consciously perceive and take for granted. This may have resulted in a skewed image of both organisations.
- Considering the limitations mentioned above, comments can be made on how well both cases are comparable.

## 9.5 Recommendations for further research

Based on the outcomes and limitations of this research, several recommendations are provided for further research.

- How effective are the identified coping mechanisms? This research has identified several mechanisms to cope with the inherent tensions, but has not been able to identify the effectiveness of these mechanisms. Adding this information to the existing research would clearly be very valuable for organisations who are confronted with the inherent tensions in the process of making internal performance agreements.
- Expand the comparison by extending the number of cases. This research involved a comparison between an organisation which organised its asset management department on processes and an organisations which is organised on asset types. Comparing organisations with the same organisation principle may offer ways to identify positive and negative effects of the inherent tensions which are probable to emerge in case of opting for one of these organisational principles. Comparing between a larger mixed pool may offer more possibilities to identify generalisable outcomes.
- The subject has now been researched by incorporating concepts from theories on multi actor systems, agency relations and performance measurement. There may be more applicable theories which can contribute to interpret the complex reality encountered in the organisations. The literature review also involves theory on strategic behaviour, which contains means to further interpret the situation at the researched organisations, for instance sources of strategic behaviour. What is the influences of these sources in the process of making internal performance agreements? Furthermore the concept of 'trust' was mentioned frequently in interviews and informal conversations at Schiphol and also after the presentation of this research. Therefore it is assumed that this concept may influence the process of making internal performance agreements.
- This research has indicated that infrastructure management organisations have similar issues, despite their differences. It may be valuable to research other processes besides that of making internal performance agreements in these organisations, for instance through an organ as Next Generation Infrastructures.

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# APPENDIX A – PRELIMINARY STUDY AMSTERDAM AIRPORT SCHIPHOL

*As part of this research a preliminary study was conducted at Amsterdam Airport Schiphol to obtain a better understanding of the research subject, the circumstances and the associated questions. This appendix contains sections which are left out of the main report for reasons of focus, clarity and readability.*

## **Service level agreements at Schiphol**

Similar to other contracts at Schiphol, the contracts concerning the aircraft stands include a type of performance agreements: service level agreements (SLAs). The SLAs are used on three interfaces when it comes to the aircraft stands: between the airlines and Airport Operations, between Airport Operations and Asset Management and between Asset Management and the main contractor. The processes of making the performance agreements on these three different interfaces are not equal, but organised differently.

### *SLA process with airlines*

Airlines deal with Schiphol's Airport Operations department (OPS). The sub-department Account & Contract Management of the OPS department (OPS/ACM) collects the user requirements of the airlines on an annual basis. OPS/ACM transfers these demands to the Process Management Airside sub-department (OPS/PMA), which has to make sure the user requirements are realized. The airlines also put in demands directly through OPS/PMA year-round, however account management remains responsible for overall overview. While some requirements remain relatively stable and predictable from year to year, others change (sometimes rapidly) due to developments in the aviation sector. The demands of the airlines are thus dynamic, while the communication of these demands is also dynamic. The contract between the airlines and Schiphol however is based on a fixed price, which is determined each year during the airport charges consultation.

### *Internal SLA process*

The internal SLA regarding the aircraft stands is the result of interactions between Process Management Airside and the Asset Management department (ASM) and is to be reviewed and updated each year. Multiple sub-departments of ASM are involved in this process. Planning & Portfolio Management (ASM/P&P) is the facilitator of this process and will eventually become the owner of the SLA. In this internal SLA process PMA is the principal and their demands are in accordance with the demands of their client, the airlines. Thus a function of this internal SLA process is to ensure that the performance agreed with the airlines is actually achieved by the Schiphol organization.

ASM has to come up with solutions to meet PMA's demands. These solutions can be asset as well as non-asset solutions, of which the latter is the responsibility of P&P. Technical expertise for the asset solutions is brought into the process by the ASM sub-department Technical Expert Center (ASM/TC), while Maintenance & Operations (ASM/M&O), another ASM sub-department, provides information on the financial consequences of the possible solutions.

### *SLA process with contractors*

Contractors deal with the Asset Management department, primarily with the sub-department Maintenance & Operations (M&O). Amsterdam Airport Schiphol is divided in a number of lots, each

maintained by one main contractor. Specifically for the aircraft stands this entails that there is only one main contractor which has to execute works at a set of stands.

Schiphol uses so-called 'installation management contracts' for its contractors, in which the responsibilities between Schiphol and the contractors are stipulated. Schiphol is responsible on a strategic and partially tactical level and the contractor's responsibilities comprise the tactical (partially), operational and implementation levels. This means that Schiphol is responsible for the performance of the asset systems, while the contractor is responsible for the performance of the individual assets which make up the system. A consequence of these installation management contracts is that the actual delivery of performance is organized by the contractor, while Schiphol is responsible for that performance towards their clients, the airlines. This type of contracting is referred to as 'underpinning contracts'.

Contracts between Schiphol and its contractors have a duration of five years, with an option for an additional three years, and are on the basis of a fixed price. The SLAs, which are part of the contract, are evaluated and updated each year.

#### *Current state SLAs*

Although it was agreed to review and renew the internal SLA each year, this has not been done properly. The current state of internal SLA is not up to the desired standards.

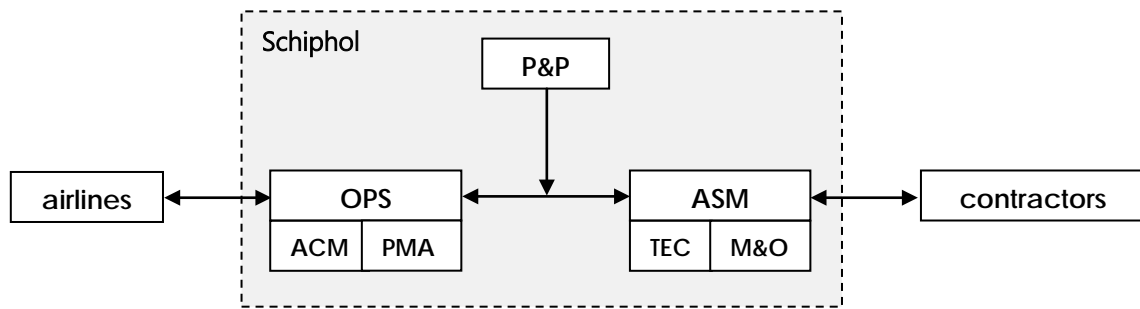
The statements about asset (system) performance are not clear and not substantiated; even one of the SLA's authors does not know how certain numbers concerning availability agreements have been determined. Furthermore there is no clear link between the values for the reliability of individual assets on a pier, the values for the availability of entire piers and the priority of the piers. According to the document one pier with top priority can have five times as much loss of availability due to failures than another pier which as low priority. Furthermore the expiration date is stated at the end of 2015, while the document is still in use in 2016. Thus the current internal SLA concerning the aircrafts stands is unclear, unsubstantiated and outdated.

As a consequence the SLA has to be revised to such an extent, that there has not been a new SLA for 2016 due to a lack of time available of the involved departments. A new SLA has been planned for 2017, but there is currently no clear plan on how the process of making the internal performance agreements should be organized.

Besides the problems with the internal SLA process, also the SLA process with the airlines does not produce the desired output. An internal research [One Smart OPS] report states that the services currently provided by Schiphol insufficiently reflect the demands of the clients. This is an indication that there are possibly problems on the interfaces between the different SLAs.

#### *Characteristics of the SLAs*

The illustration on the next page summarizes the characteristics and current issues of the SLA landscape.



airlines – OPS

- dynamic demand
- user requirements collected each year
- services provided insufficiently reflect client's demands
- fixed price

OPS – ASM

- P&P facilitator and owner of SLA
- agreed to be reviewed each year
- thorough revision required

ASM – contractors

- contracts per lot
- duration 5 (+3 optional) years
- installation management contracts: transfer of performance to contractor, but remaining responsible to airlines
- fixed price

Looking at the overview, the tensions Schiphol has to deal with become clear. While the client demands are dynamic, Schiphol's assets are developed and maintained to serve long-term purposes. The performance agreements with the airlines change each year, but the maintenance contracts have a duration of five, or even eight, years. These differences have implications for the process of making internal performance agreements, because the different actors look at the performance agreements from a different viewpoint: OPS will want flexibility to adapt to the client's dynamic demands, while ASM requires stability in order to remain close to their maintenance programs and contracts with the contractors. Change is certainly possible, but only after a thought out trade-off between the aspects function, risk and cost, seen from a long-term perspective.

*The following appendices have been left out of this public version of the thesis due to reasons of confidentiality. Please contact the author if you have any questions regarding these appendices.*

Appendix B – Service Level Agreement Aircraft Stands 2015

Appendix C – Schiphol interview: Person A

Appendix D – Schiphol interview: Person B

Appendix E – Schiphol interview: Person C

Appendix F – Schiphol interview: Person D

Appendix G – Schiphol Coffee Corner Chatter

Appendix H – Port Authority interview: Person Z

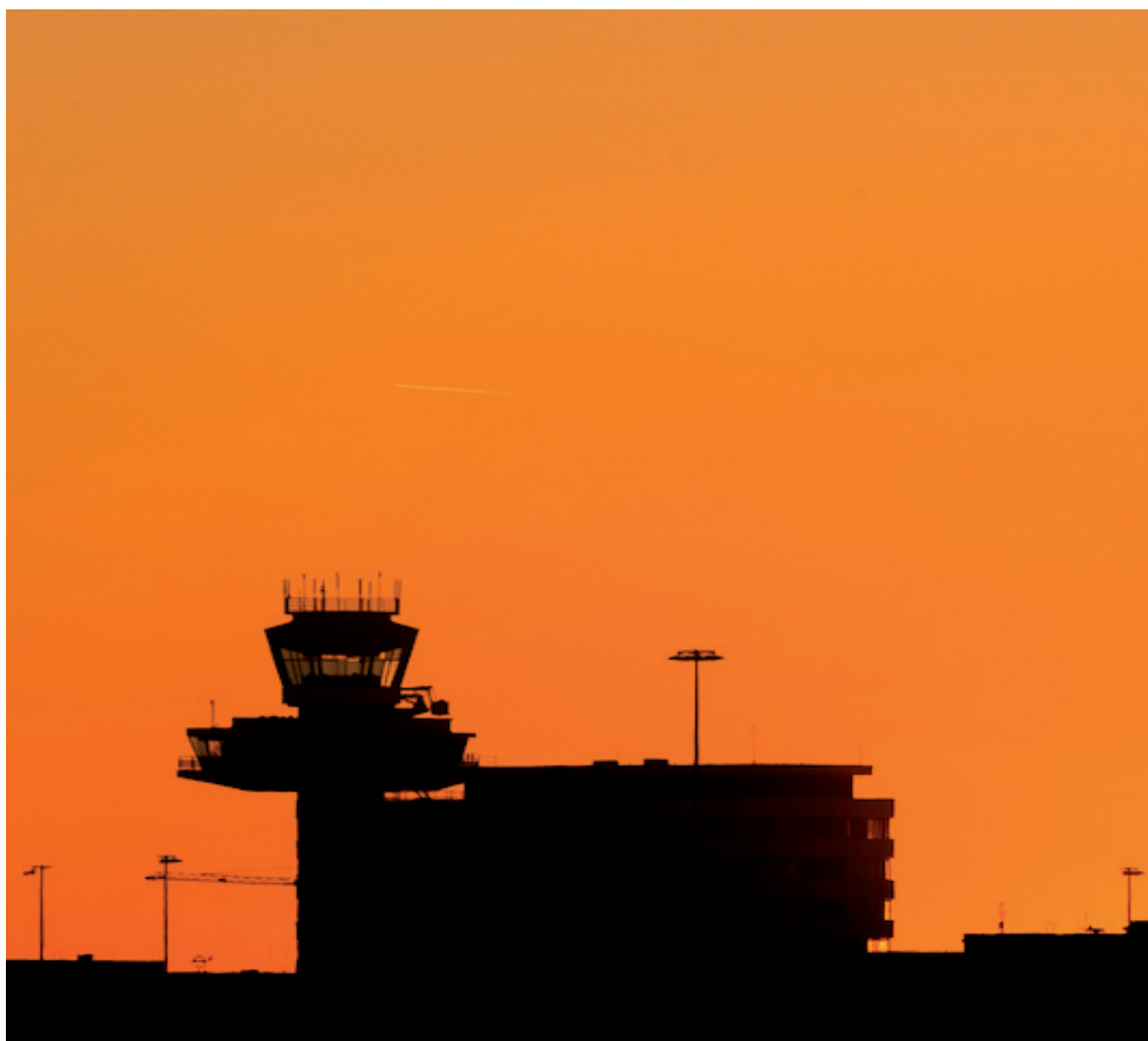
Appendix I – Port Authority interview: Person Y

Appendix J – Port Authority interview: Person X

Appendix K – Port Authority interview: Person W

Appendix L – Port Authority interview: Person V

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