Management of stakeholder driven scope changes in large structural adaptations of airport terminals

Master thesis: J.P.G. Elich
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Master
Name: Construction management & Engineering (CME)
Faculty: Civil Engineering & Geo Sciences
University: Delft University of Technology

Graduation committee
Chair: Prof. mr. dr. J.A. (Hans) de Bruijn (Faculty of Technology, Policy & Management)
First supervisor: Dr. W.W. (Wijnand) Veeneman (Faculty of Technology, Policy & Management)
Second supervisor: Dr. ir. G.A. (Sander) van Nederveen (Faculty of Civil Engineering & Geo Sciences)
External supervisor: Drs. Ing. B.M.G.J. (Benno) de Zwart (Schiphol Group)

Contact information
Author
J.P.G. (Joost) Elich BSc
Student number: 1316443
Email: joostelich@hotmail.com ; Elich_J@schiphol.nl
Phone: 06 4838 7964

Delft University of Technology
Faculty of Civil Engineering
Stevinweg 1 2628 CN Delft

Schiphol Group
Postbus 7501
1118 ZG Luchthaven Schiphol
Preface

This thesis is the result of my graduation research of the Msc programme Construction Management & Engineering (CME) at the faculty of Civil Engineering at Delft University of Technology. I was given the opportunity to perform this research the past seven months as a graduate intern at Schiphol Group, the network operator of Amsterdam Airport Schiphol. This thesis contributes to the successful management of stakeholder driven scope changes which occur regularly in the various projects that are undertaken in the airport terminal. More specifically, the root causes of these scope changes are explored and the most successful management approaches and stakeholder interactions are identified.

This thesis could not have been completed without the help of many experts in different fields. I would like to thank all those people who made their contributions to my research and final thesis.

First of all, I would like to thank Wijnand Veeneman, my first supervisor, who supported me already before starting my graduation by counselling and helping me to acquire a graduation place at Schiphol. Also later on during my graduation, his substantial advice was very much appreciated.

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At last I would like to thank my mother, who helped me with the text in this thesis.
Summary

Introduction
A large structural terminal adaptation is like most large engineering projects an enormous and complex task. A large airport deals with many stakeholders both internal and external who exert influence and could cause scope changes. The scope of a project is developed by requirements of the client and users. These stakeholders could affect the project’s scope through their interest and power position. One of the biggest challenges in such complex projects on airports is to manage the stakeholder driven scope creep or changes. The management of scope change events should be executed in such a way that they will be successful and contribute to the success of the project.

Scope changes in the Front End Development occur on a regular basis in construction projects at the terminal building of Schiphol. Scope changes are inevitable, but and may have a large impact on project costs and time. Remarkable is the fact that most changes are stakeholder driven. The reason is that many parties operate in a relatively small area. Schiphol is confronted with many stakeholders that all have their own core values and interests concerning a construction project adapting the situation at the terminal.

Research methodology
The overall objective of this master thesis is the improvement of stakeholder and scope management to increase the success of construction projects of network operators. The overall research question is: “How can airports improve the management of stakeholder driven scope changes during the Front End Development of terminal adaptation projects”? In order to research these changes five scope change events have been explored within two projects at the terminal of Schiphol airport. Approximately 30 interviews were carried out and the findings were qualitatively compared. The scope change event takes place from the moment a stakeholder makes an intervention by announcing that he disagrees with a part of the scope until the moment a resolution is found. First the root cause is explored. Then the management approaches of the project manager in the change event and the interactions with stakeholders are explored and related to success. Additionally the project context is taken into account to explain differences and similarities. The change events’ root causes, management approaches, interactions and outcomes are qualitatively compared.

In literature studies, frameworks were developed to analyse the change events. Different causes were classified and a list with overall causes was made in the end. All causes were framed into three dimensions: internal root causes, external root causes and environmental causes. A distinction between two management approaches was made. Traditional project management is characterised by a “predict and control” management approach. Disadvantage of this approach is that it presumes a static world, while in reality it is dynamic and project circumstances change. Process management is the opposite management approach, that presumes a changing world and is characterised by a “prepare and commit” strategy. In practice, not one of these approaches will generally be applied on its own, but rather a mixture of the two will be used. One of the approaches, however, can be pointed out in most cases as the dominant approach. The nature of interactions with stakeholders is
characterised by the level of trust and involvement, the stakeholder relationship, the level of power and the style of communication. Five different context variables will be taken into account in this research. In the project contexts the influence of structure and arrangements are being studied and in the change events themselves, the influence on cost and time and on the existence of a change procedure are being explored. At last, the term success will be defined, to measure the influence of the management approaches and interactions. General success can be divided in two dimensions: efficiency and effectiveness. Efficiency particularly reflects to the extent in which the original design goals and project variables were met. Effectiveness refers more to the way the project, and in this case the change, is received by its stakeholders. Especially the opinion of the client and users are important here.

Conclusions: root causes
No root causes of changes in airport terminal projects seem to occur regularly. Scope changes have more than one root cause and are generally caused by both the project team and the stakeholders. Scope changes can be divided in changes that could have been prevented and changes that could not have been prevented. External caused changes are generally harder to prevent than internal caused changes. The occurrence of preventable changes should be avoided. The unpreventable changes (and preventable that did occur nonetheless) should be managed adequately by the project manager. It is recommendable that all changes and their root causes will be analysed afterwards and the preventability will be evaluated for learning purposes.

Conclusions: management approach
Success depends on both project-oriented and process-oriented approaches. In scope changes slightly more process-oriented aspects should be used than project-oriented. This ratio is related to the fact that it is stakeholder driven. In more complex changes, management switches should be used if the PM cannot solve a change event with his (hierarchical) tools and mandate. Often project managers have limited measures to perform process management. If changes are smaller and less complex in terms of consequences, they can use both project-oriented and process-oriented management. If larger change events occur, their mandates will not allow process management and they are forced to apply project management. If this can not solve the issue and friction arises, the change event should be taken to a higher level. If the overall PM of a project can not use process management within his mandate and can not solve it hierarchically, a management switch should be made to a body in which the network of actors is represented and the issue can be discussed at one table. This is the area where process management is performed and solutions will be found by negotiating. An organisation should make sure that every project has such a body, which is available to solve and discuss complex changes.

Conclusions: interactions
Regarding the interactions, trust and involvement are crucial for a change event to be successful. A collaborative relationship contributes to success, while a conflicting relationship has a negative influence on success. In communication, especially in stakeholder driven changes, the dialogue is important. If parties are on cross-purposes, the resolution will probably be unsuccessful. Moreover, the use of informal communication is quite important, because it brings parties closer together and makes them understand each other’s interests and respect them. Formal communication, can lead
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to unsuccessful resolutions of projects. Regular meetings are important to ensure progress in the change event.

Conclusions: context
A project’s structure and arrangements can also be divided into project- and process-oriented elements. If a project has a dominant project-management structure and arrangements, a counter arrangement should be made in the change event: it should be managed with an overreliance on the opposite management approach in order to achieve success.

Schedule is very important to all parties and during discussions parties agree on aiming not to extend the projects’ "time". The schedule had not been changed in all observed change events. Larger changes in terms of money are more complex. Such projects should make a timely (probably immediate) management switch if the PM’s instruments and mandate cannot solve the change event. At all times, if a management switch is made, it will be important that the changes and sub-projects are discussed at one table. One project or issue should not be discussed at different tables, but multiple issues at one table. Existing change procedures are more a matter of formality at the end of a change event, in which the right departments should approve rather than manage it.

The uniqueness of projects at airport terminals
A comparative case research has been done at Prorail to verify the compatibility of the conclusions at other network operators. Overall, less stakeholder driven scope changes occur at railroad terminal projects. Airport terminal projects are unique in many ways and can not be compared with other network operators at all, although some of the same conclusions were drawn.
First, airports have many more complex stakeholder relations and processes in a relatively small area. Airports have multiple airlines and handlers. At the same time, the existence of security, boarder control and customs in this small area are also causing its uniqueness. This explains why stakeholder involvement is so important for success here. Another consequence is that more, and more complex stakeholder driven scope changes occur at airports.
Secondly, the budget of a project at Schiphol is more fixed and controlled because the client is an internal party.
Thirdly, this focus on costs can also be attributed to the unique way that user costs are charged by the network operators at Schiphol. Law enforces an exact coverage of the Aviation costs of Schiphol by airport charges, while users of railroads pay a fixed amount per distance. The investments of a project are paid almost directly by airlines, which makes this stakeholder more powerful as they will be affected both in operation and in expenditures. The mutual dependency between KLM and Schiphol is therefore larger and might explain the need for involvement and stronger budget controls. The use of a special purpose vehicle would be a good measure to mitigate the negative effects of this last mechanism. By creating a legal entity that can cover the business case, the costs could be separated from the aviation costs. The business case makes sure the costs are recovered after the payback period and the airlines are not affected by this. This is beneficial for airlines, but also for the airport, because the power of airlines decreases and efficiency of scope change resolutions will increase.
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Part A Introduction
1 Research Introduction

1.1 Problem introduction

1.1.1 General Introduction

Large infrastructure investments are of vital importance in any public or private institution (Flyvbjerg, et al., 2009). The assumed potential contribution of large infrastructural projects to the economic development of a city, region or country they serve are significant in the debates and final decisions by the governments to proceed such a project (Phang, 2003). Airports have a considerable contribution to the economic development of the region or country (Hakfoort, et al., 2001). One of the most important aspects of an airport is its terminal as almost all processes are bundled here.

“Terminal” could have different meanings, however it always refers to a certain end situation. In the transportation sector, the word “terminal” is used to indicate the end of a transportation line or a distribution point at the end; thus an intersection of more transportation lines such as a station. In this thesis, the word terminal will refer to the (station) building which indicates the end of a transportation line and has a distributing function. Examples of these kind of terminals are airport terminals, (sea)port terminals and public transport terminals such as a train or a bus station. Although the research has been done at an airport, some findings will be generally applicable to any kind of terminal. In addition, a comparison will be made between different kinds of terminals in the case studies by researching an extra case at a train station. Such terminal buildings exist of numerous facilities fulfilling several functions. The facilities and functionality regulations differ among the different kind of terminal buildings. However, the main function remains to collect and distribute people and goods. The unique aspect of construction projects in terminals is the fact that many activities and processes take place at a relatively small area in which multiple parties pursue their interests.

1.1.2 Occasion of the research

Schiphol is the largest airport in the Netherlands and the 14th airport in the world regarding the number of passengers (pax), handling over 50 million pax per year (annual report 2012). Furthermore, Schiphol was recognised as the best airport in Europe and it belongs to the top 5 of the world, being selected by a survey among 12 million travellers worldwide. Schiphol desires to remain Europe’s preferred airport (Schiphol Group, 2012) and is continuously searching for opportunities to adapt its terminal to the passengers’ wishes. Many projects are constantly being executed to adjust to the changing circumstances involving new technology, new laws and regulations, future passengers demand and the ever-growing demand for improved efficiency.

One of the large adaptations of Schiphol’s terminal is the CSNS (Central Security Non Schengen) project, that was later renamed in One-XS. The purpose of this project is a transition of decentralised security checks to centralised security checks. Schiphol airport has a “one terminal concept” in which all passenger related activities are processed in the same building. The departure areas are split in

1 http://www.thefreedictionary.com/terminal (consulted at 20-11-2012)
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two and are interrelated with security, border control and customs filters. One area is only used for
the departures (and arrivals) of flights to and from countries within the Schengen agreement. The
second part is used for all other flights (non-Schengen). The non-Schengen part has contrary to the
Schengen part security checks at the gate.

The desire to change to a situation with central security checks is driven by three advantages
(Schiphol_Group, 2012). First, One-XS will contribute to an improved travel and accommodation
comfort for the passengers. In the new situation passengers would be able to use all facilities in the
departure hall without the obligation to go early to the gate for the security checking process. In
addition, the transfer passengers arriving from trusted countries, will not have to be checked again at
Schiphol; this phenomena is called “one stop security”. Secondly, the efficiency of the passenger
flows will be improved. As more passengers will use the same security lanes, security guards and
equipment could be used more efficiently (economies of scale). Thirdly, the One-XS project also
allows to satisfy future European laws and regulations. Especially the right to bring lags (liquids
aerosols and gels) that each passenger will have, requires new expensive security equipment, which
is able to scan those materials. The conversion to central security requires large structural
adaptations in the terminal building itself and the piers.

A large structural terminal adaptation is like most large engineering projects an enormous and
complex task. A large airport has many stakeholders (Offerman, 2001) both internal and external.
These stakeholders create many interfaces, which is one of the most important factors of the
project’s complexity (Veeneman, 2012). Stakeholders could be the source of scope changes in the
project too (Hwang & Low, 2012). In my first interview with the One-XS project manager (De Zwart,
2012), he indicated that the most critical project risk would be scope creep. With scope creep, he
alluded to the project changes that may occur, because of important stakeholders intervening.

1.1.3 Scope changes at Schiphol
Schiphol airport has a large terminal building, which fulfils several functions. Various parties are using
this terminal building. The One-XS project will have a large impact on the daily processes at the
terminal. To begin with, the building activities will have a duration of more than 2 years. During these
activities the daily operations have to be continued. Second, the current situation in the non-
Schengen part of the terminal considering passenger and staff handling will change permanently.
This may affect many established processes of the different parties.

Schiphol Group, the network operator, has its own project management department PLUS
(Projectbureau Luchthaven Schiphol). Airport Operations (OPS), is the client in the One-XS project.
So client and project management team belong to the same parent organisation. Apart from the
client and project management team, there are also many users involved. Examples of users are
airlines, Koninklijke Marechaussee, passengers, shop operators and also some other departments of
Schiphol Group.

So next to the wishes of the client, the project management team should also take the wishes and
demands of the numerous stakeholders into account. They could affect the project’s scope having an
interest and power position. One of the largest challenge in such complex projects on airports is to
manage the stakeholder driven scope creep or changes. The stakeholder management should be
executed as such that the negative effect of “scope creep” is minimised and thus the project success will be increased.

In the One-XS case, the project management team was in charge of developing the project plan, tendering the different sub-projects and supervising the building operations. In the front end development (FED) plans were being developed to realise the client’s needs together with many advisors. Some stakeholders were involved during the meetings with the client in the early plan development. However, there were many situations in which a relevant stakeholder wasn’t involved or in which the stakeholder was involved but revised its initial viewpoint. In such occasions, a provisional or final plan about a certain aspect could already be made. If the plan should change so drastically that the scope of the project is changed, “scope creep” or a scope change is the result. As in most large engineering projects, in the Front end development of the One-XS project many of these situations occurred. The question rises, how do these moments occur and (how) can they be prevented. On the other hand: if they occur how should they be managed strategically to operate them smoothly.

1.2 Terminology

Initially it was required to look at the occurrence and management of scope creep. During the literature research, it was evident that not much was written about the term “scope creep” in a broad sense. A term that was used more often in relation to these problems was “scope change”. In the first chapter of literature studies, this conformity was explored and elaborated. Here, only the conclusion in relation to the terminology is shown.

Terminology: Scope creep is the difference between the (functions and properties of) products and services delivered by the project and the products and services initially intended to be delivered. Scope creep reflects the dynamic character of scope. Scope change is a broader used term to reflect this same idea. The term scope change will generally be used in this thesis.

1.3 Research context

This report is the result of the graduation thesis of Joost Elich to complete the Master in Construction Management & Engineering at the Delft University of Technology. This research was executed commissioned by Schiphol Group, the network operator of Amsterdam Airport Schiphol. The research was performed internally in the project management department of the Schiphol Group organisation.
1.4 Reading guide

This thesis is divided into 4 parts. In part A, the problem is introduced and the research is designed. In part B, literature studies are performed to explore the theory about scope changes. In part C, different practical cases are studied to find out the aspects found in part B. In part D the conclusions are made by comparing the cases in part C with the aspects framed in part B.

Part A: This part is divided in two parts. First chapter serves as an introduction. It introduces the problem and explains the research context. In the second chapter the research methodology is elaborated on. The research questions will be developed here as well as the plan to answer these questions.

Part B: This part involves literature studies. Much literature was consulted to explore the problem and to frame the most important aspects of the research questions. Part B consists of 5 chapters, corresponding to the 5 theoretical research questions. In the first chapter the root cause of scope changes is explored. In the second chapter two leading management approaches are elaborated. The third chapter looks at the stakeholder interactions. The fourth chapter explores the project’s context. The fifth chapter deals with the question how success could be measured.

Part C: This part is the empirical part of this research. The different projects and cases are studied here. First chapter is about the selection of the projects and cases and supposes a research protocol. In the next chapters, the two different projects will be described and their contexts will be clarified. In the One-XS project 4 change events will be described and in the 70 MB programme one change event will be described within project Backbone. These descriptions are based on the approximately thirty interviews that were taken.

Part D: In this part, the results are compared. First, the results of the Schiphol case studies are analysed both formally and informally. The formal analysis is based on the computer programme fsQCA that enables a comparison of many variables on the basis of few cases. After the comparison, the results of stakeholder driven change management on airport terminals are compared to those of railroad terminals. In this way, the compliance of these results with airport terminals is checked.

Part E: In the last part general conclusions are made and specific recommendations are done. These recommendations have been separated in the essence of the research, in which the most important variables are discussed, the recommendations for project management organisations and additional recommendations for Schiphol.
2 Research Design

2.1 Problem analysis

As was already stated in the introduction, scope changes in the Front End Development occur on a regular basis in construction projects at the terminal building of Schiphol. Scope changes are inevitable, but may have a large impact on project costs and time. Some changes might be preventable and not desired. However many other changes are desirable, in order to make the project successful. Remarkable is the fact that most changes are stakeholder driven. This can be explained by the fact that many parties operate on a relatively small area. Schiphol is confronted with many stakeholders that all have their own core values and interests concerning a construction project adapting the situation at the terminal.

The wishes of these stakeholders, the interfaces and interactions in the network of actors influence the project management. The project management team should deal with these issues in order to apply successful management. A project can be divided into three different phases: the front end development (FED), the execution and the operation phase. In the FED, the scope is defined and the plans are being made. An important point in large public projects is the tendering, which takes place between FED and execution phase. The later the scope changes, the larger the effects on costs and schedule (Meredith & Mantel, 2010). During the front end development the clients will learn. New demands and performance requirements become apparent to the client and users, which were not realised at the time of project initiation (Meredith & Mantel, 2010). So the scope is not realised instantly, but it is iteratively defined during the initiation and planning phases. This process is called scope maturation. Even in the execution phase, situations could occur in which the clients change their expectations and the scope is partly redefined.

Traditional project management uses a predict and control approach (Veeneman, 2012). In the front end development, the project is planned, tasks are divided and a budget is made. After the definite design, these tasks are controlled as they should be executed according to plan. On the other hand, process management has a prepare and commit approach, which assumes that unforeseen circumstances and change are inevitable in complex projects (De Bruijn, et al., 2010). In large projects, most of these changes occur in the FED, in which it is generally cheaper to change the scope. In Figure 1 the principle of scope maturation is schematised.
This scope maturation, iterative, process is driven by the stakeholders having new demands. The interactions between client, user and project team (described in previous section) are key in this process. All these changes driven by the project’s stakeholder have one thing in common: there are one or more intervening actor(s). After such an intervention, conflicting values will come to light and the event could lead to a conflict. The project manager is responsible to steer the process from an instable scope to a stable scope in order to proceed the project to the next step (tendering).

Changes don’t necessarily have to be undesirable. However, when a stakeholder makes an intervention the project manager has to use a management approach to come to a solution. Although: scope changes can be managed in another way: some scope changes can be avoided. Here is not meant that the change is simply declined, because in that case there is no commitment among stakeholders resulting in an unstable scope. What is meant here is that in some cases the scope could be set correctly (according to anybody’s wishes and possibilities) in the first place. These two issues should be investigated by researching the scope changes’ root causes in the first place (prevention). Secondly, the management approach and stakeholder interactions should be researched (to make a repair in the process during a change event).

### 2.2 Research objective

The overall objective of this master thesis is the improvement of stakeholder and scope management to increase the success of construction projects of network operators. The goal of this research is to give more insight in the occurrence of scope changes in large terminal adaptation projects. The main focus will be: the stakeholder driven causes of these scope changes. By developing process reconstruction an attempt will be made to understand the stakeholders’ motivations and their strategies which explain their behaviour relating to these scope change events. In this way best practices will be generated about how project managers can anticipate on changes in order to increase the success of the projects.
This thesis aims on the following, more specific, goals:

- Helping Schiphol group to improve its management of stakeholder driven scope creep or change situations in future construction projects. In addition, helping them to understand the interests and associated behaviour.
- Understanding and framing the root causes of scope changes
- Identifying measures to evaluate and prevent (unnecessary) scope changes in the front end development of terminal construction projects.
- Identifying best practices to manage stakeholders in order to process scope change events smoothly.
- Contributing to scientific literature on stakeholder driven scope changes in construction projects. There is no literature available about this subject specifically focussed on (airport) terminals.

### 2.3 Research scope

The problem statement was about how stakeholder driven scope changes could be managed successfully in structural adaptations of terminals. So only those scope changes that are the result of an intervening actor will be researched. Another important delineation in this thesis, is the fact that only changes that occurred in the front end development are taken into account. This has two main reasons. Firstly, the project that came with the request to do this research, is still in the (end) of the FED. Secondly, the project management department of Schiphol will transfer the project to the contractor that wins the tender. Changes after this point in time are of course possible, but the possibilities and interests will change drastically depending on the contract type. This will turn the whole process of the change event. It could become a subject of future research.

In order to achieve useful results in this research, a theoretical framework will be developed in which 6 different change events in 3 different construction projects within (airport) terminals will be compared. First literature studies will be done to answer the theoretical research questions and create an analytical framework. After that, the practical part will take place by interviewing stakeholders in the different change events. The frameworks developed in the theoretical part will be used to make a process reconstruction of these change events. In the end, the cases will be compared by the gathered information. The result can be seen as both an advice and scientific understanding of the stakeholder process relating scope changes in terminal projects. At last, a list of recommendations will be formulated to bring the lessons learned into a practical context.

### 2.4 Research methodology

This research will be a qualitative comparative research and starts with literature studies in order to collect valuable knowledge about stakeholder driven scope changes in structural adaptations of terminals. Literature about scope, scope creep, scope changes, project management, process management, stakeholder management, interactions, arrangements and structure has to be studied. In literature studies, a framework will be developed to perform the case studies and success factors of management of stakeholder driven scope changes in the Front End Development will be identified.
The theoretical framework, will consist of questions that have to be answered for every case study in a certain identical way. Different actions to analyse such a case will be clearly identified in order to make the cases comparable. Furthermore several context variables should be distinguished to make the cases comparable and research the influence of them. In the end the findings of the cases will be compared both formally and informally. The formal analysis will be done by the computer programme fsQCA, which makes it possible to compare many variables while few case studies have been performed.

2.4.1 Theory
In a comparative research, independent variables, dependent variables and context variables can be distinguished. By researching different cases and comparing them, it is attempted to find a relation between two variables. By alternating the independent variable and looking at the results (dependent variable) a relation might be discovered. In such a research the environment should be identical for each case. However, this is not possible in projects like this as the researcher is not in control of this environment. An attempt will be made to mitigate differences in environment by using context variables. The context variables should be identified and taken into account, as they might disturb a clear relation between the independent and dependent variable (Bouwman, 2012).

2.4.2 Project selection
The main case study will be the One-XS project, as it is the most current project and the overall research problem arose from this project. Another case study is chosen within Schiphol itself to differentiate the environment within the same organisation. The 70 MB project will be examined, as it is a very large project too, which is distant from One-XS. It has just been completed after several years of development and building. Also cases of another network operator should be investigated, in order to research a broader range of environments and management methods. The last case will be done at Prorail. This network operator is also building and adapting its terminals, better known as station buildings. Since many comparable stakeholders are involved and one of my colleague students is doing his research there, it will be an excellent opportunity to do some broad research efficiently here. The overall research method can be seen in Figure 2.

2.4.3 Independent variable
The independent variables are related to stakeholder driven scope changes because there is tried to find a general relation between stakeholder driven change management and successful management. In the previous chapter, this research was already delineated by only taking into account scope changes originated in the FED driven by the stakeholders of the project. Furthermore, in the problem analysis was discovered that this management happens on the complex interfaces where conflicts and thus interactions with the stakeholders take place. Of course, different
management approaches have to be researched to identify the successful approach in the end. Closely related to the stakeholder interactions are structure and arrangements, which all together form the instruments for management (Veeneman, 2012). These will be considered in the context. First, there is only one structure in every project, so this is the first important independent variable that could be used and identified for every case. Second, there are many more arrangements between the different actors in the shape of contracts or formal oral agreements. Third, there are numerous interactions between the actors, like meetings, phone calls, e-mails etc. It is not possible to involve all arrangements and interactions in this research as it would take too much time. A selection in the research material is therefore essential.

Additionally, it is important to look at the root causes of scope changes and explore the influence of this factor. Could a change event be prevented? So apart from the context a few variables’ influence should be researched:

- Root causes of scope change
- Management approach in change event
- Stakeholder interactions

### 2.4.4 Dependent variable

The dependent variable is project success. But how can success be measured? Success is difficult to be objectively determined. In this research it wouldn’t be useful to measure overall success as this can not be attributed to the outcome of one change event without reservation. Only the outcome of the change event will be measured to make fair conclusions.

The outcome of a change event is rather subjective. Thus, different perspectives should be looked upon when measuring the change’s success. The best way of measuring this success is by interviewing the different parties that were involved in the change event. However, a list of success factors will also be generated in literature studies by exploring articles about scope change and success. Also, a few project managers will be interviewed in advance to incorporate practical points of view about measuring success. The framework achieved, should be used as an example or guideline during the interview. This can help the responses of those interviewed to be structured.

### 2.4.5 Context variables

Different circumstances influence the way a change is processed and treated. These circumstances are important to analyse, in order to tell what happened related to the scope change. If this is done for different scope change events, these could be qualitatively compared. Once these are compared, the influence of management approach, interactions and contextual variables on project success should be clear. The comparison will partly be executed by using the fsQCA computer programme, which enables a qualitative comparison of many variables.

The moment that a change is due, an intervention will take place. One or more parties will come up with something different than what was originally in scope. Subsequently a process among this change will take place, and has a certain outcome (project success). This process is dependent on contextual variables. Most important are internal structure (project organisation) and external structure (network of stakeholders). Furthermore the arrangements, both internal and external are
important and could influence the way this process around the change develops. Within this process certain interactions take place and a management approach will also influence the course this change will go through.

Figure 3 below visualises this research method. Of course every single change event has its own root cause, although the figure shows just the upper one (for the sake of clarity).
2.5 Research questions

The overall research question of this master thesis is:

“How can airports improve the management of stakeholder driven scope changes during the Front End Development of terminal adaptation projects”?

To come to an answer, the problem was analysed in the previous chapter and a focus was chosen. The following sub questions can be distinguished:

**Cases:**
- What was the original scope?
- What was the scope change?
- Which parties influenced this scope change?
- What was probably the root cause of this scope; was it preventable and desirable?
- What kind of management approach was used during this scope change event?
- What kind of interactions was used?
- What kind of context variables was applicable?
- Was the scope change event solved successfully?
- What is the relation between management of stakeholder driven scope changes and success?

**Theoretical part:**
- How do scope changes occur and what kind of different types of scope changes do occur within terminal development?
- What kind of management approaches can be distinguished during interventions leading to scope change?
- What kind of stakeholder interactions could take place?
- What kind of relevant context variables are applicable in a scope change event?
- How can success be defined in relation to the management of stakeholder driven scope changes?
Part B Literature studies
Few research has been done about stakeholder driven scope changes in airport terminal projects, however a wide variety of scientific literature relates to this topic. Initially, the term that was used in this thesis and in the search for literature was “scope creep”. This was changed in “scope change” as it appeared to be the same as scope creep. In the first chapter of literature studies, the definition will be discussed.

In this part of this thesis, the theory about this subjects will be reviewed by focussing on the 5 theoretical research questions. In the first chapter the occurrence and different types of scope changes will be discussed. In the second chapter different management approaches will be explained. In the third chapter the stakeholder interactions and relevant dimensions to analyse these interactions will be investigated. In the fourth chapter, relevant context variables are selected and framed. In the last chapter, a list of important success variables is explored.

3 Scope Changes

3.1 Introduction

In this chapter the occurrence and root causes of scope changes will be scientifically researched and framed. Schiphol does have to deal frequently with scope changes. However, both Schiphol and the researched scientific literature do not have an overview or established list of scope change typologies and their causes. In order to be able to avoid these changes or deal with them adequately, they should be analysed and classified. In order to easily use the gathered theoretical information here, a framework will be developed. This will contribute to the overall literature, this thesis and Schiphol to help to quickly analyse and understand (future) scope change events.

The question to answer in this chapter is: “How do scope changes occur and what kind of different types of scope changes do occur within terminal development?”

3.2 From scope to scope change

As the management of stakeholder driven scope changes is key in this thesis, first the term “scope” will be introduced. According to the Oxford Dictionaries scope is “the extent of the area or subject matter that something deals with or to which it is relevant”. Meredith and Mantel state that scope, or the concept of performance is more complex than apparent. Scope would be the fourth dimension additional to the three project objective dimensions “cost”, “time” and “quality”. This fourth dimension is the expectations of the client (Meredith & Mantel, 2010). The Project Management Body of Knowledge distinguishes scope into two parts:

- **Product scope;** the features and functions that characterize a product or function.
- **Project scope;** the work that must be done to deliver a product with the specified features and functions (PMBOK, 2000).

All three explanations are different although they show similarities. The first one is broader and the last one is the most specific for project management. It can be concluded that it has to do with the
client(s)’ expectations within construction projects. This is rather vague and one could ask “what does the client expect”. The last definition, being more detailed, talks about “specified features and functions”. Veeneman (2012) explains that scope is the total of functional requirements and the system in which this is translated. Each front end development phase (FED) in a project starts with requirements that are translated into a system. At the end there should be just the system left, which fulfils the functional requirement. So Scope is functionality + system. This could be visualised as follows.

![Figure 4 visualisation scope](image)

The client(s)’ expectations should be measurable to define a scope and this should be done at a certain moment (list of specifications). There are always areas or subjects, which are not specified or specified not satisfactory, although important for the client; such issues may arise later in the process. In these situations scope changes or “scope creep” could occur.

### 3.3 Scope change

#### 3.3.1 definition

As introduced in last section, scope could be adapted resulting in scope changes or scope creep. It is important to explicitly explain what is meant by scope changes and scope creep in this thesis and use a uniform definition as this subject will be key. There is no consensus about the meaning of “scope creep” amongst both scientists and practitioners. This is probably why in scientific literature, the term scope creep is seldom used (and if used it is mostly referring to software development projects); most scientists use the word “scope change” or even just “changes”. For a summary of this literature from which the definition is extracted see appendix A.

This thesis adopts the outlined view about scope creep encompassing both non-formalised and formalised scope creep (see appendix A for further explanation). After all, a change also affects the project result and the original specifications. As in this thesis will be focussed on the role of the different stakeholders in scope creep, both situations should be considered in this project. The question if this creep is formally accepted has nothing to do with the role of a stakeholder, however, it could be interesting as a result of the interactions between all parties. In such cases, a “conflict” of interest occurs as the project manager is managing a project as (functionally prescribed) and one of the stakeholders asks or expects something different than the scope of the project on that moment. In Figure 5 the analysis of the used definition, connected with the role of stakeholders, has been schematised. Here, it will be clear that both shapes of scope creep should be taken into account to give a substantial overview of the problem.
Terminology: Scope creep is the difference between the (functions and properties of) products and services delivered by the project and the products and services initially intended to be delivered. Scope creep reflects the dynamic character of scope. Scope change is a broader used term to reflect this same idea. The term scope change will generally be used in this thesis after this chapter.

3.3.2 Why large engineering projects are sensitive to changes

Large engineering projects are temporary endeavours, which are undertaken to create a unique product or service (Meredith & Mantel, 2010). The unique and temporary character of these projects combined with the rapidly growing magnitude (Miller & Lessard, 2000) results in complexity and uncertainty. Complexity is elaborated in appendix B; in this literature the most important complexities which the cases should satisfy in the case selection are extracted. The most relevant dimensions for the change events are the social, organisational and the time complexity.

The complexity and related uncertainty results in events occurring that were not foreseen and this will cause unavoidable changes in the project planning (Boggelen, 2011) (Engwall, 2003). In such complex projects it is very difficult or even impossible at the initial planning stage to know which activities have to be carried out in order to deliver the project satisfactorily (Dvir & Lechler, 2004). “New insights” or “learning”, in Dutch “voortschrijdend inzicht” is generally the most frequently raised basic explanation of scope changes occurring both in literature and practice (Meredith & Mantel, 2010) (Olsson, 2004) (De Bruijn & Ten Heuvelhof, 2008) (Dvir & Lechler, 2004) (just to enumerate a few). The dynamic character of project uncertainties and the growing amount of knowledge by actors about the project context might reflect more or less on the project’s dynamic scope: the set of scope changes or “scope creep”. Mental and Iles-Smith (2009) also agree with this dynamic view of scope creep.

Scope changes could occur during the whole development time of a project. From the first scope defined in the feasibility study or business case until the delivery date of the project, different kind of changes in the project scope could come to light. The only phases that will be looked upon are the Front End Development (FED) phases as reasoned in the introduction; so the execution phase cannot be assessed. Scope changes may also occur later on. Furthermore, these changes could be prevented or not be prevented. Changes could occur because things were not adequately estimated or criticised at start. Changes might be desirable as flexibility is guaranteed (Dvir & Lechler, 2004). Projects are long-term endeavours, in which the dynamic of its environment should be dealt with. The desirability is of course quite subjective and different parties might reflect on this in different ways. So changes could be classified by the following quadrant in Figure 6.
3.4 Root causes scope change events

In this chapter all relevant literature that was studied, is framed into a unique paradigm that can be used to evaluate scope change events. Internal, external and environmental root causes of scope changes are distinguished. The literature, on which basis this division was made is summarised in appendix C.

3.4.1 Internal root causes

1. Lack in requirements (4)

1a. Learning
Learning or sophistication by the project team occurs when they are elaborating the assignment. Their business is not a single point in time, but rather a process over time. During this process, team members should incrementally come to a better solution direction. During the initiation and design, the team will learn from their intermediate findings and come closer and closer to the “right” system specifications. Requirements that were initially adopted can be rejected, because in this process new information is achieved (the team has learned). This is the most natural overall root cause and will adjoin or overlap with most of the other root causes. Learning is normal, but if too much is learned, it can be argued that the project team lacks specialism and experience.

1b. Requirements not clearly defined
Requirements may not clearly or not at all be defined, for example because not enough time and effort has been put into it. As was explained in the first section of this chapter, requirements are key in scope. The scope is defined from functional requirements gradually into system’s requirements. If these requirements are not (clearly) defined, changes in scope are likely to occur, especially when the project becomes more complex and difficult to overlook (Melton & Iles-Smith, 2009) (Levene & Braganza, 1996) (Coulson-Thomas, 1992). Here, small changes are generally added in a piecemeal way, to incrementally overcome the incomplete requirements light.

1c. Ambiguous requirements
The requirements can also be completely defined, however there is no common definition about it among the different participants and related parties. The involved parties do not try to define these requirements in concrete terms. This could be the case if not enough time and effort is taken to align the interpretations of all relevant parties. Another common explanation of ambiguous requirements is that all assume that everybody has a clear view of the requirements and its terms. Often this has also to do with the terminology. For example, if an Italian, an American and a Dutchman are talking about a pizza, they all could expect something different of it. Changes might occur when great disagreement about the definitions come to light (Dibble, 2001) (Turner & Cochrane, 1993) (Dvir & Lechler, 2004).
1d. Wrong people defining scope
Within the project organisation it is important that the right persons describe the scope. It should be high level managers who understand the overall processes and can give commitment (Long, unknown). They should consult experts to help them in the details. If this is neglected, later on in the process important requirements have the chance to be rejected (by high level project managers) and changes will occur (Melton & Iles-Smith, 2009) (Levene & Braganza, 1996) (Coulson-Thomas, 1992).

2. Lack in client involvement (3)
2a. No stakeholder involvement
If the project management team fails to involve the client, users or important stakeholders, changes are to occur (Dibble, 2001). Sooner or later, they will perceive the activities and come with their own requirements. If this happens these parties will probably intervene and are not likely to cooperate and approve the existing scope.

2b. Not enough time to understand client’s needs
If there is not enough time at the initiation phase to align all expectations, it is likely that there will be conflicts in later stadia (Dibble, 2001) (Long, unknown). This cause is closely related to the last root cause (2a) and the requirements not being clearly defined (1b). Although, here, the project management team has been proceeded to a next phase too quickly, without knowing what has been asked for.

2c. Bad relation with client
A bad relation with the client or users might cause a hostile attitude resulting in bad communication between project team and those parties. In this case the client’s wishes might not be well adopted. Value conflicts are postponed and likely to occur in later phases. In this case, scope changes are hardly inevitable in order to keep the stakeholders at least slightly satisfied (Dibble, 2001).

3. Interfaces not defined
Defining the relevant interfaces in the project is very important. If these interfaces are clear, the influence on and interaction with other projects are identified. Now the relation of the (sub)project on other (sub)projects is well-known, the impact can be estimated and negative influences could be mitigated. If the interfaces aren’t defined, it will not be clear what the impact will be on other (sub) projects. These will appear later on and scope changes, concerning at least one of the projects, are likely to occur (Long, unknown) (Levene & Braganza, 1996) (Coulson-Thomas, 1992) (Dvir & Lechler, 2004) (Turner & Cochrane, 1993).

4. Flexibility
It will be clear that flexibility in the project could drive scope changes as it implicitly states that something could change (Olsson, 2004) (Olsson, 2005). However, as explained in appendix C, flexibility doesn’t have to lead to a scope change. The choice of flexibility is a strategic one. In addition, flexibility has a negative impact on efficiency (as the original plan is the benchmark for key performance indicators). Nevertheless it has generally a positive influence on effectiveness as the project plan is able to adapt to new circumstances. This paradoxical statement will be analysed more deeply later on.
5. **Feature creep**

Feature creep can be the source of a sequence of scope changes. In this case, the project team adds new functions that are not asked for, but might be useful. Especially technical specialists tend to apply what is technologically possible, adapting their plans to available novelties (Melton & Iles-Smith, 2009).

3.4.2 **External root causes**

6. **New Requirements (3)**

6a. **Learning**

Next to learning in the project team, also the client will probably learn a lot during the project. In most of the projects, the client will have few or no expertise in the (technical) substance. During the process they will notice they haven’t got a clear view of their expectations. They are likely to adapt expectations, because of sophistication: by learning more about the substance they could get another view on the project. Many scope changes originate from this mechanism (Meredith & Mantel, 2010) (Dibble, 2001). Like learning internally, learning externally is one of the most natural root causes.

6b. **Change in market conditions**

Often scope changes are associated with cost and schedule overruns. Conversely, changes in the three project dimensions (cost, schedule and quality) because of change in market conditions could induce scope changes. If the client is faced with changing market conditions, he could see his business prospects change. The expectations of the project result will be adapted: in order to do so, the project’s scope may be adapted. In example, if the market is likely to shrink, the client could decide to omit a part of the project’s scope (Melton & Iles-Smith, 2009) (Dibble, 2001).

6c. **Wrong people defining scope**

If the wrong people from the client’s or users’ organisation are defining the scope, also scope changes could occur. This works identically to the internal root cause (1d). However, now from the client’s origin there should be high level managers who have a very comprehensive understanding of the business and its issues. It should be the responsibility of this group to define the boundaries of the process. If this is not the case, important managers within the client’s organisation could see their business area being affected by the project and demand for a change (Long, unknown) (Dvir & Lechler, 2004) (Turner & Cochrane, 1993).

7. **Stakeholder multiplicity (3)**

Stakeholder multiplicity is referred to as the complex interactions of stakeholders within a network of actors (Neville & Menguc, 2006).

7a. **Many users**

The more users there are, the more different possible opinions there could be. Furthermore, users and owners are likely to be more positive towards changes aimed at an increased effectiveness (Olsson, 2004). Effectiveness is related to flexibility and scope changes as explained in root cause 4. Because of the flexibility, the scope is able to change and be adapted to new wishes of the users or
other important stakeholders. The more users (combined with a large social complexity), the greater the risk of scope changes because of this mechanism.

7b. Client/user disagreement
This root cause is quite obvious. The fact that changes could occur has to do with the network of actors which is applicable here. Certain trade-offs are being made between those parties and negotiations could go on further in the process. It is possible that the client or one of the users will change its opinion, when one of them gives up his commitment. A new arrangement will be made and scope changes could be the result (Olsson, 2004).

7c. (other) stakeholder disagreement
This root cause is related to the previous one (7b.), but now not related to the client or users, but to other important stakeholders. This root cause is separated, because these stakeholders are not directly, but indirectly related to the project. The chance on these root cases is smaller, as they have more distance to the project, but their influence might be equally large (Olsson, 2004).

8. Lack in process definitions (2)

8a. Inaccurately defined processes
This root cause especially arises at the client’s side. If the client’s company can’t define its own business processes, the project team will be unable to get a good understanding on the functional requirements. Later on in the project, possibly new parts of the business process will be encountered and the system that will be build should be adapted to those “forgotten” functional requirements (Long, unknown).

8b. No recognition of interfacing processes
This root cause is related to the previous cause (8a). However in this case, the client hasn’t recognised the interfacing processes related to the business process the project is aiming at. If the interfacing processes aren’t clarified to the project team, it is unable to take these into account. If these processes appear to include certain crucial requirements, scope changes should be made (Long, unknown) (Levene & Braganza, 1996) (Coulson-Thomas, 1992). An example might clarify this root cause: a corridor for passengers will be built in a certain project. The related business process is the transfer of passengers. An interfacing process might be the cleaning service of this terminal resulting in a cleaning machine that has to pass this corridor. If this interfacing process has not been taken into account, the corridor might end up being too narrow for this machine.
3.4.3 Environmental causes

9. Uncertainty in technology
Some of the technological methods used in a project might be new or in strong development, which is subjected to changes (Meredith & Mantel, 2010) (Dvir & Lechler, 2004) (Turner & Cochrane, 1993). The technique could already be outdated, while the project still progresses. In these cases, changes in scope might be made in order to update the system. Another possible appearance of this root cause comes up when a technology hasn’t been proven and it turns out to be undesirable during the project. As this root cause is not stakeholder driven, this cause is out of scope of this research.

10. Modification of rules
If the rules are changed during the project, also scope changes could be necessary to continue the project (Meredith & Mantel, 2010). This root cause is also out of scope of this thesis as it is not stakeholder driven. Furthermore, it is not a common cause in the FED.

3.5 Intermediate conclusions

Scope creep can be seen as the dynamic character of scope: a set of scope changes. These changes could be preventable or unpreventable. Additionally, the desirability of a scope change could be different in every event. In literature different causes of scope changes have been identified. Different causes were classified and a list with overall causes was made (Figure 7). In the end, all causes were framed into three dimensions:

- Internal root causes
- External root causes
- Environmental causes

![Figure 7 Root causes of scope changes](image)

The environmental root causes will not be considered here as it doesn’t contribute to stakeholder driven scope changes in the FED. However, their existence should be kept in mind, during the case research.
4 Management approach

4.1 Introduction

In this research, scope change events are being looked upon. The first thing that happens after the intervention of a stakeholder (which leads to the scope change) is a reaction from the project manager. He can manage this scope change event in different ways. There are different ways for a project manager to manage such circumstances. There are two different basic approaches for managing projects: project and process management (De Bruijn, et al., 2010), (Boggelen, 2011), (Op de Woert, 2013). In practice, not one of these approaches will generally be applied on its own, but rather a mixture of the two will be encountered. One of the approaches, however, can be appointed in most cases as the dominant approach. Here, the literature and characteristics of these approaches will shortly be summarised. In this way, the management approaches used in the cases (in the different scope change events) will be compared to the table presented in this chapter and the dominant management approach can be appointed.

4.2 Traditional project management

Traditional project management is characterised by “predict and control” (Veeneman, 2012). The project planning is focussed on in the FED. The scope is set, the schedule is accurately planned, the costs are estimated and the tasks are clearly put into a work brake-down structure. In the execution phase, the focus lies on “control”. The process is analysed, deviations are corrected and the set milestones are monitored. Some of the strengths of this approach are the fact that everything is thoroughly analysed before action and the system can be decomposed and integrated again. (Veeneman, 2012). The direct project goals are meeting the time, cost, scope and quality (project variables) requirements (Meredith & Mantel, 2010). An additional strength of this approach is that the project variables are accurately aligned and efficiency is increased.

4.3 Critical remarks on traditional project management

The latest years, many shortcomings of project management are recognised. In complex projects like large infrastructure projects, delays and cost overruns are common. Many projects have strikingly poor performance records in terms of economy, environment and public support (Flyvbjerg, et al., 2003).

In Project management we tend to respond to a need for easy, generic and pragmatic solutions, whereas reality is, as always, complex, ambiguous and changing (Geraldi, 2008). Also De Bruin et al. (2010) reveal the weaknesses of traditional project management. In a project approach it is assumed that problems and solutions are reasonably stable within certain limits. A clear goal, a time schedule, a clear framework and a predefined end product can be used and will result in a linear and structured decision making process. The weakness here, is that one presumes a static world. In reality, the environment and even the project organisation itself are subjected to dynamics.
The changing world causes changes from the predictions that were already done. Flexibility might be needed to handle changes in these predictions (Olsson, 2004). Another insufficiency of project management is that it assumes that a project manager controls the whole project and can steer the project hierarchically. In most complex projects a network of actors is relevant rather than an hierarchical structure (De Bruijn & Ten Heuvelhof, 2008). This network of actors can even change itself during the project resulting in a dynamic field of actors which makes traditional project management not adequate anymore.

### 4.4 Process management

The other management approach, opposite to traditional project management, is process management. Process management is characterised by “prepare and commit” instead of “predict and control”. Changes are inevitable in every large project, instead of controlling them process management advocates to prepare for them and to commit the project actors.

In complex projects the decision making is often complex because of a network of actors, which assumes that different actors are interdependent. In this complex decision making, any knowledge is biased through its owner, every actor behaves strategically and has a different value system. Thus, process management suggests that best solutions are found when negotiating on and sharing of knowledge, conditions and possibilities of solution space (Veeneman, 2012).

The project manager should design the process. De bruijn et al. defined the 4 core elements of such a process design:
- Openness
- Protection of core values
- Progress
- Content

They state that a good process design is characterised by the open attitude of the initiator. Participants will only consider the environment safe when their core values are being protected. The openness of the process and the protection of the participants could slow down the process. Therefore progress should be incentivised. At last, all these elements could result in too much focus on ‘keeping the process going’. Therefore arrangements should be made to ensure sufficient substantive input.

In the cases, the above descriptions of the project and process approaches will be used to identify the dominant management approach in each change event. Therefore it is important to have a framework in which the differences between both approaches are made clear. The framework about these differences described by Boggelen (2011) is in line with the descriptions used in this thesis and is showed in Figure 8.
4.5 Management style to deal with scope change events

In relation to change events, the management approaches both have opportunities. On the one hand good project prediction and control help to avoid changes (Dibble, 2001) (Levene & Braganza, 1996) (Coulson-Thomas, 1992) (Olsson, 2004) (Dvir & Lechler, 2004) etcetera. However on the other hand one should expect changes and prepare for it (Olsson, 2004) (Dvir & Lechler, 2004) (De Bruijn, et al., 2010) (Samset, 2000) etcetera. So both project and process management approaches are related to changes.

There are however two different situations that should be distinguished. First, one of the two management approaches is leading in the project and changes can be related to that. Second, a change situation does occur and within this event the project manager reacts with a certain management approach. So it is possible that the dominant management style in the project as a whole will be different from the approach that is used as a reaction within a scope change event.

So there are two relations between change processes and management approaches. The overall management approach within the projects is revealed in the context and influences the structure and arrangements. Besides, the management approach in the change event is a reaction from the project manager to a intervening actor. Both should be incorporated in this research. The best management approach dealing with changes in practice will depend on the circumstances and might become clear in comparing the different cases.
4.6 Intermediate conclusions

In this chapter a distinction between project management approaches was made. Traditional project management is characterised by a “predict and control” management approach. Disadvantage of this approach is that it presumes a static world, while in reality it is dynamic and project circumstances change. Process management is the opposite management approach, that presumes a changing world and is characterised by a “prepare and commit” strategy.

In practice, not one of these approaches will generally be applied on its own, but rather a mixture of the two will be encountered. One of the approaches, however, can be pointed out in most cases as the dominant approach.

In the cases the dominant approach should be researched. Primarily, the dominant management approach as a reaction to the intervention by a stakeholder initiating the scope event should be analysed. Besides, the overall leading project management style in the project should be evaluated in the context.
5 Interactions

5.1 Introduction

As is focussed on scope changes driven by the different stakeholders, these stakeholders are key in this thesis. The project stakeholders are those actors which will incur – or perceive they will incur – a direct benefit or loss as a result of the project (Winch, 2010). There is a distinction between internal stakeholders, that are part of the network operator’s organisation and external stakeholders. Companies are part of an external network: they depend on the support of external parties (De Bruijn & Ten Heuvelhof, 2008). So the organisation itself cannot decide who is stakeholder and who is not. However, it should deal with them by stakeholder management, which is an important source of success in a project.

Next to the management approach described in last chapter, also stakeholder management should be performed in scope change events. Stakeholder management aims to formulate and implement processes which satisfy all and only those groups who have a stake in the project. Especially the long term success of the firm should be kept in mind by managing and integrating the relationships and interests of all those parties both internally and externally (Hit, et al., 2001). Interaction is a mutual or reciprocal relationship or influence with stakeholders (Plaza-Úbeda, et al., 2010).

There is many scientific literature available that has to do with interactions between stakeholders. However, most of this literature mentions interactions rather than analysing it deeply and making a clear framework. Most of the frameworks that were found in the literature were quantitative (Hermans & Thissen, 2009). Hence, there is a lack of qualitative approach in literature about interactions. An extensive literature review is showed in appendix D.

In this chapter, first the “network of actors” paradigm will be clarified in which interactions take place. Furthermore an analysis has been made in which 4 questions (on the basis of the literature observed and common sense) are summarising the essence of the framework that should be build in order to structure all this different literature. The framework is a result of observed literature that was combined. It is important to keep in mind that a distinction is made between overall interactions in the project and the interactions within a scope change event. Only the interactions in the scope change event itself will be relevant.

5.2 Network of actors

The weakness of the current academic understanding of corporate social interactions lies in the traditional idea of discrete, dyadic, hub and spoke relationships between stakeholders (Neville & Menguc, 2006). However a potential network of different relationships between organisations and stakeholders is lacking here (Frooman, 1999) (Rowley, 1997). So in networks complex social interactions take place which are called stakeholder multiplicity by Neville and Menguc. It should be observed that stakeholder multiplicity was one of the basic root causes of scope changes.
An organisation in which different societal interests are institutionalised is likely to have a network character (De Bruijn & Ten Heuvelhof, 2008). Such a network is defined as: “a number of actors with different goals and interests and different resources, who depend on each other for the realisation of their goals.” These networks could exist both within the organisations and between different organisations (De Bruijn & Ten Heuvelhof, 2008). So, most network operators have an internal network and are part of an external network as well.

In the initiation phase of the project the formal client, the owner of the project, will make a feasibility study and will contact the senior users (these could be internal actors or external actors) and, if applicable, the senior suppliers. In the decision making process, it is important to involve them to generate support and create a sense of urgency as these parties are mutually dependent in a network of actors (De Bruijn & Ten Heuvelhof, 2008). The following interaction can be observed in such situations.

However, as Thompson states, the owner selects a project team that will manage the project (Thompson, 1991). This project team will have the owner of the project, their principle, as a formal client. The users, who are important stakeholders, will have their own opinion and interests, which the project manager should deal with. New interfaces and interactions will be the result as is shown below.

The stakeholders are divided in three groups as is shown in Figure 10, which all have their interrelations. However, there are two ways to interact with one group, directly and indirectly. It could for example happen that the principle interacts with the user via the project team (and the other way around). This interaction is strengthened if the project team is in the same parent organisation as the principle/project owner. On these interfaces the interests of the different parties could clash and, scope changes could occur, by the interactions that take place.
5.3 Analysing interactions

Because there isn’t much literature about the qualitative analysis of the interactions itself that focusses enough to create an analytical framework, it is important to first define what is needed here to evaluate the interactions. This has been done on the basis of the literature review in appendix D and questions that arise from looking ahead on the practical cases. The essence of the interaction between stakeholders here can be summarised in 4 questions:

- Who interacts?
- What was the source of the interaction?
- What was the nature of the interaction?
- What was the conduct of the interaction?

The first question can easily be answered by looking at a stakeholder analysis, in which also the interests of the different stakeholders can be extracted. The second question is also very easy to answer. This could be a meeting or email etc. The third question is more difficult as the way of interaction should be analysed by its characteristics. So a list of characteristics should be identified through literature studies, in which different aspects have been found. Another important aspect of the interaction is what conduct is the result of the interaction, this conduct can be related to effectiveness or success in chapter 7.

5.4 Nature of interaction

The nature of interaction can be extracted from the literature review that can be found in appendix D as most of the relevant information covers this aspect of the interactions. From literature studies becomes clear that “trust” is the most linked term to interactions. Also “involvement” and “stakeholder relationship” are often mentioned as important contributors. At last “power” and “communications” are associated with interactions, while learning is more seen as a result of it.

Trust could be divided into self interested trust (trustworthy in the future) and socially orientated trust (trustworthy in the past) (Winch, 2001). Vulnerability, credibility and openness are factors that can indicate this trust (“culture” is not integrated here) (Atkinson, 2004).

Involvement can be classified in 6 different types that were described by Ives and Olson (1984).

- No involvement (users are not willing or not invited to participate)
- Symbolic involvement (user input is requested, but ignored)
- Involvement by advice (users are asked for advice through interviews or questionnaires)
- Involvement by weak control (users have approval responsibility at each stage of system development)
- Involvement by doing (the user is also member of design team)
- Involvement by strong control (users are paying directly for new development out of their own budgets)
Stakeholder relationships can be divided in 4 types: power based, collaborative, conflicting and one-sided (Onkila, 2011). Power based relationships are partial overlapped by the dimension “power”. Power can have three faces according to Winch’s (2001) framework, (that might indicate the magnitude of a stakeholder’s power):

- The ability of A to directly influence the decision by B (overt power)
- The ability of A to set the range of choice available to B (agenda setting)
- The ability of A to create a culture in which B does not consider options unacceptable to A (hegemony)

At last, communication can have different forms, divided in 3 evaluation criteria (Plaza-Úbeda, et al., 2010).

- Unidirectional versus bidirectional communication
- Formal versus informal communication
- Regular versus occasional communication

Oral versus written communication will be clear from the source analysis.

The framework of the nature of interactions is shown in Figure 11.

<table>
<thead>
<tr>
<th>Trust</th>
<th>Involvement</th>
<th>Stakeholder relationship</th>
<th>Power</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self interested</td>
<td>No involvement</td>
<td>Power based</td>
<td>Overt power</td>
<td>Unidirectional versus bidirectional</td>
</tr>
<tr>
<td>Socially orientated</td>
<td>Symbolic involvement</td>
<td>Collaborative</td>
<td>Agenda setting</td>
<td>Formal versus informal</td>
</tr>
<tr>
<td>Indicators:</td>
<td>Involvement by advice</td>
<td>Conflicting</td>
<td>Hegemony</td>
<td>Regular versus occasional</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>Involvement by weak control</td>
<td>One sided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Credibility</td>
<td>Involvement by doing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness</td>
<td>Involvement by strong control</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 11 Framework on nature of interactions

5.5 Intermediate conclusions

Three aspects of interactions should be sorted out. First, the actors who interact have to be identified. Second, the source of this interaction will be looked upon. At last, the nature of the interactions should be determined. The nature of interactions is characterised by the level of trust and involvement, the stakeholder relationship, and the level of power and the style of communication.
6 Context variables

6.1 Introduction

The project context is considered to be the complete project environment and consists of an unlimited amount of variables (Boggelen, 2011). This means that not all variables can be taken into account, however a few will be looked upon. The interactions and management approach of the previous chapters are considered separately outside of the context. This was done, because these two subjects can be influenced in scope change events, while other variables are more or less set by the project or the organisation or cannot be controlled in the event. Now a few variables should be investigated that influence the outcome of change events from the environment. Weck (2005) concluded in her research project that the management of a change depends on the characteristics of the change and the project context. So also the context of as change event has an high impact on the way the event can and should be dealt with.

The purpose of this chapter is to elaborate some specific variables from which it is desirable to know the influence on the cases. In the case studies, these variables can be taken into account and the influence of this context can be assessed. As mentioned in the research methodology, the project structure and arrangements are related to the interactions and will be considered as a context variable. The timing of the change event and the financial impact will be taken into account as additional contextual variables. The financial impact of the different scope changes in the Schiphol One-XS project appeared to be very diverse. From this perspective it was decided to incorporate this variable. At last, some projects seem to have a change procedure. The presence of such a procedure is explored.

6.2 Structure

There are three important levels of structure that are of contextual importance:
- organisational structure
- project managements structure
- external structure

The structure of a company’s organisation and the structure of the project team could be important. Moreover, the structure of the network of actors (or most important parties) is less evident, but also important.

Structure regulates responsibility and coordination (Veeneman, 2012). Structure is related to the management approach: an overreliance on one of the management approaches in structure should be compensated in the arrangements (Koppenjan, et al., 2010). This also exposes the relation between structure and arrangements. Structure is about the relations, arrangements is about the rules (between those relations) and interactions can be observed real time during the process. Structure is the first instrument to manage social complexity.
6.2.1 Organisational structure
If there are large companies involved it might be useful to take into account their organisational structure. In the case of Schiphol Group or Prorail, which will be used in this thesis, there are many parties involved in one firm, including the project management party. In example, the internal (stakeholder) structure of Schiphol Group in relation to the One-XS project can be found in Appendix E.

6.2.2 Project management structure
The project management team, which is the “central stakeholder” in construction projects, has a structure on its own. In the cases considered in this thesis, the project management team is an internal department of the parent organisation. In many project management teams a certain project management method is used such as: PRINCE 2 and PMBOK. In addition they might have their own variant on a management method. In example, Schiphol uses PRINCE2 and on this basis they created their own variant: STAP (standard aanpak projecten). The project management structure is partly dependent on the structure prescribed by those standard approaches.

6.2.3 External structure
To begin with, it is useful to categorise the different types of stakeholders and after that the stakeholders should be mapped (Winch, 2010). It will be obvious that a stakeholder analysis is necessary here.

In the FED of complex projects the client is in most cases differentiated and will not be the user itself. In this case a distinction can be made between formal client and user clients. Especially with large network operators like an airport, this is the case. In addition, in many cases, these large companies have their own support units like a project management office (i.e. Schiphol and Prorail).

In the FED of a large construction project within a network operator’s terminal, many parties are involved. As explained, these parties form a network of actors. According to Thompson, the owner of a project must provide clear direction and timely decisions, and must assist the project-management team to drive the project to a successful conclusion. He must accept the risk associated with the enterprise, and assume particular responsibility for (Thompson, 1991):

- the selection of the project team,
- thorough appraisal and realism over risk,
- championing the project in the political and public arenas.

In the external structure, there is a variety of forms (Veeneman, 2012):

- (Project manager)
- Client
- User
- Designer
- Builder
- Operator

6.2.4 Managerial characteristics structure
The importance of these structures in this thesis are its characteristics: especially the project management structure and external structure. As was pointed out: structure is the first instrument to
adapt management approaches in order to control social complexity. It is strongly related to management approaches and a structure can be evaluated having project-oriented and process oriented aspects. Here a framework will be presented to highlight the different features or elements that structure can have.

Features of structure are (Veeneman, 2012):

- Hierarchy versus network: Is the structure characterised by command and control or negotiated knowledge?
- Technical versus organisational: Lies the emphasis on the technical tasks or is a structure applied which is mainly focussed on the organisational (theoretical) system breakdown structure?
- Coordination versus competition: there are two reasons that can drive the organisational structure. The emphasis may be on the technology: here a strong coordination and integration of the different subsystems is applied and is characterised by integrated contractors. On the other hand, the emphasis may be on competition by the market. The market has gone the way of fragmentation and specialisation. Specialists are more efficient and economical so a larger number of contractors are being hired and the project structure becomes more differentiated.
- Asparagus versus spaghetti: nice and neat structure versus structures which are capricious where everyone interacts with anyone.
- Clarity versus overlap: Is there a clear distinction of tasks (to get focus) or is there redundancy through overlap (to manage the interfaces).

![Table of project structure]

**Figure 12 Project structure**

### 6.3 Arrangements

Institutional arrangements are sets of laws, regulations, and agreed to practices that form symbiotic relationships and provide effective ways of developing projects (Miller & Lessard, 2000). Scott describes them as “regulative, normative and cognitive structures that form social frameworks and give meaning to behaviours” (Scott & Meyer, 1994). Next to structure, arrangements are important instruments for management. An example of an arrangement is a contract. There is a clear link between arrangements and structure and interactions. While structure regulates responsibility and coordination, arrangements regulate interaction and control (Veeneman, 2012). Structure is only designed once in a project. There might however be multiple arrangements with multiple actors.
There are several key components in institutional arrangements (Miller & Lessard, 2000):

- Legal and regulatory frameworks (these set the rules of the game)
- Roles of the players
- Practices (types of contract regarding time, budget, scope definition etc.)
- Shared assumptions and communities of practice (basic set of assumptions about the way to work)
- Structures for solving collective-action problems (also set the rules of the game, but now they help to anchor the project. Could involve boundary conditions)

Arrangements can be described in the form of a contract. On the other hand, also agreements between parties can be considered as arrangements (even formal oral agreements). They also can be described in the shape of procedures. Many project management organisations agreed to work with standard project management methods like PRINCE2. This implies that there are also arrangements locked in such a system. These protocols are generally applicable in the project management structure and in some cases (when the PM team is part of the client’s organisation) within the organisational structure. Also the external structure could contain such protocols, but now all parties have to agree or sign these arrangements as not every party will use the same management method in the same way.

What is important for this research is that these arrangements can be approached in different ways: in a project management way or a process management way. Here the link between arrangements and management approaches becomes clear once again. However, the management approach of dealing with the scope change event should not be mixed up with the management approach of the project as a whole (a contextual variable), although it contains the same framework.

Veeneman (2012) came up with such a division between project and process management elements in arrangements. He made a distinction in the different elements concerning a contract:

- Parties: bilateral contracts versus multilateral
- Specification: Blueprint versus functional
- Conditions: controlling versus commitment
- Remuneration: lump sum versus performance dependent
- Performance indicators: Object versus actor

These elements of a contract are very similar to the key components of institutional arrangements. For this thesis these are used for this framework. The last element (remuneration) is included for completeness, but aren’t likely to be encountered in the cases as the FED’s of the different projects are being looked upon.

<table>
<thead>
<tr>
<th>arrangements variables</th>
<th>project element</th>
<th>process element</th>
</tr>
</thead>
<tbody>
<tr>
<td>role of the parties</td>
<td>bilateral</td>
<td>multilateral</td>
</tr>
<tr>
<td>specifications</td>
<td>blueprint</td>
<td>functional</td>
</tr>
<tr>
<td>conditions</td>
<td>control</td>
<td>commitment</td>
</tr>
<tr>
<td>performance indicator</td>
<td>efficiency</td>
<td>effectiveness</td>
</tr>
<tr>
<td>remuneration</td>
<td>lumpsum</td>
<td>performance dependent</td>
</tr>
</tbody>
</table>

Figure 13 Arrangements
6.4 Resource availability

The resources in terms of time, money, people and knowledge available are part of the project context that may influence the decision making in change events (Boggelen, 2011). Changes could have a different impact, especially in terms of finance and time. As the consequences in especially these variables change, also the decision making (process) will change. This also becomes clear in the different change protocols that different companies have. Managers have typically mandates for change until some level of financial or time impact.

<table>
<thead>
<tr>
<th>Resource availability variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
</tr>
<tr>
<td>Capital</td>
</tr>
</tbody>
</table>

Figure 14 Resource availability

6.5 Moment in time

In addition, it is relevant for the process around the change event to look at the moment in the project timeline (of the front end development) this event takes place. The circumstances of a change event early in time could obviously differ from the circumstances in a late change event. Project management methods such as Prince 2 use clear distinctions in project stages in the FED. Those stages can be used to appoint the change events’ moment in project timeline.

6.6 Change procedure

Project management organisations might have fixed change procedures to help to control them. The occurrence of these procedure within a project and its content could be useful contextual variables. In the case study part this can especially be interesting because in the One-XS project a change procedure was adopted later on in the project. The result is that some of the changes were subjected to a change procedure, while others did not. Thus, there are two things that have to be extracted from the context of a project:

- Was there a standard change procedure?
- Was this procedure more project- or process oriented?

6.7 Intermediate conclusions

Five different context variables will be taken into account in this research:

1. Project structure
2. Project arrangements
3. Resource availability in the change event
4. Moment in time line during the project
5. Existence of a change procedure
7 Measuring success (dependent variable)

7.1 Introduction

The different moments of scope change and the influence of the management approach and context variables should be evaluated in the case analysis. Therefore the outcome, what was successful in the considered moment, should be framed in order to make the different cases comparable.

The difficulty here is that no entire project is evaluated, but a predefined moment of scope change. If the entire project was evaluated, it would be impossible to clearly analyse the variables and circumstances in the considered moments in this thesis. Another issue is that only the FED is considered and typical success factors associated with the execution phase cannot be included here. So a new or adapted framework has to be developed to make the cases in this thesis comparable.

In order to do this, first important factors of success that were found in literature about scope changes were collected. Then some existing types of frameworks were looked upon. Additionally, the project manager was asked what his perception is on important success factors in projects. In the end a new framework that will be applied in the cases was developed.

7.2 Success factors in scope change

There is an abundant amount of literature available about success and failure in projects. Almost all scientific written documents on project management contain implicitly or explicitly factors of success and failure. The literature considered in this section contains such factors, but this literature was more focused: all articles were related to scope changes.

Most of the reasons for project failure point to inadequate scope definition (Levene & Braganza, 1996) (Coulson-Thomas, 1992). They suggest that ensuring that both scope and implementation are properly determined is a critical for project success. Melton & Illes-Smith (2009) counter this by stating that changes in requirements are necessary for project success.

Boddy (1993) also identified four “most influential” factors for success. He analysed both theory and practice by interviewing several project managers. These 4 factors are:

- Outside links (to and from other projects)
- Changing goals (priorities and market development)
- Variable ownership (lack of responsibility)
- Senior stance (lack of support and unrealistic expectations)

The first two factors focus not only on the need for adequate scope definition, but also an awareness of its changing nature and therefore a need for a strict control of the scope.

Olsson (2004) again makes clear that there is a tension between flexibility and a clear project definition. On the one hand, he makes a link between a clear project definition and project success, as was researched by many authors. On the other hand, he shows that there are also scientists who argue that flexibility in projects is important for success as it is necessary to face the changes and
uncertainty in the business environment. So parts of both flexibility and clear scope definition should be attempted to combine. In relation to scope changes and flexibility, Miller and Lessard (2000) argue that late locking is a key success criteria for large engineering projects. Samset (2000) reasons that project success depends on the use of a distinct strategy in combination with sufficient tactical flexibility (late locking is an example of such tactical flexibility).

Dvir and Lechler (2004) did research to the impact of changes on project success. They state that the original project plans and goals will have to be changed to address the dynamics caused by uncertainty, and to maximise the project success. So changing plans are indirectly related to project success. On the other hand they state that changes in a project could cause high transaction costs. Transaction costs have a negative impact on project success. So changes have an ambiguous impact on success. They recognise that measuring success is a difficult thing to do; simplistic relations, such as coming close to budget, schedule and achieving acceptable levels of performance could be used by project managers. However, several authors state that these measures are sometimes misleading.

The origination and initiation phase of projects (FED) has the greatest influence on project success (Dvir & Lechler, 2004) (Dvir, et al., 1998). The most important decisions are being made in this phase and the plans are made in a certain degree of detail. The preparation of formal design and planning documents has next to a positive effect on time and budget, also a positive effect on customer benefits. Furthermore Dvir and Lechler (2004) come to the conclusion that project managers are not aware of the consequences of frequent changes and don’t have the proper tools to deal with changes efficiently. They came to that conclusion because of the practical strong negative influences of frequent goal changes on project success. So they implicitly explain here the earlier explained paradoxical or ambiguous character. In their eyes changes should theoretically contribute to project success as the effectiveness is likely to increase. In practice, project managers have troubles with efficiently coping with these changes resulting in a negative impact on project success. This implicitly shows the tension between efficiency and effectiveness. In the end of their research they came to the conclusion that goal changes have a negative effect on success, while plan changes could have a negative effect, but not necessarily.

Many authors like (Murphy, et al., 1974), (Dvir & Lechler, 2004), (Bryson & Bromley, 1993) and (Pinto, 1986) have been shown that technological uncertainty has a negative impact on success in projects. Bryson and Bromley (1993) came also to a success factor by turning this the other way around: stability has a positive impact on project success.

Pinto and Mantel (1990) distinguished three aspects of project performance: the implementation process, the perceived value of the project and the client satisfaction with the delivered project outcome. Shenhar et al (1997) applied three criteria in their research to measure project success: meeting design goals, benefits to customers and commercial success and future potential. Obviously, each stakeholder will perceive its benefits differently. So by assessing these criteria, the success measures will vary for each stakeholder. As not every stakeholder is equally important, relative importance factors should be assigned to create an effective measure of client satisfaction.
Lipovetsky et al. (1997) also did research to the measuring of project success. Beyond that, they also searched for the most important success factors. They found 4 dimensions similar to the ones of Shenhar:

- Customer satisfaction
- Efficiency (of meeting design goals)
- Commercial success
- Future potential

They came to the conclusion that customer satisfaction is by far the most important criterion, twice as important as efficiency. Commercial success and future potential are according to these authors almost negligible.

Atkinson et al. (2006) mention different success factors in projects. They came to the conclusion that in every project the success measures are different. They make a distinction between hard and soft projects. Hard projects’ goals are clearly defined and less complex, while soft projects’ goals are less clearly defined and more complex. This is quite similar to the project and process success described in the next section. For hard projects the more quantitative success measures (like cost, time and quality) should be applied. Although, in soft projects more qualitative success measure (like customer satisfaction) that recognise the validity of different perspectives and worldviews should be applied. They also introduced an extra success criterion, which can be used during the projects: trust among parties. Moreover, any lack of trust can produce a dynamic that serves to ratchet up control mechanisms, thus preventing success (J.Coopey, 1998).

### 7.3 Frameworks on success measures

Because of only considering the effect of scope changes in FED and the fact that the One-XS project of Schiphol almost starts its execution phase, other success factors should be used than the most “usual” project success framework (Meredith & Mantel, 2010) (Winch, 2010) as is showed in Figure 15. This is because these factors need a longitudinal research period and can’t be measured yet after the FED.

![Figure 15 usual project success framework](image)

Another framework that is found in literature is the framework of process (management) success. Different sources give similar frameworks on the more “soft”, ambiguously defined and complex (especially social complexity) projects. Process success is the measurement of successful management from a process management point of view. This is the approach from a multi-actor perspective. The stakeholders, in this case users, will generally not be interested in the project success factors, which are goal-rational. Key stakeholders must be satisfied with the solution (Bryson,
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

2004). If the process of scope development is reviewed from a multi actor perspective, other criteria come to surface.

In a process approach, the evaluation is not goal rational because of 4 reasons (De Bruijn & Ten Heuvelhof, 2008):

- different parties can have different aims
- Parties can change their goals, as they may have learnt during the process
- Parties can also participate without having a goal
- The satisfaction of one stakeholder can be influenced by the outcome of other processes, which are coupled in a multi issue agenda.

Other criteria than the project management criteria are applied when processes are evaluated in a network. Different literature is available about these criteria. De Bruijn and Ten Heuvelhof (2008), summarise these criteria into questions, from which 5 are applicable in this research: Have goals including new goals been realised? Do parties perceive the results as satisfactory? Have the parties learned? Was it a fair process? Have lasting relationships developed that will facilitate future cooperation? The factors of process success are showed in Figure 16.

![Figure 16 process success factors](image)

Furthermore, the framework of Dvir et al (1998) will be introduced. They have built a framework containing success dimensions and measures which partly overlap the previous two introduced frameworks (see Figure 17 ). The “meeting design goals” dimension is very similar to the traditional project management framework in which quality is replaced for functional and technical specifications. The benefits for the customer is new, although some of these measures are similar to “realisation goals” and “stakeholder satisfaction” in the process success framework.

![Figure 17 Success dimensions and measures Dvir et al (1998)](image)
As success in projects is the most important performance indicator to project managers and (depending on the structure) to their principles, the success of the FED phase should also be qualified by project managers themselves. Not time, cost and quality are dominant factors in this phase, but scope and especially the scope development are important factors. Consequently, a practitioner’s framework is presented. By interviewing the overall project manager of the one-XS project (the major case in this thesis), a new framework was created from the project management team’s perspective. It is very important to know what the relevant practitioners understand by success, especially in cases were the actual end-product can’t be measured yet. The condition of success achieved in the FED was key in the configuration of this framework. The project manager analysed his duty as overall manager and the key success factors attached to it. Crucial was the task of making sure all involved temporarily groups of stakeholders could reasonably get along with each other in the process. The most important related aspects of the practitioner’s view are:

- Allowing parties to have a position and identity in the project
- Maximise solution space
- Respect the motives of project parties

Thus, another type of success measures should be applied considering the FED phase and eventually scope changes. In addition, it is important here that the scope was developed in a satisfactory way. The project framework cannot be used here, as no actual cost, time and quality can be measured yet. However, the further developed project plan could be assessed in order to check if the estimated budget and schedule in the business plan are still valid. Instead of quality, the functional and technical specifications can be assessed in this phase.

From the literature, the process framework and Dvir et al. ‘s framework, stakeholder satisfaction appears to be (one of the) most important success factors. Also from literature we found out that technological stability is an (external) important success factor. Furthermore, one of the most important findings in literature is the ambiguousness of changing goals being a factor of success or failure. This was related to the contribution to either effectiveness or efficiency. That is why here success dimensions (as used in Dvir et al. ‘s framework) were chosen to distinguish the different kind
of success measures. The dimensions used here are consequently efficiency and effectiveness. For efficiency it is important that the original goals were realised, while for effectiveness, additional new goals should be realised as well.

In the practitioners’ framework some overlap with the process management framework can be found. The “allowing parties to have a position and identity in the project” can be linked to “fair process”. “Respect the motives of the project parties” is very equal to the core element “protection of core values” of the process management design as stated by De Bruijn et al. (2010). Maximising the solution space is another important factor that isn’t stated in other frameworks, but will be incorporated in the framework as it comes from a practitioners’ point of view. Finally, the realisation of lasting relationships (from the process framework) will be included. This one is especially important here, because it assesses the project after the FED. Lasting relationships are very useful with a view to the progress of the remainder part of the project, when renunciation of stakeholders’ commitment should be avoided. The learning process of the users (from the process framework) will not be included. This is already assumed to be one of the root causes of scope changes. The composed framework of success measures is shown in Figure 19.

<table>
<thead>
<tr>
<th>Success dimensions</th>
<th>Success measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>efficiency</td>
<td>technological stability</td>
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<tr>
<td></td>
<td>realisation original goals</td>
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<tr>
<td></td>
<td>adequate functional specifications</td>
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<td></td>
<td>adequate technical specifications</td>
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<tr>
<td></td>
<td>schedule goals related to business plan</td>
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<td></td>
<td>budget goals related to business plan</td>
</tr>
<tr>
<td>effectiveness</td>
<td>stakeholder satisfaction</td>
</tr>
<tr>
<td></td>
<td>realisation goals, including new goals</td>
</tr>
<tr>
<td></td>
<td>maximise solution space</td>
</tr>
<tr>
<td></td>
<td>respect stakeholders’ core values</td>
</tr>
<tr>
<td></td>
<td>fairness process</td>
</tr>
<tr>
<td></td>
<td>realisation lasting relationships</td>
</tr>
</tbody>
</table>

Figure 19 General success measures framework

In addition, a small part of the execution phase can be taken into account, measuring success, because there is no strict line between the FED and execution phase. Some projects are already partly in the execution phase and by interviewing the stakeholders it is inevitable that their perception of success is influenced by recent events in the execution phase.

7.5 Intermediate conclusions

General success can be divided in two dimensions: efficiency and effectiveness. Efficiency reflects particularly to the extent to which the original design goals and project variables were met. Effectiveness reflects more to the way the project, and in this case the change, is received by its stakeholders. Especially the opinion of the client and users are important here.
Part C Research
8 Case research set up

8.1 Introduction

In this part of the thesis, the practical part of the research will start. After the theoretical research in the literature of part B, the frameworks that were created will be assessed in practical cases. Relevant case descriptions should be the result by merging theory and practice. In this chapter the case study analysis will be set up in order to perform a structured, well defined research. Two of the most important aspects in the set up are the selection of the case studies and the research protocol. If both are clear, the different cases can be analysed.

8.2 Case selection

Two levels of cases can be distinguished in this research. The different projects on structural adaptation of terminals are analysed in the context, but the scope change events within these projects will be analysed in detail. In complex construction projects many scope changes will be encountered. To compare such changes, scope change events of the same project and between projects will be analysed. However, it is not possible to select too many projects and scope change events due to time constraints in this graduation thesis.

8.2.1 Project selection

Two projects will be analysed within the parent organisation, Schiphol Group. Furthermore, the conclusion of these projects will be compared to an external case of Prorail in part D. In this way, different events within projects and different projects both internal and external can be compared.

The main project that will be observed is the One-XS project. This was the project, that demanded research and provided the preconditions for this graduation research. This is the reason that the majority of the scope change events will be analysed in the project. Besides, One-XS is such an extended project that it is divided in different sub-projects, all with their own project manager. The scope change events that will be researched should preferably be alternated among these different sub-projects.

An additional project with a different context is needed for a good comparison. In some interviews, project and programme managers were asked specific questions to identify a project that would be suitable to research concerning scope change events. Best was the seventy million bags (70MB) project. This project is quite large and extended like the One-XS project. Furthermore, many scope change events are identified and well documented. Besides this, the 70MB contains all the relevant social and organisational complexities. The time complexity was also evident for this project as it had a duration of almost 12 years. A case study was exchanged with a student doing research to conflict situations at Prorail. In interviews with a relevant project manager, scope changes in the development of large railroad terminals will be looked upon. This is an excellent opportunity to broaden the research with an external case. This case will be studied after the results of the Schiphol
cases will have been analysed, to make a comparison with the external company and the railroad business.

8.2.2 Scope event selection
In the 2 selected projects different scope change events will be analysed. The main project, One-XS will be researched extensively by analysing 4 events. In the 70 MB project 1 change event will be explored, due to time constraints. The results of Schiphol will be compared to scope changes at Prorail. The different events will be selected into a long list by several criteria. First, they should be about a scope event in which at least one major stakeholder is involved; there should be an intervening actor. Secondly, the change event must have occurred in the FED of a terminal adaptation project.

8.2.3 Event selection One-XS
Most of the scope change events that will be analysed come from the main project observed in this research. To select the different events, first an interview was held with the overall project manager of this project. As an overall project manager, he has a good overview of all the subprojects and was able to provide a long list with relevant scope change events. The long list he provided consists of:

- Ica lounge
- Hand luggage handling gate buildings: elevator change
- New Kmar counters
- Premium check in departure hall 2
- Elevators in departure hall 3
- Crew security filters in EF-Area
- Shops in the root of the F-pier
- BA/Service lounge
- Parking handling instruments
- Location escalators in Kmar area of the GH building
- Aggregation of passenger filters

These change events were afterwards verified with the sub-project managers. Some of them came with additional scope changes, which were verified again with the overall project manager:

- Reversed screening of article 15 countries
- New boarding bridges / connection points gate-buildings
- NOx project E-pier
- Change into internal gate buildings
- Change in VOP (aircraft stand) F5 and F9

In order to reduce the long list and select the 4 change events that will be researched, some criteria were developed. First, there should be a certain degree of organisational, social or time complexity as was indicated in appendix B. Secondly, the scope event should be well documented. Thirdly, the involved parties should be able to give an interview. Fourthly, the change event should be completed or almost completed.
Together with the overall project manager of One-XS the selection was made assessing the different criteria. In the end the 4 best of the remaining cases were selected by an extra criterion: the related actors and sub projects of each change event should preferably be differentiated as much as possible. The 4 events that were selected in this session are:

- **Ica lounge (sub-project: EF area)**
  A new corridor for passengers was planned to come along the KLM business lounge. KLM did not want the corridor at this place as it would block their customers’ view on the airport.

- **Location escalators in Kmar area of the GH building (sub-project: GH building)**
  The Kmar area was positioned in a newly build GH building in which passengers from the G and H pier will arrive and transfer. This is the area in which the trooper (koninklijke marechaussee or Kmar) performs boarder control. In the design of this area, the location of the stairs and escalators were not approved by the Kmar. There was some discussion here about the initial requirements.

- **Aggregation of staff filters (sub-project: security filters)**
  The staff filters (V2 and V3) between departure halls 2 and 3 and lounges 2 and 3 would remain the same. This was pushed out of scope into a separate project with the implementation of 100% checking of goods. Security saw the opportunity to aggregate the filters V2 and V3.

- **NOx project E-pier (sub-project: gate buildings)**
  NOx is a stand-alone project, separate from One-XS, that has the task to reduce the NOx gasses by changing fuel aggregates into electrical devices to supply power and pre conditioned air (PCA) to aircrafts on the VOPs (stands). This project appeared to have an interface with One-XS’s subproject “gate buildings” as these also will be constructed at the VOPs. The NOx project has perceived the opportunity to put transformation stations in the gate buildings on the E pier.

### 8.2.4 Event selection 70 MB

In an interview with the programme manager of 70MB it was decided to research a change event within the project Backbone as this was the last project in time and the only project in which the PM was still present. In an orientation interview with this project manager, the SSDOP change was selected, because it was one of the few changes that was still well documented, all selection criteria were met and from which all parties could be interviewed.

- **SSDOP change**
  When the new baggage system was built at Schiphol, check-in counters in departure hall 2 had to be adapted and a screening section would be implemented. KLM was late in the design with the wish to implement 12 SSDOPs (Self Service Drop Off Points) in these counter sections.

### 8.2.5 Intermediate conclusions

The main project that will be observed is the One-XS project. Within this project the following change events will be researched:

- **Ica lounge**
- **Location escalators in Kmar area of the GH building**
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

- Aggregation of passenger filters
- NOx project E pier

From the project Backbone within the 70MB programme at Schiphol, the SSDOP change event will be observed. From Prorail, changes in the Arnhem central station project will be compared to the changes at Schiphol, however this will be explained in part D.

8.3 Research protocol

8.3.1 Introduction
As a case study research approach was chosen, different cases will be considered. The cases considered will be scope change events in the FED of large structural (airport) terminal adaptations. In order to do this, 4 cases were selected in the One-XS project at Schiphol, 1 case was selected in the 70 MB programme at Schiphol and 1 external case was compared with the Prorail.

The goal of this case analysis is to link practice with theory and look at what factors are important for successful management of scope changes. This can be done by looking at the effect of the cause, the management approach, the stakeholder interactions and project context on dealing (un)succesfully with a scope change. On the basis of these cases, general conclusions about the management of scope change events can be made and best practices for dealing with scope changes will be presented as recommendation.

In order to achieve a structured analysis of the cases and a fair comparison, there should be a clear list of information that is minimally needed to draw conclusions. A standard working method will be used for a consistent approach. In the next paragraph, the different tasks that have to be fulfilled in this working method are elaborated. The tasks, however, can differ significantly among the diverse cases and projects as these projects and cases are different in size and content. Also the different interviews that are held, which form the most important source of data, will be different in gathered information.

8.3.2 Working method
The working method in the case research is standardised and divided in 5 different tasks.

Task 1: general introduction
For every project a general introduction will be presented to give the reader (that is not familiar with the project) a good idea of the content. For the One-XS case it will be more comprehensive than the other project as the majority of the cases will be researched here. In the general introduction, the project history, tasks, goals and main stakeholders will be presented.

Task 2: general project context
The general context of the project is evaluated. This will already be done, because the contextual variables will probably be the same in the different cases of the project (so in the one-XS case, the variables should be identified only once). In literature studies, 5 different contextual variables were introduced that should be analysed.
Task 3: Analysing the scope change events
Before analysing the scope change events that were selected in the previous chapter, a detailed description was made to explain these events. The objective elements will be clarified here including the original scope, the formal change and the parties influencing this change event. Subsequently, change events will be analysed according to the frameworks developed in literature studies. By interviewing the most important stakeholders, valuable information is gathered. With this information, derived from different parties, a process reconstruction is made according to the principles of literature studies. Thus the root cause, management approach, stakeholder interaction will be analysed. Moreover, the case specific contextual variables that are not reflected by the overall context will be explained here. At last, the success of this change event is evaluated by applying the success measure framework that was developed. The point of view of the different project parties is taken into account to assess this success. The protocol or list of needed data is shown in appendix H.

Task 4: Conclusions of case analysis
The most important findings of the scope change event regarding the different research variables are drawn here. Summary tables are made to give a consolidated view of the conclusion.

Task 5: verification and validation
During this task, a well known last step of systems engineering method is used to verify if all the needed information was gathered, point by point. The information that was collected reflects a process reconstruction. So additionally, it is important that the general idea is validated. This is done by having people, that were interviewed, read the case analysis document. Apart from, the validation purpose, it serves another goal: most project managers have indicated that they would like to read the outcome to prevent bringing up wrong ideas or interpretations of the confidential information they gave. All the interviews contain confidential information and are not documented literally. The topics that came up and were questioned will be documented and used to make the process reconstruction of the scope change events. This task is not separately described in the thesis, because nothing is presented here that has not been verified (everything is verified and validated at the completion of this thesis).

8.3.3 Interviews
Most of the information is gathered by interviewing the different project parties. People involved in the different scope change events have unique knowledge about the way this event was managed which is not documented. Another advantage is that different parties have different perspectives. The best process reconstruction is made by observing the different perspectives. The best way to do this is by interviewing these parties. As the interviews are key in this part of the thesis and a clear research protocol has been developed, the setup of the interviews should be well prepared. This paragraph describes the preparation stage of the interviews.

First, the purpose of the interview should be clear to investigate the interview type. The goal is to make a process reconstruction of scope change events, without knowing beforehand what the process looked like. The best type of interview that fits such a research is a semi structured interview (Guldemond, 2010). This type of interview offers the opportunity to divert from a rigorous set of questions.
Secondly, the time to perform the interviews is relatively short. As the interviewees are generally busy people, only one hour was planned for every interview. In such a short time, the interview should be very efficient. One way to achieve this, is by concentrating on the relevant information. This can be done by sending the subjects of the interview to the interviewees. As such, the question will not be a complete surprise. However, not the detailed questions will be sent as there should be some level for spontaneous reactions and room to alter in the questions. Another measure is that the interviews are recorded (with interviewee’s consent). By doing so, the interviewer is able to fully concentrate on the interview, without having to take notes. A last measure is to perform an intern orientation interview to get more understanding of the scope change event in advance. The relevant project manager of Schiphol was interviewed for this purpose.

Third, to structure the interviews, an interview protocol has been made (see appendix J). This protocol was made on basis of the research protocol (appendix H). This protocol is not strictly followed, but serves as a guideline. Some questions could be zoomed in if it is relevant regarding that particular interviewee.

At last, the right interviewees should be selected. All the relevant stakeholders concerning a particular scope change event are selected. This was also done in the “orientation interviews” with the internal project managers of Schiphol. Apart from the purpose of getting to know this change event, the parties closely related to the process in the change event were identified in this interview. The protocol of the orientation interviews is shown in appendix I. For a complete list with all people who were interviewed see appendix R.
9 One-XS project

9.1 Introduction One-XS project

In order to realise its ambition remaining Europe’s preferred airport, Amsterdam Airport Schiphol will need to make changes in the way passengers undergo security checks in the Non-Schengen part of the airport. All passengers at Schiphol have to be checked for security. In the Schengen part of the terminal this is done centrally, before entering the lounges (lounge 1). In the non-Schengen part this is done decentralised at the gates. It means that people in the lounges (lounges 2 and 3) are not yet security checked. After going into the gate through the security checks they cannot return to the lounges. The One-XS project has to implement a central security in the non-Schengen area, before entering the lounges. The Non Schengen area has in the current situation 130 separate security lanes divided over the different gates as is shown in Figure 20 (the Non-Schengen part is blue in this picture).

Central security is implemented because of the three reasons explained in the introduction of this thesis:
- Passenger comfort and enabling nonstop security
- Efficiency (efficient use of security guards and equipment)
- Satisfy future European laws and regulations

In the current situation, all arriving passengers enter these lounges as well. The employees that need to be in the lounges do not have to be security checked. The consequence of central security is that the lounges, after the newly build security checks will need to become a “clean area”. This means
that all people (passengers and employees) that are in these lounges should be checked by a Schiphol “approved” security check. In the future situation, passengers from a destination where security check is not approved by Schiphol, should be led to security filters before they can enter the lounges for their transfer. The passengers arriving from a country with approved security checks, will not have to be checked again (this is called one-stop security). The future situation with centralised security checks is shown in Figure 21. The number of security lanes will decrease from 130 to 50.

![Post-CSNS: 50 security checkpoints](image)

*Figure 21 Future situation security checks*  
*presentatie CSNS juli 2012*

The only way to split the passengers of different flights is to put an extra level on the piers. Through this extra level the transfer passengers can use the GH building filter or the EF area filter to enter the lounges. The passengers ending their journey at Schiphol, will not enter the lounges at all. They will be led to Kmar (koninklijke Marechaussee: trooper in English) filters to enter the country. The terminal should be adapted structurally in many ways to accomplish this. The added area is shown in Figure 22. As is shown in this figure, the D-pier will not get an extra level. This means that the D-pier will only be able to process clean flights in the future. This has to be kept in mind in the gate allocation. During the construction, the daily operations should be proceeded. The preparations of construction started in December 2012. This complex project should be finished by June 2015.
The project is split in a few sub-projects:

**Departure Filters 2 and 3:**
Another consequence is that people should be security checked after the check in. In the current situation, after checking in, passengers can proceed to the lounges after the Kmar filters. In the new situation an extra process will be added, for which not enough space is available in the current terminal. By building a mezzanine above the check-in counters in departure hall 2 and 3 passengers will be led upstairs to the mezzanine after checking in. The Kmar filters will also be placed on that level. After these two processes people will be conducted downstairs again into the lounges.

**G/H Building and extra floor on top of Pier G:**
The G-pier will get an extra level to conduct the passengers from unclean flights to security filters. There is not enough space at the root of the G pier to place these security filters. A new building, the GH building, will have to be constructed to accommodate these new security filters. In this building the passengers ending their journey in the Netherlands will go through Kmar filters. The transfer passengers will go to the security filters and enter the lounges.

**EF zone and extra floor on top of Pier E & F:**
The E and the F pier, will also get an extra level. Both unclean passenger flows will go to a newly built filter at the root of the E-pier. This area is complex, because it crosses many current processes. It is also technical complex, considering the construction methods.
Gate buildings:
On all VOPs (aircraft stands) new gate buildings will be placed. After passengers leave the aircraft through an avio bridge, they will first enter the gate building. In this building the corridors can be changed. One will lead directly to the current pier corridor. This will be used for “clean” passengers. The other one will lead upstairs to the extra level. This will be used for the “unclean” passengers.

Security filters:
New security filters will be built on the mezzanines of departure hall 2 and 3, in the GH building and in the root of the E-pier.

Logistics:
During the construction period, many processes will change. Furthermore, all the construction sites have to be prepared, which is an enormous complex task. The project manager logistics and his project management team will be responsible. This sub-project interfaces all the other sub-projects and almost all daily operations.

9.2 Project Context

9.2.1 Project structure
Schiphol Group is the owner and exploiter of Amsterdam Airport Schiphol and some other airports. Approximately 70% of the shares is owned by the Dutch government (ministry of finance), 20% by the municipality of Amsterdam, 2% by the municipality of Rotterdam and 8% by Aéroports de Paris. The organisation has 4 business areas and two support units. The business areas are: Aviation, Consumers, Schiphol Real Estate and Partnerships and Alliances (participation and ownership of other airports). PLUS (Projecten LUCHthaven Schiphol) and Information & Communication Technologies. Aviation is the business area where everything is focussed on the key activities of an airport: facilitating the infrastructure for the processes of airlines. This is a regulated market. Laws prescribe that all costs of the aviation business area will be directly translated in airport charges. So this business area will end up with no profit or loss every year. Departments within Aviation are for example operations, security and passenger services (PS). A part of the organisational structure can be seen in appendix E.

The project management structure has been derived from PRINCE2. The principles of PRINCE 2 are summarised in appendix K. Schiphol developed its own variant on PRINCE2: STAP (STandaard Aanpak Projecten). STAP gives a clear structure to projects and is based on the separation of control, management and execution. The project board controls the project, the project manager, manages the project and the project team executes the tasks. The selection of the representatives of these functions focuses on a hierarchical and balanced composition. The project board consists of the client, the senior users and the senior suppliers in order to have all important stakeholders are involved. The client takes the interests of these board members into account, but has the right to decide being chairman of the board. In Figure 23 the basic project structure according to STAP is shown.
This structure is like the PRINCE2 method very much project-oriented. The structure can be characterised by the left side aspects of the project structure framework showed in Figure 12. The structure is hierarchical; it focuses on organisational roles (instead of technical). It is hard to say something about this structure being focussed on competition or organisation as no contractors are yet involved. The structure is nice and neat (asparagus) and not spaghetti like. In the end the structure can be characterised by clarity (and not by overlap) as roles are clearly defined. In the One-XS project, such a structure is also used. The board consists of the client (operations) as chairman and the senior suppliers (Security and asset management) and the senior users (KLM, Schiphol Airline Operators Committee, Consumers, Schiphol Real Estate). In addition, KLM, as most important stakeholder, has an extra function within the structure. A programme manager of KLM is mirrored to the overall project manager of One-XS. The organisational structure of One-XS can be seen in appendix F.

The external structure of the project One-XS is partly taken into account in the project management structure since most important external stakeholders are part of this structure. The most important stakeholders that have not been mentioned yet are:
- Passengers (final users)
- Koninklijke Marechaussee (KMAR) (user)
- Customs (user)
- Benthem Crouwel Naco (BCN consortium) the designer
- Concessionaires of shops

9.2.2 Project arrangements
In PRINCE 2 and STAP arrangements are also defined. Each function and party has a long list of roles and responsibilities. Here only the framework that was made in literature will be evaluated on the basis of the following list with the reason why it is more project-oriented or process-oriented.
• The role of the parties is bilateral: the roles of client and overall project manager cannot be divided. One person should be in charge and have clear responsibilities related to other specific parties and roles.

• The specifications of most sub-projects in the One-XS project are blueprint. Only the EF-zone subproject is a design and construct contract while the others are statement of works contracts.

• The conditions are obviously based on control. It is literally stated that the PM team should plan, guard and control all project aspects.

• The performance indicator is based on efficiency. In almost all roles and responsibilities of the important project parties (such as client and PM) it is mentioned that they should safeguard the project remaining focused on the feasibility of the objectives. In addition, the product should be delivered as such that it realises the estimated benefits. So these arrangements focus on the efficient realisation of the goals set.

• The remuneration of all sub-projects of One-XS is lump sum. Not all sub-projects have been tendered yet at the time of writing. The shape of the contract is in most sub-projects a traditional “Statement of work” contract. Only the gate buildings project has an engineering and construct contract and the EF zone project has a Building Team contract.

It can be concluded that all arrangements are project-oriented.

9.2.3 Change procedure
In the beginning of the project, not a specific change procedure was specified. There were change request forms available in which the change had to be described. Most of the project managers did not know the procedure and did not fill in these forms.

Later on during the project, besides well defined Terms of references (Tor), also a change procedure was developed. This change procedure had a few principles. Changes occur in every project, the change management process has been developed to handle changes in a controlled way by:

- Handling the decision making process regarding changes both efficiently and effectively.
- Ensuring a complete and correct registration for changes
- Securing of changes in the project

The changes are divided in 4 groups: Level 1 changes until level 4 changes depending on financial impact and contribution to the original goal. The lower the change level the easier and faster, a decision can be made. The level 1 and 2 changes can be approved by a selected change authority, while the level 3 and 4 changes should be approved by the project board. In appendix L, the change procedure of One-XS is shown.

A change procedure is process-like by definition, because project management tends to omit changes. The procedure says that changes will occur and should be prepared for, according to the process management approach. The procedure itself is very hierarchically steered and roles are clearly defined. So the standard procedure is substantially more project-like.
9.3 Change NOx at E pier

Not public

9.4 Change location escalators in Kmar area of the GH building

Not public

9.5 Change Ica Lounge

Not public

9.6 Change aggregation of staff filters

Not public

10 70MB project

Not public
Part D Analysis
11 Comparison

11.1 Introduction

In this chapter, the results of the case researches at scope change events at Schiphol will be compared. This comparison can be done in different ways. It is not easy to compare the results because a low number of case studies are performed and a lot of variables play a role in this research. The dependent variable will be success in all comparisons. There were three different sets of independent variables:

- Root causes of scope change
- Management approach in change event
- Stakeholder interactions

Furthermore the contextual variables can be looked upon, if the cases of the One-XS and the 70MB projects are compared. This will be an easy comparison however as two projects should be compared. The contextual variables, though, can explain differences in the way stakeholders experienced the different change events. This cannot be explained by the numbers or outcomes of the different frameworks, but more by the big picture of the interviews with the stakeholders.

The results of the research were both a rich description of several change events and specific data related to the developed analytical frameworks presented in small tables. This data consists of the 3 different types of independent variables and the dependent variables. These data should be compared with each other in order to come to conclusions and recommendations. In this chapter there will be two ways of data analysis to reach general conclusions.

First, a formal analysis will be made, in which the computer programme fsQCA will be used to analyse data. This is the best way to obtain objective results. Second, an informal analysis will be made by comparing the researched cases with common sense. In a case study with a limited number of cases and an almost infinite number of variables, it is valuable to look at the bigger picture and add some interpretation and feeling about the cases and interviews that I did as researcher. The advantage of doing both analyses is that on the one hand logic conclusions from the own experience will be generated and on the other hand there still is room for surprise.

After both analyses, the results will be compared to the experience of Prorail, another network operator. The collaboration with a colleague student, who did a similar research at Prorail and an interview with a project manager from Prorail will be used to make the comparison between Prorail and Schiphol. As a result of this, differences and similarities will be mapped and the uniqueness of projects executed at Schiphol will be evaluated.
11.2 Formal analysis

11.2.1 Introduction
In this formal analysis the programme fsQCA will be used. Qualitative Comparative Analysis (QCA) is a new analytic technique that applies Boolean algebra to implement principles of comparison used by scholars engaged in the qualitative study of macro social phenomena. The letters fs stand for fuzzy set. A fuzzy set simply means that in the analysis not only binary numbers (0 and 1) will be used, but all numbers in between can be used as well. This will be especially useful in this thesis, because soft variables will be applied. A management approach in practice is for example not 100% project and 0% process management, but somewhere in between. In appendix Q more explanation has been given and the actual comparison is performed. In this section the relations that have been found in this analysis will be mentioned.

11.2.2 Analysis design
Three sets of independent variables were researched in this thesis. The first set, the root causes, will be mainly analysed in the next chapter. Here, the most present root causes will be analysed in order to conclude if certain changes could have been prevented. Originally it was not intended to investigate how "success" correlates with these root causes, but for the sake of completeness this will be done here.

The second set, the management approaches, has to be compared to project success in order to seek a correlation of the management approach that was used in the change events and "success". The third set, the interactions, will also be plotted against "success". If project managers know which characteristics of interactions are related to success, they can anticipate to this by providing the right atmosphere.

It will be clear that in every comparison "success" will be used as "outcome" in the truth table. However, success was defined in this thesis in two dimensions: efficiency and effectiveness. In order to enrich this research and make this analysis as complete as possible, the sets of independent variables will be compared to efficiency success, effectiveness success and "overall success".

In all analyses first the "truth table" has to be generated. If the truth table is generated, the table will be minimised to the relevant number of rows. Then the analysis can be completed and the important variables that influence success will be showed by the programme. As all sets should be fuzzy, the presence of a certain variable should be ranked for every case. This will be done by touch and might seem a little subjective. Nevertheless, this will be done as objectively as possible and this ranking is based on the tables that contain the results of the cases. For example, in the case of management approaches the ratio of process-oriented and project-oriented principles that were detected will be used.

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3 http://www.u.arizona.edu/~cragin/fsQCA/index.shtml consulted 31-5-2012
11.2.3 Results

The analyses of the data that were gathered in the case studies are executed by using the programme fsQCA. The complete analysis that was performed can be found in appendix Q. In this section, the results of these analyses will be depicted. In the analysis, the root causes of the different scope change events appeared to have no relation with the success of the resolution of these events. The relation between management approach and success as well as the relation between interactions and success have been proven. These sets of independent variables were compared to efficiency, effectiveness and overall success in order to make this analysis as extended and precise as possible.

As was expected, the root causes have no relation with efficiency, effectiveness, and success. So, no matter what caused the change, it could be resolved both successfully and unsuccessfully. In next section the findings and the substantial information of the different scope change events will be used to evaluate the root causes of the individual change events that took place. As was originally the intention, the preventability will be looked upon (and not the relation to success).

The management approaches have an ambiguous impact on success. The extremes of both methods appear to have a positive and negative relation with efficiency and success. There is not one approach that causes efficiency of changes in projects at airport terminals. A mix of both approaches should be used; however there is a slight preference for a higher ratio of process management as more. Also achieving overall success requires a mix of a project-oriented and process-oriented management approach. Again, the ratio between project and process management aspects should move slightly towards a reliance on process management. However, if only effectiveness should be achieved, a process management approach should be used. Project management approaches seem to work negatively towards effectiveness.

The interactions have obvious influences on efficiency, effectiveness and overall success. The efficiency of the resolution of a change event appears to be dependent on only three of the variables. Formal communication has a negative relation with efficiency: which would imply that informal communication contributes to efficiency. This seems unlikely, however it should be kept in mind that it is only about the efficiency of a scope change event. This might be caused by intervening actors who will be better in the understanding of the dilemmas of a project manager if the atmosphere is informal. Regular communication has a positive relation with interactions: if communication is regular in these events, the solution will be reached more efficiently, because progress is ensured. At last, the power of an intervening actor is negatively correlated with this efficiency. If the intervening actor has more power, it is likely that he can force the scope to change drastically to his preferences regardless the impact on cost and time. This is more contextual, but is important for a PM to keep in mind.

It is remarkable that effectiveness and overall success depend on exactly the same variables. Trust and involvement are very important in the interactions to achieve success. A collaborative and a non-conflicting relationship contribute to this success. These two variables were separately used in the equation, but appear to be opposites and are actually one variable. The stakeholder relationships...
“power based” and “one sided” have not been discovered in the case studies. This does not mean that these relationships do not exist. However, no conclusions can be made in this research about those two variables. Although the power of the intervening actor has a negative correlation with efficiency, it has no impact on effectiveness and success. At last, a bidirectional informal regular communication with the stakeholders attributes to a successful result of a change event. This means that the communication should consist of informal dialogues in frequent meetings.

11.3 Informal analysis

11.3.1 Introduction
The informal analysis will be done by making use of experience, executing the case studies, and common sense. The tables with the findings of all cases are used to perform the analysis. The basis here will be the formal analysis of last chapter. Now the formal outcomes of the analysis can be explained and understood. Furthermore, some nuances can be added here, as not all elements in projects can be described by (fuzzy) sets of numbers. This analysis will once more be made on the basis of the three sets of independent variables. The preventability of the changes will be evaluated on basis of the root causes. Then the relations between both management approaches and success will be explained. Also the contextual variables might explain some differences.

11.3.2 Root causes
As was predicted, all change events had more than one root cause. All cases had 2 root causes except from the Ica Lounge change, which had 4 important root causes. All one-XS changes had both internal and external root causes, while the 70MB change only had external root causes. The table with the occurrences of the root causes from last section can be used again:

<table>
<thead>
<tr>
<th>CHANGE EVENT</th>
<th>RC1B</th>
<th>RC2B</th>
<th>RC3</th>
<th>RC4</th>
<th>RC6A</th>
<th>RC6B</th>
<th>RC8A</th>
<th>RC8B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nox</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Km arrival</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ica lounge</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Staff filters</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>SSDOP</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Only root causes 1b, 2b, 3, 4, 6a, 6b, 8a and 8b were found. Again, this doesn’t mean that they do not exist in practise. No root causes occurred frequently: root causes 2b, 3, 6a and 8a occurred twice and the rest just once. So few conclusions can be made based on these numbers:
- There are no root causes of changes in airport terminal projects that seem to occur regularly
- Root causes of changes in airport terminal projects have more than one root cause
- In most cases, the changes are caused by the project team itself and the stakeholders (internal and external)
- The most complex change (Ica lounge) had more root causes than the rest. This could imply that complex changes have more root causes and the other way around. However, more data is needed to prove this.
Since no general relations can be made yet regarding the preventability of change events from the overall data, the changes’ root causes will now be evaluated independently. It is significant that all these changes were desirable. Because of this, the desirability cannot be compared.

**NOx:**
The NOx change was caused by interfaces that were internally not defined and externally by learning from the stakeholders. In this case, the learning by the stakeholder came from the project manager of NOx, who learned that his Trafo station could be placed in the ground floor of the gate buildings. The reason he learned this was a coincidence: he became also part of the PM team of One-XS. So actually, the intervening actor learned about the interface. The dominant root cause is the interface that was not defined between both projects. The gate buildings sub-project based itself on the current situation of the platforms instead of the future situation, caused by the project NOx at the E pier. In the project presentation of One-XS, the NOx project is stated as an interfacing project, however this was not particularly stated on the gate buildings’ interfacing projects. The consequences of the NOx project were clear because several other piers were already equipped with the same Trafo stations. If this interface was taken into account from the start, this change could have been prevented. The project “gate buildings” and the project One-XS should have looked upon the consequences of NOx before starting to make the requirements, designs and schedules. Only defining an interface in a presentation does not help preventing this root cause. The change was obviously desirable. If nothing had been changed, the contractor would find another situation on the platform than was predicted. The Trafo stations would have been replaced anyway. Furthermore, the clean apron policy that will be satisfied was desirable.

**Location escalators in Kmar area of the GH building:**
This change was caused by ambiguous requirements internally and inaccurately defined processes externally. Actually this change was simply caused by a difference of interpretation about a requirement. The PM of this sub-project had something else in mind than the Kmar. This could have two causes: the requirement was ambiguously set or the Kmar ambiguously defined its processes. Both parties clearly had the idea that the requirements were detailed and well elaborated. This proved to be wrong (what is precisely meant by view distance?). The interpretation of these kinds of details can never be totally equal. The only possible solution would be “experiencing every requirement in the process of Kmar”. This is of course not feasible and this change probably couldn’t be prevented. This change was without doubt desirable. If the situation would not have been changed, the Kmar would not have used the new area, making the building quite useless.

**Ica lounge:**
This change was caused internally by not spending enough time to understand the client’s needs, flexibility and interfaces that had not been defined and externally by inaccurately defined processes. The last two are actually one root cause: KLM and Schiphol are unable or unwilling (because of different interests) to define the interfaces between the project and the daily operations. It may be assumed that they are capable of defining these interfaces, since both parties share a long history at the airport. This cause is deeply rooted and is possible, but hard to prevent. If both parties would listen better and try to understand each other’s interests and openly discuss them, these changes could be prevented, having an initial design that is satisfactory. This is implicitly shown in the formal analysis and the case description itself. From the moment trust, involvement and collaboration were
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

present, a solution was quickly made. However, in this project the KLM wasn’t involved until November 2011 because of disagreement about the project. If it was considered to be contextual, this change couldn’t be prevented. Furthermore, flexibility was implemented on purpose when the PM set an ambiguous agreement in a protocol to stop the discussion and make progress in the project. Indirectly this change was caused because of this so-mentioned strategic choice. The root cause flexibility means that something is left open on purpose. This suggests that flexibility is a strategic choice, which is also showed by Olsson (2005). So this change couldn’t be prevented, because it was a strategic choice. Furthermore, KLM had not been involved early, because of reasons that were not determined in the project. This change was desirable, because if it would not have been implemented, serious conflicts with the most important user would have been the result.

**Aggregation of the staff filters:**
This change had especially a complex process during the change event, but the root causes were rather simple. There wasn’t enough time to make requirements and design studies considering the staff filters. This sub-project was pushed out of scope strategically and would be implemented as change in One-XS with a separate budget. The party to whom it was pushed, Security, had a plan in mind to make savings by merging staff filters. This would not have happened as such if the project was not pushed out of scope. So the only root cause was that it was pushed out of scope, because there was no time to look at a solution and take it along in the designs and budget! This change event could have been prevented by taking more time to elaborate on the solutions and consequences of the location and implementation of the staff filters. This change was desirable, as no clear design was available yet: so there should be one made. The aggregation (of the two staff filters) itself would be desirable to make the security process more efficient. However, different stakeholders had different perceptions about this.

**SSDOP:**
This change was caused by a change in market conditions and by no recognition of interfacing processes. Both are external root causes, which are hard to influence. KLM did not have the awareness in all departments of the company that this project was on and a decision about the implementation of the SSDOP units had to be made before a certain point in time. In addition, this decision is again dependent on developments in the market. During these prolonged projects, time complexity is applicable and such changes are unpreventable.

The changes that could have been prevented, did have an internal root cause and “learning by the client” as external root cause. In both cases, especially the internal root cause appeared to be important. It can be concluded that changes with internal root causes can be prevented more easily than changes with external root causes. The change was desirable, as the most important user had wished and paid (for a large part) for the SSDOP units. Schiphol would have only limited extra costs: PS (passenger services) would have the opportunity to optimise the passenger processes.

**11.3.3 Management approaches**
The management approaches were thoroughly analysed in the formal analysis. It has already been made clear that a combination of project management and process management are necessary to apply successful management (and to achieve efficiency). The formal analysis proved this. Furthermore, it was proved that process management has a positive impact on effectiveness, while
project management has a negative impact on effectiveness. Here, some explanations and elaborations will be given on the basis of the case contents.

Moreover, it was concluded that in stakeholder driven scope changes in airport terminals slightly more process-oriented aspects should be used than project-oriented. This ratio can practically be supported by realising that the change is stakeholder driven. Process management takes into account a network of stakeholders which are interdependent. The fact that a stakeholder can come up with an intervention proves that this is not hierarchically determined and a network is applicable. So the extra usage of a management approach that is based on this interdependence is logical.

Switches of approaches are used in events; management approaches are dynamical too. In the smaller changes, this process is negligible, but in the large change of the Ica lounge, this was particularly obvious. In the early periods of the process, the management approach was different and more project management was used. There was no coordination of the network, but the change was tried to solve hierarchically: “there is no time and money and I can’t make savings elsewhere in this (sub-)project”. Also the roles and responsibilities were clear: “we are making the designs and KLM can make reviews”. The project stages were clearly followed: this is shown by the need for progress and it was even mentioned that a certain stage didn’t have the purpose to make adjustments to a design. These are just a few examples that support the initial overreliance on project management. However, what we know is that this change was rather successfully solved and from the moment that solving began, process management was used. The switching point was obvious: the moment that the issue was discussed in the project board of November 2012. Apparently, this project board caused a switch to process management. This can be explained by the fact that a project board (in PRINCE2) consists of all relevant actors. Although the client is the chairman and has the power to decide alone, he or she will always take the opinion of all stakeholders in the meetings. The chairman of the One-XS board herself explained that she has to do it this way, or else stakeholders could give up their commitment. You could consider the project board as the physical representation of a network of actors.

Such a switch might be necessary if a PM of a (sub-)project does not have the instruments to solve a problem hierarchically. If the instruments (like costs or time) are not available within his hierarchical area, he has to take it to a level higher. If this is taken to the top (of the well known hierarchical Christmas tree) and still no solution can be found, the network of actors should be mobilised to come to conclusions. In the Ica lounge, this was evident. The extra 10 million euro that was needed to come to a solution (which was different from a corridor in front of the lounge) was not within the instruments of any PM in this project. When this issue was discussed during the project board, new stakeholders were mobilised and new solutions could be generated. SRE, for example was able to help out by making a business case that would be positive and would compensate for a part of the costs. Costs were cut initially, because of wishes of KLM (they pay for these costs indirectly via the airport charges). This constraint could also be discussed in the board since the right people can be found at this “table”.

In such issues and resolutions the switch can be visualised as is shown in Figure 24. The structure of such a project appears to have both the network of actors and a hierarchy. In most cases, the daily
project team has a hierarchical structure. The client and users are gathered in a network of actors. In projects this is expressed by the use of a steering committee or project board.

Figure 24 Hierarchy and network switches

If we take the Ica lounge change as an example again, the figure explains the following. The PM of the EF area got resistance from KLM concerning one of his sub-projects the Ica lounge. He could not steer this process hierarchically. This became evident because of the following observations. The PM wanted progress and made clear that it was too late to change the designs. Furthermore, he showed that the joint protocol would be met with, in the solution (a corridor in front of the lounge). The problem was presented to the overall PM, who tried to steer the issue hierarchically too. This could work, as he hierarchically has power over other side branches of the hierarchical tree. He was able to mitigate the time constraint, but ran into a budget constraint. The financial impacts were going to be so extensive that he would not be able to compensate for them within the other subprojects. So a project management approach did not work and a process management approach was not within his mandate. The PM literally said that they could solve this together with KLM if the budget constraint would be taken away. He shared the dilemma with the client, and in this way the management switch to the network of actors was made as such.

The client has a much larger mandate and is in the position to negotiate about scope, time, quality and money with the suppliers and users. In other words, the client is able to return to an earlier phase in which the business case is reconsidered and could find solutions in negotiations in the network of actors. This can be linked to the initial interactions that have been explained in section 5.2. Actually the first interaction that was discussed in the early feasibility study is restored here as was shown in Figure 9. The ways of interacting that were mentioned in literature studies can be
explained now. Apparently, if a stakeholder makes an intervention, the project management team will interact with him. The project manager is accountable to his client again. So the following interaction can be discerned:

![Diagram](image1)

**Figure 25** Interactions before management switch

After the management switch is made, the following interactions between the users (or suppliers) and the client can be discerned:

![Diagram](image2)

**Figure 26** Interactions after management switch

In the case of the Ica lounge, negotiations were done during the project board. The new interactions were a manner to create win-win situations. KLM and SRE, a user and a supplier, could take a part of the budget constraint away as was mentioned earlier on. In fact, the project was taken to an earlier level again as was the case in the previous feasibility study. A clear iteration step considering the project phasing was used here. If the scope might be changed so drastically, this iteration step is necessary to come to a solution. So a management switch could even result in project phase iteration. In the hierarchical structure of the project team, such iteration is not possible if the mandates are lacking. A management switch, also switches the basic ways of interaction as is shown in Figure 27.
The opposite was shown in the case of the staff filters. This change event was pushed out of scope, so off the hierarchical tree. What happened was that when problems arose, this process of escalation could not be performed. There was no project manager that could make the switch to process management. The fact that most problems occurred when SAOC, a member in the board of One-XS, learned about the merging staff filters and made an intervention, shows that this problem had never been discussed in the board, which made it harder to perform process management. The result was that things stayed separated and discussions and agreements were decided at separate tables. An overreliance on project management was applicable and no one capable of switching this was present in the project. It subsequently leads to the unsuccessful turn of events in this change event.

As this project was pushed out of scope, the project got its own project manager. The PM responsible for “the plan of the aggregation of the staff filters” could be seen as a kind of sub-project manager, who was not linked in the hierarchical structure of the One-XS project management team. In addition, the client was not the same: instead of “Operation”, “Security” was the principle in this project. The project did not have its own project board like other projects, but the project board of One-XS had adopted this role. The result was that there was not a working system like in Figure 24.

The issues that were discussed here were not in a lower branch of this structure, so no switch could be made. The client and project manager were neither present in the right hierarchical structure, nor in the right network of actors. The switch could not have been made.

At last it has been observed in case research that management approaches were not applied consciously by most PM’s. Of course, they did not all have the position and tools to use proper process management depending on the change magnitude and complexity. The NOx change, for example, was smoothly processed to a successful end. This was just a coincidence as the intervening actor, the project manager of NOx, became part of the PM team of the gate buildings. This was obviously a process-oriented approach as stakeholder and project team member were the same person (you will not treat this hierarchically towards yourself and will always be open to a change suggested by yourself).

11.3.4 Interactions
The interactions were thoroughly analysed in the formal analysis. It was already proved that success and effectiveness were caused by trust, involvement, collaborative (and no conflicting) relationship and regular bidirectional informal regular communication. Efficiency only appeared to be dependent on regular and informal communication and would be influenced negatively by an intervening actor with much power. Here, some explanations and elaborations will be given on the basis of the case contents.
Efficiency has nothing to do with the stakeholder’s satisfaction. This is why all relationship based softer variables are not important for this dependent variable. Trust, involvement, collaboration and bidirectional communication are examples of this. The phenomena that the power of the intervening actor has a negative impact were attributed to the ability to change projects drastically. In the three cases two intervening actors were spotted who had medium to high power. In the Kmar area change, the Kmar had much power. If they would not approve of the situation, they could stop a part of the airport’s operation: if Kmar would not be present in this location, nobody would be able to enter the Netherlands. What you see is that efficiency drops, because this change costs a lot of money. However, it is the best solution: the stakeholder is happy and operation would be impossible without their blessing. KLM is the most important user at Schiphol. They have a higher power position both in the Ica lounge change and in the SSDOP change. The efficiency of the Ica lounge change was not optimal, because of the extra costs. The only reason it was solved this way, is due to the power of KLM. If the most important user and partner is not satisfied, problems will arise. In the SSDOP change the extra costs were smaller, because a large part of the costs were directly transferred to KLM. Moreover, it was obvious here that the most important user wanted something and they got it. Furthermore, regular communication was positive regarding efficiency: if (design) meetings are being held every week, progress will be guaranteed.

Trust and involvement are important for effectiveness and overall success. In all cases trust and involvement were quite large except from the staff filters change, which was a case that was highly unsuccessful. In the staff filters change, SAOC had not been involved at all. From the moment they learned about the plans to remove the staff filter in “their” departure hall, affecting their operation, they were absolutely annoyed. This lack of information and involvement resulted in distrust. The result is that a stakeholder will oppose and much effort should be put into recovering trust in the relationship. This change has still not been completed at the time of writing, but a (small) staff filter in departure hall 3 will probably be maintained. This solution is not in agreement with the initial goal of Security: gaining efficiency by merging the staff filters in departure hall 2 and 3. Additionally, by not involving SAOC, they did not only create resistance, also a lot of time had to be put into the recovery of trust. This obviously shows that the choice of not involving SAOC (which might have been a strategic one) ended in a lose-lose situation. Furthermore the relationship between the PM of One-XS and the project team of this separated project was conflicting. Trust was harmed as the client was forced into a role that it had not opted for. The imbalance of this separate project and the project and project board of One-XS, is probably one of the main reasons that involvement trust and the relationship were damaged. Even communication was disrupted as will be described later in this section. An open information exchange with stakeholders appears to be important to create trust and involvement.

More evidence can be found in the Ica lounge case. In the early process, trust was lacking and involvement was at a certain moment (in between to moments of high involvement), quite low. This change event was at that time approaching an unsuccessful end. The moment that the explained managerial switch was performed, things changed and the issue was discussed in the project board with all stakeholders. Trust and involvement returned and the event became more effective and successful. Trust and involvement are probably the most important variables in the interactions considering effectiveness and success. These variables are linked in most of the cases: parties get more trust if they are involved and the other way around. Also a collaborative relationship seems to
be linked to these two variables. In the SSDOP change this became clear: the PM of KLM collaborated probably more with the PM of Schiphol than with its own rank and file.

Communication should be bidirectional, informal and regular to achieve success. Bidirectional communication, a dialogue with each other, seems to be natural, but in the staff filters case it was not the case. Parties (especially PM and Security) were on cross purposes and agreements appeared to be misapprehended time after time. For example, this was evident from the fact that the project staff filters and the PM of One-XS had different ideas about the time that certain reports should have been made and its content. The direct result was that those parties were frustrated about the behaviour of the other which in its turn diminished effectiveness and success.

It will be clear that regular communication causes success as progress is ensured. This could be observed in the change of the Kmar area. The PM of the GH building had frequent meetings with the Kmar in which multiple issues were discussed. During the numerous meetings, it became clear to the PM what issues could be resolved within scope and which had the risk to cause some “troubles”. The PM judged that the issue about the view distance to the escalators might be very important for the Kmar. Before the discussions and “negotiations” ended, the PM was able to prepare for such a change request and made sure another design would be ready. So progress was guaranteed by having many meetings: as the parties could estimate what would be important for each other, they could take this into account on time.

At last, informal communication seems to contribute to success. There is an explanation, keeping in mind that it is about the success of a stakeholder driven change event. Apparently, the problem resolution is smoothened by the parties discussing the issues informally with each other. Informal talks can be an indicator of better relationships and it forces parties to listen better to each other and to respect each other’s interests. In the Ica lounge change for example, different parties indicated that at the end of this issue communication became more informal. We know from the previous descriptions that this was the positive part of the resolution of the change event. The fact that communication became informal in most of the change event was by the interviewees attributed to the fact that participants got to know each other better.

11.3.5 Context
The contextual variables’ influences are afterwards hard to evaluate, because most change events had more or less the same context. The One-XS cases had a project-oriented structure and project-oriented arrangements, because they were all based on PRINCE2. Only the SSDOP change had a different structure and arrangements. So this case can be compared to the other cases. Furthermore, there are some case specific context variables that can be compared.

When the structure and arrangements are compared with the management approaches in the different cases that were successful, one thing is noticeable. In all successful cases in which the structure and arrangements of the project itself were project-oriented (NOx, Kmar Area and Ica lounge), the management approach in the change event was process-oriented. In the successful case that had process-oriented structure and arrangements, the management approach in the change event itself was more project-oriented. Koppenjan et al. (2010) describe “counter arrangements” that should be used to supplement dominant management approaches. This is what actually
happened in the successful changes that were described here. If the project itself had a dominant project approach, the change was successfully solved using a more process-oriented approach and the other way around. The only case that appeared to be unsuccessful did have the same dominant management approach in structure, arrangements and change events. This was the staff filter change, that had a project oriented structure and arrangements. The management approach in the change event itself was also mainly project-oriented. Some aspects are key in this approach. It was limited to one issue and stakeholders were scarcely informed. Furthermore an attempt was made to steer it hierarchically, while this could not be done, because of the hierarchical structure being imbalanced as was explained in last section. If counter arrangements had been made, these three aspects should have been turned the other way around among others. If there would be a redundant information exchange and all issues would be discussed at one table (the one-XS) table, success should have been increased.

Note that these counter arrangements are something different from the approach switches, which were explained in 11.3.3. These were switches between different bodies during one change event. Here, the leading management approach in the change event should be the opposite of the leading management approach in the structure and arrangements.

Also case specific variables and the impact on the cases can be compared. It is striking that the changes in all change events don’t have an impact on schedule. Probably schedule is very important to all parties and during discussions, parties agree on the wish to not extend the project. The impact on costs are different. NOx had no extra costs, SSDOP and the Kmar area had an extra cost of around 20,000 euro, while the lca lounge and the staff filters had much higher impacts (7,5 and 10 million euro). Larger changes in terms of money are more complex. The difference between the two large changes, is that the lca lounge was remained in scope of One-XS and extensively discussed in the project board, while the staff filter change was not. Regarding the differences in success, it will be clear that if changes occur with a large impact on costs, it is important that the project board in PRINCE2 structures is mobilised and the issues are discussed at one table. Timely management switches should be made in changes with such a large impact on budget. It does not matter if the change or issue is formally pushed out of scope (as was the case in the staff filter change): if the change event is caused by a project it should be discussed at the same “table” regardless the formal location of the budget (this has to do with accounting).

At last, the influence of change procedures cannot be compared, because the change procedure of One-XS was not used in any change at the time of writing this thesis. It was used afterwards for some changes in order to formalise them. Although, this has nothing to do with the processes between the PM and stakeholders in the change event. A similar procedure can be seen in the 70MB programme: first there is a process to a change event and later on the formalisation takes place with the change procedure. It can be concluded that the change procedures used in both projects are more a formalisation procedure at the end of a change event. Procedures that steer the change event after an intervention don’t exist (yet) in these projects.
11.3.6 Intermediate conclusions

In this section, the findings in the case studies were informally analysed by common sense. This analysis was done by using the formal analysis and the tables with findings of the case descriptions. The main conclusions of the analysis are shortly summarised.

Root causes of changes in airport terminal projects have more than one root cause and none of these root causes seem to occur regularly. In most cases, the changes are caused by both the project team itself and the stakeholders. Complex changes have more root causes and the other way around (more data is needed to prove this). Moreover, the root causes have no relation with project success. The preventability of the different changes, however, was individually evaluated. It was concluded that the NOx change and the staff filter change could have been prevented. The Kmar area change, the Ica lounge change and the SSDOP change couldn’t have been prevented. At last, if flexibility was a root cause, this was used strategically and the change was caused by purpose. Of course such events are not preventable.

Project- and process oriented management approaches should be mixed in order to achieve success. In stakeholder driven scope changes in airport terminals slightly more process-oriented aspects should be used than project-oriented. This ratio is related to the fact that it is stakeholder driven. In large changes, switches of these management approaches are used during the change events. The switching point is in PRINCE2, the moment the change is passed to the project board (and vice versa). This board is actually the physical representation of a network of actors. The overall project manager of a project is “in charge” of this switch. In a large part of change events, management approaches are not applied consciously.

Stakeholders with much power can force a project to change at costs of efficiency. Trust and involvement are linked and probably are the most important variables in the interactions considering effectiveness and success. Also a collaborative relationship is partly dependent on these two variables. A dialogue between the PM team and stakeholders is very important for success. Informal talks can be an indicator of better relationships and this forces parties to listen better to each other and to respect each other’s interests, resulting in success. At last, regular communication causes success as progress is ensured.

The context of the different projects shows that if the project itself had a dominant project approach, the change was successfully solved using a more process-oriented approach as a “counter arrangement” and the other way around. The context of the different change events showed that schedule is very important to all parties and this should not be changed. Larger changes in terms of money are more complex in their process. If changes occur with a large impact on costs, it is important that the project board in PRINCE2 structures is mobilised and the issues are discussed at one table. Change procedures used in both projects are a formalisation at the end of a change event. Procedures that steer the change event after an intervention don not exist (yet) in the projects that were researched.
11.4 The extra case: comparison with Prorail

11.4.1 Introduction
Now that the results of change events at Schiphol are analysed and on that basis conclusions were made, the situation at another network operator will be looked upon. Prorail is one of the few other companies within the Netherlands that is a network operator and builds or adapts terminals structurally. Terminals are within railroad industry generally referred to as “stations”. In order to make a good comparison, differences and similarities will be explored. The same division in variables will be used as in last section: root causes, management approaches, interactions and the project context. In the context, the differences in the stakeholder environment and the sector will be briefly discussed as well.

The organisational structure of Prorail and a comparison between the organisations of Prorail and Schiphol are shown in appendix N and O, elaborated by a colleague student, Walter op de Woert, who does his graduation research at Prorail. We collaborated in our graduation by exchanging information about the two firms.

The interview I had with a project manager of Prorail was focussed on one project: the structural adaptation of Arnhem’s station building. This project is one of Prorail’s six key projects at the moment. This adaptation is part of a station area development plan and has the objective to increase capacity, exposure and commercial facilities (retail). The reason to choose for this interview as such, was to be able to make a fair comparison. This project was similar to the projects that were researched at Schiphol. The terminal was adapted and operations should continue. Specific questions on examples from stakeholder driven scope changes were dealt with during these interviews.

11.4.2 Root causes
Most root causes of larger stakeholder driven changes within the Arnhem project were related to a new requirement of the users. This was in most changes related to a change in market conditions. For example, the NS wanted ticket counters in the original design. NS has volatile commercial strategies, which caused the counters no longer to be necessary during the project. The Casco was changed and had to be fitted as a coffee house. This kind of change events were quite easily solved as the stakeholder had to and accepted to pay for it. There were also smaller stakeholder driven scope changes that caused conflicts. These changes were caused by ambiguity in the requirements and designs and discussion arose about who had to pay for it. In the early FED, some larger changes were applicable. It is remarkable that the budget grew with these changes as Schiphol tried to fix the budget. The PM confirms that some changes could have been prevented and some changes couldn’t have been prevented.

11.4.3 Management approaches
The PM is open to changes. When a stakeholder comes up with a change, the PM team sorts out the validity of the change and the consequence. Larger changes are discussed in the joint steering committee. If the change is within the boundaries of the PM’s mandate, he can approve and implement these changes himself. The issues are generally demarcated to one and parties are
limited. All Tor are blueprint. The daily project team was steered hierarchically, while the steering committee consisted of all stakeholders and the network was coordinated. It can be concluded that the way more complex changes are treated is similar to Schiphol. If they can not be solved within the (hierarchal) project team, they will be passed on to a more process management driven committee. The management approach switches are applied at Prorail as well. Within the boundaries the PM (the smaller changes) can solve changes both project-oriented and process-oriented, which was also observed at Schiphol.

11.4.4 Interactions
The PM of Prorail indicated that a collaborative attitude is very important for project success, especially for the softer side of success (similar to effectiveness in this thesis). The PM also sensed that in many of the discussions about stakeholder driven scope changes, there was especially a lack of trust (and sometimes involvement) that caused friction between the parties. This could be attributed to the differences of interests. For example, NS stations was inclined to make claims immediately, because their commercial activities were endangered. The PM thinks that in some of the changes (sometimes even caused by NS itself), the parties should closely work together to achieve the overall goal (the new station building). These conflicts are evident in the relation between Prorail and NS. The PM sees the overall relation (of both boards of directors) back in this project. A similar pattern was found concerning the relation between Schiphol and KLM. These situations seem to be common in relationships between network operators and main user. In these conflicting relationships the PM misses trust and commitment. The fact that these changes are approved reluctantly, are received by him as unsuccessful.

The PM indicates that in successful changes the communication is bidirectional. If communication is additionally informal, it will attribute even more to success. These phenomena could be attributed to the parties coming closer together, causing more mutual understanding of each other’s interests. This is exactly in line with the findings of the analysis in last section. Only the effect of regular communication was unknown by the PM.

11.4.5 Structure and arrangements
The structure of the projects of Prorail is not related to a structure like PRINCE2, but to an own specific procedure that is called the “core process”. The core process is limited to a timeline with different phases and does not consist of a managerial project structure. This process is explained in appendix P by Op de Woert (2013).

The project structure was hierarchical. The PM had a project team with amongst others support, construction and design specialists. He was mirrored to a PM of NS and the municipality and had daily meetings with them (although he did most of the work regarding the terminal adaptation). They have to report to a joint steering committee in which all important stakeholders are represented. The stakeholders have the opportunity to review the designs, like in some of the cases of Schiphol. If a change appeared to escalate into a conflict, this issue was passed on to the steering committee that has to decide. This mechanism can be compared with the project board at the One-XS project.

The client is not an internal stakeholder as in Schiphol’s projects, but external (the ministry of infrastructure and environment and the municipality of Arnhem). Also NS financed a part of this
project, because they own and exploit the (new) shops at the terminal. NS is involved in station projects, but more on the side lines compared to stakeholders like KLM at Schiphol.

Prorail uses a fixed and precise change procedure. A stakeholder comes with a wish, the consequences are mapped by the PM. In most cases, these consequences should be compensated by this stakeholder. If the stakeholder accepts these officially, the change is approved. This procedure is like the procedure at Schiphol focussed on the approval rather than on the process of changes.

A remarkable difference considering the sectors’ structure is the way the users pay for the infrastructure. NS pays a fixed amount per distance while the airlines’ airport charges are yearly covering the Aviation costs of Schiphol (in which the costs of terminal projects are allocated too). Most of the station projects are financed by the government. A business case has been made, although this is more distant to the users. KLM (and other airlines) pay almost directly for the investments. This makes the mutual dependency between Schiphol and KLM larger than the dependency between Prorail and NS in these projects. The KLM being much closer involved in most projects and having more power in these projects than NS can be explained as such. KLM (indirectly) finances a large part of the investments of the structural adaptations in airport terminals and NS does not do that in station projects. It can be concluded that the way airport charges are billed (by law), influences the power of KLM in such projects and extends the mutual dependency between KLM and Schiphol.

Another difference is the amount of stakeholders at a terminal project. As can be seen in appendix O, Schiphol has many more operators at the airport. In most station projects, the NS and perhaps one or two other operators are affected. Additionally, Schiphol has to do with handlers, retail and restaurant owners, security and Kmar. This is because the procedures at an airport terminal are more complex. Every passenger, employee and product entering the restricted area, should be security checked. Schiphol is also a boarder with both Schengen and non-Schengen countries and boarder control makes the process more complex. Because of those processes, security restricted areas and areas “behind the Dutch boarders” should be created.
Part E Conclusions
12 Conclusions

12.1 Introduction

In part B, in literature studies, all theoretical research questions were answered. On the basis of the frameworks developed in that part, the case research was performed in part C. The practical research questions were answered in each case description. In the previous chapter of this part (part D), the results were analysed and on this basis conclusions were made.

The sub-questions have been answered in part B, part C and part D of this thesis. The theoretical questions were answered in literature studies. The root causes, the management approaches and nature of interactions within scope change events were explored and for each variable a framework has been developed. Five context variables were distinguished and for two of these, the project structure and arrangements, small frameworks have been presented. At last, success was framed and distinguished in two dimensions: efficiency and effectiveness. The first eight case research questions have been answered in the case research. In each change event all these questions were answered, partly by using the developed frameworks. The last case research question, the relation between the management and success was answered in part D.

In this chapter the overall research question, “How can airports improve the management of stakeholder driven scope changes during the Front End Development of terminal adaptation projects”, will be answered shortly as this question was analysed extensively in the previous chapter. The first variable, the root cause, has nothing to do with the success of the change event, although it is important to realise what caused a change event for its evaluation and possible future prevention. Management approaches, the second set and interactions, the third set of independent variables appear to have a relationship with the efficient, effective and overall successful resolution of a change event. Subsequently, the context can explain some of the differences among different projects and it helps the project manager to make the right choices considering his management approach. At last, the uniqueness of projects at Schiphol Airport is discussed on basis of the comparison with Prorail.

12.2 Root causes

Different internal, external and environmental root causes of scope changes have been found in literature studies. It was focussed on internal and external root causes, as only stakeholder driven root causes were researched. No root causes of changes in airport terminal projects seem to occur regularly. Some of the root causes in literature were not observed at all in practice; however few case studies were executed whereas they might exist as well. Scope changes have more than one root cause and are generally caused by both the project team itself and the stakeholders.

Scope changes can be divided in changes that could have been prevented and changes that could not have been prevented. External caused changes are generally harder to prevent than internal caused changes. In some cases, if a change event happens it is too late to prevent it, but afterwards the change should be evaluated. In the evaluation, the framework that was presented will help to analyse the change event. Which root causes can be identified? Could this cause be prevented? If this
is the case: one can learn to prevent such a change to occur in the future. The occurrence of preventable changes should be avoided.

There are of course also unpreventable changes. These cannot be avoided, so the PM should not try to do this. The root cause can tell which stakeholders had to do with this change and have to be involved in the process to come with a solution. The root cause flexibility indicates that the occurrence of the change was the result of a strategic choice and was consequently unpreventable (this was also stated in literature (Dvir & Lechler, 2004) (Olsson, 2004)). The unpreventable (and preventable that did occur anyway) should be managed adequately by the PM team.

12.3 Management approaches
In literature, two management approaches are distinguished: project-oriented and process-oriented management. Project management is characterised by predict and control, while process management can be explained by a “prepare and commit” strategy. These are two extremes of approaches that can be used to manage projects.

Overall success in stakeholder driven scope changes at airport terminals and its efficiency depend on both project-oriented and process-oriented approaches. Effectiveness only depends on process-oriented management and not on a project-oriented approach at all. As overall success should be generated, both management approaches should be mixed in order to apply successful management. In these scope changes slightly more process-oriented aspects should be used than project-oriented. This ratio is related to the fact that it is stakeholder driven. These management approaches are not applied consciously by most PM’s in change events.

In more complex change, management switches should be used if the PM cannot solve a change event with his (hierarchical) tools and mandate. Often PM’s have limited measures to perform process management. If changes are smaller and less complex in terms of consequences, they can use both project-oriented and process-oriented management. If larger change events occur, their mandates could not allow process management (they are not in a position to negotiate in the network of actors) and they are forced to apply project management. If this can not solve the issue and friction will arise, the change event should be taken to the higher level. If the overall PM of a project can not use process management within his mandate and can not solve it hierarchically, a management switch should be made to a body in which the network of actors is represented and the issue can be discussed at one table. This is the place where process management is performed and solutions will be found by negotiating. In PRINCE2 this body is the project board that can be seen as the physical representation of a network of actors. The management switch to such a body should be done by the overall PM.

In such a switch, the basic ways of interactions turn around. The interactions will not take place anymore between the intervening actor (one of the users) and the project management team and between project management team and the client, but between the users and the client directly, in the described body.
12.4 Interactions

Literature studies provided a framework in which ten different variables in 5 themes were presented to characterise stakeholder interactions. The presence or absence of trust, the level of involvement, the stakeholder relationship (collaborative, conflicting, power based and one-sided), the power of the stakeholders and the communication related aspects (bidirectional, formal and regular communication) appeared to be important theoretical aspects of these interactions. In practice one-sided and power based relationships weren’t found and “conflicting” appears to be the same dimension but opposite from “collaborative”. The other variables covered a separate set of dimensions, although a high level of trust, involvement and collaborative relationship are usually compatible. Project managers can help to facilitate the interactions and should know what contributes to success.

Success is dependent on a high level of trust, involvement and a collaborative relationship. In addition, communication should be bidirectional, regular and informal. Both effectiveness and overall success depend on these variables. The power of the intervening actor does not have any relation with overall success.

Trust and involvement are crucial for a change event to be successful. A collaborative relationship contributes to success, while a conflicting relationship has a negative influence on success. In communication, especially in stakeholder driven changes, the dialogue is important. If parties are on cross-purposes, the resolution will probably be unsuccessful. Also the use of informal communication is very important. Informal communication brings parties closer together and makes them understand each other’s interests and respect them. Formal communication, can lead to unsuccessful resolutions of projects. Regular meetings are important to ensure progress in the change event.

The efficiency of the resolution of a change event, however, only depends on the use of informal and regular communication. In addition it is inversely proportional to the power of the intervening actor. If the intervening actor has more power, it is likely that he can force the scope to change drastically to his preferences regardless the impact on cost and time. This last variable is not something the PM can influence, but he should keep it in mind.

12.5 Context

Five different contextual variables were determined in literature studies and were taken into account in this research. Two of these variables are related to the project context: project structure and project arrangements. Additionally, three variables were case specific: the resource availability in the change event, the moment in time line during the project and the existence of a change procedure.

The overall project structure and arrangements were characterised by different measures. These measures had two dimensions: project and process elements that correspond to the management approaches discussed earlier. Thus, structure and arrangements can also be divided into project- and process-oriented elements. If a project has a dominant project-management structure and arrangements, a stakeholder driven change event should be managed with an overreliance on the
opposite management approach in order to achieve success. This is in line with the “counter arrangements” theory described by Koppenjan et al. (2010).

Regarding the resource availability in different change events during projects at airport Terminals, schedule is very important to all parties and during discussions, parties agree on the wish to not extend the project. The schedule had not been changed in all observed change events. The costs of the consequences of a change event can differ. Larger changes in terms of money are more complex. Such projects should make a timely (probably immediate) management switch if the PM’s instruments and mandate cannot solve the change event. At all times if a management switch is made, it is important that the changes and sub-projects should be discussed at one table. One project or issue should not be discussed at different tables, but multiple issues at one table. This is in line with the theory described by De Bruijn & Ten Heuvelhof (2008). The impact of the moment in time line could not be researched: most changes took place more or less at the same period in time. No differences were observed. The impact could be different as it involves more work for a contractor in a few cases. At the time of writing the consequences hereof were not yet clear.

At last, a change procedure is applicable in many projects and change events. However, these change procedures are more a matter of formality at the end of a change event, in which the right departments within the organisation approve it. Procedures that steer the change event after an intervention do not exist (yet) in these projects.

12.6 Projects at airport terminals
The results presented in this chapter are applicable for stakeholder driven scope changes at airport terminals. On comparison with the project of Prorail, differences and similarities were observed. To what extent the conclusions will also be valid for other network operators can now be concluded.

In changes within projects at railroad terminals, many of the same root causes take place as in airport terminals and they could also be preventable and unpreventable. The theory of the root causes from airport terminals is also applicable for other network operators. Prorail uses a project-oriented management approach in its structure and arrangements. Within the Arnhem project complex changes causing conflicts were generally approached with a project-oriented approach as well by the PM (no mandates to perform process management in these changes). To come with a solution, the same management switches (to a body in which all relevant stockholders could discuss) were made as at Schiphol. Within interactions, some of the same principles are applicable at other network operators. Trust is important and a collaborative relationship with the stakeholder. Informal and bidirectional communication with the stakeholders appeared also important in railroad terminal projects. Involvement was less important here.

Although some of the relations that were found in projects at airport terminals are also more or less applicable in railroad terminal projects, airport terminal projects are unique in many ways and can not be compared with other network operators at all. First, airports have at a relative small area many more complex stakeholder relations and processes. Airports have multiple airlines and handlers, moreover the phenomena of security, boarder control and customs in this small area are also causing its uniqueness. This might explain that stakeholder involvement is so important for success here. Another consequence is that at airports more and more complex stakeholder driven
scope changes do occur. Secondly, the client at Schiphol is an internal party and at Prorail the client is external (government). The budget of a project at Schiphol is more fixed, while at Prorail the budget grew with the changes. The fact that the client is closer might cause more control on budget and business case. This focus on costs can also be attributed to the next (third) aspect of uniqueness. Thirdly, the way that user costs are charged by the network operators is unique at Schiphol. Law enforces an exact coverage of the Aviation costs of Schiphol by airport charges, while users of railroads pay a fixed amount per distance. The investments are almost directly paid by airlines (especially KLM), which makes this stakeholder more powerful as they will be affected both in operation and in expenditures. The mutual dependency between KLM and Schiphol is therefore larger and might explain the need for involvement and stronger budget controls. At last there is one major similarity: the overall relation between a network operator and its most important user is conflicting, because of fundamental differences in interests. This causes friction and a lot of effort is put in the discussions between these parties.
13 Recommendations

13.1 Essence of research

In this thesis many variables were researched, turning it into a broad rather than in-depth research. Approximately 15 variables were researched within 6 case studies. In this section the most important relations that have been found will be highlighted once again.

Why changes and its root causes are important:
Changes can be divided in preventable and unpreventable changes. All changes that were researched appeared to be desirable, so changes are not something negative as will be perceived by some project managers. Changes are needed to add value and work towards a successful project. Some of the changes appeared to be preventable, by taking an issue into account in the original design. Evaluation of the root causes is essential in order to judge whether a change could be prevented and learn for future projects.

Selection of the right approach (by counter arrangements):
If a change event occurs, there are a few important aspects that help to deal with it successfully. A mixture of a process and project management approach is always required; however, one of the two approaches should be dominant. In most events a process-oriented management approach should be slightly dominant. The way the project itself is managed is a good indicator for the preferred dominant approach in scope change events. Counter arrangements should be made by choosing for the opposite management approach when one approach is over relied on in project structure and arrangements.

The management switch:
If an intervention is made at some level of the project, one of the project managers has to deal with it. He could use a more project-oriented or process-oriented management approach as was explained earlier. In practise, he might not have the proper tools to use a process-oriented approach, because this could concern negotiations with stakeholders resulting in new arrangements to be made. If he is part of a hierarchical organisation or project team, he could not have sufficient mandate to perform the preferred management approach. In such a case the change event should be taken to the higher level. The overall project manager might find solutions within his mandate and could make compensations in other sub-projects. If the change has such a large impact on costs or time, that the overall PM does not have the proper tools to use a process management approach (and the project management approach would not solve the situation), he should make a management switch to the network of actors. The body that originally discussed the project feasibility with the stakeholders has to be mobilised. This is the only way to make project phase iteration. In the appropriate body all parties are present that are entitled to negotiate at one table about the issue. The pattern of interaction switches from intervening stakeholder – project management team – client to client – stakeholders.
The importance of involvement:
Within the interactions, the influence of many variables has been explored. Involvement was one of the most important and dominant aspects. Trust and a collaborative relationship also help to make the change event more successful. However, this trust and collaboration are dependent on involvement. If a party has been allowed involvement, a collaborative and trustful relation can be perceived which is an incentive for moderate behaviour. When parties meet repeatedly because of their involvement, their behaviour will have to be cooperative (De Bruijn & Ten Heuvelhof, 2008).

Powerful actors cause less efficient change events:
In change events in which a powerful actor makes the intervention, efficiency is likely to drop. This is inevitable, but should be kept in mind. If powerful actors are involved early, future interventions that might lead to inefficient changes will be limited.

The importance of the right communication:
Within the communication three variables have been distinguished. Especially informal communication is important for success in change events. Informal communication also leads to moderate behaviour. It will be obvious and almost redundant to mention that a dialogue in communication is most important. In some change events this dialogue appears to be still missing, though. At last this communication should be frequent. Frequent meetings cause success, especially because of the progress it guarantees.

13.2 Recommendations project management organisations

The recommendations for project managers and project management organisations at airports can be extracted from the previous chapter, the conclusions. Here a short list with some of my recommendations will be presented:

- Analyse each change event afterwards with the presented framework of root causes. What were the root causes and was the change preventable? Learn from this evaluation.
- Avoid preventable changes and do not try to prevent unpreventable changes.
- If a change event occurs choose as a project manager an opposite dominant management approach as was used in the project context (from project-oriented to process-oriented and vice versa).
- If a project manager does not have enough instruments or mandate to perform this management-approach, the change event should be taken to a higher level.
- If the overall project manager does not have enough instruments or mandate to perform this management-approach, he should make a management switch to a body in which all important stakeholders can discuss it at one table (the project board in PRINCE2).
- Make sure as organisation that each project has a (physical) representation of the network of actors (important stakeholders), which is available to solve and discuss complex changes.
- Make sure that you involve all important stakeholders. By involving them, trust and a collaborative relationship will be realised. This will result in moderate behaviour of all parties.
- Dialogue with these stakeholders in an informal way and organise regular meetings to ensure progress. Informal communication causes moderate behaviour too. Make sure that
representatives of different parties get to know each other and link people that know each other in the interactions of a change event.

- Negotiate about issues and changes in the projects at one table. Even if a part could formally be out of scope (because of accountancy purposes to keep a part out of budget).

The fourth and fifth recommendations, taking the issue to the higher level and the management switching might not be easy. The superior in the higher level could cause resistance. In this case the project manager could use different strategies to make sure he can solve this issue in the network (increasing his mandate) or take it to the higher level. The following strategies have been presented by De Bruijn & Ten Heuvelhof (2008):

- **Involving the superior in the process of consultation and negotiation.**
  The project manager can involve his superior by informing him which leads to learning by the superior. Additionally, by informing he will be committed and expectations will be managed. A good strategy to do this is by “dilemma sharing”. The progress of the process is presented in a dilemma, which is likely to lead to a trade-off. This implies that the superior stops steering this project hierarchically and will negotiate with stakeholders or give the subordinate more mandates to do so.

- **Making procedural agreements with the actors in the network about what to do when the superior disagrees.**
  If the project manager does not have the mandates to make new arrangements with the stakeholders, he can share his problem with the stakeholder(s) in the network. By doing so, he will involve the stakeholder and use a process-oriented management approach without having the mandate. The actors will be forced to show moderate behaviour and are probably willing to make procedural agreements in case the project manager’s superior does not agree in the end.

- **Making the damage of a hierarchical approach explicit to the superior.**
  If a project manager’s superior refuses to take over the negotiations with stakeholders or give more mandates, this may cause relational damage, reputational damage and even substantial damage (if actors give up their commitment the entire scope might have to be changed altogether). If the project manager can point out the actual risk of these damages, he might mobilise his superior (or the project board).

- **Activating the actors in the network.**
  Another strategy is to use the relationship with the stakeholder to influence the superior. The intervening actor or other persons in his organisation might have good connections with the superior. If the superior is informed by these connections outside of his own organisation he might be mobilised in the network. This has an additional advantage for the project manager: he will not be the (only) messenger of bad news.
13.3 Recommendations Schiphol Airport

The recommendations for Schiphol specifically are rather similar to the recommendations for project management organisations that were shown in last section. A few specific observations and recommendations can be added:

Projects at Schiphol's terminal tend to have more stakeholder driven scope changes than the average construction project. This can be attributed to the large number of stakeholders who have interests and who operate on a relatively small area. In addition, all their processes need to continue during building activities. This is why stakeholder involvement is even more important here than in other projects. Schiphol should make sure that all powerful stakeholders like KLM, SAOC, Kmar and internal departments of Schiphol Group will be involved closely. This will provide a trustful and collaborative atmosphere, which increases the chance of success.

Changes are generally desirable (although sometimes preventable) and contribute to successful projects. I noticed that especially budget constraints caused the project managers to be careful and scope change averse tending to avoid discussions and negotiations with the stakeholders. This caused friction in some of the cases and made the relationship laborious. If certain project managers would get more mandates to make trade-offs, projects are likely to run smoother. The other option is to create an atmosphere in which issues are easily and quickly taken to a higher level and management switches are recommended. The current settings, especially the one of the project board, appear to function excellent in changes, so management switches in scope changes will generally lead to success. More and smaller changes should also be processed in this way more easily in order to meet less resistance from stakeholders and run the project smoothly. The disadvantage of this last option is that it requires more time from high level managers.

Another observation that I made is related to the previous one. In many cases, “accountancy” tricks were used to avoid a budget constraint. In some cases I learned that changes were delayed, because a change procedure was waited for in order that the change could generate additional budget instead of using the existing budget. In the staff filters change, a whole sub-project that had not been specified adequately in the feasibility study was pushed out of scope. This was especially done because of budget constraints. The result of such cases is that both efficiency and effectiveness are negatively influenced. In the example of the staff filters, problems could have been avoided if they had been added to the One-XS project as a sub-project and had been treated by the same overall project manager and the same project board. Naturally, the costs of One-XS would increase anyhow. Nevertheless would it matter if these costs are classified under One-XS or classified under a newly started project? All costs will return in the same airport charges in the end. By separating the projects, because of “accountancy” reasons, things went wrong and relationships between stakeholders were harmed. Furthermore, the additional project will probably experience delays because of this solution. These were just a few examples; I noticed a general tension which seemed to say “I will not adopt this change or sub-project because it will be subtracted from my budget”. This only causes negative effects on projects and stakeholder relationships and actually does not generate savings. Tasks should be allocated to those (sub) projects where it fits substantially best. Budget constraints should be taken away.
At last an additional idea is recommended although law should have to be changed in order to achieve it. The way airport charges are billed influences the relationship with important actors in airport terminal projects. If the airport decides to make such an investment on basis of a positive business case (the investment costs will be covered by operational savings or extra profits), it implicitly decides about the investment of airlines. This increases the interests and power of the stakeholder. If the intervening actor has more power, changes will be resolved less efficiently as was shown in the analysis in chapter 11. Thus, do not give stakeholders such power. The use of a special purpose vehicle would be a good solution. By creating a legal entity that can cover the business case, the costs could be separated from the aviation costs which have to be recovered directly by airlines. The business case enables the costs to be recovered after the payback period and the airlines will not be affected by these investments (which they do not desire in the current economical situation). This could be beneficial for airlines, but also for the airport, because the power of airlines will decrease and efficiency success will increase.

13.4 Integrated view

In this section a link is be made between variables dealt with in this thesis by looking at the bigger picture. The elements that were explored in this thesis are placed in the context of projects and organisations. Where can management approaches be found within an organisation and at what levels? What can project managers decide and what has been decided for them? How can they use interactions to resolve changes with their stakeholders? It will be clear that not one approach could be called the best, but trade-offs should be made.

A project management team has to deal with scope changes, as these will occur in all large construction projects. In brownfield projects, such as terminal adaptations, project managers have to deal with many stakeholders who will make interventions continuously. Managers can deal with these changes in several ways and can give different reactions, regardless of the root of this change. The way this is done, is only partly dependent on the project manager himself. In the case a project management department is part of the parent organisation, the parent organisation decides more or less what management approach can be used. A project manager might not have the mandate and tools to deal with changes in all possible ways. The project management organisation has a vision that steers project managers in a certain direction. This becomes evident from the use of a project management method (i.e. Schiphol uses STAP). The client too has a share in this direction as he will set more or less strict boundary conditions which also influence the mandate and tools. Project managers and the project management team more or less have to follow this line. So the way they deal with changes has for a large part been determined by the organisation and project management method. What exactly could an organisation do and what can project managers themselves do?

Management approaches come back in many levels of an organisation and within a project. The overall structure and arrangements can be characterised by a project or process management approach, but also the way a programme, sub-projects, and changes are managed. On all these levels, different management approaches can be and should be applied (depending on the situation). A project management organisation should be arranged in such a way that different approaches could actually be used in these levels of a project.
There is always a tension between manageability of a project and the integration. If you look at Prorail, the project’s budget increases in the case of large changes in terms of money, while Schiphol fixes the budget and these changes are separated into another project. The main reason that project managers at Schiphol have an aversion towards changes and additional projects is because of budget constraints. They do not want extra scope, as it will not fit in their budget. Changes could become separate projects and not be allocated to the part of the project it belongs to. The division of the scope of projects and scope changes can be done in two ways. Scope could be integrated in order to make sure that the right scope is allocated to the right project manager who has the best knowledge of this scope. Interfaces will be minimised by this integration. On the other hand, the manageability will decrease. The system has not been decomposed and scope can increase in all directions making it rather capricious to the project manager. The parent organisation and management of a project management organisation should make a trade-off between manageability and integration of scope in the management method they prescribe.

So project and process management approaches on the level of structure and arrangements are very dependent on the method and boundary conditions defined by high level managers. In change events the internal reaction depends on the management approaches set in the project. Of course project managers can give their own twist to it, but might have limited tools to use the discussed approaches freely (dependent on this management approach) as the scope is managed by the client and high level managers of Schiphol. This can cause friction in relationships lower in the organisation. Management switches might be a managerial necessity in order to make the counter arrangements work. On the other hand, if the organisation lets go, the scope of a project could explode and might no longer be under control. Again the trade-off should be made.

In the case of conflicts about scope with stakeholders after an intervention, the (project management) organisation have two options, regardless the trade-off that they have made as was explained earlier. An organisation can give the project manager enough mandate themselves to negotiate with the specific stakeholder to resolve the issue, or they should facilitate the possibility to take issues easily to higher level managers who could assist them to come to a solution with the stakeholder and give commitment.

Although there is only one structure and limited arrangements within a project, in which the management approach is partly fixed, there also are unlimited interactions. The interactions are within the control of the project managers. Despite not having complete power to make a decision, he can use the interactions in such a way that it can contribute to the successful resolution of a change event. For example, the fact that a stakeholder is involved does not say anything about the decision that is going to be made in the change event, but it helps to maximise solution space, create acceptance and moderate behaviour by the stakeholder.
14 Reflection

I worked during this research with much enthusiasm at Schiphol Group where I could write my graduation thesis as a graduate intern. Next to the topics that were covered by this thesis, I learned a lot about project management in practice and the aviation and airport industries. The start was very unstructured and open. Many aspects were looked upon to generate a focus and a good research plan. Literature studies were, partly because of the wish of the graduation committee, quite profound and thorough. Afterwards, this was the only period I might have done differently. It took too much time to read and merge literature into new paradigms. This stage could have had one level of detail less. The next section was intensive as approximately 30 interviews were taken to explore the details. It was useful that for every case more interviews were taken. This became clear when various stakeholders told similar, but also different sides of the stories. In the last part of this research the findings of the different cases had to be compared. The programme fsQCA was a good tool to scientifically compare the results. Especially, because the programme can make qualitative comparisons in researches with few cases and multiple variables. A case study at Prorail was planned, but because of difficulties making an appointment for interviews, this had to be cancelled. In the end, because of an interview and information exchange with a colleague student, I was able to incorporate an extra case in this thesis. This was unfortunately in a late stadium, after the case comparison had been made. This is the reason that was chosen for a comparison of the Prorail case with the results of the cases at Schiphol.

In this chapter, the research will be reflected. First the contribution to scientific literature will be discussed. Then, with a critical look, the limitations of the research will be given. At last, on this basis, recommendations will be done for future research.

14.1 Contribution to literature

This research has many contributions to scientific literature; the most important are summarised below:

- This research shows a way to evaluate stakeholder driven scope changes in projects at (airport) terminals. A framework of the root causes of these changes is provided.
- This research shows how project- and process- oriented management approaches are used and should be used within change events in projects at airport terminals.
- This research shows what interactions with important stakeholders contribute to success.
- In this research a unique representation of the resolution of a change event is developed. The success of a change event is divided in an efficiency dimension and an effectiveness dimension.
- In this research a connection is made between the structure and arrangements of a project and the management of changes.
- This research shows the uniqueness of projects at airport terminals and the way stakeholders form a complex network of actors, depending on each other.
14.2 Limitations

Of course, if this research is looked upon critically, there are many limitations in the results. Especially the lack of time to perform more case studies caused less reliability on the results. The following specific limitations can be appointed:

- Not enough data were available compared to the number of root causes that were found in literature to draw conclusions about their occurrence.
- Only changes at Schiphol airport and no other major airports were studied, because of distance constraints. The application of these conclusions might be more limited than expected.
- In this research most of the project context appeared to be the same. Only two different contexts were observed, making the comparison and influence of these contextual variables harder to determine. This was due to quite standard project management methods that are used.
- The organisational structure was not relevant here, as all airport terminal changes occurred at the Schiphol organisation. Research at other airports within the Netherlands was originally planned, but turned out to be irrelevant as they are also part of Schiphol Group.
- In all the scope changes that were researched the most important contextual variables structure and arrangements were admittedly different, but those two were within every project the same. In the conclusion was drawn that the opposite leading management approach should be performed. However, there has been no situation researched in which the context was project-oriented and the arrangements were process-oriented or vice versa. This combination might not exist within airport terminal projects.

14.3 Recommendations for further research

When more research is done on change events, the results could be stronger, leading to more and better conclusions. Some presumptions could not be translated into a result because of the low quantity of cases. I would recommend to do a similar research on basis of the same literature and starting points. Many additional case studies will be able to be performed, as one could start with the case studies immediately. I have the following more specific recommendations for future research:

- Perform the same research in the future to more projects and change events at Schiphol airport to achieve more data, also after the FED.
- Perform the same research at some other major international airports, such as London Heathrow, Paris Charles de Gaulle, Frankfurt Airport and New York JFK. Next to the benefit of additional data, new project contexts and organisational structures can be compared.
- If more data are obtained, it should be used to check if some root causes occur more regular than other ones. This could lead to conclusions about the project management method and interactions with stakeholders which should be kept in mind.
- I have the presumption that complex changes are caused by more root causes. More data are needed to support this presumption.
• Future research should concentrate on the existence of projects that have different management approaches in their structure and arrangements. If this is the case it is advisable to explore what management approach should be applied in a change event in order to achieve success.
• The relation between a network operator and the major user(s) appears to be difficult and conflicting. This was attributed to a fundamental difference in interests. Further research could be done to the root causes and characteristics of these relationships and the way how stakeholder driven scope changes are related to this. It might be interesting to look at the way KLM and Schiphol depend on each other and have friction and compare it to the relation NS - Prorail and maybe Air France-Aéroports de Paris.
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Management of stakeholder driven scope changes in large structural adaptations of airport terminals


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Master Thesis J.P.G. Elich


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Appendices
A. Scope change and scope creep

There is no consensus about the meaning of “scope creep” amongst both scientists and practitioners. This is probably why in scientific literature, the term scope creep is seldom used (and if used it is mostly referring to software development projects); most scientists use the word “scope change” or even just “changes”.

In talks and interviews with practitioners this discrepancy also became evident. Some of the interesting perceptions of “scope creep” I encountered in literature and practice were:

Groff & Jones describe in “Introduction to knowledge management” scope creep as “a phrase used to describe a situation in which project goals are altered or expanded so often that the assignment no longer resembles the original project commitment” (Groff & Jones, 2003).

Ryan A Dibble says that the context, the objectives, the function and the performance make up the scope. Scope creep is the expansion of this scope (Dibble, 2001).

Katy Long defines scope creep as “the unplanned expansion of a project” (Long, unknown).

Mental and Iles-Smith (2009) describe scope creep as “the incremental change of scope over time”.

Website PMWIKi, a platform for project management describes Scope Creep as “the phenomenon whereby the scope slowly and almost imperceptibly is extended without a new scope being explicitly defined. In this case cost and time are being spent on activities and products that are not budgeted or planned and the overrun is a fact. Scope Creep is a serious risk for each project4.“ If the scope is explicitly changed, the impact on costs, schedule, quality, business case is defined leading to a new agreement between the client and the contractor (or steering committee and project manager). There is a new scope agreed and a change in scope has been formalised. The scope is deliberately changed taking all the consequences and risks into account. From that moment, the new scope should be controlled.

In an interview, one of the project managers, who has been working for 25 years at Schiphol, explained what his perception of Scope Creep was: “everything that doesn’t contribute to the project’s function and isn’t approved by the client (by adapting budget/time)”. For example: the existing metal beams in the terminal appear to miss a obligatory fire resistant coating. If there is asked to also handle this problem in the One-XS project, this would be scope creep as it doesn’t contribute to the function of “central security”. This is not in scope of the project unless the client adopt this task in the project by taking into account more time and money. In such a case the scope creep becomes a scope change (the clients or users adapt their expectations by learning).

4 http://www.pmwiki.nl consulted on 29-11-2012
It can be concluded that scope creep is described by different sources in different ways. Also the difference between scope creep and scope change is not always clear. In some of the detailed descriptions scope creep was referred to a situation in which an executed task hasn’t been prescribed and is not officially approved by the client or client’s agent. If it is approved by the client or client’s agent, the scope is adapted: so this would concern a scope change.

In an earlier graduation thesis about the phenomenon “scope creep” came to the same conclusion. Here, scope creep was described as the difference between the (functions and properties of) products and services delivered by the project and the products and services initially intended (Van der Heijden, 2005). Van der Heijden made the same observations and states that there is in some literature an important accentuation on this definition which is used differently. That is why formalised and non formalised scope creep can be distinguished.

*Non-formalised scope creep* is a difference between initial and actual product and services, while this wasn’t noticed by the project organisation. In this case no arrangements about the consequences in aspects like time and costs have been made.

*Formalised scope creep* is a difference between initial and actual product and services, known to the project organisation. This difference has been recorded and set. Furthermore, there are arrangements about the consequences between project manager, owner and in some cases other stakeholders (i.e. an extra budget has been approved).

In 70 % of the literature scope creep is referred to as both formalised and non-formalised scope creep. In 25 % of the cases formalised scope creep is not seen as scope creep, but explicitly as scope change. The last 5 % uses another definition (Van der Heijden, 2005).
B. Complexity

As complexity is the basic root of project uncertainty and thus influences scope and scope changes as pointed out in the first chapter of literature studies, project complexity should shortly be explained. After all, the cases that will be assessed must comply to this description in order to make this theoretical framework applicable.

Many scientific literature looks upon the term complexity. Here, only a few will be discussed because just a means of case verification should be developed. Turner and Cochrane (1993) describe a classification of projects according to uncertainty. They distinguish two kinds of uncertainty: uncertainty in project goals and uncertainties in the methods to achieve these goals. Baccarini defines complexity as a variety of interrelated parts. There is both a differentiation in varied elements and an interrelation which resembles the connectivity of these parts (Baccarini, 1996). Williams (1999) combines these two views into a framework. He divides complexity in the structural complexity of Baccarini and the uncertainty described by Turner and Cochrane. Also Veeneman (2010) shares this view of many parts being connected. Something is complex if it has “two way multiple connections between multiple points”.

Concerning this thesis and the cases that will be examined the two extra aspects, described by Williams (1999) are interesting. Conflicting goals and stakeholder multiplicity would also be important aspects of complexity in engineering projects. Neville and Menguc (2006) agree with the aspect of stakeholder multiplicity and defines it as the complex interaction between stakeholders. Bosch Reckvelt et al. (2011) developed an extensive framework for characterising project complexity in large engineering projects, which can be used to adapt the FED phase of engineering projects to the particular complexity. This large framework was inducted from existing literature and empirical work consisting of several interviews on 6 different projects. The framework describes three kinds of complexity: Technical, organisational and environmental complexity. This TOE framework is again subdivided into different subcategories, which each consist of several questions. To analyse the project’s complexity in this framework 50 questions have to be answered. In Table 1, the subdivision of this framework is schematised.

<table>
<thead>
<tr>
<th>Technical</th>
<th>Organizational</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Size</td>
<td>Stakeholders</td>
</tr>
<tr>
<td>Scope</td>
<td>Resources</td>
<td>Location</td>
</tr>
<tr>
<td>Tasks</td>
<td>Project team</td>
<td>Market conditions</td>
</tr>
<tr>
<td>Experience</td>
<td>Trust</td>
<td>Risk</td>
</tr>
<tr>
<td>Risk</td>
<td>Risk</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 TOE framework subdivided (Bosch-Rekveldt, et al., 2011)

Related to infrastructure projects, Hertogh and Westerveld (2009) have defined six complexity dimensions in infrastructure projects from the practitioner’s point of view and additionally two different perspectives of complexity. A distinction has been made between technical, social,
financial, legal, organisational and time complexity. On the other hand also a distinction was made between detail complexity and dynamic complexity.

The 6 complexities dimensions:

1. Technical complexity is related to the technical uncertainty and unproven technology in projects
2. Social complexity is related to the degree of conflicts of interests among the stakeholders, the difference in interpretations and perceptions among these stakeholders and the impact on environment.
3. Financial complexity is related to the cost-benefit ratio, cost calculations, financial control, and the financing itself.
4. Legal complexity relates to the ever changing extensive laws rules and legislation.
5. Organisational complexity relates to the division of responsibilities and positioning of the project organisation. Especially the managerial interfaces are an important factor of this kind of complexity.
6. Time complexity relates to the long time frame with continuous developments and the non sequential project processes or phases.

As stated, Hertogh and Westerveld added two perspectives to all these complexity dimensions. Detail complexity refers to a system which has many interrelated components. Thus, this complexity is partly dependent on the number of parts and partly about the interconnection between them in an intricate way. Dynamic complexity implies that systems have the potential to evolve and over time. Those systems are self-organising and characterised by co-evolution. This has in most cases to do with the dynamic stakeholder system. Furthermore, dynamic complexity is characterised by a limited amount of understanding and predictability, especially by the decision making parties. This last point is closely related to uncertainty. Figure 28 shows a visualised scheme of this paradigm.
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Detail complexity</th>
<th>Dynamic complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>Mega sized products (scope)</td>
<td>Unproven technology</td>
</tr>
<tr>
<td></td>
<td>Many relationships between parts of the product</td>
<td>Technical uncertainty</td>
</tr>
<tr>
<td>Social</td>
<td>Large number of stakeholders</td>
<td>Different meanings and perceptions</td>
</tr>
<tr>
<td></td>
<td>Many relationships</td>
<td>Changes of interest over time</td>
</tr>
<tr>
<td>Financial</td>
<td>Difficulty in calculating cost for all sub elements of the product</td>
<td>Changing market conditions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Different perceptions about definitions and agreements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strategic misinterpretation</td>
</tr>
<tr>
<td>Legal</td>
<td>Large number of consents and permits needed which are often related</td>
<td>Changing, non-existent and conflicting laws</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Many decisions with no clear best solution</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Future developments influencing the project delivery organisation</td>
</tr>
<tr>
<td>Organisational</td>
<td>Large number of involved organisations</td>
<td>Researchers are part of the system</td>
</tr>
<tr>
<td></td>
<td>Numerous working processes that interfere</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large number of contracts with numerous interfaces</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>Planning of separate activities and their relationships</td>
<td>Long term frame with continuous developments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No sequential process of implementation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Planning has to deal with numerous uncertain and ambiguous processes</td>
</tr>
</tbody>
</table>

Figure 28 Complexity framework of Hertogh and Westerveld

Relating to this research especially the dynamic complexity is applicable. The dynamic character of scope can be linked with the dynamic complexity of this framework. The 6 dimensions of complexity can also be found in the large projects which are executed at Schiphol airport. In this research and consequently the practical cases, the most relevant dimensions are the social, organisational and possibly the time complexity. Social and organisational factors both have to do with the project’s stakeholders. Time complexity has to do with the length of the project and the iteration of different project phases. A long timeframe has continues developments. Due to these developments the chance of changes will increase.
C. Scope change events

In the scientific literature, not much has been written about the occurrence of scope creep; the term is occasionally used without analysing it properly in most of this literature. However, as discussed in the terminology, scope changes could be analysed as well, as it is actually the same. In this paragraph, both expressions will be used depending on the expression used in my references.

Meredith & Mantel (2010) state that Project changes could result from three basic causes:
- Uncertainty about the technology on which the work of the project or its output is based.
- A modification of the rules applying to the process of carrying out the project or to its input.
- An increase in the knowledge base or sophistication of the client/user leading to scope creep.

Coping with these changes are according to interviews with more than 500 project managers the most important problem in projects. Furthermore, Meredith and Mantel make clear that the most common changes are due to the natural tendency of the client and the project team members to try to improve the product or service. There is, however, no insurance against the risks and impact associated with project changes. Total quality management and employee involvement will help if both the deliverable and the process by which it is to be produced are carefully studied by thoughtful teams that represent the interest of the major stakeholders any project (the client, senior management, the project team and the community). They propose a formal change control system to overlook and regulate the project’s changes.

A more practitioner related source, PMwiki\(^5\), defines two main sources of scope creep:
- Externally: The client/user: If these parties don’t have a sufficient clear view of their expectations, they could be tempted to continuously expanding the scope.
- Internally: Project team members: Especially technical specialists often tend to apply the technological potential solutions rather than fulfilling the client’s wishes. In case the project manager has little insight into the work of these specialists, the scope of the project could grow unnoticed.

The same distinction between internal and external scope changes is made by Mental and Iles-Smith (2009). They only add that the external source of scope changes also could be the supplier or the environment (i.e. project stakeholders).

In addition, three results of these changes are defined. A scope change could influence the schedule, resulting in a schedule change. It is also likely to change cost and perhaps quality resulting in a cost and quality change. Here, it can be concluded that the four main project management variables described by i.e. Meredith & Mantel all depend on each other. Scope changes may have an impact on schedule, costs and quality. On the other hand it also works vice versa: if there are concerns about costs or the project should be finished earlier, the scope or quality could be adapted to reach this objective.

\(^5\) http://www.pmwiki.nl/kennis/scopecreep consulted on 11-01-2013
This process is described by Melton & Iles-Smith (2009). They conclude that scope changes come in three general types:

- Requirements change
- Cost change
- Scope creep

Requirements change is a change in the requirements of the project, because new goals or forecasts are applicable. If the requirements were adequately defined in the beginning, this is quite easy to cope with. Through a change process the impact on the variables will be clear and a decent consideration can be made. Cost changes can occur because of changes in the project environment leading to reduced funds. This could have major impact on the project’s outcome. These changes are hard to cope with as the stakeholders have to accept a change in value delivery. The problem is that with this kind of scope change the budget is cut, but the expectation remains the same. The scope creep is in Melton & Iles Smith’s description a set of changes that incrementally occur. They divided this type of change further into:

- Requirements creep
- Feature creep
- Instruction creep

Requirements creep are requirements added on in a piecemeal way. This happens when the new requirements are not clearly defined in the original scope. Feature creep is the occurrence of new functions that are not asked for but might be useful. Instruction creep is applicable when the requirements are ambiguous and thus the different parties all have different expectations: the ideas are not aligned.

Also Dibble (2001) concludes that the impact of scope creep is an increase in resources. The risk of scope creep is that it drives up costs and lowers client’s profits. Dibble also describes different occurrences of scope creep. Scope creep appears often in projects with a short FED time resulting in not enough time to fully understand the client’s needs. Another possible appearance is scope creep in incrementally phased projects. Not all resources are clear at the beginning of the projects and in new phases requirements change by changing client expectations. This is very common to the “learning” or sophistication cause earlier described. Also non time related aspects could cause scope creep. First, project team members represent themselves as an expert in an area they are not familiar with resulting in a wrong scope definition and missing requirements. Second, a very important reason is a lack of client involvement and accountability. If the client or one of the major stakeholders is not involved enough, the requirements could be unaligned with the expectations. Third, a cause related to the first two is the inability to define a clear scope because of a bad relationship between project team and the client.

Long (unknown) defined 6 different root causes of scope creep. First, defining the (daily) processes inaccurately could be a major issue. Almost all processes are cross-functional and almost all processes connect or interface with each other. So not only the functional area of the project should be looked upon in setting the requirements, but also other areas and business processes could be influenced by the project. Second, the wrong people are defining the scope. Participants should be high level managers who have comprehensive understanding of the business. When the correct
group is defining the scope, they are also making resource commitments. Third, there could be no common definition among all participants and related parties. Not enough time is spent by discussing the terms of a project as people assume that everybody understands the system, processes and related terminology the same. Fourth, the major interfaces are not defined. With the right people “in the room” those can be easily defined. The scope can be better defined when all interfaces are clear. Fifth, in line with the fourth root cause is the failure of doing a health check on these interfaces. Here the important aspects are separated from the unimportant aspects, so that only relevant aspects will be included in the scope. Sixth, failing to make a manageable delineation. Depending on the project team too large business areas can be taken into account to make the project manageable.

Olsson (2004) describes scope changes as the most important causes of stakeholder disagreement and cost overruns. Also, vice versa, is stakeholder disagreement a root cause of scope changes as Olsson states that the more users practically cause the more scope changes and need for flexibility. Flexibility in projects is also a root cause of these scope changes, but not necessarily, late locking could also be a strategy to keep flexibility without coping with changes. Finally, scope changes have a negative impact on efficiency. This is in line with the other authors talking about the impact of scope creep: it has (in most cases) a negative impact on costs schedule and quality, but also in the efficiency that the goals of those three variables can be achieved. Probably earlier measures (before scope change) have been serving no goal.

Olsson (2005) again indicates that flexibility in engineering projects is a root cause of scope change, however it gives opportunities to manage uncertainty. If this is done effectively and proper strategies have been used (like late locking) than scope changes doesn’t have to occur. This can be done by just in time, lean construction methods or more generally the “last responsive moment” is used to achieve flexibility in projects. The essence is to postpone irreversible decisions until more information is available. Good interface management is needed to make sure no other processes are affected by this strategy. To find out the room to manoeuvre is important here to keep flexibility and trying to eliminate or mitigate scope changes. A decision is within the room for manoeuvring if it does not violate the consequences of previous decisions. Otherwise changes are a fact and efficiency drops. Olsson also describes three impacts of changes:

- Transaction costs will increase
- Efficiency will decrease
- Effectiveness will increase

Levene and Braganza (1996) and Coulson-Thomas (1992) underline the importance of adequate scope definition once again. They point out that bad scope definition is the most important reason of scope changes. However they consider organisational transformation projects, this can be applied to a wider variety of projects. Levene and Braganza suggest that focussing on the interfaces between different projects and project elements is essential, as projects are becoming larger and more complex. Without the identification of these interfaces a good scope definition is hard to make and changes are likely to occur.

Dvir and Lechler (2004) state that the front end development is the most important period in which changes occur. Trade offs are usually made between cost schedule and scope: which drives scope changes. They identify two types of changes:
Plan changes originate from the project environment. The scope nor goals will not change, but the plan should change in order to achieve the same scope. So scope creep or scope changes are not applicable here. This could impact the other two traditional project constraints: costs and schedule. Bad weather conditions or shortage in resources are examples of this.

Goal changes, on the other hand, are typically a result of a conscious decision by the stakeholders to change the goals of the project. These changes are enforced by new or changing requirements. This is why they underline the need of client and end-user involvement to properly define the goals and requirements in the first place (and avoid the unnecessary occurrence of scope changes). Furthermore they found 6 important drivers out of a set of drivers from Turner and Cochrane (1993) for goal changes:

- Strategic importance of the project (related to social complexity)
- Level of the experience of the project team
- Personnel constraints within the organisation undertaking the project (related to organisational complexity)
- Parallel projects undertaken at the same time (similar to earlier mentioned interface identifications)
- Technological breakthrough
- Technological uncertainty (related to technological complexity)
D. Interactions in networks (literature review)

The information that was found about the interactions was very diverse and is related to multiple scientific disciplines. Not only project management articles have been found, but also psychology, philosophy, business ethics and society studies supply different kind of information about these interactions. In these literature studies, many literature has been consulted and the most relevant statements are summarised here.

It has been argued that the quality of interaction between users and project managers is a key factor in determining project success (Amoako-Gyampah & White, 1993). The interactions between stakeholders regulate conduct (Veeneman, 2012), and occur on the interfaces. Interfaces occur on the different subsystems and with the environment; they could be managerial or technical (Verbraak & Veeneman, 2010). Within the front end development of large construction projects in terminals many managerial interfaces occur both internally and externally as we speak of a network of actors. The interactions on these interfaces are not only a key factor on project success, but also on process success (Veeneman, 2012); success measuring is discussed in chapter 7.

The interactions (on managerial interfaces) are regulated by arrangements within and among organisations (Veeneman, 2012). These arrangements depend again on structure, because within the project organisation a certain structure has been made. When one of the management styles is over relied on in structure, it should be repaired in arrangements. If in the arrangements one of the management styles is also over relied on, it should be repaired in the interactions. So, when looking at the interactions in the managerial interfaces with the stakeholders, also the structure and arrangements should be analysed as they are strongly interrelated. The structure and the existing arrangements are more or less set in the project. So when looking at scope change events, structure and arrangements are contextual variables.

Amoako-Gyampah & White (1993) showed that it is important that managers are aware of the nature of the interactions that occur among users and the project management team. The perceptions of the users and their evaluations on the nature of their interactions with the separate project groups were found to be positively related to user involvement and user satisfaction. So the quality of the interactions have a direct effect on user satisfaction according to Amoako-Gyampah & White.

Mayer et al. (2004) also underline the importance of interactions, without elaborating it profoundly. They state that interactions have a strong socio-constructive foundation. They come with tools and techniques to stimulate interaction and learning between the team members and stakeholders. So in their opinion, learning (an important root cause of scope changes) is stimulated and speed up by interactions. They assume that interactions and involvement will have positive effects on the perception of users.

Onkila (2011) studied stakeholder interactions, focussing on stakeholder relationships. She identified 4 types of stakeholder relationships: power-based, collaborative, conflicting and one-sided
relationships. Furthermore she points out that no common stakeholder management tools can be used. Stakeholder interaction management requires an analysis of the actors involved, the attributes of relationships and the attributes of stakeholder interests.

Atkinson et al. (2006) point out that early interactions are important for the project success. Failure to communicate with stakeholders about their expectations and priorities can cause major difficulties later in the project. “The expectations of stakeholders in terms of interactions will also affect the ability to reduce uncertainty in the interest of achieving clarity and control” (Atkinson, et al., 2006). Again, this isn’t elaborated deeply and it has more to do with a root cause of scope change than with a tool in a scope change event. However, it proves that interactions play a major part in the occurrence of scope change events and in the process during the event itself (this should not be mixed up). Nevertheless, they come with another aspect which could be an interesting dimension affecting the interactions between stakeholders: “Trust”. The problem is that total control over all activities of the project parties is neither possible nor desirable. Trust instead of controls reduces uncertainty and control costs and promotes effectiveness. A framework of trust proposed by Atkinson (2004) contains these factors:

- Vulnerability (to the action of others)
- Credibility (what could a party do and what will it do)
- Culture
- Openness (of information)

Except the more abstract factor culture; the other three factors could be used to measure trust in the interactions.

Driessen et al. (2001) describe in their research in interactive policy making about three perspectives to assess interactions between stakeholders: First, the course of the process should be evaluated by looking at the key players being mobilised and activated or not. This can be done by investigating whether or not the most important actors have been drawn into the project and if these actors got enough room in the project organisation. Second, the democratic legitimacy should be evaluated; this perspective is especially related to interactive policy making by governments. Third, the problem resolution should be assessed. To which extend have the objectives been reached. The original objectives are not necessarily the criteria, as objective could have been changed in the eyes of one of the actors during the process (or event).

Ives and Olson (1984) wrote about the effect of (perceived) user involvement on success. However they elaborate a little about user involvement as an interaction. Six types of involvement, which can be seen as a part of the interaction, are distinguished.

- No involvement (users are not willing or not invited to participate)
- Symbolic involvement (user input is requested, but ignored)
- Involvement by advice (users are asked for advice through interviews or questionnaires)
- Involvement by weak control (users have approval responsibility at each stage of system development)
- Involvement by doing (the user is also member of design team)
- Involvement by strong control (users are paying directly for new development out of their own budgets)
Robey (1979) adds that the reaction of an actor on the action or involvement of a project team member could be supportive or resistant.

Winch (2001) states that in complex systems industries such as construction, clients tend to interact with multiple actors in the value system. He argues that the exercise of power and the level of trust between the parties are important aspects in the interactions. Power is defined as having three faces (Winch, 2001):
- The ability of A to directly influence the decision by B (overt power)
- The ability of A to set the range of choice available to B (agenda setting)
- The ability of A to create a culture in which B does not consider options unacceptable to A (hegemony)

Two types of trust can be distinguished according to Winch:
- Self-interested trust (the expectation that one’s transaction partner will behave trustworthy in the future)
- Socially orientated trust (this is past orientated as it is the results of obligations of earlier interactions in a social network)

The intensity and frequency of communication with stakeholders is one of the most used methods of measuring interaction with and between stakeholders (Plaza-Úbeda, et al., 2010). So communication is also a central element in the interactions. This communication can take different forms:
- Unidirectional versus bidirectional communication
- Formal versus informal communication
- Regular versus occasional communication
- Oral or written communication

Additionally they state that trust is an important element as well (like Winch (2001) and Atkinson (2004)) and has a relation with communication. The frequency of personal relationships helps to generate trust between two parties. Communication would, next to trust, also have an effect on the relationships with stakeholders, the learning process of those stakeholders, to choose appropriate strategies and to identify the degree of satisfaction of different stakeholders (Plaza-Úbeda, et al., 2010).
E. Organisational structure Schiphol Group

A simplified impression is here given about the organisational structure of Schiphol Group and the way this company is divided among its shareholders. The project management department PLUS is a support unit of the company and doesn’t belong to one of the 4 business areas. Aviation is the business area in which all aviation related activities take place. Airport operations is one of the sub-departments of aviation. All the costs that are made in this business area should (exactly) be covered by the airport charges that airlines pay. This is forced by law and every year the charges will be measured on this basis. Consumers, Schiphol real estate and Alliances and Participations (with/in other airports) are allowed to make profit.
F. Project management Organisation One-XS

The organisational structure of One-XS is showed below. The overall project manager has to report to the project board. Additionally he is “mirrored” to the programme manager of KLM.
G. Project management Organisation 70MB

The project management structure of the 70 MB programme and the relation to project Backbone are displayed below. The level of the steering committee can be compared to the project board in One-XS.
H. Research protocol

A list of all data needed in the case research is presented here. The frameworks that were developed in literature studies are guideline in this thesis.

1. Root cause of the scope change event.
   a. Was there an internal probable cause and which reason of the developed framework can be appointed?
   b. Was there an external probable cause and which reason of the developed framework can be appointed?

   a. How was the scope change event managed?
   b. Was there an overreliance on project or process management in this management method?

3. Stakeholder interactions.
   a. Who were interacting?
   b. What were the sources of interaction?
   c. Were the interactions founded on trust or no trust at all?
   d. What was the degree of involvement (based on developed framework)?
   e. What was the stakeholder relationship in the scope change event (based on developed framework)?
   f. Did one of these stakeholders have a certain degree of power and what kind of power (based on developed framework)?
   g. How can the communication between main stakeholders be evaluated (based on developed framework)?
   h. What was the conduct of interaction?

   a. What is the organisational, project- and external structure? Is this structure more project or process like?
   b. How were the arrangements set (based on developed framework)?
   c. What was the impact on project schedule and costs?
   d. In which moment in the project timeline did the change occur?
   e. Was there a standard change procedure and was this, more project or process like?

5. Success measures.
   a. Was this event successful in terms of efficiency (based on developed framework)?
   b. Was this event successful in terms of effectiveness (based on developed framework)?
   c. Which success dimension was important for each stakeholder?
   d. Was the change event successfully dealt with?
I. Interview protocol of the orientation interview

This protocol was made for the orientation interviews. After the cases were selected, the concerning project manager was interviewed to get a basic idea of the change and to list all the important stakeholders. In this way, the change event’s context and the stakeholders who should be interviewed were investigated.

1) What was the original scope?
2) What was the change?
3) Which parties were involved?
4) What was the financial impact?
5) What was the impact on schedule?
6) When did the change event take place (stage of PRINCE2)?
7) How were agreements set?
8) Why do you think this change event was complex? (verification)
J. Interview protocol: interviewing stakeholders scope change

1. Root cause of scope change

- Who was the initiator of the change
- What was your interest considering this change?
- What do you think was the source of this change
  - Were the requirements clear
  - Where parties enough involved
  - Were interfaces clear
  - Were running processes properly defined

2. Management approach

- Who was intervening actor and why (do you think)?
- How did the PM react on this?
  - Focus on performance or satisfaction?
  - Hierarchical steering or steering the process?
  - Limited or redundant communication?
  - Open/closed to change?
  - Start with conflict/postpone conflict?
- What did this change do to the different parties and their behaviour?
- Did you have a strategy/goal in mind with the way you started this intervention/ reacting on this intervention

3. Interactions

- Who were the interacting parties considering this case (verification)
- What were the sources (media) of the interactions?
- What was the nature of interaction?
  - Why/ why not trust? Level of trust?
  - Degree of involvement
  - Stakeholder relationship: Power based/collaborative/ conflicting/ one sided?
  - Did you or other stakeholder have a certain power/ what kind of power?
  - How went communication?
    - Unidirectional-bidirectional
    - Formal – informal
    - Regular – occasional
- What was conduct?
  - Supportive or resistant interaction with whom?
o Was the conduct of your interaction in line with intervention/ reaction on intervention?
  o How is your relationship with other parties developed during this interaction?
  o Did you and the other parties learn about each other’s points of view and interests and is a shared solution found in this change?

4. **Context**

- What was moment in timeline (which stage of PRINCE2) that this change took place? (verification)
- What was impact on schedule? (verification)
- Where there many parties involved, specialists hired? (Was there an hierarchical relationship between different parties)
- How were agreements set? What kind of agreement was made and on which basis:
  o Role of parties: bi/multilateral
  o Specifications: blueprint or functional
  o Conditions: control or commitment
  o Performance indicator: efficiency or effectiveness

5. **Success**

- Do you think this change (event) was successful and successfully proceeded?
- What do you think is success?
  o Is efficiency important for you?
  o Is effectiveness important for you?
K. PRINCE 2 principles and evaluation

In his graduation thesis, Koen van Boggelen summarised the main principles of PRINCE 2 (Boggelen, 2011). The Prince 2 method is corresponding to the traditional project management approach, and is currently the most common used method used for project management. It originated from the best management practices of information systems projects by the United Kingdom government. The method Prince 2 stands for “Projects in Controlled Environments”, and gives managers clear guidelines during the complete project life cycle. Bentley (2010) describes the seven core principles of the Prince 2 method. A project should always have a viable business case where lessons should be sought at the start of the project. By appointing clear roles and responsibilities and by dividing the project into stages an accurate planning can be made. The focus should be on the product and exceptions go through a standard procedure.

<table>
<thead>
<tr>
<th>Core principle</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous business justification</td>
<td>Do not start a project without a viable, sounded and approved business case, and stop the project when justification has disappeared.</td>
</tr>
<tr>
<td>Learn from experience</td>
<td>Lessons should be sought at the start of the project.</td>
</tr>
<tr>
<td>Defined roles and responsibilities</td>
<td>People know each others roles and responsibilities.</td>
</tr>
<tr>
<td>Manage by stages</td>
<td>Divide project in stages, and make an accurate planning for the next stage.</td>
</tr>
<tr>
<td>Manage by exception</td>
<td>Each management level has its tolerance limits in time, costs, quality, scope, risk and benefits.</td>
</tr>
<tr>
<td>Focus on products</td>
<td>Focus on definition and delivery of products.</td>
</tr>
<tr>
<td>Tailor to suit the project environment</td>
<td>Suit the project to the environment before the start. Roles, processes and documents may be combined or split.</td>
</tr>
</tbody>
</table>

Figure 29 Core principles PRINCE 2  Schiphol STAP

The Schiphol STAP method uses the same core principles as PRINCE2. Within this thesis, most of these core principles are project-oriented management approaches. Almost all principles can be literally or very similarly found back in the management approaches’ framework. Only the Learn from experience part could be related to process management. Although, process management focuses on learning of earlier phases or sub-projects instead of earlier projects. It can be concluded that PRINCE2 has an overreliance on project-management.
L. Change procedure One-XS

This change procedure was developed by Schiphol Group. Different levels of change have been identified, which have different kind of approvals:

<table>
<thead>
<tr>
<th>Change-level</th>
<th>Binnen kader business case</th>
<th>Criteria*</th>
<th>Check op criteria</th>
<th>Akkoord op uitvoering change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Ja</td>
<td>&lt; 50k€ (all-in) • Binnen changebudget deelproject</td>
<td>Change Manager (CM)</td>
<td>Change Authority (CA)</td>
</tr>
<tr>
<td>Level 2</td>
<td>Ja</td>
<td>&lt; 250k€ (all-in) • Binnen changebudget deelproject</td>
<td>Change Manager (CM)</td>
<td>Change Authority (CA)</td>
</tr>
<tr>
<td>Level 3</td>
<td>Ja</td>
<td>Binnen kader businesscase (change is noodzakelijk voor project One-XS)</td>
<td>Change Authority (CA)</td>
<td>Project Board (PB)</td>
</tr>
<tr>
<td>Level 4</td>
<td>Nee</td>
<td>Buiten kader businesscase (change is niet noodzakelijk voor project One-XS &gt; exception report)</td>
<td>Change Authority (CA)</td>
<td>Project Board (PB)</td>
</tr>
</tbody>
</table>

* Overschrijft niet de procuratieregeling Schiphol
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

An example of the change process is shown below:
M. Visualisations Ica Lounge Case

Figure 30 Ica Lounge with corridor in the front to combined E-F filter  Schiphol Group 2012
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

Figure 31: Ica Lounge with corridor in the back to combined E-F filter

Corridor in the back

KLM ICA-Lounge

G27.343
Studie CSNS KLM ICA-Lounge
Alternatief 1B-1 - tweede verdieping - EF-gebied
Schaal 1:500 - 09 01 2013

Corridor in ICA-lounge, rekening lounge: 115 m²

Utility and lounge 730 m²

Commissie lounge 540 m²

New office building b.v. van lounge (Onder, trap, hotel, E- door)

Corridor in ICA-lounge, verlenging lounge: 475 m²

Schiphol Group 2012

Master Thesis J.P.G. Elich
N. Organisational structure Prorail

ProRail has a separate project management department, as projects are part of their core business (Op de Woert, 2013). The other departments are: “finance”, “operations”, and “transport & train tables”, as can be seen in the organogram on the next page. All of these departments are somehow involved in the realisation of new station projects. Their role is limited to requirements setting and approving the projects and they are not part of the project team. The organisation can therefore be regarded as a matrix organisation.

The project organisation consists of twelve hundred employees and is divided in “relation management”, “procurement, conditioning & innovation”, and “project development & execution”. Project development & execution is divided in station, rail expansion and rail related projects. It is a matrix organisation with six supporting departments like “construction management”, “safety and environment” and “project support”.

One of the disadvantages of a matrix organization is that employees have two managers. Project team members have to report to their project and functional manager while both have different interests. This makes it more difficult to coordinate work. Another disadvantage of a matrix organisation is that the employees are always involved in multiple projects making it hard to spread their attention. Some project managers have more than five projects at the same time with different teams. This makes it hard to feel truly involved and to reach economics of scale. This is also the case for other departments. A juridical expert has to give advice to twenty five projects at the same time. Larger projects do not have similar problems because they have a permanently assigned project team and experts. The organisational structure of Prorail is displayed on the next page.
O. Comparison Schiphol and Prorail

Schiphol and ProRail are both infrastructure operators; they develop, maintain and operate infrastructure. Schiphol sells, just like ProRail, capacity on their network to carriers that transport freight and/or passengers. Both organisations can be characterised as High Reliability Organisations; they perform complex operations and cannot permit pitfalls in practice and organisation. Another similarity is that they are both (partly) state-owned.

There are of course also differences. The main difference is that Schiphol is a commercial organisation that wants to make profit. As a result, Schiphol is less dependent on the government because they create their own profit which they can partly use to reinvest. The carriers at Schiphol are private companies while the NS, the most important carrier at ProRail, is state owned. Another difference is the competition in the sector. Schiphol is in competition with other airports in Europe, especially regarding the hub function. Train carriers, however, do not have another alternative regarding rail infra operators. Hence, Schiphol must be innovative and keep improving to attract as much flights as possible. A final difference is the focus: Schiphol operates worldwide, while ProRail has a national focus.

The size of the organizations also differ; a short comparison is made in Figure 32.

<table>
<thead>
<tr>
<th>Factor</th>
<th>ProRail</th>
<th>Schiphol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees (fte’s)</td>
<td>4,121</td>
<td>2,087</td>
</tr>
<tr>
<td>Passengers /year</td>
<td>438 million</td>
<td>51 million</td>
</tr>
<tr>
<td>Freight /year</td>
<td>42 million tonnes</td>
<td>1,5 million tonnes</td>
</tr>
<tr>
<td>Transport movements / year</td>
<td>26 million</td>
<td>4,234 million</td>
</tr>
<tr>
<td># Carriers</td>
<td>28</td>
<td>101</td>
</tr>
<tr>
<td>Turnover / year</td>
<td>€1,653 million</td>
<td>€1,353 million</td>
</tr>
<tr>
<td>Value assets</td>
<td>€19,82 billion</td>
<td>€3,9 billion</td>
</tr>
<tr>
<td>Square meter stations &amp; terminals</td>
<td>1,905,000 m²</td>
<td>650,000 m²</td>
</tr>
<tr>
<td>Projects / year</td>
<td>2000</td>
<td>350</td>
</tr>
</tbody>
</table>

Figure 32 Comparison Schiphol Prorail (Op de Woert, 2013)
P. Procedures and regulations Prorail

There are many standardised processes and procedures within ProRail (Op de Woert, 2013). This is partly a response to the complexity and amount of the projects. The most relevant procedures are described in this appendix.

ProRail has a “core process” for the execution of projects (Figure 33). The goal of this procedure is to give structure to the projects, create a single language for internal and external parties, create more transparency, enable better managed of the project portfolio and to provide a basis for continuous improvement. The core process is limited to a “timeline” and does not consists of a managerial project structure like PRINCE2 has.

The process consists out of four main phases. In the “prephase”, the wish from a client is transformed into an offer to work out alternatives. The alternatives are elaborated in the second phase which is called the “alternative study phase”. The result of this phase is a preferred variant. This variant is worked out in detail in the “detailed design phase”. The phase ends with a clause for execution in order that the project can be executed in the “realisation phase”. The building manager has an important role in this last phase. The process consists of the nine major decision moments, twelve main documents and 116 subdocuments. Each document needs to be signed in order to pass the decision moment unless there are made exeptions. The decision moments in the “core process” are “hard”. This means that everybody needs to agree, and all the analyses need to be revised. The decision moments of the “core process” make sure that the right parties are involved, who will be able to defend their interests, and that all the necessary analysis are done. False promises and wrong time schedules are prevent in this way. The “core process” actually stimulates functional conflict so that a well-considered trade-off is made between different interests.

A negative aspect is that the decision making moments increase the interdependence of the departments and that they formalise the decision making leaving less room for trust. Sometimes the “core process” is seen as a goal instead of a mean. This is partly caused by the all the signatures that are needed in the decision moments. Employees of different management levels need to sign the decision moments of the “core process” in the right hierarchical order to ensure the compatibility of the decisions within the strategic goals of ProRail. This takes time and increases the chance on obstruction.
Q. fsQCA Analysis

Introduction
In this formal analysis the programme fsQCA will be used. Qualitative Comparative Analysis (QCA) is a new analytic technique that applies Boolean algebra to implement principles of comparison used by scholars engaged in the qualitative study of macro social phenomena. The letters fs stand for fuzzy set. A fuzzy set simply means that in the analysis not only binary numbers (0 and 1) will be used, but all numbers in between can be used as well. This will be especially useful in this thesis, because soft variables will be applied. A management approach in practice is for example not 100% project and 0% process management, but somewhere in between.

"By formalizing the logic of qualitative analysis, QCA makes it possible to bring the logic and empirical intensity of qualitative approaches to studies that embrace more than a handful of cases and research situations that normally call for the use of variable-oriented, quantitative methods. Boolean methods of logical comparison represent each case as a combination of causal and outcome conditions. These combinations can be compared with each other and then logically simplified through a bottom-up process of paired comparison. Computer algorithms developed by electrical engineers in the 1950s provide techniques for simplifying this type of data. The data matrix is reformulated as a "truth table" and reduced in a way that parallels the minimization of switching circuits. These minimization procedures imitate case-oriented comparative methods but accomplish the most cognitively demanding task, making multiple comparisons of configurations, through computer algorithms. The goal of the logical minimisation is to represent the information in the truth table regarding the different combinations of conditions that produce a specific outcome. For a complete explanation of this software see http://www.u.arizona.edu/~cragin/fsQCA.

Root causes to success
Now the relation between the root causes and success will be explored. As was already mentioned, the root causes will have to be analysed by common sense to come to valuable conclusions. The question whether a change event could have been prevented cannot be analysed with such a tool. Although it might be an interesting case to check if there is a root cause at all that could generate more success than others.

To make the analysis, first the datasets should be created in order to create a "truth table". All the root causes are named by their number. In example, root cause 1c will become RC1C in the tables. Subsequently, the fuzzy sets will be filled in for all cases. In this comparison only binary numbers will be used, as a root cause was appointed or not at all. It will be assumed that certain root causes will not occur to a greater or lesser extent. Consequently, the following table can be derived in Excel:

---

6 http://www.u.arizona.edu/~cragin/fsQCA/index.shtml consulted 31-5-2012
Management of stakeholder driven scope changes in large structural adaptations of airport terminals

As can be seen the root causes 1a, 1c, 1d, 2a, 2c, 5, 6c, 7a, 7b and 7c that were found in literature were not discovered in any of the cases. This doesn't mean of course that they do not exist in practice. To make the comparison fair, these columns should be deleted. So the table can be deduced to:

When the fsQCA software is used to compare these data sets to success, no single consistent relation could be found with efficiency nor effectiveness nor overall success. It was already expected that root causes of a scope change event wouldn't have a relation with "success", however now it was formally proven. In section 11.3 this table and the substantial information of the different scope change event will be used to evaluate the root causes of the changes. As was originally the intention, the preventability will be looked upon (and not the relation to success).

Management approaches to success
One of the key analyses is to qualify the relation between management approach and success to help to answer the overall research question. The management approaches are divided in two extremes: a project-oriented approach and a process-oriented approach. In real life, a management approach will not be 100% project- or process oriented, but a mix if the two will be applicable. This was also showed in the cases. In this case, the fuzzy set will be useful, as numbers between 0 and 1 can be assigned to the different management approaches.

In this comparison, for every case the ratio of the management principles that were found is filled in the truth table. For example, if 3 process-oriented principles were observed and 7 project-oriented, then process management approach will get a 0.3 and the project management approach will get a 0.7 assigned. In order to make this comparison fair, the two assigned numbers should add on to 1, because there will be one hybrid management approach. The following table can be drawn and related to efficiency, effectiveness and total success.
Management approach to efficiency:
If management approaches are related to efficiency the following minimised “truth table” will be extracted:

<table>
<thead>
<tr>
<th>Change Event</th>
<th>Process Appr</th>
<th>Project Appr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nox</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Kne counters</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Ica lounge</td>
<td>0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Staff filters</td>
<td>0.2</td>
<td>0.8</td>
</tr>
<tr>
<td>SSDL</td>
<td>0.4</td>
<td>0.6</td>
</tr>
</tbody>
</table>

If the empty cells in the rows with a consistency of >0.8 are set to 1 and the residual is set to 0, the programme gives the following solution:

<table>
<thead>
<tr>
<th>Raw Consist.</th>
<th>PRI Consist.</th>
<th>SYM Consist.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
<tr>
<td>0.954545</td>
<td>0.933333</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

**Algorithm:** Quine-McCluskey

--- SIMPLEX SOLUTION ---

frequency cutoff: 2.000000
consistency cutoff: 0.954545

<table>
<thead>
<tr>
<th>Raw Coverage</th>
<th>Unique Coverage</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>process appr*project appr</td>
<td>0.651163</td>
<td>0.325811</td>
</tr>
<tr>
<td>-process appr*project appr</td>
<td>0.488372</td>
<td>0.162791</td>
</tr>
</tbody>
</table>

solution coverage: 0.813953
solution consistency: 0.972222

This solution means that no conclusion can be made about the usage of a project- or process-oriented management approach regarding efficiency (* means that a combination was found between these variables and ~ means negative). In some cases a process management approach was used to get a positive efficiency, while in other cases a project-management approach was used. It has to be kept in mind that it is about the extremes of these approaches here. So what the results show here, is that there is not one approach that causes efficiency of changes in projects at airport terminals. A mix of both approaches should be used; however there is a slight preference for a higher ratio of process management. This can be concluded out of the fact that the coverage of process management approaches in the cases is higher than project approaches, in relation to efficiency.

Management approach to effectiveness:
If management approaches are related to effectiveness the following minimised “truth table” can be extracted:
If the empty cells in the rows with a consistency of >0.8 are set to 1 and the residual is set to 0, the programme gives the following solution:

<table>
<thead>
<tr>
<th>processappr</th>
<th>projectappr</th>
<th>number</th>
<th>effectiveness</th>
<th>raw consist.</th>
<th>PRI consist.</th>
<th>SYM consist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0.964286</td>
<td>0.958522</td>
<td>0.958522</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0.681818</td>
<td>0.588235</td>
<td>0.588235</td>
<td></td>
</tr>
</tbody>
</table>

If management approaches are related to overall success the following minimised “truth table” can be extracted:

<table>
<thead>
<tr>
<th>processappr</th>
<th>projectappr</th>
<th>number</th>
<th>overallsuccess</th>
<th>raw consist.</th>
<th>PRI consist.</th>
<th>SYM consist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0.818182</td>
<td>0.733333</td>
<td>0.846154</td>
<td></td>
</tr>
</tbody>
</table>

If the empty cells in the rows with a consistency of >0.8 are set to 1 and the residual is set to 0, the programme gives the following solution:

This solution means that process management generally has a positive contribution to effectiveness and a project management approach has a negative contribution to effectiveness. This was the only relation to be found, so it is a single valid relationship that has been found. It might be remarkable that the usage of an extreme management approach can cause effectiveness success. However, effectiveness is not about the traditional process management variables (time, costs and quality) at all. Effectiveness is purely about “softer” stakeholder related success, such as satisfaction, fairness of the process and lasting relationships. Subsequently, this kind of measures depend totally on the use of process management principles, which is not hard to imagine as process management focuses on networks of actors instead of hierarchy.

**Management approach to overall success:**
If management approaches are related to overall success the following minimised “truth table” can be extracted:

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This solution means that overall success depends on both project- and process-management approaches, just like efficiency. This was expected, as overall success consists of both efficiency and effectiveness. So once again: for overall success in scope changes in projects at airport terminals a combination of process and project management aspects is needed. A slightly larger ratio of process management in relation to project management should be used to achieve (overall) success in these kind of projects.

Interactions to success

Furthermore, the interactions have to be researched being a set of independent variables. These variables might influence success as well. Steering the interactions is supposed to be essential for the management of stakeholder driven scope changes together with the management approach. The interactions should be plotted against success too.

Regarding these interactions, more or less 10 variables were found in literature studies. The presence or absence of trust, the level of involvement, the stakeholder relationship (4 dimensions), the power of the stakeholders and the communication related aspects (3 dimensions) appeared to be important theoretical aspects of these interactions. The presence of trust was estimated on basis of the case descriptions on a scale from 0 to 1. The involvement could be easily determined because 6 levels of involvement were specified. Only the fine tuning had to be done by estimation. Considering stakeholder relationships the exact relation between “power based”, “collaborative”, “conflicting” and “one sided” was not clear. They all have to be incorporated separately in the equation. The power position is hard to take into account, especially because most stakeholders have different power positions. In this analysis, only the magnitude of the power of the intervening actor is taken into account and is estimated. At last, the stakeholder communication has 3 aspects: bidirectional (versus unidirectional), formal (versus informal) and regular (versus irregular) communication. Also these aspects were estimated on basis of the case descriptions. Now, the following table can be derived and related to efficiency, effectiveness and total success.
As can be observed, the “power based” and “one sided” stakeholder relationships, that were found in literature, were not discovered in any of the cases. This of course doesn’t mean that they do not exist in actual practice. To make the comparison fair, these columns should be deleted. Otherwise, the fsQCA could come with conclusions about its contribution to success, while they weren’t observed at all. The remaining stakeholder relationships “collaborative” and “conflicting” seem to be the same variable, but opposites. They will be examined separately for completeness. Thus, the table can be reduced to:

<table>
<thead>
<tr>
<th>Change event</th>
<th>Trust</th>
<th>Involvement</th>
<th>Collaborative</th>
<th>Conflicting</th>
<th>Power intervactor</th>
<th>Bidirectional</th>
<th>Formal com</th>
<th>Regular com</th>
<th>Number</th>
<th>Efficiency success</th>
<th>Raw consistency</th>
<th>PRI consistency</th>
<th>SVM consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>N°1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
<tr>
<td>N°2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

**Interactions to efficiency:**

If interactions are related to efficiency the following minimised “truth table” can be extracted:

This solution means that both the presence and absence of trust, high and low level of involvement, collaborative and conflicting stakeholder relationships and unidirectional and bidirectional communication contribute to efficiency. So no clear conclusions can be made about the contribution of these variables to efficiency. However the solution gives an unambiguous attribution of three variables to efficiency. The power of the intervening actor has a negative influence on efficiency: if the intervening actor has more power, the efficiency of the change is likely to drop. This seems logical: if the intervening actor has more power, it is likely that he can force the scope to change drastically to his preferences regardless the impact on cost and time. Also formal communication has a negative relation with efficiency: which would imply that informal communication contributes to efficiency. This seems unlikely, however it should be kept in mind that it is only about the efficiency of a scope change event. This might be caused by intervening actors who will be better in the understanding of the dilemmas of a project manager if the atmosphere is informal. At last regular
communication has a positive relationship: if communication is regular in these events, the solution will be reached more efficiently, because progress is ensured.

**Interactions to effectiveness:**
If interactions are related to effectiveness the following minimised “truth table” can be extracted:

If the empty cells in the rows with a consistency of >0.8 are set to 1 and the residual is set to 0, the programme gives the following solution:

<table>
<thead>
<tr>
<th>trust</th>
<th>involvement</th>
<th>collaborative</th>
<th>conflicting</th>
<th>poweractor</th>
<th>bidirectionalco</th>
<th>formalecom</th>
<th>regularcom</th>
<th>number</th>
<th>effectiveness</th>
<th>raw consist.</th>
<th>PRI consist.</th>
<th>SYM consist</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.000000</td>
<td>1.000000</td>
<td>1.000000</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.142857</td>
<td>0.000000</td>
<td>0.000000</td>
<td></td>
</tr>
</tbody>
</table>

This solution means that there is a very unambiguous relation between all variables except from the power of the intervening actor and effectiveness in changes. Trust and involvement both contribute to effectiveness. A collaborative relation is positive for effectiveness and a conflicting relationship negative (this strengthens the suspicion that they are opposites). If communication in change events is bidirectional, informal and regular, change events have the best chance to be solved effectively.

**Interactions to overall success:**
If interactions are related to overall success the following minimised “truth table” can be extracted:

If the empty cells in the rows with a consistency of >0.8 are set to 1 and the residual is set to 0, the programme gives the following solution:
This solution means that the same relation is found between interactions and overall success as between interactions and effectiveness. So trust, stakeholder involvement, a collaborative relationship and bidirectional informal regular communications have a positive effect on overall success. It is remarkable that considering the efficiency only informal and regular communications come back in overall success. Apparently, the power of an intervening actor causes less efficiency, but this impact is too small to affect overall success of the change event.