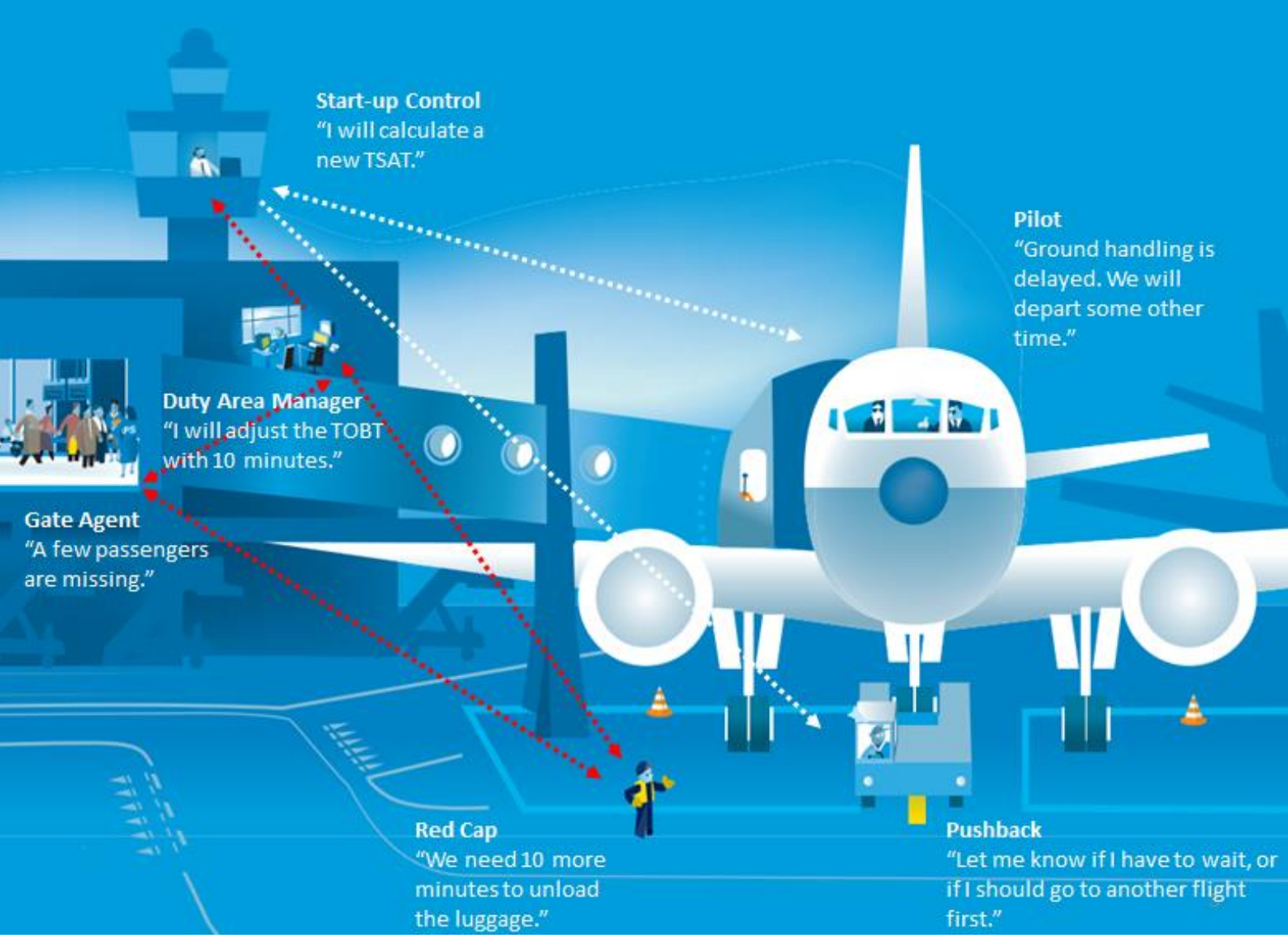

Collaborative Decision Making at Schiphol Airport

Challenges of Decision Making in a Multi-actor Environment

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By

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The only mistake in life is the lesson not learned.

ALBERT EINSTEIN

The quality of an organization can never exceed the quality of the minds that make it up.

DWIGHT DAVID EISENHOWER

Preface

This report concerns my master thesis for graduation on the MSc Construction Management and Engineering (CME) at the Faculty of Civil Engineering and Geosciences from Delft University of Technology (TU Delft). Beforehand I obtained a bachelor degree in Systems Engineering, Policy Analysis and Management and a bachelor degree in Mechanical Engineering. This is the end work after seven amazing years at TU Delft.

This research was conducted from January 20th 2014 till September 2nd 2014 at the Schiphol Group. The Schiphol Group, together with KLM, TU Delft, TNO and NLR, initiated an Innovative Main Port Alliance (in Dutch called SIM) which provides many graduation projects. With the help of Wouter van Daal, Chairman Program Council at SIM, I came in contact with Berend Onnes, Program Manager CDM and my external coordinator. Without this connection I would have never ended up doing my thesis about the CDM program. I am very grateful for the opportunity to do my thesis about this interesting program and the experiences I gained thanks to the CDM team. Being able to conduct my thesis at the Schiphol Group was exceptional. It is an amazing company with great staff.

My thesis would have never been of such quality and completeness without the help of many people. Therefore, I would like to thank:

- My supervisors from TU Delft: Eefje Cuppen, Marian Bosch-Rekveldt and Hans de Bruijn. Thank you for the interesting discussions, advice and knowledge throughout this research.
- My Schiphol Group supervisor: Berend Onnes. Thank you for being the best external supervisor ever and the opportunities you gave me by including me on the team.
- My SIM supervisors Wouter van Daal en Astrid Dijkstra for the opportunity to graduate at the Schiphol Group through SIM. It was the best place to graduate I could ever imagine.
- The SIM students for their fun and inspiring talks during the last months.
- All members from the BT and IB for the inspiring Thursday meetings.
- All participants of the Q-methodology and other interviews. Thank you for your time and your participation to fill in the Q-sort. And thank you for showing me around such an interesting environment and all the knowledge you provided me.

I hope you all enjoy reading my thesis,

Caroline

Schiphol, August 2014

Summary

The increased traffic volumes within the European air space make it harder to handle air traffic at airports efficiently. In order to improve the overall process of aircraft handling by integrating the processes, operational information between all cooperating actors at the airport must be shared. Due to better information sharing every stakeholder can plan his process better. Especially for a hub-airport like Schiphol Airport, punctual information is important. This method of sharing operational information with specific times between actors at an airport is called Collaborative Decision Making (CDM) and is currently carried out at Schiphol Airport by Amsterdam Schiphol Airport (AAS) operated by Schiphol Group (SG), Air Traffic Control the Netherlands (LVNL), home-carrier KLM (Royal Dutch Airlines), all other airlines represented by the Schiphol Airline Operators Committee (SAOC), the Ground Handlers, and lastly the European Network Manager Eurocontrol. The CDM program is the first large project ever undertaken at Schiphol Airport that involves but also affects that many actors. However, decision making within the program is absolutely not without flaws.

The CDM program is very complex. This is because of the mutual dependent and repetitive relationships at Schiphol Airport. All actors are dependent on each other and they all need to cooperate and work according to the new CDM procedures. Another unique and important aspect of the CDM program is that they have to cross the line together; only when all actors simultaneously agree CDM can be implemented. Although the overall structure of the program can be understood as a network, the decision making structure is hierarchical with representatives from this multi-actor environment. This research is executed to show how to deal with decision making in multi-actor environments and the challenges associated with it. The main research question is defined as follows:

How can challenges be successfully dealt with that occur during decision making in a multi-actor environment based on the CDM program?

In the first phase of this research the complexity of the CDM program is structured. Without a clear understanding of what makes the CDM program challenging there can never be advice given on how to deal with the occurring setbacks. However, theory showed that no single way of structuring complexity exists. Complexity consists of many interrelated sub-systems but the way of dividing complexity into these sub-systems depends on the managers or researchers view. Based on 18 interviews on the complexity of the CDM program and a model from Hagan, Bower and Smith (2011) a division of seven challenges has been made. This answers the **first** sub-question: *What are challenges that the CDM program faces?*

The seven challenges justify the complexity of the program. The challenges that summarize the complexity of the program are 1) Getting everyone to work in the same direction, 2) Dealing with mutual dependent relationships, 3) Developing a flexible and transparent process, 4) Collaborate between decision-making layers, 5) Evaluate costs and benefits, 6) Dealing with technological uncertainty and 7) Communicate. The cycle of data collection can be assigned to the Grounded Theory Approach (GTA). In order to give advice on how to deal with these challenges a theoretical background is also provided per challenge. This is not only done to compare theory with practice but also as a stepping stone for the managerial recommendations.

A few of the problems associated with the challenges can be described as follows. In the CDM program decisions are made on different executive layers as the Steering Board (SB), Implementation Board (IB) and project team (BT). Many layers in the organization exist which is accompanied by many opinions and long lead times within and between this multilayer system. CDM is a change in the operational process and therefore it affects the culture. At the beginning of the project they did not map all interests and strategies. Thus assumptions are made and understanding of other stakeholders is lacking. When actors do not want to put effort in the program, do not think the program is attractive, or do not understand the necessity of collaboration, the project will fail. A memorandum of understanding (MoU) is signed, however a clear shared vision and commitment from management is lacking. Stakeholders have to fully trust each other and be willing to share all information. Due to this they might give in some of their autonomy, especially at the operational level as the pilots and start-up controllers. This results in resistance and because the program only succeeds when all actors finish simultaneously, blocking power has a huge impact. Another factor is the transparency associated with CDM. The question is, if all actors benefit from this transparency then what they will receive in return? The sense of urgency to connect to the network by implementing CDM is also questioned. This is also associated with the technical complexity of the system. Are all systems ready for implementation? The program will result in different benefits for each actor, however they all point out to a different actor that get most benefits or acts as the bad guy. It is all part of different perspectives. Do they not have things well organized or are they not aware of this sense of urgency?

One of the most difficult aspects of a multi-actor environment is that all the stakeholders have to cooperate. Checking who causes this complexity and who has to deal with the challenges in the CDM program answers the **second** sub-question: *Which stakeholders are involved in the CDM program and how is their decision making influenced by their operational processes?*

The most important stakeholders in the CDM program are Amsterdam Schiphol Airport (AAS), Air Traffic Control the Netherlands (LVNL), home-carrier KLM (Royal Dutch Airlines), all other airlines represented by the Schiphol Airline Operators Committee (SAOC), Ground Services (GS), and lastly the European Network Manager Eurocontrol. Because of the different interests, KLM is divided into KLM Hub Control Center (HCC) with the same interest as Ground Services and KLM Operations Control Center (OCC) with the same interest as the SAOC. Many of these stakeholders are represented in one of the decision making layers that have to manage, control and support the program. However, a start-up controller should also be involved in these layers since they are key players. The three most important layers are Steering Board (SB), Implementation Board (IB) and the project team (BT).

Runway configuration and handling of more than 100 aircrafts an hour in peak moments make Schiphol Airport a complex airport for air traffic controllers, pilots, ground handlers, and all other planning people at LVNL, KLM, Ground Services and AAS. Many things influence the complexity of operation but also processes are influenced by other processes and actors. One circumstance therefore affects many planning systems. This contributes to the difficulty in decision making between all actors.

What do the stakeholders think of this complexity? In which way do they believe this influences decision making in the CDM program? To answer this, 28 people involved from the different

companies and different decision making layers AAS, KLM HCC and KLM OCC, LVNL, SAOC, GS, SB, IB and BT have been asked to rank 43 statements on the complexity of CDM. These 43 statements all cover the seven identified challenges. This resulted in the **third** sub-question: *What are different and similar perspectives on CDM according to the stakeholders?*

This method whereby respondents have to rank statements in a forced normal distribution is called Q-methodology. It resulted in three factors, or perspectives, that show the viewpoint of a particular group of respondents. The first perspective can be described as 'The optimistic and closely involved manager'. Fourteen participants of AAS, KLM, LVNL and KLM OCC and BT load on this factor. The most important statements for people within this perspective are based on the close collaboration of the stakeholders since all actors are mutually dependent. Improvement of communication seems important because implementation of CDM is urgent. The difference with other perspectives and this one is the involvement of top management. People within Factor 1 believe CDM should be implemented top-down, top management should make a vision and more resources should be provided. Whereas the people within Perspective 2 totally believe CDM should be implemented bottom-up. Creativity and knowledge of the specialists should be taken into account more. Implementation of CDM is less urgent because it only results in benefits when all airports have implemented it. Delays are mostly caused by the ICT infrastructure at Schiphol Airport and the availability for specialists to express their expertise. These people are still a proponent of CDM but only under certain conditions. Five people from the operational field, especially the majority of Ground Services, have loaded significantly on this Factor 2, called 'The omnipotent and independent specialist'. Notable is the fact that Perspective 2 is most carried by the IB whereas the BT, who at first glance appear to be more operational, does not load on Factor 2 at all. The last factor, Perspective 3 'The collaborating manager', is quite similar to Factor 1. However, the importance of strong leadership has been left in the middle. The importance of collaboration and cooperation, having one common goal and the results of CDM are most important. They believe the processes will be greater by far compare to the current processes and together they will help to bring Schiphol Airport to a higher level. The high correlation between Factor 1 and 3 shows a large part is common perspective. Five employees from AAS, KLM HCC, LVNL, GS, BT and IB load on this factor.

Distribution of the factors also showed the common view on CDM between KLM HCC and GS, between KLM OCC and SAOC, and between LVNL and AAS. Whereas the first two were expected but a close view between LVNL and AAS is an important observation.

The last phase of this research is a connection between the first and second phase. The last and **fourth** sub-question is answered: *What are managerial implications to improve decision making within the CDM program?*

As a result from this research it can be said that getting everyone to work in the same direction by letting top management make a vision would be a good start of the program to facilitate decision making. The Q-methodology, literature, and own experience showed most ascertained topics can be related to 'Challenge 1: Getting everyone to work in the same direction', 'Challenge 4: Collaborate between decision-making layers' and 'Challenge 7: Communicate'. This research showed everyone in the program is a proponent of CDM, but they sometimes simply do not how to move on. Top management should therefore motivate and inspire. It is important to create awareness, one direction and commitment with a good discussion at the front. Next this should be communicated to

the rest of the organization. A good start of a program seems to be the hardest challenges in a multi-actor environment. Due to the many people involved, it is important to first understand who is involved, followed by their interests and operational processes. It is also important to communicate frequently, but there must be understood on how and whom to communicate. An extensive stakeholder analysis will simply help to understand this. Communication is the key to clearness instead of confusion. Fewer assumptions need to be made by asking more questions. Special attention need to be paid to the ground handlers in order to increase their awareness. However, creating a flexible and transparent process, dealing with mutual dependent relationships, dealing with technological uncertainty and evaluation of costs and benefits is experienced to be part of complex programs, but not the hardest challenges to achieve success. The hardest challenges within multi-actor environments deal with functioning of the top layers of the organization.

This research showed that Q-methodology could be used as a useful method to verify own observations based on the stakeholders. This does not only create consensus but also the most important topics can be indicated. Topics that are ranked much different between the respondents will probably result in resistance within decision making. This knowledge can be used to tackle challenges occurring when decision making in multi-actor environment. Thus said, the steps of indicating challenges followed by verifying these with Q-methodology is a useful way to deal with challenges that occur during decision making in a multi-actor environment. With this, also the main objective is achieved:

To show multi-actor organizations how decision making can be improved by taking stakeholders perspectives into account.

Abbreviations

AAS	Amsterdam Airport Schiphol
ATC	Air Traffic Control
ATM	Air Traffic Management
ATFM	Air Traffic Flow Management
BT	Bolletjes team /project team
CEO	Chief Executive Officer
CDG	Charles de Gaulle (airport)
CDM	Collaborative Decision Making
CISS	Central Information System Schiphol
Ch.	Chapter
CTOT	Calculated take off time
EIBT	Estimated in-block time
ELDT	Estimated landing time
EUR	European
FAA	Federal Aviation Administration
GH	Ground Handlers
GS	Ground Services
HCC	Hub Control Center
IATA	International Air Transport Association
IB	Implementation Board
ICA	Intercontinental
KLC	Cityhopper
KLM	Royal Dutch Airlines (Koninklijke Luchtvaart Maatschappij)
LVNL	Air Traffic Control the Netherlands (Luchtverkeersleiding Nederland)
MoU	Memorandum of Understanding
MUAC	Maastricht Upper Area Control
OCC	Operations Control Center
Pax	Passengers
RVO	Roosevelt Overleg
SAOC	Schiphol Airline Operators Committee
SB	Steering Board
SES	Single European Sky
SESAR	Single European Sky ATM Research
SG	Schiphol Group
SIM	Innovative Main Port Alliance (Samenwerking Innovatieve Mainport)
SUC	Start-up controller
TOBT	Target off-block time
TSAT	Target start-up approved time
TTOT	Target take-off time
VDGS	Visual docking guide system

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Chapter 1 Introduction

The increased traffic volumes within the European air space make it harder to handle air traffic at airports efficiently. Within the process of handling aircrafts many actors are involved like the airport, air traffic control, airlines and ground handlers. Each of these actors attempts to handle its own process as efficient as possible. In order to improve the overall process of aircraft handling the only way out is by sharing operational information between these actors, so that the individual processes are integrated better. This is only possible when all these actors are willing to cooperate (Schiphol Group, 2014). This method of sharing operational information with specific times between actors at an airport is called Collaborative Decision Making, from here on it will be referred to as CDM. In the end CDM is not an isolated goal but a method to optimize the total chain of processes. Collaborating and working towards a shared goal should result in more efficient processes and reduced delays. This should contribute to 'survive' and to accommodate growth in a high dynamic, competitive aviation industry. CDM is already applied at many European airports. However, one of the airports that has not implemented CDM yet is Amsterdam Airport Schiphol (AAS). The CDM program is the first large project ever undertaken at Schiphol Airport that involves but also affects many actors.

Many actors working together can be described as a 'network'. De Bruijn and Ten Heuvelhof (2008) describe the term network as "1) a number of actors with 2) different goals and interests and 3) different resources 4) who depend on each other for the realization of their goals." Although the different companies can be seen as a network the decision-making structure has hierarchical layers. Most of the key companies within the CDM program have representatives in one of the decision-making layers. The fact they have to make decisions together, does not improve the decision-making process since they all have different interests. However, there are many projects with many actors and different interests. A well-known industry that deals with many actors is the construction industry where many different interests have to be taken into account when building infrastructure. Not only because of the CME master but also because the construction industry is seen as the most complex industry (Baccarini, 1996), is this industry used in comparison to the CDM program. Usually within these projects much attention is paid to the complexity of the project and causes of delays (Bosch-Rekveldt, 2011). Within many of these projects a conflict of interest occurs between the government and other groups (De Bruijn & Ten Heuvelhof, 2008). Wherein, for example, environmental groups delay the process with their blocking power. The CDM program is a different program, but nevertheless very complex with many factors that influences decision making. A difference with other projects and the CDM program is the mutual dependent and repetitive relationships at Schiphol Airport. Whereas actors in the construction industry, for example, may decide to work with another constructor this is not directly possible at Schiphol Airport; they all have to work together. Even though there is competition among different airlines and different ground handlers at Schiphol Airport it is not possible to involve only one. Eventually, they all have to work according to the CDM procedure. Another unique and important aspect of the CDM program is the holdup problem; only when all actors simultaneously agree CDM can be implemented. The fact that decision making on this program is running for over 10 years shows that there are drawbacks in the program. Decision making within the program is absolutely not without flaws.

This research is about decision making in multi-actor environments and the challenges associated with it. Special focus will be on the CDM program at Schiphol Airport; a unique program with many

involved stakeholders and different perspectives that influences decision making. During this research the terms program and project are both used. A project is a temporarily activity undertaken to establish (often tangible) outputs whereas a program can be seen as a portfolio comprised of multiple projects. A program is managed and coordinated as one unit with the objective of achieving (often intangible) outcomes for the organization (ICB, 2014). So, the CDM program consists of many projects which increases the complexity associated with it. The differences will not be analyzed further in this research but the fact that the CDM program contains the whole picture should be remembered. This chapter starts with an introduction to the complex world of the CDM program. This chapter also includes the problem definition, research questions and the research outline. Knowledge of CDM is necessary throughout this entire research.

1.1 What is Collaborative Decision Making (CDM)?

The concept of Collaborative Decision Making (CDM) was initially defined by a group of airlines in the early '90 in the United States in response to what the airlines perceived as inadequate co-operation between airports, the Federal Aviation Administration (FAA) and the airlines themselves (Wilco, 2010). The concept was then brought to Europe by the International Air Transport Association (IATA) and developed by Eurocontrol, the European Network Manager, as an integral part of the Single European Sky program (SESAR, 2012). Airport Collaborative Decision Making as we know today aims at improving operational efficiency at airports by reducing delays, improving the predictability of events during the progress of a flight, and optimizing the utilization of resources (Schiphol Group, 2010). CDM is a reaction on the improvement objectives of the Air Traffic Management (ATM) Masterplan where the network is served with more accurate and timely information to derive better en-route capacity planning (SESAR, 2012). In order to improve that operational efficiency all partners have to share accurate and timely information, adapt operational procedures and processes and make use of the CDM portal. The main partners in this program are Amsterdam Airport Schiphol (AAS), Royal Dutch Airlines (KLM) and Air Traffic Control the Netherlands (LVNL).

Airport Collaborative Decision Making is about sharing accurate information. This mainly involves five specific CDM times;

- ELDT: Estimated landing time
- EIBT: Estimated in-block time
- TOBT: Target off-block time
- TSAT: Target start-up approved time
- TTOT: Target take-off time

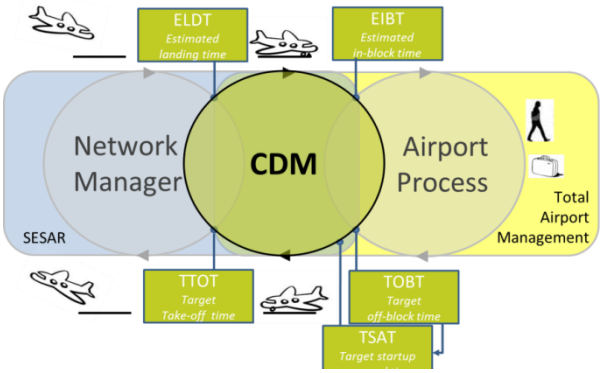


Figure 1 CDM Turnaround process (Onnes, 2013)

First of all, it is important to have unambiguous agreements on the meaning of these terms. The question of when a flight has landed had a different meaning for every person before CDM was introduced. For example, it is now agreed on that the estimated landing time (ELDT) for the aircraft is when it hits the runway. If the European network manager Eurocontrol and local network manager LVNL indicated the ELDT, there can be calculated when the aircraft will be blocked in at the apron (EIBT). EIBT is mainly the ELDT plus taxi time. Once arrived at the gate the turnaround process of the ground services starts. This process includes inter alia unloading and loading of passengers and baggage, cleaning, catering, refueling, water cartage

and de-icing. The amount of time ground handlers need can be determined per type of aircraft and flight. The ground handlers will pass on the target off-block time (TOBT). However, this is often accompanied by unexpected circumstances as no show passengers or weather conditions. When TOBT is set the pilot has to call within a window of five minutes for start-up approval (TSAT). The push-back truck has to be ready when TSAT is given and after pushing back the aircraft will taxi to the designated runway and starts his flight plan. LVNL determines an optimal departure process which is updated continuously. At KLM Operations and Control Center (OCC) an optimal flight plan will be developed. Slots, the time period within take-off has to take place issued by Eurocontrol, also has to be taken into account when making a flight plan. The point is that due to better information sharing every stakeholder can plan his process better, involving people and tools ready on the right place and time, planning of an optimal flight plan, gate planning, arrival and departure planning etc. Due to many (unexpected) conditions all processes are adjusted constantly, and thereby the CDM times fluctuate.

The expected benefits of CDM for all actors include, but are not limited to (Van Zuijlen, 2012):

- Improve predictability
- Improve on-time performance
- Reduce ground movements
- Reduce (ATFM) slot wastage
- Reduce apron/taxiway congestion
- Optimize use of resources as ground handling equipment & personnel, gates, stands, terminals and airport infrastructure

Schiphol Airport was the 4th airport of Europe in number of passengers, the 5th in aircraft movements and the 3rd in cargo in 2013 (Schiphol Group, 2014). The main goal of Schiphol Airport is to stay the preferred airport. Schiphol Airport is a hub airport; 70% of the passengers that fly with KLM do not have the Netherlands as final destination (KLM, 2012). Specifically for the transfer passengers accurate arrival and departure information is necessary. Other airports in Europe also try to be Europe's preferred airport; therefore Schiphol Airport has to make sure both passengers and airlines choose Schiphol Airport as the airport.

The expecting growth of the aviation industry and the growing needs to reduce costs is a continuous challenge for airports. CDM will contribute to the goal of being Europe's preferred airport. Due to the fact it will result in less delays, more efficient use of infrastructure, less fuel and therefore sustainable. Eurocontrol, the European Network Manager, is able to utilize slots more efficiently and reduce buffer capacity. This is preferable since the commercial aviation industry is growing. According to IATA the number of passengers will grow to 3.6 billion worldwide in 2016, which is a 5.3% growth per annum between 2012 and 2016 (IATA, 2012). The efficient utilization of slots and capacity is only possible when more airports implement CDM. CDM was first introduced in 2001, but still Schiphol Airport cannot be seen as a fully implemented CDM airport, this in contrast to, for example, Munich Airport, Brussels Airport, Paris Charles de Gaulle Airport and Frankfurt Airport (Eurocontrol, 2013).

Figure 2 Airspace Congestion (van Zuilen, 2011)

1.2 Problem Definition

The mentioned benefits in Section 1.1 are not decisive for everyone. Each stakeholder will gain other benefits from the CDM program. The most crucial stakeholders at Schiphol Airport are Amsterdam Schiphol Airport (AAS) operated by Schiphol Group (SG), Air Traffic Control the Netherlands from now on LVNL (Luchtverkeersleiding Nederland), home-carrier KLM (Royal Dutch Airlines), all other airlines represented by the Schiphol Airline Operators Committee (SAOC), the European Network Manager Eurocontrol, and lastly Ground Services. These stakeholders all have different goals, values, interests, and strategies. Not to mention the internal differences. The most important aspect and at the same time the most difficult one of CDM is that all partners work together, and share data at the same time in a more efficient and transparent manner. Only then CDM will be successful and result in the mentioned benefits. Although CDM at Schiphol is initiated by AAS, KLM and LVNL, the Schiphol Group is in this case the facilitator of this research and can therefore be seen as the problem owner of this research.

In the CDM program decisions are made on different executive layers as the Steering Board (SB), Implementation Board (IB) and project team (BT). In each layer are representatives of the Schiphol Group, KLM, LVNL and Ground Services. Many layers in the organization exist which is accompanied by many opinions and long lead times within and between this multilayer system. CDM is a change in the operational process and therefore it affects the culture. At the beginning of the project they did not map all interests and strategies. Thus assumptions are made and understanding of other stakeholders is lacking. When actors do not want to put effort in the program, do not think the program is attractive or do not understand the necessity of collaboration the project will fail. But also support and commitment from management is necessary to succeed. Stakeholders have to fully trust each other and be willing to share all operational information. Due to this they might give in some of their autonomy, especially at the operational level as the pilots and start-up controllers. This results in resistance and because the program only succeeds when all actors finish simultaneously, blocking power has a huge impact. Another factor is the transparency associated with CDM. The question is, if all actors benefit from this transparency then what they will receive in return? The sense of urgency to connect to the network by implementing CDM is also questioned. The program will result in different benefits for each actor, however, they all point out to a different actor that get most benefits or acts as the bad guy. It is all part of differences between individual versus CDM team perspectives. Do they not have things well organized or are they not aware of this sense of urgency? This is only a small outline of the challenges that the CDM program faces. A more detailed overview will be given further in this report.

It is clear that cooperation in the CDM program is extremely complex. Even though the program is called Collaborative Decision Making it sometimes feels like the collaborative part is about sharing the times but decision making goes individual. Currently they especially linger on decision making of the CDM times TOBT and TSAT. Despite the many benefits of the project there still appears underlying reasons that complicate the progress of the program. Information on what moves the actors and what are the challenges to face in the program have to be collected. When the programs complexity is charted and the stakeholder perspectives on CDM are understood, advice to improve decision making can be given. After all the main goal of maintaining and strengthening Schiphol Airport as Mainport and Hub airport is in interest of all stakeholders, they just have to recognize this.

1.3 Research Objective and Questions

Given the defined research problem a research goal and research questions are formulated that will be answered throughout the research:

The main research objective is:

To show multi-actor organizations how decision making can be improved by taking stakeholders perspectives into account.

The main research question is:

How can challenges be successfully dealt with that occur during decision making in a multi-actor environment based on the CDM program?

A number of sub-questions are composed in order to structure the research and to support answering the main research question. The methods used to answer these sub-questions will be explained in the next section.

1. *What are challenges that the CDM program faces?*
2. *Which stakeholders are involved in the CDM program and how is their decision making influenced by their operational processes?*
3. *What are different and similar perspectives on CDM according to the stakeholders?*
4. *What are managerial implications to improve decision making within the CDM program?*

The problem definition indicates a gap between knowledge and design. The research objective should contribute to the overall mission of successful decision making in multi-actor environments. The four consecutive sub-questions will lead to an answer on the main research question. To maintain overview this research is divided into three phases.

In the first phase the complexity of the CDM program is structured. Without a clear understanding of what makes the CDM program challenging there can never be an advice given on how to deal with these challenges. This is done by first showing characteristics of a projects complexity and how complexity can be described which lead to the description of the specific CDM program's complexity.

One of the main challenges in the CDM program, but actually in all multi-actor networks, is the collaboration between many actors. Not only do these actors contribute to challenges in the program but they also have to deal with other challenges. Without knowing why the stakeholders make decisions in a certain way it is impossible to improve the decision-making process. Therefore their way of decision making must first be understood followed by their opinion on the challenges that complicate decision making. Herewith the challenges are also verified. All stakeholders and their perspectives on CDM are executed in Phase 2.

The third phase shows managerial implications on how to deal with challenges in a multi-actor environment. This advice is based on the outcome of the occurring challenges and the stakeholders' perspectives. The CDM program can be seen as the case study used to answer the main research question. This advice on decision making should therefore not only boost the program but should also give advice for further programs at Schiphol Airport. A summary of the three phases, with their problem statements, research goals, output, questions, and methods is provided in Figure 3.

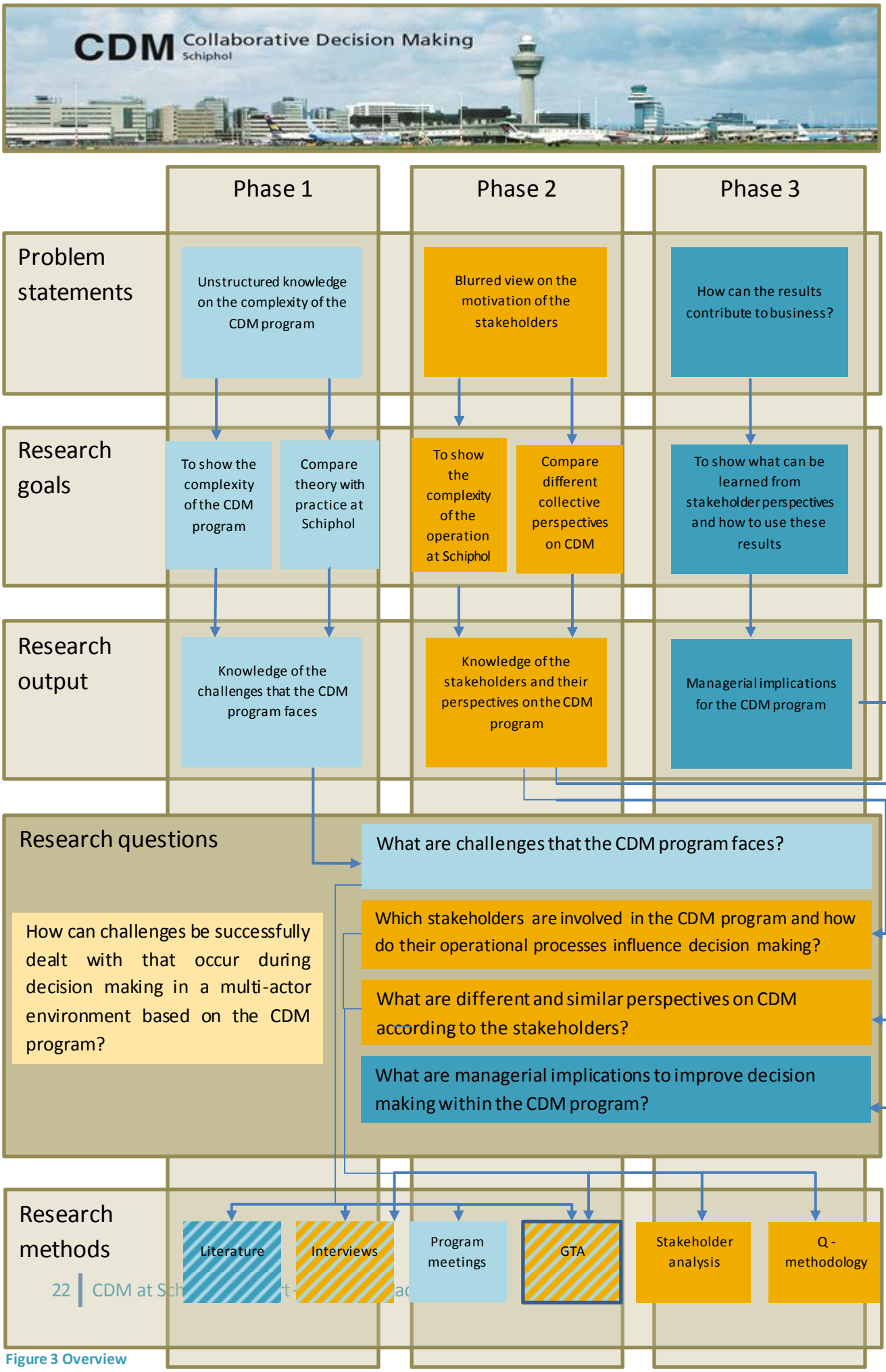


Figure 3 Overview

1.4 Research Outline

Figure 4 links the different chapters with the three previously identified phases and shows how the report should be read. In the next chapter, Chapter 2 Methodology, all methods used throughout this research will be explained. Some will be discussed in more detail during the specific analyses.

In Phase 1 the complexity of the CDM program is described combined with theory. Chapter 3 provides theory on complexity which leads to a description of the specific complexity in the CDM program (Chapter 4). As a result of the interviews with stakeholders of the CDM program seven challenges were extracted. All challenges are provided with theoretical background. This is done to compare theory with the practice at Schiphol Airport and as a stepping stone for the managerial recommendations. This chapter will result in an answer to sub-question 1.

Thereafter the interest of the stakeholders and their perspectives on CDM are revealed in Phase 2. In order to understand the decisions made by the stakeholders is it necessary to understand their processes; because the complexity of operation at Schiphol Airport contributes to difficult decision making. First, the key stakeholders are described in more detail, followed by an extensive stakeholder analysis with an overview of all stakeholders' interests, goals and power (Chapter 5). Support from the organization is needed for a successful implementation. Therefore, the perspectives on the challenges in the CDM program must be identified. This is done by asking stakeholders what they think of the CDM program. Ranking statements will give knowledge on the perspectives of the stakeholder. This method used is called Q-methodology. With this method the challenges are also verified and will get a more objective interpretation. This technique will first be described in more detail followed by the execution of it (Chapter 6 and 7). The result of this second phase about the stakeholders will give an answer to sub-question 2 and 3.

Lastly, an advice on how to deal with decision making in multi-actor environments will be provided in order to help decision making in the CDM program. The managerial implications are based on information gained from the result of literature, interviews, stakeholder analysis and Q-methodology (Chapter 8). The link between Phase 1 and 2 shows how empiricism can be used for scientific addition. These findings help to show how decision making in the CDM program can be improved and will therefore answer sub-question 4. The managerial implications help answering the question on how to deal with decision making in multi-actor environments. Finally, the conclusion of this research (Chapter 9), recommendations for further research (Chapter 10) and a reflection (Chapter 11) will be presented.

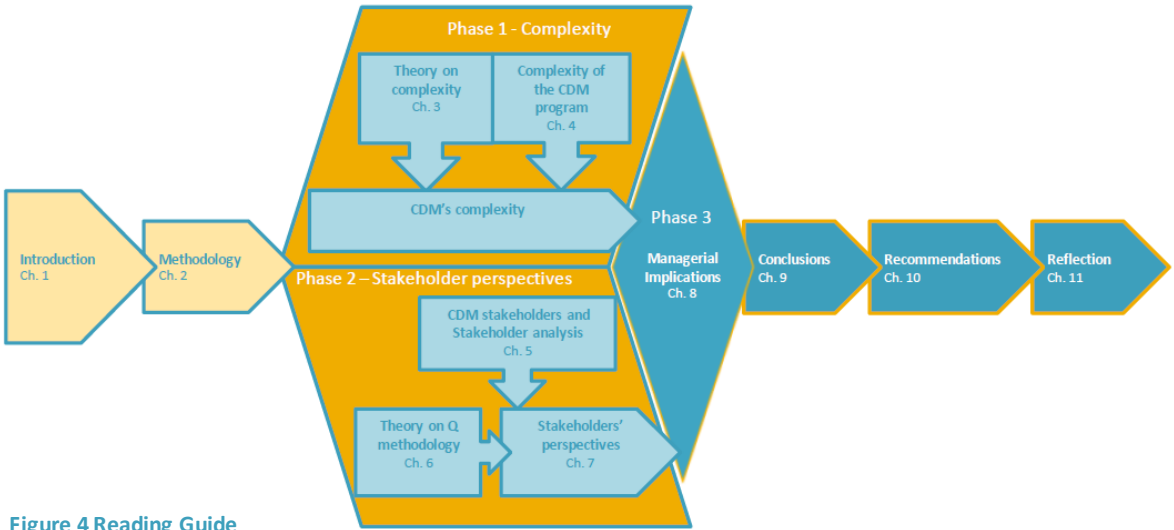


Figure 4 Reading Guide

Chapter 2 Methodologies

This chapter describes which methods are used throughout this research and why there is specifically chosen to carry out these methods. Information for this research is collected by interviews, weekly program meetings and literature. Other methods used to conduct this research are Grounded Theory Approach (GTA), Stakeholder analysis, and Q-methodology. Some methods (interviews, literature) are used throughout the whole research whereas others (GTA, Stakeholder analysis and Q-methodology) are used to answer a specific sub-question. The Grounded Theory Approach is used to map the complexity of the program based on interviews. This will answer sub-question 1. The stakeholder analysis is used to answer sub-question 2 by showing the complexity of the operation at Schiphol Airport that all stakeholders face and the impact of this on decision making. Q-methodology is used to show the perspectives of the stakeholders and is necessary to answer sub-question 3. The methods are specific and suitable and correspond to a sub-question that together help to answer the main research question (Overvoorde, 2012). All methods are in line with the storyline of this research and will help to provide an answer to the problem at Schiphol Airport.

2.1 Interviews

First, during the exploratory phase, information has been collected by literature on CDM and interviews in order to form research questions. These interviews started as an exploratory study in order to understand the different positions and tasks of the people involved. An elaboration of these interviews can be found in Appendix D. Gradually, there has been a focus more on the challenges that the program faces. These more specific questions and the elaboration of the interviews can be found in Appendix E. Appendix E has been verified by the interviewees and adjusted with their feedback which increases the validity of the analysis. In the end 18 people involved in the program have been interviewed between February 3rd and April 22nd 2014. These people are the decision-makers, active or passive users of CDM times. At least their processes are affected somehow by the introduction of CDM.

2.2 Grounded Theory Approach

The first phase of this research is based on empirical research wherein the interviews, but also information gained through meetings, are used to describe the complexity of the program. The working method that led to the complexity of the program can be related to the Grounded Theory Approach (GTA), as described by Glaser and Strauss (1967). GTA is a research methodology where a theory is formed from an inductive and iterative manner. After an initial phase of data collection follows a reflective analysis in order to adjust the next data collection (De Boer, 2011). The collection of data is directed to the development of discovered keywords or concepts. The concepts on the programs complexity are described into seven challenges based on the most stated problems in the interviews.

2.3 Literature Study

These seven challenges are also linked to literature. The literature study is a synthesis and analysis of relevant published work that inspires further research and provides a basis for this research (Gould, 2011). However it is also used to compare and test the findings (De Boer, 2011). With the theoretical background on the challenges the theory can be compared with the practice at Schiphol Airport. It is used to relate findings about complexity of cooperation at Schiphol Airport to previous knowledge. This knowledge is specifically gained from literature about complexity at decision making, change management, process management and stakeholder engagement. The literature study is the foundation of knowledge throughout this research. Both literature study and interviews are methods for qualitative research.

2.4 Stakeholder Analysis

In the second phase of this research is focused on the stakeholders. First context setting of Schiphol Airport is done by looking at the programs main characters AAS, Schiphol Group, KLM, LVNL, Ground Services, and Eurocontrol. A description of these key operating companies at Schiphol Airport with their background and business operation is provided in order to understand the complexity of Schiphol's operation, followed by an extensive stakeholder analysis that takes all specific CDM related functions into account. This stakeholder analysis will help to get insight on stakeholder's decisions. When seeking to influence decision making, what types of influence strategies do stakeholders have available, and what determines which type the stakeholders choose to use it is necessary to execute a stakeholder analysis (Frooman, 1999). In the stakeholder analysis all the actors involved in the CDM program are listed in Tables 16, 17 and 18 (Appendix F). Their department, interest, influence and power on the CDM strategy, resources, replaceable and if they are critical is mentioned. With this list also the internal differences within departments in influence and interest can be seen. Besides the primary and secondary stakeholders also the different layers in management are analyzed. The difference in power and interest within the CDM program is also visualized with a power-interest grid.

2.5 Q-Methodology

Lastly, in order to check what the perspectives of the stakeholders on the decision-making process are, Q-methodology is used. This is a well suited method that provides insight into the perspectives of different stakeholders towards a certain issue (Brown, 1980). This systematic study of subjectivity provides a person's viewpoint, opinion, beliefs etc. (Brown, 1993). People are presented with statements about a certain topic, in this case about the complexity of the CDM program. The respondents, called the P-set, are asked to rank-order the statements, which is called the Q-set, from their point of view. These individual rankings are then subject for factor analysis (Van Exel, 2005). Q-methodology can be seen as an inversion of conventional factor analysis whereas it correlates persons instead of tests. Stephenson (1953) described this as: "[w]hereas previously a large number of people were given a small number of tests, now we give a small number of people a large number of test-items." The result of Q-analysis is categories of subjectivity that are operant because correlations between personal profiles indicate similar viewpoints (Brown, 1993). A more detailed description on how Q-methodology works will be provided in Chapter 6, followed by the results of the analysis in Chapter 7.

Phase 1 – Complexity

Source: Schiphol Group Brand Portal

Chapter 3 Theoretical Background on Complexity

A few different academic subjects are conducted in this research. This chapter provides a theoretical background on the complexity of a project, since complexity is one of the main themes of this research. Many projects or programs executed these days suffer from occurring setbacks. It is easy to see these setbacks as a problem. However, it would be better to turn these problems into challenges that need to be tackled. But what are the challenges that cover the complexity of a project?

The issue raised here is different for every project. But certain characteristics will help understanding complexity, which is provided first in this chapter. Followed by a model that shows how complexity can be divided into several sub-systems.

3.1 What is Complexity?

The importance of understanding complexity is an increasing agreement for project management because difficulties associated with decision making and goal attainment appears to stem from complexity (Remington, 2009). Also managerial actions are needed on high level basis in order to complete a project successful (Baccarini, 1996). According to an IBM study on 1500 CEO's the biggest challenge for organizations is "the rapid escalation of complexity" (IBM, 2010). Many aspects can contribute to the complexity of a project or program. Even though the construction industry is seen as the most complex industry by Baccarini (1996) there are many overlapping aspect that display great difficulty in the CDM program. According to Bosch-Rekveldt (2011) complexity can be seen as twofold; complex projects and project's complexity. Complex projects are mainly based on size, budget and uncertainties and this complexity takes structural, dynamic and interaction elements into account (Remington, 2009). However, in the CDM program it is not as much about size and budget but about the focus on what aspects make the project complex. Therefore CDM is a typical example of a project that has to deal with its project complexity. According to Baccarini (1996) project complexity can be defined as "consisting of many varied interrelated parts and can be operationalized in terms of differentiation and interdependency." This definition can be related to dimensions such as organization, technology, environment, information, decision making and systems. When describing the project complexity it is important to clarify which dimensions are dealt with. Simon (1962) mentioned a similar definition: "one made up of a large number of parts that interact in a non-simple way." Especially in the construction industry much attention is paid to 'structural complexity' and 'uncertainty' (Baccarini, 1996) (Maylor, 2010) (Gigado, 1996). According to Baccarini and Gigado the interdependence of a construction delivery process is caused by the factors:

- "Degree of operational interdependencies and interactions between project organizational elements
- The degree of interdependencies between tasks, teams, different technologies and inputs" (Baccarini, 1996)
- "Number of technologies involved in a task and their interdependencies
- Rigidity of sequence between the various main operations

- Overlap of stages or elements of construction" (Gigado, 1996)

Except for the last factor which refers to construction, they can all be related to the CDM program as well. This also counts for the factors related to uncertainty. Uncertainty underpins complexity from the tasks, employed resources and/or external environment:

- "Incomplete specification to enable execution to be carried out
- Lack of familiarity by management of the operating environment and resources (inputs)
- Uniqueness of projects resulting in lack of uniformity of materials, teams, and work
- Unpredictability of environment" (Gigado, 1996)

Based on literature it can be said that complexity associates with multiple-interacting components. However, the division of these components and their behavior is less explicit (Bosch-Rekveldt, 2011) (Baccarini, 1996) (Simon, 1962). At least the complexity assumed with the many actors involved is important.

According to Simon (1962) the complexity or simplicity of a structure depends critically upon the way it is described. Most of the complex structures found in the world are enormously redundant, and this redundancy should be used to simplify their description. Simon (1962) stated that complexity deals with hierarchy, time, dynamic properties, and the relation between complex systems and their descriptions. Of which hierarchy is the central theme in complex systems. Hierarchic systems have some common properties that are independent of their specific content which means that a system that is composed of interrelated subsystems, each of the latter being, in turn, hierarchic in structure until some lowest layer of elementary subsystem is reached (Simon, 1962). Complexity has also been divided in terms of difficulty of task performance, usually by vertical and horizontal differentiation (Baccarini, 1996). According to the literature there are many factors causing complexity. These factors are especially based on the construction industry, but can also be related to the CDM program. However, no single notification and division of the complexity of a structure exists. At least all authors agree on the fact complex projects consists of many interrelated sub-systems.

3.2 How to Divide Complexity into Different Sub-systems?

What can be learned from the theoretical background on complexity is that complexity consists of many interrelated sub-systems but the way of dividing the complexity into these sub-systems depends on the managers or researchers view. Therefore, there must be a way to divide and therewith describe the complexity of the CDM program. In order to understand the complexity of the CDM program it must be divided into different sub-systems, this will simplify the complexity and will turn the unstructured knowledge on the CDM program into structured.

An example of a division of complexity is the model from Hagan, Bower and Smith (2011). They adapted a framework from Challenger, Clegg and Robinson (2009) in order to simplify complexity from a socio-technical systems perspective. The fact that the CDM program involves interaction between people and technology in workplaces refers to a socio-technical system. However, this research is not about describing what kind of system the CDM program is but about how the complexity of it influences decision making. Therefore, the characteristics of a socio-technical system will not be elaborated. However, the model is a good example to take into account when dividing the complexity of the CDM program.

According to Hagan et al. (2011) the organization should be viewed as a single, interrelated system whose sub-systems must be considered jointly for maximum performance in order to simplify complexity. They divided the organizations complexity into six main themes in order to observe, investigate and manage the different factors that contribute to complexity. These main themes are 1) Process 2) People 3) Goals 4) Product 5) Resource availability, allocation and scheduling and 6) Decision making. The six main themes can be divided into several factors that cover the sub-systems. These factors can be found in Figure 5.

Area of Concern	Main Themes	Factors
Project Complexity	Process	Organizational and project structures
		No and variation of organizational / project management processes
		Planning and scheduling procedures
		Operational procedures
		Performance criteria
		Decision-making structures
		Procurement routes
		Change control procedures
	People	No of teams / department / clients / stakeholders / supply chain
		Diversity of stakeholders
		Relationships
		Team location
		Technical knowledge, expertise or experience
		Newness of team
	Goals	Goals definitions
		Outcomes
		Project objectives
		Organizational goals
	Product	No of elements
		No of technologies
		Newness / novelty of technology
		Type of product
		Location
		Scope definition
Multi-Project Environment	Resource availability, allocation and scheduling	Simultaneous management of throughput times, allocations and cost
		Allocation of scarce resource
		Dealing with resource queues
		Information
		Planning and control cycles
		Project times / programme schedules
	Decision-making	Hierarchical decision-making
		Coordination, interfacing
		Communication plan
		Prioritization
		Planning
		Organizational structure

Figure 5 Main themes and factors of project complexity (Hagan, 2011)

3.3 Division of the CDM Program's Complexity

Now typical factors that cover the complexity are known, it is time to divide the CDM program into several sub-systems. Although holism explains the CDM program, a breakdown of the complexity will help understanding the CDM program. It would also be easier to find solutions in order to improve decision making when the complexity is broken down into several sub-systems. In order to make the division there is chosen to make use of interviews. Interviews are a qualitative research method of collecting data. By doing interviews experience about the program was collected in an interactive and personal way. An elaboration of the interviews can be found in Appendix D and E. The mentioned topics, usually problems, during the interviews were gathered and can be found in Table 1. Also the corresponding factor from the model is appointed.

Table 1 Mentioned topics during interviews

Topic	Factor	Appendix
Airline is depending on LVNL and Schiphol	Relationships	D2
Ground handlers tune TOBT but do not see consequences	Operational procedures	D2
Concern of other slot times	Operational procedures	D2
Consensus within KLM but not everyone convinced of success	Communication plan	D2
Not holding too tight to the milestones	Performance criteria	D2
Have to match own system with CISS	No of elements	D3
Ground handler is chosen by the airlines	Relationships	D3
When de-icing depending on weather but also on call from pilot	Relationships	D3
Common goals not clear enough in beginning and still vague	Goals definitions	D4
Connecting CISS and portal	No of elements	D4
Communication can improve	Communication plan	D4
Transparency for KLM results in slots	Operational procedures	D4
Less interest for LVNL	Outcomes	D4
Not sure about the status of Schiphol	Communication plan	D4
Actors keep information for themselves	Operational procedures	D5
Communication to keep deployment of confidence	Communication plan	D5
Different opinions between management and operations	Hierarchical decision-making	D5
Commitment management lacks	Organizational goals	D5
Lack of openness results in distrust	Operational procedures	D5
Experiences of France should be taken into account	Information	D5
Development of portal including new ideas	No of technologies	D6
Way of working in Germany is preferred	Information	D6
KLM benefits from high punctuality	Outcomes	D6
Not always good sharing information	Operational procedures	D7
Acceptation of the decisions	Change control procedures	D7
Designated benefits	Organizational goals	D7
Stress for GH of setting times	Operational procedures	D7
Calculation of benefits is not decisive	Information	D7
Satisfied with CDM info for their planning	Planning and scheduling procedures	D8
Still improvements possible if LVNL send information earlier	Operational procedures	D8
All airports need CDM to get the benefits	Goals definitions	D9
Flight priorities LVNL and KLM	Performance criteria	D9
Tower is conservative	Organizational structure	D9
Poorly fitting infrastructure is underestimated	Type of product	D9
Complexity of tangential runway system	Location	D9
Too many new proceedings	Operational procedures	D10
User-friendliness system is important/ one single system	No of elements	D10
Culture difference makes cooperation difficult	Organizational structure	D10
Airlines are not informed properly by AAS	Communication plan	D11
Airlines not allowing GS to change TOBT	Operational procedures	D11
Too many different systems	No of elements	D12
Not understanding each other's tasks	Technical knowledge, expertise or experience	D13
Assumptions of prioritizing	Operational procedures	D13

Lack of knowledge in CDM team	Technical knowledge, expertise or experience	D13
Bad communication in past	Communication plan	E2
No mission/vision was communicated	Goals definitions	E2
Combine representatives of KLM	Diversity of stakeholders	E2
Temporarily solution from top management	Prioritization	E2
No budget or resources available	Allocation of scarce resources	E2
Storyline for top management	Communication plan	E2
Business case should have been done at the beginning	Information	E2
Nowadays it is a bottom-up structure	Relationships	E3
Commitment top management showed by the resources	Allocation of scarce resources	E3
Blocking power LVNL	Prioritization	E3
Row top management occurred	Organizational structure	E3
Reduction project team with new PM	Diversity of stakeholders	E4
Necessity of mandate	Hierarchical decision-making	E4
Priority meetings is low	Prioritization	E4
Transparency SUC is questioned	Performance criteria	E5
Hidden agenda appear	Prioritization	E5
Other airlines not involved	Diversity of stakeholders	E5
Underestimation Schiphol's operational system	No of technologies	E5
Resources are scarce	Allocation of scarce resources	E5
No cost-benefit analysis made in the past	Information	E6
No joint ambition	Goals definitions	E6
More trialing is advised	Planning and scheduling procedures	E6
Should involving Eurocontrol	Diversity of stakeholders	E6
Political playing field	Relationships	E7
Set up project team	No of teams	E7
No attention to change management	Change control procedures	E7
Training of performance	Planning and scheduling procedures	E7
Row management resulted in less resources	Coordination	E7
Mandate in escalation levels	Hierarchical decision-making	E7

Table 1 show that many factors from the six main themes of Hagan et al. (2011) can be used in this case. But a division of all those factors would be too extreme. Hence, another reduction needs to take place. Complexity reduction improves the quality of the decision (De Bruijn & Ten Heuvelhof, 2008, p. 61). The table shows that the most frequent mentioned topics deal with the relationship between the actors, communication, the connection between the technical systems, resources and budget related topics, goals definitions and commitment, and assumptions on operational procedures. The topics are mostly seen as setbacks that do not improve decision making within the program, therefore they are turned into challenges that need to be tackled. By an inductive and iterative manner this has led to seven challenges which summarize all related factors. These seven challenges cover the most frequently mentioned topics and thereby justify the complexity of the program. The seven challenges the CDM program faces are:

1. Getting everyone to work in the same direction
2. Dealing with mutual dependent relationships
3. Developing a flexible and transparent process
4. Collaborate between decision-making layers
5. Evaluate costs and benefits
6. Dealing with technological uncertainty
7. Communicate

All seven challenges will extensively be explained in the next chapter.

Chapter 4 Challenges to Face

From the empirical analysis the most important and most indicated problems have resulted in seven challenges. The iterative process of data collection can be assigned to the Grounded Theory Approach (GTA), as described in Chapter 2. The interviews started as an exploratory study but gradually, there has been a focus more on the challenges that the program faces. An elaboration of the interviews can be found in Appendix D and E. The outline of the interview has been adjusted with feedback from the interviewee which increases the validity of the analysis. In the end 18 people involved in the program have been interviewed between February 3rd and April 22nd 2014.

Information from the interviews has resulted in seven challenges that describe the summarized complexity of the CDM program. In order to give advice on how to deal with these challenges a theoretical background is provided per challenge. This is done, not only to compare theory with practice, but also as a stepping stone for the managerial recommendations.

4.1 Challenge 1: Getting Everyone to Work in the Same Direction

It is hard to say when the CDM program exactly started. At least the intention of it arose at Schiphol Airport around 2001/2002. This means the idea of CDM started in 2001/2002 but not until approximately 2008 the first documents and strategy were made (Appendix E6). A memorandum of understanding (MoU) has been signed on October 23rd 2009 between AAS, LVNL and KLM. According to previous and current employees of the Schiphol Group it took many years to sign, because of trust and support of strategic management. A difference in opinion between management and operations occurred at AAS and they did not agree well on the front. According to the AAS sector project manager, there were no joint ambitions for implementation at the start of the program but the necessity of it was clear (Appendix E6). The lack of commitment from management can be related to the amount of resources that is provided. In the past a row between strategic management of KLM and Schiphol Group occurred. According to the project team this did have an impact on CDM because cooperation (temporarily) stopped (Appendix E3 and E4) and fewer resources were provided. Experience from Aéroports de Paris learned they had a good discussion at the front and sought after commitment from higher management from the start. The French paid more attention to commitment from the beginning on, which is part of their culture (Appendix D5).

For more than 12 years many people worked on this subject. Over the years many stakeholders within the organizations have worked on the program due to retirements, changing jobs, cutbacks etc. The duration of the program and the attendant variation of people involved contribute to complexity. In 2007 the first CDM organization was formed; a team existing of an implementation manager and two sector managers. They were asked to work on CDM and had responsibility to managerial level. Not until the moment the first program manager was designated in 2009 the current CDM formation with Steering Board (SB), Implementation Board (IB), and project team (BT) was created. When Onnes took over the responsibility of program manager the project team got a new interpretation in 2012.

This uncertain start of the program without a recorded vision or direction still contributes to dimness in the program. For example the continuity of Schiphol Airport is in interest of all stakeholders, but

the benefits from CDM differ per stakeholder. Schiphol Group says most benefits are for the airlines and that they, as airport operator, are the ones that have to invest most due to the contract of visual docking guide systems (VDGS). Whereas KLM calls that Schiphol Group wants the CDM mark and they will eventually have to pay for it by airport taxes (Appendix D9). However these designated benefits are in interest of all of them but dangerous to say when it is not based on facts, it is now all based on perception. As a result of all interviews it can be said that all actors still designate different benefits. This conflict of interest is a huge deal in the program.

4.1.1 Theoretical Background of Challenge 1

"I have a dream", speech by Martin Luther King is by most people seen as one of the best visions ever. Almost every author mentions the importance of having a clear vision, goals of mission at the start of the project (Wallaert, 2009) (Turner J. &., 1993) (Kotter, 1996). No success will be achieved when starting a project without knowing the direction and when top management can no urgency get across (Kotter, 1996, p. 14). According to Jonker et al. (1998, p. 106), change starts with a vision. A vision inspires in the form of 'dream, drive, and direction'. Wallaert (2009) described a vision as the Pole Star. It is important that you can navigate on it, but also that everyone knows where to find it, else no final destination will be reached (Wallaert, 2009, p. 15). A vision describes the desired situation within a specified time frame and the way of achieving this. It also needs to inspire people and must be ambitious to attract the organization. It is important that an organization can navigate on this vision (Kotter, 1996, p. 89). It must be feasible as well, so rather less ambitious than impossible. Only when top management feels this vision they can involve the rest of the organization. A vision is usually translated into specific strategies or objectives that are defined as a plan which are measurable (Wallaert, 2009, p. 22). Traditionally, strategy has been seen as a one-way process, nowadays it is not just implemented from the top down but combined with feedback from the organization (Maylor, 2010). A strong coalition is necessary because individuals cannot face traditions or inertia (Kotter, 1996, p. 16). Wallaert showed that having a vision will result in clearness and not having a vision in confusion (Wallaert, 2009, p. 24). Leadership is necessary for clearness but also to make sure people understand it and that they realize how important it is. Leadership is necessary to motivate people to action that is not for their own good; however management should provide this with planning and budgets (Kotter, 1996, p. 91). The motivation and effort with heart and soul or 'empowerment' is necessary in order to manage this changing environment. Coupled with this is good communication to convey this urgency (Kotter, 1996). But it is also very important to not affect the core values of other actors, else trust is seriously harmed. This does not mean the core values cannot be changed but they have to be treated with respect (De Bruijn & Ten Heuvelhof, 2008).

4.2 Challenge 2: Dealing with Mutual Dependent Relationships

An important factor in this program is that the program only succeeds when all actors finish simultaneously. Only when all stakeholders agree CDM can be implemented. When the program goes live they all have to start sharing information the same way, if they will not simultaneously do this, there will be no benefits. Blocking power will therefore have a huge impact on the process. Coupled with this goes the waiting game the stakeholders play. They all start training people with new procedures when they know for sure the program goes live. Besides this hold-up problem CDM

also influences many other projects at Schiphol Airport. Common ground does not simplify decision making.

Another factor of mutual dependency is that all actors at CDM, like many other programs at Schiphol Airport, are mutually dependent on each other's existence. Therefore the program can be seen as a forced marriage with repetitive relationships. All actors are that much related to each other that they would ruin each other. When KLM would declare bankruptcy AAS and LVNL would not survive either. A manager from Schiphol Group tried to awaken the group by announcing that there would not build a new terminal. The team responded letting him know that it would not be an option. This realization forced the two into a marriage for each other's survival. However, the win-win situation might be more top level whereas the operational field sees the program as win-lose. This might be about cutting jobs at operational level when a more efficient operation occurs. Nevertheless the operational level is the beating heart of the CDM program.

Besides the cooperation and dependency between the actors at Schiphol Airport they are also dependent on other airports, other airlines etc. The CDM program is initiated by Eurocontrol as a result of a packed network due to the increase in air traffic. Change of the system is needed from a technological and competence perspective. To solve this main problem many projects were initiated. One of these projects is the Single European Sky ATM Research (SESAR) and intends to completely overhaul the European airspace and its Air Traffic Management (ATM), whereas the CDM program should contribute to a more local efficient process. The linkage of the specific times should result in an overall efficient network. Schiphol Airport was one of the first airports working on CDM but nowadays the only, out of the six biggest airport consortiums, that has not implemented CDM. According to a manager from the Schiphol Group this makes the punctuality unreliable because the link with the network is missing. This will result in a last spot at the decision table of Eurocontrol. This shows the priority of CDM and a problem for top management.

4.2.1 Theoretical Background of Challenge 2

At Schiphol Airport all actors are mutually dependent. There is reciprocal exposure, which means that the stakeholders will not be in a position to walk away from the relationship (Lawler, 1987). In this case the welfare of each will be related to the other, so each will only do well by attending to the needs of the other (Frooman, 1999). De Bruijn and Ten Heuvelhof (2008) describes the relationship of actors that all have their own resources and interests but mutually dependent on others for the realization of their goals as a 'network'.

According to Mitchell et al. (1997) urgency, legitimacy, and power are the three key attributes of a stakeholder, these attributes are indicators of the amount of attention management needs to give a stakeholder. However, many authors define power as the most important one (Frooman, 1999), because a qualified blockade can totally stagnate the project (Kotter, 1996, p. 21). Actors may notice during the decision-making process that the solution seems to prevent itself harms their interests, therefore they might try to block further decision making (De Bruijn & Ten Heuvelhof, 2008, p. 27). Intention is reached to consensus, but when an actor wants to strengthen his owns negotiating position he will block the consensus (De Bruijn & Ten Heuvelhof, 2008, p. 40): the greater the variety of stakeholders the smaller the reach of an intervention. De Bruijn and Ten Heuvelhof (2008) also mentioned that the greater the variety the greater the chance of an intervention with at least some of the actors. Coalitions between actors can be formed for cooperation. It is important to not just

know the opinion of the other actor, but also the underlying interest, this will create room for decision making (De Bruijn & Ten Heuvelhof, 2008, p. 37). Sense of urgency is crucial for the team; else they are not able to cooperate (Kotter, 1996, p. 50). A strong coalition with the right people, the right confidence level, and a common goal, is always important to start with (Kotter, 1996). This variety of people is called the wisdom of the crowd. It is assumed that in a hierarchical structure a superior has the information and power for effective decision making (De Bruijn & Ten Heuvelhof, 2008, p. 8). According to Maylor (2010, p. 249), the characteristics for effective teamwork are: a clear, elevating goal, provide a results-driven structure, competent team members, unified commitment, foster a collaborative climate, standards of excellence, external support and recognition, institute principled leadership. According to Jeurissen et al. (2013, p. 63), a bottom-up structure is an important factor for stakeholder engagement because when you let people formulate their own idea the decision will be carried by them. In the program the professionals appear to have the power. This resembles a professional organization where the organizations members beat their managers and directors on expertise and competencies (Mintzberg H. , 1993). The problem with more knowledge, expertise and competencies required is that the least possible it is to steer from the top. In a professional organization the professional has the power while in a hierarchical organization culture the boss is the hero. This hampers steering from the top and can only be kept up with enough autonomy (De Bruijn & Ten Heuvelhof, 2008, p. 2).

4.3 Challenge 3: Developing a Flexible and Transparent Process

There have been six CDM trials so far. The first one went well, but at the second trial at December 5th 2013 a no-go was given due to unstable TSAT's and the problem of how to get TSAT in the cockpit. The two challenges were tackled as two different projects called 'Workable departure process' and 'CDM times at the apron'. These projects were executed down to the last details, and democratic decided which project to apply after the no-go. Many projects in the program are accepted as a temporarily solution, but not as a permanent solution from the start. The program endured many phases which are executed very careful and step by step. With the programs, glitches have occurred and details need to be ironed out. When a new, usually temporary, solution has been created it turns out they can never agree on it in advance. It always has to be checked by the IT architects and experts whether or not it is a workable procedure. For example the Actual Start-up Approval Time (ASAT), another CDM time, was suddenly necessary for towing direction. The project team first thought the new procedure was workable (that did not include ASAT) but apparently they use to tow the aircraft to a buffer. In this case this aircraft will not depart but does need time to be towed. A whole new discussion opens because the CDM times also influences other processes. The Visual Docking Guide Systems (VDGS) also affects other processes but they are the condition for the 'CDM times at the apron' project. In order to solve the problems, the people have to cooperate and be flexible while working because processes are constantly adjusted. Because not all circumstances can be predicted in advance there should be more trials according to the program manager.

Milestones are made by Eurocontrol as a guideline for the operational procedures. All airports are different and therefore the process has to be developed according to their own preferences. However, once these operational procedures are made people should work according to these. A pilot already mentioned during the meetings that he was not willing to do that. It is not going to work with this individual's attitude.

Due to CDM the times are adjusted, which helps predicting the process. But on the other way the times fluctuate due to these constant adjustments. Everyone should learn how to deal with this new information. A flexible attitude is appreciated when organizing a change.

Besides a flexible working attitude the problem is also only going to be a success when the process is done in a transparent way. However, the question arises if the actors want to be flexible and transparent in their way of working and sharing information. According to KLM, it is from managerial perspective not good to always share all information. When people are given the space, they will instantly use the given space. When, for example, the bus transfer from AAS has a delay of 15 minutes they will also bring the passengers by bus to the aircraft 15 minutes later. As a result, you will not eliminate the delay. It is better for KLM and the ground handlers that they will already be on board (Appendix D7). But transparency might also disturb the processes for LVNL. According to LVNL's sector project manager, the start-up controllers do not have a problem with transparency. However, they do not appreciate their professionalism being questioned. During peak moments there is no room for discussion on the radio frequency. The experts in the CDM program can confirm if the procedure is workable and therefore feasible (Appendix E5 and D13). This program is all based on sharing information, flexible and transparent so when stakeholders are not willing to do this the program will not be a success.

4.3.1 Theoretical Background of Challenge 3

In a network decision making and change are a matter of course, because the actors are mutually dependent on each other to realize a change (De Bruijn & Ten Heuvelhof, 2008, p. 5). Change management has grown tremendously over the last years due to more and frequent changes, value system of empowerment and competitive advantage (Prosci, 2014). But the willingness to cooperate or flexibility is less natural. According to Bennet et al. (2008), flexibility means "the capacity to learn to maintain an open mind, not prejudiced by past success and bureaucratic traditions or rigorous thinking; the ability to assess an occurrence in the environment objectively; and the wherewithal to take whatever rational action makes sense—either on the basis of logic or intuition and judgment—to achieve decision making goals." The amount of flexibility that is seen usually depends on people's own point of view (Jonker, 1998, p. 8). "Flexibility means that decision-makers must be willing to try new approaches, moving beyond conservative solutions that have proven themselves in the past, and be willing to take risks in new areas where outcomes are uncertain (at best) and perhaps completely unknown (at worst)" (Bennet, 2008).

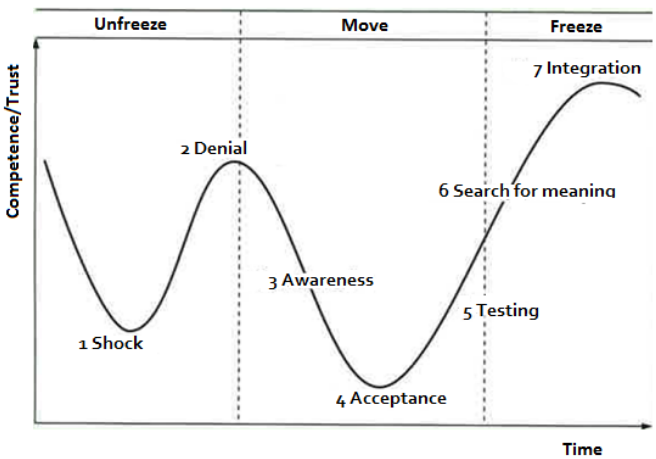


Figure 6 Relation between organizational and personal change (Lubberding, 2009, p. 99)

People want to change, but not be changed (Kloosterboer, 1999) (Jonker, 1998) (Lubberding, 2009). A difference occurs between organizational and personal change. Lewin described an organization as a quasi-stationary equilibrium that could be changed in three steps: unfreezing, moving and refreezing (Jonker, 1998, p. 90). The project is temporarily 'disconnected' from the organization and is replaced after the implementation. Meanwhile the rest of the organization is continuing normally.

Lubberding (2009) combined Lewin's phases of organizational with personal change. According to De Bruijn and Ten Heuvelhof (2008) all steps in decision making undergo the same strategic issue: chose an actor to freeze, unfreeze or refreeze the situation? Acting individually in this program can be referred to unfreeze, for example, if pilots keep working according to their own preference. However, everyone should try to work collaboratively according to the new CDM procedure; only then, the change can be realized in both personal and an organizational way.

Figure 6 shows that change is of temporary and transient sort. Organizations never stop; they are dynamic entities that are constantly evolving. Unlike structures, strategies are never finished (Mintzberg H. &., 2005, p. 20). Therefore both persons and organizations must be flexible. People must be capable and willing to work with each other, and others they have not worked with before, work in new ways, and take unfamiliar actions. All of these aspects deal with flexibility, whether it is organizational, team, cognitive, social or resource flexibility (Bennet, 2008).

4.4 Challenge 4: Collaborate Between Decision-Making Layers

At the CDM program many hierarchical layers exist and the structure can be seen as a multi-layer system. The organizational chart can be found in Appendix B. This means the decision-making layers have a hierarchical structure whereas the overall program is situated in a network. The different companies together form the decision-making layers which makes the organization complicated. This set-up stems from the individual hierarchical organizations AAS, KLM and LVNL.

Weekly meetings take place at the project team (BT), once every two weeks a meeting within the Implementation Board (IB) and then less frequently the Steering Board (SB). Everything is discussed at the project team and from this it will be send to Implementation Board. At this moment the operational level (project team) is enthusiastic, has eye for details, and structure and initiative exist within the team according to the program manager. The Steering Board is only interested in the most important issues, because they have many more projects to handle. Also, when the Steering Board takes place only every few months and is planned much in advance, a cancellation at the very last moment will not be tolerated. It is up to the problem owner to guide strategic management by making a good storyline. With a bureaucratic structure like this it is necessary to understand the responsibilities. The program results in capabilities and it is up to the Implementation Board to realize the benefits with it (Appendix E4). Members of the team hide behind bureaucracy.

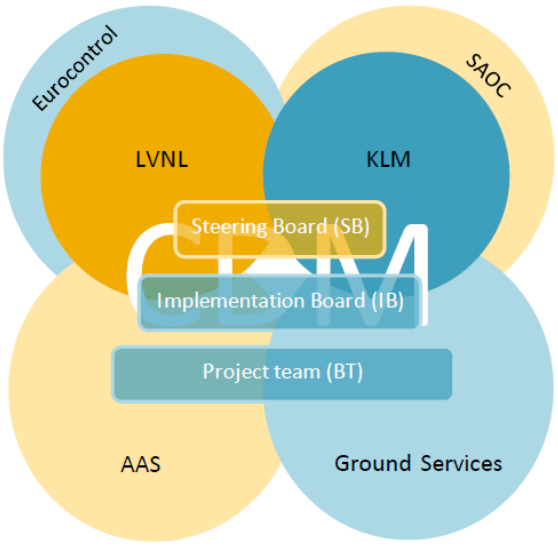


Figure 7 CDM structure

The Dutch polder model assumes that many people should be involved in the project and are able to take part in the decision-making process but the delegation in the marriage is very important and the responsibilities of each must be clear. Nowadays, the project team is almost halved, only sector project leaders take place in the project team. Since Onnes started as program manager, also the ground handlers took place in the Implementation Board; a delegation for them was not represented

at first. In the program the specialists have the power. For example the people at the LVNL tower ultimately determine what will happen even before top management. At KLM the pilots are also the ones that raise their voice in case of decision making. The pilots were not involved before the 5th trial (Appendix E6). Depending on who has to be involved, making appointments with people in continuous services hard.

4.4.1 Theoretical Background of Challenge 4

One of CDM's complexity factors deals with the organizational set-up. Heylighen (1989) describes this characteristic of realistically complex systems as a multi-layer structure. In a social organizational structure, or the decision making structure, this interrelation can be seen as the authority at that subsystem (Keren, 1979). Therefore, in a hierarchic formal organization, each system consists of a 'boss' and a set of subordinate subsystems. Each of the subsystems has a 'boss who is the immediate subordinate of the boss of the systems (Simon, 1962). However, only the formal structure of the CDM organization can be seen as hierarchical. Other characterizations of the CDM program all refer to a network instead of hierarchical model. This is because of a great variety between the actors, mutual dependencies, and a dynamic surrounding (De Bruijn & Ten Heuvelhof, 2008). In the organizational structure of CDM three layers exist (e.g. SB, IB, and BT) including many delegations of different companies who have responsibility to a higher subsystem. In the end the RVO is the highest decision layer but they deal less with CDM. This means there are interactions within and among the subsystems. In this parts-within-parts structure the number of subordinates who report directly to a single boss is called his span of control (1962). De Bruijn (2008) mentioned that hierarchic models are seen as preferable because they reduce complexity by making it transparent and manageable. According to Keren and Levhari (1979) the span of control should increase as one goes down the layers of the hierarchy or the greater. The formation of these layers depends on the time. The structure of the project team has changed over time. Simon (1962) mentioned time as one of the four dimensions of complex systems. Many authors described this time dependent factor as emergence (Bennet, 2008) (Heylighen, 1989). However, due to the emergence of globalization steering from a hierarchical form is no longer effective according to De Bruijn et al. (2008). Emergence results from the interactions and relationships among its agents (people) and between the agents and their environment. This has to deal with culture, trust, attitudes, organizational identity and team spirit. Thus, culture and other developed habits are created by a series of historical interactions and relationships that evolve over time (Bennet, 2008). Maylor (2010) described this characteristic of a project as a benefit that was known while undertaking the project, but the exact objectives and means to achieve them could be determined only once a certain amount of works had been done. However, during the process the goals will also emerge. Emergence is not random, but a learning curve of interactive gain that produces synergy (Nikolic, 2013). It is hard to predetermine the emergent properties, but when for example, creating a specific culture which is more acceptable than the one before, the situation can be guided to the intended outcome by finding the right set of actions. This journey is the decision strategy (Bennet, 2008). According to Mintzberg (2005, p. 17) a strategy consists of five P's: plan, plot, pattern, position and perspective.

Another factor of the complexity of the organization is the same as in the construction industry; it is a temporary multi-organizational structure. In the CDM program no one had ever worked together in this formation before. Baccarini (1996) divided the organization complexity by task differentiation in vertical and horizontal. At a vertical level, three layers exist for the CDM program whereas at horizontal level much different professionalism exists. Persons performing a wide range of activities,

thereby increase in task complexity of a single job position takes place. The well-established body of knowledge asserts that differentiation and interdependencies are managed by integration, that is, by coordination, communication and control (Baccarini, 1996). Complex decision making is a motivated, cognitive process. Managers have to cope with this integration of multiple sources. Some of the most important managerial decisions are concerned with how to use human talent and how to guide and motivate human effort (Bandura, 1989).

4.5 Challenge 5: Evaluate Costs and Benefits

Most CEO's base their decisions on quantitative analyses. Last year a business case was made as part of a cost benefit analysis. This business case is a rough estimation made by the project team but is not mentioned at the decision table. According to the sector project manager of KLM and AAS, they should have done a high level business case with a value for savings at the beginning of the program. Nowadays, the savings are spread out over the organization too much and the budget cannot be adjusted to this (Appendix E2). By evaluating costs and benefits in the initial phase there can be checked whether a project is feasible, viable and desirable. Risks need to be managed, not excluded.

Looking earlier at the experiences from other airports and their occurring challenges can also be decisive. Today, members of the project team and experts visit other airports rarely. Less attention is paid to lessons learned from other airports. For example, in Germany they told Lufthansa that they had to cooperate without any discussions (Appendix D6). They learned from experienced pilots that the rest of the world has visual docking guide systems (VDGS) with count-down times. At Schiphol Airport much time is spent by checking these possibilities (Appendix D9). At Charles de Gaulle (CDG) airport they saved money due to CDM. A Schiphol Group expat said FedEx wrote a letter to CDG that thanked them for the program since they saved a ton of Euro each month on kerosene. When no comparison between the airports exist it is hard to say the position of the airport. Some interviewees said Schiphol might be a CDM airport already, but no one can admit this (Appendix D4).

4.5.1 Theoretical Background of Challenge 5

For centuries change was the most natural thing in the world. Since consultants no longer speak of change but of innovation, it suddenly became an important concept in the business world (Jonker, 1998). Consultants use all kinds of methods in order to deal with change and project performance as Lean Six Sigma and Total Quality Management (TQM). According to Simon (1962), "One way to solve a complex problem is to reduce it to a problem previously solved – to show what steps lead from the earlier solution to a solution of the new problem." This way of solving a problem by looking at similar projects, trends and developments in the past is called benchmarking (Kleijn, 2012, p. 123). Benefit analysis does not always have to be about quantitative measurements, as long as it is feasible it will be essential for a successful project. Carrying out a pilot study, benchmarking and modeling are strategies to use when struggling with intangible benefits (Maylor, 2010, p. 89). With this analysis the added value of the program can be measured. There has been advice given to make a business case that includes: value of the benefits, risks to achieving the benefits, costs for delivering the project, and timescales for achievement (Best Management Practice, 2011).

This can be challenging when benefits may not be purely financial. Many companies use the project method PRINCE2 which uses the business case as an essential step in the process (Graham, 2009). KPMG demonstrated in a study that 75 per cent of the projects that undertook a business case the

targets were not meet (Maylor, 2010). Therefore, Maylor (2010, p. 193) concluded that, "both costs and benefits should not necessarily be to dispense with the method of business case analysis altogether but to use experience of similar projects to provide a critical approach of costs and benefits, and be aware of the levels of risk or uncertainty attached to either." This uncertainty or risk of a project has to be mapped somehow in order to not be totally surprised at the outcome (Ruzius, 2012). However, there are many methods to see the risks of a project. Whether this valuation of costs and benefits is done by benchmarking, SWOT analysis, cost-benefit analysis (CBA), Lean Six Sigma, a business case or trial and error depends on the type of project and the way project performance is measured, but it is essential to take the risks into account (Graham, 2009, p. 148). When no comparison with others can be made it is impossible to know your position, this is why benchmarking is important for performance measurement (Sayer, 2007).

4.6 Challenge 6: Dealing with Technological Uncertainty

The program is also technically very complex. Every person uses his own (company) related IT systems. This means that all kinds of different systems have to be linked to each other in order to share the times. All IT systems have to run simultaneously because this is the whole idea of the program. For example one manager at KLM uses already four different programs during the day which is all connected to the main system at Schiphol Airport: Central Information System Schiphol (CISS). There is no uniformity in the systems; all systems have to be connected to each other and the information does not always correspond. This also means that the information is not always in sync. User-friendliness of the system is also an important preference. This poorly fitting infrastructure does not reduce the complexity. Many stakeholders mentioned the complexity of Schiphol's operational system has been underestimated (Appendix E8).

The tower system of LVNL is conventional. Whereas the rest of the world works with a digital system LVNL still has paper strips. They want to digitalize the tower but according to the start-up controller this stagnated when crises started (Appendix D13). Only twice a year the tower will adjust system requirements. Any doubt will not result in an adjustment. LVNL's main goal is safety. The complexity of the tangential runway system at Schiphol Airport complicates this. Meanwhile the main goal of KLM and Schiphol Group is, the common interest in safety and commerce, but leans more towards commerce. This consideration between capacity and safety is an example of low risk high impact decision. When an accident occurs this will have a huge impact on the safety ensuring.

4.6.1 Theoretical Background of Challenge 6

Attached to increased competition and globalization leans towards higher risk projects because projects are more critical to business performance. Because each project is unique some degree of uncertainty is involved. According to Raz et al. (2002) technological uncertainty is one of the major dimensions among project management. Shenhar classified technological uncertainty into four levels:

- "Type A: low-tech projects are those projects that rely on existing, and well-established technologies.
- Type B: medium-tech projects use mainly existing technology; however, they incorporate some new technology or new feature that did not exist in the past.

- Type C: high-tech projects are typical in situations in which most of the technologies employed are new, but exist.
- Type D: super high-tech projects are based on new technologies that do not exist at the time of project initiation." (Shenhar, 2001)

Although the technical system of CDM can be seen as type B still many problems occur. All systems need to be connected which is not the most high-tech solution; however the fact they all have different sources does not reduce the complexity of it. Organizations must realize that projects are risky undertakings and not always end as planned, and that delays and overruns are common outcomes. However this is usually because of a lack of awareness and over-optimism (Raz, 2002). Aladwani (2002) paid more attention to specific IT project uncertainty and defined uncertainty into the dimensions project size, project structure and technical newness. Complex systems are built with multiple interrelationships and therefore have an interdependence that may follow some power law, which has a much higher probability of extreme occurrences happening than does the bell curve (Bennet, 2008). This can have a huge impact therefore special attention should be given to risk management that will improve better attainment of product performance and specifications (Raz, 2002).

4.7 Challenge 7: Communicate

One of the biggest challenges is communication. Needless to say is that it is very difficult to update everyone constantly in such a large organization, especially when more than hundred airlines with many pilots fly at Schiphol Airport. How do you contact a person, to mention the change in procedures, to someone that arrives at Schiphol Airport only once a year? In the program some people say to be well aware of CDM, others are less aware. For example, the SAOC (Committee that represents all airlines) wants to be informed more. With good communication consensus will be created. According to LVNL the actors are in contact more often due to the CDM program which is a good experience because it is the first large project undertaken ever at Schiphol Airport that involves so many actors. But also many assumptions or interpretations on the processes are made in the program. Some said the adjustment of times result in stress for ground handlers and pilots (Appendix D9), but when asking the pilots and ground handlers this turned out not to be the case (Appendix D9 and D11). Besides this, KLM thought it had advantages as home carrier about getting slots. After a meeting with two people from Eurocontrol and an interview with the start-up controller of LVNL these assumptions appeared to be false. Because many assumptions are made due to scattered information the stakeholders thwart for the wrong reasons. The perception of preferences overrules.

Another factor is the importance of the last few percent of implementation and the awareness of CDM. Inbound and turnaround processes are already fully operational. The start-up procedure (outbound process) is not operational yet, but the corresponding times are already visible in the system. The various actors do use them unofficially in their decision-making processes. The discussion is whether or not to connect to the European Network Manager (NMOC) whilst the start-up process is not yet in place. The discussion is fed by the fact that today's operation at Schiphol Airport is already positive and the requirements from the NMOC for connection are minimal (Appendix E5). It is up to strategic management to decide on this. It is difficult when no one knows 'where Schiphol Airport is' compared to the other European airports. Many have a CDM mark at this time but the fact that they share times with Eurocontrol does not necessarily make them better. So

maybe even without the CDM mark Schiphol Airport functions as 'CDM airport' very well, but this is hard to tell.

4.7.1 Theoretical Background of Challenge 7

Communication plays a vital role. Communication creates awareness of the problem and/or opportunity (Kloosterboer, 1999). It mobilizes creative and innovative ideas and is the connection between project members that create real synergy. But the way of communication can also be strategically: information might be available, but not shared, shared too late, or distorted (De Bruijn & Ten Heuvelhof, 2008, p. 72). Good communication ensures that stakeholders remain at the same level and will make a difference between involvement and resistance (Wallaert, 2009, p. 12). In order to get to the same level the vision must be made clear well and communicated to everyone. The real power of a vision will be unleashed when the actors are willing to share their views and interests. Understanding and commitment also has to be communicated. Usually this is not done properly by management and contradictory messages are sent (Kotter, 1996).

Accepting a futuristic view can be an intellectual and emotional task. The intellectual task means they have to answer all the questions on their own which takes a lot of time and communication, whereas time is a scarce resource for management. The emotional task might be even harder like letting go the status-quo. According to Bennet et al. (2008), "issues are not always clear to us because we're just too close to them. How we view a situation, what we look for and how we interprets what we see depend heavily on our past experience, expectations, concerns and goals." This is a result of hardly any communication; assumptions are made based on these experiences. Asking for feedback or explanations is a learning moment. Feedback costs time, but skipping someone/something will eventually remain in more time (Wallaert, 2009). Bennet et al. (2008), mentioned open communication as an important factor "so that team members who face a problem at the point of action understand the decision direction and intent, and have the ability and freedom to talk to anyone within the problem domain—and perhaps even external to that domain when needed—to quickly access information and expertise to assist in handling surprise events or opportunities." At successful programs top management pushes urgency by continually venting the vision and strategy (Kotter, 1996). This way of communication gives a meaning to inconveniences and motivates people. This motivation is often needed by employees when a project is taken a long time. According to Kotter, the few important elements of effective communication are:

- Simplicity
- Using examples, metaphors or analogies
- Diversity of communication; forums
- Repetition
- Set an example to others
- Explanation of inconsistencies
- Know how to give and take (Kotter, 1996, p. 111).

4.8 Conclusion Phase 1

Understanding complexity is of great importance for managers. The CDM program is a typical example of a program that has to deal with its complexity. Many aspects contribute to the complexity. Complexity is described as multiple-interacting components but the division and their behavior is less explicit. It therefore all depends on the description of the complexity. When complexity is divided into different components it is easier to understand the complexity and the challenges associated with it. In order to understand the components of complexity, the CDM program is divided into seven challenges. These challenges are all based on 18 interviews with people involved in the CDM program. Due to an iterative process of grounded theory the most mentioned and most important topics could be summarized in seven challenges. These challenges are all interrelated, which is one of the characteristics of complexity. The challenges also cover the main themes of the model from Hagan et al. (2011). These seven challenges as the result of a breakdown in complexity and the link to the model simplify complexity from a socio-technical systems perspective. This is the answer on sub-question 1: *What are challenges that the CDM program faces?*

The first challenge is **'Getting everyone to work in the same direction'**. Even though the intention of the program started around 12 years ago still no clear vision or goal is generated on paper. However, many authors mention the importance of having a vision, goal or mission to start your project with. It is necessary to get everyone on the same page. The insufficient amount of resources provided to the program can be related to commitment from management. Commitment of management is necessary in order to motivate and inspire people. This challenge is related to 'Goals' in the model.

The second challenge is **'Dealing with mutual dependent relationships'**. At Schiphol Airport all actors are mutually dependent on each other; not only on their existence but also the cooperation within the program. The variety of people within the program results in more creative solutions but also in more discussion. Because all actors have to cross the line simultaneously a hold-up problem exists, blocking power has a huge impact and other projects are affected by CDM. This challenge is linked under 'People' in the model.

The third challenge is **'Developing a flexible and transparent process'**. It is important that all stakeholders are willing to cooperate and be flexible in their way of working else no change can be realized. Sharing information transparently is a key success in the program. Although sharing this information might be against the principals. Trials and training are necessary for implementation of CDM. This can all be related to 'Process' in the model.

The fourth challenge is **'Collaborate between decision-making layers'**. The CDM program is divided into the hierarchical layers Steering Board (SB), Implementation Board (IB) and project team (BT). Within every layer representatives of different actors take place in decision making. However, there is doubted if all important stakeholders are represented within this structure. Even though the task of the different layers is stated in the MoU their coordination, prioritization and authority does not always conform to the description. There is much overlap of discussion between the different layers. This challenge is linked to 'Decision making' in the model.

The fifth challenge is **'Evaluate costs and benefits'**. Much can be learned from experiences of other airports. However, in the beginning there has been minimal effort at looking at these experiences. There are also other methods to compare, evaluate or improve process performance and how they

can be used. A business case is usually done at the beginning of the program. Because it has been done later in the decision phase it was not decisive for management. A business case is made to check the feasibility of the program but is not been taken seriously. Improvement can be made by paying more attention to lessons learned. However, for every project the benefits will be different and also the methods are designed specifically for a certain case. But reinventing the wheel takes a lot of time and is not always necessary. The risks can be taken into account when evaluating the project. This can be related to 'Resource availability' in the model.

The sixth challenge is **'Dealing with technological uncertainty'**. The difficulties in decision making are influenced by the technique. Every actor uses his/her own related company IT systems but in order to share information in a transparent way this does not reduce the complexity. A CDM portal has been made but also all the other systems need to be connected. Because not all systems show or define the important information the same way it is hard to communicate. Also the conventional tower system is hard to work with. It is very difficult to change the tower system because there is a huge safety aspect that has to be taken into account. The systems cannot be taken down; the operational system has been underestimated in the beginning. Complexity of technology does often result in delays and overruns. This technical uncertainty can be linked to 'Product' in the model.

The last and seventh challenge is **'Communicate'**. Needless to say is the importance for good communication in every project. Not only clear communication about the vision, goals, tasks etcetera but also on the awareness of CDM. Without communication a lack of knowledge exists and people are making assumptions. This resulted in wrong assumptions, and therefore delays and ineffective decision making. Good communication results in consensus. Communication about the program will also contribute to knowledge of the status of CDM. This challenge is also linked to 'Decision making' in the model.

This results in the following model that shows the interrelated challenges, based on Hagan et al. (2011).

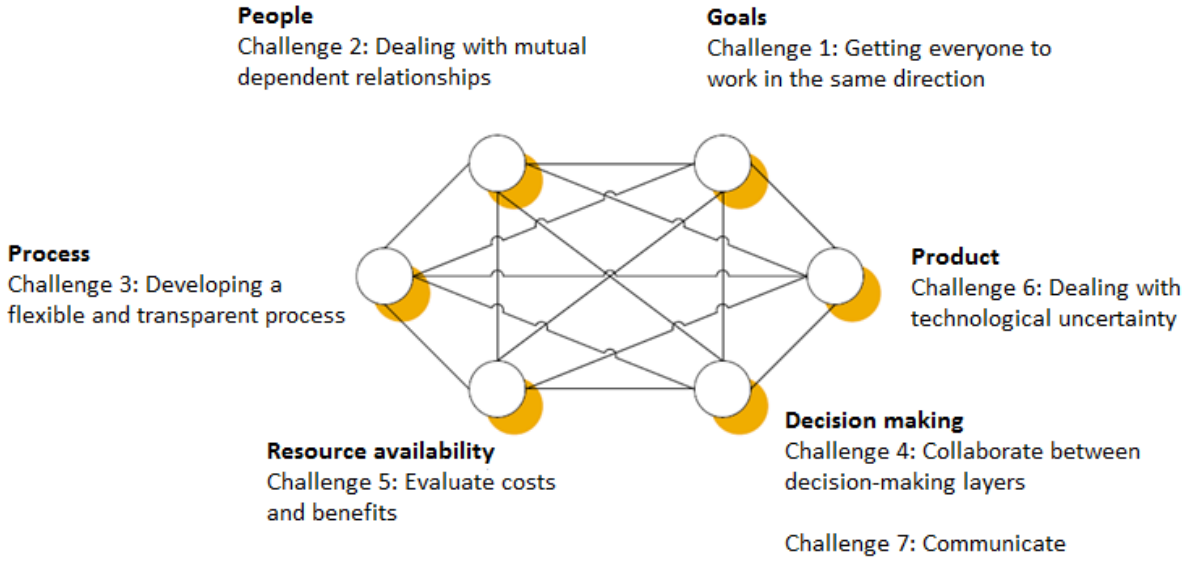
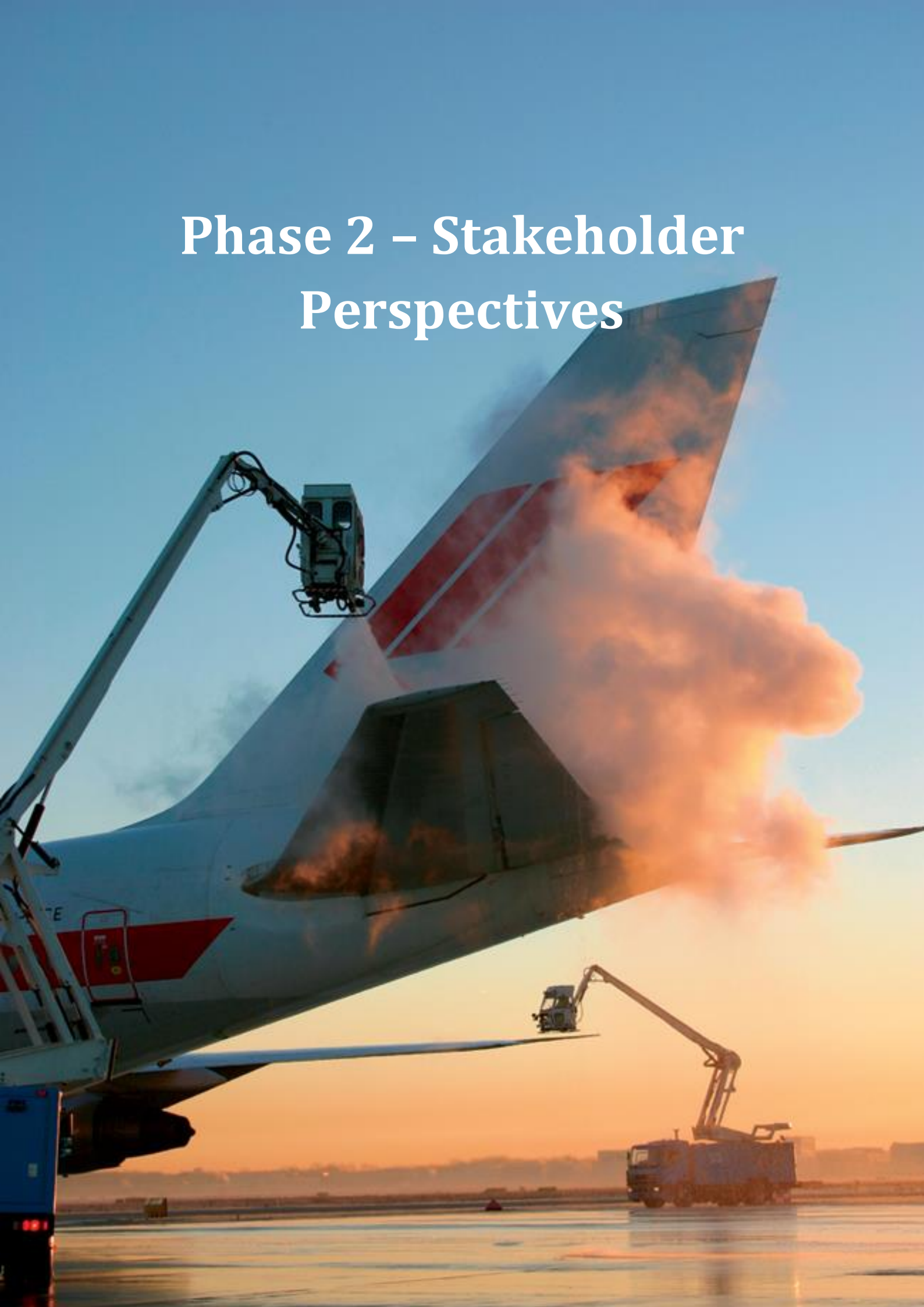


Figure 8 Relation between the challenges

Phase 2 – Stakeholder Perspectives



Source: Schiphol Group Brand Portal

Chapter 5 Stakeholders

The CDM program can be seen as goal realization in networks. There is the situation of an actor that has a certain goal but needs the cooperation from stakeholders, usually within a certain timeframe (De Bruijn & Ten Heuvelhof, 2008). The chapter on complexity showed that cooperation between the many different companies and within different decision-making layers is one of the most challenging parts of the CDM program. Not only do they have to cooperate but they also have to take many different viewpoints and interests into account. This does not improve decision making. If you want to manage effectively you must take your stakeholders into account in a systematic fashion (Freeman, 1984, p. 48). From the interviews, it could also be concluded that the stakeholders do not always understand each other's processes or interests. First of all, from a rational perspective there must be understood who the stakeholders are. Giving advice on multi-actor networks without knowing who part of it is would be impossible. Knowledge of their operational processes is also necessary, because complexity of the operational processes will influence the stakeholders' way of decision making. So how can decision making be successful when interest, processes and knowledge of the stakeholders is not understood? Phase 2 is used to enrich the way how the stakeholders think about the CDM program.

In this chapter an overview of all stakeholders in the CDM program is provided. First, the key operating companies in the program are extensively described with their background and business operation in order to understand the complexity of Schiphol's operation. The key operating companies are AAS, KLM, LVNL, Ground Services, and Eurocontrol. Also their specific CDM related functions are mentioned which will be used further on in the stakeholder analysis. The stakeholder analysis shows all functions with their tasks, power and resources (Appendix F). The stakeholder analysis results in a power-interest grid. Knowledge of all stakeholders and their way of decision making can be used to improve the decision-making process.

5.1 Amsterdam Airport Schiphol (AAS)

Amsterdam Airport Schiphol (AAS) is the biggest (international) airport in the Netherlands. Schiphol Airport is located in the municipality Haarlemmermeer in Noord-Holland, about 15 kilometers southwest of Amsterdam. Schiphol Airport is the fourth largest passenger airport of Europe after London Heathrow, Paris Charles de Gaulle and Frankfurt and the third largest airport in cargo. With 317 direct destinations 51 million passengers and 1.5 million ton cargo where brought to their destination through AAS in 2012 (Schiphol Group, 2013). Schiphol Airport is the home of Royal Dutch Airlines (KLM), Martinair, Arkefly, Transavia and Corendon Dutch Airlines (Van Zuijlen, 2012).

Figure 9 AAS area (Schiphol Group, 2013)

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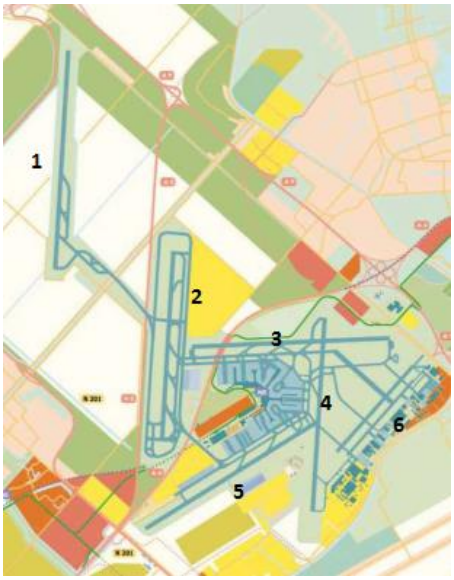

Figure 10 Runway system

AAS has about 650.00 m^2 terminal area and 6 take-off and landings runways (see Figure 10), named: the 1) Polderbaan (18R – 36L), 2) Zwanenburgbaan (18C – 36 C), 3) Buitenveldertbaan (09 – 27), 4) Aalsmeerbaan (18L – 36R), 5) Kaagbaan (06 – 24), and 6) Oostbaan (04 – 22) (Schiphol Group, 2014c). Schiphol Airport is located closely to the North Sea and therefore Schiphol Airport has to deal with many wind directions and forces. Because aircrafts have to land and take off facing the wind they build a tangential system with runways in different directions located around the terminal. Schiphol Airport is unique with its one-terminal concept where all passengers can arrive and depart from one terminal. The terminal is divided in Schengen (European flights), non-Schengen and low-cost airlines (Schiphol Group, 2014b). This complex runway system makes it complicated for LVNL with switching between runways during the day due to peak moments and weather conditions, this for example, in comparison with London Heathrow Airport which has five terminals but only 2 runways.

Amsterdam Airport Schiphol (AAS) is operated by the Schiphol Group, and is therefore assumed to be the same throughout this research. Schiphol Group operates their main airport Schiphol as Airport City, a dynamic metropolitan area where travelers and airlines are provided with services 24-hour. The services are divided into four main business areas that complement and reinforce each other. Aviation provides and manages the infrastructure that passengers, baggage and cargo need in order to arrive and depart in an efficient, reliable and pleasant way. The CDM program is part of the Aviation Business area (Appendix B). Consumer Products and Services offer traveler's products and services for careless and comfortable travelling. The Real Estate business area develops and manages real estate at Schiphol Airport and its surroundings. Alliances & Participations are responsible for the other airport interests and Schiphol Telematics and Utilities. According to the annual report of 2012 the revenues, operating result and investments where respectively 1353, 296 and 298 million euros. Figure 11 shows the distribution per business area.

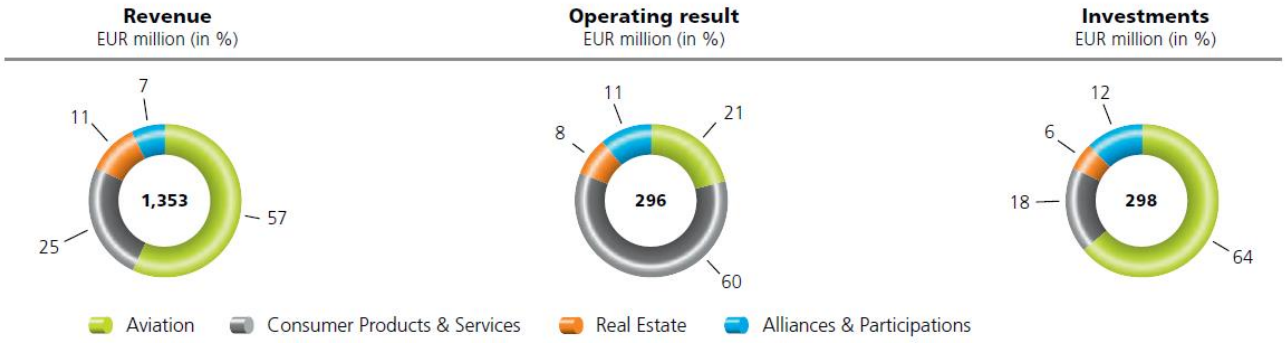

Figure 11 Financial Business area information (Schiphol Group, 2013)

The Schiphol Group employed 2131 people in 2012 (Schiphol Group, 2013). Schiphol Group has four shareholders, namely (Appendix B):

- Dutch government 69.77%
- Municipality of Amsterdam 20.03%
- Municipality of Rotterdam 2.20%
- Aéroports de Paris 8.0%

The activities at Schiphol Group airports have an important social and economic function within the Dutch society. Aviation contributed more than 26 billion euros to the gross domestic product of the Netherlands in 2012 (Schiphol Group, 2013). It is therefore important to keep Mainport Schiphol Airport an attractive and high quality node. The strategic objectives of the Schiphol Group are divided in four categories named Top Connectivity, Excellent Visit Value, Competitive Marketplace and Sustainable Performance. They all contribute to keep Schiphol Airport a preferred airport in Europe. CDM contributes especially to the strategies Top Connectivity and Excellent Visit Value (Appendix A). The interest of the Schiphol Group is to keep all actors satisfied, not just in advantage for the travelers but also the many companies located at AAS. In addition to this they must base decisions on the future in order keep Schiphol Airport preferable.

The specific functions involved in the CDM program at AAS are:

- **Management Team Operations (MT OPS)**
  - **Director Airside Operations**
- **Airside Operations Manager (AOM)**
- **Chief Information Officer (CIO)**
- **Manager Apron Planning and Control**
- **Functional Manager CISS & Portal**
- **Shift leader Apron Control**

5.2 Airlines and SAOC

Around a hundred airlines offer services at Schiphol Airport. The biggest customer of Schiphol Airport is KLM, they handled 50.7% of all aircraft movements in 2013 (Schiphol Group, 2014). The home carriers of Schiphol Airport KLM, Martinair, Arkefly, Transavia and Corendon Dutch Airlines together account for 60% of the total aircraft movements in 2013 (Schiphol Group, 2014). This means that more than hundred airlines who together account for 40% of the movements at Schiphol have to be informed on the new procedures due to CDM. Many European airlines have heard of CDM, although other airports in Europe have implemented CDM already, the procedures at Schiphol Airport will be slightly different.

At almost every International airport an organization exists which takes care of the common interests of the airlines operating regularly at that airport. Such organization, in line with IATA recommendations, is called an Airline Operators Committee (AOC); at Schiphol Airport this committee is called the SAOC (Schiphol Airline Operators Committee). The SAOC is involved in the CDM program. Because KLM represent more than 50% of the total movements at Schiphol Airport they will be explained in more detail. For all around 110 other airlines that represent the other 49.3%

of the aircraft movements at Schiphol Airport, the same functions and interests as KLM can be assumed. Therefore these will be taken into account as one general stakeholder, called the SAOC, with the same interest as the KLM Flight Operators at KLM Operations Control Centre. Because only the flight operators part of the other airlines is interested in the process at Schiphol.

5.2.1 KLM

KLM (Royal Dutch Airlines), home carrier of Schiphol Airport, was founded in 1919 (KLM, 2012a). With the Netherlands as very small domestic market, KLM focused on the global network since the first day. In 2004 KLM merged with Air France and their SkyTeam partners. KLM, Air France, Delta and Alitalia also have a joint-venture (KLM, 2013). With 130 direct destinations almost all important economic regions in the world are connected through Schiphol Airport. As member of the SkyTeam airline alliance there are 898 destinations in 169 countries connected with each other (KLM, 2012). Of all KLM passengers about 70% is transfer passenger. Specifically for these passengers punctual information on their transfer time is important. KLM contributes to the accessibility of the Netherlands by providing infrastructure through air by its extensive global and frequent attendant quality network (KLM, 2012). KLM was one of Europe's first carriers that introduced a hub-and-spoke model. In a very short time many flights arrive after which they leave in a short time again. Due to this system passengers have many possibilities to transfer. The arrival and departure flights are concentrated in seven peaks of 1.5 to 2 hours.

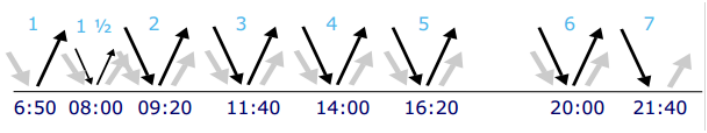

Figure 12 Peak moments at Schiphol (KLM, 2012)

In the morning the first intercontinental flights arrive (grey arrows) and passengers (and cargo) transfer to European flights (black arrows). If passengers cannot transfer fast and cheap at Schiphol Airport they will divert to other airports with negative consequences for KLM and with direct impact on a competitive and economically prosperous Netherlands (KLM, 2012). KLM has divided all flights in three groups: Intercontinental (ICA), European (EUR) and Cityhopper (KLC). Figure 13 shows this deviation at a peak moment with its amount of passengers (pax) and cargo.

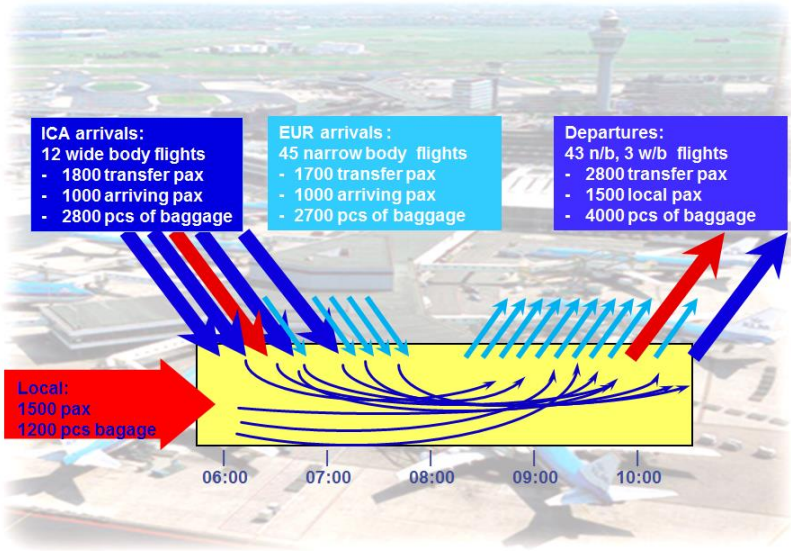

Figure 13 Hub Schiphol (KLM OCC)

Airlines have a hard time to survive these days, even on their own home base they have to keep up with competition as arising low cost carriers (EasyJet at Schiphol Airport for example). Efficiently use of resources is necessary for airlines to keep up.

In this research KLM is divided into KLM Operations Control Center (OCC) and KLM Hub Control Center (HCC). However, in the CDM program KLM is represented with three representatives of different divisions. To simplify this, pilots are included in KLM OCC. KLM HCC is responsible for the Ground Services. At KLM OCC they are responsible for the planning of equipment and crew of the entire KLM fleet. At KLM OCC they make sure the KLM schedule is executed punctually and solve disruptions as proactively as possible. A broken engine, problem with the baggage carousel, no show passenger or rapidly deteriorating weather conditions can easily cause delays. The fleet of KLM does not have many reserve aircrafts; therefore any maintenance problem will have a huge consequence for the punctuality of the flights. The staff at OCC keep track on the arrival and departure times of KLM flights and partners (Ploos van Amstel, 2008).

The core tasks of KLM OCC are:

- Acceptance of flight schedules
- Monitoring and controlling of network operations
- Support of network operations in exceptional situations
- Evaluation of network performance

The stakeholders at KLM OCC are:

- **Pilots**
- **Operations Control**
    - Duty Manager Operations
    - Senior Operations Controller
    - Operations Controller
    - Current Schedule Manager
- **Maintenance Control Wide & Narrow Body**
    - Duty Maintenance Manager
    - Technical Specialist
    - Planner
- **Air Traffic Management**
    - Supervisor Flight Dispatch
    - Flow Controller
    - Flight dispatcher
- **Crew Resource Unit**
    - Duty Manager Flight
    - Duty Purser
    - Crew Production Controller

- Cockpit Crew Controller
- Cabin Crew Controller

- **Load Control**
  - Supervisor
  - Load Controller
  - CAPLAN

Further in the stakeholder analysis, the specific functions will be summarized in the main functions Operations Control, Maintenance Control Wide & Narrow Body, Air Traffic Management, Crew Resource Unit, and Load Control due to their common interest and tasks. These main functions will represent the entire (sub) group of KLM OCC.

5.3 LVNL

Air Traffic Control the Netherlands, in Dutch Luchtverkeersleiding Nederland (LVNL) deals with air traffic control in the Dutch civil airspace and the Dutch civil airports. The key elements for LVNL are safety, efficiency and environment of which safety has the highest priority (LVNL, 2014). Therefore, as long as a procedure is not safe, they will block the decision. They control air traffic by giving clearances and instructions to pilots. Air traffic is split into three sub-disciplines: area control, approach control and aerodrome control. Converging runways, extensive environmental regulations and the handling of more than hundred aircrafts an hour in peak moments make Schiphol Airport a complex airport for air traffic controllers and pilots. Hence there are many procedures that air controllers should persist. In the Aviation Act other tasks are recorded as renewing and managing technical systems, the provision of aeronautical information, providing training for air traffic control and the provision of aeronautical charts and publications. LVNL has to account to the Minister of Infrastructure and the Environment (LVNL, 2012).

Luchtverkeersleiding Nederland
Air Traffic Control the Netherlands

The Dutch airspace is, despite the limited airspace, within Europe's busiest airspace. Airspace is divided into civil, military and recreational aviation. A large part of the Netherlands is military airspace, which LVNL has to take into account since airlines cannot fly through this space. Appendix C shows a map with the deviation of Dutch airspace. Tower Control (TWR) is responsible for the area around the airport and for guiding aircrafts when arriving and departing. Approach Control is responsible for the area around the airport (until 100 km) and less than 3 km height. Then Area Control takes over and is responsible for En-Route control with usually a height of more than 3 km. In 2012 LVNL handled 522.052 flights at Amsterdam Area Control Centre, 434.237 at Schiphol Tower/Approach. Approach and Area Control are located at Schiphol-Oost.

Because of the hub LVNL has to deal with arrival and departure peaks. Runways are interspersed throughout the day due to weather conditions and Schiphol's tangential runway system. Usually there are three runways used during peak moments, depending on arrival or departure peak LVNL uses a 2 – 1 system. When two runways are in use, the departing aircraft gets the runway that suites best in terms of the direction to the destination. The choice of runway has a major impact on taxi times, the occupation of gates and the system of taxiways. It also has a direct impact on handling of traffic in the airspace around Schiphol Airport (LVNL, 2014a). But also the tangential piers make it

hard for start-up controllers to plan pushback. When much congestion in a bay exist it is hard to pushback two aircrafts the same time due to this system. It is the task of LVNL to facilitate safe and structured processes within this complex context.

The specific functions involved in the CDM program at LVNL are:

- **Supervisors**
- **Delivery controller**
- **Start-up controller (SUC)**
- **Ground controller**

5.4 Ground Services

In 2013 at Schiphol Airport there were five main Ground Services. Those are KLM Ground Services (KLM HCC), Swissport Cargo, Servisair, Aviapartner, and Menzies. Their tasks can mainly be divided into three categories which are 1) station management and administration, 2) passenger services and 3) aircraft servicing and ramp handling. Station management and administration includes tasks as load control, station control and weather briefing. Passenger services include tasks as check-in services, gate services, lounge services and special passengers and VIP services. Aircraft handling includes aircraft loading and unloading, baggage sorting and transportation, cabin cleaning, push-back, de-icing and toilet and water services (Swissport, 2014). Because main tasks are at busy aprons (area where most aircrafts are parked and serviced during their stay at the airport), safety is an important aspect. But an ever bigger aspect is competition. There are more ground handlers at the airport and therefore it is important to deliver good services for a low price. Only then the airlines want them to be their handlers. Thus, the amount of handlers and the airlines they handle changes. The ground handlers have to estimate the time the aircraft is loaded. When they can predict a stable time they need for the handling services all other processes can be calculated on this time. Therefore they are an important stakeholder in the CDM program.

KLM Ground Services handled 70.5% of all aircraft movements in 2012 (Fischer, 2013). KLM Ground Services is controlled by KLM Hub Control Centre or HCC which will be used throughout this report. The same as with the 'other airlines', Swissport Cargo, Servisair, Aviapartner and Menzies are taken into account as 'other ground handlers'. Due to the fact they generally have the same tasks and interests. The specific functions can be named differently at every ground handler. For example, at Aviapartner, second largest ground handler at Schiphol Airport, their involved CDM functions are summarized under Coordinator Flightwatch and Platform Coordinator, however the tasks of these functions are guaranteed under the KLM HCC functions.

The involved stakeholders at KLM HCC are:

- **Duty Hub Managers (DHM)**
    - **De-icing coordinator (DeCo)**
- **Duty Area Manager (DAM'er)**
- **Apron Coordinator**
- **Towing Director**
- **Red Cap (Teamleider Omdraai, TLO)**
- **Gate Agent (GA)**

5.5 Eurocontrol

Eurocontrol is the European Organization for the Safety of Air Navigation, an international organization founded in 1960. With its headquarters close to Brussels, they coordinate and plan air traffic control for all of Europe. The primary objective of a Network Manager is to improve the performance of the European aviation network. They work closely together with their 40 Member States, air navigation service providers (ANSPs), civil and military airspace users, airports, the aerospace industry, professional organizations, intergovernmental organizations and the European institutions (Eurocontrol, 2013) to ensure that European Air Traffic Management (ATM) response to the needs of a changing society.

Air traffic in Europe is growing but airspace is not an infinite resource and users' needs evolve continuously. External conditions such as weather, social disruption or even sporting events have impact on the available airspace. Eurocontrol takes into account the complexity of these needs and conditions in response to them by operational and technological requirements related to safety, cost efficiency and the environment all with the aim to deliver a highly efficient and responsive network (Eurocontrol, 2010). In order to cope with growing complexity, changing society and requiring flexible airspace they work on a Single European Sky (SES) that serves all 40 member states. When too many aircrafts are in the air at the same place and time it could lead to unsafe situations. Therefore Eurocontrol issues slots; this is a period of time within take-off has to take place, usually -5 and +10 minutes from CTOT.

One of their well-known departments is Maastricht Upper Area Control Center (MUAC) from which much en-route air traffic is guided. Besides the development and coordination of the implementation of pan-European ATM programs (as CDM) and support for rule-making and regulation European aviation, they also collect and redistribute route charges on behalf of the Member States (Eurocontrol, 2013a). Eurocontrol has to satisfy many actors in Europe (not just AAS), several projects must guarantee their priorities and many aspects have to be taken into account, this makes the environment for Eurocontrol very complex.

The departments important for the CDM program at Eurocontrol are:

- **Maastricht Upper Area Control (MUAC)**
- **Network Manager (NMOC)**

5.6 Decision-Making Layers

It is not only important to look at the stakeholders involved but also at the ones that have to direct, manage, control and support the program as designed. This is what it is all about in this research. All at Schiphol located key players (this means without Eurocontrol) take place within one of the decision-making layers. The organizational structure must enable effective decision making. The nature and size of this organizational structure will influence decision making. The different involved decision-making layers are:

- **Strategic Board / Roosevelt Overleg (RVO)**
    - Chief Operations Officer (AAS) Ad Rutten
    - Chief Executive Officer (LVNL) Paul Riemens

    - Accountable Manager & Deputy COO (KLM): Michiel van Dorst
    - Chief Operating Officer (KLM): Pieter Elbers
- **Steering Board (SB)**
    - Director OPS (AAS): Birgit Otto
    - SVP Operations Control (KLM): Miriam Kartman
    - SVP Hub Operations (KLM): Adriaan den Heijer
    - Manager Flight Operations (Aviapartner): Madmar Aziz
    - VP Air Traffic Management (KLM): Maarten Oort
    - Director Operations (LVNL): John Schaap
- **Implementation Board (IB)**
    - Manager Apron Planning & Control (AAS): Arno Veenema
    - Capt B747 (KLM): Arjen Blom
    - Dep VP ATM (KLM): Eme Tillema
    - Director HCC (KLM): Sjoerd Roorda
    - Operations supervisor (Aviapartner): Sander Molleman
    - Manager Operational Development & Support at ATC (LNVL): Frank Dijkgraaf
- **Project Team (BT)**
    - Sector Project Manager AAS: Frans Duivenvoorde
    - Sector Project Manager KLM: Frank Sonsma
    - Sector Project Manager LVNL: David Zwaaf
    - All handlers representative: Jos van Buuren
    - All airlines representative: Berend Onnes

The ICT board called **SOLL** and the Change Advisory Board (**CAB**) are important advisory groups within the CDM program.

Lastly, there are a few other stakeholders which can be seen as secondary or external stakeholders. They are somehow connected to the CDM program but will not be directly involved or affected by CDM. Because of the change in operational procedures due to CDM will not have an effect on them, they are not described in further detail. These actors are:

- **KNMI**
- **Government**
- **Passengers**
- **Other airports**
- **Airport Council International (ACI)**
- **International Civil Aviation Organization (ICAO)**

5.7 Power-Interest Grid

The goal of a stakeholder analysis is to get an understanding of the power and influence of others, the interest they devote to the project and to see whether you should or should not involve them in the project (Hermans, 2012). As can be concluded from the program's complexity and the theoretical background it is important to only involve dedicated and/or critical actors. In order to come up with advice that is based on these dedicated stakeholders, there must be checked whether all actors involved now are indeed dedicated and critical. The stakeholder analysis shows the stakeholder's interest, power, influence, tasks, criticality, responsibilities, and replaceability. A stakeholder analysis is a relatively simple method based on tables and diagrams to rate actors' position in the program (Hermans, 2012). The stakeholder analysis is based on its own assessments and assumptions, literature and interviews.

All stakeholders are listed with their interest, power, resources, replaceability and criticality in Appendix F. Where the influence/power of the stakeholder and how replaceable the stakeholder is are ranked on rate low, medium and high. This list also provides an overview of the differences in opinion within the same company. Critical actors are those on whom a problem owner critically depends on for solving the problem. This is usually because of the dependency relations by resources, power and influences (Enserink, 2010). Actors that cannot be ignored for their power of realization or their blocking power are critical. If the dependency on actors does not depend on the influence of the resources but on their interest in the problem and their willingness to use the resources it is a dedicated actor. This means the actor is affected by clear costs or benefits of the program.

	Dedicated actors		Non-dedicated actors	
	Critical actors	Non-critical actors	Critical actors	Non-critical actors
Similar/ supportive interests and objectives	Pilots, Air Traffic Management, DAM, Other airlines/SAOC, Other Ground handlers, NMOC, RVO, SB, IB, BT, Program manager,	DHM, Maintenance Control Wide & Narrow Body, Load Control, Operations Control, Crew Resource Unit, Red Cap, Apron Coordinator, Towing Director, Gate Agent, AOM, MT OPS, Manager Apron Planning and Control, Shift leader Apron Control, Government, Other airports, Passengers	CAB, SOLL, MUAC,	KNMI,
Conflicting interests and objectives.	Supervisors LVNL, Start-up controller,	Delivery controller, Ground controller,	ACI, ICAO, CIO,	Functional Manager CISS & Portal

Table 2 Overview of critical actors

In this case many stakeholders are in some way affected by clear costs or benefits of the program. This is mainly because many stakeholders benefit from CDM; due to the shared times they can plan their processes better and easier. Therefore many stakeholders are dedicated. The non-dedicated like KNMI only give information on the weather conditions but CDM does not have any impact on their predictions. The critical actors have interesting power and/or resources. These actors are mainly the experts in the program so their knowledge or processes are necessary and they have resources like budget and authority to make the program possible. All stakeholders in the decision-making layers are critical due to their resources and power. However, the CAB and SOLL team are advisers when asked and therefore not dedicated. LVNL supervisors and the LVNL start-up controllers are potential blockers of certain changes, because their processes are not made easier due to CDM. This also counts for the other controllers however their processes are less affected by CDM. It is important to involve actors in decision making that are willing to participate and potentially strong allies. But also the ones with conflicting interests should be involved. This is the first column with both dedicated and critical actors. A key point to make is that all key players are at this moment represented by someone in the BT/IB/SB/RVO except for the start-up controllers and Eurocontrol. However, this CDM program is located at Schiphol Airport; therefore, involving Eurocontrol is less interesting for local implementation. When the topic is discussed on linking to the (European) network they should be involved. Eurocontrol is located in Brussel and can therefore not be represented in weekly meetings; however, regular contact is necessary.

The interdependencies can also be visualized in a power-interest grid. In this grid the critical actors are those with a high level of power – among other things important resources – while dedicated actors are those with high level of interest in the problem. This overview is used to characterize actors and to formulate an advice regarding the types of relationships the problem owner might establish. The power-interest grid is a helpful tool and can be used as the basic foundation for the communication plan. Since communication is one of the challenges to deal within the program it is important to have this stepping stone in order to improve the communication.

Within the power-interest grid there are four different categories; key players, keep satisfied, monitor and keep informed. The actors with low interest and low power (like KNMI) have to be monitored and will have minimal effect on the CDM program. Make sure not to bore them with excessive information. The actors with low power but with high interest have to be adequately informed. These people can be very helpful with the details of the project but communicate with them to make sure that no major issues arise. These are actors like many of the KLM OCC departments. The actors with low interest but high power have to be satisfied, for example the Chief Information Officer (CIO) or the Change Advisory Board (CAB). Keep them satisfied but also do not provide too much information to prevent them from getting bored. The most important actors or the key players have to be managed closely. These are the people to fully engage and to make the greatest effort to satisfy (Enserink, 2010). These are inter alia the pilots, KLM ATM, SAOC, Duty Area Manager, other ground handlers, MT OPS, Apron planning and control, Start-up controllers, Eurocontrol NMOC. Within the meetings the program manager represents the SAOC (see Appendix B).

Once again start-up controllers are important stakeholders that are not directly involved in the BT, IB, or SB. Also Eurocontrol should be involved when discussions appear on linking to the network.

All actors within the power-interest grid are part of the multi-actor network called the CDM program.

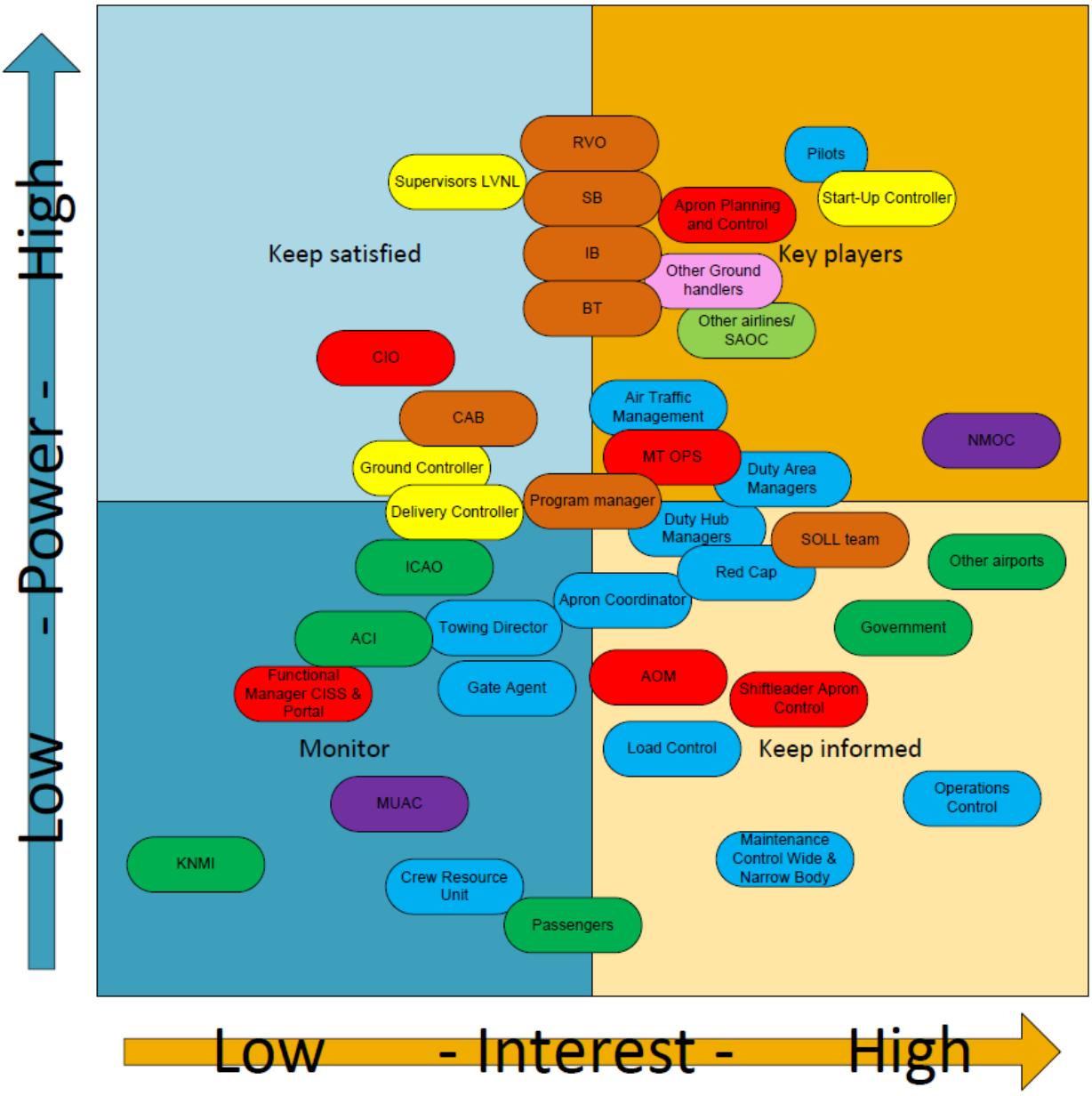

Figure 14 Power-interest grid

Table 3 Legend power-interest grid

Stakeholder group	Color	Stakeholder group	Color
KLM	Blue	Other ground handlers	Pink
LVNL	Yellow	Other airlines/ SAOC	Light green
AAS	Red	Decision-making layers	Brown
Eurocontrol	Purple	Secondary stakeholders	Dark green

Chapter 6 Theoretical Background on Q-Methodology

The challenges cover the overall complexity of the program. However, the mentioned statements in the challenges can still be taken individually and not felt by the overall program. Because this program is all based on collaboration, it is good to get the collective perspective on CDM. As described in the previous chapters, this will give the most satisfying result for all stakeholders because consensus needs to be created. To make sure decisions are not based on the individual perspective but on the collective perspective of the stakeholders their opinion has to be collected. By returning the statements to the stakeholders the statements are verified. This information can be used to make sure decisions will be based on the most important topics. This will also turn the researchers' subjective description into a more objective description. In order to do this the specific method Q-methodology is used. In this chapter the way Q-methodology works is explained followed by the results of it.

6.1 Why Q-Methodology?

Q-methodology is a research technique, and associated set of theoretical and methodological concepts, originated and developed by the British physicist-psychologist William Stephenson. Stephenson introduced Q-methodology in 1935 as an innovative adaption on Spearman's traditional method for factor analysis (Watts, 2012, p. 7). Regular factor analysis reveals factors that show differences between variables mapped at the population level. Stephenson noticed that the information ought to have more 'interest to general rather than to individual psychology (Stephenson, 1936). Q-methodology focuses on the subjective viewpoints of participants. A well-delivered Q-study reveals the key viewpoints extant among a group of participants and allows those viewpoints to be understood holistically and to a high level of qualitative detail (Watts, 2012). The shift in analytical focus of running the analysis 'by-person' instead of 'by-variable' is the basis of Q-methodology or as Brown (1980, p. 12) described the correlation and factorization by rows of the same matrix of data that in regular factor analysis is factored by columns. In order to compare and interpret the scores, a standardization of scores (or Z scores) is necessary. It is impossible to compare introversion and verbal ability scores when different measuring units are involved. Stephenson invented the Q-sort, a prearranged frequency distribution to further standardize the ranking procedure (Watts, 2012).

The reason why Q-methodology is used in this research instead of some other kind of method for studying subjectivity can be explained according to the example of McKeown & Thomas (1988). There are two ways of measuring subjectivity: 'the method for impression' and 'the method for expression'. The method of expression is used when you need the external point of view of the respondent. The method of impression is more about the weight and value that the respondent attaches to the respondents personals viewpoint. The distinction between both methods can be showed with the following example:

Table 4 Left: Method of expression, Right: Method of impression (McKeown, 1988)

	Characteristic	Important?	
		Yes	No
1	Location	A, B	
2	Number of bedrooms	A, B	
3	Price	A, B	
4	Schools nearby	A	B
5	Garden		A, B

Ranking of characteristic	Respondent	
	A	B
Most important	4	2
	3	1
	1	3
	2	5
Least important	5	4

If two people (A and B) want to buy a house, different characteristics of the house may be important to them. When they will not attach weight to the possible characteristics and five different characteristics will be given it may look like the left column in Table 4. When the method of impression is being used and the two persons are asked to rank the different characteristics to their own personal view it looks like the right column in Table 4. The method of impression shows the priorities and wishes much clearer than in the table where each characteristic stands on its own and no real scale or internal relation is defined (Van Loenhout, 2013). This reference provides us with much more information than the 'yes, no' question ever did (McKeown, 1988). Q-methodology can be seen as a method for impression and is used in this research to gain contextual information on the respondents' viewpoint on CDM and choices that are made or will be made. An advantage of Q-methodology is the amount of possibilities and flexibility. About anything can be provided as stimulus items and most participants will be able to rank them in order of personal salience (Watts, 2012, p. 23). Even though Stephenson's work has been criticized it is now being widely adopted and used for systematic study in, for example, psychology, health sciences, education, political science, behavioral and human sciences (Brown, 1980).

Besides the fact Q-methodology shows the subjectivity of a group, also the way of conducting a Q-methodological factor analysis is subjective. There is no common agreement on the best way of factor extraction and rotation; it depends on the researchers' perspective (Watts, 2012, p. 92). The basic function of factor analysis is to account for as much of variance as possible – to explain as much as we can about the relationships that hold between the many Q-sorts in the group – through the identification of a sizable portions of common or shared meaning that are present in the data. These portions or dimensions of shared meanings that are the so called factors. Factor analysis is known as a data reduction technique because there will be considerably fewer factors than there are Q-sorts in the group. It attempts to identify distinct regularities or patterns of similarity in the Q-sort configuration produced and hence in the viewpoints our participants have expressed (Watts, 2012, pp. 96-99). In order to analyze the data a specific statistical program called PQMethod (Version 2.35, March 2014) is used.

Basically, a Q-methodology study will be executed as follows. People are presented with a sample of statements about some topic; this is called the Q-set. This collection of statements is selected from

the concourse of the subject. The concourse is 'the flow of communicability surrounding any topic' (Van Exel, 2005). The respondents, called the P-set, are asked to rank-order these statements from their individual point of view. The statements are ranked from 'most in accordance with my opinion' to 'least in accordance with my opinion'. This is done according to a quasi-normal distribution which is the Q-sort. The rankings of statements, or Q-sorts, are studied on the basis of their correlations to each other. The correlations are calculated and factorized. This factor analysis gives information on the dissimilarities and similarities in viewpoints of respondents, which is exactly what is looked for.

6.2 Defining the Q-Set

A concourse is the overall population of statements from which a final Q-set is sampled. In this case a concourse of 70 statements was extracted from the interviews with the stakeholders. The nature of the concourse to be sampled is unlikely to become clear until it has been circumscribed by the particular research question (Watts, 2012, p. 34). According to Stephenson (1988) a concourse is likely to be shaped and defined by 'a collection of self-referable statements spoken by the participants'. Different ways of going about the process of item sampling and Q-set design exist. Watts and Stenner (2012, p. 59) mentioned structured versus unstructured Q-sets. In designing a structured Q-set the researcher begins the sampling process by breaking down the relevant subject matter into a series of component themes or issues, on the basis of some preconceived theory or simply through research and observation. It is important that the Q-set and its items cover all the ground and effectively without overlap, unnecessary repetition or redundancy (Watts, 2012, p. 59). An unstructured Q-set refers to the process whereby is begun with the identification of key themes and issues rather than for purposes of subsequent dissection. Structured or unstructured is not associated with the origin of the different statements, but rather refers to the choice that was made on which statements to include and which to leave out.

The Q-set covers all opinions related to the CDM program. The size of the Q-set is dictated by the subject matter itself but a Q-set between 40 and 60 statements is advised (Watts, 2012, p. 61). To make sure the statements cover all topics and are effectively without overlap, unnecessary repetition or redundancy, employees from the Schiphol Group as well as my supervisor Eefje Cuppen have checked the statements. The fact that all statements need to cover the seven challenges can be related to a structured Q-set. The challenges indicated were: 1) Getting everyone to work in the same direction, 2) Dealing with mutual dependent relationships, 3) Developing a flexible and transparent process, 4) Collaborate between decision-making layers, 5) Evaluate costs and benefits, 6) Dealing with technological uncertainty and 7) Communicate. The wording or phraseology of items has been adjusted as well. There has specifically chosen to show the respondents the statements in Dutch because the interpretation in own mother language is easier to understand. The Dutch statements were alphabetical order ranked and randomly provided to the respondents. Before the statements were printed and sorted, the Q-set was reviewed by domain experts and tested in a pilot study, to ensure content validity and check if the Q-set is balanced. The final Q-set consists of 43 statements:

Table 5 Statement with belonging challenge

	Statement	Challenge
1	All ICT systems at Schiphol Airport should be uniform.	6

2	All actors should have *one* common goal for the CDM program.	1
3	All actors should have equal votes in decision making.	4
4	Efficient utilization of slots and capacity will only be realized when all airports in Europe implement CDM.	2
5	Sharing all information transparently results in a disadvantage for other processes.	3
6	Decisions are being influenced by external factors which are not directly relevant for CDM.	3
7	Core values and culture should be respected more within the CDM program.	2
8	CDM is more of strategic interest than operational interest.	1
9	Because the benefits of CDM are not equal for all actors they do not have to put equal effort in the program.	3
10	CDM should be the number 1 priority project at Schiphol Airport.	2
11	CDM should be implemented top-down instead of bottom-up.	1
12	CDM will help making Schiphol Europe's preferred airport.	5
13	The business case is not made at the beginning of the program therefore it is not sufficient.	5
14	The complexity of Schiphol's environment (compared to other airports) makes decision making within the CDM program difficult.	6
15	Because of the variation in attending team members decision making is difficult.	4
16	The diversity of people in the CDM program results in more creativity and increased decision quality.	4
17	The delay of implementation is especially caused by the underestimation of the poorly fitting infrastructure.	6
18	Due to CDM jobs are issued.	3
19	Due to CDM the processes are not improved in comparison to the current processes.	5
20	A vision should be made by top management.	1
21	Effective decision making in CDM is not possible because stakeholders are not flexible in their cooperation.	3
22	Better communication is necessary to increase the awareness of CDM.	7
23	Higher priority should be given to CDM meetings.	4
24	They should gain more experience from other airports.	5
25	Less attention should be paid to temporary solutions and more to permanent solutions.	5
26	More trials should be executed.	5
27	Fewer adjustments should be made on decisions that are already taken.	3
28	People should ask more questions to eliminate assumptions.	7
29	Many new proceedings because of CDM do not improve user-friendliness.	6
30	Not being a CDM airport makes the punctuality unreliable.	5
31	The CDM program is purely beneficial for all stakeholders and never affects them negatively.	5
32	Implementation of CDM is not possible yet because the company ICT systems are not ready.	6
33	Implementation of CDM is urgent.	7
34	Local CDM should be linked to Eurocontrol/NMOC soon.	6
35	Everyone should be more open for creative ideas without holding tight to the CDM milestones.	3
36	Resources are currently insufficient for realizing CDM ideas.	1
37	At Schiphol Airport they are all depending on each other's existence therefore they should collaborate to achieve the goals.	2
38	At the moment all important stakeholders within the CDM program take place in decision making.	2
39	Schiphol should stop with CDM.	5
40	Specialists (like pilots and SUC's) may have more power in decision making because of their operational experience.	4
41	Top management should be more committed to CDM.	1
42	Of all actors Schiphol Group should invest most in CDM.	5
43	More people with mandate should be involved for effective decision making.	4

6.3 Defining the Q-Sort

The Q-sorting procedure consists of each person ranking a set of 43 statements according to a condition of instruction, in this case there is chosen for a distribution from 1 (most disagree) to 11 (most agree). Brown (1980) suggested using an 11-point distribution for 40-60 statements.

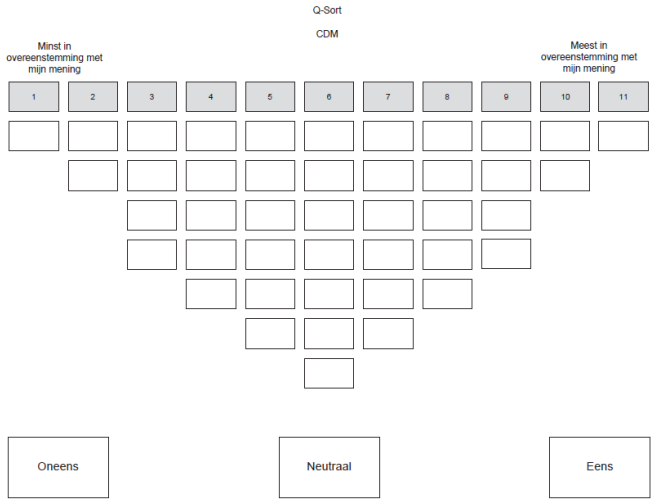

Figure 15 Used ranking sheet for the Q-sort with 43 statements

The statements are conventionally arrayed in a forced, quasi normal distribution (Watts, 2012), with a fixed number of places per score. This means the respondents can only place one statement under column 1 (most disagree) and only two statements under column 2.

Brown (1980) presented an array of very helpful statistical comparisons, covering a range of distributions, both symmetrical and otherwise, that clearly demonstrate that 'distribution effects are virtually nil'. This means although the use of a forced distribution may appear to risk distortion of the naturalistic structure of the participant's viewpoint, in fact indicate a negligible format effect (Watts, 2012, p. 77). Important to note is that the order within the column is entirely irrelevant. However, chosen is to use a shallow distribution, because all participants are familiar with the subject matter. A steep or narrow distribution would have been advised when the participants were unfamiliar with the topic (Watts, 2012, p. 90).

The statements were all printed on separate cards and plasticized. Together with the Q-sort (printed on A1 format) the statements were provided to the respondent. All Q-sorts were done in a face-to-face interview. The respondents were asked to rank the statements from their own perspective, to avoid mixing the personal perspectives with the professional perspective. When the sorting process started the respondent was first asked to divide the statements into three piles: disagree, neutral, agree. The amounts of cards in the piles were counted. Next, the respondent was asked to actually place the cards on the provided ranking sheet. The ranking took the respondents about 30 minutes. When the actual sorting was finished the respondent was asked to explain the extreme statements (column 1, 2, 10 and 11). An explanation on the extremes could show interesting facts on the respondents' perspective on CDM. With these open questions information could be gathered on how the participant has interpreted the statements given especially high or low rankings in their Q-sort, and what implications those statements have in the context of their overall viewpoint. They were asked if a topic was missing relevant to their position. This was hardly the case. The total overview of questions and Q-sort can be found in Appendix H.

6.4 Defining the P-Set

The next step is to define the interviewees, or P-set. It is important to interview many persons related to the CDM program to check whether they have the same or different perspectives on CDM. To gather all perspectives on the program, it is important to have a good representation of all organizations (Overvoorde, 2012). Diversity of respondents is the most important criteria for the P-set. There has been attempt to interview many persons from Amsterdam Airport Schiphol (AAS), Royal Dutch Airlines (KLM), Air Traffic Control the Netherlands (LVNL), SAOC (Schiphol Airline Operators Committee), and Ground Services (Aviapartner and Servisair). KLM is represented by both Ground Services (KLM HCC) and Operations Control (KLM OCC) in the CDM program. Because KLM HCC should have the same interests as the other ground handlers and KLM OCC should have the same interests as the SAOC, they have been split into KLM HCC and KLM OCC in order to check whether KLM HCC would have indeed a common perspective with the other ground handlers and KLM OCC with the SAOC. These abbreviations will be used throughout the analysis.

Many participants from the project team (BT), Implementation Board (IB) and Steering Board (SB) were interviewed in order to look at the common perspectives between the different layers (operational versus managerial). A large part of the P-set consists of people that were interviewed before. In the end 28 people were interviewed between May 27th 2014 and June 14th. This resulted in 28 useful Q-sorts. Since Q-studies proceed typologically and reveal qualitative segments that exist in a population, there is far less need to rely on large numbers of respondents, a P-set of 28 is considered as well represented (Brown, 1986). Of course more people could have been interviewed but due to time limits, and being dependent on people's holidays and continual services the P-set seems satisfied.

The final P-set consist of two representatives from the SAOC, six respondents from AAS, nine respondents from KLM OCC, four respondents from KLM HCC, two respondents from other airlines, four respondents from Ground Services, and three respondents from LVNL. Also two representative executives of the SB, five managers of the IB and seven project team members are interviewed. No attention is paid to demographic characteristics, however only three out of the 28 persons are female.

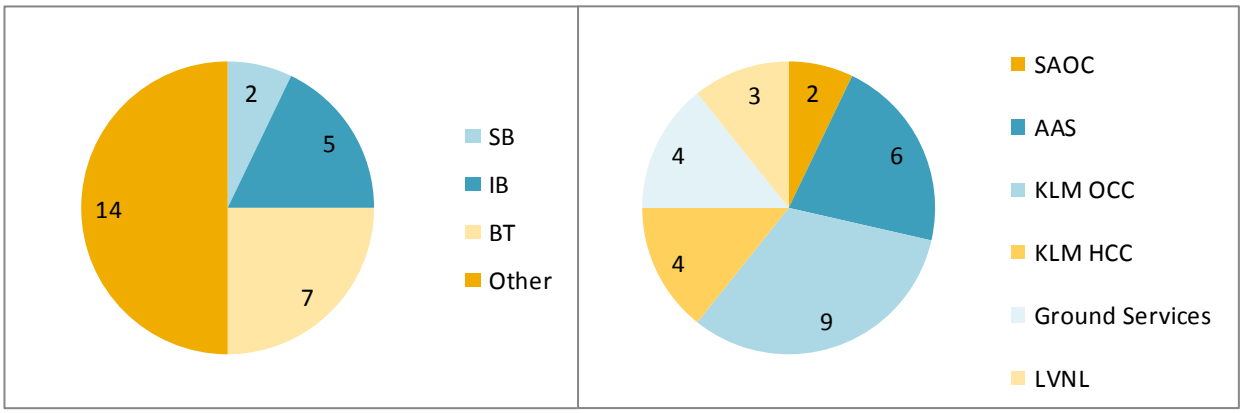

Figure 16 Amount of participants

Chapter 7 Perspectives on CDM

Extracting factors is an iterative process whereby only at the end of the process can be determined whether the factors are acceptable. 'A factor can be explained as the mathematical representation of the perspective shared by a group of respondents' (Van Loenhout, 2013). Each participant has a loading on a specific factor: the degree to which that Q-sort is similar to the factor's perspective. Both Centroid Analysis and Principal Components Analysis can be used to extract factors from the data set. In this research a Centroid Factor Analysis is used because this is usually preferred (Watts, 2012). It falls outside the scope to explain the difference between the two methods. In order to go through the Centroid Factor Analysis you need to know how many centroids, or factors as named here, have to be extracted (Watts, 2012). The software program PQMethod generally computes seven factors; however this will not be the final amount of factors. There are a few methods on how many factors should be extracted. The 28 Q-sorts on CDM have resulted in three factors. Why this is specifically chosen for three factors and the result of these three factors is gradually be explained throughout this chapter.

7.1 Correlation between the Q-Sorts

The first output file in PQMethod is 'Correlation matrix between sorts'. The correlation matrix shows the correlations between each Q-sort. The correlation between two Q-sorts can be calculated with the scores the participants gave to the different statements. This is showed by a simple example of two persons ranking four statements.

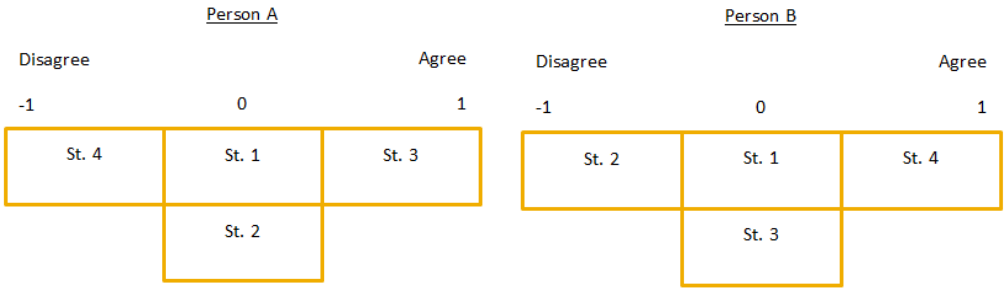

Table 6 Correlation example

Statement	S_A	S_A^2	S_B	S_B^2	D	D^2
1	0	0	0	0	0	0
2	0	0	-1	1	1	1
3	1	1	0	0	1	1
4	-1	1	1	1	-2	4
Sum	0	2	0	2	0	6

The correlation can be calculated with the following formula:

$$r = 1 - \frac{\sum D^2}{\sum S_A^2 + \sum S_B^2}$$

With

- r is the correlation between Q-sort A and Q-sort B
- D is the difference between statement A and B
- S is the score given to the statement

This results in:

$$r = 1 - \frac{6}{2+2} = -0.5$$

The correlation matrix is a result of all correlations between the Q-sorts, therefore this is presented in an N*N, or in the CDM case 28*28 matrix. The larger the amount of Q-sorts, the smaller the change of two Q-sorts being similar or the complete reverse. The correlation matrix for CDM can be found in Appendix I. The correlations are very low, with only a few correlations above 50%. The highest correlation is 68%. Only 35 out of the 756 possible correlations have a correlation of at least 50%. This means there is a very large difference in Q-sorts amongst all participants. This confirms the various opinions on CDM which influences decision making.

7.2 Criteria for Choice of Factors

The second PQMethod output file is the 'Unrotated Factor Matrix'.

Table 7 Unrotated Factor Matrix

Q-sort	Factor 1	Factor 2	Factor 3	h^2	h^2 (%)
1	0,4629	0,3703	0,2614	0,42	42
2	0,6136	-0,1099	-0,3079	0,48	48
3	0,5167	0,0737	0,2975	0,36	36
4	0,6083	0,0518	0,2638	0,44	44
5	0,1596	0,5373	-0,1133	0,33	33
6	0,4175	0,5276	-0,1748	0,48	48
7	0,7015	0,0088	-0,3634	0,62	62
8	0,594	0,1597	0,2671	0,45	45
9	0,4775	0,0457	0,0983	0,24	24
10	0,7154	-0,0732	-0,0972	0,53	53
11	0,54	-0,318	0,0058	0,39	39
12	0,4572	-0,4007	0,1893	0,41	41
13	0,6613	-0,2868	-0,2935	0,61	61
14	0,3717	-0,2991	0,0953	0,24	24
15	0,6598	-0,245	0,1122	0,51	51
16	0,5628	-0,0535	0,0664	0,32	32
17	0,3552	0,3679	-0,1581	0,29	29

18	0,4824	0,1202	0,11	0,26	26
19	0,5782	-0,0833	0,1539	0,36	36
20	0,139	0,464	-0,0341	0,24	24
21	0,4126	0,3082	-0,1871	0,30	30
22	0,5727	-0,0523	-0,1991	0,37	37
23	0,6388	-0,5345	0,2036	0,74	74
24	0,6532	-0,2957	0,1388	0,53	53
25	0,536	-0,1959	0,0258	0,33	33
26	0,5203	-0,1248	-0,4409	0,48	48
27	0,6513	0,2953	-0,2641	0,58	58
28	0,6805	-0,2143	0,3147	0,61	61
Eigenvalue	8,3315	2,2838	1,2964		
Variance (%)	30	8	5		

Table 7 shows the initial or unrated factor loadings. In factor analysis it is usual that the first factor extracted will account for the largest amount of study variance with successive factors steadily decreasing in size (Watts, 2012, p. 100). Besides the factor loading the table also shows the communality (h^2), eigenvalues and variance. The highest loading in Factor 1 is Q-sort P10 with 0.7154 whereas the lowest loading is Q-sort P20 with 0.1390. A factor loading needs to be squared to ascertain how much of what is going on in a particular Q-sort. In the case op Q-sort P10, Factor 1 currently accounts for 51% (0.7154*0.7154) of its variance. On the other hand it explains only 1.9% (0.1390*0.1390) of the configuration captured in Q-sort P20 (Watts, 2012, p. 101). The three factors together show 43% (30% + 8% + 5%) of the total study variance. According to Kline (1994) anything in the region of at least 35% is considered a sound solution. The communality is calculated for every Q-sort by summing its squared factors loadings. This means that, for example for Q-sort 1, 42% of the variance is common variance. This can be interpreting as 42% holds in common with all the other Q-sorts in the study group. A high communality, in this case is Q-sort 23 with 74% the highest, means that that Q-sort is highest representative of the group as a whole (Watts, 2012, p. 104). The eigenvalues and variance show similar information to the communality but in relation to the factor instead of the Q-sort. The eigenvalues are very important criteria to meet for accepting a factor. According to Watts and Stenner (2012, p. 106) the factors should have an EV of 1.00 or above, it then satisfies the so-called Kaiser-Guttman criterion. This cut-off point is used because an extracted factor with an EV of less than 1.00 actually accounts for less study variance than a single Q-sort. When four factors were extracted it showed a very low eigenvalue for the fourth factor. When extracting three factors in PQMethod they all satisfy this condition.

7.3 Factor Rotation and the Preparation of Factor Arrays

There are different decision making criteria on extracting factors. Based on the Kaiser-Guttman criterion three factors are acceptable but there is also chosen to check whether the amount of significant loading Q-sorts is acceptable. This is done with factor rotation. The factor loadings were already expressed as correlations and indicated to which each Q-sort is associated with each extracted factor. With factor rotation these same loadings will take a spatial or geometric function.

Rotation does not affect the consistency in sentiment throughout individual Q-sorts or the relationships between Q-sorts, but it shifts the perspective from which they are observed (Van Exel, 2005). There are two methods in PQMethod to execute factor rotation: by-hand and varimax. Again there is the method depends on own preferences but according to Watts and Stenner (2012) the system suggest involving the use of a varimax rotation in PQMethod followed by a by-hand rotation. For varimax PQMethod will rotate the factors, to account for the maximum amount of study variance. This is done by selecting the individuals Q-sorts that load significantly on that factor and that factor alone. If a Q-sort loads significantly on more than one factor it is called confounded. First, the significance level should be calculated in order to say whether the factors load significantly. The significant factor loading at the 0.01 level that has to be used is (Brown, 1980, p. 222):

$$= 2.58 * \left(\frac{1}{\sqrt{N}}\right)$$

With

- N is the number of statements in the Q-set

$$= 2.58 * \left(\frac{1}{\sqrt{43}}\right)$$

$$= 2.58 * \left(\frac{1}{6.5574}\right) = 2.58 * 0.1525$$

$$= 0.393446 = 0.40$$

Now, the Q-sorts can be flagged (selected) on their unique significance after the PQMethod has rotated them automatically. It is also checked whether more Q-sorts load significant if the factors would be rotated manually. This is done by a few by-hand adjustments to the initial varimax solution to ensure that the maximum possible number of participants is included in the various groups of Q-sorts associated with the study factors. As can be seen in Figure 17 the Q-sorts are very spread out. An iterative process of manual rotations did not result in an improvement of the amount of significant factor loadings or the variance.

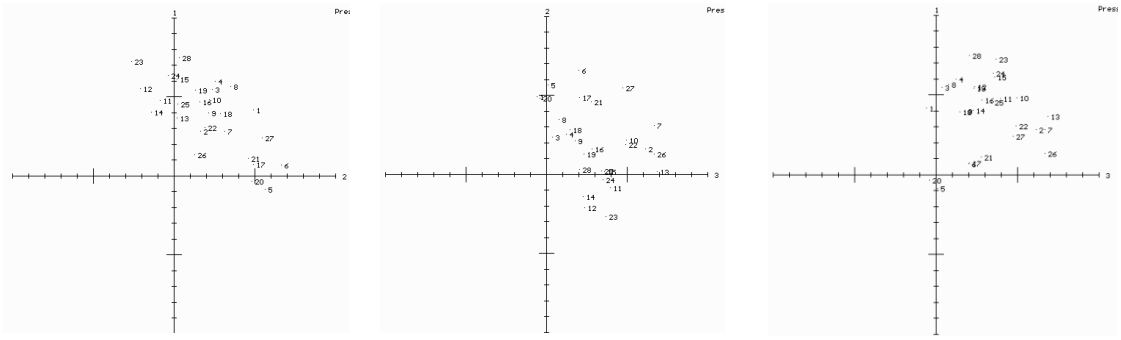

Figure 17 Left: Factor 1 vs 2, Middle: Factor 2 vs 3, Right: Factor 1 vs 3

The final unique significant loadings are:

Table 8 Factor defining (Bold type is indicative for factor loading of ≥0.60)

Factor	Q sort	Total
1	3 4 8 9 12 14 15 16 18 19 23 24 25 28	14
2	5 6 17 20 21	5
3	2 7 1322 26	5
Confounded	1 10 11 27	4
Non-significant	-	0

Table 8 shows that 14 Q-sorts load significantly (≥ 0.40) at Factor 1, five Q-sorts load significantly at Factor 2 and also five Q-sorts on Factor 3. After the rotation it turned out that Q-sorts 1, 10, 11, and 27 were confounded. In total the three factors account for 24 out of the 28 Q-sorts. Five Q-sorts load on Factor 2 and also five on Factor 3 which is, due to a minimum of two Q-sorts (Watts, 2012), enough information to keep the factor.

Based on the fact that, when extracting three factors, enough Q-sorts are loading significantly on these factors and their eigenvalues met the criterion of higher than 1.0, three factors are acceptable. When more factors were extracted they did not meet the criteria. For example, with four factors the eigenvalue of the fourth factor was only 0.2, this was the reason to reduce the factors to three. Also two factors were extracted but then it turned out to have non-significant Q-sorts and the variance was only 35%. Therefore there is chosen to extract three factors.

7.4 Most Commonly Agreed Statements

To get an impression of the overall opinion on CDM, an overview of the most five agreed and most five disagreed statements is given in Table 9 and 10. The total Z-scores, calculated by summarizing the Z-scores of the three individual factors, can be found in Appendix I.

Table 9 Top 5 most agreed upon

Statement		Total Z-score
1	At Schiphol Airport they are all depending on each other's existence therefore they should collaborate to achieve the goals. (37)	4,62
2	Efficient utilization of slots and capacity will only be realized when all airports in Europe implement CDM. (4)	4,139
3	Better communication is necessary to increase the awareness of CDM. (22)	3,159
4	Because of the variation in attending team members decision making is difficult. (15)	2,749
5	Less attention should be paid to temporary solutions and more to permanent solutions. (25)	2,525

Table 10 Top 5 most disagreed upon

Statement		Total Z-score
1	Schiphol should stop with CDM. (39)	-7,396
2	Sharing all information transparently results in a disadvantage for other processes. (5)	-3,787
3	Due to CDM jobs are issued. (18)	-3,713
4	Due to CDM the processes are not improved in comparison to the current processes. (19)	-3,657
5	The CDM program is purely beneficial for all stakeholders and never affects them negatively. (31)	-2,607

The overall impression is that due to the relationship of all actors at Schiphol Airport close cooperation is necessary to accomplishing goals. Not even with the actors at Schiphol Airport but also other airports, only when all airports implement CDM will it become more efficient. No jobs will be at stake due to CDM, the processes will be improved, so Schiphol Airport should not stop with CDM. However, everyone seems to know that it does not yield only benefits. The CDM program structure should be more stable and more attention should be paid to long-term solutions.

7.5 Factor Interpretation

It is clear that three factors are taken into account but what do they actually signify? The three factors make up a certain viewpoint or common perspective on CDM represented by a particular group. In order to know which statements have to be used they have to be standardized. This is done by the Z-score or factor array given to the statement (Watts, 2012). These Z-scores denote how far each statement is from the overall group mean (Van Exel, 2005) this is also described in factor arrays which is more or less the same distribution as used in the Q-sort, only this time from -5 till +5. The statement with the highest Z score is awarded with +5 and least with -5. So far, the results were explained in a statistical way now a theoretical or conceptual interpretation is used. For this purpose the most extreme or distinguished statements are used. The distinguished statements are the statements ranked statistically higher or lower ($p < 0.01$) by that particular factor compare to the other factors. Besides the most extreme and distinguished statements, also quotes from the interviews are used to describe and explain the factors (Cuppen, 2010). The factors are given a name that mostly fit the characteristics of the respondents.

7.5.1 Factor 1: The Optimistic and Closely Involved Manager

The people loading on this perspective think close collaboration is most important. The most important statement is that all actors have one common goal for CDM [2]. Of course “concessions should be by made by individuals to reach a higher goal, but in the end this higher goal should benefit for all actors.” Eventually close collaboration is necessary because all actors at Schiphol Airport are mutually dependent [37]. “There is no single boss within the program, everyone is intertwined.” However, it is also very important that communication must be improved in order to increase the awareness of CDM [22]. When people are not involved in the decision-making layers they should be updated more frequently. “Also when you are not presented in meetings you should know what to do.” “Communication is the neglected topic in CDM.”

People loading on Factor 1 disagreed most on the statements 39, 5 and 18. They definitely want to continue with CDM [39]. They do not think jobs will be issued [18], and if jobs get issued due to CDM the optimist believes it will be necessary to survive. Also sharing information does not result in disadvantages for other processes [5]. "It's all about operational information, not commercial information."

In comparison to the other factors, people loading on Factor 1 ranked statements about commitment of top management different. People with this perspective think CDM should be implemented top-down (from top management) instead of bottom-up [11]. "The differences within the organization are too big to implement CDM bottom-up; of course the project team should be involved but not be responsible for it." The complexity of Schiphol's operational system is not the cause for difficult decision making [14]. It is more about top management; they should be involved more [41] and more people with mandate should be involved to have effective decision making [43]. A vision should be made by top management [20]. "They are responsible for creating and propagating this vision."

They also ranked the statement 'paying less attention to temporary solutions and more to permanent solutions [25]' much lower than people loading on the other factors. 'Temporarily solutions will eventually result in solid solutions. "When solutions are implemented it can always be 'fine-tuned', it is important to have a good discussion at the front with important expertise." They also think implementation of CDM is urgent [33]. "Precisely because of being a hub-airport CDM should have been implemented way earlier." People with this perspective also find the milestones more important [35]. "Milestones are a condition to link to the network."

Fourteen participants are significantly associated with this factor. These are four people from AAS, one from SAOC, one from KLM OCC and one KLM HCC, two from LVNL and one from GS. There are also six people from the BT, one from IB and one from SB loading on this factor.

Table 11 Statements for Perspective 1

	Statement	Array F1	Z-score
Agree (+5)			
2	All actors should have *one* common goal for the CDM program.	5	1,632
Agree (+4)			
22	Better communication is necessary to increase the awareness of CDM.	4	1,561
37	At Schiphol Airport they are all depending on each other's existence therefore they should collaborate to achieve the goals.	4	1,378
Other distinguished statements (ranked significantly higher than at the other factors with $p < 0.01$)			
11	CDM should be implemented top-down instead of bottom-up.	3	1,248
33	Implementation of CDM is urgent.	3	1,16
41	Top management should be more committed to CDM.	2	1,136
43	More people with mandate should be involved for effective decision making.	2	1,1039

20	A vision should be made by top management.	2	0,93
Disagree (-5)			
39	Schiphol should stop with CDM.	-5	-2,973
Disagree (-4)			
5	Sharing all information transparently results in a disadvantage for other processes.	-4	-1,668
18	Due to CDM jobs are issued.	-4	-1,931
Other distinguished statements (ranked significantly lower than at the other factors with $p < 0.01$)			
25	Less attention should be paid to temporary solutions and more to permanent solutions.	0	-0,07
14	The complexity of Schiphol's environment (compared to other airports) makes decision making within the CDM program difficult.	-2	-0,664
35	Everyone should be more open for creative ideas without holding tight to the CDM milestones.	-3	-0,787

7.5.2 Factor 2: The Omnipotent and Independent Specialist

People loading on Factor 2 have a very different opinion than the people loading on Factor 1 and 3 because of the many distinguished statements. This means they ranked the Q-sorts different. Whereas the believers of Factor 1 think CDM should be implemented top-down, the believers with Perspective 2 totally believe CDM should be implemented bottom-up [11]. “Specialists do know exactly how the processes work”, therefore, they should have more input in decision making [40]. “The project team is an important platform of knowledge and it is important to get operational groups along.” However people with this perspective think more individually. Compared to the other factors one common goal is less necessary for the people loading on Factor 2 [2], also CDM meetings are of less importance [23] and effort put in the program does not have to be equal [9]. Within this perspective people believe Schiphol Group should invest most in CDM because they want the CDM ‘mark’ [42].

The most important statement according to the people loading on Factor 2 is that all airports in Europe implement CDM [4]. Only then maximum benefits will be achieved with slots and capacity. Due to CDM processes will be improved compare to the current situation [19]. But also a link to the network is necessary for this improvement [34]. More pressure on the program should be made at all airports, todays implementation is therefore less urgent [33]. People agree that Schiphol Airport should continue with CDM [39], however, this is not their most important issue since they do not believe CDM will help Schiphol to be a preferred airport [12]: “Because passengers do not care about CDM.” So, people loading on Factor 2 are a proponent of CDM but with many conditions.

Creativity of the specialist is appreciated and people should hold less tight to the milestones [35]. People with this perspective remain deeply attached to the insufficient resources to realize the ideas [36]. People within this perspective also attach great importance to the underestimation of the ICT infrastructure [17]. Systems cannot handle implementation yet [32] and “when the processes were more uniform the discussion would have been easier” [1]. However, the delay is not caused because

of poor communication and the corresponding assumptions [28]. But fewer adjustments should be made on decisions that are already taken [27]. So, people loading on Factor 2 do want CDM but make a mountain out of the mole hill.

Five participants are significantly associated with this factor. These are two people from KLM OCC and one KLM HCC, and two from GS. Only one member of the IB is loading on this factor.

Table 12 Statements for Perspective 2

	Statement	Array F2	Z-score
Agree (+5)			
4	Efficient utilization of slots and capacity will only be realized when all airports in Europe implement CDM.	5	1,876
Agree (+4)			
17	The delay of implementation is especially caused by the underestimation of the poorly fitting infrastructure.	4	1,621
36	Resources are currently insufficient for realizing CDM ideas.	4	1,843
Other distinguished statements (ranked significantly higher than at the other factors with $p < 0.01$)			
42	Of all actors Schiphol Group should invest most in CDM.	3	1,282
40	Specialists (like pilots and SUC's) may have more power in decision making because of their operational experience.	3	1,172
35	Everyone should be more open for creative ideas without holding tight to the CDM milestones.	3	1,117
32	Implementation of CDM is not possible yet because the company ICT systems are not ready.	2	0,837
9	Because the benefits of CDM are not equal for all actors they do not have to put equal effort in the program.	2	0,833
1	All ICT systems at Schiphol Airport should be uniform.	1	0,753
19	Due to CDM the processes are not improved in comparison to the current processes.	-1	-0,435
Disagree (-5)			
11	CDM should be implemented top-down instead of bottom-up.	-5	-1,991
Disagree (-4)			
12	CDM will help making Schiphol Europe's preferred airport.	-4	-1,532
39	Schiphol should stop with CDM.	-4	-1,708
Other distinguished statements (ranked significantly lower than at the other factors with $p < 0.01$)			
34	Local CDM should be linked to Eurocontrol/NMOC soon.	0	0,026
28	People should ask more questions to eliminate assumptions.	0	-0,032

27	Fewer adjustments should be made on decisions that are already taken.	-1	-0,575
2	All actors should have *one* common goal for the CDM program.	-2	-0,715
23	Higher priority should be given to CDM meetings.	-2	-1,051
33	Implementation of CDM is urgent.	-3	-1,356

7.5.3 Factor 3: The Collaborating Manager

People loading on Factor 3 are a huge proponent of close collaboration, like the people loading on Factor 1. Everyone should work together closely, because in the aviation industry all actors are dependent on each other [37]. Not only at Schiphol Airport but this counts for entire Europe; only when all airports CDM the most efficient process will be achieved [4]. This only works when one shared goal is been strived for [2]. People within this perspective do not think you have to put energy in the program fair to the gained benefits [9]. "Together we should bring Schiphol to a higher level."

It is important that Schiphol Airport should not stop with CDM [39]. Due to CDM the processes will be improved in comparison to the current processes [19]. "Processes are arguably improved, looking at the same times is already an improvement, and why stop when improvements are all over the place." The people within this perspective believe that not being a CDM airport makes the punctuality unreliable [30], more than the people loading on Factor 1 and 2. CDM will help making Schiphol Europe's preferred airport [12]. But it is commonly known that CDM does not only result in advantages [31]. "The benefits gained from CDM are bigger than the costs associated with." "CDM is a total chain optimization." Compare to the other factors they think trials are more important [26]. They remain less attached to the resources [36]. The biggest difference with Factor 1 is that those people think leadership, and the associated tasks, is far more important. This is left in the middle within Factor 3.

Five participants are significantly associated with this factor. These are two people from AAS, one from KLM HCC, one from LVNL and one from GS. There is one member from the BT and two members from the IB loading on this factor.

Table 13 Statements for Perspective 3

	Statement	Array F3	Z-score
Agree (+5)			
37	At Schiphol Airport they are all depending on each other's existence therefore they should collaborate to achieve the goals.	5	2,292
Agree (+4)			
2	All actors should have *one* common goal for the CDM program.	4	1,378
4	Efficient utilization of slots and capacity will only be realized when all airports in Europe implement CDM.	4	1,427
Other distinguished statements (agreed upon with $p < 0.01$)			
26	More trials should be executed.	3	1,014
12	CDM will help making Schiphol Europe's preferred airport.	2	0,812
30	Not being a CDM airport makes the punctuality unreliable.	0	-0,125
Disagree (-5)			
39	Schiphol should stop with CDM.	-5	-2,715
Disagree (-4)			
19	Due to CDM the processes are not improved in comparison to the current processes.	-4	-1,572
31	The CDM program is purely beneficial for all stakeholders and never affects them negatively.	-4	-1,752
Other distinguished statements (disagreed upon with $p < 0.01$)			
36	Resources are currently insufficient for realizing CDM ideas.	-2	-0,623
9	Because the benefits of CDM are not equal for all actors they do not have to put equal effort in the program.	-3	-1,123

7.6 Similarities and Differences between the Factors

The software program PQMethod also calculated the correlations between the factor scores. A higher correlation between two factor scores means more similarities between the perspectives. All correlations are moderately positive and fall between the values 0.15 and 0.63. This is in line with the positive correlation matrix for the Q-sorts and indicates that there is consensus between the factors within the organization. The correlation matrix (Table 14) shows that Perspective 1 and 3 are similar ($r = 0.63$). Both perspectives focus on the importance of collaboration between all actors in order to reach the common goal of CDM. The correlation between Perspectives 1 and 2 is the lowest ($r = 0.15$). People loading on Perspective 1 are optimistic and focused on the importance of leadership but people with Perspective 2 are more about individualism and the power of the specialist. This is very top-down versus bottom-up. Perspective 3 is mainly focused on the close collaboration between

all actors and the higher goal that will be reached together. Based on the correlation it seems that Perspective 2 is most different from the other perspective.

Table 14 Correlation between factor scores

	F1	F2	F3
F1	1.000	0.154	0.630
F2	0.154	1.000	0.349
F3	0.630	0.349	1.000

The statements that have a large array factor difference will probably result in resistance when decision making because the opinion on these statements differs extremely. Therefore they need special attention within the decision-making process. The statements with an array factor of at least five points are:

- All actors should have *one* common goal for the CDM program. [2]
- CDM should be implemented top-down instead of bottom-up. [11]
- CDM will help making Schiphol Europe's preferred airport. [12]
- The delay of implementation is especially caused by the underestimation of the poorly fitting infrastructure. [17]
- A vision should be made by top management. [20]
- Implementation of CDM is urgent. [33]
- Everyone should be more open for creative ideas without holding tight to the CDM milestones. [35]
- Resources are currently insufficient for realizing CDM ideas. [36]

7.6.1 Array Differences between Factor 1 and Factor 2

People within Factor 1 and 2 disagree strongly on the way CDM should be implemented. The people with Perspective 1 believe CDM should be implemented top-down but people with Perspective 2 believe CDM should be implemented bottom-up [11]. In addition, there is a large gap between the urgency of implementation [33]. There is also a disagreement on the cause of the delay. People within Perspective 2 dedicate the delay to the ICT infrastructure, which has been underestimated and is not ready for implementation yet [17]. Perspective 1 focuses on the importance of having top management involved and them making a vision [20]. People with Perspective 2 do not think this is important and care more about enough resources [36] to execute creative and solid solutions made by the specialists [35]. Consensus exists on the statement if the punctuality is unreliable due to not being a CDM airport [30]. More differences can be found in Table 35 (Appendix I).

7.6.2 Array Differences between Factor 1 and Factor 3

Again people within Factor 1 and 3 disagree on the way CDM should be implemented [11]. The people with Perspective 1 believe CDM should be implemented top-down but people with Perspective 3 believe CDM should be implemented bottom-up. This should be taken into account when people from these factors collaborate. People within Factor 3 attach more value to the

disadvantages due to CDM [31] and the amount of advantages for each stakeholder [9]. There is also disagreement on the outcome of CDM. People with Perspective 1 do not believe CDM might contribute to help making Schiphol Europe's preferred airport [12]. Both Factor 1 and 3 are ranked similar on the underestimation of the poorly fitting infrastructure [17]. More differences can be found in Table 36 (Appendix I).

7.6.3 Array Differences between Factor 2 and Factor 3

Disagreement exists on the importance of the provided resources in the program [36]. People with Perspective 2 believe the resources are not sufficient. However, this seems less convincing for people with Perspective 3. People with this perspective also believe that actors have not put equal effort in the program [9] and the Schiphol Group should invest most in CDM [42]. Having one common goal for CDM does not seem to be important for Perspective 2 but is highly appreciated by the people with Perspective 3 [2]. Most consensuses exist on the statement of CDM being top priority at Schiphol Airport [22]. Both factors are loaded slightly negative on this statement. More differences can be found in Table 37 (Appendix I).

7.7 Relation between the Different Actor Types

Interviews were given to as many persons as possible that are involved, including as many persons from all different companies and decision-making layers. As mentioned in Section 6.4 people from AAS, KLM, LVNL, SAOC and Ground Services (GS) were interviewed. Because KLM HCC and KLM OCC execute total different tasks they have been separated into KLM HCC and KLM OCC. As resulted from the stakeholder analysis can be said that KLM HCC should be in line with Ground Services and KLM OCC should have more in common with the SAOC as airline operator. The next step is to check on which perspective each participant most and least adhere to. So far four Q-sorts were not included due to the fact they were confounded. However, even when a person is not defining a perspective, it is still possible to support the perspective to a certain extent. The higher the factor loading of a person on a factor the more this person shares this perspective (Cuppen, 2010). The average factor loading per actor type on each of the three perspectives is calculated in order to investigate further to what extent each of the perspectives is represented within each actor type (Cuppen, 2010). In order to compare the different actor types, like the different companies and differences in decision-making layers, all Q-sorts are taken into account from now on. This means the Q-sorts 1, 10, 11 and 27 are apportioned to the factor with the highest loading. This is also done to make sure that on every actor type at least two Q-sorts load, which is necessary to say something about the actor type. This resulted in a list of 28 persons representing three perspectives on CDM. The data was inserted in the statistical program SPSS.

Level * Factor Crosstabulation

Table 15 Level distribution

Count

		Factor			Total
		1	2	3	
Level	BT	6	0	1	7
	IB	1	2	2	5
	SB	1	0	1	2
Total		8	2	4	14

Table 16 Company distribution

Company * Factor Crosstabulation

Count

		Factor			
		1	2	3	Total
Company	KLM OCC	6	2	1	9
	AAS	4	0	2	6
	LVNL	2	0	1	3
	GS	1	2	1	4
	SAOC	1	1	0	2
	KLM HCC	1	2	1	4
Total		15	7	6	28

The majority of the respondents (15 out of 28) can be related to Factor 1: The optimistic and closely involved manager. They believe strong leadership is necessary to implement CDM. Most BT members (6 out of 7) feel this perspective and think top management should be more concerned. Also one member of the IB and one member of the SB agree with this.

Figure 18 and 19 show how heterogeneous or homogenous actor types are in terms of perspectives on CDM. The three axes represent the three perspectives and each line an actor type. The higher the average factor loading on the score the further the point is located from the center.

Figure 18 shows that the biggest differences prevail within IB. Notable is the fact that 2/5 of the IB members load on Factor 2, and another 2/5 load on Factor 3: The collaborating manager. Apparently most managers are less in favor of strong and concerned leadership and feel more like the importance of operational field. BT and SB load much higher on Factor 1 followed by Factor 3. This is also noteworthy since the only significant loading SB member believes top management should be involved more. As resulted from the Q-methodology, the Implementation Board (IB) appeared to be the most heterogeneous actor type. Because there were only two respondents from the Steering Board, less can be said on the variation between them. This variation explains the lack in commitment and different directions they work in.

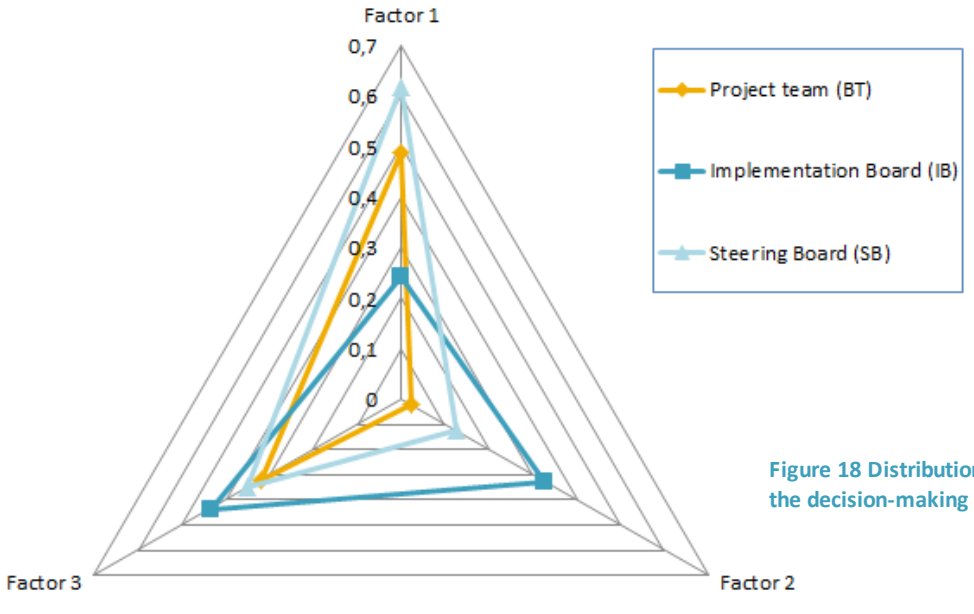

Figure 18 Distribution of average factor loadings for the decision-making layers

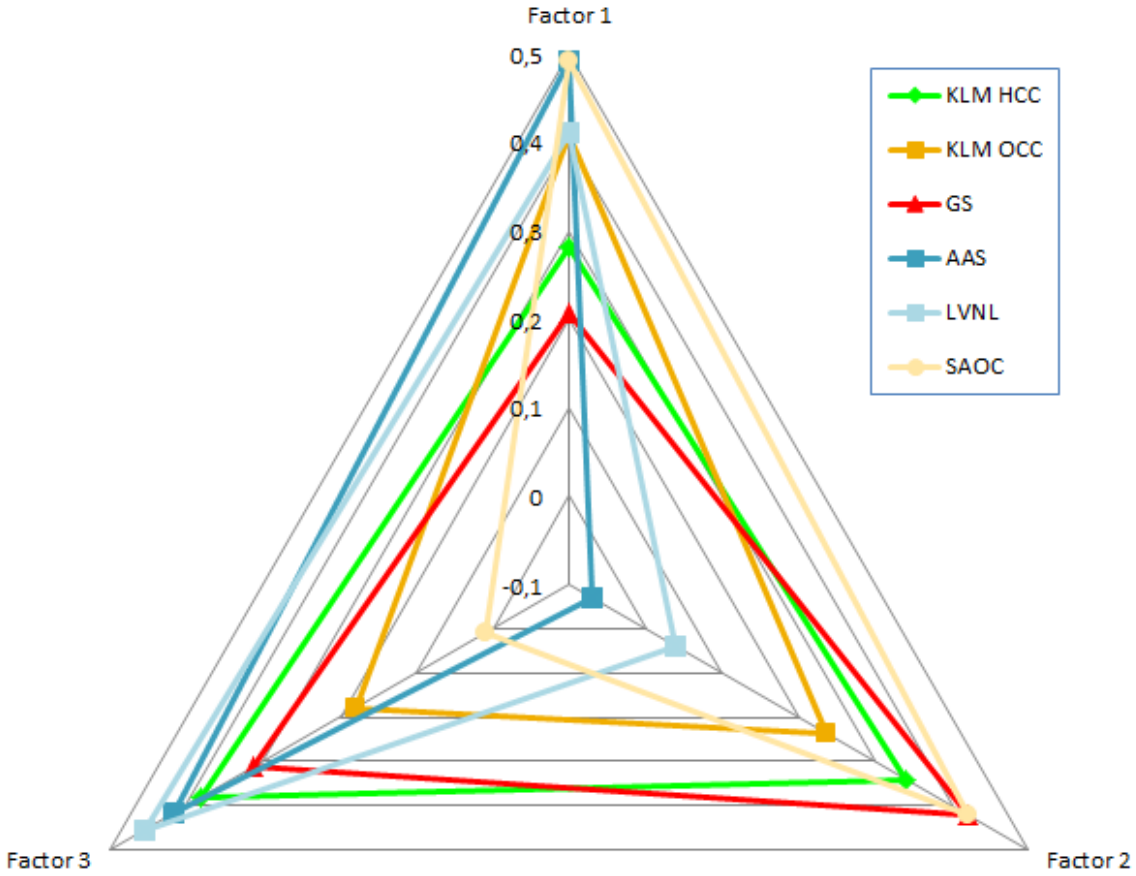

Figure 19 Distribution of average factor loadings per company

The majority of employees from KLM OCC, SAOC, AAS, and LVNL load on Factor 1. The majority of the other ground handlers and KLM HCC are more in favor of Factor 2: The omnipotent and independent specialist. This is not surprising since they are related to the operational field.

KLM HCC is Ground Services and as can be seen in Figure 19 they have most in common with the other Ground Services as well. Whereas KLM OCC should have more in common with the SAOC as airline operator, this seems to be the case. Factor 3 belongs to the minority of the respondents. Only six employees from KLM OCC, AAS, LVNL, GS and KLM HCC agree on this perspective. However, 1/3 of the AAS employees can be related to this perspective. However, due to the scattered lines within the web all actor types are rather heterogeneous in terms of perspectives. The IB, KLM HCC, GS and KLM OCC show the most heterogeneous paths of all actor types.

Besides the loading on factors between the different layers and companies something can be said about the opportunism on the Q-set (see Table 38, 39 and 40 in Appendix I). For each person the amount of statements on disagree, neutral and agree were counted. Whereas the BT agreed on most of the statements (with a mean of 16.43), the IB and SB members disagreed on most statements (with a mean of 18.60 respectively 18.50). The BT was more opportunistic on the 43 statements. The biggest difference is within the project team with a range of 14 respectively 19. Apparently there are fewer consensuses on the statements within the project team.

7.8 Conclusion Phase 2

The first sub-question in Phase 2 that had to be answered was:

> *Which stakeholders are involved in the CDM program and how is their decision making influenced by their operational processes?*

Schiphol Airport has many complex operational processes. Schiphol Airport is located closely to the North Sea. Therefore, many wind directions and forces occur. To deal with this, a tangential runway system with runways located in different directions around the terminal has been build. Safety is a huge deal for LVNL since all aircrafts fly at each other due to this runway system. When two runways are in use, the departing aircraft gets the runway that suites best in terms of the direction to the destination. Due to six runways it is possible to switch between runways when wind changes occur. However, switching runways has many consequences on a direct impact on handling of traffic in the airspace around Schiphol Airport. The Dutch airspace is, despite the limited airspace, within Europe's busiest airspace. Whereas Eurocontrol uses slots, a period of time within take-off has to take place. The choice of runway also has a major impact on taxi times, the occupation of gates and the system of taxiways. In addition, this is also affected by the peak moments at Schiphol Airport. Schiphol Airport is a hub-airport which means that in a very short time many flights arrive after which they leave in a short time again. The peak moments are especially crucial for all processes. The Ground Handlers need to handle many aircrafts, baggage and passengers in a short time.

More than hundred airlines visit Schiphol Airport weekly. Of all KLM (Schiphol's home carrier) passengers about 70% are transfer passenger. This means each circumstance that causes a delay will have a consequence on hundreds of passengers. The best and most profitable option for all passengers are calculated conform the cor-noc principle. However, many, even small incidents as no show passengers will have a huge consequence on the punctuality of a flight. Besides the fleet of KLM does not have many reserve aircrafts so maintenance problems will also have a huge impact on the planning. KLM must also compete to all the emerging low cost carriers so good services for low costs are the ultimate goal. This also counts for the different Ground Services at Schiphol Airport. There is a lot of competition therefore it is important to be able to predict the time for handling all processes in a punctual manner. Schiphol Group tries to satisfy all actors by providing the most suitable solution for all processes.

So, runway configuration is influenced by and does influence much variation in the process. Although the process of flying seems unpredictable it is important to try to deliver accurate information. This is difficult for the air traffic controllers at LVNL, pilots, KLM, Ground Services and AAS due to the complex processes at Schiphol Airport. All processes are integrated and one circumstance therefore affects many planning systems. This contributes to difficulty in decision making between all actors.

As can be concluded from the Stakeholder analysis many stakeholders are critical and/or dedicated in the CDM program. Therefore their interest has to be taken into account and cooperation between them is necessary. However due to the complexity of operation at Schiphol Airport it is difficult to fulfill everyone's wishes.

It is now clear that the complexity of the operation influences decision making in the CDM program, whereas many interests and process have to be taken into account. The next sub-question dealt with

how the stakeholders thought about the challenges in decision making in order to fulfill as many wishes as possible.

What are different and similar perspectives on CDM according to the stakeholders?

To answer this sub-question Q-methodology is used. This is a statistical research technique to study the subjective viewpoints of a group. A group of participants, called the P-set, has been asked to rank 43 statements on the complexity of CDM according to their own opinion. The 43 statements cover all seven challenges that deal with 1) Getting everyone to work in the same direction, 2) Dealing with mutual dependent relationships, 3) Developing a flexible and transparent process, 4) Collaborate between decision-making layers, 5) Evaluate costs and benefits, 6) Dealing with technological uncertainty and 7) Communicate. For this ranking a forced normal distribution is used, called the Q-sort. In the end 28 people from AAS, KLM HCC and KLM OCC, LVNL, SAOC and GS and people from the decision-making layers project team (BT), Implementation Board (IB) and Steering Board (SB) have ranked the statements. Whereas the BT agreed on most of the statements, the IB and SB members were less opportunistic on the 43 statements. Less consensuses on the statements occurred at the project team. Distribution of the factors also showed the common view on CDM between KLM HCC and GS, between KLM OCC and SAOC, and between LVNL and AAS. Whereas the first two were expected, but a close view between LVNL and AAS is an important observation.

The Q-methodology has resulted in three factors, or perspectives, that show the viewpoint of a particular group of respondents. To get to these three factors 24 out of the 28 Q-sorts could be used. The first perspective can be described as 'The optimistic and closely involved manager'. Fourteen participants are significantly associated with this factor. The majority of AAS, KLM, LVNL and KLM OCC and BT load on this factor. The most important statements for people within this perspective are based on the close collaboration of the stakeholders since all actors are mutually dependent. Improvement of communication seems important because implementation of CDM is urgent. The difference with other perspectives and this one is the involvement of top management. People within Factor 1 believe CDM should be implemented top-down, top management should make a vision and more resources should be provided. Whereas the people within Perspective 2 totally believe CDM should be implemented bottom-up. Creativity and knowledge of the specialists should be taken into account more. Implementation of CDM is less urgent because it only results in benefits when all airports have implemented it. Delays are mostly caused by the ICT infrastructure at Schiphol Airport and the availability for specialists to express their expertise. These people are still a proponent of CDM but only under certain conditions. Five people from the operational field, especially the majority of the other ground handlers, have loaded significantly on this Factor 2, called 'The omnipotent and independent specialist'. Notable is the fact that Perspective 2 is most carried by the IB whereas the BT, who at first glance appear to be more operational, does not load on Factor 2 at all. The last factor, Perspective 3 'The collaborating manager', is quite similar to Factor 1. However, the importance of strong leadership has been left in the middle. The importance of collaboration and cooperation, having one common goal and the results of CDM are most important. They believe the processes will be greater by far compare to the current processes and together they will help to bring Schiphol Airport to a higher level. The high correlation between Factor 1 and 3 shows a large part is common perspective. A few employees from AAS, KLM HCC, LVNL, GS, BT and IB load on this factor.

Phase 3 – Managerial Implications

Source: Schiphol Group Brand Portal

Chapter 8 Managerial Implications

The rate of change in the environment where companies have to survive in is growing, due to economic globalization and relating technological and social trends. This will result in terrible risks, but also in wonderful opportunities. Being aware of the challenges that may occur during decision making in a multi-actor environment is essential. Knowing how the challenges can be dealt with is the key to success in setting up a joint program. Phase 1 of this report showed seven challenges the CDM program faces. The challenges were based on interviews, meetings, and substantiate with a theoretical background as a stepping stone for this chapter. In Phase 2, the challenges were tested with Q-methodology after a systematic fashion of the stakeholders was made. This chapter is the link between Phase 1 and 2. This results in the most important challenges the CDM program faces according to the stakeholders. But also from my own critical viewpoint, ascertained topics lead to managerial implications provided in this chapter. This chapter is an advice, especially for the program manager, to improve decision making within the CDM program and answers the last sub-question: *What are managerial implications to improve decision making within the CDM program?*

8.1 Choice of Implications

The Q-methodology, literature, and own experience showed that most ascertained topics can be related to 'Challenge 1: Getting everyone to work in the same direction', 'Challenge 4: Collaborate between decision-making layers' and 'Challenge 7: Communicate'. It is important to have one direction, by creating awareness, and commitment with a good discussion at the front. Next, this should be communicated to the rest of the organization. A good start to a program seems to be the hardest challenges in a multi-actor environment. Topics related to these themes have been rated more extreme. Whereas everyone believes the processes will be improved and no one thinks jobs will be issued. Although sharing information transparent and flexible is the key to succeeding in this program, the stakeholders do not think this topic is critical. Therefore, 'Challenge 3: Developing a flexible and transparent process' seems to be less hard within the CDM program. The fact that everyone is working together for the first time due to the CDM program is experienced as good within the program. 'Challenge 2: Dealing with mutual dependent relationships' seems to be part of a complex program, but it is also not experienced as the hardest challenge. This also counts for 'Challenge 6: Dealing with technological uncertainty' which is causing many discussions. Although it should definitely not be underestimated, from own background it hard to say how it should be improved. Besides, 'Challenge 5: Evaluate costs and benefits' is not mentioned as the most important challenge. Many respondents had never heard of the business case. The respondents also did not think looking at other airports was important. The hardest challenges within multi-actor environments deal with the functioning of management. Next, three managerial implications on improving decision making in multi-actor environments will be provided. All three are divided in why this implication is necessary, how it should be executed and the limitations of the implication.

8.2 Implication 1 Creating a Common Direction

8.2.1 Why

The most important topic was indicated as 'Challenge 1: Getting everyone to work in the same direction'. Half of the respondents, respondents loading on Factor 1, indicated the statement 'All actors should have *one* common goal for the CDM program' as most important. Also respondents loading on Factor 3 indicated this with array factor +4, although respondents loading on Factor 2 ranked this statement as less important. From this research there can be concluded that most of the respondents think one common goal is necessary but the definition of one common goal and the execution of it is less clear. They want to design one process; this will only be achieved when having one common direction. Boundaries for decision freedom need to be set.

It is hardly impossible to have successful agreements during decision making if everyone goes his/her own direction. It is important to have a vision, mission or common goal as mentioned in the theoretical background in Section 4.1.1. This is never made in the CDM program; at least one common goal for CDM is never made explicit on paper and propagated to the whole organization. Unless all parties work in unison, a common objective will not be achieved. A good discussion on the front is necessary. It is very important to have the whole team on the same page; else everyone will keep working in his/her own direction. In the recent Steering Board meeting of June 25th 2014 a discussion appeared on the Key Performance Indicators (KPI's). In order to evaluate success of a particular activity KPI's are used, these can either be strategic or operational goals. Apparently, when a discussion on KPI's appears in a meeting of top management there is no clear direction known. Creating one common direction for all stakeholders is crucial for the program to succeed. The stakeholders have to understand the overlap in interest to get to an overall direction. Otherwise a decision might be a long time coming if waiting until general consensus has been reached. The vision will also set the boundaries for decision freedom. When starting a program in a multi-actor environment it is crucial to pay enough attention on understanding each other's business and to design one common direction at the start the program. Eventually this will save time because of transparency.

8.2.2 How

It does not matter if the discussion is about a mission, vision, goal or direction. Yet, one of them is certainly necessary to deliver a successful project. Most commonly known is the project-managerial technique; SMART. Specific goals which are Measurable, Attainable and Realistic need to be realized in a Timely fashion (De Bruijn & Ten Heuvelhof, 2008, p. 131). Wallaert (2009) also mentioned that 1) there must be consensus on the vision and mission at the top, only then this can be made clear to lower levels, 2) text must be crystal clear, 3) if the context is vague it is mainly about the lack of context of the spectator and 4) experience is necessary. It is important to say that it is never too late to establish a direction. Wisdom gained so far should be used to formulate the direction in a favorable way, and besides, goals emerge over time.

Hendriks (2014) showed how to design an effective vision in a practical way (see Appendix J). A vision with the necessity of CDM in order to survive for the whole sector should be created. In the end some parties might need to do concessions. However, it is all for a higher cause; they have to recognize the overlap in interests. Only creating a vision is definitely not enough. It must also be propagated by top management, and line management should guide the implementation of it.

Therefore, advised is to organize a meeting with the Steering Board and start creating one common direction. This can be done in either an extra meeting or workshop. It would be wise to involve an external, independent, person to guide this meeting.

8.2.3 Limitations

Despite the importance, a vision is also experienced as difficult, especially within a multi-actor environment. Designing a vision and decision making is frightening for managers; making something that seems big and vague into manageable and practical. Besides, a vision should be in line with the company's core values. This is even more difficult with the many different companies in the CDM program, and few shared interest. They have to play this political game. However, they all strive for a predictable process, by anticipating on unexpected circumstances with maximal gain and minimal costs. They "just" have to find the overlap in the gain and costs.

Members of the Steering Board (SB) have to guide many more projects and time is scarce. When members of the SB will not make time for a meeting or workshop the members of the Implementation Board can replace them and do some advance work. However, as mentioned in literature it is recommended that the members of the SB will do it themselves. A good vision will prevent needless discussions in the future.

Furthermore, not everyone will accept the vision with open arms and resistance will appear. This appears to be part of the change, but it also implies the vision is communicated in such a way that the message came up to them. Especially individuals loading on Factor 2 do not see the necessity of having one common goal and will probably resist. Their freedom and expertise is more important than collaboration. However, there is only decision freedom if the employees have a framework within they can decide. This vision is the first step of the framework and must be formed by top management, and then the rest of the organization can give feedback without crossing the borders of the framework. Frequent communication is the key to this.

Lastly, the CDM program contains many projects. As mentioned in the introduction, CDM is not an isolated goal, but a method to optimize the total chain of processes. The scope is not limited, which will make it even more difficult. Besides, goals in a program might be less tangible. However, a vision is still necessary to make sure everyone is working in the same direction.

> The essence of strategy is choosing what **not** to do.
>
> Michael Porter

8.3 Implication 2 Get Management to Commit

8.3.1 Why

A mission and vision without involvement of top management is not worth much (Mullane, 2002). The importance of commitment from management is seen as follow-up to creating a common

direction. Many authors mention that commitment from (top) management is essential to succeed (Wallaert, 2009) (Kotter, 1996) (Jeurissen, 2013). It is not only important to get everyone to work in the same direction but also to create commitment to this direction. Experience from Aéroports de Paris learned they had a good discussion at the front and sought after commitment from higher management from the start. This resulted in a better decision-making process. According to Kotter (1996), there is an important difference between management and leadership. As mentioned in Section 4.1.1, leadership is necessary to make sure people understand the direction, urgency and to motivate people to action that is not for their own good; however management should provide this with planning and budgets (Kotter, 1996, p. 91). At this moment the operational field cannot function with the current resources. Topics are even postponed due to a lack of resources. This delay eventually costs even more; it is better to finalize topics.

Many stakeholders want strategic management to be involved more and resources need to be provided. People loading on Factor 2 have stated 'Resources are currently insufficient for realizing CDM ideas'. People loading on Factor 1 ranked the statement 'Top management should be more committed to CDM' higher. Although the results from Q-methodology are less unanimous, experience learned (top) management is minimal committed. It is clear CDM is not top priority for top management when a meeting holds every two to three months is being cancelled. Apparently a burning platform with the urgency to implement CDM does not exist. They should then stop with CDM. However, the most agreed statement is 'Schiphol should not stop with CDM'. It is acceptable when no urgency exists, but this definitely does not improve decision making.

Therefore, another tactic is necessary to create commitment. Within the program the whole Steering Board (SB) has the final responsibility. However, this is shared by several people. In almost every structure in the world one person has the final responsibility; the president. It has been many years since the program started, but so far without success. This is because no one has the decisive vote. The only way to speed up the decision-making progress is to get them committed.

8.3.2 How

In the beginning of this research, it was thought that the three escalations layers were too much. Experience and theory showed the representatives are satisfying. However, still their tasks are not always clear. This should be understood better to make sure the same discussions do not appear within two different levels. It would be good to start with simple process mapping. They will only be committed to this vision if all layers are taken into account. Therefore, each layer should answer questions on the layer below, like: What will be the result for you? What do we expect from you? Which resources does he need? What should be changed in your position? Recommended is, to ensure a sustainable culture change, that the project group does this work in advance (in agreement with the IB). In this way, it is already clear what the preconditions are to make sure this organization change is possible at every level.

Although commitment from management is mentioned by many authors, in practice this turns out not to be the case. Within the decision-making layers there is not a person with the final responsibility. In every layer, an employee from AAS leads the meetings. However, this does not mean they have the final responsibility. In order to create commitment they should put a different party into power. They will probably not agree on who will get this responsibility. In many structure this responsibility changes over time, also, within politics. This is crucial to support decision making

because it is better accessible and the acceptance is greater. This power should be rotated between LVNL, AAS and KLM. Or it is possible to divide the program in different projects and put a responsible person on top. Finally, it is a program that can be divided into different projects. It has been tried to work with equal responsibility but this did not improve decision making.

8.3.3 Limitations

Only with a completely transparent process where everyone understands the importance of involvement within a burning platform it would have worked. Unfortunately this burning platform does not seem to occur. This tactic will meet the fundamentals of collaboration but in practice equal responsibility does not improve the decision-making process.

Creating responsibility will result in resistance, especially from the ones without this position. However, projects can be divided equally to minimize resistance. In any case, someone will have final responsibility and the power to force decisions. This is necessary to improve decision making within a multi-actor environment else it will go on forever without any success. Besides, resistance means the message came up to them. Even at this late stage it is better to know the problems than adopt a head-in-the-sand approach.

> With the furious pace of change in business today, difficulty to manage relationships sabotages more business than anything else – it is not a question of strategy that gets us into trouble, it's a question of emotions.
>
> John Kotter

8.4 Implication 3 Improving Communication

8.4.1 Why

When one common direction is created and everyone is committed, communication is necessary to improve decision making. All three implications can therefore be seen as following implications which are all necessary to improve decision making. Thousands of books are written on communication. Yet, it remains a difficult issue. As mentioned in the first implication frequent communication to the organization is necessary to pervade the vision. Without imprinting the vision to the rest of the organization no common direction will be reached. This should conjunct with the awareness of CDM, since the vision should include the urgency of CDM. The statement 'Better communication is necessary to increase the awareness of CDM' is the third most common agreed upon. It is ranked positive at all three factors and even ranked with an array factor +4 by the people loading on Factor 1. This topic was already identified as 'Challenge 7: Communicate'. However, the statement 'CDM should be the number 1 priority project at Schiphol Airport' has been ranked negatively. This, together with the current commitment, proves urgency must be increased.

8.4.2 How

It is clear that communication must be improved. This has been identified by the interviews as challenge 7 but verified as important by all respondents with Q-methodology. However, different ways of communication can be used. First, there is advised to simply ask more. When people will not ask questions, (wrong) assumptions are made. This turned out to be a problem in the program, wrong assumptions delayed the process. Everyone has expertise on his/her own processes and many tasks happen by experience. Therefore, they should not doubt another's professionalism, because they cannot see the overall picture. At the moment, individual pictures occur. For example, the meeting with Eurocontrol seemed very satisfying because they took away many concerns. Therefore, these specific meetings should be organized more often. Or at least communicate with them more frequently as well since they are not involved in one of the decision-making layers. They should definitely be involved when Schiphol wants to connect to the (European) network. They are key players within this topic.

Second, the urgency of CDM should be communicated better/different by the managers. Communication is strategized through information that might be available, but not shared. (De Bruijn & Ten Heuvelhof, 2008, p. 72). The power-interest grid provides a way of how to communicate to the stakeholders. Although no one wants to stop with CDM, due to the long duration, the sense of urgency decreases. It is therefore even more important to increase the awareness of the final implementation step. Based on the interviews there can be said some believe this maximum amount of benefits is already reached. However, most interviewees believe this is not the case, therefore urgency must be increased. A burning platform should be created where everyone experiences an urgency to make them committed. Everyone is able to work on CDM; however, complacency within the program should be abated.

The communication between the different layers should be improved. It occurred that, for example, people between the Implementation Board (IB) and the project team (BT) did not talk. Then the same discussion occurs in BT meetings and IB meetings. If they talk about the same topics one of the layers is superfluous, which is not the case. Recommended is to make a matrix, which shows what, to who, and how it will be communicated to the other decision layer.

Lastly, the group that requires special attention is the ground handlers. Most other groups seem to be informed quite well according to the interviews. They all indicate different benefits and tasks due to CDM. This also results from the Q-methodology because they (mostly defined under Factor 2), do not think CDM is urgent. This can also be concluded from the priority they give to CDM meetings. However, they also have to fulfill an important task as ground handler by providing the TOBT.

8.4.3 Limitations

Communication takes time. No one in the program has or creates enough time to spend on CDM tasks, as followed from the amount of resources. Besides the costs, hiring an external person for communication also takes time because this person has to be informed. Because of the duration of the program many people were involved. As concluding from the interviews as well as Q-methodology it is not appreciated to explain the program many times. Therefore, hiring external persons is not advised. Besides, frequent communication between management and their department will create consensus.

Awareness at the ground handlers' level has to be improved. This should be done by top management of the ground services, only then they will participate. Top management should show them that the sum of the shared information will be greater than the whole (De Bruijn & Ten Heuvelhof, 2008, p. 34). Although all communication takes time is necessary to succeed. Finally as mentioned in Section 4.7.1 Feedback costs time, but skipping someone/something will eventually remain in more time (Wallaert, 2009). Besides, communication ensures that stakeholders remain at the same level and will make a difference between involvement and resistance (Wallaert, 2009, p. 12).

> The main thing is to keep the main thing the main thing.
>
> Stephen Covey

Chapter 9 Conclusion

This research was executed to show how to deal with decision making in multi-actor environments and the challenges associated with it. The main research question was defined as follows:

How can challenges be successfully dealt with that occur during decision making in a multi-actor environment based on the CDM program?

As a result from this research it can be said that getting everyone to work in the same direction by letting top management make a vision would be a good start of a program to facilitate decision making. This research showed that everyone in the program is a proponent of CDM, but they sometimes simply do not how to move on. (Top) management should therefore motivate and inspire. It is important to create awareness, one direction and commitment. Next, this should be communicated to the rest of the organization. Although many actors are involved in the decision-making process someone needs to have the final responsibility. This tactic will meet the fundamentals of collaboration but in practice equal responsibility does not improve the decision-making process. This implication is therefore necessary to improve decision making within a multi-actor environment. Due to the many people involved it is important to first understand who is involved, followed by their interests and operational processes. It is also important to communicate frequently but it must be understood on how and whom to communicate. An extensive stakeholder analysis will simply help to understand this. However, creating a flexible and transparent process, dealing with mutual dependent relationships, dealing with technological uncertainty and evaluation of costs and benefits is experienced to be part of complex programs, but not the hardest challenges to achieve success. The hardest challenges within multi-actor environments deal with functioning of the top layers of the organization.

To get to this final answer a few sub-questions were answered as part of different steps within this research. Literature on projects complexity showed that there are many definitions of complexity and many influencing factors. Therefore the challenges occurring in the CDM program had to be identified first. This lead to the sub-question: *What are challenges that the CDM program faces?*

The identified challenges the CDM program faces are: 1) Getting everyone to work in the same direction, 2) Dealing with mutual dependent relationships, 3) Developing a flexible and transparent process, 4) Collaborate between decision-making layers, 5) Evaluate costs and benefits, 6) Dealing with technological uncertainty and 7) Communicate. This division of complexity was made by an iterative process of grounded theory with information gained from 18 interviews and a model from Hagan, Bower and Smith (2011) that showed the complexity of a socio-technical system. Despite the interrelation between al challenges the division of seven challenges makes the complexity of the CDM program comprehensible.

The division of complexity showed that cooperation between the many different companies and within different decision-making layers is one of the most challenging parts of the CDM program. The hierarchical decision structure based on the network makes the CDM program a unique but complex program. Not only they have to cooperate but they also have to take many different viewpoints and interests into account, without harming the others' value due to the mutual dependent relationships. This does not improve decision making. Therefore, a systematic fashion of the stakeholders and the

stakeholders' behavior, processes, interests and goals had to be made. This resulted in an answer on the following sub-question: *Which stakeholders are involved in the CDM program and how is their decision making influenced by their operational processes?*

Runway configuration and handling of more than 100 aircrafts an hour in peak moments make Schiphol Airport a complex airport for all planning people at Air Traffic Control the Netherlands (LVNL), Network Manager Eurocontrol, Royal Dutch Airlines (KLM), Ground Services (GS) and airport operator AAS. Many things influence the complexity of operation. One circumstance affects many planning systems. This contributes to difficult decision making between all actors. Besides, only when all actors are convinced implementation will be possible, so when for example LVNL does not think a procedure is safe implementation is postponed. The stakeholder analysis showed that the key players within the CDM program are pilots, KLM ATM, Schiphol Airline Operators Committee (SAOC), Duty Area Manager (DAM), other ground handlers, MT OPS, Apron planning and control, start-up controllers, NMOC (Eurocontrol). The only important stakeholder group that is not involved within one of the three decision-making layers is the start-up controller. When the topic is about linking to the (European) network Eurocontrol should be involved as well.

The challenges cover the overall complexity of the program. However, the mentioned statements in the challenges can still be taken individually and not felt by all stakeholders. Because this program is all based on collaboration it is good to get the collective perspective on CDM. Therefore, the opinion on CDM was checked by the stakeholders. This was done with Q-methodology, a technique to study common perspectives of a group of people. In the end 28 people ranked 43 statements related to the seven identified challenges. These 28 people were all involved and/or affected by CDM. These were people from AAS, KLM Hub Control Center (HCC) and KLM Operations Control Center (OCC), LVNL, SAOC and GS and people from the decision-making layers project team (BT), Implementation Board (IB) and Steering Board (SB). With this, the sub-question *'What are different and similar perspectives on CDM according to the stakeholders?'* could be answered.

This resulted in three factors that show the perspective of 24 out of the 28 people. The first perspective can be described as 'The optimistic and closely involved manager'. Fourteen participants are significantly associated with this factor. The majority of AAS, KLM, LVNL and KLM OCC and the project team (BT) load on this factor. The most important statements for people within this perspective are based on the close collaboration of the stakeholders since all actors are mutually dependent. Improvement of communication is important because implementation of CDM is urgent. The difference with other perspectives is the involvement of top management. People within Factor 1 believe CDM should be implemented top-down, top management should make a vision and more resources should be provided. Whereas the people within Perspective 2 totally believe CDM should be implemented bottom-up. Creativity and knowledge of the specialists should be taken into account more. According to people loading on Factor 2, implementation of CDM is less urgent because it only results in benefits when all airports have implemented it. Delays are mostly caused by the ICT infrastructure at Schiphol Airport and the availability for specialists to express their expertise. These people are still a proponent of CDM but only under certain conditions. Five people from the operational field, especially the majority of Ground Services, have loaded significantly on Factor 2, called 'The omnipotent and independent specialist'. Notable is the fact that Perspective 2 is most carried by the Implementation Board (IB) whereas the BT, who at first glance appear to be more operational, does not load on Factor 2 at all. The last factor, Perspective 3 'The collaborating

manager', is quite similar to Factor 1. However, the importance of strong leadership has been left in the middle. The importance of collaboration and cooperation, having one common goal and the results of CDM are most important. They believe the processes will be greater by far compare to the current processes and together they will help to bring Schiphol Airport to a higher level. The high correlation between Factor 1 and 3 shows a large part is common perspective. A few employees from AAS, KLM HCC, LVNL, GS, BT and IB load on this factor.

The complexity of the CDM program showed it is not that easy to start implementation once a decision has been taken. The extra aspect of the CDM program is that all actors simultaneously have to cross the line before implementation can start. Therefore, the topic is about decision making for the last 10 years, whereas implementation is pushed forward. The amount of effort put in the program has almost resulted in a point of no return. This can be concluded from the statement 'Schiphol should stop with CDM', which was given the most negative degree by almost all participants. Nevertheless, the question arose if all actors were satisfied with the outcome or if they only cooperated because they will need the other actors in the future and do they not want to block the package deal? From the Q-methodology can be concluded that despite some grumbling everyone sees the benefits of CDM. Everyone understands that there are not only benefits, but the advantages outweigh the disadvantages. Sharing information transparent does not seem to be a problem. Mainly benefits are created and due to the fact it is all about operational information and not commercial everyone is willing to cooperate. Most employees do not believe jobs will be issued, so this cannot harm decision making.

To deal with this, they are advised to organize a meeting or workshop were top management (SB) formulates a vision. An external and independent person should guide this meeting to identify the overlap between the different interests. With this vision they must getting everyone to work in the same direction and inspire the rest of the organization. Management (IB) should provide this with planning and resources. A representative of each company is involved in one of the decision-making layers. However, no one has the final responsibility. This is necessary to improve the progress. In order to create commitment they should put a different party into power. This power should be rotated between LVNL, AAS and KLM to increase accessibility and acceptance. Also much attention needs to be paid to the improvement of communication. Fewer assumptions need to be made by asking more questions. Special attention needs to be paid to the ground handlers in order to increase their awareness. Thereby the last sub-question has been answered *'What are managerial implications to improve decision making within the CDM program?'*

Before the start of this research a gap between knowledge and design occurred. This research is based on a very unique program with hierarchical escalation layers based in a network. New aspects of decision making have emerged from this study. This research showed that Q-methodology could be used as a useful method to verify own observations based on the stakeholders. This does not only create consensus but also the most important topics can be indicated. Topics that are ranked much different between the respondents will probably result in resistance within decision making. This knowledge can be used to tackle challenges occurring when decision making in multi-actor environment. Thus said, the steps of indicating challenges followed by verifying these with Q-methodology is a useful way to deal with challenges that occur during decision making in a multi-actor environment. With this the main objective:

To show multi-actor organizations how decision making can be improved by taking stakeholders perspectives into account.

is achieved.

Chapter 10 Recommendations for Further Research

This research studied potential challenges that occur in multi-actor environments. The findings of this research are relevant for the business sector and interesting for science. However, they are also bound to some limitations that imply grounds for further research. In this chapter recommendations for further research are provided.

This research first showed a way to divide complexity based on interviews. Therefore, the model from Hagan, Bower and Smith was used as theory and inspiration. This method can also be applied at other programs, in the same as well as other industries. Since no single description exists there is no right way to divide complexity. However, only one model is used as inspiration for a division whereas there would be advised to investigate more models. Generally, more data could be gathered by repeating the Q-methodology interviews in a broader audience, in order to find more significant relations between the different companies and decision-making layers. No attention is paid at demographics within this research. Influences of different demographics on decision making could also be further investigated.

Specifically for the CDM program it would be advised to check the decision-making layers at other European (CDM) airports. So far, only experience from Aéroports de Paris learned they had commitment. Experience from other airports on decision making within the CDM program could be useful.

Furthermore, this research is focused on only one program. It would be advised to apply the same methods on more cases to check whether this will lead to corresponding challenges. This research showed one of the hardest challenges in complex programs is the start of the program. Case studies with successful decision-making processes should therefore be investigated. Another result is the importance of leadership. Commitment from (top) management, autonomy, and one direction are very important. These topics could be related to a hierarchical organization according to literature (De Bruijn & Ten Heuvelhof, 2008). However, the CDM program is a unique program whereas the hierarchical escalation layers formed out of a network. According to De Bruijn and Ten Heuvelhof an organization features both of a network and hierarchy is a hybrid organization. However, programs with a hierarchical structure based on the network with mutual dependent relationships are not mentioned. More research on unique programs like the CDM program would be advised.

Lastly, although it did not appear to be the hardest challenge it would be interesting to check the influence of the mutual dependent relationships. This could be done by investigating a project within the construction industry which usually does not have mutual dependent relationships. After this a statement could be made if the construction industry could still be seen as the most complex industry.

Chapter 11 Reflection

This chapter is the final chapter of this master thesis. It reflects on the theory and methods used during this research and the process of this research.

11.1 Reflection on Theory of Complexity

Much literature exists on the topic of complexity, change management, stakeholder engagement, and process and project management. It should be mentioned that the starting point of this research was to identify the bottlenecks occurring in decision making. During the research many bottlenecks appeared to be causing difficult decision making which were hard to explain as a whole. The model from Hagan, Bower and Smith showed a fundamental division for complexity. However, there is no single way to describe complexity. Many characteristics of complexity stem from the construction industry. These can also be related to other projects. Although characteristics of complexity are explained comprehensive, fewer examples could be found on how to apply this to complex programs in other industries. A program is a paramount objective for many projects and therefore even more complex than a single project. No information could be found on how to deal with program's complexity like the CDM program. The research shows a method on how to understand a complex program by dividing it into several challenges. From this perspective, this research is a valuable addition to the literature. It provides an example of understanding complexity which is not related to the construction industry.

Another theoretical addendum is the method of verification. Many authors mentioned that the way of describing complexity depends on the researcher. To get a more objective description on complexity Q-methodology is used. Despite the fact Q-methodology has not been used as a verification method prior this research, it is also a good method to involve the stakeholders. Within a multi-actor environment the many stakeholders do not only have to deal with parts of complexity but are also causing a large part of the occurring complexity. This research shows the scientific contribution of Q-methodology as an innovative method for verification.

11.2 Reflection on Methodologies

This research project started with a literature study to get a basic understanding of challenges to face when implementation is necessary. In the beginning the direction of the thesis was not totally clear therefore much literature was read. With the help of my supervisors the direction of this thesis became clearer along the way. The most difficult part of this thesis was the process of defining the challenges. By an iterative process it took quite some time to get to the seven challenges, including the link with the model from Hagan et al.

The choice of doing interviews is considered to be a good choice. Due to the interviews I already got a lot of useful data in the very beginning without even knowing this. It started as exploratory study and to get to know the people from the CDM program. However, information gained during these interviews appeared to be very useful information. I was welcomed with open arms by all the people I have interviewed.

Before I have started this research, I read about Q-methodology. This method seemed very interesting which convinced me to use Q-methodology during my thesis. I am glad I choose Q-methodology as method; I would have never thought it to be so useful for this research. The book of Watts and Stenner taught me the theoretical and practical concept of Q-methodology. For everyone using Q-methodology I would recommend to use their book. Besides, Q-methodology appeared to be an interesting and pleasant method by the respondents. Feedback from the respondents showed positive results about this method. Filling in Q-sorts was experienced as a new, fun, interesting and interactive way of interviewing.

This combination of methodologies shows its value in supplement and substantiates each other's conclusions. When only the interviews would have been used, verification on the observations would lack. On the other hand, when only Q-methodology was used, fewer setbacks would have been identified. Besides, a theoretical background functioned as inspiration and as stepping stone for the managerial implications. In addition, based on the combination of these methods, the research questions could be refined.

11.3 Reflection on my Process

Overall, I would say that the research process went quite smoothly. It took some time to understand how CDM works. Still, this is not totally clear to me because every time during meetings new topics appear. The CDM program is a very complex program, with many underlying technological systems. During this research I have not focused on the technical systems which are still hard to understand. Luckily, I did understand the organizational complexity quite decent.

During my research at the Schiphol Group I was present at the Thursday meetings. This meant that I almost every Thursday made the minutes of the project team (BT) and the Implementation Board (IB). Hence, I could never work on my report on Thursdays but being part of the team resulted in greater benefits. In the beginning of my research we had a fun trip to Amsterdam with the project team. Hereby, I got to know the members of the team. But also the other members got to know each other in a social surrounding which was very good for the team effort. I admit making minutes is not my favorite activity, however, by doing this I received much more in return. I have learned a lot during the meetings and being so closely involved in the team was a great and unique opportunity as a graduate student. In return, everyone was more willing to help me with my interviews.

Still, the main hurdle in this project was the interviews. Because I wanted to finish this thesis before September I could not wait months to do all the interviews. A tight schedule is necessary; luckily that is one of my specialties. However, being dependent on many other busy schedules did not improve this. Therefore much pressure was put on arranging the statements on time. However, if I would have had more time I would have interviewed more people from the Steering Board and LVNL.

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