



Air Traffic Control the Netherlands



Delft University of Technology

TRUST IN THE DUTCH AVIATION SECTOR

Design of a game to support trust building

M.Sc. Thesis

Henk de Vries
September 2008

Delft University of Technology
Faculty of Systems Engineering, Policy Analysis & Management

TRUST IN THE DUTCH AVIATION SECTOR

Design of a game to support trust building

Author: Henk de Vries

Email: H.J.deVries@student.tudelft.nl

Student number: 1097989

Graduation committee:

Prof. dr. ir. A. Verbraeck (Chair)

Dr. Ir. G.L. Kolfshoten (First supervisor)

Dr. A.C. Fernandes da Costa (Second supervisor)

Drs. R. Dubbeldam (Supervisor LVNL)

PREFACE

This report is the result of my master thesis project for the master System Engineering, Policy and Management at the faculty of Technology, Policy and management of Delft University of Technology.

I conducted my research project at Air Traffic Control the Netherlands (LVNL) between February and September 2008. Conducting my research at LVNL has been fun and provided me with a lot of documents and insight information I would not have been able to retrieve otherwise.

Over forty people have contributed to my research project in some way or another. First of all I would like to thank the members of my graduation committee: Prof. dr. ir. A. Verbraeck, Dr. Ir. G.L. Kolfshoten, Dr. A.C. Fernandes da Costa and Drs. R. Dubbeldam. They have helped getting and keeping me on the right track. Thank you.

Further, I would like to thank the people that have been willing to give up their time for participating in an interview or one of three game sessions. Also, I would like to thank Casper Hartevelde, Armand Jongen, David van 't Hof, Hans Wrekenhorst and all colleagues at LVNL for constructive comments and ideas which helped me to conduct my research.

Finally, I would like to thank Jolien for her comments, support and love and my parents who have kept supporting me throughout my study.

Henk de Vries

Delft, 9 september 2008

SUMMARY

To accommodate a continuous growth in air transport demand, since the 1990's, the European aviation sector has increasingly focused attention on Collaborative Decision Making (CDM). In the Netherlands CDM has been initiated at Schiphol Airport in 2003. The aim of this CDM program is “to realize a more efficient whole of flight processes on the day of operation where the passenger, the control of traffic flows and the efficient use of resources are key”. The organizations that participate in the CDM program at Schiphol Airport consist of the three key players of the Dutch aviation sector: Amsterdam Airport Schiphol (AAS), Royal Dutch Airlines (KLM) and Air Traffic Control the Netherlands (LVNL).

The participating organizations are highly interdependent for the success of the CDM program. Further, CDM requires the sharing of information, which maneuvers organizations into vulnerable positions. In a network where organizations are highly interdependent trust is an important factor. Trust reduces the risk of opportunistic behavior, leads to improved communication, higher commitment, and is important for reaching efficiency benefits within the network. Furthermore, trust leads to cooperative and constructive behavior.

Within the CDM program AAS, KLM and LVNL are looking for means to improve trust between their organizations. The aim of this research report is to present a design of an approach to support trust building within the Collaborative Decision Making program in the Dutch aviation Sector. The main research question is: *How can trust building be supported within the Collaborative Decision Making program in the Dutch aviation sector?*

To answer this research question first the research problem has been explored. Secondly, an exploration has been made of the role of trust within the CDM program. Thirdly, a decision for an approach to support trust building has been made. Fourthly, a design has been made that supports trust building.

The problem exploration consisted of a detailed problem description and a review of relevant literature. This has resulted in a focus of the research on one of the CDM projects at Schiphol Airport, the collaborative pre departure sequence planning (CPDSP).

The role of trust with the CDM program has been explored by conducting interviews with operational employees from AAS, KLM and LVNL that are involved in the pre departure sequence. The interviews have shown that trust plays an important role in CDM in the Dutch aviation sector. Although trust has developed among a relatively small group of employees that participate in the CDM program, it still needs to be developed among a large group of employees that is not actively involved in CDM. Further, the interviews have shown that to improve trust within the CDM program openness is especially a key factor that needs to be stimulated. Therefore, the research has further been focused on the stimulation of openness to support trust building within the CDM program.

To see which approach is most suitable for the stimulation of openness between AAS, KLM and LVNL the suitability of twelve approaches has been discussed. The discussion indicated that gaming is the most suitable approach for stimulating openness. Games can be used to stimulate openness between participants because it enables people to broaden their horizon and thereby creating an understanding of each others decisions

and actions, it enables the sharing of experiences, and it creates interaction. By using games people have the opportunity to go through multiple cycles or scenarios, which creates the opportunity of accumulating knowledge. Further, a game enables participants to see the consequences of their actions on other organizations. Therefore, the decision has been made to design a game for the stimulation of openness between AAS, KLM and LVNL.

The game has been designed by using the game design method of Duke (1981). This method consists of four phases: initiation, design construction and use. During the initiation phase requirements for the game have been identified. These requirements can be divided over four categories: requirements that ensure that earlier defined mechanisms for reaching the desired level of trust are present in the game, requirements that ensure that characteristics of the operational processes of the pre departure sequence are present in the game, requirements that enhance the positive effects of using games, and practical requirements for the game.

The design phase consisted of constructing a conceptual design by going through an iterative process of design and discussion. This was followed by the construction phase which consisted of an iterative process of construction, testing and evaluation. Furthermore, the design and construction phase together also constituted an iterative process where during construction feedback was provided to the conceptual design.

The evaluation of the game occurred during a game session with operational employees of KLM and LVNL. Unfortunately no employees from AAS could be present. The game has been evaluated based on two kinds of data retrieved from the session: a report of the game session including the discussion among the participants and a questionnaire completed by the participants. The game session report and the results of the questionnaire showed a positive evaluation of the requirements related to the stimulation of openness.

Further, the data from the evaluation session indicates that the game supports the development of trust among the participants by letting the participants cooperate, communicate and discuss with each other. This made the game session a positive experience for the participants which supports trust building among them. The development of trust among the organizations is stimulated through the development of trust among the participants and through the lessons learned during the game session. The lessons learned increase the awareness of the importance of openness for the success of CDM. Although, increasing the awareness does not directly lead to a change in working processes it can provide a basis for developing trust among the organizations. However, additional measures might be necessary to ensure a further development of trust and openness between AAS, KLM and LVNL.

The research has indicated that trust building can be supported within the Collaborative Decision Making program in the Dutch aviation sector by stimulating openness through the use of gaming. Within the aviation sector openness is one of the key factors for improving trust between the involved organizations. There is a strong indication that the game “Mine Rescue” stimulates the creation of openness between AAS, KLM. The game stimulates trust building by increasing the awareness of the importance of openness as well as through creating a positive experience for the participants.

TABLE OF CONTENTS

PREFACE	4
SUMMARY	5
TABLE OF CONTENTS.....	7
PROBLEM EXPLORATION	
1 INTRODUCTION	9
2 PROBLEM DESCRIPTION	12
2.1 THE DUTCH AVIATION SECTOR	12
2.2 THE CDM PROGRAM.....	13
2.3 RESEARCH FOCUS – COLLABORATIVE PRE DEPARTURE SEQUENCE.....	15
2.4 ORGANIZATIONS IN THE DUTCH AVIATION SECTOR.....	17
2.5 CONFLICTS OF INTERESTS.....	19
3 RESEARCH QUESTIONS AND METHODS	20
3.1 RESEARCH QUESTIONS.....	20
3.2 RESEARCH METHODS	21
3.2.1 THE CURRENT ROLE OF TRUST	21
3.2.2 TOOL DEVELOPMENT.....	22
4 LITERATURE REVIEW	24
4.1 NETWORKS OF ORGANIZATIONS.....	24
4.2 COOPERATION	25
4.3 TRUST.....	26
4.4 TRUST BUILDING.....	29
4.5 CONCLUSION.....	32
RESEARCH PART I: EXPLORING THE ROLE OF TRUST	
5 THE ROLE OF TRUST	34
5.1 ANSWERS TO RESEARCH QUESTIONS	34
5.2 CONCLUSION.....	41
RESEARCH PART II: DECISION, DESIGN, EVALUATION	
6 TOOL DECISION	44
6.1 PURPOSE	44
6.2 STRATEGIES.....	44
6.3 APPROACH	45
6.4 CONCLUSION.....	48

7	THE GAME.....	49
7.1	GAME DESIGN METHOD.....	49
7.2	GAME DESIGN PROCESS.....	50
7.2.1	INITIATION PHASE.....	50
7.2.2	DESIGN PHASE.....	52
7.2.3	CONSTRUCTION PHASE.....	60
8	EVALUATION.....	74
8.1	APPROACH.....	74
8.2	RESULTS.....	76
8.3	DISCUSSION.....	80
8.4	IMPLEMENTATION.....	82
9	CONCLUSIONS.....	84
9.1	RESEARCH QUESTIONS PART I.....	84
9.2	RESEARCH QUESTIONS PART II.....	85
9.3	MAIN RESEARCH QUESTION.....	87
9.4	RECOMMENDATIONS.....	88
	REFERENCES.....	89
	APPENDIX A: INTERVIEW PROTOCOL.....	94
	APPENDIX B: CAUSAL-RELATIONS DIAGRAM.....	97
	APPENDIX C: GOAL TREES.....	99
	APPENDIX D: PROCESSES PRE DEPARTURE SEQUENCE.....	102
	APPENDIX E: INTERVIEWS.....	106
	APPENDIX F: REPORTS GAME SESSIONS.....	107
	APPENDIX G: ABBREVIATIONS.....	114
	APPENDIX H: EVALUATION FORM.....	115
	APPENDIX I: RESULTS EVALUATION FORMS.....	116

1 INTRODUCTION

The demand for air transport in the Dutch aviation sector has grown rapidly over the last decade and is expected to continue to grow in the future. In the Netherlands most of the air transport is accommodated by Schiphol Airport. The number of aircraft movements per year at Schiphol Airport has grown from about 360.000 in 1997 to about 450.000 in 2007 (CBS StatLine, 2008). Furthermore, the number of aircraft movements per year at Schiphol Airport is expected to grow to 480.000 in 2010 and even to 600.000 in 2020 (Schreuder, 2007).

The Dutch aviation sector is a network of organizations that consists of about 600 companies which can be divided into different categories: airports, airlines, air traffic control, industry, government bodies and interest groups. Amsterdam Airport Schiphol (AAS), Royal Dutch Airline (KLM) and Air Traffic Control the Netherlands (LVNL) are the largest players within their respective category and together they constitute the core of the Dutch aviation sector (Commissie Tarieven Divisie Luchtvaart, 2004; Ministerie van Verkeer en Waterstaat, 2005; Project Mainport Schiphol, 2005).

To be able to accommodate the continuous growth of air transport demand there is a need for the organizations in the Dutch aviation sector to optimize their combined processes, especially at Schiphol Airport. For this purpose, in 2003 AAS, KLM and LVNL together initiated a program for Collaborative Decision Making (CDM) (AAS, KLM, & LVNL, 2005a). The CDM program has been initiated to target daily disruptions in the value chain. These disruptions lead to a declining reliability of Schiphol Airport as a hub, non-optimal use of resources and a less efficient operation (AAS, KLM, & LVNL, 2004). The aim of the CDM program is to “realize a more efficient whole of flight processes on the day of operation where the passenger, the control of traffic flows and the efficient use of resources are key” (AAS, KLM, & LVNL, 2003). The CDM program is based on the improvement of mutual understanding, gaining knowledge about each other and improving the sharing of information and procedures (AAS, KLM, & LVNL, 2007a).

AAS, KLM and LVNL closely cooperate within the CDM program at Schiphol Airport. The cooperation requires an effort of each participating organization, however, the organizations have differing interests, and this might lead to conflicts, rivalry and negative attitudes towards one another. As a consequence of rivalry there is a risk that one of the organizations behaves opportunistically at the cost of other organizations in the network. In the CDM program at Schiphol Airport cooperation of all organizations is of key importance for success. Rivalry resulting in opportunistic behavior will lead to failure of the CDM program which would be counterproductive for all involved organizations. Therefore, if AAS, KLM and LVNL want the CDM program to be a success they have to deal with the differing interests and adopt a cooperative attitude (Wit, Meyer, & Breed, 2000). Further, to deal with the risk of opportunistic behavior the organizations have to trust each other to refrain from opportunistic behavior.

In CDM organizations highly depend on each other for success. Further, CDM requires the sharing of information, which maneuvers organizations into vulnerable positions. In a network where organizations are highly interdependent trust is an important factor. Trust reduces the risk of opportunistic behavior, leads to improved communication, higher commitment, and is important in reaching efficiency benefits in a

network. Furthermore, trust leads to cooperative and constructive behavior (Axelrod, 1984; Barney & Hansen, 1994). Therefore, trust is an important factor and prerequisite for realizing CDM (AAS, KLM, & LVNL, 2005b).

AAS, KLM and LVNL recognize that trust is an important factor for realizing CDM. Therefore, they are looking for means to improve trust between the organizations involved in the CDM program. The aim of this research report is to present a design of an approach to support trust building within the Collaborative Decision Making program in the Dutch aviation sector.

To arrive at a design it is first necessary to explore the current role and functioning of trust between AAS, KLM and LVNL within the CDM program at Schiphol Airport. Second, based on the exploration a decision for an approach will have to be made. Third, a design will have to be made that supports trust building.

The structure of this report can be divided into three parts: problem exploration, research part I, and research part II.

The problem exploration consists of a problem description, research questions and methods and a literature review. The problem description is provided in chapter two and consists of an overview of the Dutch aviation sector, the CDM program at Schiphol Airport, and the most important organizations and their interests. Furthermore, in chapter two the research will be more focused on a part of the CDM program. In chapter three relevant literature on networks of organizations, cooperation, trust and trust building will be reviewed and applied to the cooperation of AAS, KLM and LVNL within the CDM program at Schiphol Airport. Chapter four presents the research questions and research methods.

The second part of the report is the research part I which consists of interviews with employees from AAS, KLM and LVNL. The results of these interviews are presented in chapter five.

The third part of the report is the research part II which consists of a decision, presented in chapter six, for an approach or tool that will be designed to support trust building within the CDM program. Further, chapter seven describes the actual design process and the final design. Chapter 8 discusses the evaluation of the design.

Finally, chapter nine provides the conclusions of the report.

TRUST IN THE DUTCH AVIATION SECTOR

PROBLEM EXPLORATION

2 PROBLEM DESCRIPTION

The Dutch aviation sector needs to accommodate the continuous growth in air transport demand. For that purpose, amongst others, AAS, KLM and LVNL have set up a program for Collaborative Decision Making (CDM). Further, they want to build trust among their organizations because trust is a prerequisite for the success of CDM.

Before being able to design an approach to support trust building within the CDM program in the Dutch aviation sector it is first necessary to have an overview of the aviation sector and the structure of the CDM program. Therefore, in this chapter the Dutch aviation sector, the positions of AAS, KLM and LVNL within the sector and the CDM program at Schiphol Airport are described. Further, a profile of AAS, KLM and LVNL and their interests will be provided. Based on these interests possible conflicts of interests which pose a threat to the development of trust will be discussed.

2.1 THE DUTCH AVIATION SECTOR

The Dutch aviation sector consists of about 600 different companies. These companies can be categorized into seven sub sectors: airports, large aviation, general aviation, small aviation, training centers and simulators, maintenance and construction industry, and airspace (Commissie Tarieven Divisie Luchtvaart, 2004).

In 2007 there were a total of 645.519 aircraft movements from or to Dutch airports. These movements are divided over five airports: Schiphol Airport, Rotterdam Airport, Eindhoven Airport, Maastricht Aachen Airport, and Groningen Airport Eelde. Table 1, provides an overview of the division of aircraft movements from and to Dutch airports (CBS StatLine, 2008).

Airports	Aircraft movements
Amsterdam Airport Schiphol	454354
Groningen Airport Eelde	85724
Rotterdam Airport	65529
Maastricht Aachen Airport	23208
Eindhoven Airport	16704
Total Dutch Airports	645519

Table 1: Aircraft movements Dutch airports (CBS StatLine, 2008)

With more than 70 percent of all aircraft movements in the Netherlands Schiphol Airport is by far the largest Dutch airport. A distinction must be made between mainport Schiphol, Schiphol Airport, and Amsterdam Airport Schiphol. Mainport Schiphol concerns all economic activities which are directly or indirectly related to Schiphol Airport. Schiphol Airport consists of the infrastructure which accommodates air traffic. Amsterdam Airport Schiphol (AAS) is the airport operator at Schiphol Airport and is part of the Schiphol Group. Mainport Schiphol is important for the Dutch economy as it contributes about two percent to the Gross National Product. Currently more than 61.000 people are working at mainport Schiphol (Regioplan, 2008).

Royal Dutch Airlines or KLM is by far the largest airline company of the Netherlands. KLM is part of the SkyTeam airline alliance and has its home base at

Schiphol Airport. Together with its SkyTeam partners KLM accounts for about 65 percent of total air traffic at Schiphol Airport (KLM, 2007). In the year 2006/2007 KLM has achieved a total number of more than 72,000 million passenger-kilometers for passenger traffic and more than 4,800 million ton freight-kilometers for cargo traffic. Further, KLM employs more than 30.000 fte's.

Air Traffic Control the Netherlands is responsible for all civil air traffic within the civil airspace of the Amsterdam Flight Information Region (FIR) which stretches over Dutch territory and a large part of the North Sea. Further, LVNL also provides air traffic services at Schiphol Airport, Rotterdam Airport, Groningen Airport Eelde and Maastricht Aachen Airport (LVNL, 2007a).

The Dutch aviation sector consists of a large number of organizations. The three largest and most important organizations are AAS, KLM and LVNL. Further, often when authors refer to the Dutch aviation sector they refer to these three organizations. (Koning, Verkade, & Hakfoort, 2002; Schiphol Group, KLM, & Luchtverkeersleiding Nederland 2005).

2.2 THE CDM PROGRAM

Collaborative Decision Making has been an issue within the European aviation sector since the end of the '90s. During the '90s several initiatives have been deployed by the European Civil Aviation Conference (ECAC) Transport ministers to enhance the capacity and efficiency of the European aviation sector. Examples of these initiatives are the European Air Traffic Control Harmonization and Integration Program (EATCHIP) and the Airport / Air Traffic System Interface (APATSI). Although these initiatives were successful they were overtaken by the continuing growth in demand for air transport. Therefore, there was a need to come up with new strategies which would supersede the previous initiatives. At the request of the Transport ministers strategies were developed for the Years 2000+. One of the main strategies that has been developed was Collaborative Decision Making. The development of CDM in Europe was also stimulated by positive experiences with CDM in the United States where it has been implemented at all U.S. airports since 1998. Since the year 2000 several European airports have engaged in trials with CDM (Euro-cdm, 2008; Eurocontrol, 2006b).

The CDM program at Schiphol Airport has been initiated in 2003, following a decision in 2002 by the "Operationeel Schiphol Overleg", consisting of the Chief Operation Officers of AAS, KLM and LVNL. The aim of the CDM program at Schiphol Airport is "to realize a more efficient whole of flight processes on the day of operation where the passenger, the control of traffic flows and the efficient use of resources are key". Following the initiation of the CDM program AAS, KLM and LVNL have formulated a vision on CDM at Schiphol Airport (AAS, KLM, & LVNL, 2005a). In this vision two definitions for CDM in Air Traffic Management are provided. The first definition is: "*Collaborative Decision Making is a concept in which the stakeholders collaborate to achieve overall operational enhancements, taking into account the objectives of each stakeholder*". The second definition is a more practical one: "*Collaborative Decision making (CDM) is about improving the way air traffic management, airlines and airports work together at an operational level. It means*

putting power in the hands of the people best placed to take decisions” (AAS, KLM, & LVNL, 2005a; Euro-cdm, 2008).

The CDM program at Schiphol Airport approaches the operational processes as a value chain. Each process in the chain adds value, and success is measured as the performance of the total chain. If each organization would benefit equally from an optimization of the value chain then optimization would be reached easily by optimizing all sub-processes. However, in general the benefits of optimization are not equally distributed. In terms of money for the CDM project the airlines are expected to benefit the most, followed by the airport, ATC will benefit the least (Eurocontrol, 2007).

CDM components

The CDM program at Schiphol Airport distinguishes five components of CDM. The first component is understanding each others' processes and the type of decisions that have to be taken within those processes. This includes knowledge about the organization in the decision process and the required timeframe.

The second component is sharing information that is important for the decision process. An important aspect of the shared information is that each recipient understands the data-definition and accuracy of the data. Information is not to be withheld, even if it is feared that it may trigger a decision that is not beneficial for the organization that is providing this information.

The third component is using the shared information and the knowledge about the processes in the value chain to take decisions that result in the best overall result. All organizations should agree on the performance indicators for the overall process so that data analysis and forecasting methods can be used to support the decision making process.

The fourth component is acceptance of a new paradigm or mindset by all organizations, aimed at improving the efficiency and quality of the total value chain instead of just improving the efficiency of the process of one player.

The fifth component is that continuous interaction between the organizations will probably remain the most vital underlying element of the CDM approach as the processes of all main organizations in the air transport process are still managed by human operators. This also calls for the involvement of operational personnel during the definition phase of any new CDM concept (Baroni & Weder, 2005).

Involved organizations

The CDM program at the Schiphol Airport involves the organizations presented in Figure 1: Air Traffic Control, Aircraft Operators, Airport Operations, Ground Handlers and the Airspace and Flow Management Unit. The boundaries of the local CDM cell are equal to the boundaries of the Amsterdam FIR. Within the local CDM cell a division is made between ground and air. In this research project the ground processes of the Schiphol CDM cell are the object of investigation. On the ground there is communication between the aircraft crew, the KLM Hub Control Centre (HCC), the KLM Operational Control Centre (OCC), AAS, Air Traffic Control (Tower/Approach), and the ground handlers.

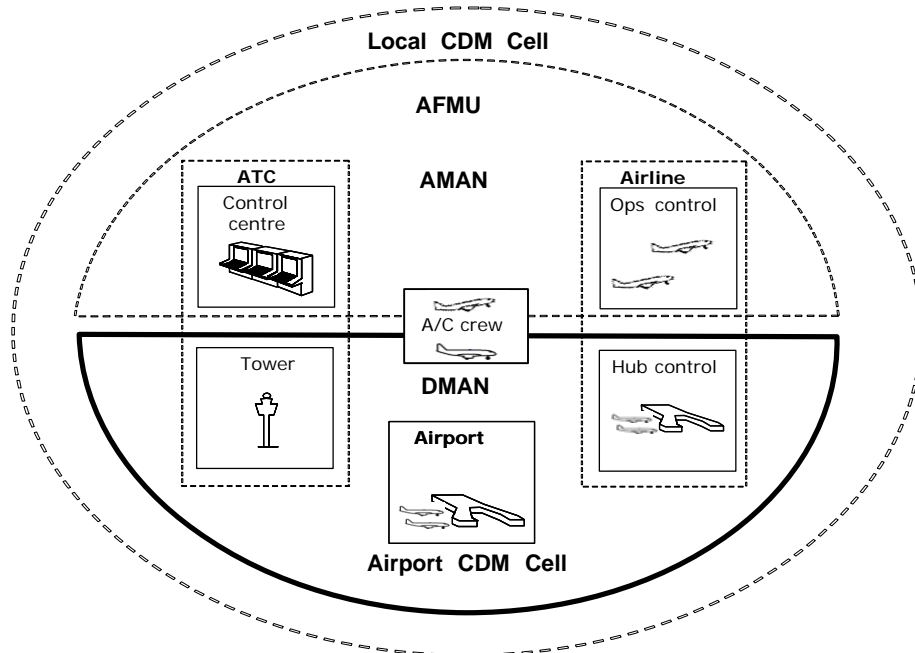


Figure 1: Organizations involved in airport operations and CDM (AAS, KLM, & LVNL, 2005a).

Advantages of CDM

CDM involves several expected advantages for each participating organization. For ATC the expected benefits are: a flexible pre departure planning, reduced apron and taxiway congestion, and a smooth flow of traffic that eases air traffic controllers' workload. For aircraft operators the expected benefits are: a daily program of flight operations and turn-round times on schedule, possible schedule disruptions predicted early, thus managed efficiently, preferences and priorities taken into account, fuel and time savings with reduced taxi and holding time. For airport operations the expected benefits are: increased departures and arrivals punctuality and airport slot adherence, efficient use of infrastructure i.e. stands and gates, accelerated operational recovery in adverse conditions or other disruptions, reduced environmental nuisance e.g. emissions and noise. For ground handlers the expected benefits are: enhanced punctuality of operations, maintaining Service Level Agreements and optimized resource management (Eurocontrol, 2003).

2.3 RESEARCH FOCUS – COLLABORATIVE PRE DEPARTURE SEQUENCE

Within the CDM program at Schiphol Airport five projects are conducted: CDM Information Storing & Processing (P1): the flight information needed for CDM is centrally processed and stored by AAS. The CDM Milestone Approach (P2): which (flight) information is CDM, how should that information for inbound and outbound flight be connected and which procedures will be used. The outbound planning or Collaborative Pre departure Sequence Planning (CPDSP) (P3): in this project it is determined how an off-block planning can be made based on the information of the

airport operators, airline operators and air traffic control. CDM Information Sharing (P4): all organizations are provided with CDM flight information by AAS. This project will realize the necessary interfaces. CDM portal (P5): realizing the CDM decision support tool. This is a website where all information for CDM can be found. It will be accessible for all involved organizations (AAS, KLM, & LVNL, 2007a).

The focus of the research will be on trust between the airlines and air traffic control during the collaborative pre departure sequence, P3. The main objectives of the collaborative pre departure sequence are to enhance flexibility, improve punctuality, improve slot adherence, improve transparency, improve ground handling efficiency, and improve stand and gate management (Eurocontrol, 2006a).

Processes

The pre departure sequence consists of a number of different processes. Figure 2 provides a high-level overview of the input, output, people and systems involved in the five main processes of the pre departure sequence. Figure 2 is based on the “Voorschriften Dienst Verkeersleiding” or Regulations Air Traffic Control for Schiphol Tower/Approach (LVNL, 2008b). A more detailed overview of all processes can be found in appendix D.

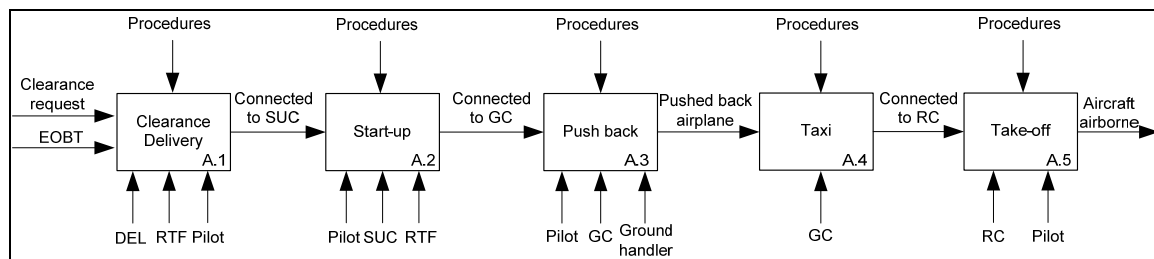


Figure 2: Overview pre departure sequence

The pre departure sequence consists of five main processes: Clearance Delivery, Start-up, Push back, Taxiing and Take-off. During Clearance Delivery a pilot requests clearance at the Delivery Controller (DEL) of ATC. Based on amongst others the Estimated Off Block Time (EOBT) the DEL then provides clearance and provides a Calculated Take Off Time (CTOT) and Target Start-up Approval Time (TSAT). When the pilot has confirmed the clearance he switches to the frequency of Start-up Control.

During start-up the pilot requests start-up approval at the Start-up Controller (SUC) of ATC. When approved the pilot can execute start-up of the aircraft and switch to the frequency of Ground Control.

During the push back process the pilot requests push back approval at the Ground Controller (GC) of ATC. When the pilot receives approval he sends this approval to the ground handler who can then push back the aircraft.

During the taxi process the pilot maneuvers the aircraft to the runway following the directions of the Ground Controller.

When the aircraft approaches the runway the aircraft will be transferred to the Runway Controller (RC) which will give the pilot clearance for take-off. When the clearance is received the aircraft takes off.

Figure 2 shows that a number of different organizations are involved in the pre departure sequence: the pilot, for ATC the Delivery Controller (DEL), Start-up Controller (SUC), Ground Controller (GC), Runway Controller (GC), and Ground handler.

Furthermore, the pre departure sequence is just one of the parts of the whole chain of processes at the airport. It is very important for CDM that there is a good communication and sharing of information between the airline operator and air traffic control. When an aircraft for some reason is delayed it is important that the airline operator reports this to air traffic control so that the departure planning can be updated. Therefore, for CDM within the pre departure sequence the airline operators and air traffic control are the most important actors.

Problems

The CDM program aims to solve a number of problems which are directly or indirectly related to the pre departure sequence. Currently, during the pre departure sequence ATC applies a “first come first served” principle meaning that the pilot that reports to the tower first will be the first to leave. This might lead to a relatively invaluable flight departing while another more valuable flight might have to wait. So, there is no prioritizing in which flight will be served first.

Further, there is a lack of synchronization of handling times between the organizations which leads to disruptions in the value chain. An example of such a disruption is that a departing aircraft “suddenly” occupies a gate longer than expected which results in the next aircraft planned to park at that gate has to stay on the platform and blocks other aircraft. This can be prevented if the airline operator informs the gate management of AAS in time that the aircraft will be delayed (AAS, KLM, & LVNL, 2008).

These are two examples of a longer list of problems that can be avoided with the implementation of the collaborative pre departure sequence planning.

2.4 ORGANIZATIONS IN THE DUTCH AVIATION SECTOR

The Dutch aviation sector consists of a large number of organizations. The three largest and most important organizations are AAS, KLM and LVNL. Therefore, in this research project the Dutch aviation sector will be confined to AAS, KLM and LVNL. Further, if mention is made of the network these three organizations are meant.

According to the “Wet luchtvaart” and the “Luchthavenverkeersbesluit” the airlines, airport operator and LVNL have a common duty. They have to make sure, individually and in cooperation with each other, that boundaries for noise, air quality and external safety are not violated (Ministerie van Verkeer en Waterstaat, 2005).

Amsterdam Airport Schiphol (AAS)

AAS is part of the Schiphol Group which is in principle an independent commercial organization that operates within the boundaries set by the government. The Schiphol Group is entirely owned by the government: 75,8 percent is owned by the Dutch State, 21,8 percent is owned by the municipality of Amsterdam and 2,4 percent is owned by the municipality of Rotterdam (Project Mainport Schiphol, 2005).

The mission statement of the Schiphol Group is: “to create sustainable value for its stakeholders by developing Airport Cities and by positioning Amsterdam Airport Schiphol as the leading Airport City” (Schiphol Group, 2008). The annual report 2006 states that AAS want to maximize the efficiency of operations and ensure safety. However, it also states that AAS would like the environmental regulations to be alleviated in order for AAS to increase the number of flights. Further, the annual report also shows that AAS needs and wants to closely cooperate with LVNL and KLM (Schiphol Group, 2007) to ensure safety and increase efficiency.

Royal Dutch Airline (KLM)

KLM is a commercial airline that has its home base on Schiphol Airport and is the largest customer of AAS (Project Mainport Schiphol, 2005). The mission statement of KLM is: “by striving to attain excellence as an airline and by participating in the world's most successful airline alliance, KLM intends to generate value for its customers, employees and shareholders” (KLM, 2008b). Furthermore, its corporate profile shows that the objectives of KLM are to realize: “growth opportunities at the Schiphol home base, access to all markets that add to the quality of the network, and a level playing field for all. KLM seeks to balance the company’s interest with those of its local surroundings” (KLM, 2008a).

Further, the annual report 2006/2007 of KLM states: “Thanks to the joint efforts of KLM, Air Traffic Control the Netherlands and Amsterdam Airport Schiphol, the airport has grown into an international mainport that is of vital importance to the Dutch economy” (KLM, 2007). This statement shows that KLM recognizes the importance of cooperation within the network for the development of Schiphol Airport.

Air Traffic Control the Netherlands (LVNL)

LVNL is an Independent Administrative Body (ZBO). The tasks and responsibilities of LVNL are specified by the air transport law (“Wet luchtvaart”): first, provide Air Traffic Services within the Amsterdam FIR. Secondly, the definition, acquisition, installation, management and maintenance of technical installation systems for air traffic control. Thirdly, the provision of aeronautical information and the issuing of aeronautical publications as well as aeronautical maps. Fourthly, the provision of training for air traffic control. Fifthly, provide the ministers of Transport, Public Works and Water Management with advice for tariffs. Sixthly, provide advice on air traffic control (“Wet Luchtvaart”, 2008).

The mission statement of LVNL is: “LVNL founds the organization of its services on a dialogue with all stakeholders, always seeking the optimum balance between – sometimes even conflicting – interests and demands. Aiming for result is the key: creating an added value with a favorable costs/benefits relation for the stakeholder” (LVNL, 2008a).

The role of LVNL within the network is equivocal. Not only is LVNL a ZBO with specified responsibilities, LVNL is also part of the Dutch aviation sector and is therefore often seen as one of the parts of Schiphol Airport as a large company. This leads to different views of other organizations or parts of other organizations on the role of LVNL. Some view LVNL as a governmental body while others view LVNL as an air

transport company which is part of the aviation sector (Ministerie van Verkeer en Waterstaat, 2005).

2.5 CONFLICTS OF INTERESTS

In this paragraph a number of differing interests of AAS, KLM and LVNL will be described. These issues provide an insight into the complexity of developing policies for Collaborative Decision Making. Further, these issues potentially may lead to a decrease in the level of trust between the organizations.

AAS, KLM and LVNL cooperate at Schiphol Airport. However, as noticed before, their interests are sometimes conflicting. In order to provide insight into these conflicts of interests a goal tree for each organization has been constructed which can be found in appendix C as well as a causal-relation diagram which can be found in appendix B. A goal tree can be used to provide insight into the goals of a specific organization. A causal-relation diagram can be used to analyze the relationships between different factors. By constructing a causal-relations diagram based on the goal-trees of the organizations the relationships between the goals of the different organizations can be provided (Bots, 2002).

To provide insight into the conflicts of interests between AAS, KLM and LVNL a causal-relations analysis has been made of the relationships between the factors: safety, efficiency, and environment combined with the interests of each organization derived from the goal trees. Safety, efficiency and environment are chosen because these are the three high-level issues at which AAS, KLM and LVNL cooperate.

The main conflicts of interests that can be derived from the causal-relations diagram have to do with the demand for air traffic. It is in the interest of AAS and KLM to increase the number of movements because it enhances their turnover. However, if the demand of air traffic increases this has a negative influence on the risk of collision, the punctuality and on the produced noise.

Further, safety and the number of incidents negatively influence the demand for air traffic. Therefore, it is also in the interest of AAS and KLM to maintain certain safety levels. This shows that AAS and KLM have to find a balance between turnover and safety levels. However, this does not exclude the possibility that they would accept lower safety levels than demanded by the government because of commercial interests.

A more direct conflict of interest concerns the noise criteria. LVNL and AAS have a common duty to stay within the noise criteria set by the government. However, KLM has no direct interest in maintaining these noise criteria. Further, AAS wants to increase the number of movements per year. Therefore, it is in the interest of AAS and KLM to alleviate those criteria to enable them to increase their operations.

3 RESEARCH QUESTIONS AND METHODS

The problem description has provided an overview of the Dutch aviation sector and the structure of the CDM program. Further, the research has been focused on trust between AAS, KLM and LVNL during the collaborative pre departure sequence. Based on the purpose of the research project, formulated in the introduction, and the information provided in the problem description it is possible to formulate research questions and methods. These research questions and methods together form the basis of the research project.

3.1 RESEARCH QUESTIONS

The objective of the research project to design an approach that supports trust building within the Collaborative Decision Making program in the Dutch aviation sector. Following this objective the main research question is:

How can trust building be supported within the Collaborative Decision Making program in the Dutch aviation sector?

To answer the main research question the research is divided into two phases. During the first phase of the research the objective is to gain insight into the current role of trust in the network which will provide the necessary information to make an informed decision for a method or tool to support trust building. In order to make that decision, during the first phase the following research questions need to be answered:

What is the role of trust in Collaborative Decision Making in the Dutch aviation sector?

- What is the function and importance of trust within the CDM program?
- What is the current level of trust in the network of AAS, KLM, and LVNL?
- Which level of trust are AAS, KLM and LVNL aiming for?
- Which factors contribute to trust?
- Which obstacles exist that block trust building?
- Which measures may contribute to the removal of these obstacles?

The results of the first phase of the research will make clear which level of trust the organizations within the CDM program aim for. The literature on trust building described in chapter four provides trust building mechanisms that can be used to achieve that level of trust. Further, Tschannen-Moran and Hoy (2000) have defined five dimensions of trust: benevolence, reliability, competence, honesty, and openness. By relating the answers to the research questions to these five dimensions additional information will be provided on which dimension(s) needs the most improvement.

During the second phase the conclusions of the first phase will help to create a list of strategies/mechanisms that can be used to support trust building. Based on the defined trust building strategies/mechanisms a choice can be made for a method or tool that is best suitable to support trust building. After a choice has been made a design method

must be chosen for the design of the game as well as a method to evaluate the game. Research questions for the second phase are:

- What is a good approach for a support concept to support trust building?
- Which strategies/mechanisms are available to support trust building?
- Which kind of tool or method is suitable to support trust building?
- What are the requirements for a tool to support trust building?
- What is a good design method for such a tool?
- What is a good method to evaluate the tool?

3.2 RESEARCH METHODS

In this paragraph the research methods used for answering the research questions will be described. The research is divided into two phases: during the first phase the current role of trust is explored and during the second phase a method is chosen. Following that method a tool will be developed and validated to support trust building.

In order to be able to answer the research questions it is important to have an understanding of a number of the theoretical concepts of networks of organizations, cooperation, trust and trust building. Therefore, before the answers to the research questions are provided, in chapter four these theoretical concepts will be described.

3.2.1 THE CURRENT ROLE OF TRUST

The objective of the first phase is to gain knowledge of the current role of trust between AAS, KLM and LVNL. The result of the first phase should be to have a clear view on the function, importance and level of trust within the network as well as the level of trust the organizations aim for. Further, an overview of factors in the network that contribute to trust, obstacles that stand in the way of improving trust and measures that contribute to the reduction of these obstacles.

To gather the data needed for the first phase interviews will be conducted. For that purpose an interview protocol will be constructed. Further, the level of trust that AAS, KLM and LVNL aim for within the CDM program will be based on documents of the CDM program. For the construction of the interview protocol use will be made of Yin (2003) on the conduction of case studies and Klein and Myers (1999) who provide seven principles for conducting and evaluating interpretive field studies.

Yin (2003) provides an approach for conducting case studies. This approach can be used for the construction, execution and analysis of the interviews. Yin argues that it is necessary to set-up a case study protocol which should have four sections: an overview of the case study project, field procedures, case study questions and a guide for the case study report. For the interview protocol only the case study questions will be defined. The overview, field procedures and guide for the case study report are part of the research report.

For the case study questions Yin (2003) distinguishes five levels of questions: Level 1, questions asked of specific interviewees. Level 2, questions asked of the individual

case. Level 3, questions asked of the pattern of findings across multiple cases. Level 4, questions asked of an entire study. Level 5, normative questions about policy recommendations and conclusions, going beyond the narrow scope of the study. For the interview protocol in this research project only the level 1 and level 2 questions are relevant. The level 2 questions are the general research questions that need to be answered during the research project. The level 1 questions are the interview questions which should provide data to answer the questions at level 2.

Klein and Myers (1999) provide seven principles for conducting interpretive field studies. The first principle is that “we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships”. This means that it is only possible to understand a complex problem if the parts of the problem and their interrelationships are understood. The first principle is the basis of the other six principles. The principle of contextualization aims to set the problem in its social and historical context so that it becomes clear for the intended audience how the current situation under investigation emerged. The principle of “interaction between the researcher and subjects” aims to take into account the influence of the interaction between the researcher and subjects on the retrieved data. The principle of abstraction and generalization aims to relate the retrieved data to general concepts. The principle of dialogical reasoning aims to create a “dialogue” between the theoretical preconceptions guiding the research and the actual data retrieved during the research. This may mean that the preconceptions may be altered because the actual data deviates from the preconceptions. The principle of multiple interpretations aims to retrieve multiple viewpoints and confront them with each other. The principle of suspicion aims to detect systematic biases and distortions in the data retrieved from the participants.

These principles can be used partly for the conduction and partly for the interpretation of the interviews.

3.2.2 TOOL DEVELOPMENT

During the second part of the research a tool will be developed to support trust building between AAS, KLM and LVNL. Therefore, first a decision must be made what kind of tool will be chosen. In chapter six the decision is made to create a game to support trust building.

To create the game the design approach of Duke (1981) will be followed. Based on that approach four phases are distinguished for the design process of the game. The first phase is the initiation phase. During this phase a problem analysis is made which will result in a list of requirements that should be fulfilled by the game. The second phase is the design phase. In this phase a conceptual design will be constructed of the game consisting of a description of: the scenario of the game, different roles, linkages between roles, different cycles in the game, the steps of play, the rules of the game, and performance indicators. The third phase is the construction phase. This phase consists of constructing the different components of the game followed by calibration and test runs. The fourth phase is the phase of use. During this phase the game is transferred from the designer to the operator of the game.

Although the four phases are described as different parts, the design process is actually an iterative process. Especially phase two and phase three of the design process are part of the same iterative process. Figure 9 provides an overview of the game design process. The figure shows that phase two and three both have internal iterative cycles. Furthermore, together they also constitute an iterative cycle.

For the game design process the four phases as displayed in Figure 9 will be followed.

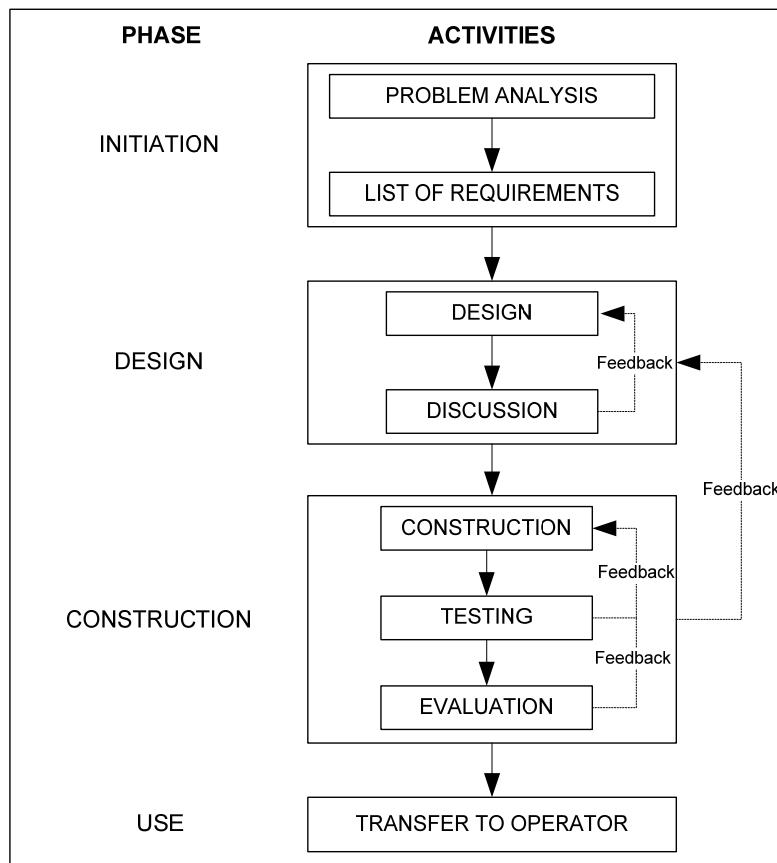


Figure 3: Game design process (based on Duke (1981))

4 LITERATURE REVIEW

The aim of this research report is to present a design of an approach to support trust building within the Collaborative Decision Making program in the Dutch aviation sector. In chapter two an overview has been provided of the Dutch aviation sector and the CDM program. Further, before being able to design an approach that supports trust building it is necessary to have an understanding of the theoretical concepts of networks of organizations, cooperation, trust and trust building and how these concepts apply to the cooperation between AAS, KLM and LVNL within the CDM program.

In this chapter a description is provided of the theoretical concepts of networks of organizations, cooperation, trust and trust building. Further, each concept will be applied to the cooperation of AAS, KLM and LVNL within the CDM program. This will provide insights into the functioning of trust and trust building and how this relates to the cooperation of AAS, KLM and LVNL. These insights can be used in the further research to explore the role of trust and design an approach to support trust building.

4.1 NETWORKS OF ORGANIZATIONS

Transaction cost economics (TCE) provides the rationale for the existence of networks (Williamson, 1985). The theory of TCE tries to specify the way an organization should govern its activities and exchanges with other organizations to minimize the costs of transactions and production. TCE bases its argument for a certain governance mode on three factors: uncertainty, asset specificity and frequency. Uncertainty arises due to bounded rationality about and the risk of opportunistic behavior of other organizations. Opportunism is defined as “self-interest seeking with guile” (Williamson, 1985). Asset specific exchanges involve unique equipment, processes, or knowledge developed by participants which cannot be readily used in other transactions. Frequency refers to the frequency with which transactions between organizations occur.

Based on TCE, Jones *et al.* (1997) identify at which level of asset uncertainty, asset specificity and exchange frequency a network is preferable above other governance mechanisms. These levels are: uncertainty in demand with a stable supply, high human asset specificity, complex tasks integrating diverse specialists and frequent exchanges among organizations in the network.

Theory application

The characteristics identified by Jones *et al.* (1997) can be applied to the network of AAS, KLM and LVNL. The level of uncertainty in the network is mainly depending on the ability of the airlines to take their business elsewhere. This ability creates dependence of AAS, and LVNL on KLM. The level of asset specificity is high because the transactions within the network require highly specific human assets, e.g. pilots and air traffic controllers. Further, the air traffic management system has a high level of complexity. The frequency of exchange is high because each aircraft movement can be viewed as an exchange within the network. These characteristics of the exchanges between AAS, KLM

and LVNL show that a network is a suitable governance mechanism for the Dutch aviation sector.

4.2 COOPERATION

Cooperation can be defined as social interdependence where people share information and work together to achieve agreed-upon goals. Cooperation provides a number of benefits above individual efforts. Cooperation motivates individuals, stimulates innovation, promotes higher achievement and leads to greater productivity than independent efforts (Johnson & Johnson, 2003). However, when engaging in cooperation, people and organizations have to take into account the risk of opportunistic behavior by their partners. Therefore, for people to engage in cooperation the benefits of cooperation have to outweigh the risk of opportunistic behavior. By using game theory an analysis can be made of the reasons for people to engage in cooperation in strategic situations.

Game theory tries to capture the behavior of organizations in strategic situations where an organization makes a choice to maximize his profit or utility based on the expected behavior of other organizations (Fudenberg & Tirole, 1991). The most famous example used in game theory is that of the so called prisoners' dilemma, which is shown in Figure 4.

	C	D
C	1, 1	-1, 2
D	2, -1	0, 0

Figure 4: Prisoners' dilemma

The prisoners' dilemma describes a strategic situation, or game, between two self-interested players. Each player has the option to either cooperate (C) or defect (D). If both players cooperate they each receive 1. If both players defect they each receive 0. If one cooperates and the other defects then the cooperator receives -1 and the defector receives 2. Figure 1 shows that no matter what the first player chooses the second player will always be better off by defecting, and vice versa. Therefore, both players will always defect, and both will receive 0. However, if they both would cooperate they would both receive 1 which is clearly a better option than receiving 0 (Fudenberg & Tirole, 1991).

The strategy to defect is a stable outcome in the case of a one time interaction or "one-shot" game. However, game theory also shows that if a game is played repeatedly and players are able to communicate with each other then players are able to make an agreement to always cooperate. In that way the profit of all players will be increased.

The prisoners' dilemma shows that the reason for people to engage in cooperation is the expectation of higher benefits compared to individual efforts. Further, cooperation is only profitable if other players also cooperate and a coordination mechanism is necessary to ensure that players will indeed cooperate and refrain from opportunistic behavior.

Theory application

AAS, KLM and LVNL cooperate at Schiphol Airport and provide services to each other. However, the cooperation is not entirely voluntary. AAS and LVNL are geographically bounded to Schiphol Airport because of their dependence on the infrastructure available at Schiphol Airport. Further, they need each other to be able to operate. Therefore, they have no other choice than to cooperate with each other. KLM is more flexible in choosing an airport to operate from, however, having Schiphol Airport as their home base gives them a number of benefits which they might not receive anywhere else. In that way KLM is also depending on AAS and KLM for their operation.

The prisoners' dilemma can also be applied to the CDM project at Schiphol Airport. AAS, KLM and LVNL all benefit from CDM. To reach those benefits an investment has to be made in creating the CDM structure. While complete defection is probably not possible each organization might try to invest less than their partners to profit from their investments and increase their own benefits. However, if all three organizations adopt such an attitude this may hamper the investments which might lead to a failure of CDM. Therefore, in some way AAS, KLM and LVNL have to come to an agreement on how to divide the costs and benefits from the CDM project.

4.3 TRUST

Trust has been widely acknowledged as being an important factor as well as in interpersonal as in inter-organizational relationships. Trust is essential to negotiations, has been related to competitive advantage, is a factor in leadership, effective decision making, innovation and managerial effectiveness (Brown, Poole, & Rodgers, 2004).

Over the past decades a large amount of research has been conducted into trust in intra and inter-organizational relationships. However, there does not exist one definition of trust. Several definitions are provided by a large number of authors (see e.g.: Costa, 2000; Giddens, 1990; Rousseau, Sitkin, Burt, & Camerer, 1998). Most definitions of trust have in common that: trust assumes a degree of interdependence between trustor and trustee, trust provides a way to cope with risk or uncertainty in exchange relationships and trust avoids vulnerability resulting from the acceptance of risk (Lane & Bachmann, 1998).

Tschannen-Moran and Hoy (2000) have made an analysis of seventeen definitions of trust. The aim of their analysis was to provide insight into similarities between different definitions of trust. Based on these similarities they have created a multidimensional definition of trust: *“Trust is one party's willingness to be vulnerable to another party based on the confidence that the latter party is (a) benevolent, (b) reliable, (c) competent, (d) honest, and (e) open”*.

A more economic definition of trust is: *“Trust denotes the willingness to engage in a transaction in the absence of adequate safeguards.”* (Noorderhaven, 1992).

Berulava and Lezhava (2007) provide a definition of trust as a governance mechanism of exchanges between organizations: *“trust is an informal mechanism for coordination of economic activity, alternative and supplementary to price and authority, based on the belief of one party in honest and predictable behavior of the other party, and which allows for more effective and flexible mode of transaction governance”*.

These definitions show that the basic concepts of trust between persons and organizations are the acceptance of a vulnerable position and the acceptance of the risk of opportunistic behavior.

Sources of trust

Based on literature on trust Klein Woolthuis (1998) distinguishes four sources of trust: propensity of trust, which refers to the general willingness of an organization to trust other organizations and is based on earlier experiences in other relationships. Cognitive based trust, which is based on the knowledge of the other organization's capability to perform the negotiated tasks. Affect based trust, which is based on feelings or beliefs. Process based trust, which refers to the development of trust during relationships. This means that positive experiences during the relationship might enhance trust among the partners.

The first three sources of trust concern trust before starting a relationship while the fourth source of trust concerns the development of trust during a relationship. This shows that trust can be seen as a precondition as well as a result of cooperation. Trust is a precondition because if an organization thinks that a possible partner is not capable of performing required tasks he will be reluctant to cooperate. Further, trust is also a result of cooperation because positive experiences during cooperation may enhance trust.

Game theory shows that a repeated game promotes trust and cooperation (Sydow, 1998). Further, trust based on previous experiences may be seen as deriving from a "repeated game" (Axelrod, 1984; Miller, 1992). Conversely, Sydow (1998) states that if communication during a game is absent trust building is much more difficult.

Functions of trust

The most important function of trust is to "reduce the risk of opportunistic behavior" (Bachmann, 1999; Blomqvist, 1997; Klein Woolthuis & Nooteboom, 2002; Vangen & Huxham, 2003). The risk of opportunistic behavior is shown by the prisoners' dilemma, see Figure 4. It shows that if one player cooperates then there is the risk of opportunistic behavior that the other will defect. Therefore, a player will only cooperate when he trusts that the other to also cooperate. The player is thus willing to accept the risk of opportunistic behavior because he trusts the other player.

By establishing trust, actor A will more likely do things that he wouldn't do otherwise because he trusts actor B (Klein Woolthuis & Hillebrand, 1998). This, again, can be shown by the prisoners' dilemma. If actor A trusts actor B to cooperate and they also have to work together in the future then actor A will be inclined to also cooperate. This holds because knowing that they have to work together in the future, defection by player A will lead to distrust and defection by player B in the future. Therefore, to maximize profit over all games it is in both their interest to cooperate (Fudenberg & Tirole, 1991).

Three other functions of trust are mentioned by Zand (1972). Trust may lead to more accurate, comprehensive, and timely exchange of information. Trust may lead to less defensive behavior to influence and control by others. Trust may lead to relaxation of controls by others. This is also supported by Dirks and Ferrin (2001) who mention positive attitudes, higher levels of cooperation and superior levels of performance, as results of trust.

Klijn *et al.* (2007) give four arguments for the usefulness of trust in networks, based on a literature study. Trust reduces transaction costs, it enhances investments in and stability of relationships, it stimulates learning and exchange of information and knowledge, and trust has the ability to stimulate innovation.

Disadvantages of trust

Besides the functions and advantages of trust it is also important to take into account possible disadvantages of trust. Williamson (1993) argues that if trust goes beyond calculative self-interest it leads to blind trust, which is unwise and will not survive in competition. Other authors contradict this statement arguing that people cannot only be seen as calculative but also have moral values behaving within a social context (Furlong, 1996). However, the authors agree on the fact that blind trust is disadvantageous. So, it does not have to be negative when trust goes beyond calculative interest as long as it does not constitute or approaches blind trust.

Further, a high level of trust may preserve the status quo and make interorganizational change more difficult. Moreover, such a high level of trust creates opportunities for malfeasance and manipulation (Sydow, 1998).

The main disadvantage of trust seems to be the risk of blind trust which creates the risk of a less critical attitude towards one another, preserving the status quo, malfeasance, and manipulation.

Relationship between trust and contracts

The most commonly used mechanism to reduce opportunism in inter-organizational relationships are formal contracts. A formal contract can be defined as “an agreement in writing between two or more parties, which are perceived, or intended, as legally binding”. Contracts and trust are often seen as either substitutes or complements of each other (Klein Woolthuis, Hillebrand, & Nootboom, 2005). Although both can be used to reduce opportunism they are distinctly different.

Several different views exist on the relationship between trust and contracts. According to TCE a contract is a basis for trust because it limits the opportunities and incentives for opportunism. Therefore, according to TCE, a contract is a prerequisite for trust. On the contrary, social scientists perceive contracts to be a sign of distrust and therefore detrimental to the development of trust (Bradach & Eccles, 1989). A third way to look at the relationship between contract and trust is that trust precedes relationships. A certain level of interfirm trust is indispensable for any cooperation between organizations to be formed and to function (Das & Teng, 1998). In that way trust can decrease or even eliminate the need for a formal contract (Klein Woolthuis, Hillebrand, & Nootboom, 2005). Based on an empirical case study Klein Woolthuis *et al.* (2005) conclude that contracts and trust can both be complements as well as substitutes depending on the intentions of the partners. If there is low-trust among the partners then large emphasis may be put on contracts and detailed safeguards. In that case contracts substitute trust. However, if there is high-trust among the partners then safeguards may be left out of the contracts. Then trust substitute's contracts. Furthermore, contracts and trust may complement each other if a contract is not interpreted as a strict legal safeguard.

Theory application

The provided definitions of trust show that the basic concepts of trust between persons and organizations are the acceptance of a vulnerable position and the acceptance of the risk of opportunistic behavior. In the application of the prisoners' dilemma to the CDM project, in paragraph 4.2, it becomes apparent that in the cooperation between AAS, KLM and LVNL there exists a risk of opportunistic behavior. Creating trust between the organizations can help to deal with the risk of opportunistic behavior to make the cooperation in the CDM project a success.

There are a number of sources of trust between AAS, KLM and LVNL. The organizations have already been working together for a long time at Schiphol Airport. The previous experiences in the cooperation influence how the organizations view and are willing to trust each other (propensity of trust). Further, AAS, KLM and LVNL provide services to each other that require specific knowledge. They each have to trust that the other organizations are capable of performing the services they offer (cognitive based trust). Further, the cooperation between the organizations is executed by individuals of each organization. The culture of each organization as well as the feelings and beliefs of the individuals affect the willingness of AAS, KLM and LVNL to trust each other (affect based trust). Further, trust may develop between the organizations when they have positive experience with the cooperation in the CDM program (process based trust).

Trust as well as a contract can reduce the risk of opportunistic behavior between AAS, KLM and LVNL. Contracts are used on a high level by signing a Memorandum of Understanding (MoU) on the CDM project by the upper management of the three organizations. This MoU ensures that the organizations will be committed to the CDM project. However, the implementation of CDM into the operational processes is too complex to lay down in a formal contract. In this case trust can function as factor that reduces the risk of opportunistic behavior. Furthermore, trust can help to increase the communication and sharing of information that is required for CDM.

4.4 TRUST BUILDING

The aim of trust building is to enhance trust between partners. This suggests that there are multiple levels of trust that might exist between partners. Three levels of trust can be distinguished: calculus based-trust, knowledge-based trust and identification-based trust. Calculus-based trust is the lowest form of trust which exists when both parties can be trusted to keep their word. The primary motivation for a party to keep its word at this level is the fear of discontinuation of the relationship or retribution when it does not keep its word, as well as the expectance of reward when it does keep its word.

Knowledge-based trust is the second level of trust which is based on knowing the other party sufficiently well that its behavior is predictable. This kind of trust relies more on information than on the fear of punishment or reward. Further, it develops over time through repeated interactions.

Identification-based trust is the third and highest level of trust and is based on the full internalization of the other party's preferences. Trust exists because each party understands the others preferences and needs. This may result in the formulation of

shared values and goals. (Lander, Purvis, McCray, & Leigh, 2004; Lewicki & Bunker, 1996; Shapiro, Sheppard, & Cheraskin, 1992).

Development of trust

The development of trust in a relationship is a cyclical process. At the start of a relationship, when there is no history of trust among the organizations, an organization must be willing to take a risk and become vulnerable to the actions of the other organization(s) (Mayer, Davis, & Schoorman, 1995). This means that there must exist a minimum of trust necessary to initiate the relationship. Once, the relationship has been initiated trust can be gradually developed through satisfactory experiences: “When one trusting act is reciprocated by another, gradually a basis for cooperation can be erected” (Axelrod, 1984).

The cyclical process of trust building is shown in Figure 5. After initiation of the relationship trust still needs to be built up, therefore it is important to initiate the collaboration through modest, low-risk initiatives (Das & Teng, 1998; Webb, 1991). Then, when the organizations increasingly trust each other more ambitious goals can be set. To ensure that the cyclical process of increasing trust is sustained the goals set by the organizations need to be balanced with the existing level of trust between them (Vangen & Huxham, 2003).

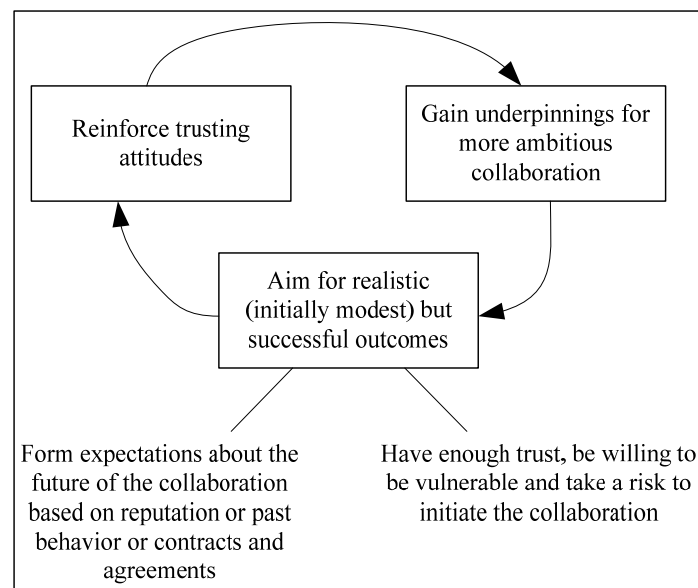


Figure 5: The Cyclical Trust-Building loop (Vangen & Huxham, 2003)

When Figure 5 is applied to the levels of calculus, knowledge and identification-based trust then it shows that at the initiation of a relation calculus-based trust needs to exist. Then after initiation the calculus-based trust can develop gradually through repeated interactions into knowledge based trust and ultimately into identification based trust.

Measures to create trust

For each level of trust a number of trust building mechanisms exist that contribute to reaching and maintaining that level of trust. Table 2 provides an overview of different trust building mechanisms for each level of trust.

Level of trust	Trust building mechanism
Calculus-based trust	Using reputation Getting to know various stakeholders well prior to beginning of project Using early team building efforts Fulfilling promises Telling the truth Consistency Dependability Responsibility/accountability Rewards/punishments
Knowledge-based trust	Encouraging communication Sharing knowledge and appropriate information Providing timely feedback Creating common language Creating shared vision Offering explanations for decisions Openness Receptivity
Identification-based trust	Delegating obligations Sharing and delegating control Fairness Respecting others Apologizing for unpleasant consequences Showing concern for various stakeholders' interests Using co-location Availability Involving in meaningful participation Interactions/cooperation Loyalty Stressing the long-term interests of participants Job satisfaction Achieving early successes Competence Providing training and personal growth opportunities Selection of vendor/negotiation of contract Commitment of appropriate resources Change management

Table 2: Trust building mechanisms within trust levels (Lander, Purvis, McCray, & Leigh, 2004)

Theory application

AAS, KLM and LVNL have initiated the CDM project. This shows that there exists at least a minimum level of trust between the three organizations. Now there is a need to further develop trust to a level that is required to make the CDM project a success. Therefore, it needs to be determined what level the organizations are aiming for and, after that, based on the measures listed in table 2 tools for the development of trust can be created.

4.5 CONCLUSION

The literature on networks of organizations shows that due to the characteristics of the organizations and the exchanges between them a network is a suitable governance mechanism for the Dutch aviation sector.

The literature on cooperation shows that by cooperating the organizations in the Dutch aviation sector can achieve benefits they would not achieve on their own. Furthermore, cooperation is stimulated by the interdependence that exists between their operations.

The literature on trust shows that trust increases the benefits of cooperation by: reducing the risk of opportunistic behavior, improving the exchange of information, creating positive attitudes, create higher levels of performance and stimulating innovation.

The literature on trust building shows that there are three levels of trust that can exist between organizations: calculus, knowledge and identification-based trust. To reach a certain level of trust each level has its own trust building mechanisms. Further, trust building is a cyclical process where each cycle can lead to improved trust.

TRUST IN THE DUTCH AVIATION SECTOR

RESEARCH PART I:

EXPLORING THE ROLE OF TRUST

5 THE ROLE OF TRUST

In this chapter the research questions for the first phase of the research project will be answered. As explained in chapter four the answers to the research questions are based on the interviews except for the research question on the level of trust that AAS, KLM and LVNL aim for within the CDM program which is based on documents of the CDM program.

For each research question the answers will be related to the definition of trust of Tschannen-Moran and Hoy (2000) who have defined trust as consisting of the five dimensions: benevolence, reliability, competence, honesty, and openness. By relating the results of the interviews to these five dimensions an overview will be created of those dimensions that need to be improved in order to support trust building within the CDM program at Schiphol Airport. Finally, the separate answers to the research questions will lead to a conclusion that answers the main research question of the first phase of the research project.

The participants for the interviews consisted of three participants of LVNL, two participants of AAS and two participants of KLM. The participants are all involved with the daily operations on Schiphol Airport, are involved with CDM and are directly or indirectly involved in the pre departure sequence. The interviews were conducted under the condition of confidentiality. Therefore, in this report only the answers for the research questions are presented. Appendix E gives an overview of the participants and a summary of each interview, this appendix is confidential and not publicly accessible.

After the answers to the research questions have been provided some additional information on the communication during the operational processes between AAS, KLM and LVNL will be provided. This will enhance understanding of the role of trust within the network.

5.1 ANSWERS TO RESEARCH QUESTIONS

In this paragraph the answers to the research questions will be presented, followed by additional information on the communication between AAS, KLM and LVNL during the operational processes.

What is the function and importance of trust within the network?

The interviews show that each participant views trust as an important prerequisite for CDM. Further, the participants were asked to provide their definition of trust. From these definitions a number of elements of trust can be derived as viewed by the participants: taking stakes of other organizations into account and not behaving opportunistically, openness in sharing information, adopting a vulnerable attitude, assume that received information is accurate and reliable, organizations striving for the same goals and improvement of the overall process.

Table 3 provides an overview of the functions of trust that were mentioned during the interviews as well as the dimensions of trust associated with each function.

Functions of trust	Dimension(s) of trust
Create openness in the sharing of information	Openness
Enable cooperation and an undisturbed operation	Benevolence, Reliability
Trust that agreements will be fulfilled	Reliability
Cope with criticism	Openness, Benevolence

Table 3: Functions of trust

The functions of trust mentioned by the participants can be categorized into openness, benevolence and reliability as important dimensions of trust. Openness is important because all the participants indicated that sharing information is the most important aspect of CDM. To improve information sharing each organization must be open towards the other organizations. Benevolence is important because for CDM it is important that each organization takes the stakes of the other organizations into account when making decisions. Reliability is important because the organizations are depending on the information they receive from the other organizations which therefore needs to be reliable and up-to-date.

Quotes:

“My definition of trust is that other organizations take the right decision in light of the common goals and are not behaving opportunistically”

“Trust is essential because if one party does not cooperate the whole chain can be disrupted”

What is the current level of trust within the CDM program?

The interviews show that trust exists between the people that are involved with CDM and within the CDM workgroups. The existence of trust between those people is shown by their openness in discussing issues with each other and talking about far reaching measures. However, the trust within the workgroups might be threatened when decisions need to be made. When decisions need to be made that have consequences for the own organization people tend to become more critical towards one another and maybe unwilling to reach agreements.

Although trust exists within the workgroups there is still a large group of people within each organization that is not involved and unfamiliar with CDM. The participants view that these people might not be committed to CDM and do not trust the other organizations because of different corporate cultures, interests and negative experiences in the past.

Quotes:

“There is a small group of people who are very positive about CDM; they do not need to be convinced. However, there is also a large group of mildly skeptic people that need to be convinced.”

“There is already a basis of trust which is shown by the fact that the three organizations are discussing far reaching measures.”

Which level of trust are AAS, KLM and LVNL aiming for?

The fundament of CDM is considered to be: mutual understanding and knowledge of each other's organization as well as information sharing. In order to achieve that the organizations need to: speak one language, know each other's organizations, goals and procedures, have mutual respect, share data, combine information, create an overview of the situation and create procedures for information sharing (AAS, KLM, & LVNL, 2007a).

“CDM is not just a system, hardware or software, meeting or telephone call; it involves culture change, handling of sensitive data, procedural changes and building confidence and understanding of each partner's operational processes. The concept of CDM endeavours to bring all the main airport partners (ATC, Aircraft Operator, Airlines, CFMU and Ground Handlers) together and share information and decision making criteria in a transparent way. Information sharing is essential for achieving common situational awareness. Enhancing decision making processes will lead to achieving maximized operational efficiency and best use of the available airport infrastructure and resource management” (AAS, KLM, & LVNL, 2007b).

From the literature on trust building, as described in chapter four, three different levels of trust can be distinguished: calculus, knowledge and identification based trust. When the characteristics of these levels of trust are compared to the information from the documents of the CDM program then the basis of the CDM program shows large resemblance with knowledge based trust. Knowledge based trust is mainly based on understanding each others behavior and information sharing. This resembles the basis of CDM as described by the document on the CDM program. Therefore, AAS, KLM and LVNL aim for knowledge based trust as a basis for the CDM success.

Which factors contribute to trust?

The interviews show that most participants know they can trust someone by his or her behavior. This means that the participants' are willing to trust someone as long as he or she behaves in line with the common goal.

Table 4 provides an overview of functions contributing to trust as mentioned during the interviews as well as the dimensions of trust associated with each factor.

Factors contributing to trust	Dimension(s) of trust
Communication	Openness
Sharing information	Openness
Understanding each others processes.	Openness

Table 4: Factors contributing to trust

The participants view that communication, sharing information, and understanding each others processes contribute to trust. This is shown by the fact that the people within the CDM workgroups are working closely together and as a result trust among those people has increased.

Communication, sharing information and understanding each others processes can be viewed as indicators of openness. This shows that the participants are valuing openness to be important with respect to trust.

Quotes:

“Whether I can trust someone is a difficult question. I think that that is the reason we have setup CDM in such a way that there are a lot of workgroups where people get to know each other.”

“I know how to trust someone by the behavior he has shown in the past. Trust needs to be gained and that takes time.”

Which obstacles exist that block trust building?

The participants mentioned a lot of obstacles that could block trust. These obstacles can be summarized in the following issues: diverging interests, diverging corporate cultures, possibilities for and existence of opportunistic behavior, conflicts at other levels of cooperation between the organizations, conservatism and inflexibility, individual employees having a strong influence on the operation, competition between internal parts of organizations, lack of communication and alignment of processes, externally as well as internally.

The interests of AAS, KLM and LVNL often differ. KLM is a commercial company and is profit oriented while LVNL is a government owned organization which is not profit oriented. Amsterdam Airport Schiphol is also government owned but is more profit oriented because it is trying to “sell” its airport to passengers and airlines. The differing interests can be a source of conflicts between the organizations. These conflicts can be obstacles for the development of trust because they might lead to more reticence and reluctance to share information.

The organizations also have to deal with different corporate cultures. The interviews show that the culture of LVNL is often viewed as being inflexible, reticent, and that individual air traffic controllers have too much influence. Inflexible in the sense that it is not easy to change working processes. Reticent in the sense that other organizations feel that there should be more communication about decisions made by LVNL. Further, individual air traffic controllers have the ability to make decisions on their own which affect other organizations. KLM has a commercial culture characterized by internal competition. In the CDM program the Hub Control Centre and the Operational Control Centre of KLM some times have different objectives. Further, because of its commercial interests KLM is always pushing to get more capacity from LVNL. AAS has not so much differing interests with KLM and LVNL but it is a large organization with a lot of different parts which do not always communicate with each other.

No matter how strict procedures are, there will always exist possibilities for opportunistic behavior, When organizations or individuals use these possibilities at the costs of the other organizations this will reduce trust between the organizations.

Conflict and problems at other levels of cooperation between AAS, KLM and LVNL also influence the people involved in CDM. This might result in a less cooperative, more reticent attitude towards one another and a reduction of trust between the organizations.

Conservatism or inflexibility within the organizations means that people are unwilling to change their working processes because they view the current situation as positive, or better than the new situation. Inflexible employees are present in each organization. Within the CDM program the reluctance of employees of an organization to

change their processes can be interpreted by the other organizations as being unwilling to cooperate. This can lead to a decrease in trust in each others willingness to cooperate.

Currently individuals are very important within work processes in the pre departure sequence. They are important for decisions on e.g. capacity or synchronization of information. Individuals make decisions based on their knowledge and experience. E.g. a supervisor at Tower/Approach makes a decision on how much capacity they are able to provide, while another supervisor might make another decision under the same circumstances. This sends mixed signals to AAS and KLM and leads to distrust in the information provided by LVNL. This is not only true for LVNL but also for certain positions at AAS and KLM.

Internal competition concerns diverging interests between departments of the same organization. The competition results in a non-optimal functioning of operational processes which also affects the others organizations that are part of the value chain. Further, the internal competition might lead to different departments sending different messages to the other organizations which results in the other organization receiving mixed signals.

The participants thought that a lack of communication and alignment of processes in general poses an obstacle for the development of trust. Because of a lack of communication the other organizations are not provided with the rationale behind decisions, which leads to a lack of understanding. The lack of alignment of processes may lead to delays and disruptions in the value chain. The organizations may try to blame the delays on the processes of the other organizations which can lead to irritation and distrust.

Table 5 provides an overview of the factors that block trust and associated dimensions of trust.

Factors that block trust	Dimension(s) of trust
Diverging interests	Benevolence
Diverging corporate cultures	Benevolence, openness
Possibilities for and existence of opportunistic behavior	Benevolence
Conflicts at other levels of cooperation between the organizations	Benevolence
Conservatism and inflexibility	Openness
Individual employees have a strong influence on the operation	Reliability
Competition between internal parts of organizations	Reliability
Lack of communication	Openness
Lack of alignment of processes	Openness

Table 5: Factors that block trust

The obstacles mentioned by the participants can be categorized in openness, benevolence and reliability. The obstacles concerning openness are conservatism, the lack of communications, lack of alignment of processes, and differing corporate cultures. These obstacles are related to openness because they concern reticence towards the other organizations.

The obstacles concerning benevolence are diverging interests, possibilities for and existence of opportunistic behavior, conflicts at other levels between the organizations and different corporate cultures. These obstacles are related to benevolence because they are about taking the interests and the effects of decisions on other organizations into

account. Further, conflicts between the organizations might reduce the benevolence to cooperate as well as differing corporate cultures when these cultures collide.

The obstacles concerning reliability are the dependence on the decisions of individual employees and the competition between internal parts of the organizations. These obstacles are related to reliability because they lead to mixed signals towards the other organizations. The mixed signals lead to distrust in the reliability of the received information.

Quotes:

“Obstacles that are in the way of trust in CDM are other activities between the organizations. When there is an argument within other interorganizational activities then that also effects the cooperation in the CDM projects.”

“The different corporate cultures stand in the way of trusting each other.”

“Once CDM is implemented there will be more time pressure, this might be an incentive for people to show opportunistic behavior to avoid penalties. There will always be possibilities for opportunistic behavior.”

Which measures may contribute to the removal of these obstacles?

According to the participants creating an understanding of each others processes and decisions and creating full commitment of each entire organization to CDM will contribute most to the removal or reduction of the aforementioned obstacles. The participants expect that by creating a mutual understanding people will better understand why certain decisions are being made, how their own decisions affect the other organizations and why processes are designed in a certain way. A better understanding will result in a reduction of the number of conflicts and more openness towards each other. This will lead to an increase in information sharing and more commitment towards CDM and the overall goal.

To create mutual understanding the participants have made several suggestions: ensure a continuous evaluation with all organizations about the operational processes and see how the organizations together can improve the overall process. This also has to happen within each organization in order to improve the cooperation within the different departments.

By organizing workshops and other kind of meetings with employees from all three organizations they can be informed about CDM and have the chance to meet each other. This can increase commitment towards CDM and through socializing it may create a better understanding.

To reduce the possibilities for opportunistic behavior procedures and processes can be designed in such a way that these possibilities are minimized. Further, to ensure that different people will make the same decisions under the same circumstances certain decisions should be more standardized or based on procedures.

Table 6 provides an overview of the measures that contribute to the removal of the obstacles and associated dimensions of trust.

Measures that contribute to the removal of obstacles	Dimension(s) of trust
Creating an understanding of each others processes and decisions: <ul style="list-style-type: none"> • Continuous evaluation • See how overall processes can be improved 	Openness
Creating full commitment: <ul style="list-style-type: none"> • Organizing workshops 	Openness

Table 6: Measures that contribute to the removal of obstacles

The measures to remove the obstacles mentioned by the participants mainly involve the openness of the organizations. The participants view that by being more open people will develop an understanding of each others processes and will be more committed to CDM. The openness will also lead to increasing benevolence because it will reduce the number of conflicts and frustrations. Further, mutual understanding will increase the commitment of people to share information and take each others interests into account.

Quotes:

“If someone would try to manipulate certain information to his own advantage that would be “killing”. Therefore, there has to be a sort of continuous evaluation where parties will be open towards criticism of the other parties.”

“We have to make agreements on how to minimize the possibilities for strategic behavior. (...)Trust will also be developed when people understand that they will benefit from CDM. To develop trust and get people to be familiar with CDM we will organize workshops.”

Communication and trust during operation

The answers to the research questions are strongly related to openness and communication between AAS, KLM and LVNL. Figure 6 gives an impression of the communication on the day of operation between AAS, KLM and LVNL before the start of the CDM project. Figure 7 gives an impression of the desired communication structure. Figure 6 shows there is a lot of communication between AAS, KLM and LVNL as well as within each organization. These figures show that each organization is depending on the others for its information. Therefore, it is important that the organizations are willing to provide each other with sufficient, accurate and up-to-date information, and trust each other to do so.

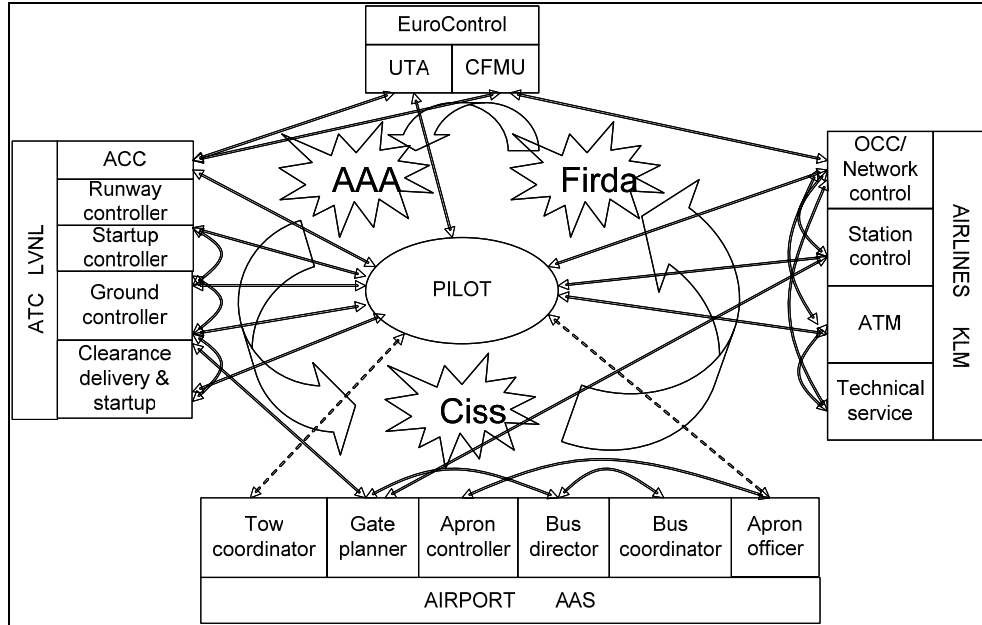


Figure 6: Communication before the CDM project (AAS, KLM, & LVNL, 2004)

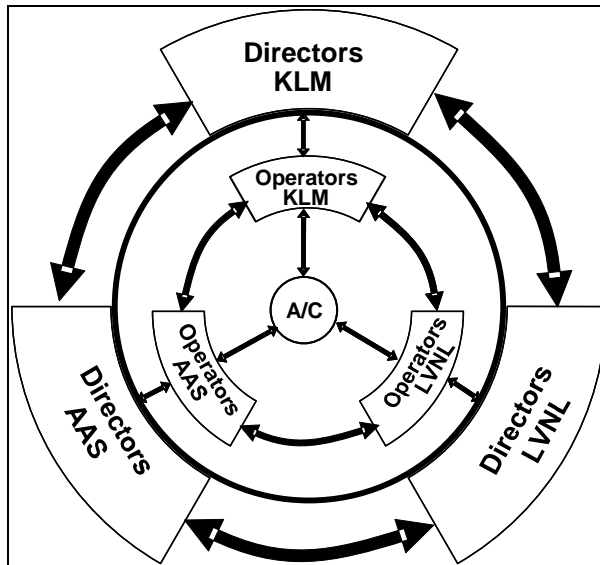


Figure 7: Desired communication structure (AAS, KLM, & LVNL, 2004)

5.2 CONCLUSION

Based on the sub questions the main research question of the first part can be answered: *What is the role of trust within CDM in the Dutch aviation sector?*

Trust is important for the success and the functioning of CDM. Trust creates openness in the sharing of information, it enables cooperation, leads to the fulfillment of agreements, and helps to deal with criticism. Within the CDM workgroups trust exists between the participants. Trust has grown between those people through the discussions

and activities in the CDM workgroups. However, a large group of people in each organization is not yet involved with CDM and for these people trust between the organizations still needs to be developed.

AAS, KLM and LVNL aim to develop trust to the level of knowledge based trust. Obstacles in the development of trust between the organizations are: differing interests, differing corporate cultures, the possibility for and existence of opportunistic behavior, conflicts at other levels between the organizations, conservatism, individual employees having a strong influence on the operation, competition between internal parts of organizations, lack of communication and alignment of processes external as well as internal.

The obstacles can be reduced or solved by providing each organization with more information and rationale behind decisions of the other organizations. Further, by showing how decisions affect the other organizations people will be more aware of the overall process. Methods to enhance the mutual understanding and thereby increasing trust are for instance workshops, regular evaluation meetings, or visiting each others organizations. Another measure is to redesign processes and procedures to reduce the possibilities for opportunistic behavior.

The interviews indicate that openness, benevolence and reliability are important for trust building within the CDM program. Especially, openness is a key factor because the sharing of information, enhanced communication and providing insight into each others processes will also lead to an increase in benevolence and reliability.

TRUST IN THE DUTCH AVIATION SECTOR

RESEARCH PART II:

DECISION, DESIGN, EVALUATION

6 TOOL DECISION

In chapter five the role of trust has been explored. Based on these results in this chapter the rationale for a tool will be provided to support trust building within the CDM program at Schiphol Airport. The purpose of the tool will be defined, strategies that are available for the support of trust building will be provided and a decision for an approach will be made.

6.1 PURPOSE

The purpose of this research project is to support trust building within the CDM program at Schiphol Airport. The answers to the research questions presented in chapter five have indicated that AAS, KLM and LVNL are aiming for developing trust to the level of knowledge based trust. Further, the results of the interviews indicate that three of the five dimensions of trust are important for trust building within the CDM program: openness, benevolence and reliability. The results also indicated that especially openness needs to be improved because most issues and contributing measures to the development of trust mentioned by the participants are related to openness.

Furthermore, the improvement of openness will also lead to a positive development of benevolence and reliability. Openness in the CDM program at Schiphol Airport comprises the sharing of information and communication between the involved organizations. By improving the sharing of information, communication and insight into each others processes people will be more benevolent to commit to CDM and the reliability of the information will be enhanced.

Therefore, the purpose of the second part of the research will be to support trust building for the development of knowledge-based trust by stimulating openness between AAS, KLM and LVNL.

6.2 STRATEGIES

The second part of the research will focus on the stimulation of openness. Two types of openness can be distinguished: reflective and participative openness. Reflective openness is about challenging your own thinking, be open for new ideas, opposing opinions and new ways of doing things. Participative openness is about the freedom to speak one's mind, to not have any hidden agenda's, explaining intentions and sharing information freely (Senge, 1992; Tsuchiya, 2005; Wall, 2005).

In order to improve openness in general the reflective as well as the participative openness of the organizations need to be improved. Literature on trust and openness provide a number of tactics for the improvement of reflective and participative openness. Further, in chapter four, Table 2 has provided a number of trust building mechanisms that can be used to achieve knowledge-based trust. Table 7 provides an overview of the tactics to improve openness as well as the list of mechanisms for trust building to achieve knowledge-based trust. By placing tactics and mechanisms that are similar next to each

other and overview is created of those tactics and mechanisms that stimulate openness as well as contribute to the development of knowledge based trust.

Tactics to improve openness	Trust building mechanisms knowledge-based trust
Create understanding of the basis of other organization's culture	Offering explanations for decisions
Sharing experiences	Encouraging communications
Sharing information	Sharing knowledge and appropriate information
More interaction time	Encouraging communications
Emphasis on feedback	Providing timely feedback
Create goal congruency	Creating shared vision
Support over blame	
Create understanding of the basis of own organization's culture	Creating common language
	Openness
	Receptivity

Table 7: Tactics and mechanisms to improve openness (Senge, 1992; Tsuchiya, 2005; Wall, 2005) and achieve knowledge-based trust (Lander, Purvis, McCray, & Leigh, 2004).

Table 7 shows that the tactics for the improvement of openness are for a large part similar to the trust-building mechanisms for achieving knowledge based trust. This shows that knowledge-based trust is mainly based on openness. By combining these two lists a comprehensive list of mechanisms is created that supports trust building for the development of knowledge-based trust by stimulating openness. These mechanisms are: Create understanding of the basis of other organizations culture. By providing the rationale for decisions and procedures the organizations will have a better understanding of each others organizations which will lead to fewer frustrations. Further, by encouraging communication, sharing experiences and more interaction a mutual understanding of each others organization can be created. Sharing information and knowledge can increase trust and openness when it is reciprocated by the other organizations. By providing feedback and being receptive for feedback organizations trust will increase because organizations experience that their partners listen to their feedback. By creating goal congruency and shared goals the organizations ensure that they strive for the same goal which creates commitment towards each other. These mechanisms can be used as strategies to support trust building.

6.3 APPROACH

The purpose of the research is to support trust building between the organizations involved in the CDM program. Following the results of the interviews the focus will be on the support of trust building for the development of knowledge-based trust by stimulating openness between AAS, KLM and LVNL. An approach has to be chosen that is most suitable for applying the trust building mechanisms defined in paragraph 6.2. For an approach to be suitable it has to take into account the characteristics of the target audience. Therefore, first, a description will be provided of the target audience based on the problem description in chapter two and the results of the interviews presented in

chapter five. Secondly, based on the purpose of the research and the characteristics of the target audience an approach will be chosen from a list of available approaches.

Target audience

The target audience for the approach consists of operational employees of AAS, KLM and LVNL involved in the pre departure sequence. As described in chapter four the human assets in the pre departure sequence, like pilots and air traffic controllers, are highly specific. Meaning that the employees involved in the pre departure sequence are mostly highly trained professionals which execute a specific task. This makes them experts in their field which can create reluctance to accept criticism or advice from someone who is less familiar with their field of expertise.

Further, each employee operates according to its own specific standard operating procedures. The employees might have been following, and are used to, certain procedures for years. This might make them reluctant to change for these processes.

Further, the interviews have shown that AAS, KLM and LVNL have diverging cultures which influences the attitudes of their employees. The different cultures cause the employees of each organization to look at issues from different points of view which might be conflicting.

For an approach to be effective in stimulating openness among these organizations an approach will have to enable the employees to look beyond their individual task, expertise and organization. By doing this the approach can create an atmosphere where the employees are willing to accept lessons on openness.

Approaches

McConnell (1993) describes several approaches for transferring a message to an audience:

1. Group training – involves three or more persons who participate in a common learning activity along with a facilitator.
2. Coaching – uses one-on-one training which includes demonstration, lecture, and observation.
3. Mentoring – assigns an experienced employee to a new employee. It is much more of a formal approach, but introduces the employee to the culture and environment.
4. Self-Paced Learning – allows the learner to determine the rate of speed for mastering the concepts of instruction.
5. E-learning – used to describe learning activities conducted from the user's desktop via the internet.
6. Computer-Assisted Instruction- learning based on computer instructions in which the learners progress is tracked and used to direct the learner to appropriate learning material
7. Distance Learning Training – describes instruction in which the trainer is geographically separated from the learner.
8. Self-Study – refers to learning activities initiated and participated in by an individual.

9. Simulations – are controlled and standardized representations on a job, activity, or situation.
10. Lectures – include structured oral presentations delivered for information transfer.
11. Job Assignments – place an individual into the actual position, limited to a period of time, for which the goal is to learn part of the process.
12. Job Rotation – includes several assignments in a preplanned order or exchange of jobs with another person.

The purpose of the research is to stimulate openness between AAS, KLM and LVNL. The description of the target audience shows that this requires participants to look beyond their own processes. This can not be achieved by just handing over documents to each individual because it also requires the transfer of tacit knowledge. This can best be achieved by letting the participants experience the importance of openness. This requires “learning by doing” or “experiential learning. Therefore, the individual more or less passive approaches of the twelve mentioned above are not suitable for the stimulation of openness between AAS, KLM and LVNL. These approaches are: coaching, mentoring, self-paced learning, e-learning, computer-assisted instruction, distance learning training, self-study and lectures. Further, because of the highly specific skills required for the different processes job assignments and job rotation are not suitable within this context. This leaves group training and simulation.

Experiential learning theory defines learning as “the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience” (Kolb, 1984). The process of experiential learning is shown in Figure 8. The process consists of experiencing, reflecting, thinking and testing. Concrete experiences are the basis for reflections. These are distilled into abstract concepts which lead to implications for actions. These actions can be tested and lead to new experiences (Kolb & Kolb, 2008).

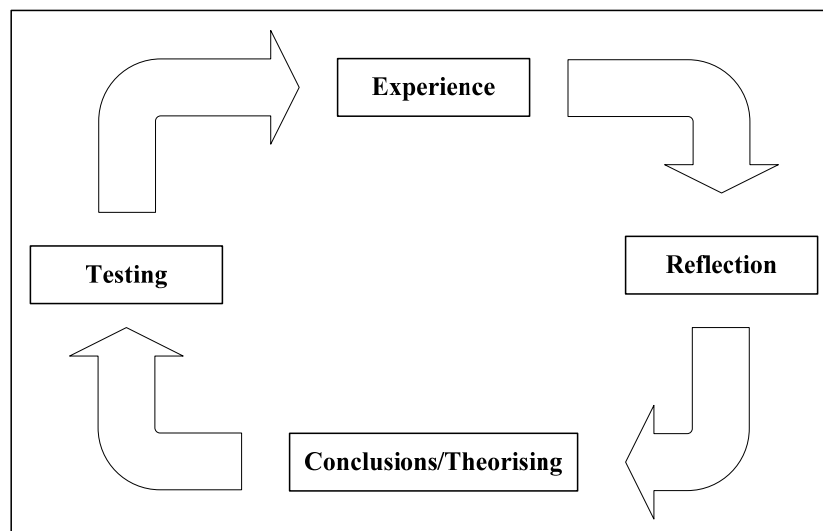


Figure 8: Process of experiential learning (Kolb, 1984)

From the twelve mentioned approaches group training and simulation could be used for the stimulation of openness. Gaming is method that can combine group training,

simulation and experiential learning. Gaming creates a direct experience for the participants which is one of the most powerful learning methods (Senge, 1992). Gaming broadens the learning horizon of participants because they can be provided with a more holistic view of the situation and people can experience the consequences of their actions and decisions within a short time period. The learning process is accelerated because the participants can experience multiple learning cycles during the game. A game provides a risk free environment for trial and error. A game gives participants the opportunity to share experiences which leads to individual frameworks coming closer together which can result in a change in action in real life. A disadvantage of gaming is that it takes relatively much time to develop and it is therefore costly (Kindley, 2002; Michael & Chen, 2005; Prensky, 2003; Tsuchiya, 2005).

Gremmen and Potters (1997) have shown that gaming is more effective than traditional lecturing in terms of learning achievements. However, they also note that gaming is much more costly to construct and therefore is in most situations not suitable to replace lecturing. Tsuchiya (2005) has shown that games can be used to stimulate openness. Further, he shows that a game is more effective than the case study method in stimulating openness.

6.4 CONCLUSION

For the stimulation of openness between AAS, KLM and LVNL gaming is the most appropriate approach. Games can be used to stimulate openness between the participants because it enables people to broaden their horizon and thereby creating an understanding of each others decisions and actions, it enables the sharing of experiences, and it creates interactions between the participants. Further, by using games people have the opportunity to go through multiple cycles or scenario's which creates the opportunity of accumulating knowledge. A game enables participants to see the consequences of their actions on the other organizations. Therefore, gaming will be used to stimulate openness between AAS, KLM and LVNL in order to support trust building.

7 THE GAME

In chapter six the decision has been made to use gaming as an approach for stimulating openness between AAS, KLM and LVNL. In this chapter the game design will be provided. First, the method that is used for the game design is elaborated upon. Secondly, the game design process is described and the final game is presented.

7.1 GAME DESIGN METHOD

In paragraph 3.2.2 the game design method has been discussed. Figure 9 presents an overview of the phases and activities during the design process. In this chapter the first three phases: initiation, design and construction will be discussed. In chapter eight the evaluation of the game will be discussed.

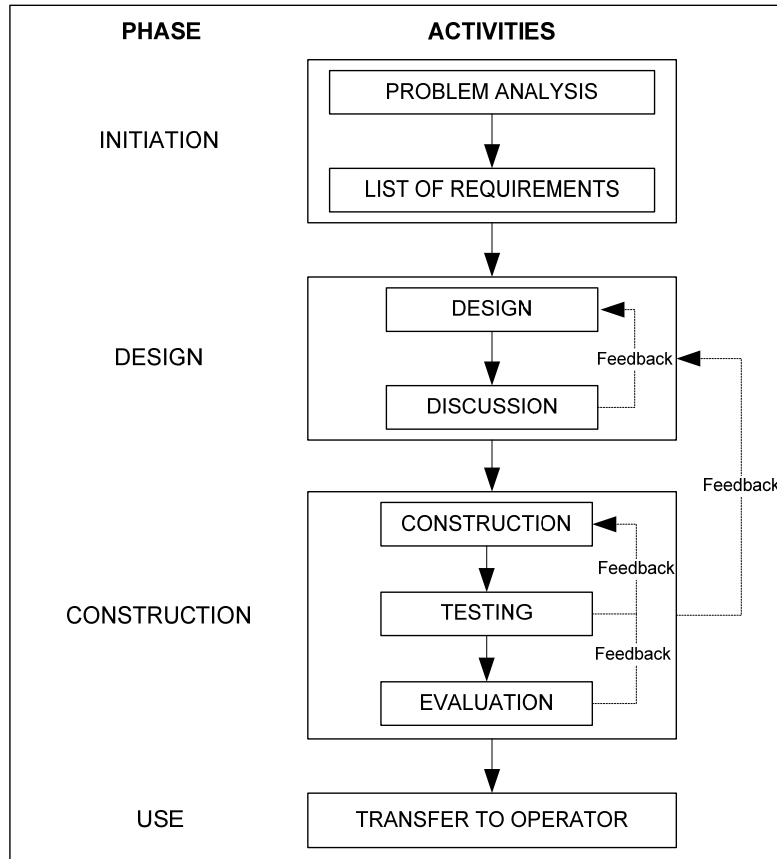


Figure 9: Game design process (based on Duke (1981))

During the initiation phase a list of requirements has been formulated. This has been done following the approach of Duke (1981) who states that the list of requirements for the game should be based upon a problem analysis.

During the design phase a conceptual design of the game has been created. This has been done by going through an iterative process that consisted of multiple cycles of

design and discussion. The conceptual design consists of a description of seven game elements which are derived from the game design approach of Duke (1981). Further, for each of the game elements one or multiple key design choices have been made.

The construction phase consists of an iterative process of multiple cycles of construction, testing and evaluation. The construction phase has been divided into four stages. The first and second stage consisted of constructing the game based on the conceptual design. The third stage consisted two test cycles. Each test cycle consisted of a test session and adaptation of the game based upon the results of the session.

The evaluation phase consisted of an evaluation session with participants from the target audience. Following Yin (2003) the game has been evaluated using multiple sources of evidence: the report from the evaluation session and an evaluation form which has been designed based upon the Goal Question Metric approach (Basili, Caldiera, & Rombach, 1994).

7.2 GAME DESIGN PROCESS

In this section the game design process will be described. The initiation, design and construction phase will be described according to the sequence displayed in Figure 9. The phase of use will follow upon this research project and will therefore not be described.

7.2.1 INITIATION PHASE

The initiation phase of the game design process consists of a problem analysis resulting in a list of requirements. The problem analysis has already been described in chapter two, further, in chapter five and six the problem has been focused on the stimulation of openness between AAS, KLM and LVNL. To summarize the most important elements of the problem description, following Duke (1981) five game elements will shortly be described: client, purpose, subject matter, intended audience and context of use. The clients for the game are the organizations participating in the CDM project: AAS, KLM and LVNL. During the game design process these clients were represented by the LVNL which has been involved with the entire game design process.

The primary purpose of the game is to stimulate openness between AAS, KLM and LVNL. Further, the problem is focused on the pre departure sequence within the CDM project at Schiphol Airport, therefore this constitutes the subject matter that the game should deal with. The pre departure sequence has been described in chapter two.

The audience for which the game is intended consists of the operational employees of AAS, KLM and LVNL that are involved in the pre departure sequence. More specifically for AAS these are the airside operation managers and hub planning, for KLM these are employees from the KLM Hub Control Centre and the part of the KLM Operational Control Centre that are involved with the pre departure sequence at Schiphol Airport. For LVNL these are the Delivery, Start-up, Ground and Runway controllers. The game will be part of the CDM project which is, therefore, the context of use for the game.

Based on the five elements of the problem at hand a list of requirements can be constructed to ensure that the game is acceptable for the client, achieves its purpose, deals

with the subject matter, is suitable for the intended audience and fits into the context of use.

The purpose of the game is to stimulate openness between AAS, KLM and LVNL within the CDM program. To ensure that this purpose is being achieved requirements need to be formulated that contribute to the stimulation of openness. In chapter six strategies have been formulated to support openness: create understanding of the basis of other organization's culture, encouraging communication, sharing experiences, more interaction, sharing information and knowledge, provide feedback, create goal congruency. By transforming these strategies into requirements for the game it is ensured that these trust building mechanisms are present in the design.

The game:

- Should support the creation of mutual understanding
- Should encourage communication
- Should enable the sharing of experiences
- Should encourage interaction
- Should involve the sharing of information and knowledge
- Should involve participants providing feedback towards each other
- Should involve a level of goal congruency

Although all of the above requirements contribute to openness, for the game to support openness not necessarily all of these requirements have to be fulfilled. In order to ensure that the game supports openness the game will be required to return a positive result on at least four of the seven requirements listed above.

The subject matter that the game should deal with is the pre departure sequence, further, the intended audience are employees of AAS, KLM and LVNL that are involved in the pre departure sequence. Therefore, in order to ensure that the game deals with the pre departure sequence and fits into the mindset of the audience the game:

- Should contain characteristics of the pre departure sequence
- Participants should be able to recognize characteristics of the pre departure sequence

From the literature on gaming additional requirements can be added. Games are more successful when they are fun to play (Pivec, Dziabenko, & Schinnerl, 2003). When a game has multiple scenarios or rounds a game enables participants to accumulate knowledge and directly apply it in the next round, which increases the learning effect of a game. Further, the learning effect can be enhanced by evaluating a gaming session with the participants. Through discussion at the end of a session the participant can share the problems and experiences they have encountered during the game. This will enable them to learn from each other (Kindley, 2002; Michael & Chen, 2005; Prensky, 2003; Tsuchiya, 2005).

The game:

- Should be fun to play
- Has to have multiple rounds
- Should include a discussion at the end of the session
- Should be suitable for multiple participants

Further, some practical requirements can be added for the game. The game will be played by employees from AAS, KLM and LVNL. Therefore, to be able to play the game with participants from each organization it has to be suitable for at least three participants in one session. Further, because a lot of people must be able to participate in the game the design must allow for multiple sessions. To ensure that a lot of people can participate within a reasonable time the game should not take too long, therefore, the game should have a maximum duration of about four hours. This creates the possibility to have two sessions a day. Further, because there is not a lot of budget available at this time the game should be relatively inexpensive. Finally, the game should be finished within 10 weeks.

The game:

- Has to be suitable for at least three participants in one session
- Should have a maximum duration of about four hours
- Has to be suitable for multiple sessions
- Should be inexpensive
- Should be finished within 10 weeks

These different lists of requirements together form the requirements for the game. A categorized list of all requirements is provided in Table 13.

Category	Requirements
Desired level of trust	(1) Should support the creation of mutual understanding (2) Should encourage communication (3) Should enable the sharing of experiences (4) Should encourage interaction. (5) Should involve the sharing of information and knowledge (6) Should involve participants providing feedback towards each other (7) Should involve a level of goal congruency
Operational processes	(8) Should contain characteristics of the pre departure sequence (9) Participants should be able to recognize characteristics of the pre departure sequence
Gaming	(10) Should be fun to play (11) Has to have multiple rounds (12) Should include a discussion at the end of the session (13) Should be suitable for multiple participants
Practical	(14) Has to be suitable for at least three participants in one session (15) Should have a maximum duration of about four hours (16) Has to be suitable for multiple sessions (17) Should be inexpensive (18) Should be finished within 10 weeks

Table 8: Categorized list of game requirements

7.2.2 DESIGN PHASE

The problem analysis and requirements from the initiation phase are the input for the design phase. The design phase consists of an iterative cycle of design and discussion where the discussion is meant to improve the conceptual design. Furthermore, the design phase is also part of an iterative cycle with the construction phase. In the construction

phase deficiencies or opportunities for improvement of the design may become apparent. Based on these findings in the construction phase the design can then be adapted.

For the design of the game multiple cycles of design and discussion have been gone through resulting in a conceptual design before going to the construction phase. In this paragraph a description will be provided of the final conceptual design. In the paragraph on the construction phase more attention will be paid to different iterative cycles.

The conceptual design will be described by describing the design choices made during the design process which resulted in the conceptual design. The conceptual design consists of a description of the scenario of the game, different roles, linkages between roles, different rounds in the game, the steps of play, the rules of the game, and performance indicators.

Scenario

A scenario is a description of the plot of the game (Duke, 1981). For the scenario of the game the first design choice that needed to be made was whether the game should be a simulation of the real world situation or should contain characteristics of the real world situation on a more abstract level. Each option has its own advantages and disadvantages.

The advantage of simulating the real world situation is that the participants immediately recognize the scenario as their work environment. This may help the participants to transfer or implement the learning effects of the game into their work environment. A disadvantage of simulating the real world situation is the difficulty to exactly replicate the situation. This creates the risk that participants will argue that the game is not a correct reflection of the real situation and that lessons learned from the game can therefore not be applied in reality. Another disadvantage of creating a simulation of the real world situation is that it might take a lot of time to construct.

The advantage of creating a game which contains characteristics of the real world situation on a more abstract level is that it allows for creating a scenario that enables participants to think free of their normal work environment, processes and procedures. By creating a scenario that participants do not immediately recognize as their work environment participants will not fallback on the routines and procedures that they use in their daily work which will allow them to think freely. Another advantage is that it gives the designer more freedom in creating the game which can make it easier to fulfill different requirements. A disadvantage is that it might be hard for the participants to see the similarities with the real situation which might reduce the learning effects. Therefore, if this kind of scenario is chosen the operator of the game must ensure that there is a discussion at the end of the session to discuss the similarities between the characteristics of the game and the real situation.

In order to make a decision which kind of scenario to choose for the game first the real situation has been looked into to see whether it would be feasible to construct a game that would simulate the pre departure sequence. The real world situation shows that the pre departure sequence is such a complex chain of processes that it might not be feasible at all to create a game that would provide a good reflection of reality and that it is not possible to create it within the timeframe of the project. Therefore, it has been decided to choose a scenario for the game which will contain characteristics of the real situation but will not try to simulate the real situation.

Design choice (1)

For the game a scenario will be used that will contain characteristics of the real situation without trying to simulate the real situation.

After the choice for this kind of scenario a decision must be made for the kind of plot for the scenario of the game.

The choice for a scenario has been made by going through a creative process that consisted of brainstorming about possible plots based on literature on existing games, discussions with an expert on serious gaming and discussions with the client. An example of an existing game for the creation of openness is a game of Tsuchiya (2005) who has created a game to “open the mind of the participants for learning on the subject of openness through objective observation of their own action in the exercise”. In his game he used a crisis situation where different people possessed different kinds of information and they are required to share information and adopt an open attitude if they wish to succeed in their mission.

Based on the creative process the decision has been made to choose a rescue mission as plot for the game. The plot comprises a rescue mission where different teams must work together to rescue as much people as possible.

Design Choice (2)

The plot of the scenario consists of a rescue mission where different teams have to cooperate to rescue as much people as possible.

The scenario description is as follows: Somewhere in the middle of China there exists a mine. In this mine groups of workers work on different locations within the mine. One day, while in operation, the area where the mine is located is struck by an earthquake. This earthquake has left groups of mine workers stuck at different locations in the mine. The locations of the groups of mine workers are yet unknown. To save the mine workers a rescue mission has been set up. The aim of the mission is to save as much mine workers as possible. Although, the location of the groups of mine workers are yet unknown each group possesses a radio which enables them to report their location.

Roles

The scenario of the game consists of a rescue mission where different teams have to cooperate to save as much people as possible. The rescue mission consists of three different roles: a planning team, a coordination team, and a rescue central. The role of the rescue central is operated by the facilitator while the other two roles are operated by the participants. The choice for these three roles has again been made based upon discussion with a gaming expert and discussions with the client. The role of the rescue central is assigned to the facilitator because it primarily consists of executing simple tasks which reduces the chances of learning. If the role of the rescue central would be assigned to a participant he or she might be disappointed because they got the idea that they did not learn anything.

Design Choice (3)

The game consists of three different roles: a planning team, a coordination team and a rescue central. The role of the rescue central is operated by the facilitator, the other two roles are operated by the participants.

The roles have been created in such way that the planning team as well as the coordination team will possess specific information that the other team does not possess. This division of information prohibits the teams from having insight into each others processes. The aim of the division of information is to show the participants that not having the same information or not having insight into each others processes will lead to confusion and suboptimal results.

Design Choice (4)

Each role will be given specific information which the other roles do not possess.

Further, to enhance the fun of playing the decision has been made to create competition. By letting two teams play the game simultaneously competition is created. Each team will consist of a planning team and a coordination team. There is only one rescue central which will process the information to and from each team. Both teams will receive exactly the same information at the same time.

Design Choice (5)

The game will consist of two teams who will compete with each other on rescuing as much people as possible.

Further, to enhance the fun of playing and to encourage communication and providing feedback to each other it has been decided to assign two participants to each role. This means that a session will consist of a total of eight participants.

Design choice (6)

Each role will be operated by two participants.

Role description linkages between roles and steps of play

The linkages between the roles follow from the role descriptions. Figure 10 provides an overview of the linkages between the roles and the steps of play. The first step is the provision, by the rescue central, of assignments to the planning team and of safety information to the coordination team. The second step is the planning that is send by the planning team to the coordination team. The third step is the planning approval that is send by the coordination team to the planning team. The fourth step is the decision to use a RT for an assignment.

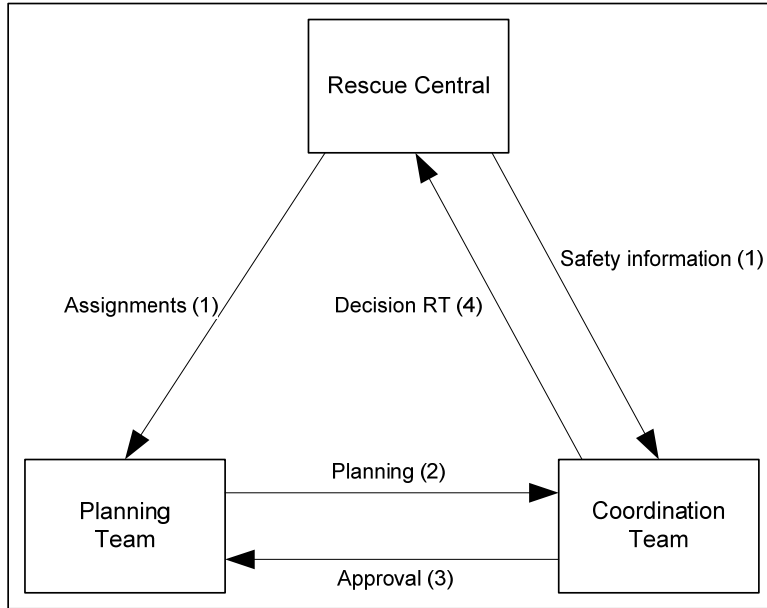


Figure 10: Role linkages and steps of play

Role description

Here, each role will be described. The planning team receives assignments which consist of information about groups of mineworkers that need to be rescued. The information consists of coordinates (X, Y), number of workers, and the time within which a group needs to be rescued. Based on this information the planning needs to make a prioritization of which group to rescue first. When they have made a planning they have to send the assignments to the coordination team. For each assignment they will receive an approval of the coordination team. If not approved they can submit an assignment again later on. If the assignment is approved it will be executed. Figure 11 provides an overview of the processes for the planning team.

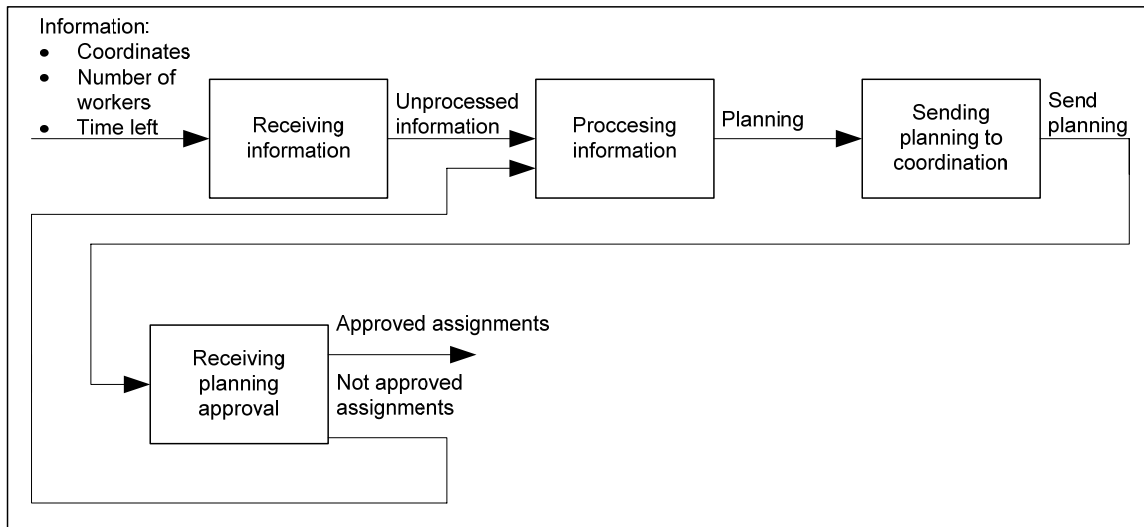


Figure 11: Overview processes planning team

The coordination team receives two kinds of information: assignments send by the planning team consisting of the coordinates of the location of a group of workers. Further, it receives information about the safety situation in the mine consisting of coordinates between which no assignments can be executed. Based on the information on the safety situation the rescue team gives its approval to the assignments send by the planning team. If an assignment has been approved it can be executed by one of the three rescue teams that are available. For each rescue team it will take a different time to execute an assignment. The coordination team will have to look up how long it will take for each rescue team to execute an assignment. Based on that information they will have to make a decision to assign a task to a rescue team. As long as a rescue team is busy executing an assignment it can not be allocated to another assignment. The coordination team can allocated a rescue team to an assignment by sending the assignment with the number of the rescue team to the rescue central. Figure 12 provides an overview of the processes for the coordination team.

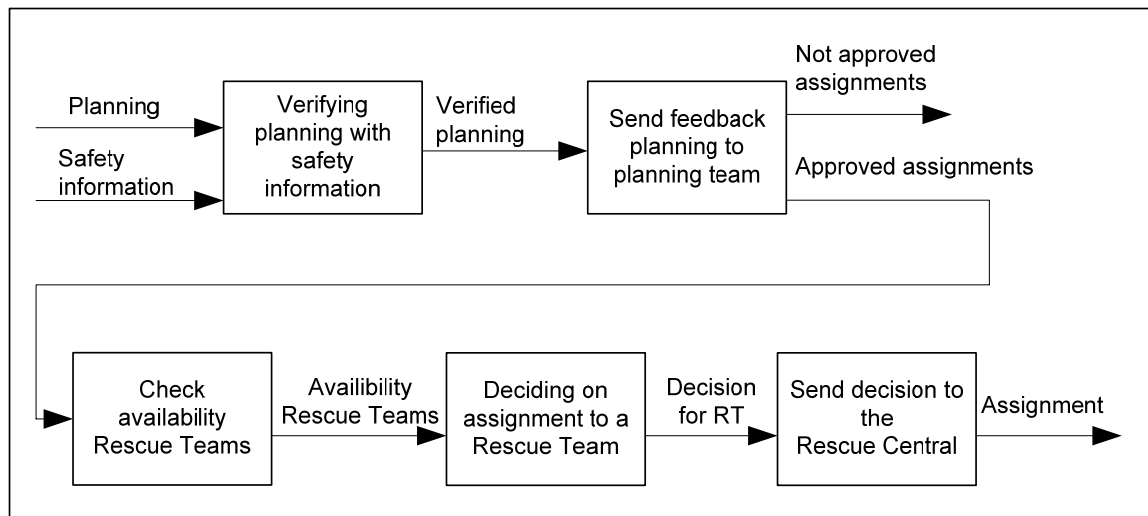


Figure 12: Overview processes coordination team

The role of the rescue central is operated by the facilitator and consists of: sending assignments to the planning team, sending information on the safety situation in the mine to the coordination team, and processing the allocation of rescue teams to assignments received from the coordination team. Figure 13 provides an overview of the processes for the rescue central.

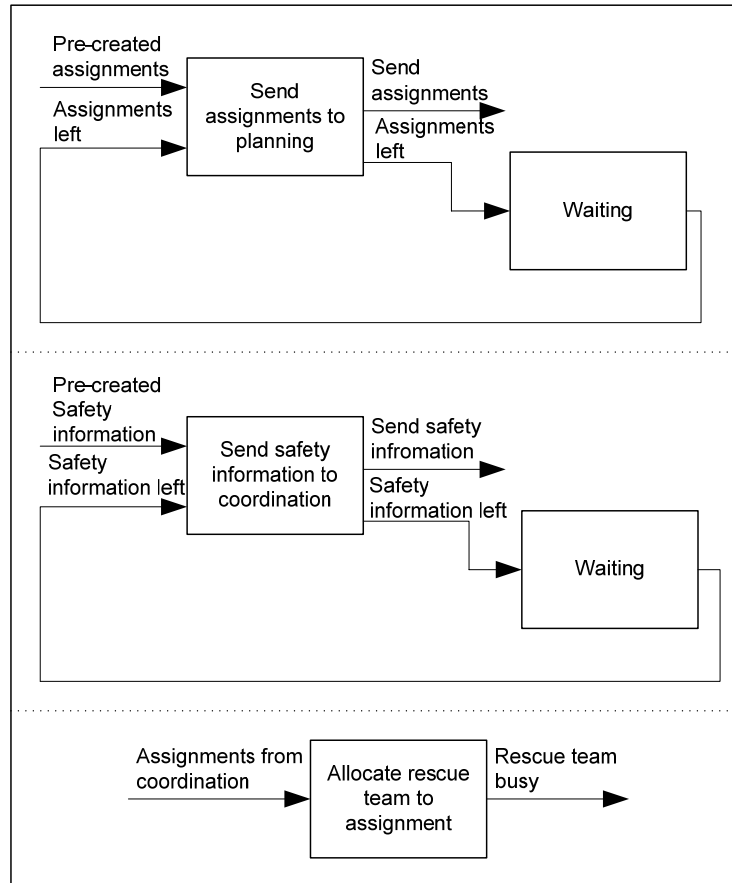


Figure 13: Overview processes facilitator/rescue central

Performance indicators

The two teams will be competing with each other on rescuing as much people as possible. During the test session this has been the performance indicator for each team. During the discussion at the end of the second test session the participants indicated that it would be a good idea to have separate performance indicators for the planning, coordination and the whole team. According to the participants this would be more like the real situation where each organization has its own performance indicators. Based on that discussion the performance indicators have been changed to the total number of people saved for the planning team, the total number of assignments executed for the coordination team and the average number of people saved per assignment for the entire team. A more elaborate discussion of the test sessions is provided in the construction phase.

Design choice (7)

Performance indicators for each role will be the total number of people saved for the planning team, the total number of assignments executed for the coordination team and the average number of people saved per assignment for the whole team.

During the game the performance indicators will be visible to the participants and updated in real-time. This will enhance the feeling of competition among the participants.

Design choice (8)

During the game the performance indicators will be visible to the participants and updated in real-time.

Rounds of play

Based on the test sessions the decision has been made to let the game consist of three rounds of play. The first round is the introductory round. During this round the facilitator will provide an introduction to the game. After the introduction the teams will have some time to read the instructions for their role and have the opportunity to ask questions about the instructions to the facilitator. Next, the game will be played which consists of twenty minutes of play time. The test sessions have showed that twenty minutes play time for a round is suitable: if shorter the participants will not have enough time to execute assignments and if it would be longer it would be repetition of the same processes. After this play time there will be a short break where the participants have sometime to discuss with their partner how they can improve their strategy. This ends the first rounds.

The second round of play will then start with again twenty minutes of play time. Besides new assignments the configuration of the game will be the same as during the first round. During this round the participants have the opportunity to apply their improved strategies. After the twenty minutes of play the teams will have the opportunity to discuss with each other how they can improve their communication in order to enhance their performance.

During the third round of play the team will be able to apply their improved strategies. Further, the participants will be supplied with more insight into each others processes by providing more data to each team. The round will end with a group discussion on the game, the similarities with reality and the lessons learned.

Design Choice (9)

The game will consist of three gaming rounds of play

Rules of the game

The rules of the game are that the participants have to use standard messages for communication with the other participants as provided in the instructions. Further the participants are not allowed to communicate more than the provided standard messages.

Language

The language of the game and game instructions will be Dutch. The participants of the game will primarily be Dutch and by choosing their native language it will be prevented that the language will be a barrier for participants. However, the game and instructions will also be translated into English in order to be able to play the game with non-Dutch participants. In this report the game will be described in English.

Design Choice (10)

The language of the game and game instructions will be Dutch.

Requirements

During the initiation phase requirements have been identified for the game. These requirements have been translated into the conceptual design of the game.

The planning and the coordination team each possess different information. During the game the participants will notice that they do not possess the information that the other team possesses. Further, they will notice that they have no insight into each others processes. This design of the roles will show to the participants that it is important to share information and knowledge, that it is important to understand the processes of the other team, that it is important to communicate, provide feedback and share experiences. This will be amplified during the third round when the participants will experience that more openness will result in better achievements.

The performance indicators designed for the game will show to the participants that it is import to have a level of goal congruency.

Characteristics of the pre departure sequence have been designed into the game by providing the information in an ad hoc way and the assignments and processes of the planning and coordination teams are similar to real operational processes. The planning is most similar to the role of the airline operator, the coordination is similar to air traffic control and the rescue teams are similar to push back trucks.

The element of competition has been brought into the game to increase the fun of playing. The performance indicators will be updated in real time, which will enhance the feeling of competition among the participants.

The other requirements have been directly transferred into the game: multiple rounds, a discussion at the end of the session, suitable for multiple participants, maximum duration of four hours, suitable for multiple sessions, and inexpensive.

7.2.3 CONSTRUCTION PHASE

The conceptual design of the design phase is the input for the construction phase. The construction phase consists of an iterative cycle of constructing, testing and evaluating the game. Further, based upon issues that arise during the construction phase the conceptual design can also be adapted. In this paragraph attention will be paid to multiple iterative cycles of constructing and testing the game.

The construction phase consists of constructing the different components of the game followed by calibration and test runs. The construction is a trial-and-error process which progresses through several stages. The first stage of construction consists of a very rudimentary construction of the game. This construction is “talked through” by the designer and the client. This will provide a good basis for further construction and saves time because in an early stage of construction various problems can be discussed and treated appropriately. This stage can consist of multiple cycles of construction, discussion and adaptation.

During the second stage of construction the game is adapted and constructed in more detail. Again the game is talked through by the designer and the client. This stage can also consist of multiple cycles of construction, discussion and adaptation.

The third stage of construction consists of testing the game with a group of participants which can consist of colleagues and volunteers. This can again consist of multiple cycles of construction and testing.

The fourth stage of construction consists of formal testing, after most “bugs” have been eliminated during the third stage of construction. This entails an evaluation of the finalized version before it is turned over to the client (Duke, 1981).

First & second construction stage

During the first and second construction stage the game was constructed based on the conceptual design. The construction of the game consisted of:

- Creating a map of the mine
- Generating the assignments as input for the planning team
- Generating the safety information as input for the coordination team
- Creating instructions for each role
- Deciding on how to facilitate the communication between the players
- Creating items for communication between the teams
- Deciding on how to visualize the rescue teams
- Creating the visualization of the rescue teams
- Creating the visualization of the game time
- Deciding on how to visualize the performance indicators
- Creating the performance indicators

The map of the mine is displayed in Figure 14. The width of the mine goes from A to S and the depth of the mine goes from 4 to 25. The shafts of the mine are displayed by the lines on the map. However, the location of a group of workers can be on any combination of X and Y coordinates below the surface.

The assignments for the planning team consisted of an assignment number, location coordinates, number of workers and time left to rescue the group of workers. Each assignment received a unique number from one to one hundred to enable the players to identify each assignment during the game. Further, each assignment received an X-coordinate which consisted of a random generated letter between A and S according to the width of the mine and an Y-coordinate which consisted of a random generated number between four and twenty-five according to the depth of the mine.

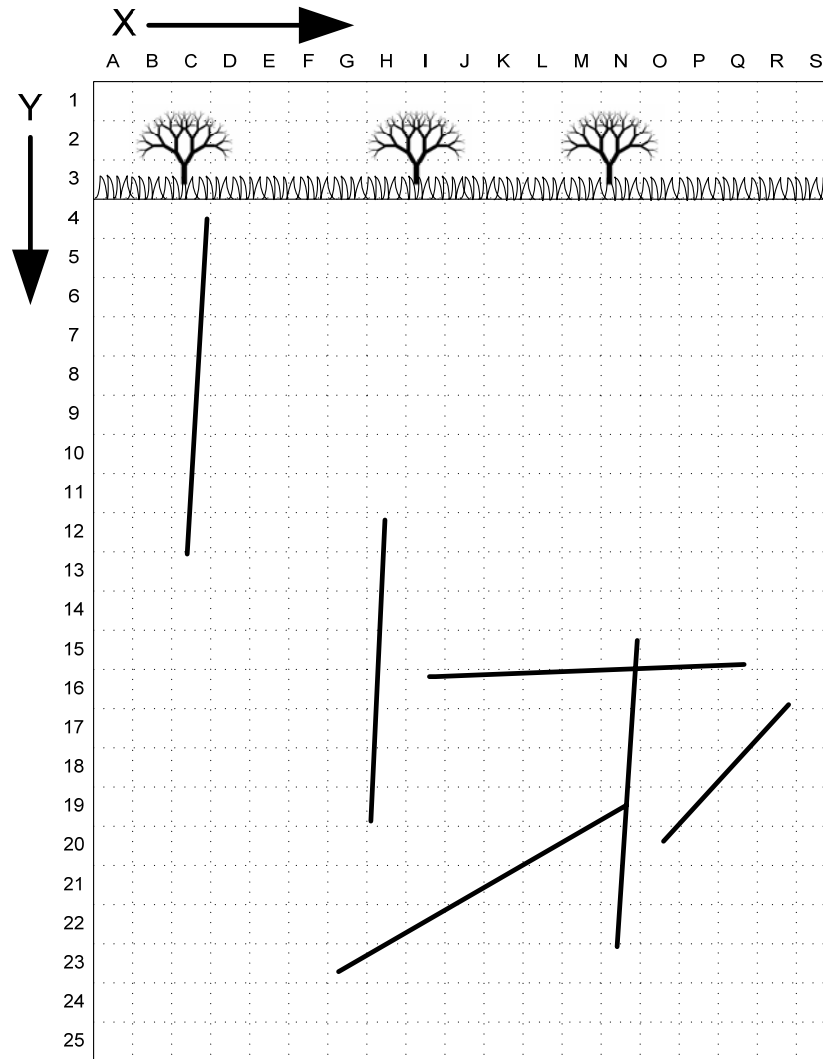


Figure 14: Map of the mine

Further, each assignment received a number of workers consisting of a random generated number between one and twenty-five. For the time left to rescue the group of workers each assignment received a random generated time between five and ten minutes. An example of an assignment as send to the planning team is:

Assignment number: 34, X-coordinate: E, Y- coordinate: 18, Number of workers: 15, Time left: 9:42

The safety information for the coordination team consisted of an area between two X-coordinates and two Y-coordinates which together formed a square within which no assignments could be executed. The areas where chosen in such away that between ten and thirty percent of the assignments could not be executed. An example of the safety information send to the coordination team is:

Due to an unstable condition of the soil it is not possible to execute assignments in the following area:

Between the X-coordinates	E H
Between the Y-coordinates	15 21

The creation of a description for each role consisted of a description of the scenario of the game, the goal of the game, the task of each team and the rules of the game.

For the facilitation of the communication between the teams at first it was decided to facilitate the communication between the players with “pen and paper” which would consist of standard forms for each kind of communication between the players. This decision was made because it would ensure that the communication would be smooth and ensure that the teams would not communicate more than intended by the design. However, during the construction of the standardized forms it was discovered that it would take too much time for the players to fill in the forms and the exchange of the forms would also be difficult. Therefore, it was decided to use a local area network for the communication instead of “pen and paper”. This would save time because: for the facilitator the assignments could be within an excel sheet and then copied and pasted during the game when the assignments needed to be sent to the planning team. Further, for the communication between the planning team, coordination team and rescue central the exchange of messages could be done a lot quicker which would allow the participants to focus more on their primary tasks. To support the communication it was decided to use laptops connected together through a local area network. The software that would initially be used was the GroupSystems software package (GroupSystems, 2008), this package was chosen because it was directly available and installed on the laptops that would be used for the game.

The items created for the communication between the different teams consisted of creating standard messages that the teams were obliged to use during the game. This would ensure that there would be no confusion about the meaning of a message. Further, it would ensure that the participants would not exchange information that was not intended to be exchanged. These standard messages were included in the role instructions.

The rescue teams needed to be visualized in order for the coordination team to see whether a rescue team was still busy or not. Therefore, it was decided to visualize each rescue team by a separate timer. For that purpose a free flash stopwatch was used (Online-stopwatch.com, 2008).

For the visualization of the game time: the time left for playing also the flash stopwatch was used. Figure 15 provides a screenshot of the timers for the rescue teams: four rescue teams for each team and a timer for the time left for playing.

The performance indicators would be visualized at the end of each round by showing a graph of the number of people rescued and not rescued. An example of the visualization of the performance indicators is provided in Figure 16.

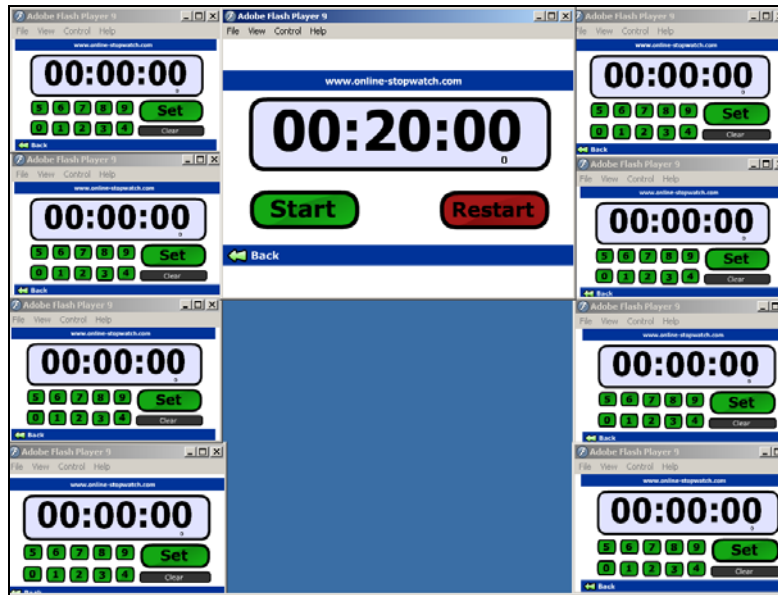


Figure 15: Screenshot timers

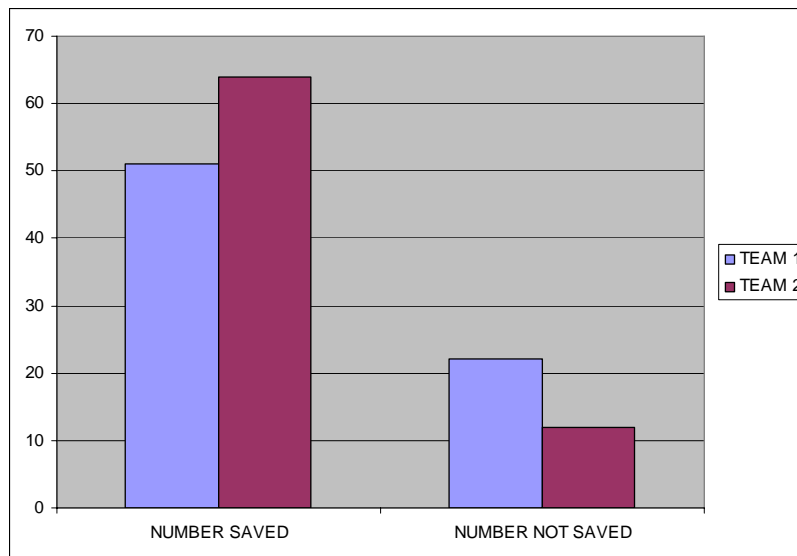


Figure 16: Example performance indicators

Third construction stage

The third construction stage consists of testing the game. A test session can be used to discover bugs and bottlenecks in the game. Based on the results of a test session the game can then be adapted. Within the timeframe of this project it was feasible to do two test sessions. In this paragraph a description will be given of the test sessions, more elaborate reports can be found in appendix F.

The choice has been made to do the first test session with participants without knowledge of the operational processes at Schiphol Airport and the second tests session with participants with knowledge of the operational processes at Schiphol Airport. In this way the first session could be focused on the processes and structure of the game and not on the substance. After that the game could be adapted and the second session could be

more focused on the comparison with the operational processes. The reason to have the test sessions in this sequence was that it would prevent the participants of the second session to be confronted with a bad structure and processes and would be distracted from the comparison with the operational processes at Schiphol Airport.

The first test session was held on July 2nd 2008. The first session was primarily focused on testing the processes and communication of the game. Further, the participants could provide feedback on the different game elements. The participants consisted of seven persons from whom two people had earlier experience with playing serious games, the other participants had no experience with serious games. Further, the participants were all from outside the Dutch aviation sector and did not possess knowledge about the CDM project or operational processes at Schiphol Airport. The first test session resulted in the following opportunities for improvement of the game. First, the session showed that the game instructions could be made clearer in order to ensure that it is clear for each player what is expected before the start of the first round of play. Secondly, during the session the facilitator became a bottleneck in the communication because its workload was too high and he was not able to process all information within a reasonable time. Thirdly, the participants indicated that the feedback on the performance indicators should be in real-time instead of only at the end of a round of play. Fourthly, the number of rescue teams could be reduced because during the session there was almost always a rescue team available for executing an assignment and the coordination, therefore, did not really have to make a choice which assignments to execute first. Fifthly, the GroupSystems software had some drawbacks: the different teams could see each other messages which could provide them with more information than intended and the software did not have a real chat functions which hampered the communication.

Based on the first session the following adaptations have been made to the game. First, based upon suggestions of the participants during the first session the instructions have been clarified and elaborated.

Secondly, the workload of the facilitator has strongly been reduced. This has been done by: instead of using the flash timers, which the facilitator had to adjust to the right time for each assignment, the timers have been programmed into excel. The timers make use of a timer add-in for excel from xlDynamic.com (2008). The timers automatically adjust to the right time when an assignment is allocated to a rescue team. Further, during the first session the coordination team had to request at the facilitator the duration for executing an assignment for each rescue team. Instead each coordination team will receive an excel sheet which has been programmed in such away that the coordination team can lookup the duration of executing an assignment for each rescue team one assignment at a time.

Thirdly, real-time feedback on the performance indicators will be provided to the participants. This will be done by showing the performance indicators on the beamer screen which will be updated in real time. Figure 17 provides an example of the timers and performance indicators.

Fourthly, the number of rescue teams has been reduced to three. In that way the coordination teams will be forced to make a more conscious choice of allocating a rescue team to a certain assignment.

Fifthly, instead of the GroupSystems software package an instant messaging tool, Outlook LAN messenger (Srimax Software System, 2008) for local area networks will be used to support the communication.

Except for the communication software the game is now completely supported by Excel. Excel has been chosen for two main reasons: the game designer was familiar with excel and excel is a widely known software package which will make the game easier to use and adapt for any operator of the game.

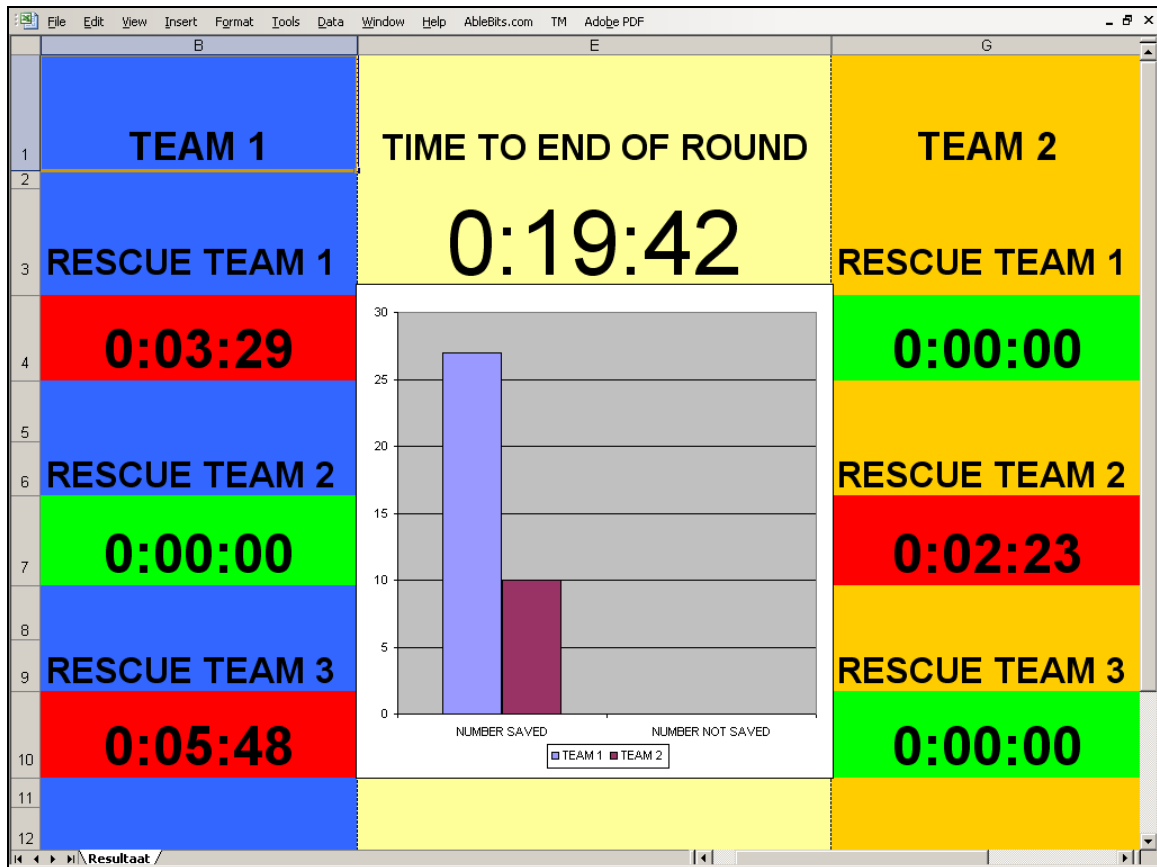


Figure 17: Screenshot timers and performance indicators

The second test session was held on July 8th. Besides testing the adaptations made after the first session the second session was primarily focused on discussing the similarities between the characteristics of the game in the pre departure sequence and reality. The participants of the second session were all employees from the Research & Development department of LVNL and all possessed more or less knowledge of the pre departure sequence.

The second session resulted in the following conclusions on the similarities between the game and the pre departure sequence in reality: the ad hoc way of provision of information, not having insight into each others processes, the lack of communication, and the use of standard communication messages. Further, the participants viewed that the planning team was similar to the planning system of Operational Control Centre of KLM, the coordination team was similar to the task of LVNL and the rescue teams similar to the push back trucks.

Further, during the discussion at the end of the sessions the participants discussed with each other that it was important to share information and have insight into each others processes to reach an overall optimal solution.

The second session showed that the improvements made after the first session were successful in what they aimed to achieve. The two main suggestions for improvements of the game based on the second session were: to improve the similarities with reality separate performance indicators could be used for the planning team, coordination team and overall performance. Suggestions are to use the number of people saved as a performance indicator for the planning team and use the number of assignments executed as a performance indicator for the coordination team.

Further, the participants indicated that for the third round they experienced an information overload and that it should be presented in a more structured way.

Based on the suggestions for improvement of the second session the performance indicators have been adapted. Further, the timers have slightly been adapted to make it more professional. An example of the adapted performance indicators and timers is shown in Figure 18. Further, the information for the third round has been adapted.

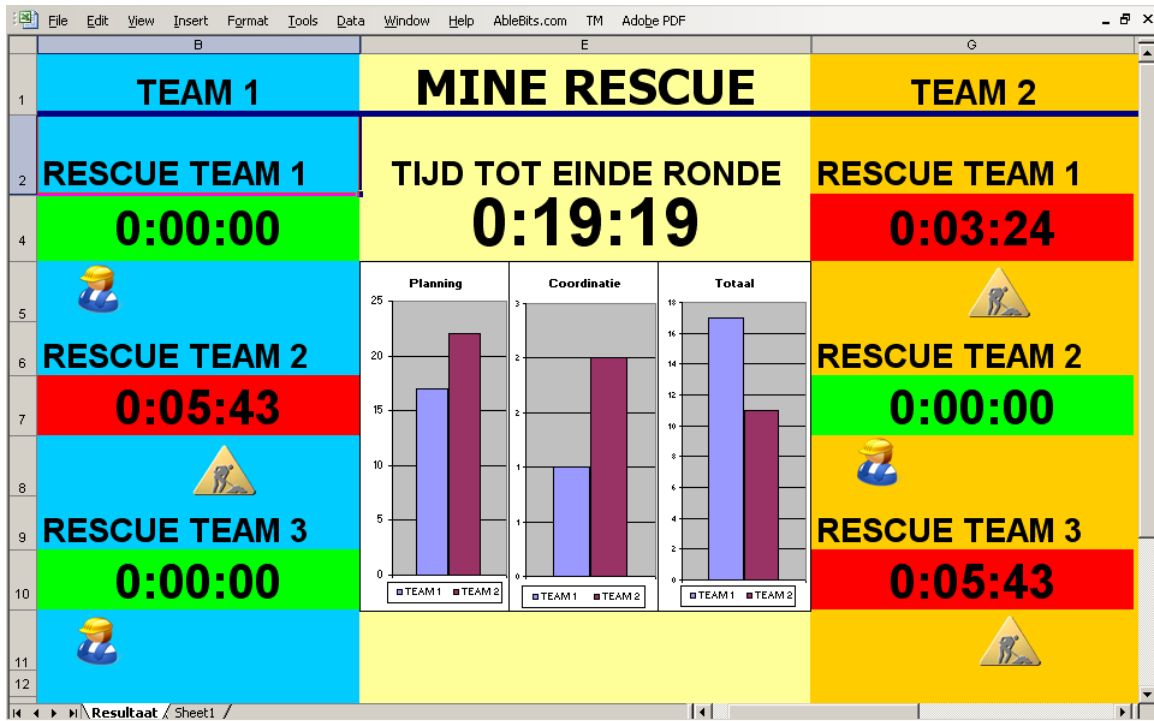


Figure 18: Adapted performance indicators and timers

After the third round the game has been finalized. Figure 19 provides a flow chart of the final versions of the game and gives an impression of how each round is played. In the flowchart T represents the current time, counting down from twenty minutes, and Tx is the time at which new assignments and safety information are send by the rescue central to the planning and coordination.

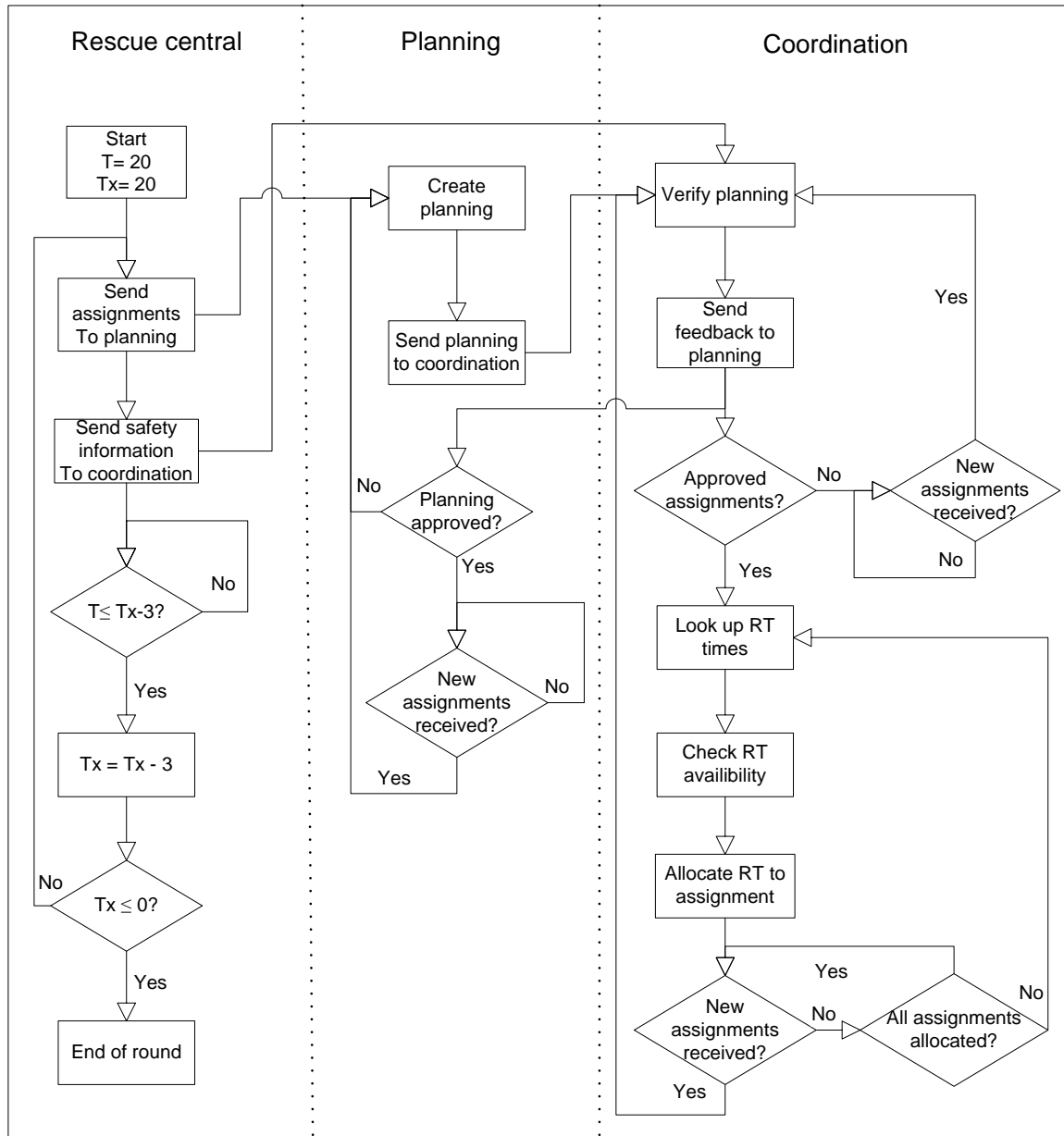


Figure 19: Flowchart “Mine Rescue”

Fourth construction stage

The fourth stage entails an evaluation of the finalized version before it is turned over to the client. The gaming session for the evaluation of the final game has been held on August 6th. The focus of this session has been to evaluate the game with participants from the target audience.

Planning game session

The game will be part of a game session that exists of a number of activities. Table 9 provides an overview of the activities during a game session.

Time (hh:mm)	Activity
00:00	Introduction
00:05	Introduction participants
00:10	Ice breaker: “Lost on the Moon”
00:40	First round of play
01:30	Short break
01:40	Second round of play
02:05	Discussion
02:20	Third round of play
02:45	Discussion & evaluation
03:15	End of game session

Table 9: Planning game session

The game session will start with a short introduction by the facilitator on the agenda of the session. Next, the participants will all be asked to each tell shortly who they are and what they do in their work.

After all participants have been introduced a short game will be played called “Lost on the moon”. Lost on the moon has been selected as an icebreaker for the game session because: most participants will not have any experience with serious games, lost on the moon will show the participants how a simple game can be used for learning. Further, playing the game together will help to “break-the-ice” between participants which will decrease the barriers of communicating with each other during the actual game.

Lost on the moon (Hall & Watson, 1970) “is a multi-stage game frequently used in small-group research. The problem explains that the reader is a crew member of a spaceship that has crash-landed on the surface of the Moon. From the crash, only 15 items in working condition were salvaged from the wreckage. The task for the reader is to rank the fifteen items listed in terms of their importance for survival” (Vaugh, 2005). After the participants have completed the game individually they will be divided into two groups and then play the game again with their group. After the groups have finished the game the participants' individual and group rankings are then subtracted from the correct rankings and the absolute deviations are added to produce a performance score.

After the ice-breaker the first round of playing the game will commence. The participants will be randomly given a role and the participants will be asked to take a seat at the right table according to their assigned role. Figure 20 provides an overview of a typical arrangement of tables and roles for a game session. After the participants have taken their positions they will be given some time to read the instructions, after that the first round of 20 minutes will played.

After the first round there will be a short break after which the second round will be played with the same instructions and rules but with new assignments. After the second 20 minutes of play the planning and coordination teams will be given some time to discuss what can be improved.

During the third round the participants will be provided with more insight into each others processes. Each will receive an excel sheet which provides them with the critical information that they did not possess before.

After the third round the game will be evaluated. The evaluation will constitute of a structured discussion with the participants. The discussion will be structured in the following way: the participants will be asked to write down on snow cards the

characteristics they recognize from the pre departure sequence and the lessons they view that are conveyed by the game, one item per snow card. Next, the facilitator will collect the snow cards and put them on a whiteboard. First, the recognized characteristics will be discussed. The facilitator will take a snow card and ask the person who has wrote to elaborate why he has written it down. Then the other participants will be asked to comment on it. Secondly, the lessons learned from the game will be discussed in the same way.

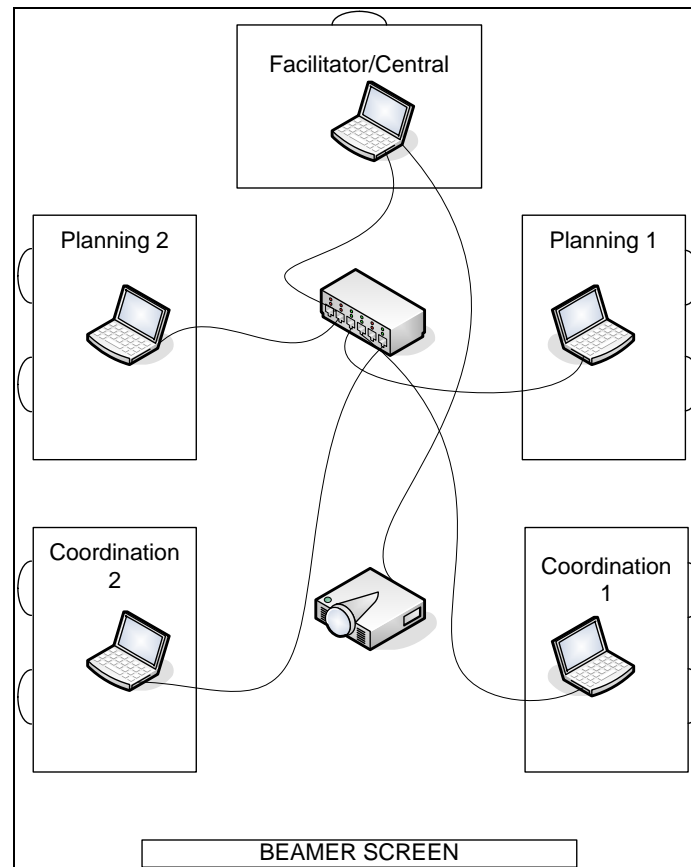


Figure 20: Floor plan game session

Description evaluation session

The evaluation session on august 6th started with a short introduction by the facilitator and an introduction round where each participant shortly told something about himself. After that the session continued with playing lost on the moon. After each participant individually completed the game form they were divided into three groups. With the groups they again had to fill in the game form. This resulted in a lively discussion in each group, an impression is given in Figure 21.



Figure 21: Playing lost on the moon

After “Lost on the moon” the evaluation session continued with “Mine rescue”. After the introduction the participants had been given some time to read the instructions and ask questions. Then the first round began. Figure 22 and Figure 23 give an impression of the participants and the beamer screen during the first round.



Figure 22: Participants during first round



Figure 23: Beamer screen during first round

Figure 24 gives an example of the communication between the planning and coordination during the first round. The example shows that although the teams had been instructed not to communicate more than the standard messages provided in the instruction they tried to provide extra information. However, as soon as it was discovered by the facilitator they were again told not to communicate more than the standard messages and they stopped. It did not affect the course of the game.

<p>Planning 1 says 6,h,22</p> <p>Coördinatie 1 says 2 available as well</p> <p>Coördinatie 1 says request 2 or 6?</p> <p>Coördinatie 1 says 2 ja</p> <p>Coördinatie 1 says 6, nee</p>
--

Figure 24: Example communication planning – coordination

Further, what was remarkable is that one of the planning teams decided to create paper strips of each assignment similar to the strips used in the tower for planning aircraft movements. Furthermore, it was remarkable because these participants were not air traffic controllers.

After the first round had ended there was a short break where each planning and coordination team had to discuss on its own how they could improve their performance. After that the second round started which was similar to the first round.

After the second round each team was provided with information that provided insight into each others processes. Furthermore, the planning and coordination teams were given some time to discuss a common strategy to increase their performance, see Figure 25 and Figure 26.



Figure 25: Discussion team 1



Figure 26: Discussion team 2

After the third round, the game was evaluated by using snow cards. Figure 27 gives an example of a number of snow cards. The results of the evaluation will further be discussed in chapter 8.



Figure 27: Snow cards

8 EVALUATION

In chapter seven the first of the three phases of the game have been described up to and including testing the game. In this chapter the evaluation of the game “Mine Rescue” will be described. First, the approach for the evaluation of the game will be discussed. Secondly, the results of the evaluation will be provided. Thirdly, the results will be discussed.

8.1 APPROACH

The evaluation of the game can be divided into a number of steps: (1) determine the objectives of the evaluation, (2) selecting an evaluation approach, (3) constructing evaluation items, (4) data collection, (5) constructing an evaluation report (Fitz-Gibbon & Morris, 1987; Herman, Morris, & Fitz-Gibbon, 1987).

Determine the objectives of the evaluation

The objective of the evaluation of the game is to evaluate to what extent the game stimulates openness between AAS, KLM and LVNL. Based on this objective the requirements for the game design have been formulated. These requirements are the basis of the evaluation (Duke, 1981).

Selecting an evaluation approach

For the evaluation the requirements for the game can be divided into two categories: requirements that can directly be observed from the game design and requirements that cannot directly be observed from the game design. The requirements that can directly be observed from the game design are: the game:

- Has to have multiple rounds
- Should include a discussion at the end of the session
- Should be suitable for multiple participants
- Has to be suitable for at least three participants in one session
- Should have a maximum duration of about four hours
- Has to be suitable for multiple sessions
- Should be inexpensive
- Should be finished within 10 weeks

The requirements that cannot directly be observed from the game design are: the game:

- Should support the creation of mutual understanding
- Should encourage communication
- Should enable the sharing of experiences
- Should encourage interaction
- Should involve the sharing of information and knowledge
- Should involve participants providing feedback towards each other
- Should involve a level of goal congruency
- Should contain characteristics of the pre departure sequence

- Should be fun to play

For the requirements that can directly be observed no evaluation tool has to be designed. For the requirements that cannot directly be observed a suitable evaluation approach has to be chosen. Herman *et al.* (1987) present the outcome approach as an evaluation approach that “examines the extent to which the goals of a product or program are being achieved”.

The objective of the evaluation of the game is to evaluate if the game stimulates openness between AAS, KLM and LVNL. The outcome approach fits this objective by stating the following main question: To what extent is the game meeting its goals? The outcome approach subdivides the main evaluation question into three sub questions:

- What are the goals of the game?
- How can they be measured or otherwise assessed?
- What do the measures show about the degree of goal attainment?

The goal of the game has already been determined: stimulating openness between AAS, KLM and LVNL. The goal has been subdivided into a number of requirements. The purpose of the evaluation is to see to what extent these requirements are met and to what extent the overall goal of the game is achieved.

For the measurements of the requirements there are several options: interviews with participants after the session, questionnaires answered by the participants and reports of the gaming sessions. Yin (2003) argues that in order to have a strong case multiple sources of evidence should be used. Within the timeframe of this project it is not possible to do any interviews with the participants after the session. Therefore, for the measurement of the requirements questionnaires and the report of the gaming session will be used.

The questionnaire for the evaluation of the requirements has been constructed following the Goal Question Metric (GQM) approach (Basili, Caldiera, & Rombach, 1994). The GQM approach uses a measurement model which has three levels: The first level consists of the goals that need to be evaluated. The second level consists of the questions that will determine to what extent a requirement is fulfilled. The third level is a set of data that answers each question in a quantitative way. Figure 28 provides an overview of the measurement model of the GQM approach.

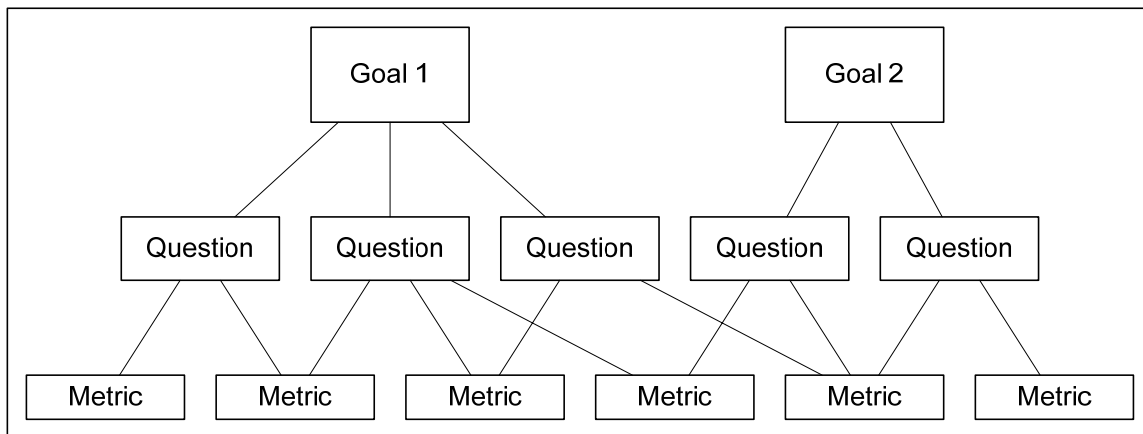


Figure 28: Goal Question Metric model (Basili, Caldiera, & Rombach, 1994)

For the questionnaire the first level of the GQM consists of the requirements of the game. For each requirement the question can be asked to what extent that requirement is met. These questions form the second level of the GQM. An example of such a question is: *“To what extent does the game stimulate the sharing of knowledge and information?”* To answer these questions each requirement has been formulated as a proposition that the participants can rank on a seven-point Likert scale from strongly disagree (1) to strongly agree (7). Examples of such propositions are: *“The game stimulates the sharing of knowledge and information”* or *“The game shows that it is important to share information”*.

Further, the evaluation form has been constructed by going through an iterative process of construction and discussion. Appendix H provides the evaluation form with the questionnaire which will be used for the evaluation. Besides the questionnaire the participants are also given some space to add comments.

8.2 RESULTS

In this paragraph the results of the evaluation will be provided. First, a summary will be provided of the evaluation discussion at the end of the game session of August 6th. A more elaborate report of the game session can be found in appendix H. Secondly, the results from the questionnaire will be presented and discussed.

Results evaluation discussion

The evaluation discussion started directly after the participants had finished the third round of play. The participants were asked to write down on snow cards the characteristics of the real operational processes they recognized in the game and the learning goals they got from the game. Table 10 provides a categorized list of the characteristics the participants had written down. The list of items and the discussion about the items showed that the main characteristics the participants recognized are: planning, having limited information, not having insight into each others processes and cooperation.

Category	Items
Cooperation	CDM Cooperation Consultation -> efficiency Own optimization
Information	Limited information More information, efficiency up Limited information about each other
Insight in processes	Coordination Keep oversight Understanding other processes Mutual tuning of processes Tuning communication
Planning	Setting priorities Planning Planning vs. execution Planning Priorities Overload planning More info better planning

Table 10: Recognized characteristics of operational processes in the game.

Table 11 provides a categorized list of the learning goals the participants have written down. The list of items and the discussion of the items showed that the main learning goals the participants recognized are related to: cooperation, communication, sharing of information, common goals and have more insight into each others processes.

Category	Items
Cooperation	Cooperation Mutual communication Cooperation Cooperation
Sharing information	Sharing information
Common goals	Take decisions together Have clear goals Work according to agreements Develop a strategy together
Insight in processes	Let other people do their work Better tuning of processes More information makes responsibilities unclear.
Other	Optimal planning makes for efficient operation Difficult to give everyone an equal workload. Use of team is a challenge Shift quickly Short standard terminology promotes communication

Table 11: Learning goals of the game perceived by the participants

The results of the evaluation discussion show that the participants recognized four different kinds of characteristics of real operational processes in the game. Further, the results show that a number of mechanisms for stimulating openness as defined in chapter six are present in the game. Especially sharing information, goal congruency,

communication, and understanding each others processes were frequently mentioned by the participants.

Results of the evaluation form

At the end of the game session all participants completed the evaluation form with 15 propositions. Table 12 shows the average, lowest and highest score on the 7-point Likert scale as well as the standard deviations. A more detailed overview of the results is provided in appendix I.

Proposition	Lowest	Mean	Highest	SD
1. The goal of the game is clear	6.0	6.0	6.0	0.0
2. The game shows that it is important to have a mutual understanding for each others decisions	4.0	6.0	7.0	0.9
3. The game shows that it is important to communicate with each other	5.0	6.1	7.0	0.6
4. The game stimulates the sharing of experiences	5.0	5.9	6.0	0.4
5. I enjoyed playing the game	5.0	6.1	7.0	0.6
6. The message of the game is unclear	1.0	2.5	6.0	1.9
7. The game shows that it is important to share information	6.0	6.1	7.0	0.4
8. I found it difficult to recognize the pre departure sequence in the game	1.0	2.6	4.0	1.1
9. The game instructions were clear	5.0	5.9	6.0	0.4
10. The game shows that it is important to provide feedback to each other	5.0	6.0	7.0	0.5
11. The game shows that it is important for people to work on a common goal	6.0	6.5	7.0	0.5
12. The game shows that it is important to have sufficient communication from both sides	3.0	5.9	7.0	1.2
13. I recognized multiple characteristics of the pre departure sequence	4.0	5.1	6.0	0.8
14. The game can contribute to an open atmosphere between AAS, KLM and LVNL	4.0	6.0	7.0	0.9
15. After playing the game I am more open towards the sharing of knowledge and information	4.0	5.1	6.0	1.0

Table 12: Results evaluation form (n=8)

For the construction of the evaluation form the GQM approach has been used. Now, the results can be used to answer the question if the requirements are present in the game.

The results of the evaluation forms indicate that all requirements that are evaluated by the form are present in the game. Further, the results show that on average the participants agree to most propositions and slightly disagree to disagree on the two propositions that were negatively formulated. The participants especially recognized the importance of working on a common goal in the game. Further, on average they only slightly agreed on the propositions on the characteristics of the pre departure sequence and on there attitude towards the sharing of knowledge and information.

For ten of the fifteen propositions (1, 3, 4, 5, 7, 9, 10, 11, 13 and 15) the difference between the lowest and highest score is equal to or less then two points. For these propositions none of the participants had a strongly deviating opinion. The standard deviation indicates how strong the division is among the participants. E.g. the standard deviation of proposition fifteen indicates that the participants were divided into a group which scored four and a group that scored six. Because, for these propositions there were no strongly deviating scores they will not further be discussed.

For five of the fifteen propositions the difference between the lowest and highest score is larger then two points. This means there was a stronger division among the participants which is also indicated by the standard deviations. Therefore, there is a need

to discuss these propositions. Especially the deviating negative scores are relevant because these might indicate the need for improvement of the game.

For three (2, 12, 14) of these five propositions there was only one participant who's score deviated more than two points from the most positive score. Furthermore, the deviating scores of these three propositions were all scored by the same participant. For the propositions 2 and 14 this participant scored 'neither agree nor disagree' and for proposition 12 'slightly disagree'. During the discussion this participant also indicated that he found it important that each of the three organizations should not interfere too much with decisions of the other organizations and he saw that as a risk of CDM. However, it is difficult to tell if this explains its more negative attitude on these three propositions. Because it was only one participant there is no need to improve the game on these issues at this moment, but future game sessions should point out whether there is a need to improve the game on these issues.

For each of the other two propositions (6, 8) there were two participants whose score deviated more than two points from the most positive score. Their negative scores for proposition six, 'the message of the game is unclear', contradict with their scores on proposition one, 'the goal of the game is clear', where each participant agreed with the proposition. The evaluation discussion during the game session gives no further explanation for these deviating scores. However, it should be looked into how the message of the game could be made clearer.

For proposition eight two participants scored a 4. Proposition eight is similar to proposition thirteen. One of the participants also scored a 4 on proposition thirteen the other a 5. So these scores are more or less consistent. These two participants were the two non-operational employees that participated. Further, one of them indicated that not being an operational employee might give him less understanding of the pre departure sequence. Therefore, this indicates that these two participants scored more negative on proposition eight because they are not actively involved in the pre departure sequence. However, future game sessions should point out if the operational people do recognize characteristics of the pre departure sequence in the game.

Conclusions evaluation discussion and evaluation form

The results of the evaluation discussion and evaluation form give a strong indication that the game: supports the creation of mutual understanding, encourages communication, enables the sharing of experiences, encourages interaction, involves the sharing of information and knowledge, involves participants providing feedback towards each other, involves a level of goal congruency, contains characteristics of the pre departure sequence, and is fun to play.

The results show that the awareness of the importance of openness in the cooperation between AAS, KLM and LVNL has grown during the game session. However, the participants also indicated that they will not directly change their way of working. They see more a need for a cultural change within the organizations.

Quotes:

“Without information you will only be optimizing your own process which is less efficient overall”.

“Creating a common strategy will lead to a different way of working, this will require a cultural change”.

This shows that the game can support trust building to the extent that it increases the awareness of the importance of openness, but that the game does not lead to a change in the way of working by the individual participants.

Further, the game will have to be further evaluated during multiple sessions and with the participation of employees of all three organizations. For further evaluation of the game it will be essential that employees of AAS will also participate in game sessions. However, as described in paragraph 2.3 KLM and LVNL are the most important actors in the pre departure sequence.

The evaluation session also has shown that the game does not have to be constricted to the pre departure sequence. Multiple participants have indicated that the game could be used, without adaptation, for employees in other operational processes. The game has generic characteristics which are present in a lot of the operational processes.

8.3 DISCUSSION

The aim of the game is to support trust building within the CDM program in the Dutch aviation sector. In this paragraph the effect of the game on trust building between AAS, KLM and LVNL will be discussed.

The effect of the game on trust building can be divided into two different aspects: the effect on the attitudes of the participants towards each other and the effect on the attitudes of the participants towards the other organizations in their work environment. Figure 29 provides an overview of the effect of the game on trust among the participants and trust among the organizations. A plus indicates a positive causal relationship between two factors meaning that if the first factor increases the second also increases.

The effect of the game on the attitudes of the participants towards each other is shown in Figure 29. The game session has been a positive experience for the participants. It has been a positive experience because the participants enjoyed cooperating, communicating and discussing with each other. Through playing the game and competing with each other the participants interacted in away they usually do not do during their work. That the participants experienced the game session as something positive is shown by the results of the evaluation form and their reactions during the game session. This positive experience influences the participants process based trust. Process based trust refers to development of trust during relationships, see also paragraph 4.4. The literature on trust building indicates that trust develops through positive experiences, see Figure 5. So, during the game session the participants develop an open trusting attitude towards each other. It is hard to predict how this attitude within the game session will translate into cooperating with the same people outside the game session in their daily work. However, the positive experience of the game session probably lowers the barriers that obstruct the development of trust.

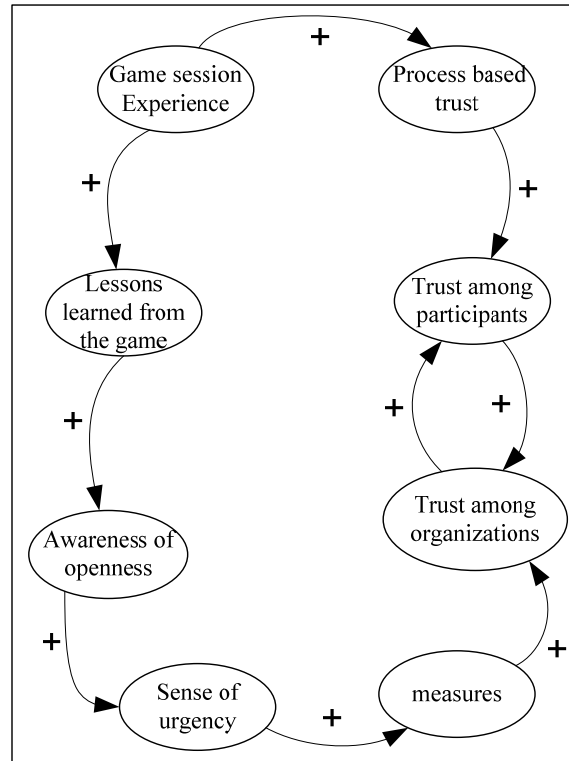


Figure 29: Development of trust

The attitudes of the participants towards the other organizations have been influenced in two ways: through the positive experience with participants of the organizations and through the message conveyed by the game. The positive experience of the participants, as described above, can have a positive effect on how they view employees of the other organizations this can lower the barriers for being more open towards the other organizations and supports trust building. Further, the message conveyed by the game has increased the awareness of the participants of the importance of openness. This increase in the awareness of the importance of openness creates a sense of urgency among the participants because they are confronted with a discrepancy between the lessons learned from the game and the actual situation. The more employees of the organizations have participated in a game session the stronger the sense of urgency within the organization will become. This is also where the influence of the game ends. It is possible that the game session affects the attitudes of the participants when there is a need to cooperate or share information with the other organizations. However, to make a real change and build trust AAS, KLM and LVNL will have to take further steps and concrete actions.

Therefore, the game contributes to trust building by increasing the process based trust among the participants and through increasing the awareness of the importance of openness.

8.4 IMPLEMENTATION

The game session and evaluation results indicated that the game supports trust building within the CDM program at Schiphol Airport. To develop trust among AAS, KLM and LVNL the game should become a part of the CDM program through organizing game sessions with participants of each organization.

As discussed in paragraph 8.3 the game can contribute to creating a sense of urgency within the organizations. Further, the larger the number of employees that have participated in a game session the higher the sense of urgency within the organizations will become.

As indicated in paragraph 8.3 the game is a first step in building trust between AAS, KLM and LVNL within the CDM project. To really make a change on openness and trust building between the organizations additional measures are needed. Therefore, in addition to the game sessions the organizations should think about follow-up sessions in which the step is made from increased awareness and a sense of urgency towards concrete steps and possible measures.

Further, the game has been created to support trust building within the pre departure sequence. However, the reactions of the participants during the game sessions indicate that the game has a lot of generic characteristics that make it suitable to be applied for other operational processes. This is confirmed by the fact that KLM has shown interest in using the game for an internal training program.

A limitation of the game is that each participant can only play it once. The game is based on a scenario where the participants do not know which information the other participants possess. After the game session each participant knows exactly which information the others possess, therefore, a participant can not play it a second time. Again, the game is a first step in supporting trust building. If in the future the organizations want to build or maintain trust they cannot use the game a second time but should look for other approaches.

Practical implementation

To realize the game sessions, first, for each organization it should be determined which and how much employees should participate in the game sessions. This could be employees active within the pre departure sequence, however, as discussed before the game might also be suitable for other employees. Further, the effect of the game session might be enhanced by combining it with other activities, e.g. workshops more focused on the content and technical part of CDM. Combining game session with other activities might increase the awareness of the importance of CDM and the importance of trust among the organizations. Therefore, it has to be determined:

- Which employees should participate in the game sessions
- What other activities can be combined with the game sessions
- Within which timeframe the game sessions should be held
- How much resources should be allocated to the game sessions in order to facilitate the game sessions for the identified number of employees within the selected timeframe
- Who should facilitate the game sessions

- How the game can further be improved

Further improvement

The evaluation of the game shows that there is still room for the improvement of the game. Future research should point out whether the game can be improved so that it will not only increase the awareness but also influences the way of working. However, as mentioned before, this might also be achieved by combining the game with other activities within the CDM program.

Further, the communication between the coordination teams and the rescue central can be improved. If the coordination teams would be able themselves to allocate rescue teams to assignments the facilitator would have time to walk around and see how the participants are doing.

Another improvement might be to reduce the duration of the first round to ten minutes. The first round is meant to make the participants familiar with the game and this might also be achieved in ten minutes instead of twenty. However, this should be tested because some participants indicated that they would have liked the rounds to be thirty minutes instead of twenty.

9 CONCLUSIONS

In this chapter an answer will be provided to the main research question: *How can trust building be supported within the Collaborative Decision Making program in the Dutch aviation sector?* To answer this question first the research questions of the first part of the research will be discussed. Secondly, the research questions for the second part of the research will be discussed. Thirdly, the answer to the main research question will be provided. Fourthly, recommendations will be provided.

9.1 RESEARCH QUESTIONS PART I

In this paragraph answers will be provided to the research questions of part I of the research. The research questions for part I are:

What is the role of trust in Collaborative Decision Making (CDM) in the Dutch aviation sector?

- What is the function and importance of trust within the CDM program?
- What is the current level of trust in the network of AAS, KLM, and LVNL?
- Which level of trust are AAS, KLM and LVNL aiming for?
- Which factors contribute to trust?
- Which obstacles exist that block trust building?
- Which measures may contribute to the removal of these obstacles?

These questions have been answered by conducting interviews with operational employees from AAS, KLM and LVNL. The interviews have shown that trust plays an important role within CDM in the Dutch aviation sector. Trust is important for CDM because it creates openness in the sharing of information, it enables cooperation, leads to the fulfillment of agreements, and helps to deal with criticism.

Currently, the people involved in CDM have developed trust among each other through joint activities in the CDM workgroups. However, among a larger group of people, who are not involved in CDM, trust still needs to be developed.

To make CDM at Schiphol Airport successful AAS, KLM and LVNL aim to develop trust among their employees to a level which is based on knowing the other organizations sufficiently well that its behavior is predictable, this is called knowledge-based trust. This level of trust relies on sharing of information and providing insight into each other's processes.

Obstacles that stand in the way of reaching the desired level of trust are: differing interests, differing corporate cultures, the possibility for and existence of opportunistic behavior, conflicts at other levels between the originations, conservatism, importance of individuals, competition between internal parts of organizations, lack of communication and alignment of processes, externally as well as internally.

The organizations can reduce these obstacles by providing each other with more information and rationale behind their decisions. Further, by showing how decisions affect the other organizations employees will be more aware of the overall process.

Methods to enhance the mutual understanding and thereby increasing trust are for instance workshops, regular evaluation meetings, or visiting each others organizations.

The interviews have shown that to improve trust within the CDM program openness is especially a key factor that needs to be stimulated. Therefore, the research has further been focused on the stimulation of openness to support trust building within the CDM program.

9.2 RESEARCH QUESTIONS PART II

In this paragraph answers will be provided to the research questions of part II of the research. The research questions for part II are:

What is a good approach for a support concept to support trust building?

- Which strategies/mechanisms are available to support trust building?
- Which kind of tool or method is suitable to support trust building?
- What are the requirements for a tool to support trust building?
- What is a good design method for such a tool?
- What is a good method to evaluate the tool?

Mechanisms that are available to reach the desired level of trust are a combination of mechanisms for stimulating openness and for reaching knowledge-based trust. These mechanisms are for a large part similar to each other and combining them resulted in the following six available mechanisms: First, create an understanding of the basis of other organization's culture. By providing the rationale for decisions and procedures the organizations will have a better understanding of each other's organizations, which will lead to fewer frustrations. Secondly, by encouraging communication, sharing experiences and more interaction a mutual understanding of each other's organizations can be created. Thirdly, sharing information and knowledge can increase trust and openness when it is reciprocated by the other organizations. Fourthly, by providing feedback and being receptive for it, trust between the organizations will increase because they experience that their partners listen to their feedback. Sixthly, by creating goal congruency and shared goals the organizations ensure that they strive for a common goal, which creates commitment towards each other.

To see which approach is most suitable for the stimulation of openness between AAS, KLM and LVNL the suitability of twelve approaches has been discussed. The discussion indicated that gaming is the most suitable approach for stimulating openness. Games can be used to stimulate openness between participants because it enables people to broaden their horizon and thereby creating an understanding of each others decisions and actions, it enables the sharing of experiences, and it creates interaction. By using games people have the opportunity to go through multiple cycles or scenarios, which creates the opportunity of accumulating knowledge. Further, a game enables participants to see the consequences of their actions on other organizations. Therefore, the decision has been made to design a game for the stimulation of openness.

The requirements for the game can be divided over four categories: requirements that ensure that defined mechanisms for reaching the desired level of trust are present in the

game, requirements that ensure that characteristics of the operational processes of the pre departure sequence are present in the game, requirements that enhance the positive effects of using games, and practical requirements for the game. Table 13 provides an overview of the requirements for the game.

Category	Requirements
Desired level of trust	Should support the creation of mutual understanding Should encourage communication Should enable the sharing of experiences Should encourage interaction. Should involve the sharing of information and knowledge Should involve participants providing feedback towards each other Should involve a level of goal congruency
Operational processes	Should contain characteristics of the pre departure sequence Participants should be able to recognize characteristics of the pre departure sequence
Gaming	Should be fun to play Has to have multiple rounds Should include a discussion at the end of the session Should be suitable for multiple participants
Practical	Has to be suitable for at least three participants in one session Should have a maximum duration of about four hours Has to be suitable for multiple sessions Should be inexpensive Should be finished within 10 weeks

Table 13: Game Requirements

For the design of the game the design method of Duke (1981) has been chosen. His method is a generic approach for the design of games and consists of four phases: initiation, design, construction and use. For the design of the game these phases have been gone through in both a sequential as well as an iterative way. During the initiation phase based on the problem description and the results of the interviews requirements have been identified for the game, see Table 13. During the design phase a conceptual design has been made by going through an iterative cycle of design and discussion. After that the game has been constructed in an iterative cycle of construction, testing and evaluation. Furthermore, from the construction phase feedback has been provided to the conceptual design which has been adapted based on that feedback. So, these two phases together also constituted an iterative cycle. The phase of use consists of the transfer of the game to the client represented by the LVNL.

The evaluation of the game consisted of a game session with operational employees of KLM and LVNL. No operational employees of AAS were able to attend to the session. For the evaluation two sources of data have been used: the report of the game session and a questionnaire that has been completed by the participants. For the construction of the questionnaire the Goal Question Metric (GQM) approach (Basili, Caldiera, & Rombach, 1994) has been used. The GQM approach consists of defining the goals which need to be evaluated. These are the requirements for the game. Next, questions are defined to what extent these goals are met. Thirdly, propositions have been formulated that have provided quantitative data to answer the defined questions.

The game session report and the results of the questionnaire showed a positive evaluation of the requirements related to the stimulation of openness. The game supports

the development of trust among the participants by letting the participant cooperate, communicate and discuss with each other. This made the game a positive experience for the participants which supports trust building among the participants. The development of trust among the organizations is stimulated through the development of trust among the participants and through the lessons learned during the game session, see Figure 30. The lessons learned increases the awareness of the importance of openness for the success of CDM. Although, increasing the awareness does not directly lead to a change in working processes it can provide a basis for developing trust among the organizations. However, this is also a limitation of the game since additional measures are necessary to make a real change in the way of working. Therefore, the game is a first step in stimulating trust building which should be followed by other steps to build and maintain trust.

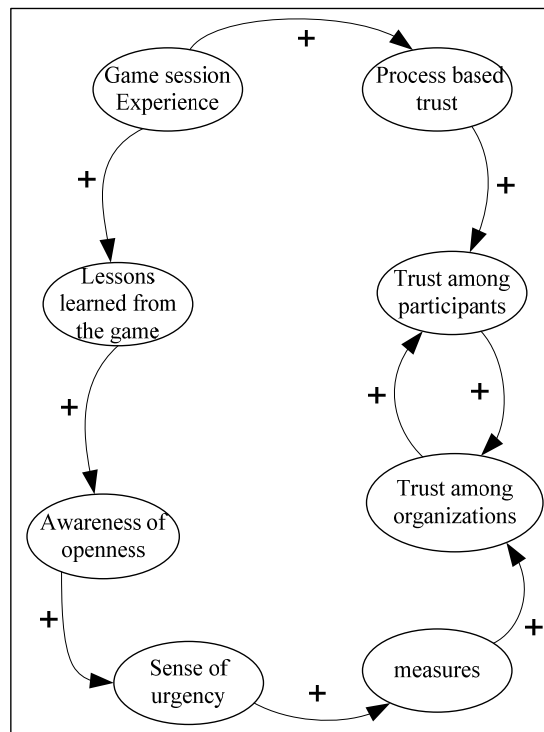


Figure 30: Development of trust

The game needs further evaluation during multiple sessions with the participation of employees of all three organizations. Therefore, the evaluation gives a strong indication that the game stimulates the creation of openness and is a good approach for supporting trust building between AAS, KLM and LVNL.

9.3 MAIN RESEARCH QUESTION

The main research question is: How can trust building be supported within the Collaborative Decision Making program in the Dutch aviation sector?

Trust building within the CDM program in the Dutch aviation sector can be supported by stimulating openness through the use of gaming. Within the aviation sector openness is one of the key factors for improving trust between the involved

organizations. There is a strong indication that the game “Mine Rescue” stimulates the creation of openness between AAS, KLM and LVNL by showing the participants that it is important to: create mutual understanding, communicate sufficiently, share experiences, interact with each other, share information and knowledge, provide feedback to each other and create common goals.

The game stimulates trust building by increasing the awareness of the importance of openness as well as through creating a positive experience for the participants. However, the game does not lead to a direct change in the way of working.

9.4 RECOMMENDATIONS

The game has been developed to support trust building within the Collaborative decision making program in the Dutch aviation sector. The results of the evaluation indicate that the game can increase awareness of the importance of openness. The client, AAS, KM, and LVNL, can use the game for increasing the awareness of operational employees of the importance of openness among their organizations. Further, it is recommended to look into possibilities for improving the game or combining it with other activities in order to achieve a stronger effect on trust building.

The game sessions have shown that the application of the game does not necessarily have to be constricted to the pre departure sequence but could easily be extended to other projects. This is also shown by the fact that KLM has shown interest in using the game for an internal training program. It is recommended to look for other possibilities for the application of the game.

Further, it is recommended to see if it is possible to further improve the technical part of the game, e.g. let the coordination team directly allocate rescue teams to assignments.

REFERENCES

- AAS, KLM, & LVNL. (2003). Programma 'Ketenoptimalisatie' Luchtvaartsector middels Collaborative Decision Making.
- AAS, KLM, & LVNL. (2004). Ketenoptimalisatie door Collaborative Decision Making. Visie van de sector.
- AAS, KLM, & LVNL. (2005a). CDM – Vision and Strategy.
- AAS, KLM, & LVNL. (2005b). Time Line Convergence.
- AAS, KLM, & LVNL. (2007a). Collaborative Decision Making. Schiphol CDM Hub Project.
- AAS, KLM, & LVNL. (2007b). SCHIPHOL AIRPORT COLLABORATIVE DECISION MAKING (CDM) CDM HUB. PROGRAM MANAGEMENT PLAN, FIRST VERSION OCTOBER 2007.
- AAS, KLM, & LVNL. (2008). Project Plan. Collaborative Pre-Departure Sequence Planning (CPDSP).
- Axelrod, R. M. (1984). *The Evolution of Cooperation*. New York: Basic Books.
- Bachmann, R. (1999). *Trust, Power and Control in Trans-organizational Relations*: ESRC Centre for Business Research, Dept. of Applied Economics, University of Cambridge.
- Barney, J. B., & Hansen, M. H. (1994). Trustworthiness as a Source of Competitive Advantage. *Strategic Management Journal*, 15, 175-190.
- Baroni, A., & Weder, J. (2005). Orchestrating airport operation. *International Airport Review* (1).
- Basili, V. R., Caldiera, G., & Rombach, H. D. (1994). The Goal Question Metric Approach. *Encyclopedia of Software Engineering*, 1, 528-532.
- Berulava, G., & Lezhava, D. (2007). The impact of trust on the mode of transaction governance between manufacturer and distributor. *EERC Working Paper Series*
- Blomqvist, K. (1997). The many faces of trust. *Scandinavian Journal of Management*, 13(3), 271-286.
- Bots, P. W. G. (2002). Inleiding Technische Bestuurskunde. leerboek. *TU Delft subfaculteit Technische Bestuurskunde, Delft*.
- Bradach, J. L., & Eccles, R. G. (1989). PRICE, AUTHORITY, AND TRUST: From Ideal Types to Plural Forms. *Annual Review of Sociology*, 15, 97-118.
- Brown, H. G., Poole, M. S., & Rodgers, T. L. (2004). Interpersonal Traits, Complementarity, and Trust in Virtual Collaboration. *Journal of Management Information Systems*, 20(4), 115-138.
- CBS StatLine. (2008). Luchtvaart; maandcijfers regionale luchthavens Heerlen/Voorburg, Netherlands.
- Commissie Tarieven Divisie Luchtvaart. (2004). *Analyse*. Zoetermeer: Inspectie Verkeer en Waterstaat.
- Costa, A. C. (2000). *A Matter of Trust: Effects on the Performance and Effectiveness of Teams in Organizations*: Kurt Lewin Instituut.
- Das, T. K., & Teng, B. S. (1998). Between Trust and Control: Developing Confidence in Partner Cooperation in Alliances. *The Academy of Management Review*, 23(3), 491-512.

- Dirks, K. T., & Ferrin, D. L. (2001). The Role of Trust in Organizational Settings. *Organization Science*, 12(4), 450-467.
- Duke, R. D. (1981). The Game Design Process. *Principles and Practices of Gaming-Simulation*, Sage, Beverly Hills/London, 47-53.
- Enserink, B., & Koppenjan, J. F. M. (2004). Analyse van complexe omgevingen, leerboek 2004. Faculty Technology, Policy and Management. *Delft University of Technology, Delft*.
- Euro-cdm. (2008). Retrieved 14 April, 2008, from <http://www.euro-cdm.org/>
- Eurocontrol. (2003). *Airport CDM applications guide*.
- Eurocontrol. (2006a). Airport CDM Implementation: Eurocontrol, Brussels, Belgium.
- Eurocontrol. (2006b). Airport CDM Operational Concept Document: Eurocontrol, Brussels, Belgium.
- Eurocontrol. (2007). Airport CDM Cost Benefit Analysis.
- Fitz-Gibbon, C. T., & Morris, L. L. (1987). *How to design a program evaluation*: Sage Publications Beverly Hills, Calif.
- Fudenberg, D., & Tirole, J. (1991). *Game Theory*: Mit Press.
- Furlong, D. (1996). *The conceptualization of "trust" in economic thought*: Institute of Development Studies.
- Giddens, A. (1990). *The Consequences of Modernity* (Cambridge: Polity).
- Gremmen, H., & Potters, J. (1997). Assessing the efficacy of gaming in economic education. *Journal of Economic Education*, 28(4), 291-303.
- GroupSystems. (2008). from <http://www.groupsystems.com>
- Hall, J., & Watson, W. H. (1970). The Effects of a Normative Intervention on Group Decision-Making Performance. *Human Relations*, 23(4), 299.
- Herman, J. L., Morris, L. L., & Fitz-Gibbon, C. T. (1987). *Evaluator's Handbook*: Sage.
- Johnson, D. W., & Johnson, R. T. (2003). Training for cooperative group work. *West, M. A., Tjosvold, D. & Smith, KG International handbook of organizational teamwork and cooperative working*. West Sussex: Wiley.
- Jones, C., Hesterly, W. S., & Borgatti, S. P. (1997). A General Theory of Network Governance: Exchange Conditions and Social Mechanisms. *The Academy of Management Review*, 22(4), 911-945.
- Kindley, R. (2002). The Power of Simulation-based e-Learning (SIMBEL). *The eLearning Developers' Journal*, 17.
- Klein, H. K., & Myers, M. D. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly*, 23(1), 67-93.
- Klein Woolthuis, R., & Hillebrand, B. (1998). *Bringing Trust and Dynamics Into the Analysis of Inter-organizational Relationships*: Research centre of the University of Twente Entrepreneurship centre.
- Klein Woolthuis, R., Hillebrand, B., & Nooteboom, B. (2005). Trust, Contract and Relationship Development. *Organization Studies*, 26(6), 813.
- Klein Woolthuis, R., & Nooteboom, B. (2002). Trust and Formal Control in interorganizational Relationships.
- Klijin, E. H., Edelenbos, J., & Steijn, B. (2007). Trust in governance networks: its impact and manageability. *9th Public Management Research Association Conference, Tucson, Arizona*.
- KLM. (2007). *2006 / 2007, a year in perspective*.

- KLM. (2008a). Company profile. Retrieved 28 February, 2008, from http://www.klm.com/travel/corporate_en/mission_people/company_profile/index.htm
- KLM. (2008b). Mission Statement. Retrieved 28 February, 2008, from http://www.klm.com/travel/corporate_en/mission_people/mission/index.htm
- Kolb, A. Y., & Kolb, D. A. (2008). *Experiential Learning Theory: A Dynamic, Holistic Approach to Management Learning, Education and Development*. London: Sage Publications.
- Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*: Prentice-Hall.
- Koning, M., Verkade, E., & Hakfoort, J. (2002). *Gevolgen van uitbreiding Schiphol*. Den Haag: Centraal Planbureau.
- Lander, M. C., Purvis, R. L., McCray, G. E., & Leigh, W. (2004). Trust-building mechanisms utilized in outsourced IS development projects: a case study. *Information & Management*, 41(4), 509-528.
- Lane, C., & Bachmann, R. (1998). *Trust Within and Between Organizations: Conceptual Issues and Empirical Applications*: Oxford University Press.
- Lewicki, R. J., & Bunker, B. B. (1996). Developing and maintaining trust in work relationships. *Trust in Organizations: Frontiers of Theory and Research*, 114-139.
- LVNL. (2007a). *ANNUAL REPORT 2006. Air Traffic Control the Netherlands*.
- LVNL. (2007b). VEM Management for Mainport Schiphol.
- LVNL. (2008a). Mission. Retrieved 28 February, from <http://www.lvnl.nl/html/en/aboutlvnl/mission/index.html>
- LVNL. (2008b). Voorschriften Dienst Verkeersleiding. Schiphol Tower/Approach.
- Marca, D. A., & McGowan, C. L. (1993). *IDEFO-SADT Business Process and Enterprise Modelling*: Eclectic Solutions Corporation.
- Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995). An Integrative Model of Organizational Trust. *The Academy of Management Review*, 20(3), 709-734.
- McConnell. (1993). *The Trainer's Dictionary*. Amherst, Mass: HRD Press.
- Michael, D. R., & Chen, S. L. (2005). *Serious Games: Games That Educate, Train, and Inform*: Muska & Lipman/Premier-Trade.
- Miller, G. J. (1992). *Managerial Dilemmas: The Political Economy of Hierarchy*: Cambridge University Press.
- Ministerie van Verkeer en Waterstaat. (2005). *Evaluatie Performance Luchtverkeersleiding Nederland (LVNL) van het Veiligheid, Efficiëntie en Milieu (VEM) Raamwerk*. Den Haag.
- Noorderhaven, N. G. (1992). Trust and inter-firm relations. *Paper for the 1992 EAEPE Conference*.
- Online-stopwatch.com. (2008). Retrieved 22 July, 2008, from <http://www.online-stopwatch.com/download-stopwatch/>
- Pivec, M., Dziabenko, O., & Schinnerl, I. (2003). Aspects of Game-Based Learning. *I-Know*, 3, 217-224.
- Prensky, M. (2003). Digital game-based learning. *Computers in Entertainment (CIE)*, 1(1), 21-21.
- Project Mainport Schiphol. (2005). *Mainport Schiphol beleidsinformatie Achtergronddocument*.

- Regioplan. (2008). *Overzicht werkgelegenheid luchthaven Schiphol per 26 oktober 2007*. Amsterdam.
- Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. (1998). Not so different after all: A cross-discipline view of trust. *Academy of Management Review*, 23(3), 393-404.
- Schiphol Group. (2007). *Annual Report 2006*.
- Schiphol Group. (2008). Strategy. Retrieved 28 February, 2008, from <http://www.schipholgroup.com>
- Schiphol Group, KLM, & Luchtverkeersleiding Nederland (2005). *Werken aan de toekomst van Schiphol en de regio*.
- Schreuder, A. (2007, 12 June). Alders: Schiphol kan nog groeien. *NRC Handelsblad*
- Senge, P. M. (1992). *The fifth discipline: the art and practice of the learning organization*: Century Business, London.
- Shapiro, D. L., Sheppard, B. H., & Cheraskin, L. (1992). Business on a Handshake. *Negotiation Journal*, 8(4), 365-377.
- Srimax Software System. (2008). Outlook LAN Messenger. Retrieved 22 July, 2008, from http://www.outlookmessenger.com/OM/lan_messenger_download.asp
- Sydow, J. (1998). Understanding the Constitution of Interorganizational Trust. *Trust Within and Between Organizations: Conceptual Issues and Empirical Applications*.
- Tschannen-Moran, M., & Hoy, W. K. (2000). A Multidisciplinary Analysis of the Nature, Meaning, and Measurement of Trust. *Review of Educational Research*, 70(4), 547.
- Tsuchiya, S. (2005). Utility deregulation and business ethics: More openness through gaming/simulation. *Simulation & Gaming*, 36(1), 114.
- Vangen, S., & Huxham, C. (2003). Nurturing Collaborative Relations: Building Trust in Interorganizational Collaboration. *The Journal of Applied Behavioral Science*, 39(1), 5.
- Wall, T. (2005). More Trust, Better Communication Solve Workplace Problems. *Leadership Unlimited*. Retrieved 26 May, 2008, from <http://www.expertclick.com/NewsReleaseWire/default.cfm?Action=ReleaseDetail&ID=9306>
- Wagh, C. K. (2005). EFFECTS OF GROUP COMPOSITION AND CONSENSUS TRAINING. *Online Journal for Workforce Education and Development*, 1(1).
- Webb, A. (1991). Coordination: A problem in public sector management. *Policy & Politics*, 19(4), 229-242.
- Wet Luchtvaart. (2008). Retrieved 26-02-2008, from <http://www.wetten.nl>
- Williamson, O. E. (1985). *The economic institutions of capitalism: firms, markets, relational contracting*. New York: Free Press.
- Williamson, O. E. (1993). Calculativeness, Trust, and Economic Organization. *Journal of Law and Economics*, 36(1), 453-486.
- Wit, B., Meyer, R., & Breed, K. (2000). Strategisch Management van publieke organisaties. *De overheid in paradoxen, Lemma, Utrecht*.
- xldynamic.com. (2008). XtraTime - Excel Countdown Timer. Retrieved 5 August, 2008, from <http://www.xldynamic.com/source/xld.XtraTime.html>
- Yin, R. K. (2003). *Case Study Research: Design and Methods*: Sage Publications Inc.

Zand, D. E. (1972). Trust and managerial problem solving. *Administration Science Quarterly*, 17

APPENDIX A: INTERVIEW PROTOCOL

The aim of the interview protocol is to provide a protocol for performing the interviews for researching the role of trust during the collaborative pre departure sequence at Schiphol Airport. This protocol has been set-up following the case study protocol presented by Yin (2003) and the seven principles for conducting and evaluating interpretive field studies presented by Klein and Myers (1999).

Theory of Klein and Myers

Klein and Myers (1999) give seven principles for conducting interpretive field studies. The first principle is that “we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships”. This means that it is only possible to understand a complex problem if the parts of the problem and their interrelationships are understood. The first principle is the basis of the other six principles. The principle of contextualization aims to set the problem in its social and historical context so that it becomes clear for the intended audience how the current situation under investigation emerged. The principle of “interaction between the researcher and subjects” aims to take into account the influence of the interaction between the researcher and subjects on the retrieved data. The principle of abstraction and generalization aims to relate the retrieved data to general concepts. The principle of dialogical reasoning aims to create a “dialogue” between the theoretical preconceptions guiding the research and the actual data retrieved during the research. This may mean that the preconceptions may be altered because the actual data deviates from the preconceptions. The principle of multiple interpretations aims to retrieve multiple viewpoints and confront them with each other. The principle of suspicion aims to detect systematic biases and distortions in the data retrieved from the participants.

These principles can be used partly for conducting and partly for the interpretation of the interviews.

Theory of Yin

Yin (2003) provides an approach for conducting case studies. This approach can be used for the construction, execution and analysis of the interviews. The case study protocol should have four sections: an overview of the case study project, field procedures, case study questions and a guide for the case study report. For the interview protocol only the case study questions will be defined. The overview, field procedures and guide for the case study report are described in the research report.

For the case study questions Yin distinguishes five levels of questions: Level 1, questions asked of specific interviewees. Level 2, questions asked of the individual case. Level 3, questions asked of the pattern of findings across multiple cases. Level 4, questions asked of an entire study. Level 5, normative questions about policy recommendations and conclusions, going beyond the narrow scope of the study. For the interview protocol in this research level 1 and level 2 questions are relevant. The level 2 questions are the general research questions that need to be answered during the research project. The level 1 questions are the interview questions which should provide data to answer the questions at level 2.

The aim of the interviews is to provide answers to the research questions belonging to the first phase of the entire research project. These questions are:

What is the role of trust during the pre departure sequence at Schiphol Airport?

- What is the function and importance of trust within the network of involved organizations?
- What is the current level of trust in the network of involved organizations?
- Which factors contribute to trust?
- Which obstacles exist that block trust building?
- Which measures may contribute to the removal of these obstacles?

These questions are the level 2 questions, according to Yin (2003). To answer these questions level 1 questions have to be formulated. Further, following the principles of Klein and Myers (1999) also questions have to be formulated regarding the context surrounding the collaborative pre departure sequence. These questions include questions about the organization of the participant, the function of the participant, and its view on the CDM program in general.

Interview Questions

- Which organization do you represent?
- How long have you worked for your organization?
- What is your function within the organization?
- Why are you involved with the CDM program/ collaborative pre departure sequence?

General questions regarding the CDM program/collaborative pre departure sequence:

- How do you view the CDM program in general?
- What is the purpose of the collaborative pre departure sequence?
- How important is the collaborative pre departure sequence within the CDM program?
- What are the benefits for your organization?
- What are the benefits for the other organizations in the network?
- What are possible disadvantages for your organization?
- What are possible disadvantages for the other organizations in the network?
- Which involved organization has the most to gain and which has least to gain by the collaborative pre departure sequence?

Questions regarding trust:

- Is trust important in CDM? And in the collaborative pre departure sequence? Why?
- What does trust constitute, in your opinion?
- How do you recognize trust?
- Do you think the participants in the collaborative pre departure sequence trust each other? How does this affect CDM?

- What is the function of trust in the CDM program? How can trust contribute to the functioning of the CDM program?
- What would the trust relationship ideally look like? What would be the ideal situation regarding trust?
- Which obstacles stand in the way of reaching that ideal situation/improving trust?
- Which measures can help to solve these obstacles/improve trust?
- Are there any trust building efforts/activities at this moment?
- Which processes/activities/exchanges might benefit from trust and which are more suitable for a contract.
- Do you have any examples of trust or mistrust?

After all the questions have been asked and answers the interviewer will try to summarize the participants view on CDM and trust and gives the participant the opportunity to respond. After that the interviewer will thank the participant for his or her participation, will ask if he or she would like to have a transcription of the interview and if he or she may be approached for any further participation later on in the research project.

The interviews will have a conversational structure where the questions of the protocol are a guideline for the conversation.

APPENDIX B: CAUSAL-RELATIONS DIAGRAM

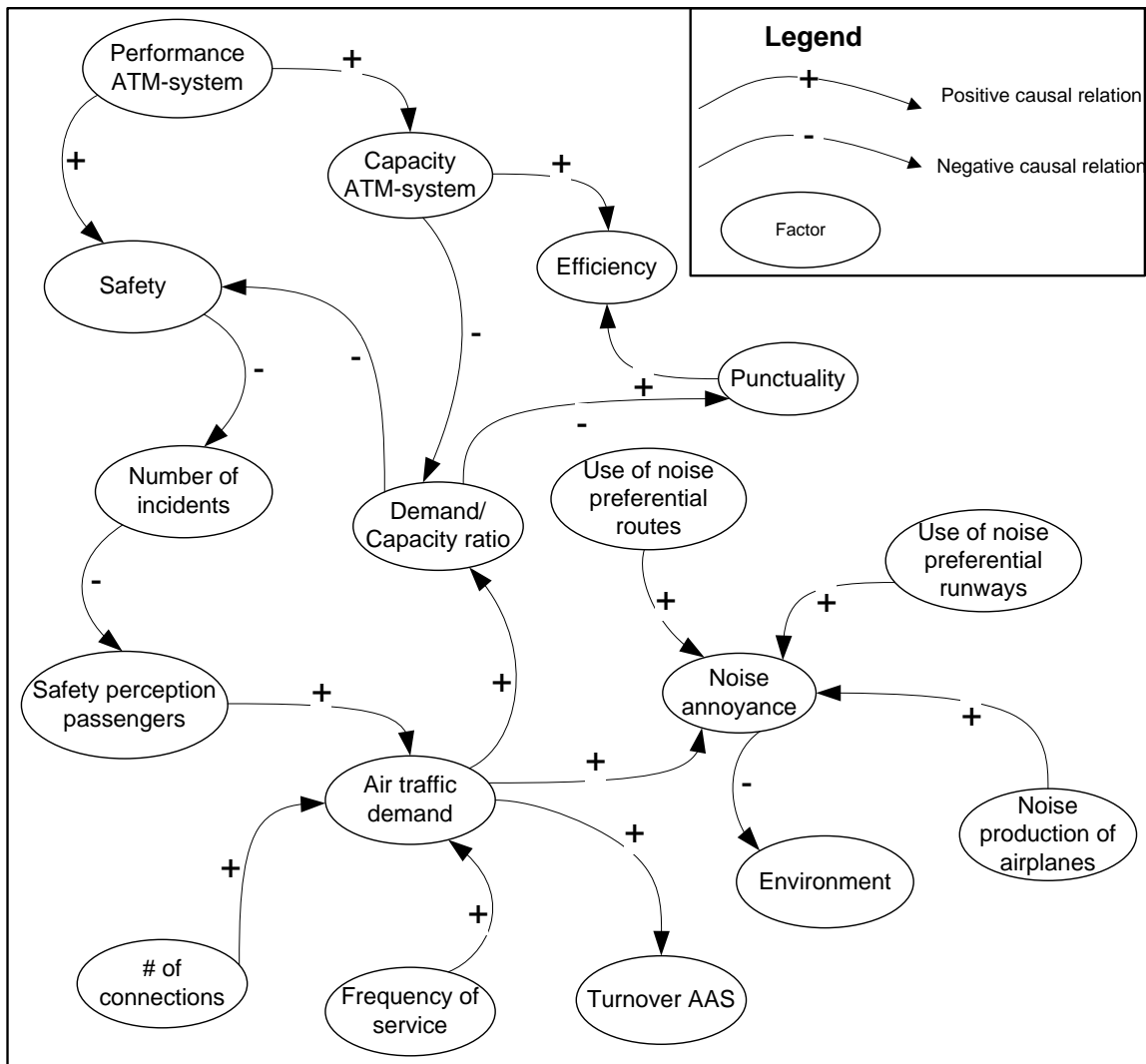


Figure 31: Causal-relations diagram

Explanation causal-relations diagram

The aim of the causal-relations diagram is to provide insight in the factors that influence safety, efficiency and environment. The arrows give the relations and the direction of the relation between two factors. The plus sign indicates a positive causal relation between two factors and a minus sign indicates a negative causal relation (Enserink & Koppenjan, 2004). Further, combining the diagram with the goal-trees of AAS, KLM and LVNL provides insight into conflicts of interest.

The diagram shows the factors that influence safety, efficiency and environment. Safety is influenced by the quality of the ATM-system and the demand/capacity ratio. Environment is influenced by noise annoyance which in turn is influenced by the use of noise preferential routes, the use of noise preferential runways, the noise production of aircrafts and the air traffic demand. Efficiency is defined as the extent to which airlines

are able to operate according to their schedules. Efficiency consists of two factors: punctuality and the capacity of the ATM. The capacity is influenced by the quality of the ATM-system. Punctuality is influenced by the demand/capacity ratio (LVNL, 2007a, 2007b). Table 14 presents an overview of all factors in the diagram and their units.

Factor	Unit
# of connections	Number
Air traffic demand	Movements/year
Capacity ATM-system	Movements/year
Demand/capacity ratio	-
Efficiency	-
Environment	Number of violations
Frequency of service	Movements /connection
Noise nuisance	Number of complaints
Noise production of aircrafts	dB
Number of incidents	Number
Punctuality	% on time
Performance ATM-system	-
Safety	Assessed incident risk
Safety perception of passengers	-
Turnover AAS	€/year
Use of “noisy” routes	Complaints/route
Use of “noisy” runways	Complaints/runway

Table 14: Factors causal-relations diagram

APPENDIX C: GOAL TREES

In this appendix goal-trees will be presented for the Schiphol Group, KLM and LVNL. The aim of the goal-trees is to provide insight into the goals of the organizations in the network. Further, combining the goal-tree's with the causal-relations diagram in appendix B provides insight into conflicts of interest between the organizations in the network.

Schiphol Group

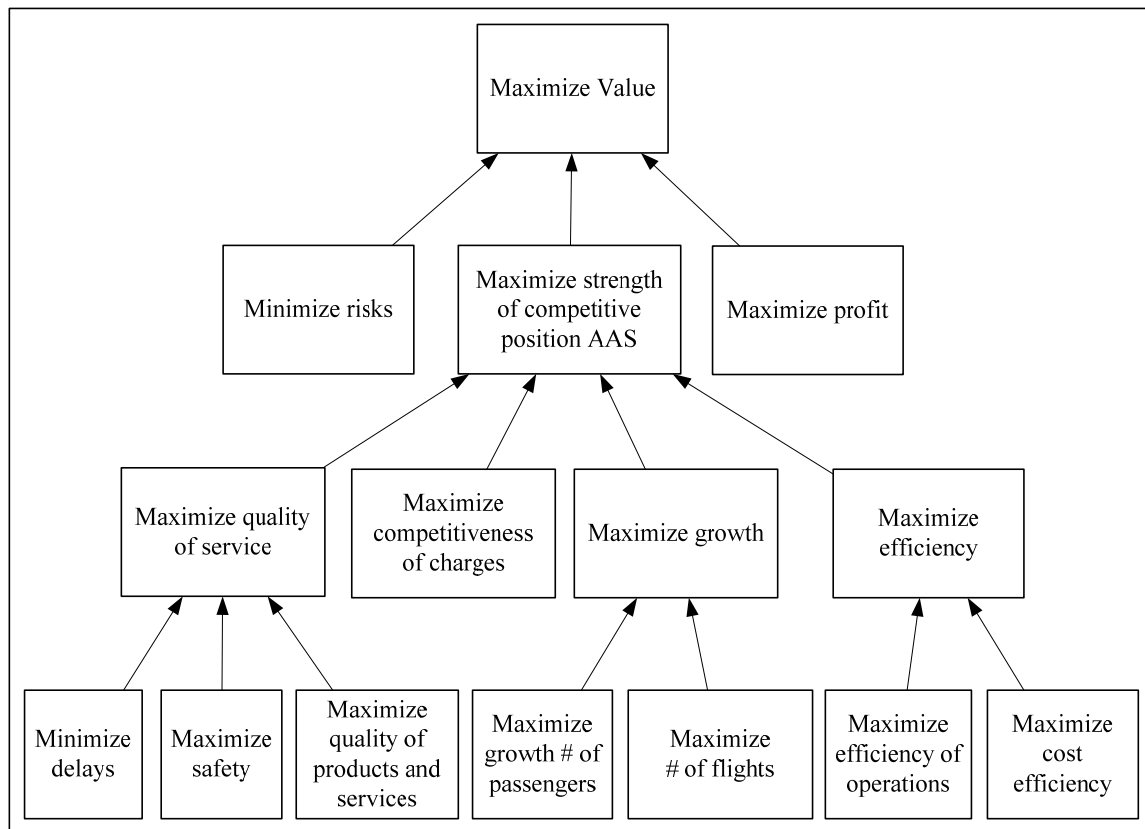


Figure 32: Goal-Tree of the Schiphol Group

The goal-tree of the Schiphol Group is based on their strategy statement (Schiphol Group, 2008) and the annual report 2006 (Schiphol Group, 2007).

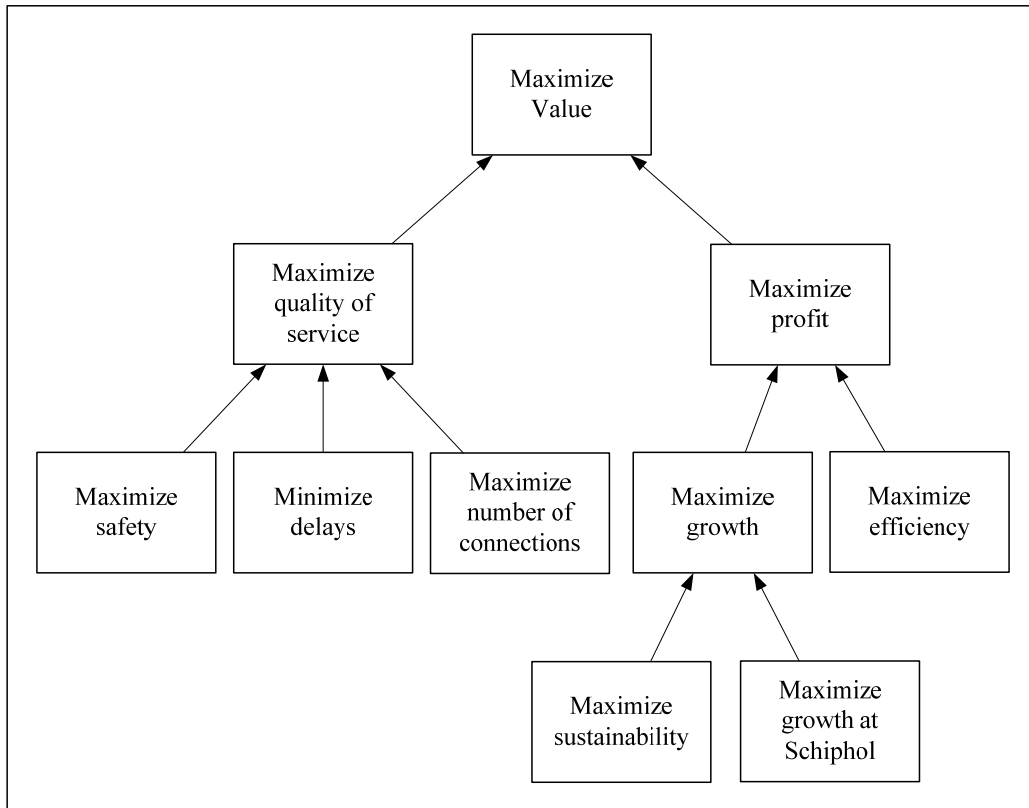
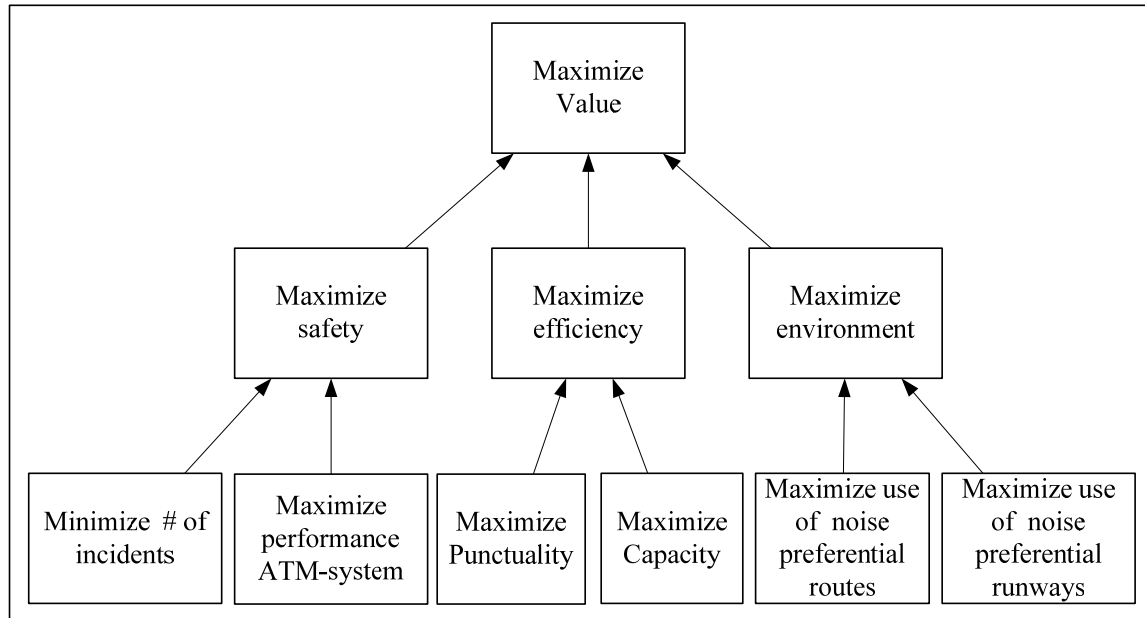
KLM

Figure 33: Goal-tree of KLM

The goal-tree of KLM is based on their company profile (KLM, 2008a), mission statement (KLM, 2008b) and on the annual report 2006/2007 (KLM, 2007).

LVNL**Figure 34: Goal-Tree of LVNL**

The goal-tree of LVNL is based on their mission statement (LVNL, 2008), the law on air transport ("Wet Luchtvaart", 2008), the annual report 2006 (LVNL, 2007a) and a report on the VEM framework (LVNL, 2007b).

APPENDIX D: PROCESSES PRE DEPARTURE SEQUENCE

This appendix presents an overview of processes in the pre departure sequence as defined in “Voorschriften Dienst Verkeersleiding” or Regulations Air Traffic Control for Schiphol Tower/Approach. The overview of the processes has been constructed following the SADT method (Marca & McGowan, 1993). This means that the processes will be presented with an input (left), output (right), support (bottom), and procedures (top). Further, the SADT method shows the processes in hierarchical fashion from high level to more detailed levels. The A.0 is the highest level and shows the input, output, support and procedures for the entire pre departure sequence.

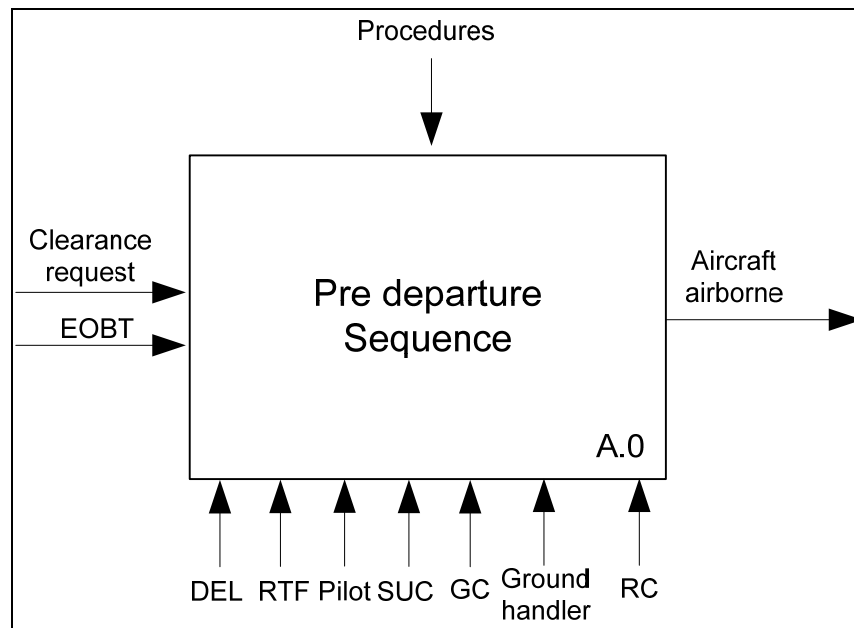


Figure 35: A.0 overview pre departure sequence

The A.0 has been subdivided into five sequential processes: clearance delivery (A.1), start-up (A.2), push back (A.3), taxiing (A.4) and take-off (A.5). These processes are shown in Figure 36, Figure 37 and Figure 38.

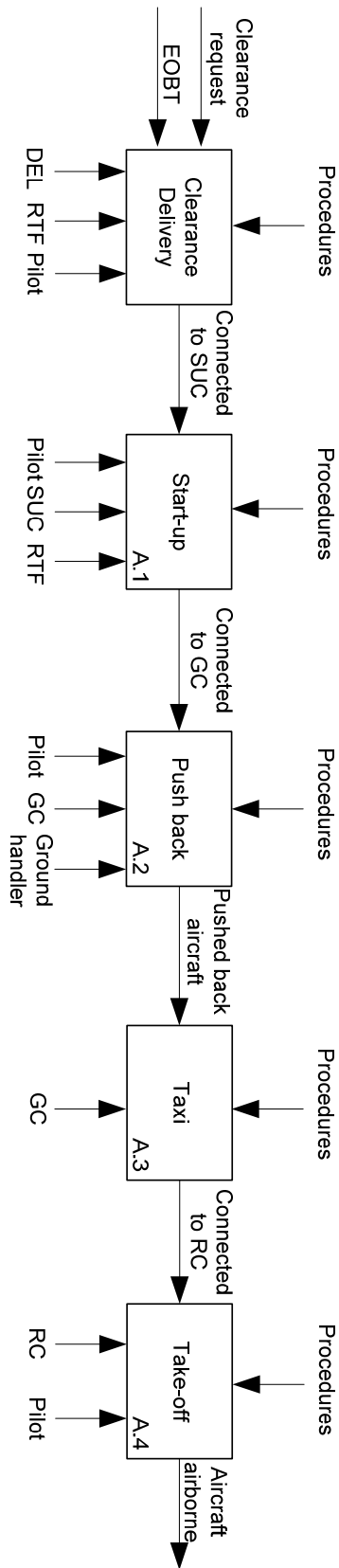


Figure 36: A.1 – A.5 processes pre departure sequence

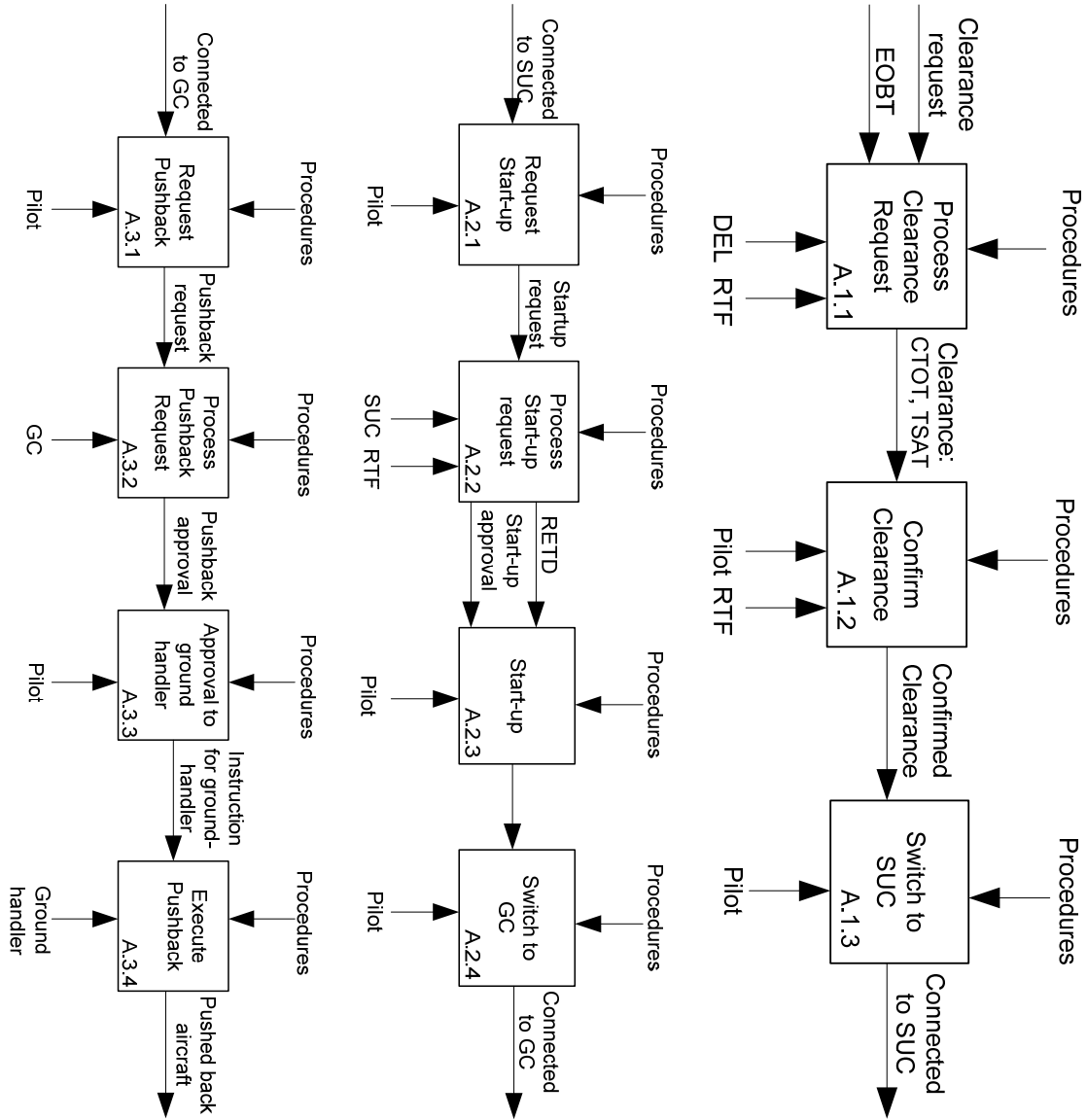


Figure 37: A.1.1 – A.3.4 processes pre departure sequence

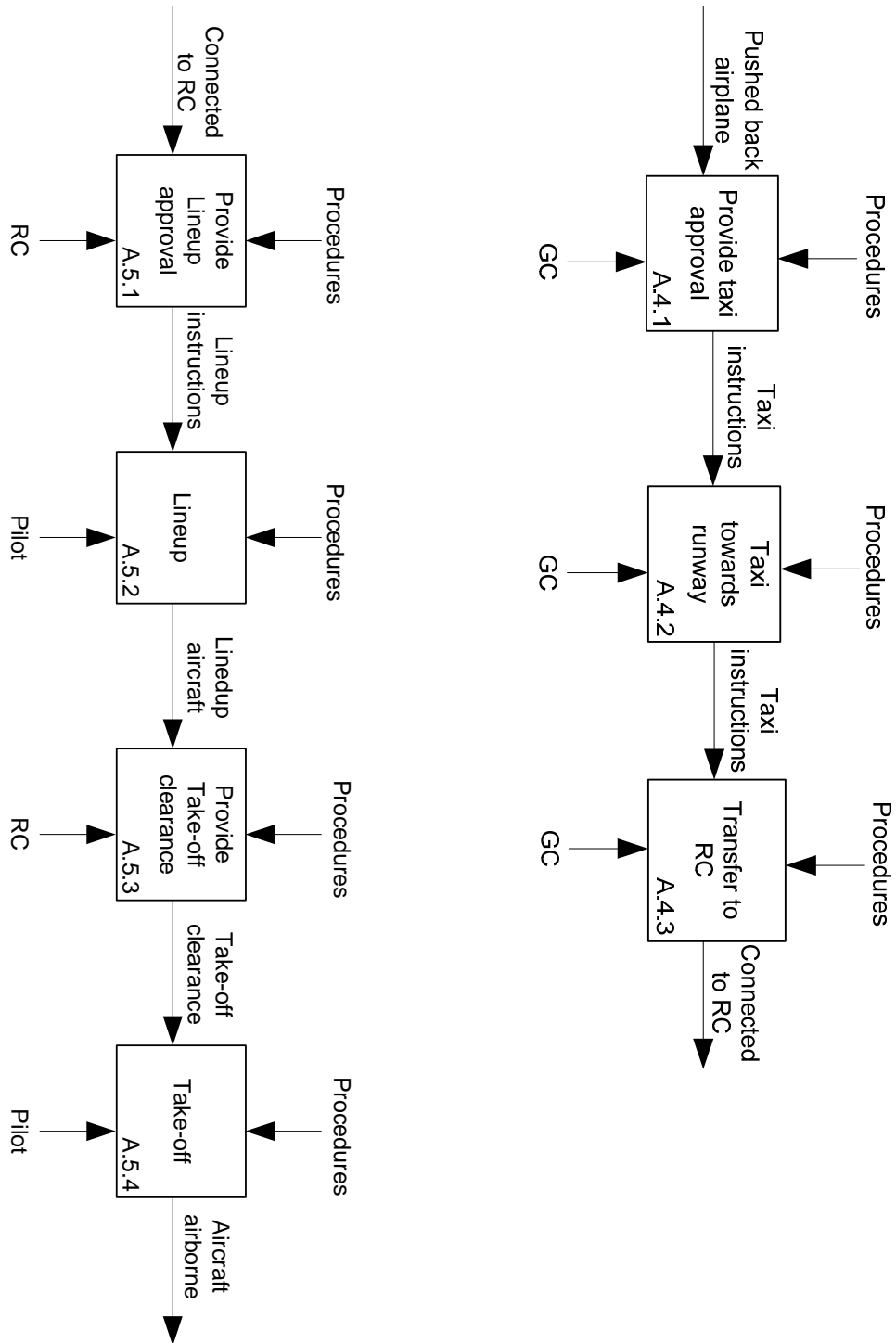


Figure 38: A.4.1 – A.5.4 processes pre departure sequence

APPENDIX E: INTERVIEWS



APPENDIX F: REPORTS GAME SESSIONS

Report Gaming session Wednesday July 2nd

On Wednesday July 2nd the first of two test session was held. The first session was primarily focused on testing the processes and exchanges in the game. Further, the participants could provide feedback on the different game elements. The participants consisted of seven persons from whom a view people had earlier experience with serious games, the other participants had no experience with serious games. Further, the participants were all from outside the Dutch aviation sector and, therefore, did not possess knowledge about the CDM project or operational processes at Schiphol Airport.

First round of play

The session started with a short introduction by the facilitator on the research project and an introduction to the game. After the introduction the seven participants were divided of the four different roles, two participants for each role except for one planning role. Next, the participants were given some time to read the game instructions for their role.

When the participants had read the instructions the first round commenced.

Conclusions from the first round:

The instructions could be clearer:

- Although most participants understood the instructions some interpreted them in the wrong way. One participant with a planning role thought that the planning had to determine the most efficient route to rescue the workers.

The first round did not go as smooth as desired:

- The participants clearly had to get accustomed to their role.
- The coordination did not request any rescue team times. Asked why they did not do that they replied they just did not do it.
- One coordination team almost did not get any messages because their planning team did not understand the instructions

During a short discussion everything that still was not clear was explained and the participants then understood their role.

Conclusions from the second round:

During the second round the game went more smoothly. The participants clearly knew what was expected from them and acted accordingly.

However, now there was a bottleneck at the facilitator, this resulted in:

- The facilitator having a high workload, resulting in mistakes.
- Requests and assignments from the coordination team could not be processed instantly which led to “frustration” of the participants.
- Because of the high workload the facilitator was not able to sent new safety information to the coordination team, which made to game more easy for the coordination team.

The planning teams said they just send the assignments to the coordination teams as quick as possible without prioritizing them. Further, there was almost always a rescue team available to execute an assignment. This made it easier for the coordination team because they did not consciously have to think about which assignment to execute first. The configuration of assignments and rescue times seemed to be right as each team was able to process a lot of assignments but not all workers were saved.

Conclusions from the third round:

During the third round the participants were given more information:

- The planning team received information about the assignments that would follow
- The coordination team received the times of the RT's which allowed them to directly allocate the RT that could execute it the quickest to an assignment.

The provision of more information led to a better result as was expected beforehand. Again the facilitator was the bottleneck which led to a delay in the execution of assignments.

Conclusions about the software:

The categorizer tool of the GroupsSystems software package was used. This was not entirely suitable for the game because:

- The participants could view all the information if they wanted to.
- The participant wanted a chat functions which would allow them to send messages directly to other participants. Now, participants would have to click on a button to create a new message creating a window which would overlap with the messages in their bucket and after creation of a message they had to drag it to the bucket of another team.

Other remarks:

The participants indicated they wanted more feedback during the game by showing the results of people saved or not-saved during the game instead of only providing it after a round was finished.

Overall Conclusions:

- The instructions could be made clearer, so that for each team it is clear from the first round what is expected from them.
- The workload of the facilitator should be reduced
- The software should allow for a restriction in the ability of teams seeing each other.
- The software should have a more advanced chat functions.
- The participants should be provided with more feedback during the game
- The basis of the game seems to be right: the configuration and processes functioned smoothly after everything seemed to be clear. However, there could be some fine-tuning especially regarding the number of RT's. By reducing them the coordination teams are forced to make a more conscious choice about which assignment to execute next.

Report Test session Tuesday July 8th

The second test session was held on July 8th. Besides testing the adaptations after the first session the second session was primarily focused on discussing the similarities between the characteristics of the game in the pre departure sequence in reality. The participants of the second session were all employees from the Research & Development department of LVNL and all possessed more or less knowledge of the pre departure sequence.

Session

The session started with a short introduction on the program of the game sessions. Because the participants had no experience with serious games and to “break the ice” a simple game called “Lost on the Moon” was played. By playing lost on the moon the participants were shown that a game consisting of very simple means could provide a basis for further discussion on group processes.

Parallels with the real system:

After the second round the facilitator initiated a discussion by asking whether the participants saw elements or characteristics of the real system in the game. What followed was a lively discussion among the participants on the characteristics of the game and the real system. The following characteristics were mentioned by the participants which were both present in reality as well as in the game:

- The ad hoc way of provision of information
- Not having insight in each others processes
- The use of standard communication messages
- The lack of communication
- The participants recognized similarities between roles in the game and roles in reality. In that case the planning team shows similarities with KLM: KLM OCC receives ad hoc planes and prioritizes them and then sends them to ATC. ATC shows similarities with the coordination team because they receive ad hoc planes that want to depart and assign push back trucks to the planes (the rescue teams).

A suggestion for creating more similarities with reality could be to give different performance indicators for the planning and coordination. For instance: give the planning as performance indicator the number of people rescued and the coordination as performance indicator the number of number of fulfilled assignments.

For the third round, where the information it shared, the information should be more structured because the participants now felt they would have an information overload.

Report game session Wednesday August 6th

The third game session was held on August 6th. The aim of this session was to evaluate the game. For this purpose also a questionnaire has been constructed which can be found in appendix H. For the evaluation of the game it was necessary that the participants consisted of operational employees from AAS, KLM and LVNL who are working or have been working in connection with the pre departure sequence. Although a number of attempts have been made and a lot of invitations have been send no employees from AAS were able to attend to the game session. From KLM there were four operational employees presents, and from the LVNL there were two operational employees present. Further, from the LVNL there were two non-operational employees present because they were interested in the concept of serious games. Although they were non-operational they do possess knowledge about the operational processes. Table 15 provides an overview of the participants.

Name	Organization	Function/department
Martijn ten Broecke	KLM	OCC dispatch
Erik Ritman	KLM	OCC duty manager flight
Ton Lokhorst	KLM	OCC duty manager operations
Jaap van der Heijden	KLM	Ground services/ push back coordinator
Hans Bloemen	LVNL	Ground Controller
Remco Koppen	LVNL	Startup Controller
Evert Westerveld	LVNL	Manager Research
Wouter Pekela	LVNL	Program manager CDM

Table 15: Participants game session August 6th

Session

The session started with a short introduction on the program of the game session. Because the participants had no experience with serious games and to “break the ice” a simple game called “Lost on the Moon” was played. By playing lost on the moon the participants were shown that a game consisting of very simple means could provide a basis for further discussion on group processes.

Mine Rescue

After a short introduction the participants were randomly assigned to a role and given the instructions for their role. After the participants had read their instructions, the communication through the laptops was explained. After that the first round commenced. The participants first needed a number of minutes to get accustomed to their role. Some teams tried to communicate more then was prescribed in the instructions. Further, one planning team created there own way of planning by creating strips of the assignments and then shifting them to create a planning. Figure 39 shows the results of the performance indicators at the end of round 1.

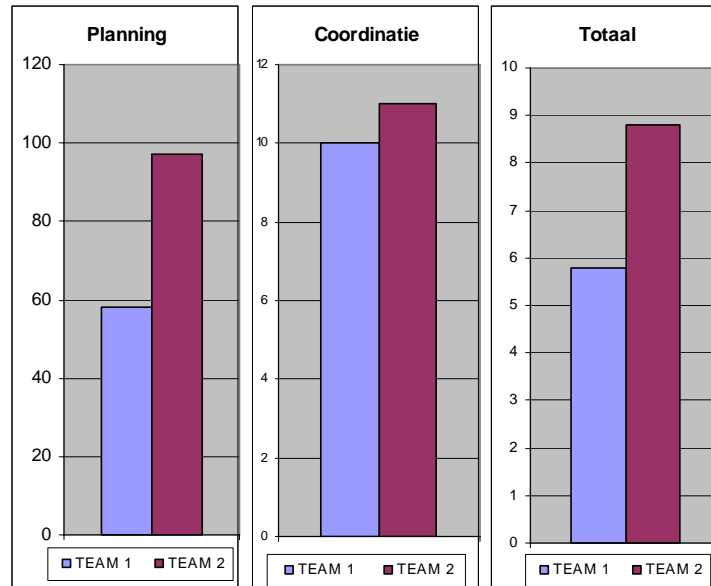


Figure 39: Performance indicators after round 1

After the first round there was a short break and the participants could talk with their partner on how to play their role better in the second round. Then the second round was played. Figure 40 shows the results of the performance indicators at the end of round 2. The performance indicators from round one and round two indicate that a learning effect had occurred because the participants achieved better results during the second round.

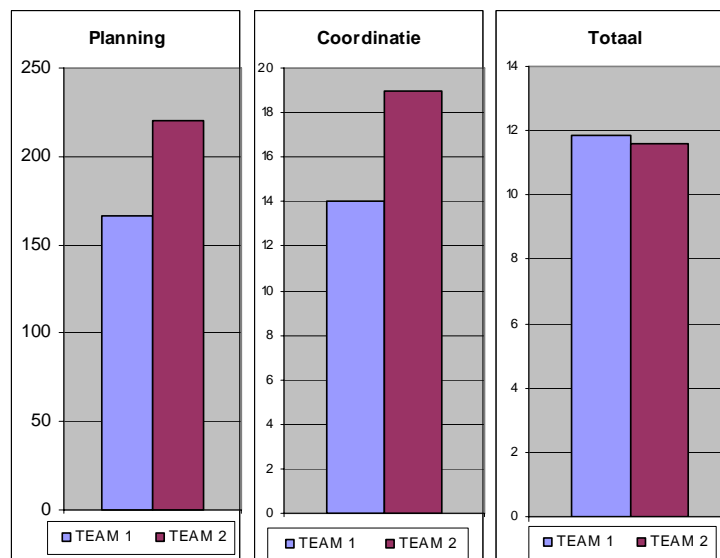


Figure 40: Performance indicators after round 2

After the second round the participants were given an excel sheet which provided them with more insight into the processes of the planning or coordination team they played with. Further, they were given some time to talk with the other team to develop a strategy for the third round. Figure 41 shows the results of the performance indicators at the end of round 3. The results of the performance indicators in round three show an

improvement in performance compared to the second round. This indicates when more information is shared, when the participants have more insight into each others processes and when a common strategy is developed the results can be improved.

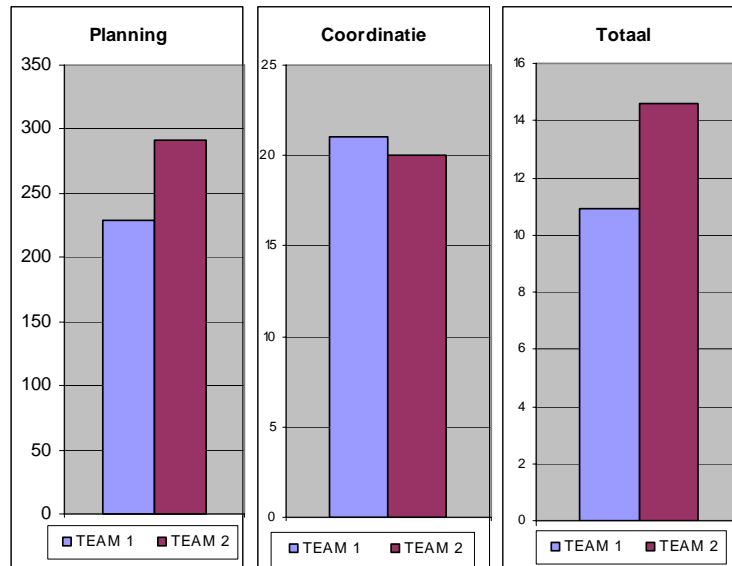


Figure 41: Performance indicators after round 3

Evaluation

After playing the game for three rounds the participants were asked to write down, on a snow card, characteristics of the real operational processes they recognized in the game. Next, the participants were asked to write down the learning goals they saw in the game. When the participants were finished writing the facilitator collected the snow cards and put them on the white board.

First, the snow cards with the characteristics were discussed. One by one the facilitator took a snow card and asked the participant who wrote it to explain it. When a participant had explained a snow card the other participants were asked if they agreed. This could be followed by a short discussion.

Table 16 provides a categorization of all items listed by the participants. Although each item has been put into one category some items could be placed in multiple categories. The listed items show that the participants recognized a lot of the characteristics of openness as defined in the requirements for the game.

Category	Items
Cooperation	CDM Cooperation Consultation -> efficiency Own optimization
Information	Limited information More information, efficiency up Limited information about each other
Insight in processes	Coordination Keep oversight Understanding other processes Mutual tuning of processes Tuning communication
Planning	Setting priorities Planning Planning vs. execution Planning Priorities Overload planning More info better planning

Table 16: Recognized characteristics of operational processes in the game.

Second, the snow cards with the learning goals were discussed in the same fashion. Table 17 provides a categorization of all items listed by the participants. Learning goals on cooperation, the sharing of information and insight into each others processes were most frequently mentioned on the snow cards as well as in the discussion of the snow cards.

Category	Items
Cooperation	Cooperation Mutual communication Cooperation Cooperation
Sharing information Common goals	Sharing information Take decisions together Have clear goals Work according to agreements Develop a strategy together
Insight in processes	Let other people do their work Better tuning of processes More information makes responsibilities unclear.
Other	Optimal planning makes for efficient operation Difficult to give everyone an equal workload. Use of team is a challenge Shift quickly Short standard terminology promotes communication

Table 17: Learning goals of the game perceived by the participants

APPENDIX G: ABBREVIATIONS

AAS	-	Amsterdam Airport Schiphol
APATSI	-	Airport / Air Traffic System Interface
CDM	-	Collaborative Decision Making
CPDSP	-	Collaborative Pre Departure Sequence Planning
CTOT	-	Calculated Take Off Time
DEL	-	Delivery Controller
EATCHIP	-	European Air Traffic Control Harmonization and Integration Program
ECAC	-	European Civil Aviation Conference
EOBT	-	Estimated Off Block Time
FIR	-	Flight Information Region
GC	-	Ground Controller
GQM	-	Goal Question Metric
HCC	-	Hub Control Centre
KLM	-	Royal Dutch Airlines
LVNL	-	Air Traffic Control the Netherlands
MoU	-	Memorandum of Understanding
OCC	-	Operational Control Centre
RC	-	Runway Controller
SUC	-	Start-up Controller
TCE	-	Transaction Cost Economics
TSAT	-	Target Start-up Approval Time
ZBO	-	Independent Administrative Body

APPENDIX H: EVALUATION FORM

Naam: _____ Organisatie: _____

	Sterk mee oneens 1	Mee oneens 2	Licht mee oneens 3	Oneens noch eens 4	Licht mee eens 5	Mee eens 6	Sterk mee eens 7					
						1	2	3	4	5	6	7
1. Het doel van het spel is helder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Het spel laat zien dat het belangrijk is om begrip voor elkaars beslissingen te hebben.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Het spel laat zien dat het belangrijk is om met elkaar te communiceren	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Het spel stimuleert het delen van ervaringen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Ik vond het leuk om het spel te spelen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. De boodschap van het spel is onduidelijk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Het spel laat zien dat het belangrijk is om informatie en kennis te delen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Ik vond het moeilijk de pre departure sequence te herkennen in het spel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. De spel instructies waren helder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Het spel laat zien dat het belangrijk is om feedback te geven aan elkaar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Het spel laat zien dat het belangrijk is dat mensen aan een gezamenlijk doel werken.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Het spel laat zien dat het belangrijk is om voldoende communicatie over en weer te hebben	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Ik herkende meerdere karakteristieken van de pre departure sequence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Het spel kan bijdragen aan een open sfeer tussen KLM, AAS en LVNL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Na het spelen van het spel sta ik meer open voor het delen van kennis en informatie.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Wat vond je van het spel?

Opmerkingen/verbeterpunten:

APPENDIX I: RESULTS EVALUATION FORMS

In this appendix the results of the evaluation forms are presented.

Proposition one is: the goal of the game is clear. Table 18 presents the results of proposition one. The results show that all participants agreed with the proposition.

Proposition 1: The goal of the game is clear		
	Frequency	Percentage
Agree	8	100

Table 18: Results proposition 1

Proposition two is: the game shows that it is important to have a mutual understanding for each others decisions. Table 19 presents the results of proposition two. The results show that except seven participants agreed or strongly agreed with the proposition while one participant neither agreed nor disagreed.

Proposition 2: The game shows that it is important to have a mutual understanding for each others decisions		
	Frequency	Percentage
Neither Agree nor Disagree	1	12.5
Agree	5	62.5
Strongly Agree	2	25

Table 19: Results proposition 2

Proposition three is: the game shows that it is important to communicate with each other. Table 20 presents the results of proposition three. The results show that all participants agreed with the proposition.

Proposition 3: The game shows that it is important to communicate with each other		
	Frequency	Percentage
Slightly Agree	1	12.5
Agree	5	62.5
Strongly Agree	2	25

Table 20: Results proposition 3

Proposition four is: the game stimulates the sharing of experiences. Table 21 presents the results of proposition four. The results show that all participants agreed with the proposition.

Proposition 4: The game stimulates the sharing of experiences		
	Frequency	Percentage
Slightly Agree	1	12.5
Agree	7	87.5

Table 21: Results proposition 4

Proposition five is: I enjoyed playing the game. Table 22 presents the results of proposition five. The results show that all participants agreed with the proposition.

Proposition 5: I enjoyed playing the game

	Frequency	Percentage
Slightly Agree	1	12.5
Agree	5	62.5
Strongly Agree	2	25

Table 22: Results proposition 5

Proposition six is: the message of the game is unclear. Table 22 presents the results of proposition six. The results show that six participants disagreed with the proposition while two participants agreed.

Proposition 6: The message of the game is unclear

	Frequency	Percentage
Strongly Disagree	3	37.5
Disagree	3	37.5
Slightly Agree	1	12.5
Agree	1	12.5

Table 23: Results proposition 6

Proposition seven is: the game shows that it is important to share information. Table 24 presents the results of proposition seven. The results show that all participants agreed with the proposition.

Proposition 7: The game shows that it is important to share information

	Frequency	Percentage
Agree	7	87.5
Strongly Agree	1	12.5

Table 24: Results proposition 7

Proposition eight is: I found it difficult to recognize the pre departure sequence in the game. Table 25 presents the results of proposition eight. The results show that six participants disagreed with the proposition while two participants neither agreed nor disagreed.

Proposition 8: I found it difficult to recognize the pre departure sequence in the game

	Frequency	Percentage
Strongly Disagree	1	12.5
Disagree	3	37.5
Slightly Disagree	2	25
Neither Agree nor Disagree	2	25

Table 25: Results proposition 8

Proposition nine is: the game instructions were clear. Table 26 presents the results of proposition nine. The results show that all participants agreed with the proposition.

Proposition 9: The game instructions were clear

	Frequency	Percentage
Slightly Agree	1	12.5
Agree	7	87.5

Table 26: Results proposition 9

Proposition ten is: the game shows that it is important to provide feedback to each other. Table 27 presents the results of proposition ten. The results show that all participants agreed with the proposition.

Proposition 10: The game shows that it is important to provide feedback to each other		
	Frequency	Percentage
Slightly Agree	1	12.5
Agree	6	75.0
Strongly Agree	1	12.5

Table 27: Results proposition 10

Proposition eleven is: the game shows that it is important for people to work on a common goal. Table 28 presents the results of proposition eleven. The results show that all participants agreed with the proposition.

Proposition 11: The game shows that it is important for people to work on a common goal		
	Frequency	Percentage
Agree	4	50.0
Strongly Agree	4	50.0

Table 28: Results proposition 11

Proposition twelve is: the game shows that it is important to have sufficient communication from both sides. Table 29 presents the results of proposition twelve. The results show that seven participants agreed with the proposition, however, one participant slightly disagreed.

Proposition 12: The game shows that it is important to have sufficient communication from both sides		
	Frequency	Percentage
Slightly Disagree	1	12.5
Agree	5	62.5
Strongly Agree	2	25.0

Table 29: Results proposition 12

Proposition thirteen is: I recognized multiple characteristics of the pre departure sequence. Table 30 presents the results of proposition thirteen. The results show that six participants agreed with the proposition while two participants neither agreed nor disagreed.

Proposition 13: I recognized multiple characteristics of the pre departure sequence		
	Frequency	Percentage
Neither Agree nor Disagree	2	25.0
Slightly Agree	3	37.5
Agree	3	37.5

Table 30: Results proposition 13

Proposition fourteen is: the game can contribute to an open atmosphere between AAS, KLM and LVNL. Table 31 presents the results of proposition fourteen. The results

show that seven participants agreed with the proposition while one participant neither agreed nor disagreed.

Proposition 14: The game can contribute to an open atmosphere between AAS, KLM and LVNL		
	Frequency	Percentage
Neither Agree nor Disagree	1	12.5
Agree	5	62.5
Strongly Agree	2	25.0

Table 31: Results proposition 14

Proposition fifteen is: after playing the game I am more open towards the sharing of knowledge and information. Table 32 presents the results of proposition fifteen. The results show that seven participants agreed with the proposition while one participant neither agreed nor disagreed.

Proposition 15: After playing the game I am more open towards the sharing of knowledge and information		
	Frequency	Percentage
Neither Agree nor Disagree	3	37.5
Slightly Agree	1	12.5
Agree	4	50.0

Table 32: Results proposition 15