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MSc. Thesis

A feasibility study towards a self-governing equipment pool in the ground handling sector at Amsterdam Airport Schiphol

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A feasibility study towards a self-governing equipment pool in the ground handling sector at Amsterdam Airport Schiphol

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I hereby proudly present to you my master thesis. The master thesis in front of you is the final result of my seven years of study at the faculty of Technology Policy and Management of the Delft University of Technology. I struggled a lot with the subject, gaming theory, psychological theory, but eventually this led to the thesis who lays in front of you. However this thesis would never been possible without the help of many persons.

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Jasper Verberne

Delft, October 2015

Executive summary

Due to growth and scarcity of space Amsterdam Airport Schiphol experiences a lot of pressure on airside. The liberalization of the ground handling market resulted in a fierce competition with low margins for the ground handlers. An equipment pool is considered as solution to solve the problem of AAS and the ground handlers at once. Equipment pooling is a concept in which the equipment of several companies is shared along to decrease risks, lower costs and increase the utilization ratio of the equipment. The liberalization of the market, resulted in a facilitating role of AAS. Thereby AAS cannot coerce the ground handlers to participate in an equipment pool. The equipment pool needs to be self-governed and accepted by the ground handling sector. Therefor the sector have to collaborate intensively.

The goal of this research was to find out to what extent an equipment pooling can be realized to make the ground handling process at AAS more efficient. A literature study and a study of equipment pools in practice resulted in a list of prerequisites which have to be met before a design of an equipment pool can be started. The involved parties indicated four important concerns causing that the prerequisites are not met; 1) they are concerned about the impact of equipment pooling on their processes and loss of independency, 2) the potential of an equipment pool is unknown, 3) a shared understanding is missing and 4) there is not trust in each other to collaborate intensively. After a model development it can be stated that there is a theoretical potential for the equipment pool, although this is not acknowledged and perceived by all the actors. The current communication bodies do not suffice in bringing change in the actors' attitudes and concerns. Therefor a workshop with role-play was done. The workshop focused on enhancing the motivation to collaborate of the prejudiced actors. Three motivational needs were taken into account; competence, relatedness and autonomy. Via a qualitative and quantitative analysis of the results conclusions are presented. During this part a separately goal stood central, to analyse whether role-play can enhance the collaboration of the actors to realize a self-governing equipment pool.

Conclusions & recommendations Equipment Pooling AAS

Regarding on the question of the feasibility of equipment pooling at AAS it can be concluded that he prerequisites are met to a larger extent and the ground handlers are convinced about the necessity of collaboration at airside. Though an equipment pool on large scale is not possible. The ground handling sector does support the further design of a self-governed staircase pool and acknowledges the possibilities.

It is recommended for AAS to further initiate and facilitate the process towards an equipment pool, bearing the design principles in mind. The costs and actual benefits need to be analysed further. Also every decision about the structure and organization of the pool influences the eventual costs. AAS can analyse other equipment types for pooling. Since an equipment pool influences the current processes of the ground handlers and needs to be institutionalized well, AAS can think big, but it is recommended to start small.

Conclusions & recommendations role-play in non-hierarchical network

Regarding on the question if role-play can enhance collaboration it can be concluded that for prejudiced actors where collaboration is needed, role-plays can be used to enhance the willingness to collaborate. The role-play created more confidence in collaboration to establish an equipment pool, by taking into account the concerns of the actors. This study showed that for this type of network a role-play sufficed in enhancing the willingness to collaborate. This generalizability and results of this study are bound to some limitations. The role-play is no guarantee for actual collaboration and the realization of a self-governed system and the long term effects of the role-play are unknown. Future research directions are identified based upon the findings and limitations. It is valuable to analyse the long term effects of the role-play in the realization of a self-governed system. Furthermore to research if other tools also result in a more collaborative network, the cost-efficiency of the role-play and if a role-play is applicable in other fields at AAS. Besides similar networks at AAS, a further research is recommended towards similar non-hierarchical networks with a facilitating organization providing the infrastructure, for instance the Port of Rotterdam and the electricity market.

Table of Contents

Acknowledgements IV
Executive summary V
Table of Contents VI
List of Figures IX
List of Tables X
List of Abbreviations XI
1. Introduction 1
1.1 Research problem & scope 3
1.2 Research question 5
1.3 Research Methodology 5
1.4 Report Structure 7
2. Literature study & desk research: self-governed associations 9
2.1 Common Pool Resources: theory behind Equipment pool 9
2.2 Equipment Pooling in other cases 12
2.3 Conclusions: Literature study equipment pooling 16
3. Actor analysis 18
3.1 Market share 18
3.2 Overview involved actors 19
3.3 Risk analysis 24
3.4 Network of actors 25
3.5 Achieve collaboration 27
3.6 Conclusion Actor Analysis 28
4. Benefits & potential Equipment Pooling 29
4.1 Data Analysis of AAS 29
4.2 Assumptions for quick scan model 30
4.3 Model Development AAS: Three scenarios 32
4.4 Verification & validation results 33
4.5 Results & analysis quick scan AAS 33
4.6 Conclusion: benefits & risks equipment pooling 37
5. Conclusions Part I: Shared understanding & incentives to collaborate are missing 38
6. Research problem Part II 40
6.1 Research Problem Part II 40
6.2 Objective Part II 41
6.3 Research question Part II 41
6.4 Research Methodology Part II 41
6.5 Report structure Part II: Role-play game 42

7. Literature study: Self-determination theory & gaming in non-hierarchical networks 43
7.1 Theory of Self-determination 43
7.2 Games to enhance collaboration 45
7.3 Non-hierarchical networks 47
7.4 Conclusions on combining Self-determination theory & games 48
8. Gamified Workshop 49
8.1 Game design 49
8.2 Testing & Validation of the motivation types 52
8.3 Workshop Design Phase 55
8.4 Process & workshop execution 58
9. Results & analyses workshop 59
9.1 Extrinsically & intrinsically motivated to attend the workshop 59
9.2 Motivation during the workshop 60
9.3 Effect of workshop on attitude equipment pooling 61
9.4 Conclusion results workshop 64
9.5 Comparison between role-play and control group regarding motivation to collaborate 64
9.6 Conclusion: role-play enhances necessity of collaboration 66
9.7 Overview & Conclusion results 66
10. Conclusions Part II 68
11. Conclusions & recommendations 70
11.1 Conclusions Equipment Pooling Part I: right preconditions not present 70
11.2 Conclusions Equipment Pooling Part II: Potential of collaborative self-governing pool 71
11.3 Overall conclusion: feasibility Equipment Pool 71
11.4 Role-play in creating collaboration for self-governing associations 71
11.5 Recommendations AAS 72
11.6 Recommendations using role-play to enhance collaboration in non-hierarchical networks .. 73
11.7 Further Research Equipment Pooling & use of role-play 74
11.8 Generalizability of the research 75
11.9 Limitations 76
12. Reflection 78
12.1 Reflection on Methodology & literature 78
12.2 Personal reflection 79
References 80
Appendix A Theoretical foundations 88
Appendix B Actor analysis 90
Appendix C Risk analysis actors 95
Appendix D Actor Approach 97
Appendix E Airline per ground handler 99
Appendix F Overview passenger piers 102
Appendix G VOPs 104

Appendix G.1 Closed VOPS at AAS 105
Appendix H Quick scan 106
Appendix H.1 Chosen weeks 2014 108
Appendix H2 Example: Model with & without memory 110
Appendix H.3 Piers dominated by handler 111
Appendix I Validation form extrinsic & intrinsic motivation 113
Appendix J MCA 114
Appendix K Workshop Design 117
Appendix L Questionnaire 131
Appendix M Results 134

List of Figures

Figure 1: Overview on types of liberalisation in the EU in 2009 (Airport Research Center, 2009) 1
Figure 2: Adjusted TIP approach (Koppenjan & Groenewegen, 2005) 6
Figure 3: the report structure of this thesis 7
Figure 4: an example of a Ground Power Unit at AAS (Stigter & Officer, 2012) 15
Figure 5: Distribution of the ground handlers at H-pier, based upon four weeks of data of 2014. 15
Figure 6: aspects per design from literature study 17
Figure 7: The number of handlings per ground handler during the four week period 18
Figure 8: the number of handlings 18
Figure 9: Position of the actors 23
Figure 10: overview of the risks of equipment pooling 24
Figure 11: Overview of the actor network 26
Figure 12: number of handlings per ground handler per pier 29
Figure 13: number of NaBo & WiBo handlings at B, C, D and G pier 30
Figure 14: Daily number of passenger handlings at AAS 31
Figure 15: the passenger handlings during 01-08-2014 33
Figure 16: needed stairs for current situation and scenario of an equipment pool at the whole airport 34
Figure 17: handlings at Pier G 01-08-2014 34
Figure 18: handlings at pier B during 01-08-2014 34
Figure 19: accumulated maximums of ground handlers vs peak when EP for Pier G & B 35
Figure 20: handlings at pier E during 01-08-2014 35
Figure 21: Results of staircase pool at AAS 36
Figure 22: Focus of this part of the report is on the Process Design 41
Figure 23: Report Structure 42
Figure 24: Taxonomy of human motivation (Ryan & Deci, 2000a) 44
Figure 25: The relations between competence, autonomy, relatedness and self-determination (Deci & Ryan, 1985) 44
Figure 26: the (un)balance between challenges and skills can result in a flow (Csikszentmihalyi, 2014) 47
Figure 27: Motivation form used during workshop (Lange, 2010) 53
Figure 28: Measurement moments for different types of motivation 55
Figure 29: overview of the workshop design & rounds 57
Figure 30: impression of the workshop 58
Figure 31: The motivation of the participants to play games or having a game element during work 59
Figure 32: motivation of the two groups during the workshop 61
Figure 33: Overview of the distribution of the number of participants 62
Figure 34: the mean scores of the groups before and after the workshop 65
Figure 35: list of attributes, retrieved from (Ostrom, 2002) 88
Figure 36: design principles for long term succesfull CPRs retrieved from (Ostrom, 1990) 89
Figure 37: amount of narrow body & wide body aircraft handled at the piers 101
Figure 38: Overview of handlers per pier at Schiphol 107
Figure 39: Scale for motivation (Guay et al., 2000) 113
Figure 41: result of consultation with IBM expert 133
Figure 42: Score Intrinsic motivation participants 133
Figure 43: Score identified regulation participants 134
Figure 44: Score external regulation participants 134
Figure 45: Score amotivation participants 135

List of Tables

Table 1: Overview of ground handlers at AAS according to September 2014 data (Schiphol Group, 2014) 1
Table 2: involved actors 4
Table 3: Types of actors in CPR 9
Table 4: Range of scores for power, attitude and interest 19
Table 5: the ground handlers & their largest clients. For the customers of the ground handlers, see Appendix EAirline per ground handler.
Table 6: Aviapartner's expected advantages & concerns of equipment pooling 20
Table 7: KLM AS' expected advantages & concerns of equipment pooling 20
Table 8: Menzies' expected advantages & concerns of equipment pooling 21
Table 9: Swissport's expected advantages & concerns of equipment pooling 21
Table 10: KES' expected advantages & concerns of equipment pooling 21
Table 11: SPS' expected advantages & concerns of equipment pooling 22
Table 12: TCRs expected advantages & concerns of equipment pooling 22
Table 13: AAS Airport Authority's expected advantages & concerns of equipment pooling 22
Table 14: AAS-PMA expected advantages & concerns of equipment pooling 23
Table 15: SAOCs expected advantages & concerns of equipment pooling 23
Table 16: Overview of piers with market share per ground handler 29
Table 17: number of VOPs per designated pier 29
Table 18: Overview of the three scenarios 32
Table 19: maximum pier B 34
Table 20: maximum pier G 34
Table 21: Adapted overview of the design principles for the motivational needs (Zhang, 2008) 45
Table 22: Overview characteristics non-hierarchical network 47
Table 23: the four types of motivation which will be measured 49
Table 24: the roles during the Flydon case 51
Table 25: List of indicators 53
Table 26: Overview of the Wilcoxon tests 55
Table 27: Results of Wilcoxon-Mann-Whitney test for factor enjoy ability 59
Table 28: scores on the scale of motivation 60
Table 29: score of the role-play group 62
Table 30: the premeasurement scores of the role-play and control group 63
Table 31: the post-measurement scores of the role-play and control group 63
Table 32: Score of groups on collaboration 65
Table 34: WFS' expected advantages & concerns of equipment pooling 93
Table 35: Overview of actors and their attitude, power and interest 94
Table 36: Overview of the risks 96
Table 37: closed VOPs 105
Table 38: List of criteria 114
Table 39: List of issues of which decisions have to be made 114
Table 40: list of participants 129
Table 41: important dates with related to-do 130
Table 42: Agenda of the workshop 130
Table 43: Overview of the motivation results for Role-play group during the workshop 135
Table 49: the score of the whole group before and after the workshop 136
Table 50: Score of Control group (A-pier) 137
Table 51: the premeasurement scores of Role-play group and 2 separately 138
Table 52: the post-measurement scores of Role-play group and 2 separately 139
Table 53: the group of interviewees 139

List of Abbreviations

AAS	Amsterdam Airport Schiphol
AAS PMA	Amsterdam Airport Schiphol Process Management at Airside
AAS AA	Amsterdam Airport Schiphol Airside Authority
CPR	Common Pool Resource
DUT	Delft University of Technology
EP	Equipment Pooling
GPU	Ground Power Unit
GSE	Ground Service Equipment Company
KLM	Koninklijke Luchtvaart Maatschappij; Royal Dutch Airlines
KLM AS	Koninklijke Luchtvaart Maatschappij Aircraft Services
KLM BS	Koninklijke Luchtvaart Maatschappij
NaBo	Narrow-body
PCA	PreConditionedAir
SAOC	Schiphol Airline Operators Committee
SDT	Self-Determination Theory
VOP	VliegtuigOpstelPlaats; Aircraft Stand
WiBo	Wide-body

1.Introduction

Since the introduction and adoption of the EC directive 96/67 the ground handling market at Amsterdam Airport Schiphol (AAS) has been liberalized. This directive requires a minimum of 2 ground handlers at AAS, AAS is an airport which handles more than 10 million passengers a year (Schiphol Group, 2015b), of which one ground handler has no direct connections with the airport authority or dominant airline (Council of the European Union, 1996).

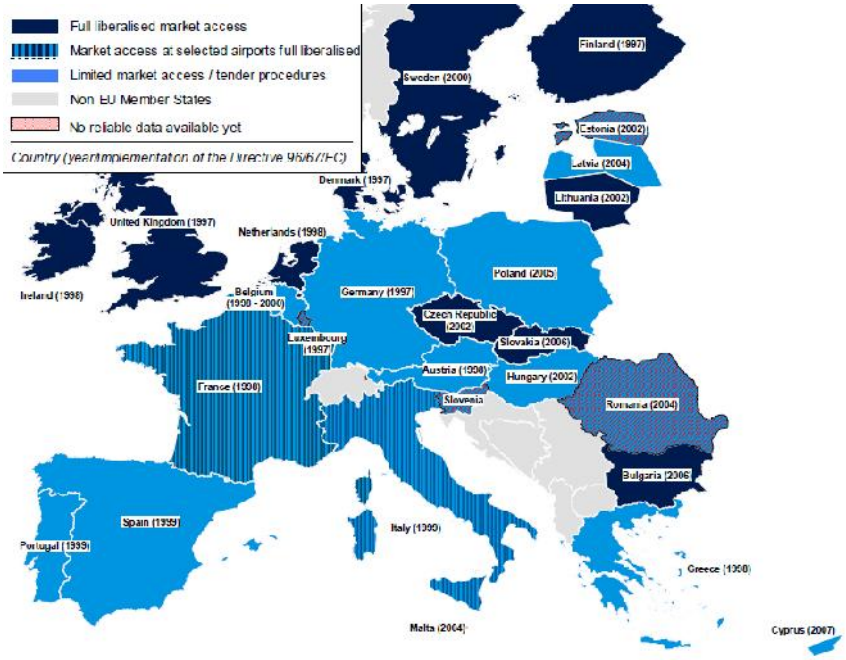


Figure 1: Overview on types of liberalisation in the EU in 2009 (Airport Research Center, 2009)

The AAS ground handling market is perceived as the most liberalized and free market of the whole European Union (Bilotkach & Polk, 2013), see Figure 1, and consists now of four major ground handling companies responsible for handling passenger aircrafts, see Table 1. The ground handling market is characterized by fierce competition between the ground handlers and with the airlines (Centre for Aviation, 2015).

Ground Handler	Largest airline customers
KLM Aircraft Services	KLM & SkyTeam partners (including Air France, Delta Airlines and Alitalia)
Aviapartner	Lufthansa, British Airways & Vueling
Menzies	easyJet, Norwegian & Aeroflot
Swissport/Servisair[1]	Arke, Emirates & Turkish Airlines

Table 1: Overview of ground handlers at AAS according to September 2014 data (Schiphol Group, 2014) [2]

Since European airlines are competing heavily and make hardly any profits (Centre for Aviation, 2013), the environment to survive in the ground handling market at AAS became even harder. Airlines are trying to fix contracts with the lowest prices and therefor ground handling costs for them are as low as possible (Centre for Aviation, 2014). The ground handling market was in the middle of a consolidation process, small players were taken over by bigger competitors and only large players or specialized

[1] Swissport acquired Servisair in august 2013 Since then the transition is in full progress and more and more parts of Servisair fall completely under Swissport and carries/bears Swissports name (Swissport International Ltd., n.d.).

[2] This is an overview of the situation of Ground Handlers from September 2014. Since then changes could have occurred, but large changes were not to be expected. Contracts last for several years and costs are involved in contracting another ground handler (Burghouwt et al., 2014).

players survived (Swissport International Ltd., n.d.). The market can be defined as an oligopoly and new take-overs or mergers are not expected. Since the margins are so small it will take a long time before investments are earned back (Burghouwt, Poort, & Ritsema, 2014).

AAS is built from the one terminal concept and reaching its limits when space is considered. The alignment between the several parties at airside results in an almost full utilisation of space, but this is not the desired situation. The future plans of AAS, like the expansion of Pier A, puts more pressure on efficient use at the scarce space available at airside. Equipment pooling, a known concept in sectors like health care and spare parts (Pasin, Jobin, & Cordeau, 2002) (Benjaafar & Cooper, 2005) (Kilpi & Vepsäläinen, 2004), but still relatively new in the ground handling sector has the potential to reduce space usage of ground handling equipment, to reduce costs for ground handlers (Forsyth, Niemeier, & Wolf, 2011) and to result in lower costs for airlines. Some pilots, executed on Heathrow and Pier H of AAS, showed promising results and make equipment pooling worth further research to see whether it is applicable to more types of ground handling equipment (Ground Handling International, 2014) (Velthuis & Stroboer, 2015).

Equipment pooling is a concept in which the equipment of several companies is shared along to decrease risks, lower costs and increase the utilization ratio of the equipment (Li, Qian, & Qian, 2013). Willingness to cooperate with each other although being competitors is the challenge (Hamel, Doz, & Prahalad, 1989). Earlier studies on equipment pooling were not focused on creating commitment and willingness for collaboration. This resulted most of the times in the continuation of traditional inefficient processes. So besides the costs and benefits several, the relations between the actors and the process needs to be taken into account.

1.1 Research problem & scope

The aforementioned dilemma of the potential of equipment pooling but the necessity of the involved parties to collaborate is further elaborated on in this chapter. Further this chapter formulate the research problem and identifies the existing knowledge gaps. The scope of this research is the ground handling sector at AAS which handles passenger flights. Since the ground handling sector has a lot of actors and is responsible for the largest part of movements and equipment at airside, the largest benefits can be obtained when a successful equipment pool is initiated in the ground handling sector. In 1.1.1. the unknowns of an equipment pool in the ground handling sector are presented. An equipment pool is a kind of common pool, this is described in 1.1.2. The reason why AAS needs this pool and not just implements it is in 1.1.3 described. The eventual research objective is described in 1.1.4.

1.1.1 Equipment pooling: feasibility in ground handling sector unknown

As earlier mentioned, equipment pooling is a concept described a lot by literature (Eppen, 1979) (Benjaafar, 1995). The healthcare sector proved to be a sector in which equipment pooling is beneficial. Not only in delivering healthcare products but also with sharing and allocate beds, surgery rooms etc. (Pasin et al., 2002)(Jun, Jacobson, & Swisher, 1999). The characteristics of the healthcare sector are to a large extent comparable with the ground handlers; increasing costs, scarce space available, high quality requirements and the pressure to perform as time and equipment efficient as possible (Jun et al., 1999) (Stewart, 2015). However in general, hospitals are not focused on making profit and the sharing of beds and surgery rooms are implemented in an organization, not inter-organizational, as is intended with ground handling.

In aviation, equipment pooling was used for sharing spare parts of aircrafts between several airports (Kilpi & Vepsäläinen, 2004). However that is equipment pooling on difference in location, instead of difference in time. The most far-reaching resource sharing concept existing is the code-share agreements of airlines, for example the Delta Airlines KLM code-share agreement on transatlantic flights. In this agreement resources and revenues are shared but the airlines are responsible for their own fleet and execution of the flights (Chen & Chen, 2003).

Two studies in the ground handling sector are known. A pilot at Heathrow which started in 2014 and involves different ground handling companies but only one type of equipment (Ground Handling International, 2014). The other pilot is executed at the H-Pier of AAS, serving low cost carriers, where mainly one ground handler is responsible for handling aircrafts (Velthuis & Stroboer, 2015). These small pilots are successes and the practicability of equipment pooling on larger scale and more actors is an interesting and research worthy. Thereby the goal of AAS is to create clean apron, preventing aircraft damage and increasing the on-time performance. Equipment pooling will reduce the amount of equipment and movements at airside. However it is unknown in which an what way equipment can be used for equipment pooling. In addition, according to literature collaboration is not described to the detail of using each other's equipment.

1.1.2 Realization of a common pool

The idea of an equipment pool is that every ground handler can use the equipment of the pool. (Olson, 1965) describes the common pool resource. A resource which is available for everyone who wants to need the resource, but when used not extractable by anyone else. The pool can result in efficiency improvements and solving allocation problems. The equipment pool has characteristics of a common pool, since every ground handler active at AAS will be able to take part in the pool. A common pool has a few important risks which need to be mitigated. (Olson, 1965) argues from a rational economic perspective that freeriding is likely to happen. The free rider problem occurs when a participant of the pool do not pay for the use of the common resources but only benefits from this pool. Thereby there is a danger for tragedy of the commons (Hardin, 1968). However since the absence of a strong governance regime, prohibited by legislation and undesired from a policy perspective, the pool needs a well-organized self-governance association to cope with the potential risks (Ostrom, 1990). Especially collaboration is essential and the involved actors have to agree about the right institutions and organizational structure.

1.1.3 Actors' complexity & AAS' influence

The success of equipment pooling depends upon the willingness and commitment of the different involved actors, see Table 2, to collaborate intensively. A good understanding of the actor complexities when considering equipment pooling is needed before a successful collaboration can be established(de Bruijn & ten Heuvelhof, 2008). There are many interdependencies between the actors and these are increasing, since organizations are becoming more lean and outsource the not core activities (Centre for Aviation, 2015)(Stewart, 2015). Allocation of the costs and resources is an important aspect in convincing the actors to take part in the equipment pool project. The costs and benefits will probably, as literature mentioned (Pasin et al., 2002) (Kilpi & Vepsäläinen, 2004)(Wong, Oudheusden, & Cattrysse, 2007), not be distributed fairly at once, so reallocation is needed.

Where AAS normally make policies in force at the airport, this project must result in policies made by the ground handlers and GSE[3], a self-governmental organization. The influence and power of AAS is limited when it comes to policy making. Thereby AAS is often searching for initiatives where general consensus is reached. AAS can facilitate and stimulate the process to come to a promising result for equipment pooling.

Actors	Extra notes
Amsterdam Airport Schiphol	
Ground Handlers	Include Menzies, Aviapartner, Swissport and KLM Aircraft Services
SAOC	Represents the airlines at AAS
GSE	Include KLM Equipment Services, TCR and SPS

Table 2: involved actors

1.1.4 Objective and deliverables of the research

The objective of this research is to find out to what extent a self-governing equipment pool can be realized to make the ground handling process at AAS more efficient. Thereby taken into account how the self-governing pool can be designed and institutionalized. The deliverables of this research are an answer if an equipment pool is feasible. This is given substance by the chosen theoretical framework of common pool resource, an actor analysis and a quantitative model. This model calculates if equipment pooling is beneficial and in what form it is beneficial. This feasibility study is presented in the first part of this research.

The second part, builds on the conclusion of Part I that collaboration is missing between the actors. The deliverables of the second part is an answer on the question if role-play, based upon the self-determination theory, enhances collaboration for the equipment pool in the ground handling sector at AAS. And if these conclusions can be generalized. For a further analysis, see Part II.

The overall focus of this research project is on the process to implement a self-governed equipment pooling at Amsterdam Airport Schiphol. After conclusions about a pool at AAS, an analysis is done to what extent the deliverables can be generalized. Thereby also giving recommendations prescribing the next steps to take by AAS.

1.1.5 Scientific and Societal relevance

The relevance of this research is twofold. The scientific relevance: can intensive collaboration, a common pool resource and or self-governed association, be achieved in the fierce competitive network in the ground handling sector. This will further concretizes the common pool resource. Furthermore the research gives insights in the use of role-play and how actors can be motivated to collaborate intensively. A more substantive answer can be given if the concept equipment pooling can help reducing costs in large industries with low margins (Stewart, 2015). In addition, a scientific article about this research is written. From a societal perspective, AAS is one of the two main ports in the Netherlands, providing and creating a lot of jobs. Thereby AAS adds a lot of value to the Dutch economy (Schiphol Group, 2015a). A research in which the position of AAS is enhanced as Europe's preferred airport, is societal relevant. When an self-governed equipment pool is feasible for AAS, could also be interesting for other parties which provides and maintains infrastructure, for instance the Port of Rotterdam or the Dutch electricity

[3] The GSE are offering lease contracts for equipment and maintenance. This sector is growing since ground handlers outsource the purchase, ownership and maintenance of equipment.

market. The gaming part and how to enhance motivation to create collaboration can be interesting for companies who must reach consensus all the time, in non-hierarchical networks.

1.2 Research question

This thesis consist of two research parts. The first part is focused on the feasibility to realize an equipment pool at AAS. However the conclusions from the first part causes a revision of the main focus towards a more process design. There is one main research question, but the second part has its own research question regarding how role-play can enhance the missing willingness to collaborate. This first and main part of the thesis will have a focus on the feasibility of equipment pooling at AAS. Therefore a research question is formulated. The research problem that will stand central is formulated as follows:

RQ1: To what extent can equipment pooling be implemented to make the ground handling process at AAS more efficient?

To be able to answer the main research question, it is decomposed into three sub questions. These sub questions provide structure to the research and are based on the need to identify the unknowns:

SQ1: What are the theoretical and practical foundations of Equipment pooling which have to be taken into account for a pool at AAS?

SQ2: What are the actors perspectives on equipment pooling and when do they support an equipment pool?

SQ3: What are the benefits of Equipment Pooling?

1.3 Research Methodology

Since there are a lot of actors present in a non-hierarchical network and those are needed for a successful implementation of equipment pooling, this system is regarded as a Multi Actor System, MAS. In a Multi Actor System different views on the problem and therefor equipment pooling are present. Complex socio-technological systems, like establishing an equipment pool in the ground handling sector, can be seen as a multi actor system.

One's point of view is not the others, one's truth is not the others truth. So for the success of equipment pooling, the focus of the research is not only on the calculation, technical part, or benefits of equipment pooling. Also the institutional and process perspective have to be taken into account. Those perspectives take also the actor complexity into account and it enables to come up with a broadly accepted solution of equipment pooling. A research approach supporting this view is the Technology, Institutional and Process approach (Koppenjan & Groenewegen, 2005). This approach is also used during the thesis. The TIP approach is adjusted to the particular case, see Figure 2. The realization of a pool is mainly an institutional challenge with the help of technological aspects (Ostrom, Burger, Field, Norgaard, & Policansky, 1999). The institutional design according to (Koppenjan & Groenewegen, 2005) must be steering the design. Therefor the institutional principles and challenges of a CPR (Ostrom, 2002) are used as theoretical framework. Conventional rational theory is not applicable and the actors have the possibilities to communicate. Especially face-to-face communication is very useful, the eventual design and decisions must be discussed via a process design with the actors. Ostrom (2002) is used as guideline to see whether this theory is applicable to the possible realization of an self-governed EP at AAS.

The research consists of two parts. The first part comprises the institutional and technological design and in addition a literature study towards the theoretical foundations of a common pool resource and self-governing association is done. In this part the main characteristics of the problem and equipment pooling are analysed, to see whether every prerequisite is met. The boundaries and characteristics of the system in which the equipment pool is mentioned to be realized, are also presented. Before the actors can be brought together it is important to identify the benefits and the risks of equipment pooling. This is done by means of a quantitative model, quick scan, about the benefits and risks of equipment pooling. In short in the first part the institutional and technical design are combined to obtain an answer for the research question.

The second part of this research includes also the main research question is mainly focused on the process design part of the TIP approach. This is handled later on in, see 6.

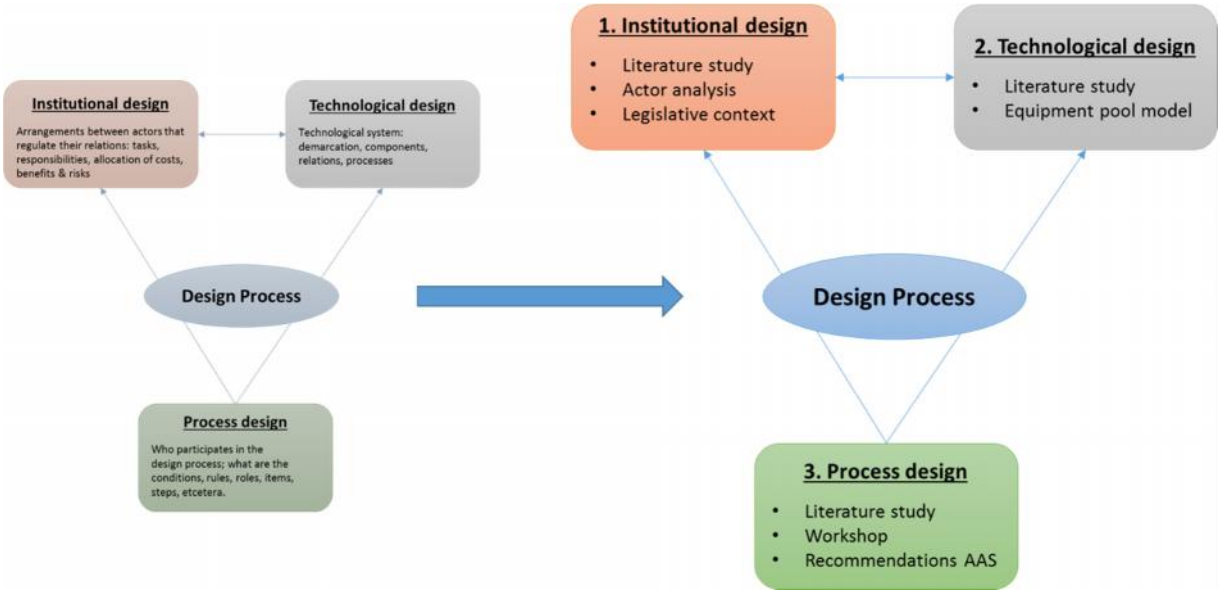


Figure 2: Adjusted TIP approach (Koppenjan & Groenewegen, 2005)

1.4 Report Structure

The report structure can be seen in this section, see Figure 3.

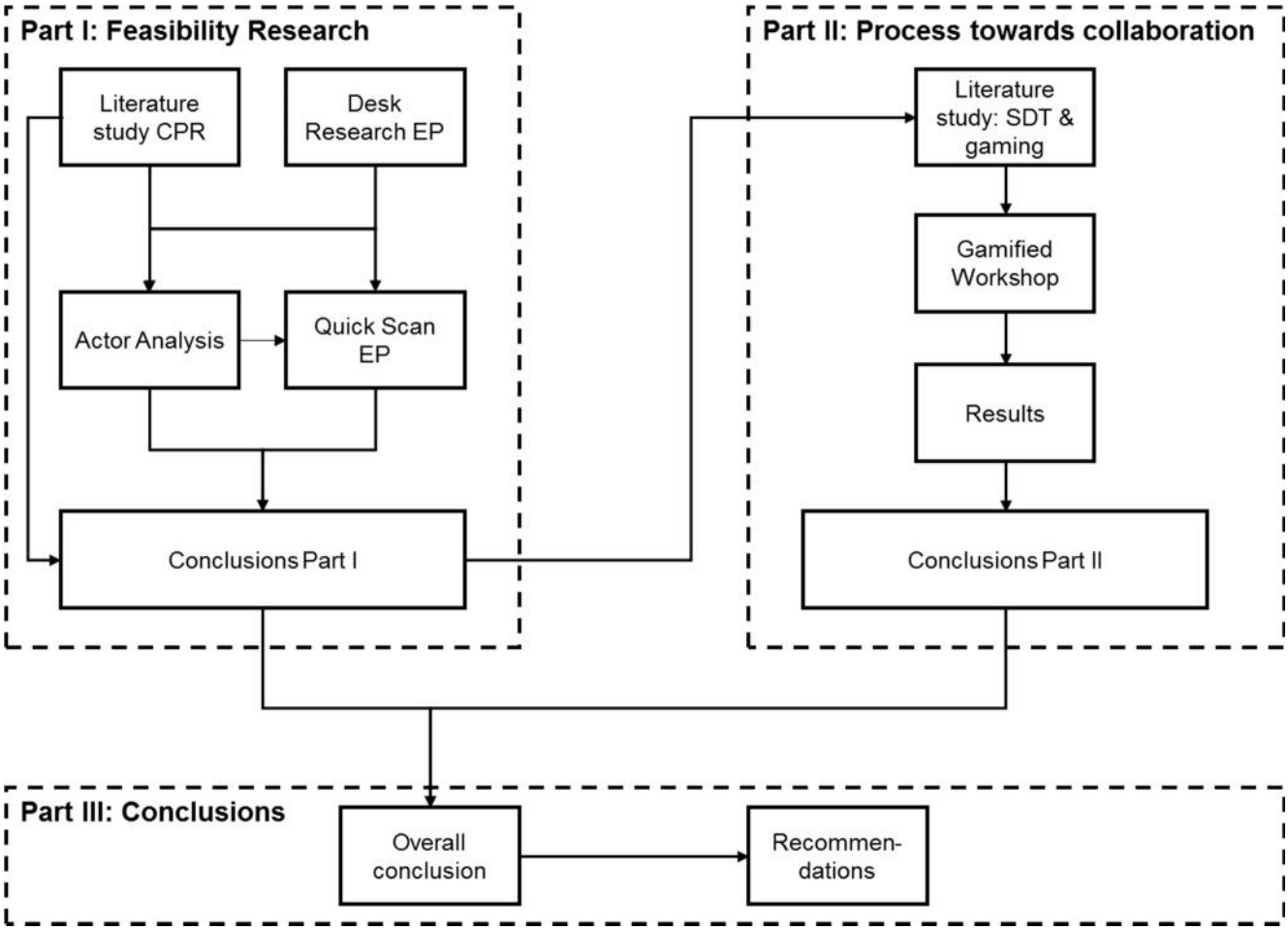
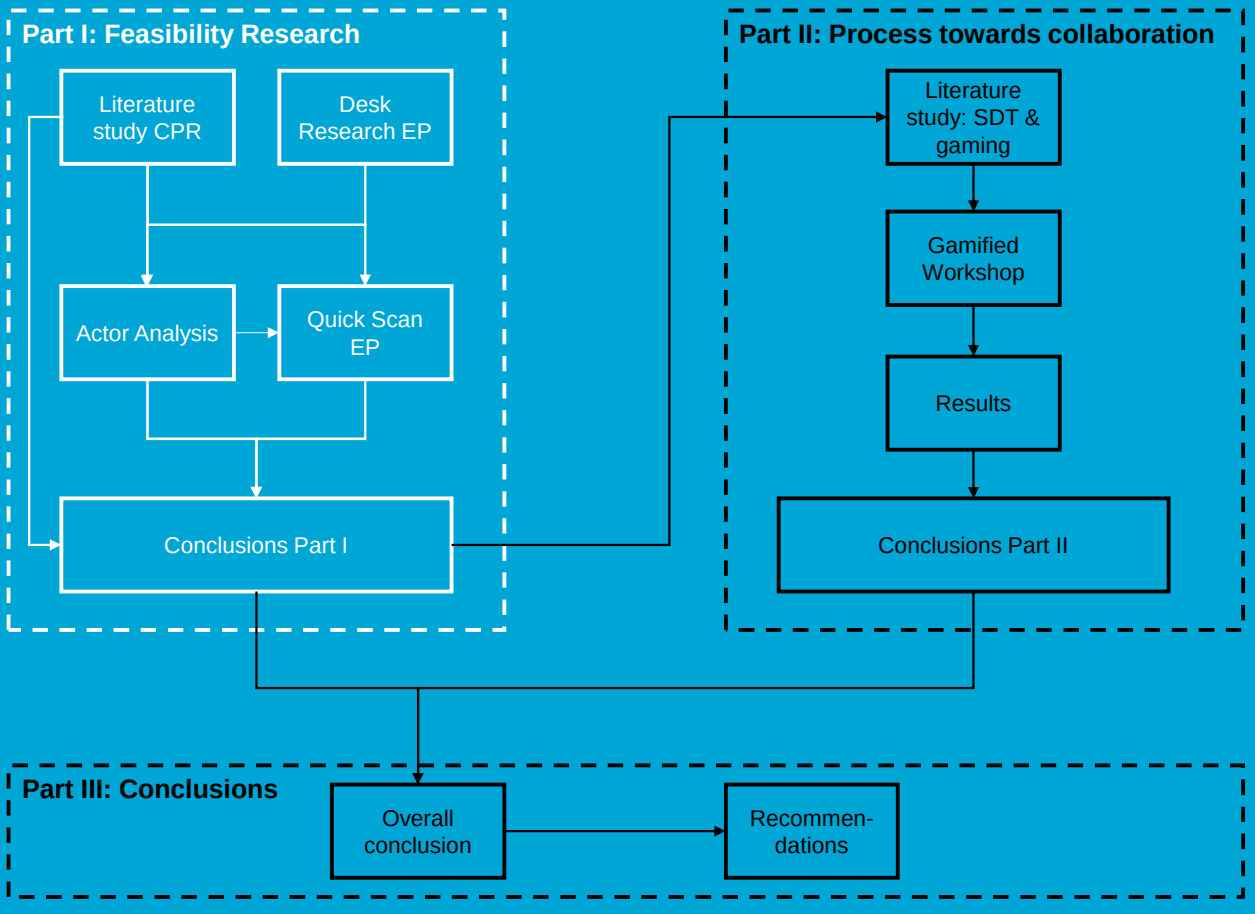


Figure 3: the report structure of this thesis

Part I:

Feasibility Research of equipment pooling in the Ground handling sector



2. Literature study & desk research: self-governed associations

In this chapter a literature and desk study research is done to the concepts behind a successful equipment pool. As was clear from the introduction a reallocation of ground handling equipment is needed. This reallocation can be achieved by an equipment pool. In the first part the common pool resource, CPR, theory is further discussed and what aspects have to be taken into account before an equipment pool can be successful. The second part is describing equipment pooling in a more detailed way; successful applications and realizations of equipment pools are studied and analysed, using the theoretical foundations of the CPR. The most important lessons from existing pools in congruence with the theoretical foundations are given in the section.

2.1 Common Pool Resources: theory behind Equipment pool

In this section the common pool resource theory is further discussed. In 2.2.1 the characteristics of the common pool are described. 2.1.2 describes the possibility for a tragedy of the commons. In 2.1.3. is described when networks can organize and institutionalize successful CPRs. A result of a well-structured pool is a rise in transaction costs. This term is shortly described in 2.1.4. Section 2.1.5. describes how a self-governed system can be realized. The conclusions and main findings are given in 2.1.6.

2.1.1 Characteristics common pool resource

The common pool is firstly described by (Olson, 1965). Part of the common pool is a common good. A common good can be described as a good which can been used by everyone. It is a rivalrous good, since when used, another party cannot use this good. A common pool resource is a resource in a which can be used by everyone being part of the pool. Often a common pool is established when allocation dilemmas can be overcome through collaboration. An equipment pool can overcome the allocation dilemma of the amount of equipment and the costs. Thereby CPRs are scarce resources and therefor using this resource can result in undesired effects. Or in other words, the resource, equipment is the stock variable consisting of a limited extractable quantity of equipment, the flow variable.

Since it is a free to use pool, the chances for freeriding becomes larger (Koppenjan & Groenewegen, 2005). The common pool resource, CPR, can best be regulated via an agreement of the involved actors, for the situation at AAS probably in a group property, where the group can exclude others (Ostrom et al., 1999). However the risk on tragedy on the commons is always present. Before a successful CPR is realized, several problems have to be dealt with. To be able to solve those problems intensive collaboration in which clear and comprehensive agreements are made are necessary (Schlager, 2002). One of the problems is that the CPR is dependent on its participants, often called appropriators in literature. Because of the fact those participants appropriate a certain amount of the resource. Since an equipment pool is considered with a lot of involved parties, actors, the appropriators are seen as the actors. The CPR's users include four specific types (Ostrom et al., 1999), see Table 3. The free-rider is an unwanted actor, but the classification of who is a free-rider depends on the actor's perspective. The actors have to be at least all reciprocal collaborators to establish a CPR.

Different Types	Short description
Free-rider	Purely self-interested & only benefit from the pool
Unwilling	Due to fear of free-riders unwilling to collaborate in a pool
Reciprocal collaborator	Willing to cooperate if others return their trust
Altruist	Try to achieve higher returns for the whole group

Table 3: Types of actors in CPR

2.1.2 Risks common pool: Tragedy of the commons

Although the current ground handling market is not a common pool as described by (Olson, 1965), equipment pooling has a lot of characteristics of a common pool resource. The equipment pool can be

seen as a common pool resource, it will be an available pool for every ground handler at AAS. In addition when a piece of equipment is by a ground handler another ground handler cannot use this piece of equipment. So scarcity is an issue. The allocation of costs is a challenge especially when there are larger and smaller members of the pool, like KLM on the one hand and Swissport, Aviapartner and Menzies on the other hand. To what extent individual organizations are willing to bear the costs of the pool is an important question standing central (Olson, 1965). A formal regulator is missing since AAS has chosen to liberalize the ground handling market. This makes it harder to mitigate adverse effects, such as the effects of the tragedy of the commons. Since there is a fierce competition between the handlers, the risk on a tragedy of the commons in the ground handling sector at AAS is present.

(Hardin, 1968) introduced the concept of tragedy of the commons. The tragedy of the commons metaphor is a metaphor for situations where the individual parties only act in self-interest and are focused on maximizing profit on the short term. Thereby depleting the resources and resulting in a smaller benefits or even losses on the long term. Three important aspects are present. 1) the individuals deplete the resource to maximize the short term profits, 2) the behaviour of an actors influence the result of the rest, 3) other actors benefit from investments done by one actor to prevent tragedy of the commons from happening. Examples for those situations are the exploitation of the worldwide resources and fishing in the oceans(Hardin, 1968). The only possible action to prevent tragedy of the commons is collaborative action to form a good organized system

The tragedy of the commons at AAS can occur relatively quick. Due to the fierce competition of the ground handlers and their focus on having as much clients as possible, small margins and stringent contracts with the airlines are accepted. Establishing a CPR where everyone is searching for maximizing their self-interest, without bearing any of the costs, increases the risk of a tragedy of the commons. An well-organized equipment pool can help the ground handlers in lower the costs and realizing that collaboration pays off, thus preventing a tragedy of the commons from happening. Stated by (Hardin, 1968), solutions have to be found in mutual coercion which is mutually agreed upon and where the members of the pool relinquish some of its freedom. According to (Hardin, 1968) this results in privatizing common goods or a strong government which regulates the market to a far extent. This approach is useful for large common pool resources like ocean fisheries, but not for the situation at AAS. The governance regime decide upon a lot the institutional and organisational form but also about the extent of appropriation of the resource. Due to legislation, which prescribes a liberalized market, the policy of AAS and the locality of this pool this approach is inappropriate.

(Ostrom et al., 1999) provides an alternative where the involved members come up with their own system of rules and institutions. Where (Hardin, 1968) assumes perfect rationality and homogenous actors operating independently, (Ostrom, 1990) assumes bounded rationality, actors who communicate and can set up a self-governing system. Also the focus of the involved shifts from the short term to the long term, ensuring a sustainable sector. In particular actors are actively searching for solutions to solve allocation problems. Since AAS desires a broadly accepted pool by the ground handlers in which the sector organizes the pool, the self-governed system is promising. Therefor the self-governed common pool resource have to be analysed further.

2.1.3 Self-governed common pool

When establishing an institution like a CPR, complexity plays a big role. Earlier economic theories where full rational actors are presumed and collaboration is a matter of a Nash equilibrium or prisoners dilemma are not applicable in the case of equipment pooling. Based on the assumption that collaboration is not possible and without governmental intervention no CPR is possible. However since the actors know each other and communicate between each other a common pool can be established and bounded rationality needs to be presumed (Ostrom, 2010). Due to the bounded rationality, the actors perspectives on the pool and interests differ to a large extent (Williamson, 1979). This heterogeneity is a challenge, but a challenge which is not insurmountable (Baland & Platteau, 1999). Besides to be able to establish an efficient pool (Johnson & Libecap, 1982) warn for too large differences in size of the users of the pool. This can result in large inefficiencies and no effective regulations. Heterogeneity of actors cannot be too large however when managed or regulated well this can be solved. (Ostrom, 1990) formulated eight design principles, based upon laboratory as field experiments, can help to create a CPR which is stable and long enduring. However the principles are rather general and broad and thereby already

discussing the actual institutional embedding of the pool (Ostrom, 2010). However considering the equipment pool first an agreement on the realization of the actual pool must be made. It is very important that the actors, of which the ground handlers will be the major appropriators, are involved and participate in the decision making process (Ostrom, 2002).

An establishment of a pool results in a change of current processes and subsequently rules for the actors. Where every handler in the current situation has its own supply of equipment and made rules to make business efficient, a pool will make processes different. An institutional change will happen with the realization of the pool. According to (Ostrom, 1990) the actors will and have to compare the costs of the current setting with the new to expected setting, where the following formula is applicable.

$$\boldsymbol{Di = BNi - BOi} \quad \textbf{(1)}$$

Where Di is the incentive to change, BNi the benefits the actor is **expecting** from the new rules and BOi the benefits the actor receive from the current situation. When BOi is larger than BNi the incentive to change in negative and will certainly not take place. Vice versa there is a positive incentive to change.

2.1.4 Transaction costs

If there is a positive incentive to change, a new important formula can be used.

$$\boldsymbol{Di > (C1i + C2i + C3i)} \quad \textbf{(2)}$$

$C1i$ are the total costs, also time, for designing and agreeing upon rules
$C2i$ are the short-term costs for the adoption of new appropriation strategies
$C3i$ are the long-term costs to maintain the system over time

If these costs outweigh the expected benefits of all actors, especially the ground handlers, the handlers will not invest money, time and resources to create the equipment pool. The costs for the institution are also known as transaction costs. Transaction costs (Williamson, 1979), can utilize a part of the potential of equipment pooling. The theoretical potential of equipment pooling can be relatively high. However to what extent the potential is used for transaction costs is unclear, but worth analysing. Certainly because the costs are not an indisputable fact. A lot of choices about the institutional arrangements of the pool have to be made by the actors. Every choice affects the transaction costs and the actual CPR. Especially additional costs are rising to cope with tragedy of the commons, freeriding and other potential adverse effects. The easier and less complicated the rules can be made, the smaller the increase of transaction costs will be. Involving all actors and ensure autonomy enlarges the possibility on low transaction costs and long enduring CPRs..

The equipment pool at AAS, where the handlers are collaborating, is striving to a situation where the following is applicable,

$$\boldsymbol{Dk > (C1k + C2k + C3k)} \quad \textbf{(3)}$$

where k is a coalition of actors

So the incentive to change is more positive than the costs for the coalition of handlers, so it can be concluded that the realization of an equipment pool is feasible.

2.1.5 Realization of a self-governing system

There are a lot of examples of communities where the tragedy of the commons is obviated. However it remains unclear how to reach the right organizational form to prevent tragedy of the commons from happening. Though collaboration is an essential aspect. Equipment pooling is focused on a sustainable, efficient and profit making ground handling sector. Persuading the ground handlers to join the pool is probably the hardest part, or in other words changing their behaviour and processes. As well the resource as the appropriator play an important role in the possibility that a self-governing pool will eventually form. Before a CPR is reality at AAS, (Ostrom, 2002) identified attributes for as well the resources as involved actors which enhances the probability of a successful pool. The list of attributes for the resources and appropriators can be find in Appendix A. Based upon those attributes a quick assessment about the equipment pool is made. However to what extent those attributes have to be present in reality is largely unknown. Therefor an analysis of already existing equipment pools is of high value. The developed design principles, see Appendix AAppendix A Theoretical foundations, which

have to be taken into account are an indicator for the success of the pool. However due to the fact that CPRs really differ from situation to situation, those principles are very general. By analysing successful existing pools, using the design principles as guidelines, a more detailed overview is created on how the principles are given substance in reality.

2.1.6 Conclusion

An equipment pool can be compared to a large extent with common pool resources. From the theoretical economic institutional foundations a lot became clear of what have to be known before such new institution as an equipment pool can be established in a successful way. A strong governance regime is undesired and impossible to establish due to European Union and Dutch legislation and AAS' policy. Therefor a self-governing institution have to be established. An strong institutional design is essential to reduce the risk of free-riders and tragedy of the commons and creating a long-enduring system. The most important theoretical conclusions are:

1) Collaboration is essential for the realization of a CPR. Therefor the willingness to collaborate needs to be present.
2) Actors behave and act according to bounded rationality.
3) The expected potential or benefits of the equipment pool have to be larger than the benefits the actors receive currently from the old situation
4) The benefits of the new pool have to outweigh the costs
5) Heterogeneity between the appropriators is a challenge but can be overcome
6) The importance of face-to-face communication
7) Very hard to estimate and gain knowledge about the actual costs and benefits of the pool
8) Trust in the other parties is important and free-riding behaviour must be avoided
9) Transaction costs have to be as low as possible

Since there are huge differences between common pool resources standard rules do not exist, only design principles (Ostrom, 1990) and preconditions. A lot of equipment pools already exist. It is very useful to see how they gave substance to the design principles and the impact of the attributes on the pools. So before action can be taken to design the actual common pool, first the focus have to be if the conditions and opportunities are present at AAS.

2.2 Equipment Pooling in other cases

To create a better understanding of equipment pooling, literature and cases where equipment pooling is applied, is searched for and analysed. In this section the equipment pooling cases are analysed using a TIP perspective (Koppenjan & Groenewegen, 2005) and the resource and actors attributes theory according to (Ostrom, 2002). Since rules for CPRs are hard to generalize, every situation is unique, the design principles are leading and it is analysed how those principles have been applied, in congruence with the attributes. First other sectors where successful pools are established are analysed by means of literature. Then the focus converges to the aviation sector and already established pools at AAS. Concluding, a short overview of the main findings is given.

2.2.1 Health care sector

In the healthcare sector there are several known examples of equipment pooling. There is a pool of suppliers of healthcare products. The one supplier which is the nearest to a client, delivers the products (Pasin et al., 2002). This reduces the amount of movements and the number of vehicles in the fleet. Small companies benefit to a larger extent than the large companies. To overcome this a problem, the parties have agreed upon an correct allocation of the costs and benefits caused by the pool. Via a transparent way this pool is established, also the parties were afraid of being penalised by the pool. By showing the net improvement parties were convinced.

Not only the transport of healthcare products has its equipment pools, also in hospitals equipment pools are established. In hospitals beds and surgery rooms are often shared. The utilization rate is increased and hospitals are closer to a break-even point in terms of finances. Researches in the United States, (Jun et al., 1999), showed that sharing beds and surgery rooms resulted in significant improvements. It is an easy system to maintain, with clear indicators.

2.2.2 Off shore & water transport

In the early 90s, oil giants like Shell, Total and GDF Suez agreed to outsource the logistic chain from and to their oil platforms to a third party. This third party is the Southern North Sea Pool, SNS Pool. The SNS Pool took over the marine and helicopter equipment of the oil companies (SNS Pool, n.d.). Nowadays Peterson manages the pool and guarantees to fulfil the requirements of the companies and establish trust. By combining the sailings from and to the platforms, cost reductions, increase of the safety and a more sustainable operation are realized (Peterson, n.d.). The vessels sailing under Petersons flag are responsible for supplying over 140 oil platforms in the North Sea. Peterson also manages a pool in Aberdeen, resulting in an annual benefit of €1.9 million (based upon exchange rate for Sterling Pound on 5-6-2015) for each member of the pool (Peterson, n.d.). So a feasible improvement is realized.

The oil sector is characterized by its giants and rich sectors. High profits are common and when looking at the top twelve of the largest companies of the world by revenue, seven companies are related to the oil industry (Fortune, 2015). Compared with the situation at AAS, this is completely the opposite. At AAS, competitor fight each other for every penny available. Thereby oil companies are granted permission to exploit oil fields. The companies do not have to compete each other for clients at location. This is different in the ground handling sector, where there is competition at location and for clients. Although they also share characteristics, both have high entry costs. In relation to the revenue equipment is a large expense. Equipment is very expensive and both sectors have to invest large sums of money. However the oil giants initiate equipment pools in services which are not their core activities.

Maersk an MSC, two of the largest shipping companies in the world, share vessels on many of its trade routes. The two companies signed the agreement about sharing vessels in order to improve the utilization rate and to increase benefits, reduce costs and offer more port pair routes (Haun, 2014).

So overall, the marine and off shore industry is contrary to the ground handling sector aware of the benefits of sharing equipment with competitors; there is common understanding. They have experienced the benefits and costs of equipment pooling and in their case it is a positive case to pool their equipment. The pools are relatively easy to manage and the parties are all committed towards making the equipment pooling concept a success.

2.2.3 Sharing & collaborative economy

Where formerly value was attached to private ownership of assets, for instance cars, gardening tools and chalets. Today the economy is more and more transforming towards a sharing economy, lease society or collaborative consumption where people add less value to be a private owner, so cars, gardening tools, chalets and even pets are shared more and more (The Economist, 2013b). Also in the Netherlands the collaborative society is growing and expected to grow significantly the next coming years (ING Group, 2015). Traditional companies have to change their business model or have to invest in new initiatives in the sharing economy. (Botsman & Rogers, 2010) already described the sharing economy several years ago, physical assets are pooled and consumed as services. People pay a fee to the real owner and can use the products for the time they need this asset. AirBnB, Lyft, and Snapgoods are sites which provide a platform for supply and demand. Liability issues and insurance are dealt with properly. The platforms survive, because it is private and normal persons are no competitors of each other. However established companies and governments sue and try to forbid the new companies, because there are some adverse effects which the new companies have to mitigate.

The sharing economy has several benefits. The transaction costs are lower due to the use of technology and less middle men. People which own equipment can earn money, people who do not, can use equipment they need. People who only use the equipment do not have to spend money on maintenance and the cost of using the product once or several times is lower than when they would buy the products. Clear distinction of responsibility and other agreements which people agreed upon when using platform as AirBnB contributes to the success Social media provide the users information about the owner and vice versa. This increases the trust in sharing economy initiatives (The Economist, 2013a).

2.2.4 Aviation

In the previous sections several resource sharing pools have been elaborated on. There are a lot of other initiatives in which sharing resources are described. The aviation sector already knows some successful and some less successful equipment/resource sharing initiatives. Several initiatives are already mentioned, see 1.1.1. In this section the realization on basis of CPR theory, of equipment pooling concepts in aviation is described.

2.2.4.1 KLM: a pool of spare parts

Airlines have a large expensive inventory in spare parts to be able to replace spare parts of aircrafts when needed. Large airlines like Air France KLM acknowledges the benefits of pooling and the minimization of costs while being able to standardize equipment and making operations less complex (Air France Industries KLM Engineering & Maintenance, n.d.). Due to the large volume, engine pooling is beneficial and applicable within the operations of the different airlines. (Kilpi & Vepsäläinen, 2004) concluded that spare parts pooling is even beneficial for the largest airlines like Lufthansa and Air France KLM. Simple adjustments could easily lead to 30% reduction of inventory in spare parts. When summing the high investments in spare parts, the conclusion can be drawn that pooling is beneficial for airlines. Airlines like Air France KLM and Delta Airlines (Delta Airlines TechOps, n.d.) (Air France Industries KLM Engineering & Maintenance, n.d.)have established pools for all components for all different types of aircrafts and they have to keep up with new developments like the Airbus A380 (Air France Industries KLM Engineering & Maintenance, 2014)

However there is a difference between a spare parts pool and ground handling equipment pool. There is always a need of spare parts in inventory and this spare part inventory can be seen as a reserve when there are failures or aging of the spare parts. Airlines only need spare parts from the pool when their current stock is empty or when there are failures, while the equipment pool is an ongoing 24/7 business.

2.2.4.2 KLM: engine pool

At AAS, KLM initiated an engine pool with its partners. Airlines could participate if they were willing to pool their own engines. It was beneficial because when airlines calculate the amount of engines they need as a reserve, airlines often need more than the integers. With such a reserve airlines are able to have aircrafts in the air at any time and are not dependent on the maintenance and availability of engines.

However when an airline for instance needs 3,6 engine as reserve, they have to purchase 4 engines. Engines are one of the most capital intensive assets of aircrafts, worth over tens of millions. So needing 3.6 engines results in the purchase of one extra engine, while only needing .6 engine extra. The initiated pool resulted in a pool where airline could hold .6 engine extra in stock, since more airlines were involved. Quality differences of engines were settled in the allocation of costs of the airlines. The pool worked successfully (Lasten, 2015). The success of the pool was partially because it was possible to assure a 100% guarantee of the availability of engines. Thereby maintenance and switching engines can be scheduled and there is not often an unforeseen demand for engine swaps.

2.2.4.3 Heathrow & Amsterdam Airport Schiphol: Stair & GPU pool

In the ground handling sector three equipment pools are described.

GPU POOL AAS

AAS has currently a GPU pool. A ground power unit, GPU, is used for providing electricity for the aircraft when the aircraft is parked at a VOP (Stigter, 2012), see Figure 4. Before every ground handler acquired a lot of these GPUs, AAS decided that the used GPU were not in accordance with the emission rules and it was a costly process for the handlers. Together with the ground handlers a GPU Pool was set up, managed by a third party KLM Equipment Serivices, KES, in which at every VOP a GPU was available. This resulted in lower costs for the ground handlers, less equipment and less equipment movements and lower emission. Invoices are sent to the handlers for each time an employee of them uses a GPU pool, which can be seen via a card system (Lasten, 2015) (Gerbracht, 2015).



Figure 4: an example of a Ground Power Unit at AAS (Stigter & Officer, 2012)

STAIRCASE POOL AAS

The staircase pool is an initiative of the Schiphol Airline Operators Committee, SAOC, and the Ground Handlers with again KES as third party managing the pool. KES is responsible for maintenance, availability and invoicing the stairs. This pool is a success (Grob, 2015; Velthuis & Stroboer, 2015) . However this pool is mainly used by Menzies, for over 98%, see Figure 5. This is the result of the airlines Menzies handles. Their clientele exists of the two largest low cost carriers present at AAS, Norwegian and mainly easyJet, see Appendix E. Only in exceptional cases other ground handlers handle aircrafts at the H-pier.

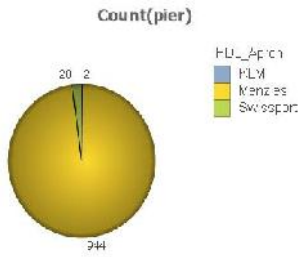


Figure 5: Distribution of the ground handlers at H-pier, based upon four weeks of data of 2014.

So from a theoretical perspective the H-pier is and has the potential to be successful. However when the H-pier is analysed in practice, not a lot of significant conclusions can be drawn, due to the dominance of Menzies. So possible tensions between the competitors are nihil and liability issues have never been an issue. The companies which used the pool system, are content with the system and KES as manager because of its convenience and clearness about responsibilities and invoicing. Though the overall conclusion about this self-governing system; it is too early to draw conclusions about the success of the stair pool due to the almost full monopoly and dominance of Menzies at the H-pier.

HEATHROW: STAIRS

There is another pilot with a stair pool. Heathrow started a pilot in September 2014 (Ground Handling International, 2014). The first results are promising and because of a track and trace system, a lot of valuable data about the stairs become available, for instance the utilisation, emission and maintenance checks of the equipment. Handlers are positive and do not worry about the possible loss in identity. Less congestion and an improved efficiency have already been noticed. Real numbers are still lacking due to the short period of time the pilot is executed. The coordination between the third party, TCR, and the handlers works well and less complaints from both sides have been expressed. The actual win-win situation in financial terms still have to be found out.

CONCLUSION

Apparently one type of equipment, stairs or GPUs, are used to start pilots with. Stairs is easy equipment to use in an equipment pool. Offering stairs as a part of the infrastructure will reduce movements at airside, enhance safety, increase quality and uniformity and lower the costs for the ground handlers and a positive business model for the company, AAS or another third party, managing this pool. However

an analysis of the implementation of a stair pool on large scale is lacking. Easy to use systems in which the resource are easily followed, in terms of quality and condition, are

2.2.5 Main findings other Equipment pools

Equipment pooling is a more and more commonly used concept to reduce costs, mitigate risks and make efficiency improvements. Private and corporate equipment pooling concepts are known, for instance the sharing economy and the Southern North Sea Pool of the oil giants. There are several differences between the sectors, but the similarities are more dominant. Especially when looking at the equipment pooling pilots already in progress at AAS and Heathrow. Referring to the goal of AAS to increase safety, reduce costs and the most important have an efficient ground handling process, equipment pooling has the potential to solve those three problems. Issues concerning the allocation of costs and benefits have easily been solved in every sector especially when the benefits became clear. Thereby strict agreements are made and a fair allocation of the costs and benefits is a precondition. The most important precondition is that the actors must trust each other and be willing to collaborate before the decision can be made.

2.3 Conclusions: Literature study equipment pooling

The equipment of the equipment pool is a type of common pool resource. The ground handlers present at AAS can use the equipment in the pool if they need equipment. Due to the absence of a strong governance regime, the equipment pool at AAS needs to be considered well an can use as well theoretical foundations as practical results. Thereby the design principles for a CPR are leading and the likelihood on a successful CPR increases when specific attributes for the equipment but also attributes of the actors are present. A lot of other sectors already have implemented equipment pools successfully. Pools in which one can use the available equipment or services is with the rising sharing economy more and more common. The success of the other pools are mainly dependent upon the following aspects, see also Figure 6:

1) Significant increase of benefits
2) Willingness to collaborate and cooperate in a pool
3) Strict agreements about responsibilities, including a third party responsible for the pool to enhance trust
4) A good and fair allocation of the costs and benefits of the pool
5) Easy to use system
6) The right equipment type where a feasible improvement can be realized
7) Aspects of all involved actors taken into account
8) Predictable resources

By having such agreements and fulfilling the requirements above for the pools, the CPRs deal with the free-riders problem, realize low transaction costs. Transaction costs which can rise and can reduce the benefits to a very large extent. So eventually a successful CPR on the long term will be established. However the one essential aspect of an equipment pool is that the benefits outweigh the transaction costs, something which cannot be derived from literature. The following chapters have to look to the institutional design and the attributes of the resource, equipment, and if the attributes of the actors are present. Only then a successful pool can be realized.

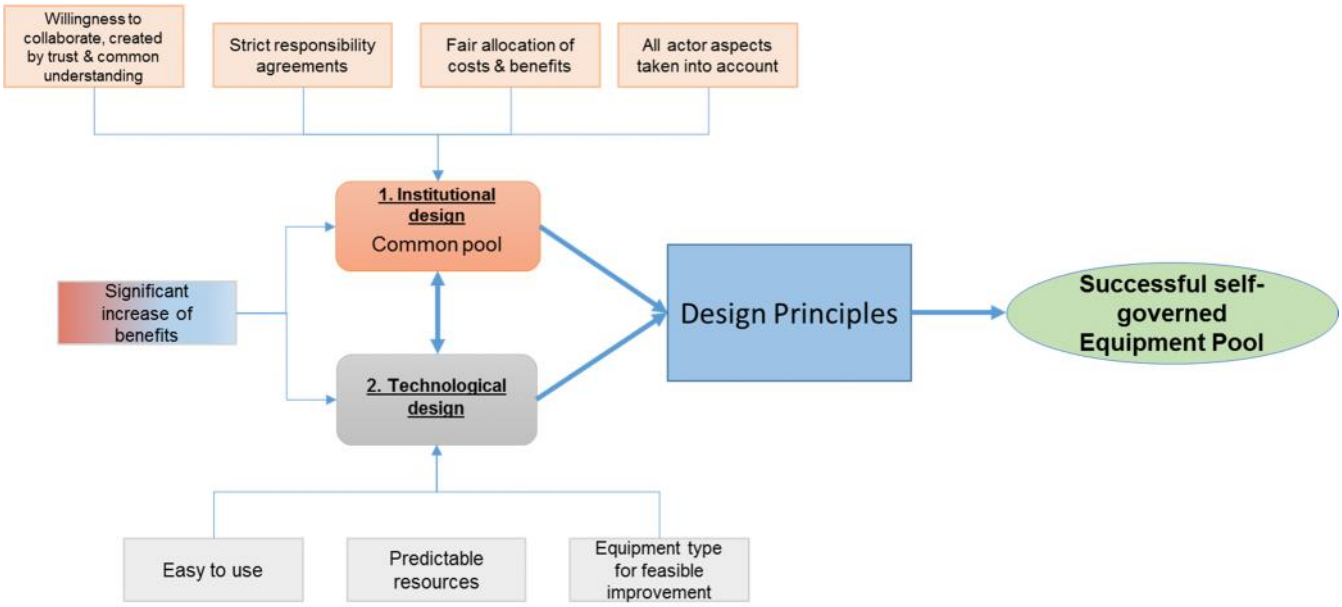


Figure 6: aspects per design from literature study

3. Actor analysis

According to the institutional design an actor analysis is an essential part of gaining knowledge about the preconditions for the pool. A company's strategy depends on the behaviour of the other actors. Understanding this behaviour is an essential part before the process of the design for the pool can be started. Core values of an organization are deeply rooted in the organization and are the cause of many of organizations actions (de Bruijn & ten Heuvelhof, 2008). In addition knowing the core values helps describing the actor's behaviour. Changing behaviour is hard, but it is the first step towards success. Next to the individual behaviours also the network of actors is vital to prevent naïve approaches and solutions and result in a more advanced process from the start (de Bruijn & ten Heuvelhof, 2008). The identification of the network of actors is necessary to understand where interdependencies exist and what the balance of power looks alike. In this chapter the actors are analysed. Thereby according to (Ostrom, 1990) and the findings of the existing equipment pools it is important to see if the actors are willing to collaborate, trust each other, feel autonomous and if the actor's processes differ to a large extent. In conclusion, if all the facets are present to start designing the institutional self-governmental pool.

First the market share of the ground handlers are analysed in 3.1. Before the actor approach can be developed the actors' core values and behaviour towards equipment pooling are identified via conducted interviews and additional information, see 3.2**Fout! Verwijzingsbron niet gevonden.**. The perceived risks are described in 3.3, which have also led to the identification if preconditions are absent. In 3.4 the network of actors and the interdependencies between them are discussed by means of a formal relation chart, see Figure 11, based on (Bryson, 2004) (Enserink, Hermans, Kwakkel, Koppenjan, & Bots, 2010). Section 3.5 discusses the importance of collaboration between the actors. The last section, 3.6, gives the conclusions of this chapter.

3.1 Market share

The market share of the handlers at AAS give an overview about the distribution of powers among the handlers. The more powerful players can, when willing to collaborate, support the pool to a large extent and have more power in decisions about the equipment pool.

Based upon four week data of 2014, the market shares of the different ground handlers for passenger aircrafts are as follows, see Figure 7 and Figure 8. The market share provides a lot of information on which parties are the most powerful and how the ground handling market is divided.

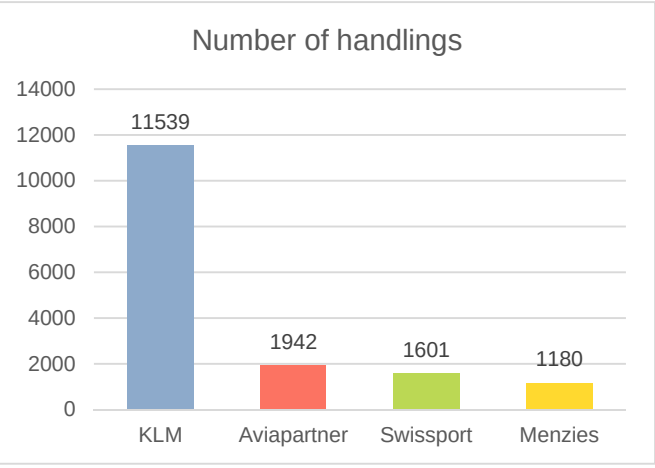


Figure 7: The number of handlings per ground handler during the four week period

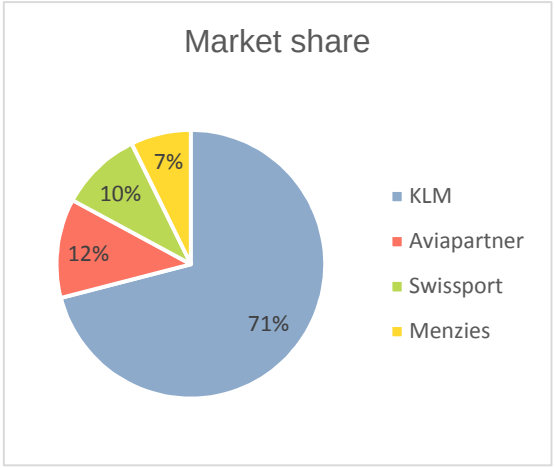


Figure 8: number of handlings

KLM Aircraft Services handles by far the most aircrafts, their market share is over 70%. Aviapartner is the second biggest, followed by Swissport and Menzies. It is stated that KLM has a strong power position and the other ground handlers are small players compared to KLM. Especially Menzies which is the smallest player and mainly its operations take place at the H-pier, see Figure 38. Other handlers can be imposed and threatened by the market dominance of KLM, KLM on its turn can be afraid of free-riders when the KLM will bear the largest part of the costs (Ostrom, 2002). A real successful pool is dependent on the participation of all the handlers, especially the participation of KLM.

3.2 Overview involved actors

In this section an overview of the involved parties is given. Based upon the interviews and additional information all the actors will receive a score for power, interest and attitude. These indicators give a meaningful indication on how the actors are situated in the actor network, based upon (Murray-Webster & Simon, 2006). An overview of the power position of the actors is given, see Figure 9. An extensive analysis of the attitude, power, interest and more general information about the actors can be found in Appendix B Actor analysis. The definitions of the three aspects are as follows:

- **Power** is defined as the ability to influence the equipment pooling concept.
- **Interest** is defined as to what extent the actor is involved and if the actor participates actively or passively.
- **Attitude** is defined as the actors perspective towards equipment pooling. So will they block (negative attitude) or support (positive attitude) the proposed concepts.

The values of the three indicators range between **- -** (hardly any power, very low interest, very negative attitude), **-, +-, +, ++** (very powerful, very high interest, very positive attitude), see also Table 4.

Range	Power	Interest	Attitude
--	No power	Very low	Very negative
-	Hardly any power	Low	Predominantly negative
+-	Limited power	Neutral/medium	Neutral/mixed
+	Powerful	High	Predominantly positive
++	Very powerful	Very high	Very positive

Table 4: Range of scores for power, attitude and interest

Hereafter the actors are shortly described, and their attitude is further analysed to identify 1) the largest gaps of knowledge of an equipment pool and 2) where the focus should lie during the realization of an equipment pool to convince the actors and to develop a long enduring, successful pool. The actors' concerns and expected benefits of the equipment pool are shown in tables, an elaboration can be found in Appendix B.

3.2.1 Ground handling companies

This whole research is about equipment pooling of ground handling equipment. The parties responsible for ground handling are the ground handlers. There are four main passenger ground handlers at AAS, see also Table 5.

A distinction between the ground handlers Menzies, Swissport and Aviapartner on the one hand and KLM AS on the other hand has to be made. Menzies, Swissport and Aviapartner only provide services in the form of ground handling. As a result, their process is optimized and as efficient and lean as possible. To survive, the right balance between equipment and personnel has to be found, the margins in this sector are extremely low, between the 2% to 4%. As a result there is just enough equipment and personnel present. These ground handlers hold hardly any reserves (Gerbracht, 2015; Grob, 2015; Weerdmeester, 2015). Where the traditional ground handlers are only responsible for a small part of the total process of flying, this is totally different for KLM at AAS[4]. KLM must deliver an efficient and qualitative process for the total process of flying. KLM can invest in more expensive equipment or hold large reserves if this is earned back in another part of the flying process. So for example, KLM can afford

[4] The ground handling actor field at AAS is taken into consideration, because here KLM has also a ground handling subsidiary. At other airports, KLM often uses the services provided of the appointed ground handlers. KLM as holding acts then just like any other airline at Schiphol.

to invest in a type of rampsnakes that is far more expensive than other rampsnakes, because when using those rampsnakes their airplanes do not have to carry extra equipment, which reduces space utilisation and weight and thus results in lower fuel costs. The reduction in fuel costs is larger than the extra investments made in the rampsnakes. This gives KLM a positive business case, where for the other ground handlers this is a high investment and probably a negative business case. So concluding there is difference in how the equipment is used by the ground handlers.

Ground Handler	Largest customers
AVIAPARTNER	British Airways Lufthansa Cathay
KLM Aircraft Services	Air France-KLM Transavia Delta Airlines
Menzies AVIATION	EasyJet Norwegian Czech Airlines
swissport	Arke Fly SAS United Airlines

Table 5: the ground handlers & their largest clients. For the customers of the ground handlers, see Appendix E Airline per ground handler.

3.2.1.1 Aviapartner

Aviapartner is a large ground handler, with a revenue of €380 million in 2012 (Aviapartner, 2013), with its focus on Europe. Aviapartner is mainly active at the B-pier, D-pier and G-pier, handling narrow and wide body aircrafts. Since Aviapartner is one of the four ground handlers at AAS, they have a lot of power. Because it will be the ground handlers that need to pool their equipment and adapt their operations. For the advantages and concerns, see Table 6.

Advantages	Concerns
Less movement of equipment at airside	Losing independency (KLM and imposing equipment choice)
Maintenance is secured	Unfair allocation of the costs
	Not possible to guarantee equipment all the time
	Unknown potential Equipment Pooling

Table 6: Aviapartner's expected advantages & concerns of equipment pooling

3.2.1.2 KLM Aircraft Services

KLM Aircraft Services, KLM AS is a division of the KLM Holding of which also the largest airline at AAS, KLM, is part. KLM AS only operates at AAS, but because KLM and its SkyTeam partners are by far the largest player at the airport, KLM AS is the largest ground handler at AAS. Over 70% of the handlings at AAS are executed by KLM AS. KLM AS's activities are widespread over the airport with a main focus on the B-buffer, B-pier, C-pier, D-pier, E-pier and F-pier, see Figure 38. KLM is a strong supporter of an integral equipment pool applicable on the whole airport, instead of several piers. This has to do with standardization of the process and only having to use one model instead of two, providing clarity and efficiency for their organization (Thijssen, 2015)(Mintzberg, 2006). For the advantages and concerns, see Table 7.

Advantage	Concern
One model for the whole airport	Unclear organization structure
Increasing safety at airside	Responsibility for and control over the equipment
Lower costs	Unknown potential Equipment Pooling
	Active role of AAS

Table 7: KLM AS' expected advantages & concerns of equipment pooling

3.2.1.3 Menzies

Menzies is a ground handler, founded by John Menzies in Scotland. It operates in 31 countries over the world. AAS is an important market for them. Menzies is an actor to take into account, however they will not have a leading role. Not trusting the other ground handlers in taking enough precautions when using

equipment made Menzies hesitant and not willing to cooperate in the equipment pool. For the advantages and concerns, see Table 8.

Advantages	Concerns
Reduce equipment fleets	Unfair allocation of costs
Less movement of equipment at airside	Not the same safety standards & control implemented through total organization
	No potential of equipment pooling
	Low trust in other ground handlers
	Lose control & overview

Table 8: Menzies' expected advantages & concerns of equipment pooling

3.2.1.4 Swissport

The largest ground handler of the world, with a yearly revenue of €2.8 billion, is also situated at AAS (Swissport International Ltd., 2014). Swissport acknowledges the fact that less equipment with equipment pooling is needed. It can result in a more positive business case, in which ground handlers can increase their margins. The true potential, dependent on location of the pool, equipment type and costs, are unknown and therefor making it hard to support on beforehand. For the advantages and concerns, see Table 9.

Advantages	Concerns
Less equipment needed	Unfair allocation of costs
Healthy business model for ground handlers	Fixed costs & variable costs unknown
No unnecessary investments & movements at airside	Independency of equipment secured
	Unknown Potential of equipment pooling

Table 9: Swissport's expected advantages & concerns of equipment pooling

3.2.2 Ground Service Equipment Companies (GSE)

The ground service equipment companies offer services to lease equipment that they have purchased. The contract duration of the contracts between ground handlers and GSE can be flexible, so only lasting a few weeks, or for a longer term or equal to the contract length of a ground handler with the airline. So when a contract between an airline and ground handler ends, the ground handler is not stuck with the contract. Besides delivering the equipment, the GSE are also often responsible for maintenance and inspections. The GSE companies can have a supportive but also blocking role. The GSE based on AAS are KLM Equipment Services (KES), SPS Group and TCR. The GSE are described below.

3.2.2.1 KLM Equipment Services – KES

KLM Equipment Services, better known as KES, is responsible for maintenance of the ground handling equipment. Because KES is a subsidiary of KLM it is self-evident that almost all equipment of KLM ground handling is maintained by KES. For the advantages and concerns, see Table 10.

Advantage	Concern
Potential for growth at AAS	First solving internal issues
Economies of scale	Liability issues
Existing knowledge on pools	Mainly maintenance company

Table 10: KES' expected advantages & concerns of equipment pooling

3.2.2.2 SPS Group

SPS Group is a company founded in 2000. They have become a large provider in small and non-motorised equipment. Their entrance in the market resulted in competition with the other GSE companies. The peak structure of handlings is also not the perfect structure to fully exploit the benefits of equipment pooling (Velthuis, 2015). If the ground handlers agree upon equipment pooling, SPS wants to pick their part of the pie and is willing to maintain and lease equipment. For the advantages and concerns, see Table 11.

Advantage	Concern
Potential for growth at AAS	Too many ground handlers
Economies of scale	Liability issues
	Redundancy in peak structure

Table 11: SPS' expected advantages & concerns of equipment pooling

3.2.2.3 TCR

TCR is a global GSE company founded in Belgium. Nowadays TCR serves 72 airports, spread across seven countries, with a revenue of more than €100 million. TCR is willing to cooperate in the pool and take the role as manager and provider of the pool. This allows them to grow further on their biggest market, AAS. However equipment pooling has to be embraced by the ground handlers before TCR wants to play a role. The organisation structure and who is when responsible for the equipment has to be fixed and well thought out. For the advantages and concerns, see Table 12.

Advantage	Concern
Large potential for growth at AAS	The choice in quality standard of the equipment
Track all useful information and can adapt their investments and policies accordingly	The unknown potential of equipment pooling
	Responsibility for the equipment

Table 12: TCRs expected advantages & concerns of equipment pooling

3.2.3 Schiphol Group (AAS)

Amsterdam Airport Schiphol (AAS) comprises many departments. Because these departments have different core values and different interests, AAS cannot be seen as one actor.[5] Two departments are directly involved in the equipment pooling decision process and part of AAS Airside Operations. AAS plays an important role, however due to legislation and policy their role will be reduced to a facilitating one.

3.2.3.1 Schiphol Group Airside Operations (AAS AO)

Schiphol Group Airside Operations (AAS AO) is the part of the company that is concerned with facilitating and guiding the process of handling aircrafts and air movements. Sub departments of Airside Operations which are directly involved in the equipment pooling question are elaborated on below.

3.2.3.2 Schiphol Airport Airside Authority (AAS AA)

The key factor for Airside Authority is safety. This department controls if everything at airside is safe and if everyone follow the airport rules. In some form AAS AA is the governing body on operational processes to see if everything is done in accordance with the rules. For the advantages and concerns, see Table 13.

Advantage	Concern
Lower amount of equipment & movement	The unknown potential reduction movements & equipment due to equipment pooling
Reduction of safety and security incidents	Responsibility for the equipment
	Embedding new concepts in clear rules & organizations

Table 13: AAS Airport Authority's expected advantages & concerns of equipment pooling

3.2.3.3 Schiphol Group – Process management airside. (AAS PMA)

AAS Process management airside is the problem owner, trying to realize a safe and efficient airside. Their perspective on equipment pooling is positive, since this can be the key to a more efficient and safe ground handling process at airside. For the advantages and concerns, see Table 13.

Advantage	Concern
Solves parking problem issue at airside	Unknown potential of Equipment Pooling
Collaboration between ground handlers, resulting in committed actors considering quality and costs	Responsibility for pool and equipment

[5] Since AAS– PMA is the client during this master thesis, when referring to AAS or Schiphol Group, AAS – PMA is meant or the whole of AAS when an issue, statement or mission is accepted organization-wide.

	Collaboration between the ground handlers
	Assure safety & efficient ground handling process at airside

Table 14: AAS-PMA expected advantages & concerns of equipment pooling

3.2.4 Schiphol Airline Operators Committee (SAOC)

The SAOC represents 48 airlines at AAS, who are responsible for more than 95% of all flight movements at the airport (Maks, 2015). The SAOC wants to be kept informed during the process and eventually lower costs for the airlines they represent. For the advantages and concerns, see Table 15.

Advantage	Concern
Increase safety at airside	Unknown potential of equipment pooling
More efficient operation	Enforcement of the rules at AAS
Lower costs for airlines	A lot of interconnections between equipment pooling and other pending issues

Table 15: SAOCs expected advantages & concerns of equipment pooling

OVERVIEW ACTOR NETWORK

The overview of the positions of the actors shows the most important actors in the network, see Figure 9. The most important handlers are not unwilling to participate. Where unknowns or doubts exist, the supporting companies like TCR and SPS can support or convince and take away some of the concerns. Also AAS plays an important role, but not decisive. But overall the attitude of the handlers and other actors is relatively positive and using the right method and approach can result in the establishment of the equipment pool.

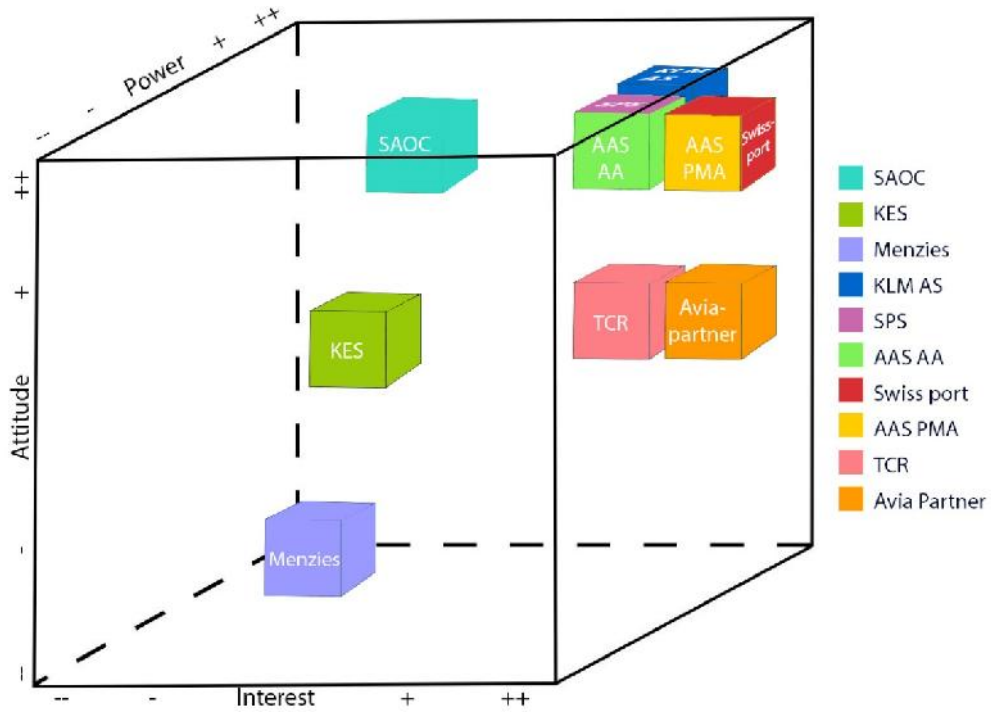


Figure 9: Position of the actors

3.3 Risk analysis

As earlier mentioned, the involved parties have some big concerns regarding the equipment pooling initiative. These concerns are a result of perceived risks. In this section a small risk analysis is conducted to comprehend the possible risks. These risks can influence the chance on success of equipment pooling. A distinction between the kind of risks is, following (Hillson & Simon, 2012), see Figure 10 is made. The identified risks partly explain the behaviours of the parties. For an extended risk analysis see Appendix C.

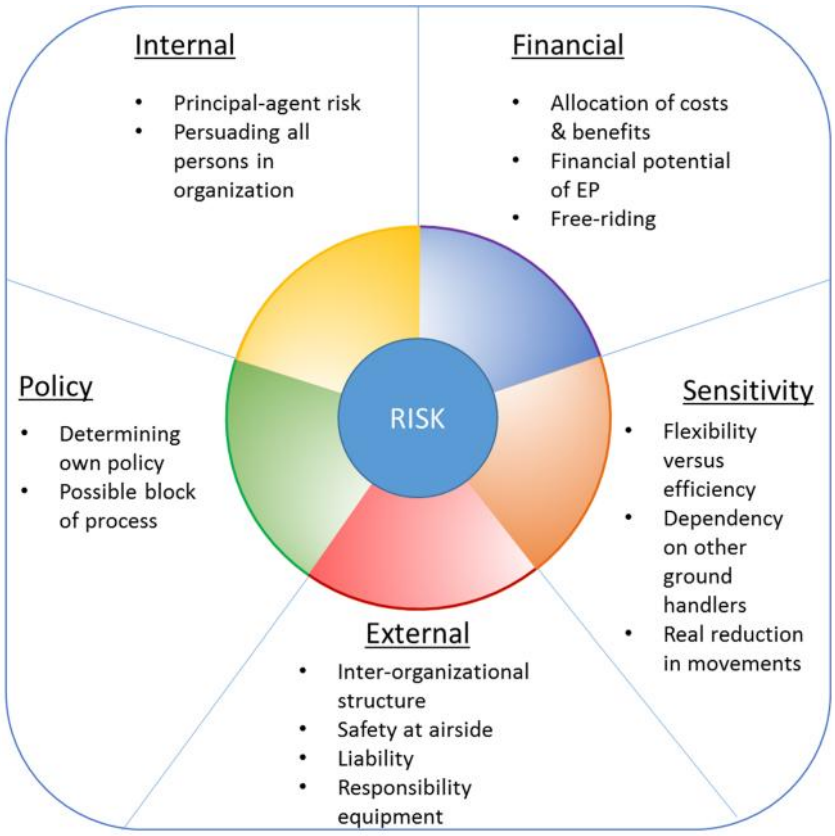


Figure 10: overview of the risks of equipment pooling

A lot of the identified risks can be referred back to the design principles and preconditions of a CPR. Realizing a pool means that the ground handlers have to give up their autonomy to a certain extent and that a trade-off between flexibility and efficiency have to be made. Furthermore the actors are afraid of being forced to work together and thereby lose a part of their autonomy. One of the most important risks is the risk on free-rider behaviour. Also trust between the actors is still lacking, the actors are afraid of liability and responsibility issues, which is seen as a lack of trust. Some aspects are for later to decide upon, like official responsibility agreements and how to overcome the problems in the own organization. Also a fair allocation of costs and benefits is essential, specifically because of the size and business differences of the handlers. Though these are decisions for during the institutional implementation, following the design principles.

However before a start can be made with the decision and design process, the financial potential and to what extent ground handling at AAS is applicable for an equipment pool have to become clear.

3.4 Network of actors

In this section, the network of actors is discussed. A formal relation chart represents the network, see Figure 11. This chart is formed using the methodology provided by (Bryson, 2004; Enserink et al., 2010). The chart shows the relations between the actors, in what meetings the actors are already sitting together and how AAS is divided itself and related to other actors. Other (in)formal relations between AAS and the involved actors or between the actors themselves are included if this adds value to the equipment pooling issue. The interdependencies are important to see how intertwined the network is and thereby the communication platforms can be analysed if those can be used to introduce and to discuss the equipment pool. Furthermore the interdependencies are seen as given and as constraints. However during the design process and decision making process the interdependencies are not further analysed.

The chart makes clear that there are many interdependencies between the actors, the ground handlers and AAS, the ground handlers and airlines etc. This network already makes equipment pooling a complex process. Pending issues at airside cannot completely be incorporated by the equipment pooling concept. More issues play a role and because only a few aspects can be covered by equipment pooling, it is important to not overplay one's hand. (de Bruijn & ten Heuvelhof, 2008). Especially the relationship between AAS and KLM is a special relationship. There is always a risk AAS compromises with KLM, thereby not implementing equipment pooling, in order to realise other shared goals (de Bruijn & ten Heuvelhof, 2008). All the consultation bodies present at the airport make this even more complex. There are also two kinds of meetings included; BOV meeting and Workgroup Parking issues.

1) The BOV meeting is about large pending issues at airside.
2) The Workgroup Parking issues meeting is about operation, tactical or strategic issues about parking of equipment at airside.

In general, issues discussed in one of the two meetings are or can be related with equipment pooling and equipment pooling can be discussed with the parties and representatives present at those meetings. However by means of observation and interviews the communication about equipment pooling during those meetings is not sufficient to make real decisions and start the process for the realization of a pool. While a communication platform in which every actor is represented and is treated respectfully is a prerequisite to come to a successful design of the equipment pool.

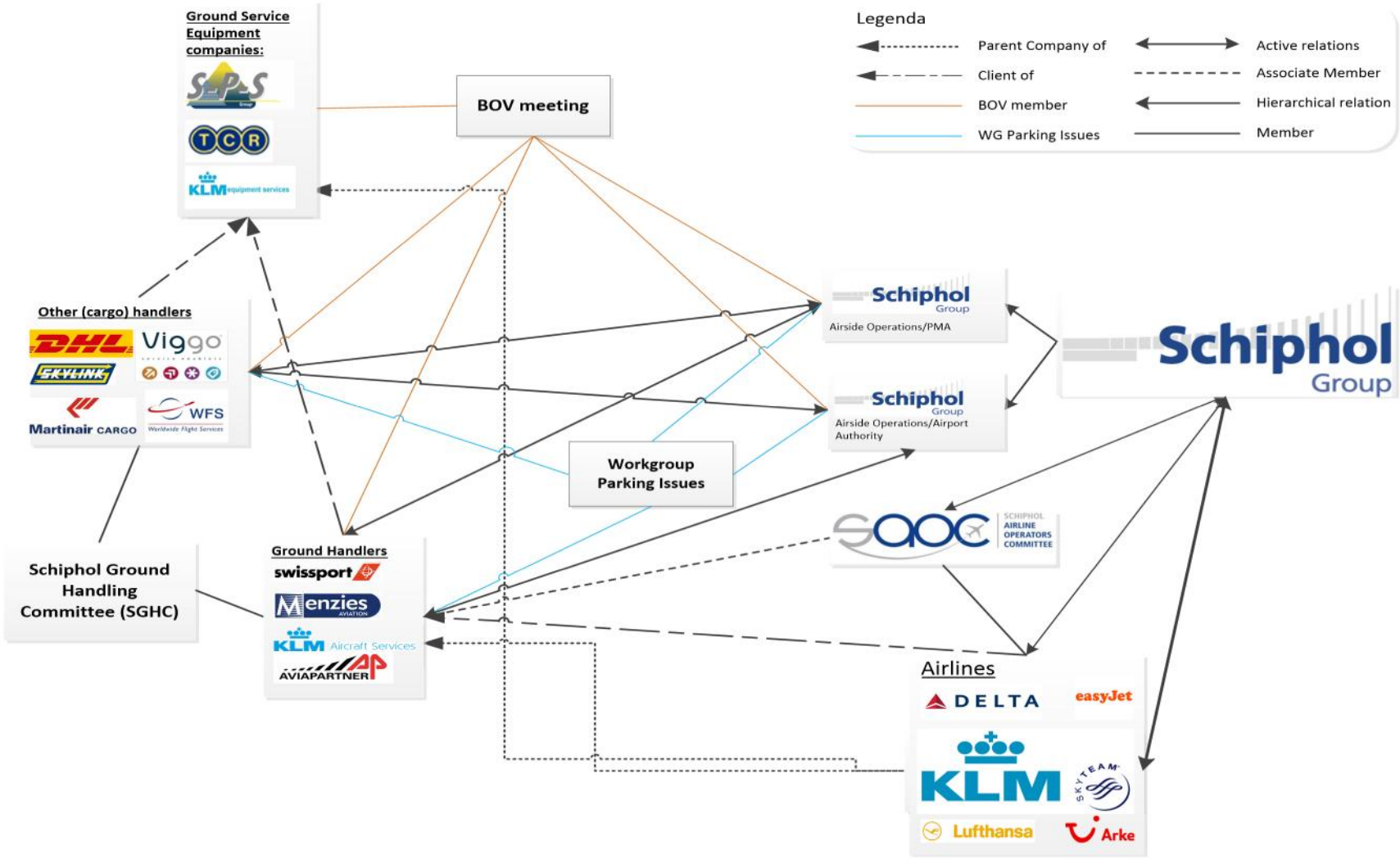


Figure 11: Overview of the actor network

Explanatory notes:

- KLM as a holding owns its subsidiaries KLM aircraft services and KLM equipment services. KLM, the airline, has therefore close ties with those companies and the processes of the different companies are aligned to create the total KLM product. Via the dashed line, originating at KLM, this is made clear.
- Arrows ending at AAS, not at a specific AAS department, are relationships of the organization or company with AAS other than Airside Operations, PMA or Authority.
- The relationship between KLM and AAS is specified by a thicker line, because of their intensive and interdependent relationship. AAS is KLM's hub and KLM accounts for 70 percent of the passengers and flights at AAS. So KLM's influence is greater than the influence of other airlines.

3.5 Achieve collaboration

Currently there is a delicate balance between cooperation and competition. Due to the fierce competition and small margins, the ground handlers are defensive in embracing new initiatives that would prescribe collaboration. Sharing company information is one of the issues that are perceived as very sensitive. So before companies share their information, strict confidentiality agreements have to be made and the benefits of collaboration have to be made clear.

There are already collaboration initiatives at the airport; the GPU pool, Staircase pool at the H-pier and FPU pool. Also at lower level they cooperate: often dollies for freight and baggage are shared or rented when one is in need for an extra dolly at specific time. However these business case are not profitable at all. So a business case in which the losses are smaller or other parties are responsible for investments, like AAS or GSEs, are preferred and embraced.

Equipment pooling will include actors' core activities and those are the activities in which the ground handlers make money and can distinguish themselves in regard to other ground handlers. That are the aspects on which they compete each other and try to win contracts of airlines. A shared understanding is needed and the differences in business can be overcome through a good design and decision process.

The need for collaboration has to be emphasized since intense collaboration is a prerequisite for realizing a self-governing equipment pool. The following concretized reasons became clear:

1) Equipment pooling is only viable when several parties participate in the pool.
2) Not only the ground handlers, but also equipment services companies can support the pool and provide the equipment.
3) Without several parties there will be neither cost reductions, nor space reductions and nor increases in safety.
4) Without good collaboration agreements, several problems can occur: interface, organisational and legal problems.
5) A quality assurance is essential, because ground handlers are concerned quality is endangered when other handlers use the equipment.

Collaboration can be established by creating a sense of urgency and shared goals between the involved actors (de Bruijn, ten Heuvelhof, & in 't Veld, 2010).

3.6 Conclusion Actor Analysis

Based upon the actor analysis of this chapter, several conclusions can be drawn according equipment pooling at Amsterdam Airport Schiphol. An approach for the actors can be developed regarding the conclusions.

In the actor network of the ground handling sector a strong governance regime, AAS, is missing on purpose. Therefore a pool must be established by all actors and every actors needs to be taken into account. First of all there is no agreement about which equipment will be pooled and at which location. Some see only the A-pier as possible location, others like for instance KLM AS support equipment pooling when it is introduced at the whole airport. Due to this heterogeneity caused by the difference in market share and business processes a common understanding about the equipment pool is missing. Due to the unknowns the actors do not know what they must accept and what it brings them. A good allocation can overcome a part of this challenge.

Nevertheless the most important conclusion is that the most important actors, regarding power, attitude and interest are not unwilling to realize an equipment pool at AAS. However they are unwilling to commit to each other and to collaborate. This collaboration is essential for the viability of the equipment pool. There is a lack of trust in each other and a lack of motivation to overcome the lack in trust and persuade each other. The status quo of not taking a decision is accepted by almost every actor and maintains the negative prejudices about each other. This puts AAS in a difficult position. By reasoning it is impossible to convince the other actors. Besides that the current communication bodies do not provide the right platform to discuss the equipment pool. A sense of urgency is required, but cannot be created during these meetings. Before further steps can be taken, the net benefits of the pool have to be estimated, so that according to (Ostrom, 1990), see also 2.1.2, the benefits of the new situation outweigh the benefits of the current situation. The drawn conclusions and information is the starting point of the process design. It is important to take the concerns of the actors into account and anticipate on the actor's perspectives and attitudes.

After the decision making process, the organization structure has to be fixed into a widely accepted agreement. Issues like liability and assurances can be handled during the discussion about the organization structure. Thereby safety is an important issue and needs to be included. As a result of the lack of space and growth of amount of aircraft movements AAS per year, safety guarantees at airside become threatened. So solutions that reduce the pressure at airside and enhance safety will be widely accepted.

Concluding not all prerequisites are present and therefore it is almost impossible to implement an equipment pool at once, following the design principles. Firstly, it must be clear if the net benefits of the new situation are larger than the net benefits of the old situation. Secondly the net benefits must be perceived by every actor as an improvement from the current situation. Thereby taking into account that the current consultation bodies do not provide the right platform to persuade the others of AAS' perspective, so another type of communication platform needs to be found.

4. Benefits & potential Equipment Pooling

This chapter covers the central topic: the potential of equipment pooling. As was concluded in the chapters before, the potential of equipment pooling is the big unknown. The improvement of the equipment pool has to be feasible and significant. The other actors are not convinced because they do not know how equipment pooling improves their operations and finances. So before the actors have the incentive to change, the net benefits must be higher than the benefits of the old situation. AAS also does not have the numbers about the benefits and costs of equipment pooling. To be in a powerful position for the process, trying to create a common understanding, and to make a more comprehensive trade-off, the benefits and risks have to be identified. In this section a quantitative model, quick scan, is developed to calculate the theoretical possible reduction, the theoretical maximum. The data analysis is described in 4.1, 4.2 discusses the assumptions to be able to execute a quick scan. The model is described in 4.3. The results and model are verified and validated in 4.4. Section 4.5 gives an overview of the results. The conclusion of this chapter is written in 4.6.

4.1 Data Analysis of AAS

Before a model can be developed, data has to be collected. In this section the collected data is presented. The data contains information about the handlings at AAS distributed on the piers per ground handler. A lot of data is acquired during the research project, originating from different sources. Lists of type and amount of equipment have been obtained by the ground handlers. The data of handlings and movements have been obtained by AAS. The data is modified, so an overview of the number of handlings and which ground handler handled which flights could be given, see also Appendix H.

KLM has a lot of their activities centralized around a few piers at AAS, see Figure 38 and Table 16. KLM has a market share over 90% at the B-platform, E-pier and F-pier and Menzies at the H-pier. For piers where KLMs and Menzies market share is over 90%, the reduction of equipment pooling will be probably negligible. However KLM is only willing to participate in equipment pooling when a pool for the whole airport is established. So these piers are also taken into account for the actual calculation. The reduction of equipment at the more differentiated piers when considering ground handlers is larger.

Pier	Aviapartner	KLM	Menzies	Swissport
B-platform	4%	91%	0%	5%
B-pier	39%	57%	2%	1%
C-pier	2%	89%	0%	9%
D-pier	13%	73%	1%	13%
E-pier	1%	96%	0%	2%
F-pier	0%	99%	0%	1%
G-pier[6]	28%	12%	7%	53%
H-pier	0%	0%	98%	2%

Table 16: Overview of piers with market share per ground handler

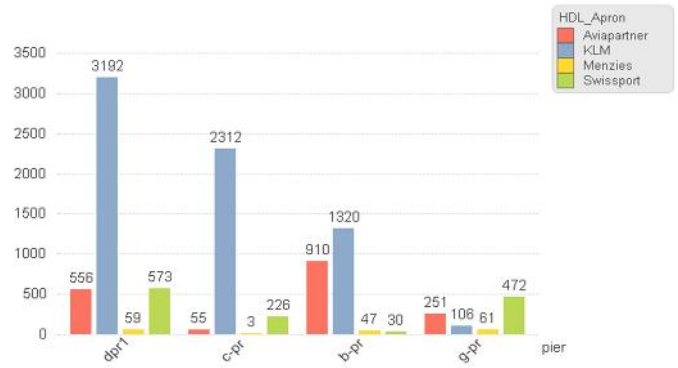


Figure 12: number of handlings per ground handler per pier

Pier	Number of VOPs
B-pier	13
C-pier	14
D-pier	33
G-pier	8

Table 17: number of VOPs per designated pier

[6] The G-buffer is included in the G-pier

The number of VOPs per pier, see Table 17, give an good overview and basis about size of the piers. Because of the differentiated market shares the focus is on the B, C, D & G-pier, see also Figure 12. For a full overview of VOPs at all piers at AAS, see Appendix D. Furthermore the number of handlings has to be put into perspective per pier. For instance, at the G-pier there are far fewer handlings when compared with the D-pier, due to only 8 VOPs at the G-pier and 33 VOPs at the D-pier. Also a distinction between narrow body and wide body aircrafts is made, see Figure 13[7]. With the acquired data an Excel model is made to look at the current situation and subsequently calculate scenarios.

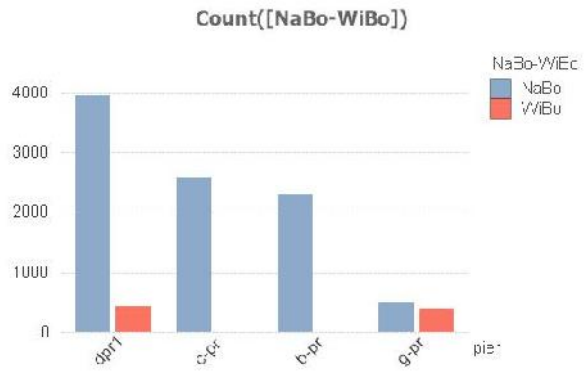


Figure 13: number of NaBo & WiBo handlings at B, C, D and G pier

4.2 Assumptions for quick scan model

For the development of the quick scan assumptions are made. The assumptions make it able to work with a sparse but at the same time a comprehensive model.

FOUR WEEK DATA SELECTION

To be able to work with a sparse but at the same time a comprehensive model, the data of four weeks of 2014 are chosen in consultation with an AAS expert. The theoretical maximum is calculated based upon this data. The busiest week of the year in July and August, one average week in March, one busy week in September and the quietest week in January are chosen. For more detailed data, see Appendix H. The whole week is taken into account, since there are not only peak difference between the seasons, peak differences during the day, but also between the days of the week, see Figure 14. This corresponds to airport economics, where seasonality plays a big role. But peak differences also play a role on a more micro level 1) during the week, because of business and leisure flight and 2) during the day because of business and hub and spoke traffic (Roling, 2014). The assumption is that a decision can be made based upon the results of this data. This data covers the fluctuation of the demand during the season and also gives a good overview of the handling of flights at AAS during the year.

ONE TYPE AND AMOUNT OF EQUIPMENT: STAIRS

One type of equipment is chosen for the model: the stairs needed for every flight and aircraft. Some ground handlers use different amount of stairs during the handling from time to time. Since an equipment pool requires standardization, this is implemented for the whole model. For the easiness of work, the stairs for the NaBo and WiBo aircrafts are seen as one. One service staircase is needed per handling[8], based upon data of the four ground handlers and due to supposed standardization.

[7] The handling time of narrow body aircrafts is significantly shorter than the handling time of wide body aircrafts, (Steevens, 2015). Where the turn-around time of narrow bodies can be optimized to 20 minutes, (Grob, 2015), wide bodies require a turn-around time for at least 1 hour (Steevens, 2015). Besides the difference in time the equipment needed for handling narrow and wide body differ in type and in amount (Gerbracht, 2015; Thijssen, 2015; Weerdmeester, 2015)

[8] It can occur that ground handlers transport equipment destined for Pier G to pier D, due to a lack of equipment at the D pier. In the calculations this is hard to take into account, when specifying on certain piers. Also ground handlers try to reduce such movements from pier to pier to the bare minimum

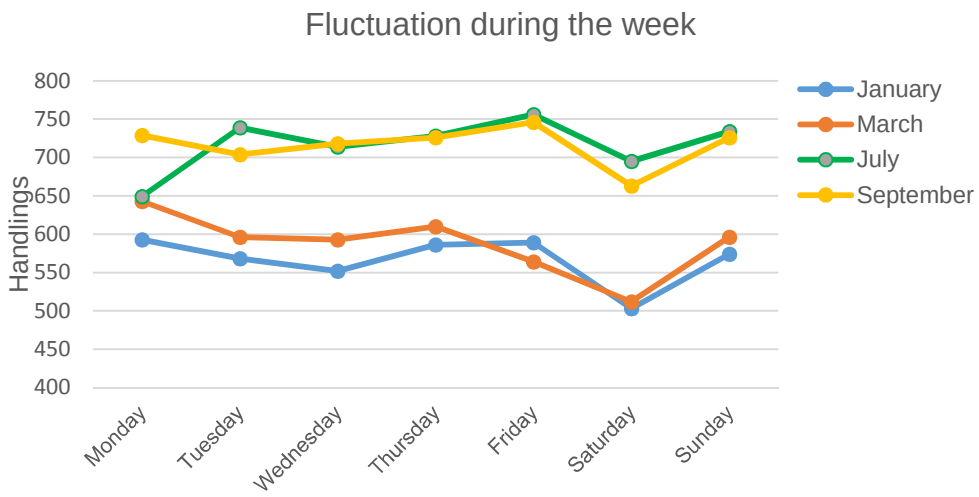


Figure 14: Daily number of passenger handlings at AAS

MODEL WITH AND WITHOUT MEMORY

The model contains the ground handling information of AAS at a specific day. So for instance, September the 17th in 2014. For flights which arrive in the evening of September the 17th and leave the next morning, so on 18th of September, the model needs memory. However due to limitations of the modelling program Excel, this is almost impossible to implement. Therefor the flights which arrive in the evening of the 17th are also counted during the morning of the 17th, instead of counted during the morning of the 18th. This averages during the days. However two types of measurements are done; one with memory but actually on the wrong day and the other one without a memory. So flights arriving late in the evening and leaving in the following morning are not accounted for. Most of the times there was no peak difference between the outcomes of the two calculations, see Appendix H for an example and corresponding explanation.

TIME DISTINCTION IN QUARTERS

The day is divided in quarters of an hour, resulting in a discrete distribution of time. This makes it possible to count the number of used stairs, There might be a slight difference between reality and the model, since in reality the stairs could have already been in an idle phase. On the other hand using quarters also includes some preparation time and time after the handling to leave the VOP with the equipment. Eventually this will average.

PASSENGER PIERS

Only passenger piers are taken into account. The considered ground handlers are passenger flight handlers. Furthermore the passenger piers the pressure at airside is the highest and the handling processes are the same. Besides the J and U buffer are not taken into account, since most of the time aircrafts are only parked over there and the processes are far away from the rest of the piers. The ground handling sectors treats these areas as separate areas.

NO MOVEMENTS OF THE EQUIPMENT IN THE MODEL

The movements of the equipment are not taken into account. Thus there is no calculation and analysis about the possible reduction for ground handling equipment when equipment is for instance bounded to a particular VOP.

STAIR IS USED DURING HANDLING

The stairs are used during the whole handling time, based on experts opinions and observation. However there are aircrafts standing for a longer time than the actual handling time at a VOP. It is very hard to determine when a stair can be used for other VOPS, for the easiness of work the stairs are used during the whole handling time.

CLOSED VOPS DURING THE CHOSEN WEEKS

There were a few VOPs at piers closed during those weeks. However this had no significant influence. Besides an airport is continuously developing and executing maintenance at airside. So continuous construction works and or maintenance at the VOPs is normal business for the last and also coming years. Therefor no further remarks are made when piers are handled separately. For the closed VOPs during the weeks see Appendix G.1 Closed VOPS at AAS.

4.3 Model Development AAS: Three scenarios

In this section the model is developed. This model calculates the theoretical possible reduction of an equipment pool at AAS. This model calculates the amount of equipment needed during the day and if a reduction of equipment through equipment pooling is possible. First the current situation of AAS is modelled. Therefor the model with memory and the model without memory is developed. Besides, this current situation scenario, two other scenarios are developed, equipment pooling for the whole airport and equipment pooling per pier, see Table 18. The proposed equipment pool where every VOP is taken into account is a subdivision of the equipment pooling per pier. However this would have resulted in a complicated model in which comparisons would be very difficult to make. The scenarios are analysed by comparing the peaks of the ground handlers. For the other scenarios other accumulations apply. The different peak formulas for each scenario are also presented.

SCENARIO 1: CURRENT SITUATION

This scenario is an analysis of the current situation. So there is no equipment pool. The peaks of the ground handlers during the day are accumulated, because the peak amount is the maximum amount of stairs the ground handler needs during the day. Because an equipment pool is not realized for the current situation, the peaks of every ground handler are accumulated separately.

$$\max_{Day} S1 = \sum \max Aviapartner + \max KLM + \max Menzies + \max Swissport \quad (4)$$

SCENARIO 2: EQUIPMENT POOLING FOR THE WHOLE AIRPORT

This scenario assumes one equipment pool for the whole airport. When needed, a ground handler can use the stairs. So when there is a peak at one pier, free to use stairs at other piers can be used to handle the peak. For this scenario another accumulation applies. For the whole airport the maximum peak of all ground handlers at a certain time is the maximum amount of equipment needed. The reduction is calculated by subtracting the scenario peak from the current peak.

$$\max_{Day} S2 = \sum \max_{Time\ x} (Aviapartner + KLM + Menzies + Swissport) \quad (5)$$

SCENARIO 3: EQUIPMENT POOLING PER PIER

This scenario assumes for every pier a staircase pool. So for the B-pier there is one pool, but also for the C-pier etc. The stairs will be available for any handling at the appointed pier. A reduction for the movements at the perimeter roads will be achieved. However this is not taken into account in the model. For the equipment pool per pier the total reduction is the accumulation of the result of the subtraction of the current situation peak from the scenario per pier peak.

$$\max_{Day} S3 = \sum \max_{Time\ x} Pier_A(Aviapartner + KLM + Menzies + Swissport), \max_{Time\ x} Pier_{..n}(Aviapartner + KLM + Menzies + Swissport) \quad (6)$$

Scenario	Extra Notes
1: Current situation	
2: EP for whole airport	One equipment pool for the airport
3: EP per pier	For every pier a pool of stairs

Table 18: Overview of the three scenarios

4.4 Verification & validation results

The model is verified with information shared by a ground handler. The peaks of the models do not exceed the amount of stairs this ground handler currently owns. Furthermore the peaks during the day coincide with the expectations of the experts and no strange outliers appear. So when verifying the model with existing data, the model suits the chosen goal.

The results are compared with experts and the actual data. The current situation in the model can be compared to a large extent with the real current situation. The assumptions, like the day division in quarters, have some influence but that is negligible. The real numbers of stairs which can be reduced by implementing an equipment pooling is hard to validate and to compare with the results of the model, since there is no equipment pool yet. However when doing calculations for all the days, every day a reduction of stairs can be realized. To make it more robust, the minimum theoretical reduction is taken. So the highest peak in the scenarios of equipment pooling are taken as milestone for the total reduction.

Due to the fierce competition, the ground handlers were not willing to share their sensitive data, and because of this it is hard to make a complete estimation about the possible reduction for the ground handlers. However compared to the given information the model is appropriate and fits well enough. In addition, for this model the busiest day is taken into account, due to a lack of information about on which day the ground handlers adjust the amount of their stair pool. It is reasonable and probably that ground handlers adapt their amount of stairs to that number that 80% of the days during the year are covered. When taken this into consideration the reduction realized by an equipment pool, the pier pool or airport pool, is larger.

4.5 Results & analysis quick scan AAS

The quick scan provides a good overview of the peaks of the different handlers during the day. The busiest day appearing in the data, the 1st of August, shows these peaks, see Figure 15. For the other days a same graph can be seen, with the same kind of peaks[9]. As expected KLM has the highest peaks and has several peaks during the day. The peaks of the other ground handlers are just before or just after the KLM peak. Thereby the average needed equipment lies between the two and three times lower than the equipment needed during a peak. A loss in the investment of the equipment is the result. The scenario with one equipment pool for the whole airport, shows a possible reduction in stairs, see Figure 16.

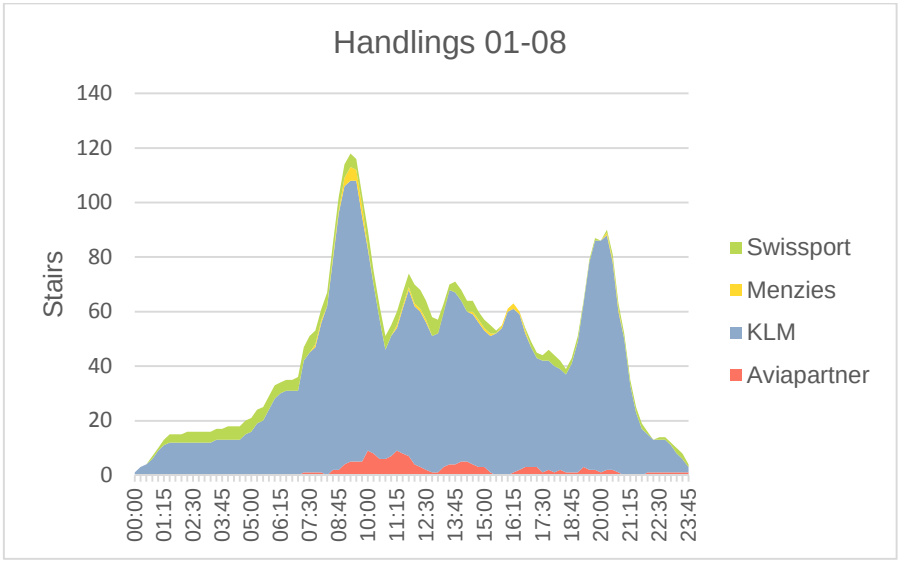


Figure 15: the passenger handlings during 01-08-2014

[9] This does not have to mean that the maximum peak of stairs is necessarily on the 1st of August. During other days the peaks of the handlers can coincide to a larger extent.

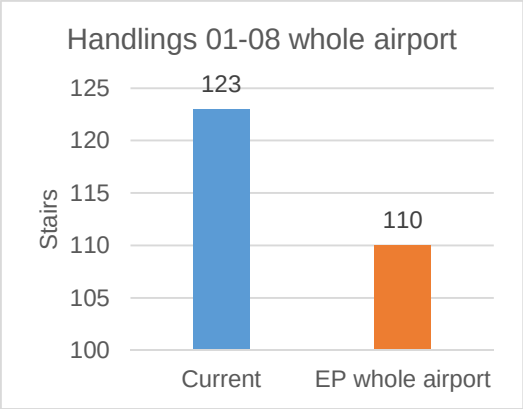


Figure 16: needed stairs for current situation and scenario of an equipment pool at the whole airport

The results of the scenario of equipment pooling per pier are analysed, because often the sum of the parts is larger than analysing the system as a whole When for instance the peaks of the B-pier and the G-pier are evaluated, see Figure 17 and Figure 17, a highly differentiated ground handling field can be derived. Also the market shares at the piers, see Figure 12, are contained in the results and analyses of the piers. When comparing the peaks of the ground handlers, see Figure 19, it can be seen that the maximum peaks and the accumulated peaks differ to a large extent. Meaning that the peaks of the ground handlers do not coincide. There is room for improvement and the piers can when an good arranged pool is established suffice with less stairs than during the current situation. Calculations concerning the piers separately shows that pier bounded equipment has potential, see also Table 19 and Table 20.

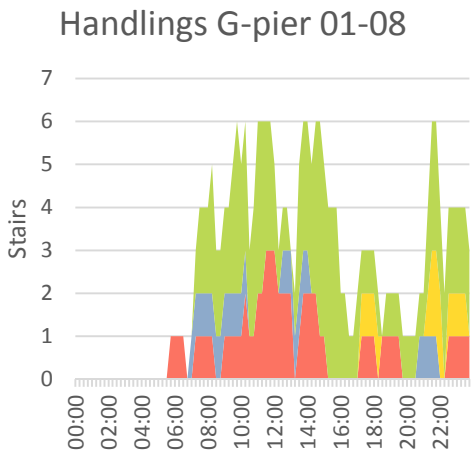


Figure 17: handlings at Pier G 01-08-2014

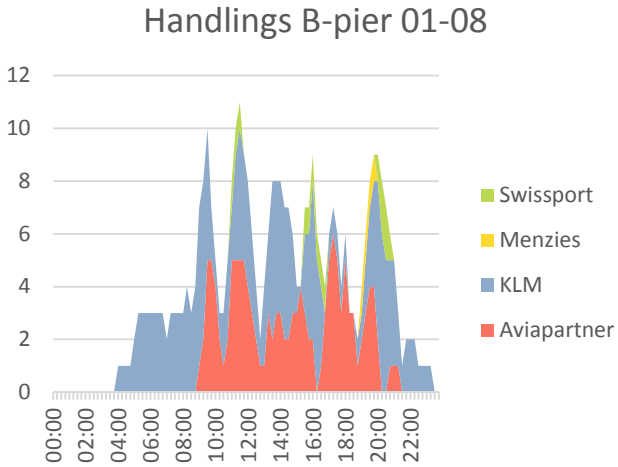


Figure 18: handlings at pier B during 01-08-2014

GH	Current Peak	Pier EP
Aviapartner	3	3
KLM	1	1
Menzies	2	2
Swissport	5	5
Total	**11**	**6**

Table 20: maximum pier G

GH	Current Peak	Pier EP
Aviapartner	6	6
KLM	6	6
Menzies	1	1
Swissport	2	2
Total	**15**	**11**

Table 19: maximum pier B

The C and D pier show similar graphs and also the different peaks of the ground handlers do not coincide. For an analysis of every passenger-pier at AAS, see Appendix H. In short, the other piers, beyond the B, C, D and G pier, have less room for improvement, due to the dominance of KLM at those piers and of Menzies at the H-pier. However there is even some little room for improvement at the dominated E-pier, Figure 20. Especially for ground handlers who not dominate that pier this will be an

improvement. Moving the equipment from other piers is time consuming, increasing pressure on the perimeter roads and in particular unnecessary since the ground handling equipment of the other ground handler is already present over there.

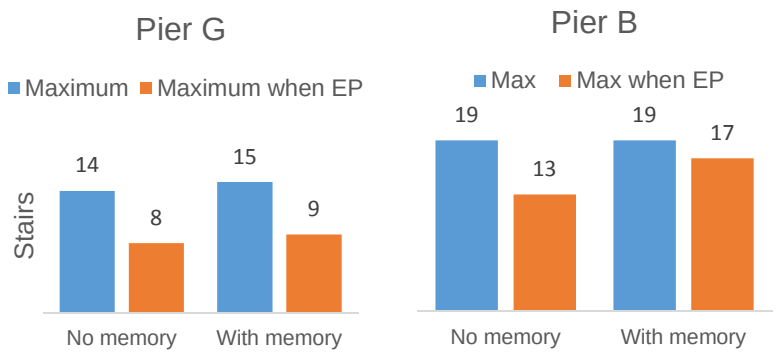


Figure 19: accumulated maximums of ground handlers vs peak when EP for Pier G & B

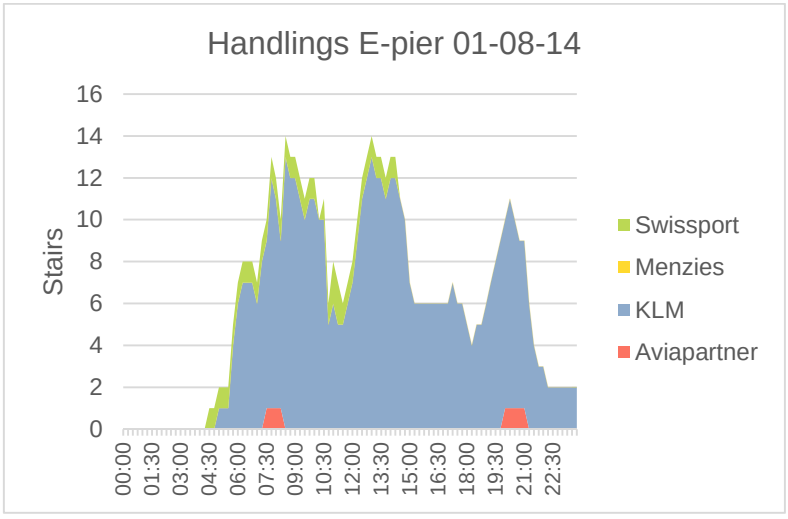


Figure 20: handlings at pier E during 01-08-2014

When the total amount of ground handling stairs is analysed, a reduction can be realized by implementing a pool. The theoretical maximum is promising and can realize a significant reduction, see Figure 21. Especially when a pool per pier scenario is considered. Also when the whole airport scenario is considered for equipment pooling a significant reduction can be realized. Though a theoretical maximum is optimized under ideal circumstances. When a pool will be established, transaction costs will rise and to assure a 100% availability some extra stairs will be acquired. Nevertheless equipment pooling is still worth considering. For the equipment pool at the whole airport an larger reduction than the calculations give can be established, because a less large reserve pool of stairs is needed. When integrating the reserves, less stairs have to be in the reserve pool, just like the engine pool, see 2.2.4.2, than when every ground handler maintains to have its own reserve. The reduction of the sum of piers will be some smaller, since a reserve per pier is needed.

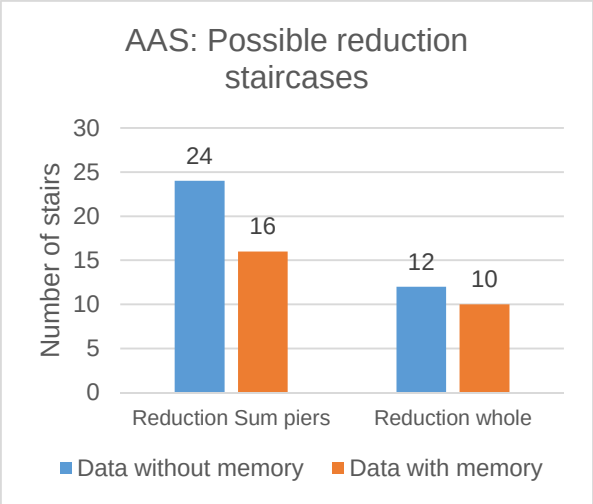


Figure 21: Results of staircase pool at AAS

COST REDUCTION

A quick scan learns that the benefits are significant and substantial. According to the current amount of stairs a reduction of around the 12 stairs can be realized in the scenario with a pool for the whole airport and around 20 stairs can be reduced with a pool per pier. So taking a purchase price of around €10.000 per stair, the theoretical potential is between the €120.000 and €200.000 in total. However establishing a pool brings costs, for instance assurances, organizational structure, extra innovations to monitor the stairs; the transaction costs. On the other side stairs can be collectively purchased an maintenance contract collectively signed. This results in even more cost reductions

In the scenario for the whole airport the reduction in stairs will probably be higher. The reserves of all handlers and all piers can be taken together and reduced. The reduction of the scenario for a pool per pier will be some lower, there has to be a reserve per pier. So both scenarios results in a significant reduction of stairs at airside. However to what extent the theoretical potential will be exploited depends on the agreements between the parties and if they share the same perspective and understanding. Also there are still a lot of institutional and organizational choices to make. All of them affects the potential and success of the pool. However this cannot be calculated and mainly depends on the actors.

4.6 Conclusion: benefits & risks equipment pooling

According to the results of the quick scan the conclusion can be drawn that a reduction in stairs can be realized and still be able to meet the demand at airside. Currently each ground handler meets the ground the demand separately. However a reduction can be realized by implementing an equipment pool. The highest reduction can be achieved by implementing a pool per pier. But with this scenario flexibility decreases, since the stairs can then only be used for that particular pier. The reduction when a pool is integrated for the whole airport is less, but more robust. However the question is if the organization can be made as efficient as possible, so that the benefits of this pool outweigh the extra organizational costs. In conclusion, equipment pooling results in a reduction of the amount of stairs where the sum of the parts, piers, is larger than the whole.

Beyond there are still a lot of decisions to make and appearing uncertainties. Decision have to be made about the location for the equipment, if the sector wants a pool for the whole airport, per pier or another not yet considered option. The benefits of other types of equipment can be estimated by reasoning, but fair estimations are missing. The influence of a different type of owner is unknown, just like the reduction or increase in costs when an general purchase is done. Also the costs of the system and to realize the pool have to be calculated further.

The theoretical benefits are known. The theoretical maximum presents that a reduction via a pool is possible. In accordance with the first formula of CPRs, the net benefits, BNi, of a pool outweigh the benefits of the current situation, BOi. So it is useful to bring the actors together. In order that the handlers perceive the same benefits as AAS and support a common understanding. In addition, the actors can give substance to the institutional design of the pool. This can reduce the transaction costs to a minimum, so that the theoretical potential is exploited to the largest extent.

$$\boldsymbol{Di = BNi - BOi} \qquad \textbf{(7)}$$

5. Conclusions Part I: Shared understanding & incentives to collaborate are missing

The most important theoretical findings resulted a list of prerequisites for considering and designing an equipment pool. To overcome institutional problems and prevent adverse effects, collaboration is essential. By means of an actor analysis and a quick scan to calculate the benefits of equipment pooling it was verified whether every prerequisite was met. If so, the process can be started subsequently and the pool can be realized based upon the design principles of successful equipment pools. It is essential that the perceived net benefits outweigh the benefits of the current situation. Only then the actors have an incentive to change.

The actor analysis gave useful insights and conclusions. There is not a total unwillingness towards the concept of equipment pooling and the actors acknowledge the potential of equipment pooling to increase efficiency at AAS. Nevertheless, there are a few aspects which hinder the realization of the equipment pool. 1) The actors, especially the handlers, are concerned about the impact of equipment pooling on their processes and the loss of independency. 2) The potential of an equipment pool is unknown by the actors and two of the most important prerequisites are missing 3) a common understanding of the actors and 4) trust in each other. While trust and common understanding are really important for close collaboration. Collaboration between the fierce competitors, ground handlers, and other actors is essential for the success of the pool. The heterogeneity between the actors can be solved by a fair allocation of costs and benefits and taking all relevant aspects of the actors into account

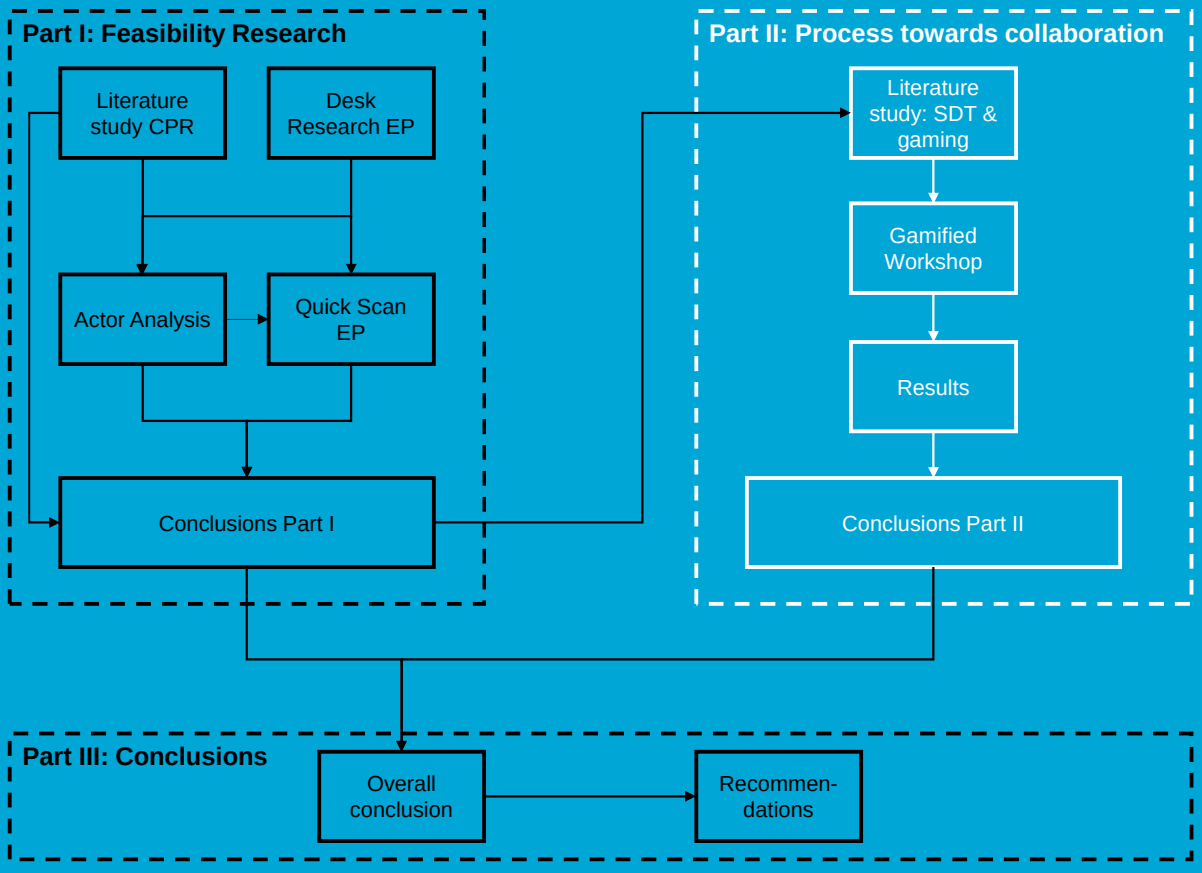
The theoretical potential of an equipment pool is promising. The new situations' benefits are higher than the benefits of the current situation. However due to the fact that a lot of decisions have to be made about the institutionalizing of the pool and the related this costs, the real benefits will probably be lower but remain unknown. The benefits are not perceived as such and accepted by the actors. If the trust increases together with the common understanding between the parties, the lower the transaction costs will be.

For the decisions about the pool, communication is necessary to bring the actors together and let them discuss the pool. But the current communication platforms do not suffice. Trust in each other, a common understanding and changing the perspective on the net benefits cannot be created by the current communication bodies. So if nothing changes, nor will the incentive to change. Thereby no actor has a dominant casting vote and the numerous interdependencies slow down the process. Until action is undertaken, the status quo in the ground handling sector will be maintained and the actors will just wait to see which way the wind blows.

Accordingly it is too early to continue the design of the equipment pool. First a new communication method and other approach have to be used to motivate the actors to take action, learn to trust each other and create a common understanding. So that eventually the right prerequisites are met to continue with the design and decision making process of the equipment pool.

Part II:

Process towards collaboration



6. Research problem Part II

As concluded in Part I, the motivation to collaborate is missing. Collaboration which is essential for the success of the equipment pool. Therefor it is too early to design the actual pool for AAS. First a deeper research about the motives and the behaviour of the actors have to be done. Because concluding from the first part the motivation to collaborate is missing. First trust in each other and trust in the equipment pool needs to be realized. The CPR framework does not provide how the required prerequisites can be met. In addition, there is not a lot of empirical research done to meet the prerequisites and create collaboration. So the focus of Part II is to develop a process to enhance the collaboration for a self-governed equipment pool at AAS. This chapter describes the renewed approach and additional research questions. In 6.1 the gaps and actual problem in motivation are identified. 6.2 elaborates on the objective of Part II. Section 6.3 present the research question for Part II. The research methodology of Part II is described in 6.4. The last section, 6.5, presents the report structure.

6.1 Research Problem Part II

The focus of this part is on process design for equipment pooling. The decision process is still in its initiating phase. Currently no action is taken by any actor involved in the network. In 6.1.1. the Self-Determination Theory is used to explain the lack of motivation and what needs to be enhanced before a pool is possible. Gaming can be used, when following the right design principles, to enhance the motivation in the process, this is shortly described in 6.1.2.

6.1.1 Self-Determination Theory as mean for enhancing collaboration

A self-governing association can only be successful if the actors actually are going to collaborate. However therefor the actors need to be motivated and be active (Schlager, 2002). The missing prerequisites, a common understanding, trust and feeling of autonomy can be derived to personal characteristics, more specifically motivational needs. The status-quo is the result of the missing prerequisites which hinder the process to realize an equipment pool. where Ostrom (2002) presumes active individuals searching for solutions to improve their standards and processes.

The Self-Determination Theory (SDT) (Deci & Ryan, 1985) state that human's behaviour has an inherent active tendency to seek challenges and establish growth since (Ryan & Deci, 2004). When a individual is not self-determined, this is because of a lack in satisfying one's motivational needs. SDT provides a framework to increase the motivational needs. The actors are not motivated and show no active behaviour, Apparently motivational needs are missing to achieve collaboration and meet the prerequisites. According to (Deci & Ryan, 2000) one's psychological needs have to be satisfied before one can become self-determined to collaborate. Self-determination increases when the three needs are enhanced, competence, relatedness and autonomy. Enhancing those aspects enhances the feeling of trust, autonomy and a common understanding about the pool at airside, according to the findings of Part I and (Ostrom, 2002).

Regarding the representatives present and responsible for the processes at AAS' airside, mainly middle management is present. Whenever decision making is required it is always the same representative from each organization who is involved in this process. Therefor the representatives know each other well. So the individuals behaviours is assumed to be the behaviour for the company for this specific self-governed equipment pool, since this representative determines to a large extent the policy of ground handling processes at AAS.

6.1.2 Gaming in the process: creating trust and common understanding for collaboration

To fulfil one's motivational needs a concretized design have to be developed. Since the current communication bodies do not suffice to have a discussion about equipment pooling; an intervention is needed to change the behaviour of the actors. The discipline of gaming can provide herein. There exists a large potential for gaming in combination with the self-determination theory and to take people out of their daily routines. Gaming have been used a lot in policy analysis and in multi-actor systems. So

probably gaming can contribute to achieve collaboration, but in what way and how it can be combined with the motivational theories is unknown. Motivational affordances according to Zhang (2008) are defined as to what extent the new initiative or process is able to fulfil the targets group motivational needs. In other words Zhang (2008) describes an more practical approach to include the self-determination theory in the game to fulfil the target groups motivational needs.

6.2 Objective Part II

The objective of this part is to analyse if the prerequisites of the self-governing equipment pool can be met by enhancing collaboration through gaming, focusing on one's motivational needs.. The societal contribution lays in the fact that it would be very interesting to see whether games add value in the initiating phase of a decision process in non-hierarchical networks. A lot of networks require a certain form of collaboration but this is often hard to realize. In the recommendations this is further analysed.

6.3 Research question Part II

The research problem that stands central during Part II is formulated as follows:

RQ2: ***Can a role-play game enhance collaboration in the self-governing equipment pool?***

To be able to answer the main research question, it is decomposed into three sub questions. These sub questions provide structure to the research and are based on the need to identify the unknowns:

SQ4: In what way can the Self-Determination Theory be used to enhance the motivation to collaborate?

SQ5: How can the Self-Determination Theory and the gaming discipline be combined in the decision process to increase collaboration?

SQ6: How does the role-play game to increase collaboration at airside look like?

SQ7: In what way and to what extent can a role-play contribute to increase collaboration?

6.4 Research Methodology Part II

This is part of the process design, so the process part of the TIP approach is applied, see Figure 22. The findings of the institutional and technological design are used for the game and the decision process. Though the focus is especially on the process and in how and in what form the actors can be activated. For the actual process, principles and parts of Process Management are applied (de Bruijn et al., 2010).

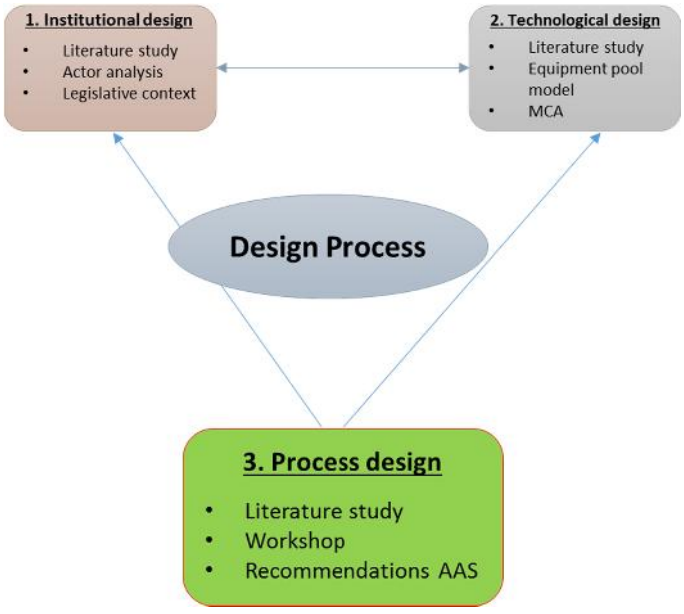


Figure 22: Focus of this part of the report is on the Process Design

6.5 Report structure Part II: Role-play game

In this part the main characteristics of the self-determination theory and gaming are described. This is brought in practice during the game design. The game and workshop design have resulted in interesting outcomes. The conclusions and recommendations for using a role-play are handled at last, see Figure 23.

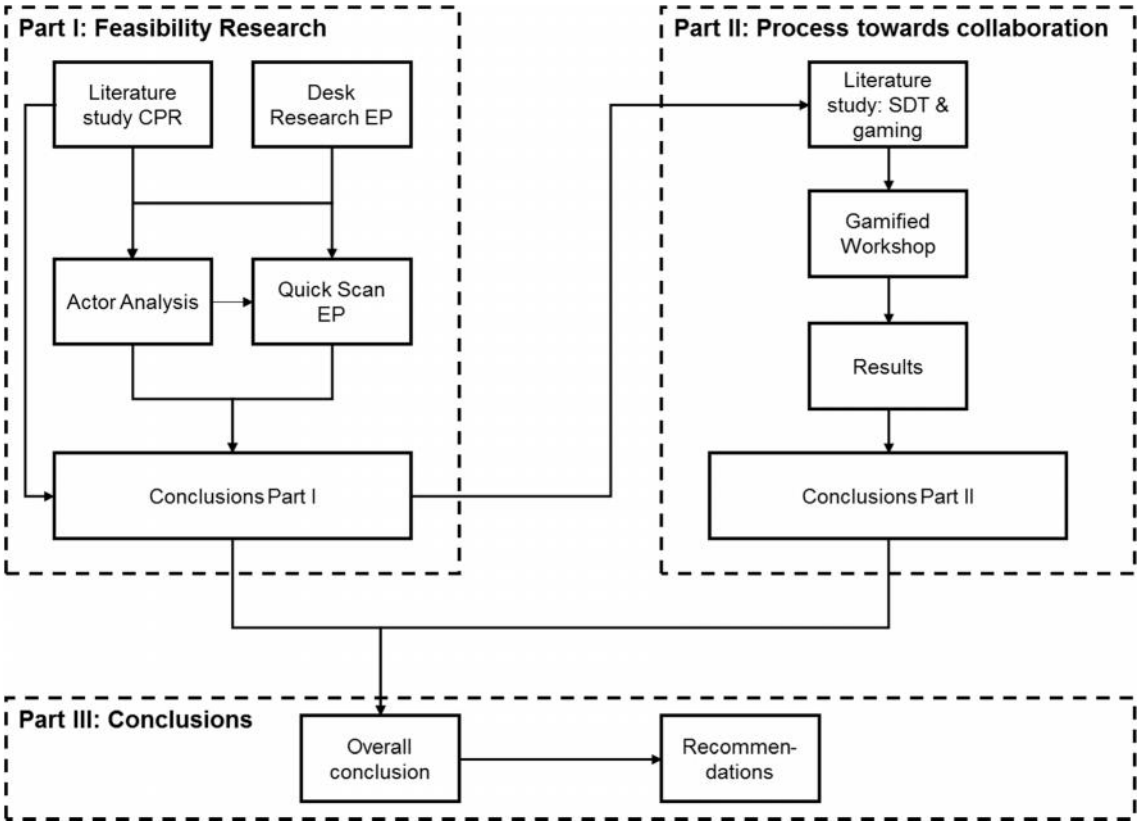


Figure 23: Report Structure

7. Literature study: Self-determination theory & gaming in non-hierarchical networks

The equipment pool can only become successful when good and intense collaboration is established and the actors are self-determined to realize a pool. The actors need to be motivated to establish good collaboration and a self-governing association. Like aforementioned the Self-Determination Theory is used. However first more knowledge about this theory and how it can be brought into practice is needed. This part of motivational psychology is discussed in 7.1. Then the step towards implementing the SDT theory including motivational affordances in an gaming format is made in 7.2. The gaming discipline shows potential, but how this can contribute to the motivation of the players, where possible gaps are and which game can contribute to fill the gap between motivation and the necessity to collaborate is also elaborated on in 7.2. The development of a process design is for a large part dependent and needs to be adjusted to the actor network. The network is further identified based upon literature and the gained information of Part I in section 7.3. Section 7.4 presents the most important conclusions.

7.1 Theory of Self-determination

In this section the Self-Determination Theory is described (Deci & Ryan, 1985). The Self-Determination Theory (SDT) is an approach to explain the behaviour of humans by means of motivation and how humans are motivated, their needs. The more self-motivated and self-determined the more optimal growth and positive outcomes can be achieved (Deci & Ryan, 2000). (Deci & Ryan, 1985) make an important distinction between the types of motivation; extrinsic and intrinsic motivation which. First this is discussed, then the three motivational needs are described. How these needs can be fulfilled and satisfied in practice is described based upon motivational affordances (Zhang, 2008).

7.1.1 Intrinsic & extrinsic motivation

(Deci & Ryan, 1985) make a distinction between the types of motivation one has. Actually three types of motivation can be derived; amotivation, extrinsic and intrinsic motivation (Deci & Ryan, 2000). Intrinsic motivation can be defined as doing things which are inherently interesting or give satisfaction (Ryan & Deci, 2000a). Extrinsic motivation plays a role when people are not internally motivated to do things, but can be motivated through external input, for instance rewards and punishments. Amotivation is also known as unwillingness, or have totally no intention to act. The four forms of extrinsic motivation differ from external regulation, which is about the external rewards or punishments regarding the individuals motivation, to integration, where external commands or expectations completely comply to the self (Ryan & Deci, 2000a). Amotivation stands in agreement with total non-self-determination, where intrinsic motivation stands equal to complete self-determination, see also **Fout! Verwijzingsbron niet gevonden.**. The more intrinsically motivated the more self-determined an individual is to complete the task or achieve positive outcomes (Deci & Ryan, 2000).

It is not often clear whether the people are intrinsically or extrinsically motivated. Focusing on the wrong kind of motivation can have undesired effects. Focus on extrinsic motivation while the participants are already intrinsically motivated can risk the intrinsic motivation of the participant, vice versa focusing on intrinsic motivation while the participants need to be extrinsically motivated will probably result in no change at all (Deci, Ryan, & Koestner, 1999). However combining them to the right extent can lead to the desired outcomes (Amabile, 1993).

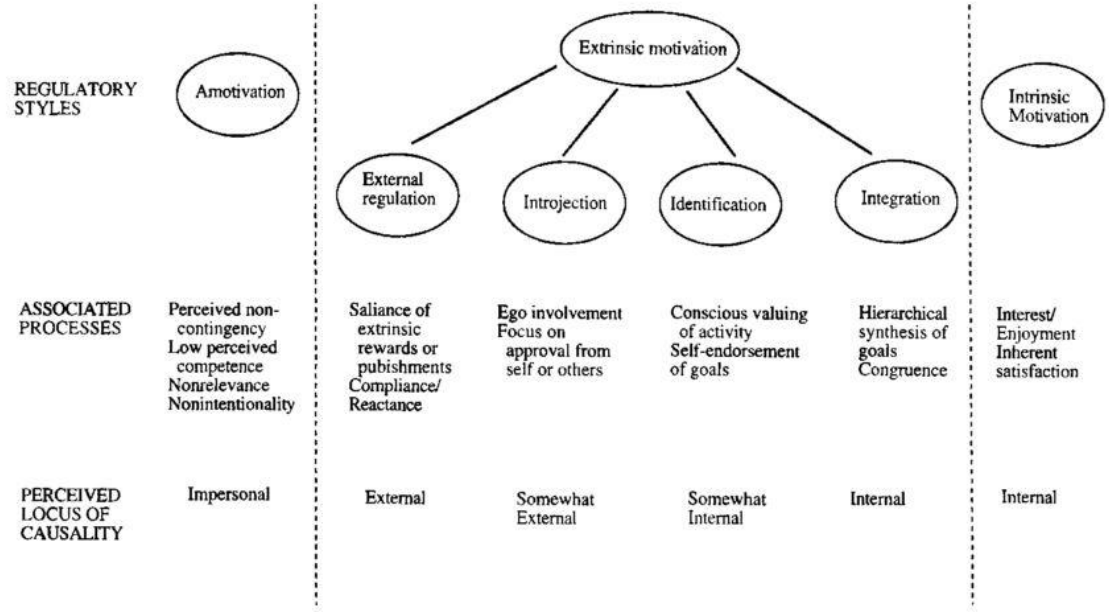


Figure 24: Taxonomy of human motivation (Ryan & Deci, 2000a)

7.1.2 Competence, autonomy & relatedness

An intrinsically motivated person is determined to fulfil one's needs. Extrinsically motivated persons need to be enhanced in their motivational needs. The needs which are essential for a person to become self-determined are competence, autonomy and relatedness. The more the person is self-determined, the more intrinsically motivated this person is (Deci & Ryan, 1985). *Competence* is the ability to do something successfully or efficiently. *Autonomy* is about deciding and doing it yourself. *Relatedness* is the need to have close relationships. When all the three needs are fulfilled tot their maximum, people have a feeling of high self-determination or intrinsic motivation (Ryan & Deci, 2000b). This is the highest level of motivation, since people are satisfied doing things without the need of external incentives .

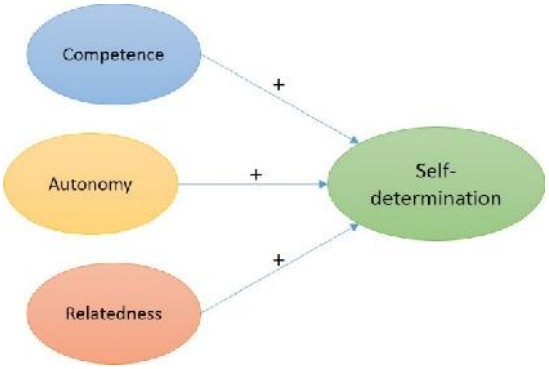


Figure 25: The relations between competence, autonomy, relatedness and self-determination. How higher the degree of one of the three needs, how higher the perceived self-determination, based upon (Deci & Ryan, 1985)

Not only competence, autonomy and relatedness of the individual itself are important for self-determination. Also what is to expected from the sociotechnical context plays a role in the motivation of a human being (Ryan & Deci, 2000b). Real intrinsic motivated individuals are not that common in business, however enhancing the satisfaction of the three needs in a positive way results in a higher self-determination. This is especially important for cases where one wants to motivate the others to create commitment or engenders effort (Ryan & Deci, 2000b). The SDT approach is a really theoretical approach. (Zhang, 2008) provides design principles which can be used to support one's motivational needs.

7.1.3 Motivational affordances: linking SDT & practice

As aforementioned, see **Fout! Verwijzingsbron niet gevonden.**, (Zhang, 2008) describes motivational affordances. Motivational affordances are a relatively new concept in science and psychology. This concept uses the description of behaviour and the causes of behaviour by (Deci & Ryan, 1985). An affordance (Gibson, 1977) contains all the action possibilities the actor can take, dependent on the capabilities. So to motivate the participants the actions have to fit this to their competences and capabilities. Motivational affordances have to do with how one's motivational needs can be satisfied. (Zhang, 2008) describes five motivational needs. Three of them are corresponding with the needs of (Deci & Ryan, 1985); *autonomy, competence* and *relatedness.* Six design principles comply with the three motivational needs. These design principles can ensure that the chosen form to convince the actors increase the satisfaction of one's motivational needs, see **Fout! Verwijzingsbron niet gevonden.**.

Motivational need	Design Principle
Autonomy	Principle 1: Support autonomy Principle 2: Promote creation and representation of self-identity
Competence	Principle 3: Design for optimal challenge Principle 4: Provide timely and positive feedback
Relatedness	Principle 5: Facilitate human-human interaction Principle 6: Represent human social bond

Table 21: Adapted overview of the design principles for the motivational needs (Zhang, 2008)

GAMIFICATION USING MOTIVATIONAL AFFORDANCES

The field of gamification uses the design principles for motivational affordances to enhance motivation (Deterding, 2011). Gamification is about enhancing extrinsic or intrinsic motivation and change behaviour in a socio-technological system with help of game elements (Deterding, 2012). A lot of gamified applications have been used in practice (Hamari, Koivisto, & Sarsa, 2014). However in this case gamification is not suitable. Gamification intervenes and influences daily operations. In this aspect gamification distinguishes itself from serious games, where participants are taken out of their daily operations, play the serious game and then return back to their daily operations. However the participants of this research need to be removed from their daily routines. Therefor the solution is gaming.

7.2 Games to enhance collaboration

The gaming discipline, including video games have researched and invested a lot in the answer for the question how to attract participants and keep them interested in games. Since motivation is therefore a really important aspects, influences on motivation by adding factors like violence have been investigated a lot (Przybylski, Deci, Rigby, & Ryan, 2014)(Przybylski, Rigby, & Ryan, 2010) (Ryan, Rigby, & Przybylski, 2006). However how motivation is enhanced by using gaming concepts in real life situations has not been investigated a lot, off course violence is not a desired motivator in real life situations. Since for a lot of issues and tasks motivation is key to success, is it very valuable to analyse the motivation of the actors involved in complex decisions.

The academic world in combination with the industry has seen that serious games add value to several types of problems. Simulation and gaming have proven to help in increasing motivation of involved parties which are involved in the simulation or gaming process. However there is not much literature about increasing motivation of participants in complex decisions, where several actors are involved.

7.2.1 Why do games work?

The effect of games is a heavily discussed subject. It is very hard to prove that it was the game itself who worked. Psychology only focusses more and more on the reason why (video)games work and how people can be attracted and motivated to play the game (Przybylski et al., 2010). A lot has been written by gaming professionals in (de Caluwe, Hofstede, & Peters, 2008). Especially what policy makers learn from games is often hard to pinpoint (Duke, 1998). But games have the unique power to capture as technical as institutional part into account (Mayer, 2009). Though the focus is on mainly creating motivation and commitment in the game, (Mayer, 2008) describes this as immersion and emersion. Emersion is the concept that it depends on the players action what the outcome of the game will be

instead of deduction from the rules of the game. Immersion is about how the games is made engaging sufficiently for its players. But this focuses on the way how one's motivational needs are satisfied by playing the game. The focus of this research is on achieving a certain motivation which result in action outside the game, back in the non-hierarchical network. The gamification discipline uses game elements to enhance motivation and a certain desired behaviour. So using elements of the gamification discipline will help in developing a game in which the extrinsic motivation and or intrinsic motivation for collaboration outside the game increases.

7.2.2 The choice for gaming: a role-play

Part I showed that there is a lack of trust between the involved parties, no common acknowledgement about the necessity of collaboration and every actor is concerned about the possible loss of autonomy when it comes to equipment pooling at AAS. Gaming removes people for their daily routines and can ease the pressure of political relationships (J. L. a Geurts, Duke, & Vermeulen, 2007). A gaming concept which can deal with the problems is the concept of a role-play in a fictive world. Like in almost every serious game a realistic fictive world is created. Role-play is appropriate to use when people are stuck into the process and make no progress in decision making or learning processes. As described by (de Laat & Geurts, 2008), when a role, interaction or relation changes, this will create dynamics in the other aspects. So the role is about to change which results in other relations and interactions between the participants. Especially, role-play coerce the participants to leave their comfort zone. The expectation is that this will result in a more open and useful discussion and helps the actors to come further in the decision analysis (de Laat & Geurts, 2008). Also that the actor will learn about the benefits and concerns of other parties. Role-play have been applied to change policies and in some way to enhance motivational aspects like autonomy (Gagné & Deci, 2005). Besides the informal setting must contribute to the overall commitment and conviction that collaboration pays off.

GAME DESIGN FRAMEWORK

A game design is needed during this process. Therefor the steps of the management approach (Peters & van de Westelaken, 2008) is taken into account with in addition (Wenzler, 2008) to help to categorize the upcoming game. The framework of (Wenzler, 2008) provide structure in the development of games. Identifies the context, players, process and environment. For each component, dimensions and their ranges are defined. The framework is useful as inspiration for the design phase, to get insights from other disciplines to develop a gamified socio-technical system. The design framework of Wenzler mainly focuses on the game components, which is considered as only the first phase in another serious gaming framework of (Peters & van de Westelaken, 2014). The framework of (Peters & van de Westelaken, 2014) provides more useful guidelines for the entire design process, specified in the four phases of design specifications, system analysis, game design and game construction.

SUCCESS OF THE GAME: CREATE A FLOW

For gaming to be successful it is also necessary to create a flow. A flow, according to (Csikszentmihalyi, 2014), is focused on intrinsic motivation (Deci & Ryan, 2000). It is the task to reach this, but it is an fragile equilibrium. There needs to be a balance between skills and challenges. However asking too much from a participants on skill and challenge level results in a status of anxiety and fear. Asking too little results in boredom. Searching the right balance is key, however due to the fragility this is the most difficult and complex task to achieve. Games or other processes with game design elements have to be adjusted continuously, so that involved persons stays in the right area.

The framework of Peters et al. (2014) provides more useful guidelines for the entire design process, specified in the four phases of design specifications, system analysis, game design and game construction.

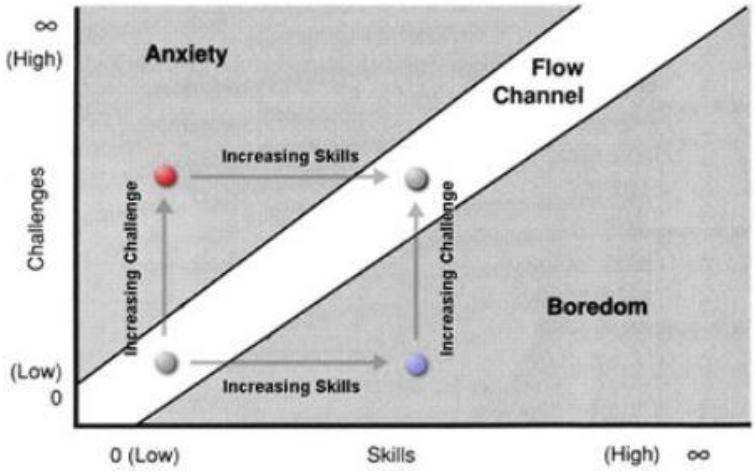


Figure 26: the (un)balance between challenges and skills can result in a flow (Csikszentmihalyi, 2014)

7.3 Non-hierarchical networks

This section discusses the non-hierarchical network of equipment pooling. Since one party cannot make a decision on its own, collaboration is needed. The self-governing form The decision process in a network differs from decision making in a hierarchical organization, this is described in 7.4.1. The approach of the decision process is to a large extent based on (de Bruijn et al., 2010). Here is described how a process management style can work in making decisions in complex decision making processes with a lot of actors.

7.3.1 Decision process in non-hierarchical networks

First of all a non-hierarchical network needs to be further identified, see also **Fout! Verwijzingsbron niet gevonden.**. The complexity at airside makes it hard to integrate new initiatives into the daily processes of the actors. Every process is aligned to other processes, for instance the passenger processes and other airline processes. Changes in the process influence other processes. This system is known for a complex situation with a lot of actors and mutual interdependencies. The established relationships exists for a long time. The involved actor know each other well. Thereby there is not one dominant party. The airport authority is the facilitating company. AAS provides the infrastructure at airside and define rules for the airport and have to control that the rules are being followed. The ground handlers differ in size and there is a dominant airline. However everyone depends on each other and there is not one leading party, or one party with the power to implement large initiatives on its own. So this type of non-hierarchical networks are characterized by a lot of involved actors, long established relationships, knowing every actor, large interdependencies and where a dominant actor is missing. Therefor general consensus is needed. The decision process for new initiatives look different than with normal projects. Normally a strict project approach can be used. However managing decision in networks is different (de Bruijn & ten Heuvelhof, 2008). Like stated in previous sections, every actor has its own rationality and will act based upon its own rationality. A project design approach will therefore be not appropriate. To reach general consensus process management is needed (de Bruijn et al., 2010)

Characteristics non-hierarchical network equipment pooling	
1)	Long established relationships
2)	Lot of interdependencies
3)	No dominant player
4)	General consensus for every new initiative
5)	A large facilitating company in infrastructure and rules
6)	Everyone knows each other

Table 22: Overview characteristics non-hierarchical network

7.3.2 Focus on Process Management

(de Bruijn et al., 2010) describes that a process can only be successful if the core values, interests and concerns of the involved players are known. Thereby process management requires four core elements: *openness, protection of the core values, progress* and *substance.*

Thereby (de Bruijn et al., 2010) describe sixteen design principles. These principles have to be taken into account in the workshop. The principles are used as framework for the design of the workshop. One of the essential parts is that the outcome of the workshop and role-play is unknown. Process management anticipate to this and requires flexibility. Occurring problems about equipment pooling and/or problems with participation in the process will be dealt with. A complete design for the decision about equipment pooling will not be made, since the focus is on motivating the actors to start the decision process and acknowledge the necessity of collaboration.

Besides knowing the perspectives and intentions of the other actors helps in improving transparency during the decision process. Especially in a network which has a high possibility in transforming into a tragedy of the commons network, transparency is key.

7.4 Conclusions on combining Self-determination theory & games

Concluding, the self-determination theory provides a proper approach towards enhancing the motivational needs important to realize collaboration. Since the actor network itself takes no action and is currently in a status quo, the actor network itself is amotivated. In addition, the actors do not take action by themselves, the self-determination for collaboration is too less. The actors are too less motivated to be activated. The extrinsic and intrinsic motivation needs to be increased to achieve collaboration in the network. By focusing on the motivational needs; competence, autonomy, relatedness this can be achieved. The field of gaming, especially a role-play, provides the solution to enhance the motivation within a short time. Role-play can be used to as way out for the status quo and creates a new environment where other relationships can be established than during the daily routines. A role-play often requires general consensus and involves a lot of interdependencies, recognizable in non-hierarchical network. Using a process management approach provides guidelines for the workshop.

Besides, the self-determination theory states that every individual has its own level of motivation. Therefor it can be said that everyone needs a different approach to enhance the self-determination. However due to the similarities between the actors and the status-quo in the non-hierarchical network the same approach is used. This will be taken into account during the workshop and role-play.

A right translation between enhancing the self-determination and extrinsic or intrinsic motivation and motivational affordances have to be found. The needs of the participants, *competence, autonomy* and *relatedness* have to be fulfilled by enhancing the intrinsic motivation to a right level, where their satisfaction is balanced (Vallerand, Pelletier, & Koestner, 2008).

8.Gamified Workshop

As introduced earlier, the intervention takes place in a workshop form. The workshop takes the actors out of their daily routines and during the workshop the equipment pool can be discussed more informally and thoroughly. Gaming is a mean to enhance the motivation of the actors to collaborate in a self-governing pool at AAS. In this chapter the workshop design and role-play is presented to increase collaboration at airside. First the game design is discussed in 8.1. The game design is used to measure several types of motivation. Section 8.2 discusses how three types of motivation and its aspects are measured and validated during the workshop. The workshop design is presented in 8.3. In the last section, 8.4, a short description of the workshop day is given.

8.1 Game design

Since a role-play is chosen as game concept and the framework for the design is also chosen, the content have to be determined. The challenges lay in the fact that there are three aspects which need to be included in the game. Firstly, according to the Self-Determination Theory and the findings in part I, competence, autonomy and relatedness have to be increased to enhance the collaboration at airside. The game focusses on three types of motivation since the goal is to achieve a positive attitude change of the actors towards equipment pooling by a role-play. Secondly two distinctive experimental groups have to be made so the influence of the role-play can be measured. Third, role play case is described and fourth the control group case is described. Collaboration is essential for the success of the eventual self-governing pool, so the focus on collaboration is described last.

8.1.1 Three types of motivations to be measured

The purpose of the workshop is to see whether gaming can help in increase motivation and collaboration in respect of equipment pooling at AAS. Consequently during the workshop three types of motivation are measured. First, the motivation to attend the workshop, second the motivation during the workshop and third the motivation to collaborate and implement equipment pooling at AAS.

MOTIVATION 1: MOTIVATION TYPE TO ATTEND THE WORKSHOP

So the question that stands central is; were the participants obliged by others or do they take voluntarily part in the workshop. In other words are they intrinsically motivated to take part in the workshop or are there external incentives which let them make the move to participate in the workshop. The participants can attend the workshop for several reasons, when focused on motivation there can be four types of motives, in which the participants can motivate their presence (Deci, Vallerand, Pelletier, & Ryan, 1991). The four types are shortly presented in Table 23. The most positive outcomes of behaviour or the reason of presence at the workshop are explained by using intrinsic motivation.

Type of motivation	Short description
Intrinsic motivation	Highest level of self-determination, pleasure and satisfaction is derived from performing the workshop itself
Identified regulation	Self-chosen to attend the workshop. However this is done as a means to an end
External regulation	Being present, as a result of external negative consequences or rewards when not attending
Amotivation	Does not know the reason for being present, no sense of purpose and no expectations regarding the workshop.

Table 23: the four types of motivation which will be measured

MOTIVATION 2: MOTIVATION DURING THE WORKSHOP

The motivation of the participants during the workshop is important to measure because when the participants would not be motivated during the workshop, the workshop itself can be the reason for a de- or increase in the attitude towards equipment pooling. For the measurement of the motivation during the workshop the scale of Lange (2010) is used. The motivation during the workshop is a good indication is the participants are in a flow (Csikszentmihalyi, 2014).

MOTIVATION 3: MOTIVATION TO COLLABORATE AND TOWARDS IMPLEMENTING EQUIPMENT POOLING

The motivation and attitude of the participants towards equipment pooling and collaboration is the key of this research. The big gap to be filled in, is if the motivation increases and the attitude changes positively towards collaboration and equipment pooling by attending the workshop with or the workshop without a role-play. Thereby to see if the role-play has the largest positive influence on establishing trust and the necessity to collaborate.

8.1.2 Control & Testing group

The purpose of the workshop is to see whether gaming can help in increase motivation and collaboration in respect of equipment pooling at AAS. To see whether the role-play is of value, a test group and control group is needed. Herein one thing, the role-play, can differ from the rest of the workshop.

Therefor the two groups, one control group and one test group, are formed. The two groups have a workshop in two separate parallel sessions. During this part of the workshop the groups will stay in two different rooms. It is of utmost importance to separate them. Between the two groups no interaction may take place and interference will be precluded. Otherwise there is a possibility of biased groups which can influence each other. So the distinction between control and testing group is assured by separating them in different rooms and different groups. Regarding the representatives group, mainly middle management is present. The group is separated into two groups with a correct mix in of companies present. Consequently this means that all representatives of KLM will not be placed with each other.

8.1.3 Role-play case

This section describes the storyline and the roles of the role-play game, for an elaboration see Appendix K. To enlarge the probability of success for collaboration and a self-governing association at AAS, the participants participate in a case, similar to the current ground handling situation at AAS. This is done because the participants will be able to use their ground handling experience, can trace the problems and interests back to AAS. Thereby creating a comfortable environment.

STORYLINE

The participants are taken to the fictive world of Flydon Airport. Flydon Airport is a large airport in the country Great Axdon. This airport handles over 65 million passengers a year. At Flydon airport, a new area is exploited; Terminal 4. Terminal 4 will be developed in the north-west of the airport area. The terminal is an expansion of the current VOPs and other operations at the airport. The airport is searching for solutions to reduce the amount of equipment and movements at airside and increase quality. The current situation puts a continuously pressure on safety, space and costs. A work group of all involved parties is established to arrange the ground handling processes at Terminal 4 and to discuss the possibilities to improve the processes. Collaboration at airside is essential for a good outcome.

ROLE ALLOCATION

Since the roles are derived from existing parties and the participants will be able to see the similarities between the real world and fictive world, the role given to the participants will be different than their current jobs. So for instance a representative of KLM Aircraft Services will not play the role of Tulip Airways Aircraft Services, since this is to comparable with KLM AS, but he will play the role of another ground handler, airport authority or ground equipment service company. The developed roles are shown below, see Table 24. For a more detailed description see Appendix K.

Role	Short description
Tulip Airways craft Services	Subsidiary of the home carrier at Flydon Airport, Tulip Airways. Handles mainly the flights of Tulip Airways and its partners.
Tulip AGES	An Ltd. but linked to the Tulip Airways holding. Carries out the maintenance of almost all the equipment of Tulip Airways Aircraft Services.

MLE	A private ground support equipment company at Flydon airport, responsible for maintenance and leasing of equipment.
International Aviation Handling	IAH is a private ground handler at Flydon Airport. Handles the flights of large low-cost carriers and some network and leisure carriers.
Beta Ground Handling	Beta ground Handling is the other large ground handler at Flydon Airport. Flydon Airport is an important airport for them and they handle mainly large leisure carriers and some network carriers.
FLYDON AIRPORT **- Airside Management**	Flydon Airport – Airside Management is a division of the Flydon Airport Group. AM wants to create a safe, efficient and organized airside.
FLYDON AIRPORT **- Authority & Enforcement**	Flydon Airport – Authority & Enforcement is a division of the Flydon Airport Group. It is responsible for the enforcement of the rules at airside.

Table 24: the roles during the Flydon case

8.1.4 Control group case

The control group cannot differ too much when compared with the role-play group. Therefor this section describes the control group design briefly, for a more detailed description see Appendix K.

CASE TESTING GROUP: A-PIER

Based upon the findings of the actor analysis, it comes forward that the A-pier is a real window of opportunity to solve some bottle necks at the airport, see also Appendix D. So the case handles the A-pier. The participants of the testing group will not change roles and can act from their own perspective.

SHORT STORYLINE

Currently during daily operations safety and availability are often at stake. As is known, AAS is busy developing the new A-pier in the south west. This pier will contain 10 VOPs, for as well NaBo & WiBo aircrafts. The A-pier is relatively far away from the rest of the operations, especially from the northern piers, like the F, G and H-pier. A mix of ground handlers is expected to handle flights at the A-pier. So the handlers will have to use the same VOPs. This new area will be open to innovative ideas and ideas which deal with current bottle necks and problems at airside. It is clear that the current daily operations are not desired and sufficient to deal with the increasing capacity and that it will be hard to integrate the new pier in existing operations. Especially because a lot of equipment is not made for transportation but for doing tasks at location, so that equipment is not transported easily from one pier to another. So a new allocation of needs is necessary to be able to deal with the challenges. Also the equipment of the ground handling operations have to be reconsidered. Equipment pooling gives an opportunity to assure high quality standards, less equipment and less congestion on the airside roads. Together the sector needs to come up with a plan to integrate an efficient ground handling process.

8.1.5 Collaboration leading the workshop

Collaboration is an important aspect of the workshop. Together the participants have to come up with an solution accepted by every party about the implementation of equipment pooling. This will provide insights in the situation at AAS and collaboration is essential for a project in the ground handling sector to become successful. Also this will ease the next steps in making decisions about equipment pooling at AAS. In addition enhancing collaboration also contributes to self-determination. Collaboration is mainly a part of relatedness and when relatedness increases the self-determination increases. However when the autonomy and competence aspects increases as well, self-determination increases to a larger extent. During the workshop it is tested if the role-play has a more positive change in self-determination when it comes to collaboration and equipment pooling than a traditional workshop.

8.2 Testing & Validation of the motivation types

In order to be able to draw conclusions about the change in attitude and motivation of the participants several measurements are taken. Since the conclusions cannot be based on observation, because observations are often biased, also interviews are conducted and questionnaires are filled in. First a starting point has to be established. By means of a questionnaire before the workshop this starting point is realised. In order to assure that the participants are not biased by the workshop already. The second questionnaire is filled in after the workshop so a comparison between the change in attitude and motivation can be made. Section 8.2.1 to 8.2.4 describes what motivations are measured. Section 8.2.5 to 8.2.9 describes how these motivations are measured before, during and after the workshop an what statistical program is used. For the actual questionnaires, see Appendix L. The measure moments and measurement forms are presented in **Fout! Verwijzingsbron niet gevonden.**.

8.2.1 Enjoyability of games

In the first part, see Appendix L, the enjoyability to play games or having game elements during work is measured. Enjoyability is defined as: *the extent to which people receive satisfaction from playing games*. Since the role-play workshop is designed as a game and as Csikszentmihalyi (2014) states having fun during games is an important indicator of the intrinsic motivation and the possible success of the workshop. Determining the enjoyability of the participants is therefore important. An overall aversion towards workshops and games influences the results towards the acceptation of equipment pooling as such. (For example if everybody dislike to play games, it would be very difficult to see whether the role-play has a positive or negative effect in changing attitudes of the participants)

8.2.2 Motivation 1: Intrinsically or extrinsically motivated to attend the workshop

This questionnaire is based upon the validated scale for measuring motivation of (Guay, Vallerand, & Blanchard, 2000), see Appendix I. As aforementioned, four kinds of motivation were measured; intrinsic motivation, identified regulation, external regulation and amotivation. The four types of motivation can be measured, using the validated Situational Motivation Scale of (Guay, Vallerand, & Blanchard, 2000). It is measured to what extent the participants were self-determined beforehand, which can be of influence on how successful the workshop is. The so called situational motivation, which is the motivation of individuals during engaging an activity. In other words are they intrinsically motivated to take part in the workshop or are there external incentives which let them make the move to participate in the workshop. This situational motivation (Vallerand, 1997) needs to be measured and this is done by means of part two of the first questionnaire. When the two groups have the same distribution in scores about the four types of motivation, then it is appropriate to look at the results of the measurements in attitude towards equipment pooling.

8.2.3 Motivation 2: Motivation during the workshop

For the measurement of the motivation during the workshop the participants have to fill in the scale which shows how motivated the participants are during the workshop. By explaining the method and what they can expect beforehand, prevents the participants of being surprised and helps the progress of the workshop. It also avoids questions when they receive the scale. This form, see **Fout! Verwijzingsbron niet gevonden.**, was filled in by the participants. The status of the participants is ranked from 1 to 5, where the ‘absent-minded, bored, no interaction with environment’ status is given a 1 and ‘the passionate and completely engaged in the process’ status with a 5. Having all the scores of the participants make it possible to analyse the motivation and compare the motivation between the groups.

HAWTHORNE EFFECT

It is important to decrease the Hawthorne effect. The Hawthorne effect is the phenomenon that participants change their behaviour in response of becoming conscious that they are observed (Roethlisberger & Dickson, 1964). This effect can be positive as well as negative. However this phenomenon becomes a problem when the influence is significant to such extent that it becomes impossible to state whether the Hawthorne effect or the measures are responsible for a decrease or increase in motivation for the workshop.

Concluding the interventions have to be as less disturbing as possible. Using this format the participants will be less disturbed during the workshop.

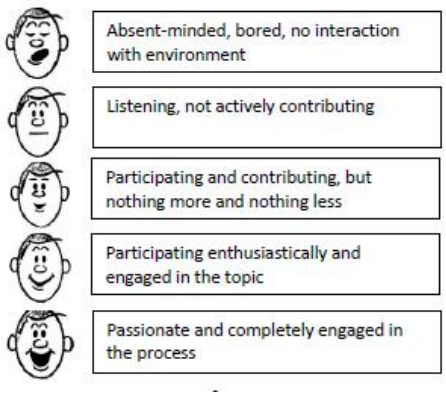


Figure 27: Motivation form used during workshop (Lange, 2010)

8.2.4 Motivation 3: Attitude change towards equipment pooling & collaboration

Equipment pooling will influence the processes at airside a lot. This can be covered by the following indicators, see Table 25. This list is also based upon the actor analysis and traditional indicators of business processes. The final decision to choose for equipment pooling will be a trade-off. This trade-off is different for every actor. However when the benefits outweigh the costs, the possibility for the realization of equipment pooling at AAS increases. The workshop intention is to change the attitude of equipment pooling positively and to see on which indicators the role-play is of more or less influence than the case with the A-pier. A list of eleven questions is formed, also ranked according the five points Likert Scale, see Appendix L. This list is filled in two times, one before the workshop to create a starting point on how the different groups are regarding the aspects of equipment pooling and equipment pooling itself. The other measure moment is after the workshop. An equivalent list of questions, see Appendix L, is formulated to test whether attitude changes occurred. The results can be analysed quantitatively and form the basis for the interviews afterwards.

Indicator	
1) Financial attractiveness	2) Space issue at AAS
3) Organisational	4) Safety at airside
5) Common understanding (basis for collaboration)	6) Trust
7) Availability of equipment	8) Feasibility (realisation of equipment pooling)

Table 25: List of indicators

8.2.5 Qualitative analysis with support of quantitative analyses

To be able to tests the motivation types during the workshops measurements before, during and after the workshop analyses have to be executed. Since the number of participants in the workshop is relatively small when comparing to similar researches and to theoretical minimums, a mainly qualitative analysis will be done. The number of participants is, regarding the limited targeted group, really high. Qualitative analysis is a good way to describe the reasons of behaviour and the influences of other factors. The interviews done beforehand, measurements during the workshop and the questionnaire after the workshop provide enough valuable moments for qualitative analysis. However a qualitative analysis can also contribute to the general understanding about how gaming increases motivation. Therefore interviews afterwards have been conducted. The interviews give substance and richness to the motivation to collaborate of the participants.

8.2.6 Interviews

Interviews with the participants give more substantiation about the change in attitudes and if the workshop and role-play were of any added value. These interviews consisted of several questions about how the role-play can be seen as added value and be put in perspective. Also the trust issue in other actors is asked for.

8.2.7 Questionnaires

Two questionnaires are filled in by the participants. One before the workshop, one after the workshop. The first questionnaire consists of three parts. The first questionnaire has two extra measurements in comparison to the second questionnaire afterwards. The first part collects information about the preferences of the participants. This was done to form a baseline for the further analysis. Thereby this provides a form of validation and will exclude external factors during the analysis of the results.

The second part is about the reason why the participants actually take part in the workshop. So the question that stands central during this part of the questionnaire are they obliged by others or take voluntarily part in the workshop. In other words are they intrinsically motivated to take part in the workshop or are there external incentives which let them make the move to participate in the workshop.

The third part is about their opinion, attitude of equipment pooling and if they are motivated to implement equipment pooling and or are willing to collaborate at airside.

The second questionnaire, filled in by the participants after the workshop, comprises the attitude towards equipment pooling and motivation part of the first questionnaire. So equivalent to the third part of the first questionnaire. In this way it is possible to analyse the influence of the workshop on the attitude of the participants towards equipment pooling and collaboration.

LIKERT SCALE

To interpret the results of the questionnaires, a Likert scale is used. The Likert scale is a proven concept used a lot in researches (Likert, 1932). The participants can choose between five options, ranked from 1 (totally disagree) to 5 (totally agree). The Likert scale is using an ordinal scale. So the scores can be tested using the Wilcoxon tests. A mainly qualitative but also partially quantitative analysis can be done using the Likert scale.

8.2.8 Wilcoxon tests

Since the results of the questionnaires are compared quantitatively, statistical tests are chosen. Due to the low numbers and a normal distribution cannot be presumed and proven. So the t-tests, in which normal distributions regarding the tested populations are supposed are not suitable to use. Consequently only non-parametric statistical tests can be used. The Wilcoxon tests provide a strong non-parametric statistical analysis method of the different groups. Thereby the Wilcoxon tests can be used for variables on the ordinal scale (Wilcoxon, 1946). Two types of Wilcoxon tests are used during this research, see also Table 26.

8.2.8.1 Wilcoxon signed rank test

There are two different moments in which the groups are compared. The change of attitude and motivation is also measured for the groups separately, to see if the workshop resulted in significant changes. To measure this, the groups are compared at two moments, one before the workshop and the other moment after the workshop, based upon the questionnaires. The Wilcoxon signed rank test is suitable for executing the requested (Wilcoxon, 1946). This test can be seen as the equivalent of the paired sample t-test, but for a population which is not normally distributed (McDonald, 2009).

8.2.8.2 Wilcoxon-Mann-Whitney test

The two different groups, the role-play group and the control group, are compared with each other to see whether the role-play causes more changes in attitudes and motivations. The non-parametric statistical test appropriate for this is the Wilcoxon-Mann-Whitney test. This test provides clarity about the differences between groups (Nachar, 2008). This test can be seen as the equivalent of the independent samples t-test.

CORRECTED FOR TIES

The Likert scale make it due to the ordinal scale possible that there will be equal measurements. Since the Mann-Whitney test assumes continuity and therefore that every measurement is unique, an correction for ties also known as equalities has to be executed (Nachar, 2008). This test is also provided by SPSS of the IBM Corporation.

Statistical tests	Purpose	Alternative (normal distribution)
Wilcoxon signed rank test	To compare one group at 2 moments	Paired sample t-test
Wilcoxon-Mann-Whitney test	To compare two groups	Independent samples t-test

Table 26: Overview of the Wilcoxon tests

8.2.9 SPSS: program for Wilcoxon Tests

SPSS is one of the leading statistical analyses programme, which can execute the required statistical tests. Also because of its user friendliness SPSS is chosen as program to execute the Wilcoxon tests.

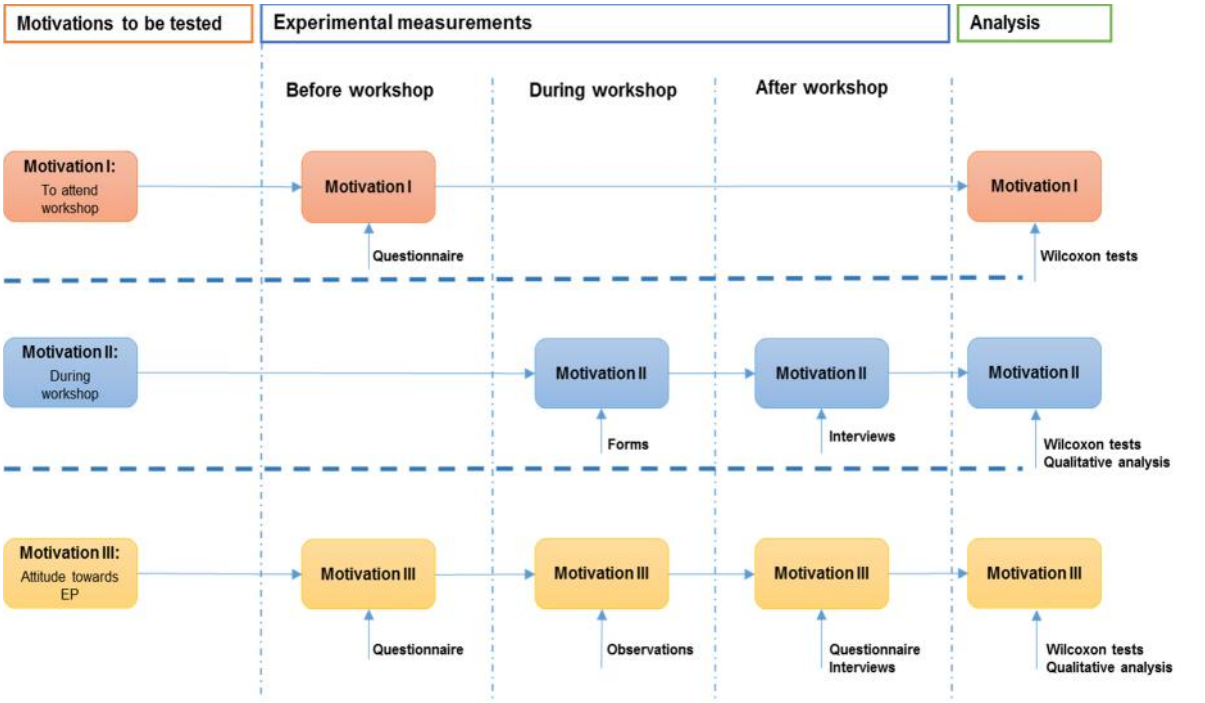


Figure 28: Measurement moments for different types of motivation

8.3 Workshop Design Phase

In this section the actual workshop design is discussed. The iterative approach during the design phase is elaborated on in 8.3.1. Section 8.3.2 shortly elaborates on the eight rounds of the workshop. The embedding of the Self-Determination Theory is discussed in 8.3.3. An elaborated workshop design can be found in Appendix K.

8.3.1 Iterative workshop design phase

The workshop is developed during an iterative process with many feedback loops, with the purpose that the content is covered and to assure that the activities and rounds during the workshop follow each other in the right sequence. To achieve this, as well experts from AAS as other aviation experts have been consulted and they have been looking at the workshop. The goal for the two different organizations, AAS and Delft University of Technology, were embedded in the workshop design. First with AAS the first workshop design was discussed and the goal of AAS for this workshop was formulated. A second revision was done in consultation with the experts of DUT. This process was repeated several times and different employees of the both institutions were asked for their opinion to develop a good workshop. From the research perspective it was important that enough measurements were built in so that what needed to be measured actually was measured. The design was tested according to the two disciplines, the gaming discipline and the actor discipline.

Besides having mainly content wise discussions about the workshop, also a senior managing consultant of IBM, have given by far more than 100 workshops to companies, differing from its CEOs and CFOs to IT specialists and to students, was consulted to develop a comprehensive workshop in which the rounds will follow up logical. Also other students and junior consultants, with gaming experience and/or designing experience, were asked for their opinion and possible improvements about the design.

This iterative process resulted eventually in a well thought workshop design. The workshop comprises eight rounds. During the workshop the participants discusses the problem based upon propositions, creating a list of criteria, developing a scenario based upon a Multi-Criteria Analysis and eventually give a presentation to the other group. For a short overview, see **Fout! Verwijzingsbron niet gevonden.**. The introduction and the last rounds are with the whole group, in which also the real issue of an equipment pool is discussed. However the role-play and normal workshop are done separately. For a more detailed description see Appendix K.

8.3.2 Self-determination embedded in role-play

In this part the three aspects of the self-determination theory are taken into account and to implement the aspects in the role-play design. Thereby based upon the design principles of (Zhang, 2008) the aspects are given substance. When these aspects would not have been present in the workshop it is hard to state whether the goal of the workshop was to enhance the motivation and increase the self-determination of the participants.

AUTONOMY

The role during the role-play gives the participant some guidelines and directions in which the participant have to play the game. However the feeling of autonomy comes when the player is totally free to take part in the discussions. Thereby the multi-criteria analysis (MCA), see Appendix J, provides a lot of opportunities when it comes to autonomy. The player can decide for itself the importance of the criteria according to a ranking system. Thereby the participant can make decisions for his own to think about how the equipment pool eventually is going to look like. The participant, together with the others, have to think about aspects like the director of the pool, the owner of the equipment, which equipment etc. In other words think about the institutional design of the pool. The autonomy in the role-play is expected to be larger, because the players are less bounded to their normal jobs in which the relationships are already settled. As described by (de Laat & Geurts, 2008), when a role, interaction or relation changes, this will create dynamics in the other aspects. So the role is about to change which results in other relations and interactions between the participants.

COMPETENCE

The participants need to get to know each other. Besides the decisions the participants have to make in the MCA challenges them to think about a good equipment pool, since every decision in the MCA affects the criteria. The participants also create a shared understanding about the pool and the potential benefits. Receiving feedback, in the form of the outcome of the MCA and a feedback session during but also after the workshop increases the competence and the skill level of the participants. Thereby when aspects, like for instance assurances and legislation, are not included but coming back to it later, this increases the potential competence increase. The competence can be increased to a larger extent in the role-play, since in a new role a larger potential to reach the new skill level is present.

RELATEDNESS

The participants have to come up together with a scenario, to increase the collaboration between the players. All players are equivalent to each other, so no decrease in autonomy or damaged relationships are to be expected. Coming up together with a scenario which have to be presented to the other group in a later phase of the workshop increases the feeling of relatedness. It is interesting to see whether the role-play increases the perception of belongingness of the players. The relatedness of the individual can be increased since the relationships between the actors already exists and they have secure and safe connections with each other (Deci et al., 1991). Therefore it is easier to step out of their comfort zone. A new role can thereby challenge the group to a larger extent to come up with a very good scenario.

8.3.3 The workshop design

Implemented relatedness, autonomy and competence aspects and the development of the MCAs resulted in a workshop design. Before, during and after the workshop several measurement are done. An overview of the workshop design and its according rounds is given, see **Fout! Verwijzingsbron niet gevonden.**. For an elaborated workshop design, see Appendix K.

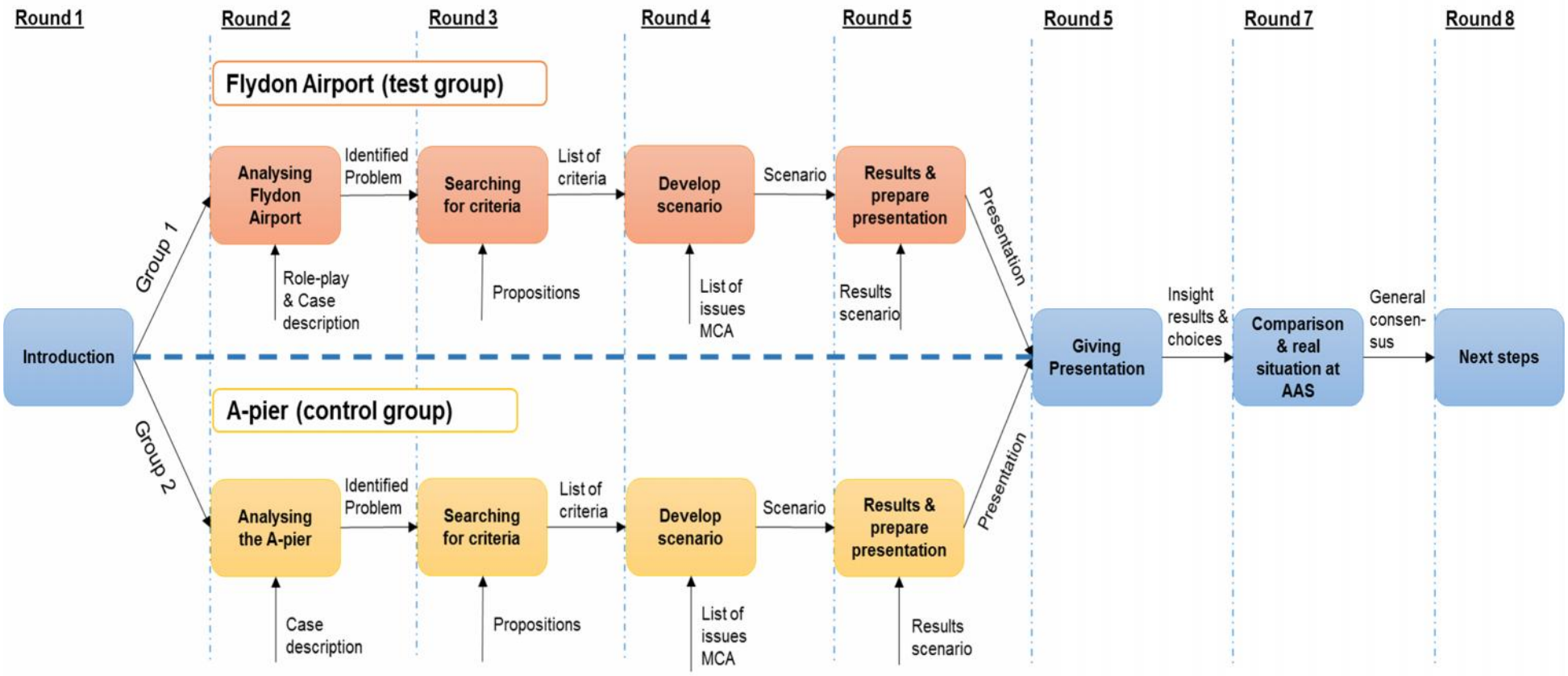


Figure 29: overview of the workshop design & rounds

8.4 Process & workshop execution

On the 2nd of July 2015 the workshop took place, see Figure 29 for an impression. Except for one important actor, every actor attended the workshop with at least one representative, see Appendix K. The workshop itself went well and no remarkable things happened during the workshop.

The questionnaires were filled in beforehand and after the workshop. During a two month period after the workshop, several interviews with the participants were conducted. In the following chapter the results are presented.



Figure 30: impression of the workshop

9. Results & analyses workshop

The workshop has provided interesting results. These results are used to analyse whether the role-play and workshop have brought equipment pooling a step further towards realization. During this chapter the results of the workshop, obtained through the interviews and questionnaires, are analysed. First the results of the role-play group and control group are compared, to test if there are any other group differences. Three research hypotheses could be tested using the results from the workshop. First the motivation of the participants to attend the workshop is discussed and validated in section 9.1. Secondly, in 9.2, the motivation of the participants during the workshop is analysed and validated. Section 9.3 presents the results of the role-play and normal workshop on the motivation of the participants to collaborate and establish an equipment pool. A brief conclusion about the workshop is provided in section 9.4. The results of the role-play and control group are compared in section 9.5, in order to analyse if role-play adds more value in creating trust in the equipment pool. The effect of the role-play on the participants motivation to collaborate in a self-governing pool, is concluded in section 9.6. Section 9.7 gives an overall conclusion on the results and their implications for the hypotheses.

9.1 Extrinsically & intrinsically motivated to attend the workshop

The part of the questionnaire that stood central, concerns the motivations of the participants to actually take part in the workshop, see Appendix L for questionnaire. First of all, the view on workshops and role-play is tested. In conclusion the motivation to attend this workshop is analysed.

ATTITUDE TOWARDS WORKSHOPS & ROLE-PLAY (ENJOY ABILITY)

A factor which can have influenced the differences of attitude outcome between the two groups could be the ability to enjoy playing games. If the groups show significant differences, the outcomes of the workshop could be biased, since one group enjoys playing games and workshops more than the other group. After the execution of a Wilcoxon-Mann-Whitney test, no significant differences, see Table 26, are noticed. The motivation to play games is average and none of the participants are completely unwilling to play games, see Figure 31.

Question	N	Mean	Significance
I love to play games	14	3.36	,629
I love to have a game element during work	14	3.07	,674

Table 27: Results of Wilcoxon-Mann-Whitney test for factor enjoy ability

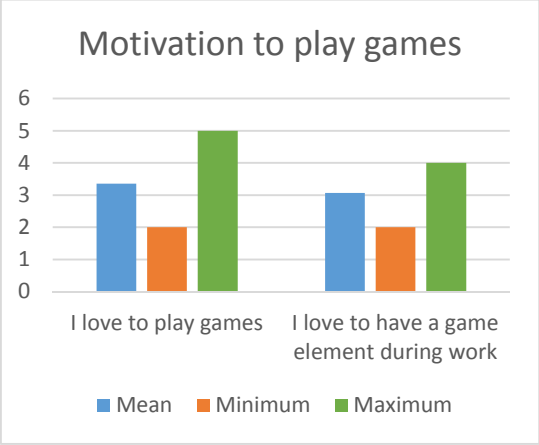


Figure 31: The motivation of the participants to play games or having a game element during work

TYPE OF MOTIVATION TO ATTEND THE WORKSHOP

It is important to test whether the differences between the groups have something to do with the preferences of the groups to participate in workshops. So to validate whether the differences between

the groups are the result of their motivation to participate in the workshop, the results are compared by means of an Wilcoxon-Mann-Whitney test. The scores were applied in accordance with the 1 to 5 Likert Scale. This means that a score close to 5 can be compared to a high degree of the concerned motivation type. **The hypothesis: there is no difference in motivation to attend the workshop.**

Most participants were present without any doubt. However beforehand there were a few participants, which were a bit hesitant and ignorant about the workshop. This was mainly because they were employees of ground handling sector parties which were interviewed but not those specific participants were interviewed. These participants were summoned by their management to take part in the workshop. Looking at the results of the questionnaire and the interviews, some interesting things can be concluded. Although some persons were not intrinsically motivated or had voluntarily chose to take part, everyone expected the workshop to be interesting and acknowledged the usefulness of the workshop. Overall the reason for participating in the workshop was mainly because of a high intrinsic and or extrinsic motivation, due to the awareness of the added value of the workshop for them personally.

There are no significant differences between the two groups, see Table 28**Fout! Verwijzingsbron niet gevonden.**. So the participants took part with the same motives. The differences in the attitude outcomes between the role-play and control group will not be influenced by the differences in motives, since there are no significant differences. Based upon the results it can be concluded that the **hypothesis: *there is no difference in motivation to attend the workshop***, is true.

Question	N	Mean	Significance between groups
Intrinsic motivation			
I expect the workshop to be interesting	15	3,93	,627
Attending the workshop is fun	15	3,73	,446
Identified Regulation			
By personal decision	15	4,00	,582
I believe that this activity is important for me	15	3,80	,325
I think that this workshop is useful for me	15	4,13	,901
External regulation			
I am supposed to take part in the workshop	15	2,07	,065
It is something that I have to do/ I don't have any choice	15	2,53	,545
Amotivation			
I don't know, I don't see what this workshop brings me	14	2,29	,726
I attend this workshop but I am not sure if it is worth it	15	2,47	,421

Table 28: scores on the scale of motivation

9.2 Motivation during the workshop

This section gives an overview of the motivation during the workshop. There were three measurements during the workshop, where the participants had to fill in the aforementioned forms.

ROLE-PLAY GROUP

Overall, the role-play group was motivated during the workshop, see Figure 32. The results during the first measurement were somewhat lower compared to the rest of the workshop. Some group members said that a possible reason could be that the participants had to get used to their role and where a bit hesitant to participate freely and enthusiastically. Since a role-play enforces participants to leave their comfort zone (de Laat & Geurts, 2008), it takes some time to establish an environment in which the participants feel free to play according to their appointed role. A significant increase can be seen when the group got used to their roles and had to develop a scenario. Something that was supported by the participants, who experienced the scenario as an unique opportunity to come together in a different role with an equipment pooling scenario.

CONTROL GROUP

It can be concluded that the participants of the control group were motivated during the whole workshop. None of the participants were at any time below the participating and contributing status, see **Fout!**

Verwijzingsbron niet gevonden. and Appendix M. A decrease in motivation by several participants can be seen during the plenary session at the end[10]. It is too premature to state, but probably this is because of group dynamics. In a group consisting of seven to eight persons participants are more likely to interact actively and take part in the discussion actively than in the original group, consisting of fifteen persons (Wheelan, 2009). This was also noticed by some participants. In the interview it was mentioned, that during the plenary session not everyone was involved actively in the discussion.

Regarding ***Hypothesis 2: The participants of the two groups were sufficiently motivated during the workshop,*** one can state that the participants who played the role-play and the participants of control group were sufficiently motivated. It can be said that both groups were motivated to a large extent and participated actively during the workshop. The two workshops were both interesting enough for the participants to participate enthusiastically. So the influence of motivation during the workshop on the effect of the role-play on the attitude towards equipment pooling, is expected to be negligible. In conclusion, the hypothesis is retained.

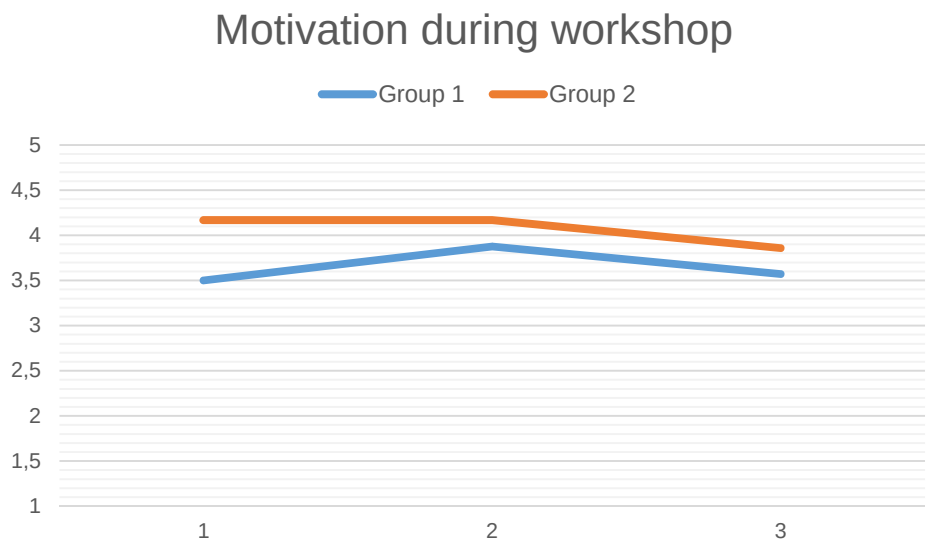


Figure 32: motivation of the two groups during the workshop

9.3 Effect of workshop on attitude equipment pooling

After performing the validation tests of the participants, there is no reason to deviate from the conclusions on the influence of the role-play and workshop on the attitude of the participants concerning equipment pooling. The motivation of the participants was high during the workshop and played no significant role for testing the second hypothesis. This section contains the results of testing the second hypothesis concerning the effects of the workshop on the implementation of equipment pooling.

Hypothesis 3: By playing a role-play game the attitude towards equipment pooling will change more positively than by having a workshop with an existing situation.

The results of the questionnaire are the starting points about the participants' views and acceptation of equipment pooling. Due to a 93% response rate for the second questionnaire the tested participant distribution is a bit different than the actual distribution, see Figure 33. By comparing the scores of the first questionnaire and the scores of the second questionnaire, the change in attitude is analysed. A distinction between the two groups is made in the following sections, to see if the attitude of the groups

[10] The weather can also have affected the results. It was extremely hot that day, around 35 degrees Celsius and a high humidity level. After a three hour workshop the participants could be more exhausted than usually, when acting and take part in workshop under normal weather circumstances.

changed separately. The first section presents a complete overview of the tables, followed by an overview of significant differences. For all the results, see Appendix M.

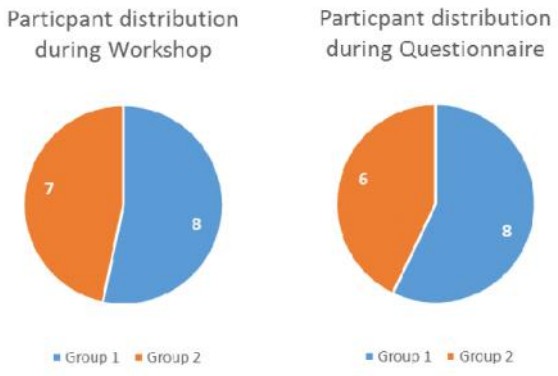


Figure 33: Overview of the distribution of the number of participants

9.3.1 Role-play group results before & after the workshop

In this section a comparison of the role-play group is made. This is done with a Wilcoxon rank sum test to test whether the attitude and opinion of equipment pooling has changed between the questionnaire before the workshop and after, see Table 29.

Propositions: Role-play group	Measure moment	Mean	Significance	Retain / reject Hypothesis
Q1: I am convinced about the benefits of equipment pooling	1	3,75	0,102	Retain
	2	3,25		
Q2: Only from a theoretical perspective equipment pooling is promising	1	2,38	0,518	Retain
	2	2,75		
Q3: I am going to convince others about the benefit of equipment pooling that the ground handling process is streamlined in a better way	1	3,00	0,480	Retain
	2	2,75		
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	3,63	0,041	Reject
	2	2,50		
Q5: Equipment pooling improves safety at airside	1	3,75	0,301	Retain
	2	3,13		
Q6: I experience the dependency on other actors, because of equipment pooling as a high risk	1	3,50	0,480	Retain
	2	3,75		
Q7: The lack of space at airside can be solved partially by means of equipment pooling	1	4,25	0,046	Reject
	2	3,75		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	3,38	0,589	Retain
	2	3,13		
Q9: Equipment pooling decreases the availability of equipment	1	2,63	1,000	Retain
	2	2,63		
Q10: Equipment pooling is financially attractive	1	3,38	0,025	Reject
	2	2,75		
Q11: I am confident about the realization of equipment pooling at AAS	1	3,38	0,020	Reject
	2	2,50		

Table 29: score of the role-play group

The results of the questionnaires show some significant changes in the attitude of the participants about equipment pooling. The main observations are:

1) The participants are more positive about collaboration, more motivated to first start cooperation before initiating new plans at AAS.
2) There is less confidence in the realisation of equipment pooling at AAS.
3) After the workshop the group members consider equipment pooling less financial attractive than before the workshop.
4) Because of a lower confidence level in the realisation of equipment pooling at AAS, equipment pooling as solution for the lack of space seems less appropriate.

Overall a negative tendency about equipment pooling can be seen. The workshop has provided the participants of the role-play group new insights which negatively changed their attitude towards equipment pooling.

9.3.2 Control group results before & after the workshop

In this section a comparison of the control group is made. A Wilcoxon rank sum test is executed to see whether there is a similar change in the attitude and opinion about equipment pooling in the control group before and after the workshop, see Appendix M, as was the case for the role-play group.

Collaboration according to the control group is perceived as more beneficial compared to operating separately. Furthermore, no significant shifts in the opinion about several aspects are noticed.

9.3.3 Comparison groups pre-measurement & post-measurement

In this section a comparison between the two groups of the first questionnaire is made. The Wilcoxon-Mann-Whitney tests are executed. Analysing the results, see Table 30 and **Fout! Verwijzingsbron niet gevonden.**, two remarks can be made.

Propositions: premeasurement	Group	Mean	Significance	Retain / reject hypothesis
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	3,63	,043	Reject
	2	2,33		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	3,38	,081	Retain
	2	2,00		

Table 30: the premeasurement scores of the role-play and control group

Propositions: post-measurement	Group	Mean	Significance	Retain / reject hypothesis
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	2,50	,662	Retain
	2	2,17		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	3,13	,008	Reject
	2	1,67		

Table 31: the post-measurement scores of the role-play and control group

Before the workshop the role-play group is less positive regarding the collaboration part at airside, necessary to make the ground handling process more efficient. Collaboration was more seen as inefficient and a millstone around the neck. However, after the workshop the role-play group is also positive about collaboration and there is no difference between the group, both acknowledging the necessity of collaboration. The control group indicates safety as a lower priority. Where this was no significant difference during the first measurement, this is a significant difference after the workshop. So the control group does not acknowledge safety as an important issue at airside.

Considering the second hypothesis: **By playing a role-play game the attitude towards equipment pooling will change more positively than by having a workshop with an existing situation,** one

can conclude that the role-play resulted in a more negative attitude rather than a positively change of attitude.

The interesting question still remains if those differences between the measurement before and after the workshop were due to the role-play, or just because the participants gained new insights during the workshop.

9.4 Conclusion results workshop

The groups were both motivated during the workshop and encouraged to take actively part in the workshop. Concerning the motivation during the workshop, both workshop formats have proven to be sufficiently motivational. There is a small difference to the extent in which participants are encouraged to take actively part in the workshop, the control group showed some better motivational results. However, it is too early to state if this is because of the workshop format. It could also depend on the workshop leader, characters of the participants and other factors. Overall it can be concluded that the workshop was interesting and challenging enough for the participants. So the participants were and stayed motivated. **Hypothesis 1*: The participants of the two groups were sufficiently motivated during the workshop*** is accepted.

Furthermore, it can be concluded that after the workshop the participants' opinion towards equipment pooling has decreased. This can in particular be seen in the role-play group. There are a few negative shifts, in financial attract ability, the space issue and confidence in the realization of the equipment pool. However, the necessity of collaboration at airside is more accepted by the role-play group. In general, there is a more negative attitude towards equipment pooling. However, the changes are very little and the changes between groups are almost negligible. Though the comparison between the groups results in two interesting findings. The first is the rise in acknowledgment of the role-play group that collaboration at airside, to make the ground handling process more efficient, is important. Besides the control group does not acknowledge safety as an important issue at airside. **Hypothesis 2: By playing a role-play game the attitude towards equipment pooling will change more positively than by having a workshop with an existing situation** is rejected.

In conclusion, the workshop resulted in motivated participants. However, the attitude and motivation towards equipment pooling at AAS decreased a little. The equipment pool is probably not seen as an ideal situation. A self-governing form can however still be preferred.

Consequently, the question still remains if the change in attitude towards collaboration is caused due to the role-play, or just because the participants gained new insights during the workshop. So the workshop itself is the reason for the change in attitude. Further research is needed to analyse what caused the large and significant change of the participants to consider collaboration as a good initiative to improve efficiency at airside. Furthermore to analyse if there still a potential to create a self-governing association in the ground handling sector at AAS.

9.5 Comparison between role-play and control group regarding motivation to collaborate

An interesting result of the comparison was the acknowledgement of the role-play group that collaboration is needed in such a complex business and network as the ground handling sector at AAS. Even though the overall attitude towards equipment pooling became more negative. The interviews afterwards were conducted to assess if it was the role-play which caused change or just the gathering of the actors. In this section the hypothesis about collaboration is tested, **Hypothesis 3: The overall attitude towards collaboration in the ground handling sector will improve by playing a role-play.**

The results of the questionnaire before and after the workshop showed a significant difference in the acceptance that collaboration leads to a more efficient ground handling process in the control group, see Table 32. As can be seen in Figure 34 , the role-play group did not seem to agree before the workshop, on whether collaboration pays off. After the workshop they agree that collaboration pays off. Just like the control group, which beforehand agreed that collaboration results in a higher improvement. So during the workshop the role-play group had really come to new insights about collaboration at airside.

Proposition: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	**Group**	**Mean**	**Significance**	**Retain/ reject hypothesis**
Hypothesis 0: There is no difference in the attitude to collaborate before and after the workshop (Role-play group)	Before	3,63	,041	Reject
	After	2,50		
Hypothesis 0: There is no difference in the attitude to collaborate before and after the workshop (Control group)	Before	2,33	,655	Retain
	After	2,17		
Hypothesis 0: There is no difference in the attitude to collaborate between the groups before the workshop (pre-measurement)	Role-play	3,63	,043	Reject
	Control	2,33		
Hypothesis 0: There is no difference in the attitude to collaborate between the groups after the workshop (post-measurement)	Role-play	2,50	,662	Retain
	Control	2,17		

Table 32: Score of groups on collaboration

ROLE-PLAY GROUP

The interviews gave a better understanding of the participants' attitude and opinion towards role-play. The members of the role-play group were all surprised by the fact that they had to play a role. Though it was perceived to be challenging, the participants found it highly interesting and like someone said 'an act of a genius' and another said 'It was surprising and real fun to do'. The participants stated they were forced to 'to think outside the box', 'being forced to think from some else's perspective' and 'think creatively about such difficult and complex subject as equipment pooling.[11] This looks like a contradiction because the widely accepted opinion is that equipment pooling is not THE solution at AAS. It will be very difficult due to the large amount of actors involved to implement it in a right and beneficial way. Although on the other hand collaboration is seen as essential at airside. The trust in the several actors is enlarged and the actors all see a lot of possibilities to deal with problems at AAS together. Thereby stating that 'you do not have to do everything on your own, the sector can solve problems together more effective and efficiently. It was remarkable that only a month after the workshop a few actors of the role-play group are self-determined to such an extent that they already show initiative to solve problems at airside

The members of the role-play group, although a lot of them knew each other for a long time and were working in the ground handling sector for many years, gained new insights. Like participants stated; it was good to be remembered that you are not alone on airside and that although you are competitors or client collaboration is needed for improving efficiency the ground handling processes. Also, the potential for solutions increases when more actors are involved. The format of role-play is worth repeating in the future.

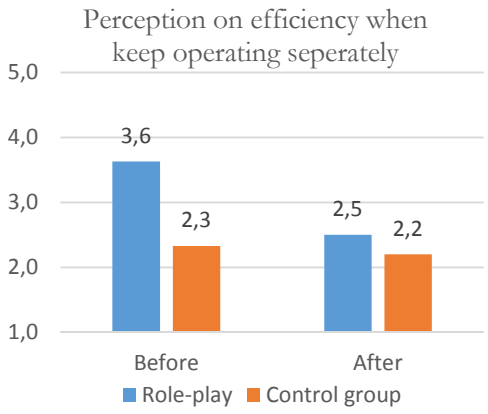


Figure 34: the mean scores of the groups before and after the workshop

[11] These are English translations of the following Dutch sentences: 'het loslaten van vaste straatjes', 'uit hun normale harnas gehaald' and 'aangezet om creatief te denken over zo'n vastgeroest onderwerp'

CONTROL GROUP

The members of the control group had a really constructive conversation about equipment pooling at AAS. The added value of a workshop was acknowledged, especially to have a good profound discussion about equipment pooling only. Not searching for solutions immediately did not turn this workshop into negotiations. However, whether or not this is the right format remains unclear. The different parties stayed in their own role, found it difficult to think outside the box without having their company interest at first place. They stated that a role-play would probably enhance the awareness of the necessity to collaborate, and that a session in the woods or a dinner could resulted in the same insights as the workshop. The workshop was mainly used to get to know the perspectives of the other actors and how to adapt their own behaviour. Though the workshop was of real added value when it comes to if the actors feel appreciated and involved in the decision making process.

SHARED CONCLUSIONS

Both groups are still positive to the further development of a small pilot, especially when stairs at the pier are considered. They feel respected and heard through this workshop format. The design of the workshop made it truly possible for all the actors to discuss the subject thoroughly, and although they had to make the choices for the development of a pool together, they felt that the design provided room for making solutions on their own and challenged them to think of a good pool design.

9.6 Conclusion: role-play enhances necessity of collaboration

Overall it can be concluded that **Hypothesis 3: *The overall attitude towards collaboration in the ground handling sector will improve by playing a role-play,*** can be accepted. Based upon the quantitative and qualitative information, an increase in the awareness and acknowledgment that collaboration pays off, is proven by the role-play group. The control group also agrees that a workshop, or gathering, adds value in the decision making process of equipment pooling. However, their attitude towards collaboration did not change to a large extent. For these reasons, the hypothesis is accepted. For more interesting and general findings of the interviews, see Appendix M.

Two remarks have to be made. First there was a large potential for the role-play group to increase their attitude towards collaboration compared to the control group. Therefore a tool which only indicate the potential of collaboration at airside or other concepts besides gaming might have been sufficient. Secondly for an unknown reason the control group did not utilize the potential left, since there was space to improve (from 2,3 score to 1 according to the Likert scale). So the question is whether a role-play should have resulted in an increase of attitude for the control group. But maybe the group was at its maximum. In questionnaires using a Likert Scale it rarely happens that people fill in the maximum or minimum score. The so called central tendency bias states that participants avoid extreme response categories (Guilford, 1954). However, the findings in the interviews afterwards validated the conclusion drawn above.

9.7 Overview & Conclusion results

Even though the workshop did not result in a more positive attitude towards equipment pooling and showed no large differences between the control and role-play group, it can be said that the role-play enhances the willingness of the ground handling parties to cooperate. Due to the workshop, the ground handling sector developed the widely accepted opinion that equipment pooling is not beneficial at AAS. However, the prerequisites for a self-governing association are to a larger extent met at AAS.

So **hypothesis 1**: **The participants of the two groups were sufficiently motivated during the workshop**, is false and can be rejected.

The participants of both groups were really motivated during the whole workshop. Most of them were enthusiastically participating and contributing to the discussion. The workshop itself and the setting were inviting enough.

Hypothesis 2: By playing a role-play game the attitude towards equipment pooling will change more positively than by having a workshop with an existing situation, is false and can be rejected.

The participants of the role-play group have gained a more negative perception about equipment pooling by attending the workshop. There were no significant differences in the attitude of the participants of control group. Having more insights from different perspectives, gained by the role-play, changed the perception to a larger extent. Nevertheless, this resulted in a more negative attitude instead of a more positive.

Hypothesis 3: The overall attitude towards collaboration in the ground handling sector will improve by playing a role-play, is accepted based upon the interviews and the results of the questionnaire.

The participants of the role-play group showed as well a very positive tendency towards a positive perception of collaboration at airside as admitted that the role-play showed them that collaboration pays off. This could not be seen with the participants of the control group, which used the workshop mainly to get to know the other stakeholders' intention and attitude better.

When the contribution of a role-play to increase collaboration is considered, the following statement is made. Awareness and motivation are created by using a workshop format. The expected positive change in attitude towards the goal, equipment pooling, decreased. However, a workshop and especially a role-play is of added value when considering complex problems. The role-play increases the motivation to collaborate between the prejudiced participants to a large positive extent. Also all the actors are still positive towards a small pilot of equipment pooling and a self-governing form of collaboration at AAS.

Based on the results in this chapter conclusions can be drawn and recommendations be made, this is done in the following sections, chapter 10 and 11. The results also have some drawbacks and interesting potentials for further research, which can also be found in chapter 11.

10. Conclusions Part II

The literature study provided guidelines for the intervention to realize more willingness to collaborate among the actors. Where the actors had a lack of common understanding, feeling of autonomy and trust in each other, the Self-Determination Theory provided an approach to take away these concerns. Thereby focussing on three motivational needs, 1) autonomy, 2) competence and 3) relatedness. The chosen game was a role-play, since that could take the actors out of their daily routines. Furthermore the role-play ensures that people establish new kind of relationships. A fictive role-play with a lot of similarities compared to the situation at AAS was developed.

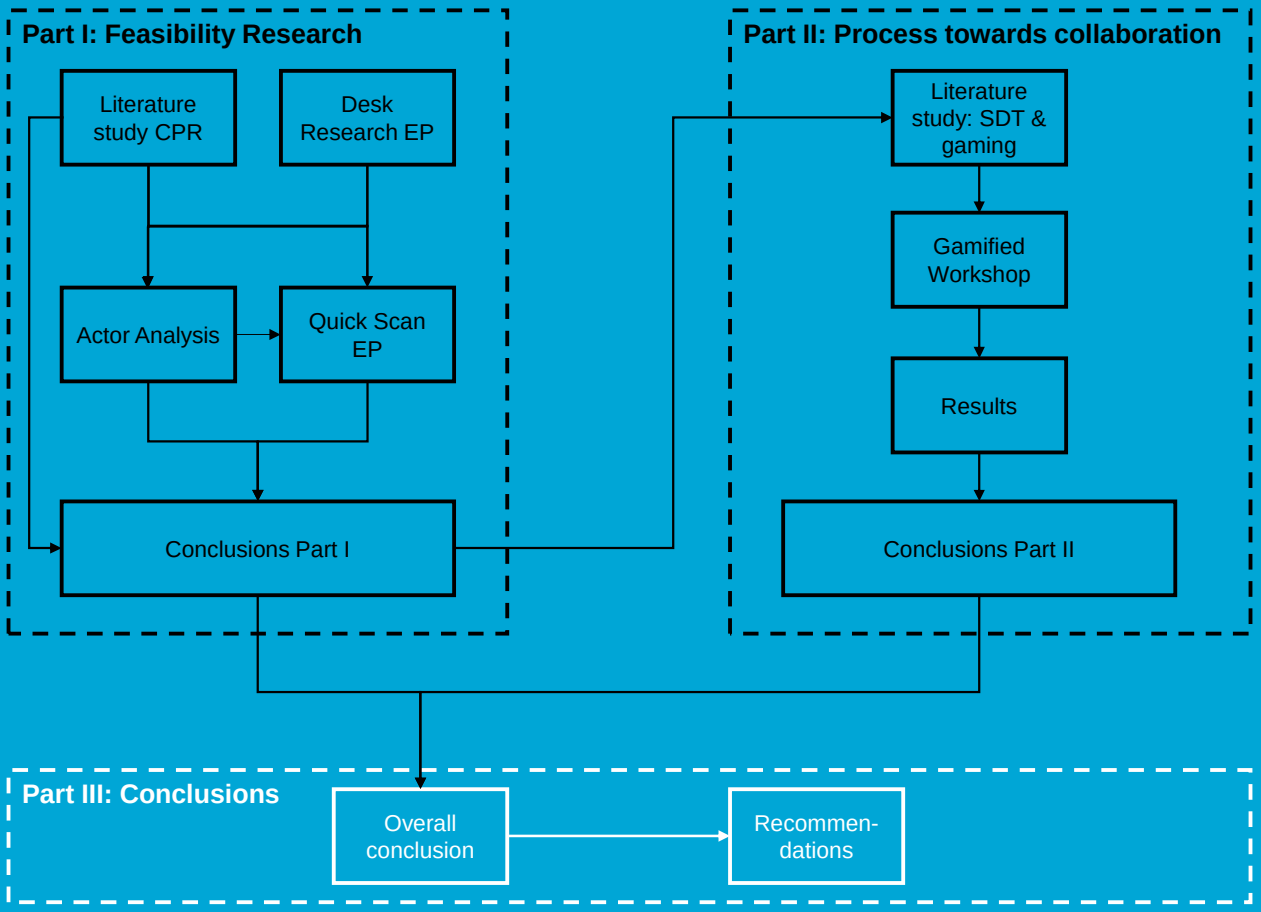
Two workshops were developed, one with a role-play and the other without a role-play. This was done to see whether the participants of the role-play were more positively changed towards an equipment pool at AAS. By means of conducting interviews, doing observations and analysing the filled in questionnaires results were obtained. Since there are no differences between the group in the motivational reason to attend the workshop and the motivation during the workshop, a further analysis of the workshop on the attitude towards equipment pooling is done. For the attitude towards equipment pooling, which was presented as a Common Pool Resource, the attitude of the role-play group changed in a negative way, on financial and feasibility aspects. The control group showed no differences in attitude before and after the workshop.

However when collaboration at airside is considered, the role-play caused a significant positive increase of attitude towards collaboration. This was also confirmed by the conducted interviews afterwards. The role-play group considers collaboration as essential at airside. Whereas the control group sees collaboration more as an outcome of negotiations. An important remark has to be made, beforehand the role-play group was prejudiced to a larger extent than the control group. So it was easier to become more positive about collaboration

In conclusion, the role-play resulted in a group where the participants do not acknowledge the potential of equipment pooling at a large scale. But the role-play improved the willingness to collaborate at airside, where the satisfaction of the three motivational needs was increased. So for a prejudiced group role-play enhances the self-determination to collaborate to a large extent. It was an increase which resulted in more initiatives at airside which include collaborations.

Part III:

Conclusion



11. Conclusions & recommendations

In this section the conclusions and recommendations of the thesis are given. The aim of this chapter is to answer the central research question: '*To what extent can equipment pooling be implemented to make the ground handling process at Amsterdam Airport Schiphol more efficient?'* First the main findings of Part I and Part II are presented and conclusions are drawn upon. Then a conclusion about the feasibility of equipment pooling at AAS is drawn. The additional research question of part II: '*Can a role-play game enhance collaboration in the decision process of the self-governing equipment pool?'* is discussed separately. The recommendations for AAS but also scientific contributions are presented by the recommendations. Further research directions for equipment pooling and gaming are identified and elaborated. The general value of this research is discussed in the following section. The drawbacks and limitations of this thesis are discussed in the last section.

11.1 Conclusions Equipment Pooling Part I: right preconditions not present

The aim of this research is to conclude if an equipment pool at AAS is feasible. An equipment pool as suggested can be related to the Common Pool Resource theory. The presumed ideal situation is an equipment pool for the whole airport for every type of equipment. Due to legislation and AAS' policy, a strong governmental regime cannot be established. So AAS cannot coerce the ground handlers to implement an equipment pool. Therefor a self-governing pool has to be established by the sector itself. Specifically spoken, this pool must be realized in a non-hierarchical network where no specific dominant players are existing. Since such a pool is already used a lot in other sectors, this shows high theoretical potential. Besides it is already realized in small pilots at AAS, and in these pilots there were a lot of indicators which stated that equipment pooling might be the solution for a more efficient and better organized airside. The realization of a self-governing pool and the prevention of adverse effects can only be achieved through intense collaboration. The literature identified several prerequisites which have to be fulfilled before actors will collaborate and before the pool can be designed.

First of all, in practice equipment pooling is much more harder to successfully be implemented than thought before. Due to the institutional and network complexities the success depends to a large extent on the involvement and persuasiveness of all the players in the network. AAS cannot realize equipment pooling on its own. In addition AAS cannot force the ground handlers, due to the liberalized market and AAS' policy, to pool their equipment or search for another solution to improve efficiency at airside.

The actor analysis with the involved ground handlers, AAS departments and GSEs, provided insights in the perspective of the actors towards equipment pooling. In general, 1) The actors, especially the handlers, are concerned about the impact of equipment pooling on their processes and the loss of independency. 2) The potential of an equipment pool is unknown by the actors and two of the most important prerequisites are missing 3) a common understanding of the actors and 4) trust in each other. Concluding, not all prerequisites are met and therefore it is almost impossible to implement an equipment pool at once, following the design principles from literature. So first, it must be clear if the net benefits of the new situation are larger than the net benefits of the old situation for all actors combined. Second, the net benefits must be perceived by every actor individually as an improvement from the current situation. Thereby taking into account that the current consultation bodies do not provide the right platform to persuade the others of AAS perspective, so another type of communication platform needs to be found.

A quantitative model, the quick scan, of the used equipment provides information about the costs and benefits of equipment pooling. Three scenarios have been analysed, where two scenarios included equipment pooling. In conclusion of the scan a significant reduction of the amount of equipment can be realized through an equipment pool. The eventual design of the equipment pool will influence on the total improvement and net benefits. To what extent the potential is utilized depends upon the organizational and institutional decisions of the actors. Subsequently it is important to bring the actors together and convince them about the benefits of a pool.

11.2 Conclusions Equipment Pooling Part II: Potential of collaborative self-governing pool

AAS cannot coerce the ground handlers to implement an equipment pool. First general consensus have to be established, before an equipment pool can be implemented. The reason for this is that in a network of actors were a lot of interdependencies exist, not one dominant player is present and there are also a lot of interrelationships. Forcing solutions will result in resistance from the actors which are essential for attaining a successful pool. Since there exist a lot of prejudices about the views of the other actors and a lot of unknowns, bringing these actors together is important for the further decision process and understanding of each other's point of view. The current consultation bodies to discuss pending issues at the airside of AAS do not suffice. Furthermore a status-quo in the network is present when a self-governed pool is considered.. An intervention was needed. From this research it could be concluded that a workshop is an appropriate format. A workshop brings these actors together and challenges them to think about equipment pooling and to search for a widely-accepted solution.

The self-determination theory states that when the participants' motivation is increased, the outcomes become the most positive and chances for success increases. The three pillars of self-determination, competence, autonomy and self-relatedness were embedded during the workshop. The field of gaming is used to enhance the three pillars even more, so the participants of the workshop are self-determined to collaborate at airside. A fictive role-play to a large extent similar to the AAS situation was chosen as gaming format. A role-play resulted in participants leaving their comfort zone, establish new relationships together and taking the whole sector into consideration instead of optimizing self-interest. Thereby not losing sight on the real ground handling problems at AAS. A role-play group and control group were formed to analyse the value of a role-play.

The results of the role-play showed contradictory outcomes. The opinions of the role play group towards an equipment pool, very similar to a common pool resource decreases on almost every aspect. Except for one aspect, that is the acknowledgement that collaboration at airside is needed to improve efficiency. After the role-play the motivation to collaborate increased to the same level of the motivation of the control group. The role paly helped in clarifying equipment pooling, unfortunately most of the times in a negative way. But on one thing - and probably the most important one when considering a self-governing association in non-hierarchical networks - role-play improved the attitude on: Collaboration.

11.3 Overall conclusion: feasibility Equipment Pool

Regarding if an equipment pool at AAS is feasible, it can be stated that it is too early to implement an equipment pool in the form of a common pool resource. Implementing equipment pooling in a fast pace and at a large scale is not suitable for AAS. Small steps and pilots are preferred. The prerequisites for forming a self-governing association at AAS are present and currently to a larger extent. The design process of the self-governing pool needs to be started. Therefor recommendations are done.

11.4 Role-play in creating collaboration for self-governing associations

In this section an answer, based upon the results of the research, on the separate research question: "*Can a role-play game enhance collaboration in the decision process of a non-hierarchical network"* is given.

Referring back to the missing prerequisites of a self-governing association, the role-play adds significant value. Especially to break the status-quo in this non-hierarchical network where actors are negatively prejudiced. From this research it can be concluded that the role-play created a common understanding, assures autonomy of the actors and creates trust between the actors, essential for good collaboration.

Comparing the role-play with the control case, the role-play was really seen as adding value to the decision process of equipment pooling. The role-play participants all admitted that the role-play format was an unique and challenging way to think about the equipment pooling subject and providing them with a lot of new insights. After the workshop some participants of the role-play indicated that they have thought about suggesting more collaborative initiatives than just equipment pooling. The role-play

activated them and made them more self-determined to collaborate and create a self-governing association. In contrast, the other case was mainly seen as interesting and in itself not that exceptional or special. A similar setting where the group would have been sitting together was also seen as appropriate.

So considering the separate research question: "*Can a role-play game enhance collaboration in the decision process of a non-hierarchical network"* the answer is affirmative. Regarding to the influence of role play on the motivation to create self-governing associations promising conclusions can be drawn. Enhancing motivation can be done with the help of gaming. Gaming, in the form of a role-play, really adds value to the decision process in non-hierarchical networks. A role-play, besides having a workshop, forces participants to come out of their comfort zone. It also provided an collaborative process in which an broadly accepted agreement. The role-play challenges the participants, give insights as well concerns as opportunities become clear. Besides, the role-play is partly freely and informal due to the fact that it takes place in a non-existing world.

However since the benefits of equipment pooling are hard to quantify and to determine beforehand, a role play does not enhance commitment concerning the implementation of equipment pooling at AAS. Extra insights that the participants have acquired during the role-play resulted in a negative tendency towards the implementation of equipment pooling, where the control group situation did not resulted in any change of the attitudes of the participants.

So although the role-play created a more negative image of equipment pooling, role-play increases motivation and especially the feeling of collaboration is essential for making processes more efficient in this non-hierarchical network.

In general, the workshop was appreciated by all participants, it was experienced as a good way to discuss such complex and prejudiced subject as equipment pooling. The workshop created a platform where equipment pooling finally could be discussed. Sitting around the table and learning each other's concerns and view on equipment pooling is very valuable and contributes to the process. A new initiative as a workshop add value to decision making in non-hierarchical networks. Using the concept of workshop and role-play is seen as a real contribution and definitely worth repeating in the future for similar decisions.

11.5 Recommendations AAS

The recommendations for an equipment pool for AAS are given in this part. First the recommendation for equipment pooling is given. Secondly the recommendations for using workshops and role-plays in creating self-determination and enhancing the motivation to collaborate at AAS.

The first steps towards a self-governing association in the ground handling sector have been made for Amsterdam Airport Schiphol. However a decision and design process consists of many steps. First recommendations considering equipment pooling are given. Then the workshop and role-play format is discussed and if this could be used in more cases in the future.

EQUIPMENT POOLING: THINK BIG BUT START SMALL

Integrating equipment pooling at a large scale is not feasible and not desirable for the next periods of time. The first steps towards a more cooperative sector have been made. However there is a big difference between actors that are motivated to collaborate and actors actually committed to collaborate in a pool form. First starting small pilots in equipment pooling will create more confidence in an equipment pool. Starting with a stair pool shows potential. This pool has the potential to become a success and the sector is interested in this pool. Moreover the handlers and GSE companies widely accept and see the staircase pool as a great possibility.

Furthermore it is getting busier and busier at the airport. So for the next coming years, especially when the A-pier is not yet developed, pressure at airside becomes very intensive at almost an unbearable level. Where now most of the ground handlers are situated at designated piers, in the future and already during 2015 more and more VOPS are and will be used by different handlers. This results in more and more airlines appointed to the E and F-pier which are mainly used by the KLM and its SkyTeam partners. So a pool will be getting more beneficial when the market share at the piers become more equal.

Thereby the A-pier itself is a window of opportunity. As stated by the different handlers, involvement in the development of the pier is really appreciated and can solve a lot of problems at the current piers. One side note have to be made. The A-pier is not a completely self-contained pier, it is part of AAS. So changes in the ground handling process at this pier will also affect the processes at the other piers.

To implement more and or larger equipment pools, it is important to start starting small with little adjustments in the businesses processes of ground handlers. The handlers found it difficult to accept everything at once. Since every equipment has a different approach, they have to adjust every process. The equipment pool is seen as a pool for every equipment part but not a pool for every type of equipment separately. So start with one type of equipment or equipment types which are complementary, like equipment needed for every handling and in the same amounts. It is recommended to use the design principles of Ostrom (1990) to establish a long-enduring institution. The track and trace system provided by the GSE can provide a monitoring mechanism, a fair allocation of the costs and benefits needs to be arranged and so on.

ROLE-PLAY & WORKSHOP USE IN DECISION PROCESSES

More complex decisions beside equipment pooling have to be made in the coming years. Many actors are involved in those networks and probably there is not one dominant party. Besides the ground handling sector at AAS, a lot of similar networks are present at AAS. Future research for implementing role-play and the workshop format to accelerate the decision making process is especially recommended for other networks where the airport authority has an facilitating role. It have become clear that motivation is an important aspect to take into account when a decision process is developed. An integral approach where the technological, institutional but for most the process design is included is of utmost importance. The role-play itself has a positive effect on the process, just like having a workshop. Discussing the subject or initiative in a workshop causes the reaction needed to activate the decision process about that subject. The generalizability of role-play is a future research direction.

11.6 Recommendations using role-play to enhance collaboration in non-hierarchical networks

In this section recommendations about the role-play, gaming and how to enhance collaboration are done. It was found that the gaming literature had a gap towards the psychological bases of their games. It is often also very difficult to prove if games work or not. However focusing on psychological theory seems an interesting field to create more direction and substance on the why. This role-play study showed first promising results about the added value of games in complex decision making processes. When actors are prejudiced about collaboration, due to several concerns conflicting with competence, relatedness and autonomy, role-play can be the solution. The questionnaires and interviews gave the augmentation needed to state this. However there are a lot of gaps which have to be filled in and other interesting directions in which further scientific research can be done.

The self-determination theory in combination with gaming to create the preconditions needed for a self-governing association worked out well. However it is important to conduct further research into this topics to see its full potential. Equipment pooling shares a lot of characteristics with a Common Pool Resource. Gaming in the form of role-play can help creating confidence in collaboration, by taking into account the concerns of the actors and to establish a common pool. This research gave insights in the concerns and why a status-quo is the current situation. The research gave particularly insights when the self-governing form influences the actors' core activities. The role play took away the concerns and prejudices to a large extent. This resulted in a more positive attitude towards collaboration, something highly necessary for such pools. However being motivated to establishing a common pool is one thing, actually establish a pool or make a decision and stay committed to the chosen alternative is another thing. In other words the long term effects of the role-play are unknown. Maybe knowing a lot of the other actors eventually results in a more bureaucratic, expensive decision process or make negotiations in a later phase impossible. To research this further, the whole decision process needs to be analysed.

A role-play is only one little part of the gaming field. There are a lot of other gaming options which can be used during such situations. For example, Veenstra, Meijeren, Harmsen, & Verbraeck (2015), used real simulations and creating confidence in the use of simulation to make well sophisticated decisions.

Looking to problems from a Multi-Actor System perspective showed that a good initiative again depends upon all the parties and their corresponding rationality. The non-hierarchical network was an interesting network. It is recommended from a scientific perspective to use role-play also in hierarchical networks, in networks where there is a more dominant player, a network where it is not normal to have consultation rounds and a network where few people know each other, for example in foreign politics. To conclude if role-play also works in those networks. Also networks with time and financial pressure, it is recommended to see whether a role-play adds value.

11.7 Further Research Equipment Pooling & use of role-play

For future research interesting directions are identified. Directions for as well further research into equipment pooling and further research in the use of role-play in combination with motivation to enhance collaboration.

EQUIPMENT POOLING AT AAS

For future research into equipment pools five directions are identified. First of all it would be interesting to extend the model, that is developed in this research, for other equipment types besides stairs and calculate the potential more accurate, also based on the expected growth. An extension of the model makes the model also more generalizable and therefor useful for other calculations on possible equipment reduction at airside.

In addition, further research towards an integral approach for the feasibility of equipment poolin at AAS can save a lot of time and resources. When this approach is easy to use simple assessments can be made. Also legislation is now seen as given. However the pool can be seen as a kind of cartel, but this is a grey area in which legislation is not always unambiguously. Further research to what kind of equipment pool is allowed can help during assessments if an equipment pool is feasible.

Thirdly, the estimation of the transaction costs and other organizational costs have to be further calculated with more certainty. So a clear estimation of the costs can be made. This is mainly dependent on the decisions the actors make about the design of the self-governing pool. The harder the agreements, the higher the costs probably will be. According to Ostrom (2002) the benefits need to be higher than the costs to establish the self-governing pool, the short-term costs for the adoption of new strategies and the long term-costs to maintain the new system. These costs are also known as the transaction costs. A good process and following the design principles to establish a long-enduring self-governing pool at AAS will utilize the theoretical potential. It is interesting to see whether following the design principles results in a long-enduring self-governing system.

Fourth, further research into the reduction of movements at airside. A pool causes a reduction in equipment but when a pool for every pier or every VOP is realized this also results in a lower amount of movements. An equipment pool is one of the initiatives to increase efficiency in the ground handling sector. A feasibility study towards other parts ground handling processes, like a study towards the guarantee that a flight from a particular destination is almost always assigned to the same VOP, can be of value as well.

The fifth direction is to make equipment pooling an integral concept at the airport. Therefor the cargo handlings also have to be taken into account. One cargo handler already showed interest for an equipment pool.

ROLE PLAY TO CREATE MOTIVATION AT AAS

For other similar collaboration problems between actors a role-play can be the solution. However further research is needed if a role-play also works in other networks of AAS. The potential is there because AAS is involved in a lot of actor networks where consensus and collaboration is needed, for instance in the airline network. Interdependencies between the actors exist and most of the time also fierce competition. It is interesting to see if role-play and workshops in other networks at AAS result in the same outcomes concerning collaboration. Besides this, the cost-efficiency have to be taken into account. Developing a role-play takes more time and resources and therefor money than with developing a regular workshop, like with the A-pier. So the further research can be focused to what extent AAS is willing to develop a role-play when the impact of the role-play is taken into mind.

The role-play itself can also be improved a lot, for instance more clarity about the workshop rules, more elaborated results of the scenarios and more information about the role, so it is easier to empathize the role.

GAMING TO CREATE COLLABORATION IN THE DECISION PROCESS

For further research into gaming and how this enhances collaboration in the decision process five directions are identified.

The difference between the role-play group and control group can be analysed further. Now the potential for the role-play group to become more positive towards collaboration was very large. So a positive change in attitude was relatively easy. By obliging the participants to fill in the questionnaire earlier the control and role-play group can be exchanged. This control case can analyse if the role-play results in the same change of attitude towards collaboration when the participants are to some extent already willing to collaborate and less prejudiced.

In addition, the added value of role-play will get more quantitative substance when done with more participants.

For the result of the decision process it is off high value if the role-play eventually leads to more collaboration than when not done, but that is very hard to say since this role-play focused on the motivation concerning creating collaboration in a network such at AAS. However this is only the start of the decision process. After this role-play a lot of other steps have to be done before the decision is made. It is interesting to see whether role-play accelerates the total decision process or not. However due this research, it can be stated that a role-play is a first step towards collaboration and it creates a platform in which collaboration is more acknowledged. Also other simulation and gaming tools are worth investigating to see whether this enhances collaboration (Veenstra, Meijeren, Harmsen, & Verbraeck, 2015).

Being motivated is one thing, being committed is another story. Playing behavioural games can contribute to an actual successful collaboration between the actors. This is a research interesting for during the design phase of such self-governing forms.

The role-play was mainly focused on a change in attitude towards collaboration to achieve a certain goal. Thereby focusing on the self-determination theory helped. A game purely focused on changing one's perspective about the proposed initiative can enhance the self-determination maybe even more.

11.8 Generalizability of the research

To what extent this research really contributes is partly dependable on the generalizability of the research. This section discusses the generalizability.

The role-play game was applied in a non-hierarchical network, characterized by fierce competition, with no dominant party and a facilitating party providing the infrastructure. Collaboration was needed by reason of efficiency and safety for a not widely supported initiative. However this motivation to collaborate was missing. Many other networks can be characterized by using this description.

Besides the ground handling sector at AAS, a lot of similar networks are present at AAS. Future research for implementing role-play and other gaming elements to accelerate the decision making process is especially recommended for other networks where the airport authority has an facilitating role. Besides AAS, other airports in Europe where the market is liberalized are worth investigating to see if role-play have the same results as it had at AAS.

Besides the aviation sector, a lot of similar non-hierarchical networks in infrastructure can be identified in the Dutch economy, for instance the Port of Rotterdam, the electricity market, the railways, the gas and oil market, water purification network and maybe even the financial transaction market. New big challenges lay ahead in these sectors as well and new initiatives in which collaboration is needed are popping up. However collaboration in these markets is often also feared and hard to find. A lot of unknowns exists and the actors are concerned about their autonomy. While collaboration and

establishing a self-governing system can be very beneficial and results in a lot of efficiency improvements.

11.9 Limitations

The contribution of this research for AAS and scientifically have to be valued. Therefore the limitations of the model are discussed in the following section. Thereafter the limitations of the role-play are discussed. In the last section the limitations of the motivational focus on collaboration are made.

11.9.1 Limitations model calculating benefits Equipment Pooling

The limitations of the model have been identified.

1) First the assumption about the model with and without memory can probably be taken out of the model by using a discrete model instead of a theoretical reduction optimization model.
2) It is unknown how the model reacts on disturbances, for instance stormy weather or snow, when a lot of delays can be expected. The sensitivity needs therefor be tested further.
3) Other equipment types than stairs were not taken into account, for every type of equipment a different process with different actions during the handling exist. T
4) The principal agent problem cannot be included in the model, so the model assumes rational behaviour, where bounded rationality can be expected.
5) The model is limited to four carefully chosen weeks of data. Besides this was data of 2014, where AAS expects to grow the coming years.
6) The amount of movements of equipment is not taken into account, only reasoned. More than three scenarios can be developed, the model however chooses three different but feasible models.
7) Last limitation, only a quick scan of the costs and benefits is made, a detailed calculation of risks, investment costs and transaction costs is missing.

11.9.2 Limitations role-play & workshop

The limitations of the role-play and workshop have been identified.

1) Although an impressive number of representatives were present during the role-play and workshop, statistically spoken 15 persons are not that many. Because of that reason the results are not generalizable. For stronger statistical analyses more participants are required.
2) There were two different workshop leaders, some results could have been influenced due to this difference.
3) Some participants had difficulties to stay into their role, since the role-play resembled the existing situation at AAS to a large extent. In addition, this was the first time the workshop and role-play was designed and played by the author resulting in some teething troubles.
4) Due to time constraints not every participant was interviewed afterwards.
5) Participants could have given socially desirable answers.
6) Not every option in the MCA was calculated, some were reasoned or based on one calculation
7) For now the role-play contributed to the decision process, because it was a new concept. However when using this concept a lot, actors can get used to it and more difficult to get away from the beaten track.

11.9.3 Limitations motivational focus on decision making/collaboration

The limitations of the motivational focus on decision making and collaboration have been identified.

1) The earlier described relation between role-play and collaboration needs an exact opposite research as well. The Self-Determination Theory is not the only motivational theory in literature, for instance the goal-oriented theory (Locke & Latham, 2006).
2) Only focussing on motivation can result in forgetting to take other aspect into account. An organization is not depending on one man's motivation when making decisions, for instance financial or qualitative aspects can account to a larger extent.
3) Concretizing motivational aspects is hard and intrinsic and extrinsic motivation are quite qualitative terms, so it depends on the chosen definition.

4) Besides one can acknowledge the necessity to collaborate but because his bad relationship with another actor the collaboration will never be established.
5) Self-determined actors can achieve a lot more and are more activated and persuasive to start the decision process and design of a self-governing system, however it is not a guarantee for collaboration.

12. Reflection

In this chapter a reflection is written. In the first part a personal reflection on the methodology is given, followed by how this thesis fits in existing literature. My own experiences and lessons during this study are briefly discussed in 12.2. In the last part a review on the quality of the results, to what extent the results are reliable and generalizable.

12.1 Reflection on Methodology & literature

The most important decision was the combination of the psychological fields in a socio-technological system. This decision was not taken at once. The initial idea was to look how gamification could influence the attitude on equipment pooling. When it became clear that it would be very difficult and dependent upon the choices of the actors what the benefits and costs of the equipment pool would be, measuring a change in attitude towards equipment pooling would be not a right measure. Thereby it became very clear that the actors were not willing to collaborate. The focus shifted therefor from the combination of the TIP approach and writing a road map for AAS how equipment pooling could be implemented to a focus on creating collaboration by means of a game. I recognized together with my committee that not a lot of research had been done to see how those fields could be included.

As guideline for the research thesis the Common Pool Resource Theory was used. This focus was also not used from the beginning. The similarities between the equipment pool and CPR were identified relatively early. Equipment pooling shares many characteristics of a common pool resource system. The current situation at AAS is not a complete common pool. A market already exists and the realization of a pool is a form to solve a part of the allocation problem of AAS' owns common pool: the scarcity of space at airside. The realization of a pool means that scarcity is introduced, though the amount of equipment can be determined by the actors. However due to the fact that the focus was on gamification and establishing collaboration between the actors, it took some time before CPR was chosen as theoretical framework. The theoretical framework of the CPR and self-governing associations was very valuable to bring structure and identify the absence of preconditions. Also the two different parts could be linked. However the guidelines of CPR are very abstract, due to the fact that every CPR is an unique situation. A CPR was sketched as the ideal scenario. This is quite unusual to do, but it worked well and showed that the realization of a complete CPR system is not feasible. However a self-governing association seems feasible. The TIP approach and methods like an actor analysis and quick scan gave real substance to the research towards the possibility of a self-governing association at AAS.

Due to time constraints is was not possible to see whether following the design principles will result in a real equipment pool and if the theoretical framework of Ostrom is applicable in similar situation, like aforementioned in the future research directions. This is something that further research can pursue.

SDT THEORY

For the prejudiced group combining the SDT theory with gaming theory and the missing preconditions proved to be valuable. It was hard to always find the right translation of SDT, Gaming, CPR and the situation at AAS, however the workshop was received well and the SDT theory is an appropriate theory to combine with the prerequisites of common understanding, norms of trust and autonomy. It is not possible to state if the SDT theory would also have helped when other preconditions of the actors were missing. But because I was convinced about the added value of implementing a psychological aspect, I used the SDT theory.

12.2 Personal reflection

Doing my master thesis, I have learned a lot of valuable lessons as well about the subject as about myself. By doing such large project on your own you become aware of a lot of positive and negative characteristics of yourself.

Practicing interviews & strategic behaviour

I have conducted a lot of interviews during this thesis. First of all, I had interviews to gain knowledge about AAS, about the ground handling activities and aviation in general. I did this so I could form a good impression about the system in which equipment pooling needs to be established. Thereafter I did the actor analysis interviews. This kind of interviews, where finding the bottle necks is the main objective, require that you must ask further and more in depth questions to really acquire the essential information. This was quite new to me and really challenging. A recommendation for every other SEPAM student is to really take time preparing the interviews if you have such interviews. And also think a lot about if you have or are going to ask question which give you the right information. Especially because the other players are not immediately sharing the necessary information with you. However learning how to conduct interviews is really useful and results in a lot new expertise. So conducting interviews is recommended to do.

Also in competitive networks be aware of strategic behaviour. I had a party who was really willing to cooperate but only if other parties took the responsibility for the realization of this pool and the equipment. Informing other parties that this party is completely open to equipment pooling is then of course far too easy.

Gamification versus Gaming

The discipline of gamification was completely new to me, since I never had courses about gamification, I read and talked a lot about gamification during the first months, because first my main focus was on gamification. It was hard to change the focus from gamification towards gaming. A large part of the literature study had to be done again. Thereby the used skill atoms for the design lenses, the method described by (Deterding, 2013), was worthless. Fortunately a lot of gaming literature was applicable to the workshop and role-play. The steps taken during the developing and analysing phase of this research complied to a lot of gaming literature. Also the built in iterative processes provided enough guidelines to develop a correct role-play and workshop.

Psychology: a new discipline

Besides doing a thesis in accordance with the requirements for a TPM study, this study showed a real qualitative psychological perspective on current problems. Having broad interests, I find it really interesting to learn about what people drives and how motivation can be of influence for the success of socio-technological problems. However since I was and still am a rookie in the psychology discipline, every theory was relatively new to me. Making this my own takes longer than I probably first expected. This resulted sometimes in less progress than promised. However I found the psychological perspective a really interesting one and often a discipline which is forgotten when in a technical environment, such as at AAS or at the Delft University of Technology.

Focus

One of the most important things, which I have also learned during my time as SEPAM student at the Delft University of Technology, was the importance of scoping. However during this thesis, it was due to the combination of a business and academic research hard to bring focus in my research all the time. During the kick-off meeting the committee already mentioned the possibility that I would do three master theses in one. Bringing focus after that meeting, was very useful and necessary. However sometimes unnoticed and without purpose my scope broadened and the focus and therefor structure during the thesis was a bit missing. With a lot of effort and with very useful and necessary help of the committee a right structured thesis is the eventual result.

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Appendices

Appendix A Theoretical foundations

The list of attributes of the resource and of the appropriators, when present the probability on the establishment of an self-governing associations or equipment pool increases.

Attributes of the resource:

R1. Feasible improvement: Resource conditions are not at such a point of deterioration that it is useless to organize, or so underutilized that little advantage results from organizing.

R2. Indicators: Reliable and valid indicators of the condition of the resource system are frequently available at a relatively low cost.

R3. Predictability: The flow of resource units is relatively predictable.

R4. Spatial extent: The resource system is sufficiently small, given the transportation and communication technology in use, that appropriators can develop accurate knowledge of external boundaries and internal microenvironments.

Attributes of the appropriators:

A1. Salience: Appropriators are dependent on the resource system for a major portion of their livelihood.

A2. Common understanding: Appropriators have a shared image of how the resource system operates (attributes R1, R2, R3, and R4 above) and how their actions affect each other and the resource system.

A3. Discount rate: Appropriators use a sufficiently low discount rate in relation to future benefits to be achieved from the resource.

A4. Distribution of interests: Appropriators with higher economic and political assets are similarly affected by a lack of coordinated patterns of appropriation and use.

A5. Norms of trust, reciprocity, and punishment: Appropriators trust one another to keep promises and relate to one another with reciprocity.

A6. Autonomy: Appropriators are able to determine access and harvesting rules without external authorities countermanding them.

A7. Local leadership and prior organizational experience: Appropriators have learned at least minimal skills of organization through participation in other local associations or learning about ways that neighboring groups have organized.

Figure 35: list of attributes, retrieved from (Ostrom, 2002)

THE EIGHT DESIGN PRINCIPLES FOR A CPR

The design principles to develop a successful, robust and CPR for the long term.

1. Clearly Defined Boundaries

Individuals or households with rights to withdraw resource units from the common-pool resource and the boundaries of the common-pool resource itself are clearly defined.

2. Congruence

A. The distribution of benefits from appropriation rules is roughly proportionate to the costs imposed by provision rules.

B. Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions.

3. Collective-Choice Arrangements

Most individuals affected by operational rules can participate in modifying operational rules.

4. Monitoring

Monitors, who actively audit common-pool resource conditions and appropriator behavior, are accountable to the appropriators and/or are the appropriators themselves.

5. Graduated Sanctions

Appropriators who violate operational rules are likely to receive graduated sanctions (depending on the seriousness and context of the offense) from other appropriators, from officials accountable to these appropriators, or from both.

6. Conflict-Resolution Mechanisms

Appropriators and their officials have rapid access to low-cost, local arenas to resolve conflict among appropriators or between appropriators and officials.

7. Minimal Recognition of Rights to Organize

The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

For common-pool resources that are part of larger systems:

8. Nested Enterprises

Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Figure 36: design principles for long term succesfull CPRs retrieved from (Ostrom, 1990)

Appendix B Actor analysis

In this appendix a more elaborated actor analysis is presented

AVIAPARTNER

Aviapartner is founded in Belgium and Schiphol is beside Dusseldorf their largest market. The equipment allocation is managed from their headquarters in Brussels. Aviapartner tries to maximize the efficiency of its fleet by pooling the fleet in the organization. So when forecasts show peaks at airports or airlines at the destined airport switch to Aviapartner, they try to move equipment from one airport and ship it to the destined airport.

Attitude, power & interest

After a sale and lease back contract with TCR, the largest part of their equipment is leased from TCR. Also temporary equipment is leased from the GSE like TCR. Owning its own equipment ensures that they can conduct their own management. This is preferable in a dynamic environment and in regards with the very strict contract agreements with the airlines. Equipment pooling is seen as a measure in which Aviapartner loses control over its fleet and activities and where a third party can decide on prices. However there is potential when independency can be assured, so a guarantee of equipment pooling, fair choice of which equipment will be standard. To prevent having actors with all the benefits and actors with all the costs, a strict allocation agreement of the costs and benefits is a prerequisite.

SWISSPORT

Unlike Aviapartner, which is only present at several European airports, Swissport operates in 45 countries over the world. The headquarters are in Zurich, Switzerland, which determines the policy for the company around the world. The Swissport formula is implemented all over the world, meaning that it does not matter at which airport an airline uses the services of Swissport, the product is the same. This has a twofold advantage, airlines know what they can expect and Swissport can buy same equipment for airports all over the world. The purchase of equipment is done by the headquarters in Zurich on request of the departments at the airports. Equipment is allocated all around the world and Swissport tries to maximize the efficiency of the equipment.

The new to develop A pier creates a window of opportunity to implement equipment pooling.

Attitude, power & interest

Swissport at Schiphol handles narrow body and wide body airplanes. The focus of the activities take place at the C-pier, D-pier and G-pier. A lot of equipment is owned and equipment is only leased on temporary basis. For the same reasons as Aviapartner Swissport wants to control its complete process and have no dependence on other third parties. (Their attitude towards EP is not completely clear, but tends to be negative. Since Swissport is one of the four ground handlers at Schiphol and will be responsible for implementing equipment pooling in their current processes, they have a lot of power.

MENZIES

Menzies Schiphol is in terms of personnel and according to the other ground handlers relatively small. This results is short lines of communication and and efficient process between agents and principals. Their biggest customer is easyJet and everything in their operations is optimized to reduce the turn-around time of easyJets aircrafts. easyJet demands an extra high safety and security level when handling flights. This is translated in the safety protocols and procedures Menzies uses. Safety is their number 1 priority and criterion. To assure high safety and security it is of interest that the processes can be standardized and therefor standardizing the equipment. The largest part of their activities take place at the H-pier, specially designed for low-cost carriers like easyJet, and a small part of their activities take place at the G-pier and B-pier. In the past years Menzies renewed its focus to only handle narrow body planes, resulting in efficient business operations.

Attitude, power & interest

Menzies already introduced together with the other ground handlers, KES and the Schiphol Group an equipment pool with stairs at the H-pier. Theoretically this sounds quite promising, however the H-pier is used for 98% by Menzies. So practically spoken there is barely any equipment pooling taking place at the H-pier. The fact remains that Menzies is willing to look for new initiatives to reduce equipment, but there are a lot of concerns about the actual reduction of equipment after implementing equipment pooling. Since also Menzies is one of the four ground handlers for passenger flights at Schiphol and will be responsible for executing the equipment pooling policies, they have power. However when is decided to implement equipment pooling at specific location, their power is limited since they are mainly situated and handling at pier H, for over 84 percent. Also they are relatively small and less differentiation in airlines. easyJet comprises more than 70 % of the handlings and this number will increase the next coming years (Luchtvaartnieuws, 2015).

KLM AS

It's equipment fleet is large and KLM AS can afford to have an equipment package for almost every VOP separately, in contrast to the other handlers. This because the large volume of flights they have to handle every day (Thijssen, 2015). A lot of equipment is KLM-custom-made and standardization between the handlers will therefore be hard to implement. A large volume combined with a very large main client, KLM, makes standardization of the process a beneficial and efficient measure in the ground handling process. KLM AS has standardized processes and equipment, so everyone knows exactly what to expect and what they have to do. The ground handling operation of KLM AS can be compared with a machine bureaucracy (Mintzberg, 2006). The dynamic aviation world forces KLM to reduce costs, putting KLM for interesting challenges in the future. KLM AS is also becoming more and more client oriented. Before the whole organization was organized to carry out operations according to KLM standards, other airlines were only accepted when having similar requirements as KLM. Introducing flexibility and signing contracts for during the off peak hours with other airlines than KLM, results in a more balanced organization in which personnel and equipment is used more equally during the day (Thijssen, 2015).

Attitude, power & interest

KLM is by far the largest ground handler at Schiphol. The success of equipment pooling depends to a significant extent to KLM. Their cooperation can accelerate the process. In this network KLM has a unique power position. KLM AS invests a lot in their own customized equipment. Sharing equipment brings a lot of risks and they do not want to share their equipment with their competitors easily. However when the equipment is owned by other third parties, like TCR or even Schiphol, KLM is willing to cooperate and discuss the possibilities of equipment pooling. According to KLM Schiphol's role as facilitator has to change. Providing infrastructure is not sufficient any more. A lack of space and the increased traffic at airside makes that Schiphol must take a more active role in reducing equipment and control if everyone comply to the rules. Common used equipment seems to have the largest potential according to KLM, for instance stairs and ASUs. The organization structure is essential to consider, so that there will be strict agreements about ownership, financial issues, control etc. This are issues which can be overcome, due to the acknowledgment of increased safety at airside, lower responsibilities and lower costs by KLM. A detailed analysis about the potential of equipment pooling is still desired.

TCR

(TCR, 2013). The ground support equipment companies are growing due to the trend of making ground handlers lean and the financial problems of the ground handlers. The ground handlers now focus on providing service and outsource the investment and maintenance in equipment.

At Schiphol, TCR rents equipment to all ground handlers, especially the cargo handlers but since last years also more and more the passenger handlers. TCR invests a lot in new equipment, to assure a high quality, and in systems which provide the company with information about the equipment, like utilisation and defects. The services provided are leasing their equipment, maintenance and fleet management. The four big ground handlers Aviapartner, Menzies, KLM and Swissport are all leasing equipment of TCR. The negotiations however are though and the ground handlers still often invest in

their own equipment and an equipment pooling concept proposed by TCR was excessively priced. Having their own equipment also preserves their independence. Nevertheless when a contract is fixed between TCR and a ground handler there is an escape option for the ground handler. This escape option can be used when an airline suddenly leaves the airport or cancel the contract with the ground handler.

Attitude, power & interest

In September 2014, TCR UK started an equipment pool in stairs at London Heathrow with quite promising results (Ground Handling International, 2014). TCR acknowledges the potential of equipment pooling. However the corresponding peaks of the ground handlers can reduce the expected benefits of equipment pooling. Since the ground handlers focus on different aspects to distinguish themselves, the quality of the equipment differs. An important aspect to decide upon is whose quality standard will become standard (Spijker, 2015).

SPS

Within 15 year SPS have become one of the largest players in Europe. A lot of the equipment it leases is made by SPS self. Looking at the shortcomings of current equipment, SPS develops equipment which overcome these shortcomings (Hockemeijer, 2015)(Landman, 2013).

The ground handlers often outsource the maintenance of their non-motorised equipment to SPS. Also equipment is leased from SPS. SPS uses yearly contract in which is arranged that SPS is responsible for maintenance, letting the frequency of maintenance and repairs out of the contract (Thijssen, 2015). When non-motorised equipment is considered, SPS can play a role in providing stairs, dollies and baggage carts.

Attitude, power & interest

When considering equipment pooling, SPS can play a role in providing stairs, baggage carts and dollies. This equipment can even be made by SPS. However SPS is concerned about the number of ground handlers at Schiphol, and sees the current situation as an undesired situation. Agreements about the responsibility for the equipment will therefore be difficult to make and liability issues are complex due to a lot of involved parties.

KES

In order to still have a form of competition not all equipment is maintained by KES, also SPS and TCR lease and maintain some equipment for KLM ground handling.

Ground handlers can fix contracts with KES for a short or longer period. At Schiphol a GPU pool consists. On almost every VOP a GPU is present. These are owned by KES and with the help of a card system, costs can be easily passed on to the ground handlers. This is a way of equipment pooling and a successful one.

AAS AA

It is acknowledged by them that a big parking problem is rising at airside. Due to this problem, the safety and security at airside become endangered. They are the executives of the airport rules and therefor have a strong mandate. If security and/or safety are at stake, this department will act to increase safety and security. Schiphol has a high safety and security standard, this results in a lot of power for Schiphol Airport Authority & Enforcement.

Attitude, power & interest

At airside there is a lack of space for all the equipment. The airport is growing every year in number of aircrafts and passengers handled. This results in more traffic and movements at airside. However since all the involved parties at airside often have no other place to deploy equipment or staff, small violations are tolerated. Measures which can lower the amount of equipment and movements will be embraced by Authority & Enforcement. This kind of measures will increase safety and security. That is why this department sees advantages in equipment pooling.

AAS PMA

Attitude, power & interest

They are the client for this research. For them efficient processes at airside in which costs are low and safety is high are key. Schiphol can facilitate and stimulate equipment pooling. Depending on the chosen design, the role for Schiphol will become clear. Initially Schiphol will bring the different involved actors together, especially the ground handlers and ground service equipment companies. Schiphol's power on the equipment pooling issue is limited to a facilitating job. However due to the many interdependencies of the different actors with Schiphol, Schiphol is powerful. Schiphol has also the ability and the will to give financial support.

SAOC

SAOC is an abbreviation of Schiphol Airline Operators Committee. SAOC is founded according to IATA and ICAO recommendations, to create a platform in which the airlines can discuss strategically and operational issues and bundle forces to other parties like the Schiphol Group.

The most important issues for the SAOC are ensuring safety and security, reduce costs where this is possible and create an efficient process in aircraft handling. They addressed equipment pooling as possibility to reduce costs for the ground handlers and eventually lower ground handling costs for the airlines. Thereby comes the fact that the safety and security is under pressure during the ground handling process. This has several reasons, including a general lack of space, too many movements of equipment at airside and toleration of small violations of the Schiphol rules.

Attitude, power & interest

The SAOC is not looking for an active role in implementing equipment pooling, since this is an issue the ground handling sector has to solve. However the Service Level Agreements (SLA) between airlines and ground handlers, give the airlines a lot of power and these SLAs cause stress and problems for the ground handlers. The power of the SAOC itself is limited.

OTHER PLAYERS

There are a few other players who are worth mentioned. With some of them an interview has been conducted. The other actors are actors which are not directly involved in the equipment pooling issue, but if the scope is broadened or they can make a contribution so equipment pooling can be implemented they can suddenly play a significant role.

WFS

A cargo handler situated at Schiphol and a lot of other airports, 120, around the globe. They are responsible for a lot of freight in the belly of passenger aircrafts. Since the cargo throughput at Schiphol is growing, WFS grows along. The equipment of the different handlers is already shared when one has a shortage. However on a higher management level, the managers are not willing to cooperate and cooperation is not allowed.

WFS is only responsible for a small aspect of the ground handling process of passenger aircrafts. This results in more movements at the VOPs. Combining cargo can reduce transporting costs, since the last kilometre is often the most expensive. WFS can play a role and will become an active actor when dollies and cargo carts are considered.

Advantages	Concerns
Higher utilisation	Standardization of equipment
Reduction in movements & costs	Responsibility
	Peak redundancy

Table 33: WFS' expected advantages & concerns of equipment pooling

Power, interest attitude table

Actor	Power	Interest	Attitude
Aviapartner	+	++	+-
Swissport	+	++	+
Menzies	+-	-	-
KLM Aircraft Services	++	+	+
KLM Equipment Services	-	+-	+-
TCR	+	+	+-
SPS Group	+	+-	+-
Schiphol Group - AO/Authority & Enforcement	+	+	+
Schiphol Group – AO/ Process management airside	+	++	+
SAOC	+-	+-	+
SPS	+	+	+
WFS	+-	-	+

Table 34: Overview of actors and their attitude, power and interest

Appendix C Risk analysis actors

In this appendix the several risks are given more substance.

Financial risks

In this industry where the margins are already really low, between 3 to 4%, higher financial risks will not be accepted. Assurance about the allocation of costs must be made clear and unambiguous. The process can be delayed or even be stopped if the parties are not content with the financial agreements. Quantification of the costs and benefits of equipment pooling will help the process and can take away concerns. Questions about the allocation of cost and benefits have to be answered later in the process.

Policy risks

All the ground handlers pursue a different policy. One's policy is based upon quality, the other on full efficiency through the whole organization. So a risk arises about which policy will be leading during equipment pooling. Parties have to give in on quality or accept a higher quality standard. Or have to give up some independencies to realize a higher benefit and more collaboration between each other. Most of the ground handlers are not anxious about a diminishing unique selling point. However the fact remains that giving up independencies in the operational process can cause tensions and actors who want to block the process. A strategy how to tackle this problems needs to be designed.

Organizational risks between actors

Organizational risks appear because the extent of equipment pooling and the influence on the daily business will be bigger than the similar projects like the stairs at the H-pier or the GPU pool operated by KES. Equipment pooling is a form of collaboration, so parties have to work together. To assure a proper working equipment pool, agreements and or contracts about the organization of the pool have to be made. Issues that need to be taken into consideration are the organizational structure of the pool, liability agreements, responsibility and ownership of the equipment and how the decision power of the different actors is embedded. Since most of the issues mentioned are implementation issues and contractual agreements, this will not be taken further into account during this research. However it will be issues with a high priority to discuss in detail when a form of equipment pooling is accepted.

Though the actors were given the opportunity to give their opinion, concerns and ideas about the chosen form. Eventually Schiphol can use these insights to suggest and support structures in which concerns will be taken away. Thereby, this gives also insights in the hesitating opinion of ground handlers and the other parties.

Internal Organizational risks

Eventually the involved ground handlers want to improve the efficiency, in which less equipment is used for the same amount of handlings. Less equipment results in less personnel. The loss of jobs can be covered by the expected growth at Schiphol. Nevertheless less personnel is needed to complete the ground handling tasks and fulfil the contractual requirements.

Influence on process, making processes more lean. So internal changes can be expected. The question is if the persons responsible for the internal transitions are powerful enough to change the traditional processes and can organize the company more towards a lean organization in which the cost reductions are realized. Equipment pooling can be seen as resource pooling within the organisation and personnel is a kind of resources. Opposition against the proposed plans can be expected.

A principal agent problem can also lay ahead in the organizations (Jensen & Meckling, 1976). Where the agents of different handlers already share equipment when needed, at principal level this is definitely ruled out. The higher management levels of the different companies face each other during contract offers for airlines. This is a fierce and hard competition, where the ground handlers, sales department, only see each other as competitors. Instead of at a lower level where co-opetition is commonplace/ It will be a challenge for the operational managers to engage and commit the other personnel to the new structure and new concept of equipment pooling. However the involved representatives have a certain amount of remit, which gives them significant clout. The implementation and the conviction of the

personnel is something for the ground handlers, Schiphol and ground service equipment companies themselves and will not be taken further into account. Some guidelines will be provided to have a basis which the personnel can use to persuade the organization

SENSITIVITY RISKS

Like earlier written, equipment pooling will make the ground handling process more vulnerable of disruptions. Less inventory means less space to manoeuvre and to be flexible. A more efficient and effective process results in lower costs which can to a large extent outweigh the loss in flexibility.

When only VOP bounded equipment is considered, a loss in flexibility will not be the case, since there will always be equipment present at the designated VOP. However when other equipment is considered a loss in flexibility occurs.

Equipment pooling makes the ground handlers more sensitive to external factors. With external factors is meant the other actors, since when they are longer busy handling aircrafts this results in a more sensitive system, since the guarantee of 100% availability all the time is harder to promise.

Risk	For who
Financial risk	
1. Allocation of the costs & benefits	Ground handlers & GSE
2. Financial potential of Equipment Pooling	Ground handlers & Schiphol Group
Policy risks	
1. Determining own policy	Ground Handlers
2. Possible block of process	Schiphol Group
External organization risks	
1. Inter-organizational structure	Ground handlers, GSE & Schiphol Group
2. Liability	Ground handlers & GSE
3. Responsibility equipment	Ground handlers & GSE
4. Higher level management agreements	KLM & Schiphol Group
Internal organization risks	
1. Principal-agent risk	Ground handlers & GSE
2. Persuading all persons in organization	Everyone
Sensitivity risks	
1. Flexibility vs efficiency	Ground Handlers
2. Dependent on other ground handlers	Ground Handlers
3. Real reduction in movements	Schiphol Group

Table 35: Overview of the risks

Explanatory notes:

- There is a risk that the higher level management decides something else, than what the middle management managers agreed upon. This is specifically the case in the KLM and Schiphol relation, because the two companies are highly dependent on each other, initiatives can fall so the relationship remains good (de Bruijn & ten Heuvelhof, 2008). For the remaining of this research this is out of scope, since there is less what the involved actors can do about this and not aware of.
- AAS has no influence in determining the policy of the ground handlers. Also AAS can only support the equipment pool. However equipment pooling can be blocked, because ground handlers are afraid of losing the control in determining its own policy.

Appendix D Actor Approach

The results of the actor analysis made clear that AAS' power is limited. Using a command and control strategy will also not work at the airport, because it is AAS' policy to use a soft control strategy towards other parties and looks to create commitment along all the actors. The underlying idea is that the airport has to be run together to be and stay Europe's preferred airport.

The approach towards the actors excludes the command and control strategy. As earlier mentioned commitment needs to be created. In this section an approach is written.

Ground Handlers

There is a significant difference between the business models of KLM and the other ground handlers, Aviapartner, Swissport and Menzies. KLM is by far the largest ground handler at the airport. Being able to make significant improvements at airside, KLMs involvement is necessary. Overcoming the difference in business models, a design which not influences the current business models has the largest potential to become successful (de Bruijn & ten Heuvelhof, 2008). This difference, also described as heterogeneity, can be overcome by rules of good allocation of costs. The difficulty is that the shared understanding, necessary before the equipment pool can be established is missing.

All ground handlers acknowledge the theoretical potential of equipment pooling. However when considering implementing it, it is unknown what the real benefits are and to what extent equipment pooling can reduce the amount of equipment and movements at airside. So preliminary analyses about the potential will provide substantive and convincing information.

Equipment pooling as a solution for parking issues is disputed. This is making equipment pooling a one-issue decision process. If equipment pooling can become a multi-issue game the chance for success increases. New issues which make the process of decision making more attractive to the actors can help.

1 Creates room for giving and taking
2 Incentive for cooperative behaviour
3 Chances of desired and unforeseen outcomes (because of the coupling, lot of outcomes possible)
4 Make trade-offs
5 Actors willing to abandon goals

Create win-win-win situation

If the full theoretical potential of equipment pooling can be fully exploited, a win-win-win situation can be realized. A win situation for ground handlers; less equipment, equipment movements will result in lower costs and a less complex, more safe process. A win situation for airlines; safer airside, reduction in turnaround time and lower costs. A win situation for the airport; smooth handling process at airside, less space utilization, safer airside.

If the win-win-win situation can last for a long time, the involved actors will be committed for a longer time to execute the plan as decided (de Bruijn & ten Heuvelhof, 2008).

A ground handler wants to be flexible, because of the potential disruptions handling aircrafts. These disruptions can have a lot of different causes, like severe weather, strikes, closure of other airports etc. However flexibility comes with a price. The efficiency of the organization decreases. Equipment pooling is a priori an efficiency measurement. The ground handlers have to make a trade-off between efficiency and flexibility. To give them a fair chance for a proper weighing of the trade-off, the concept needs to be quantified.

Safety & security

An emphasis on safety and security can enhance the chance of success. All the parties agree on the importance of safety and security at airside. This is a shared core value, which stands above all other

important factors and trade-offs of the involved organizations. So when equipment pooling can increase safety, this will definitely increase the potential and successful implementation of equipment pooling.

QUANTIFICATION

There are concerns about the potential of equipment pooling. It is unknown which costs and benefits the concept has. Also if the potential can be exploited when keeping the peak structure present at Schiphol in mind. Quantification will give equipment pooling a far more substantive basis than just being a concept. Instead of just discussing it and have prejudiced opinions about equipment pooling.

A-PIER: WINDOW OF OPPORTUNITY

Above; only existing piers are discussed. In order to be able to handle the expected growth of passengers, Schiphol has planned a new pier: Pier A (Schiphol Group, n.d.). The designs and developments of this pier are in full progress and a final decision will be made in the coming year. The pier is situated south of the current B-pier and will overlap a part of the current B-buffer. Since a lot of decisions still has to be made and there is a lot to decide upon, a window of opportunity arises (Kingdon, 1984). It is hard for the ground handlers to hold on their traditional ground handling process, this pier is located relatively far away from the rest of the activities. Mainly because the wide body aircrafts are nowadays handled at the E,F or G-pier, which are situated at the other side of the airport. The ground handlers are receptive to innovative ideas and ideas that deal with the shortcomings of ground handling at the current piers (Gerbracht, 2015; Thijssen, 2015; Weerdmeester, 2015). Thereby comes that this is a new area in which they are not yet busy working, so it is easier to implement new concepts like equipment pooling and if necessary oblige them to use it.

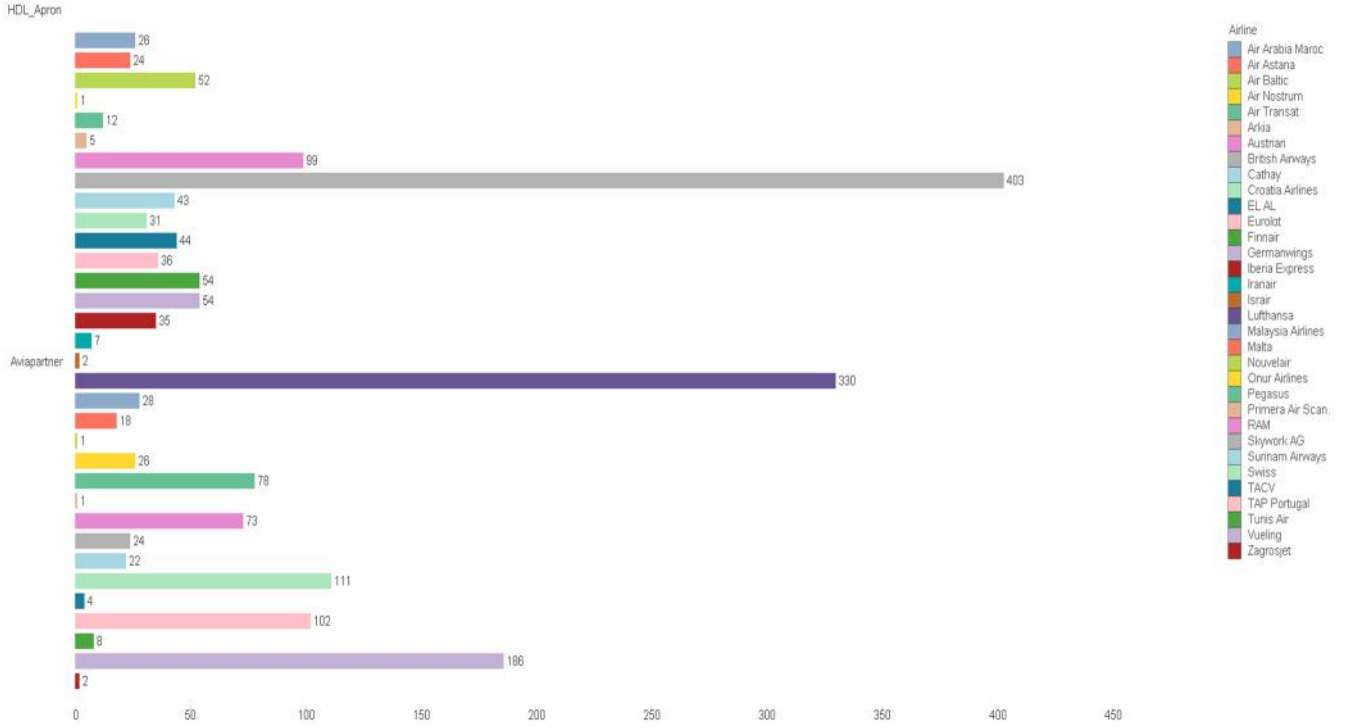
ABOUT ACHIEVING COLLABORATION: OTHERS WHO INVEST IN THE EQUIPMENT POOL

Often this are also not the core activities of the ground handlers and they are relatively easy convincible to cooperate.

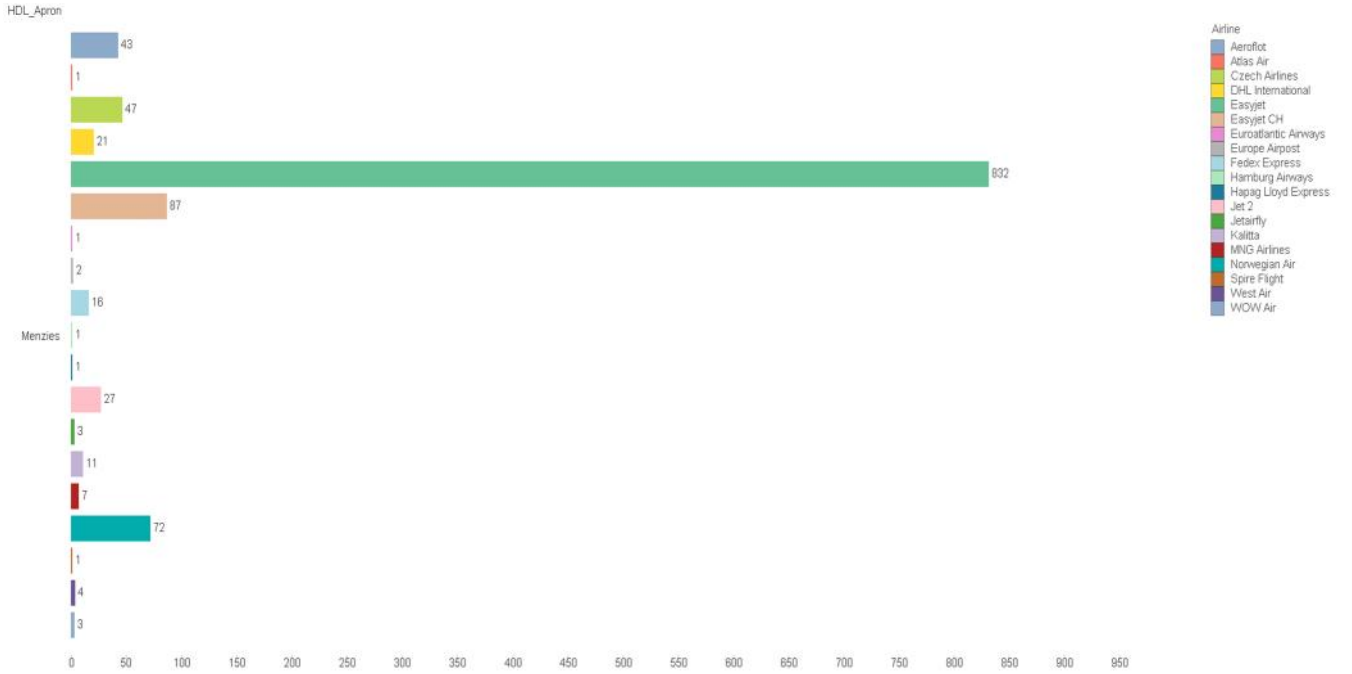
Appendix E Airline per ground handler

In the following charts the distribution of airlines per ground handler is shown. The number of flights handled by the handler is included. One remark during 2014 Aeroflot switched from handler, so Aeroflot can be seen in the chart of Swissport and Menzies.

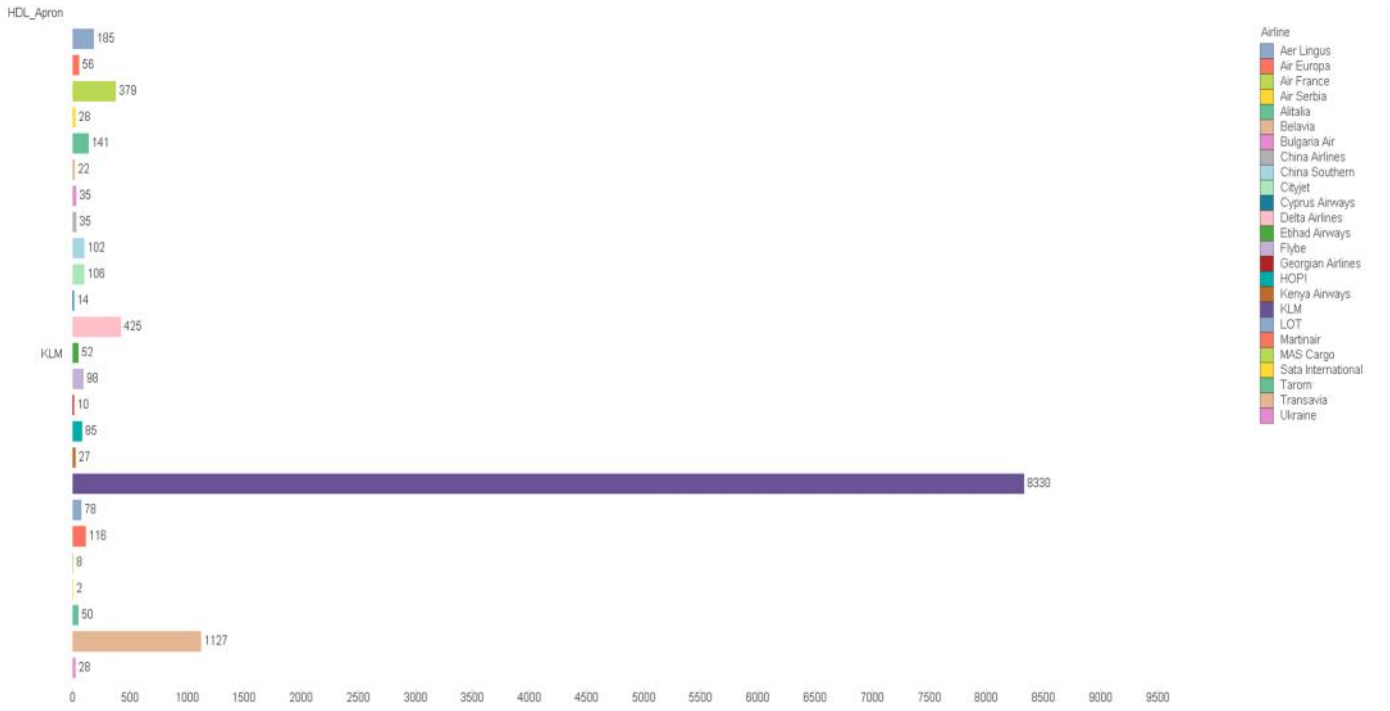
Aviapartner



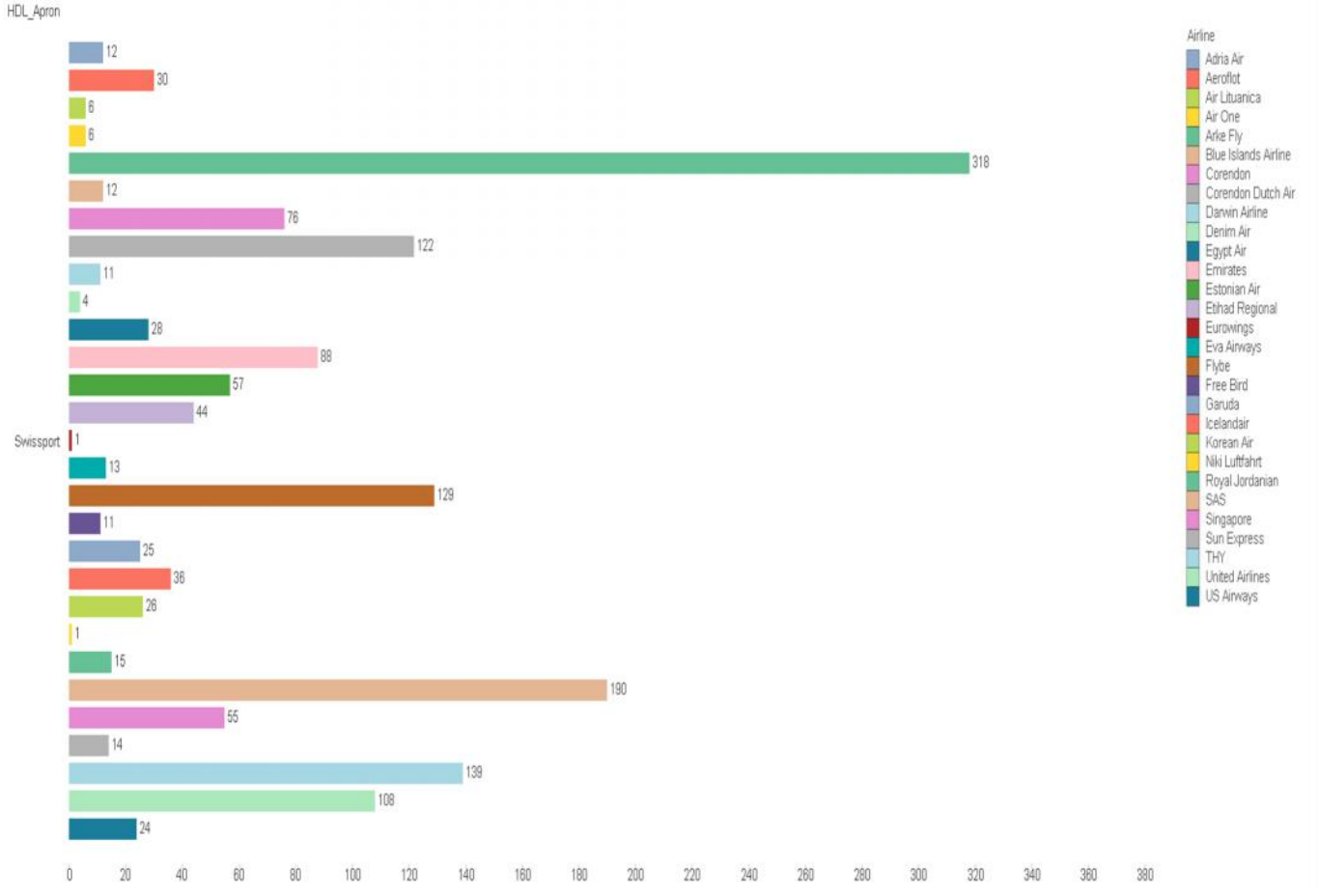
Menzies



KLM



Swissport



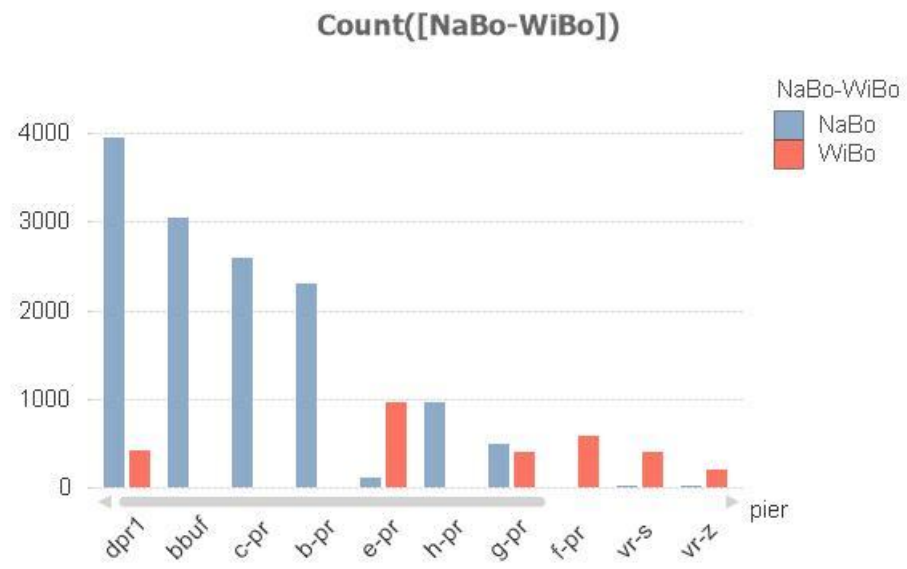
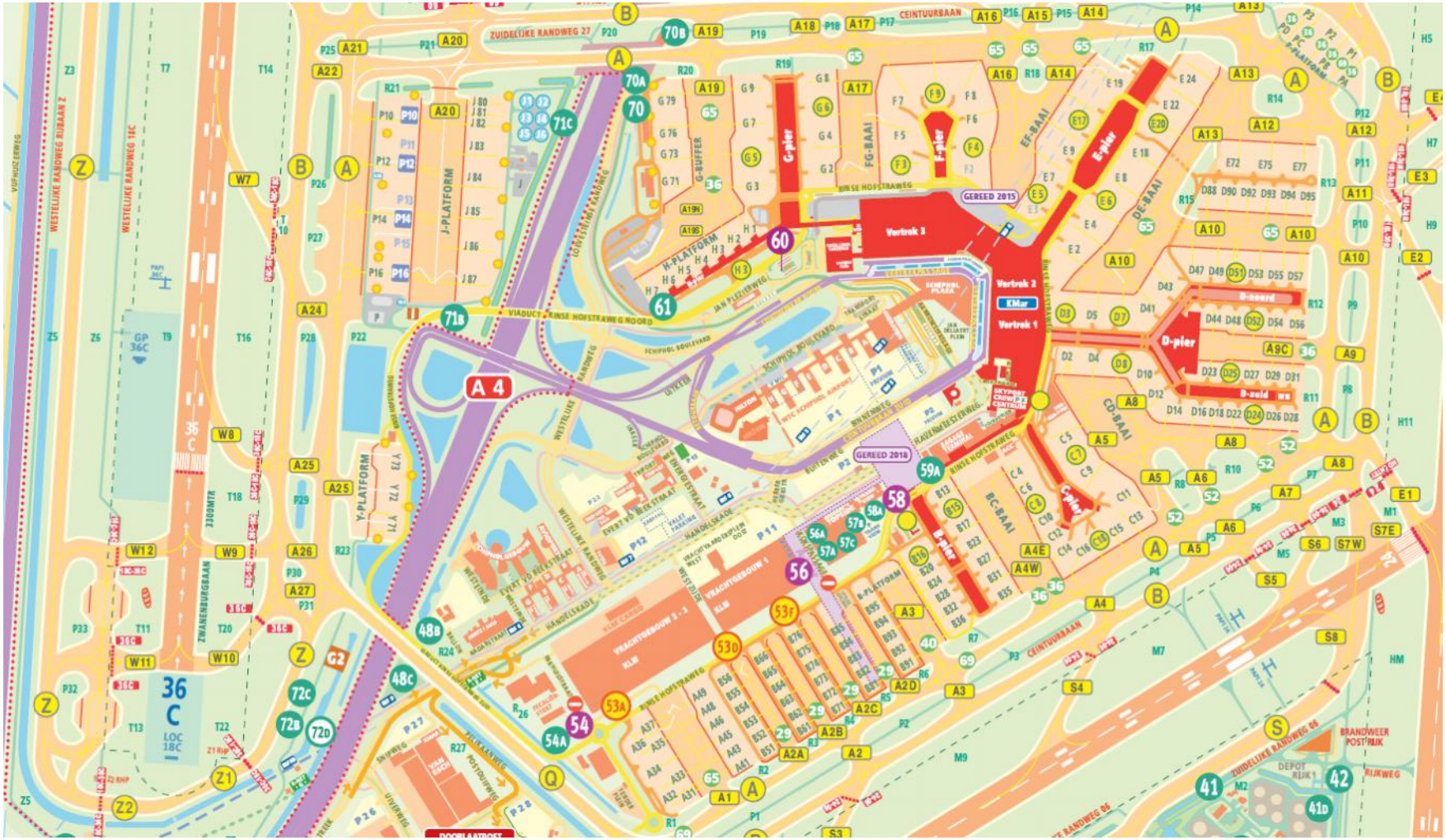
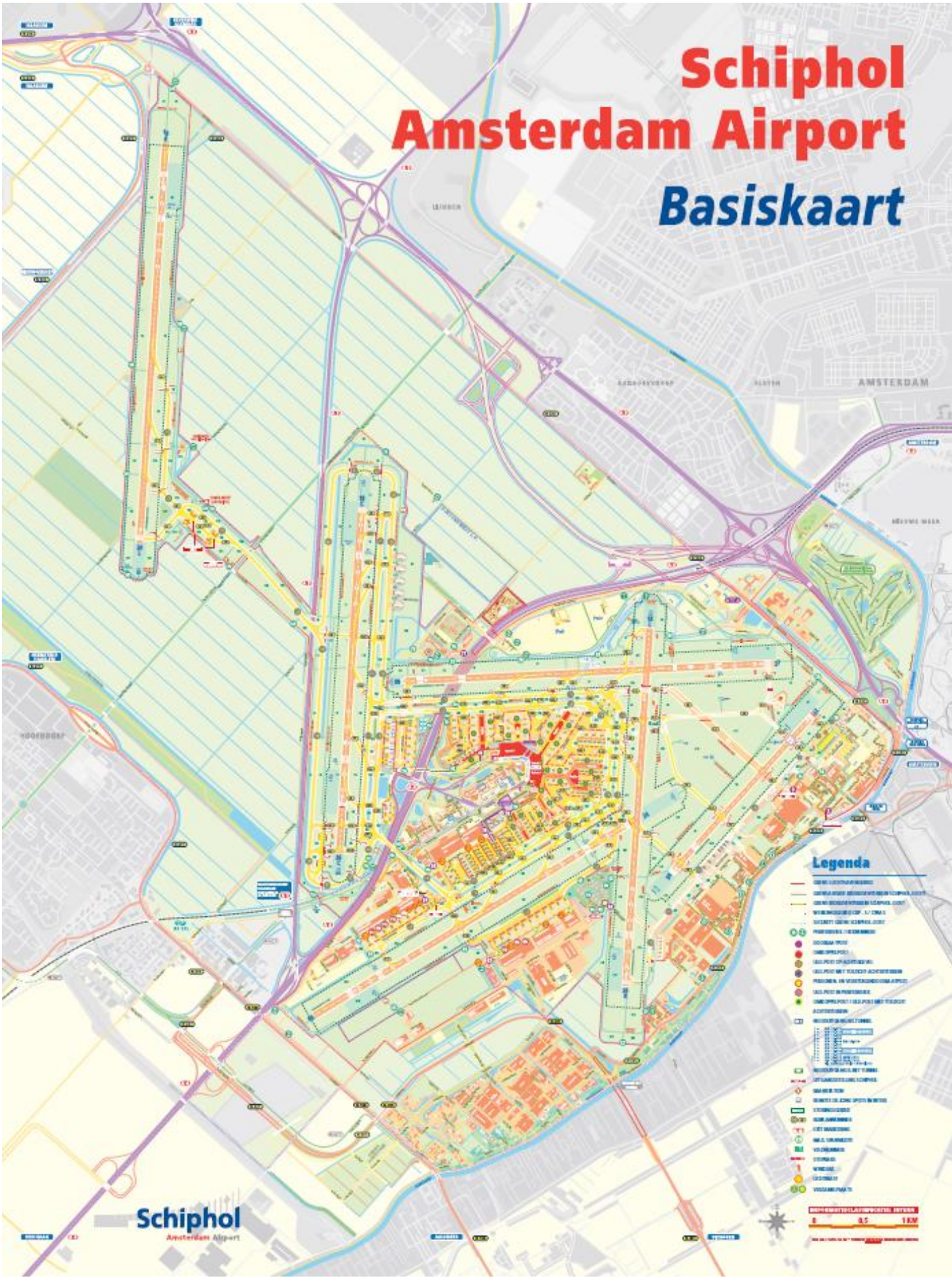


Figure 37: amount of narrow body & wide body aircraft handled at the piers

Appendix F Overview passenger piers

Below a map of the passenger piers is shown. One remark, the VOPs starting with an A belong to the B-buffer. To give an indication of scale the A-4 part between the two aircraft viaducts (from 48B-70A) is around 1.2 kilometre.




Schiphol
Amsterdam Airport
Basiskaart
AMSTERDAM
Legenda
Schiphol
Amsterdam Airport

Appendix G VOPs

The table below gives an overview of the number of VOPs per pier and per platform

Pier	Number of VOPs
B-platform	41
B-pier	13
C-pier	14
D-pier	33
D-buffer	6
E-pier	14
E-buffer	3
F pier	8
G-pier	8
G-buffer	4
H-pier	7
J-buffer	8
Y-buffer	3
Pier VOPS	97
Platform	41
Buffer	24
Total	162

Appendix G.1 Closed VOPS at AAS

Below the table which contains information about closed VOPs during the used data set are shown.

VOP	Start date	End date	Duration	VOP	Start date	End date	Duration
B15	15-9-2014 07:00	16-9-2014 07:00	24 hour	**E08**	31-7-2014 21:00	1-8-2014 05:00	8 hour
D03	14-9-2014 21:00	15-9-2014 06:00	9 hour	**E08**	1-8-2014 21:00	2-8-2014 05:00	8 hour
D03	18-9-2014 21:00	19-9-2014 06:00	9 hour	**E20**	15-9-2014 15:00	15-9-2014 23:00	8 hour
D23	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**E22**	16-9-2014 15:00	16-9-2014 23:00	8 hour
D23	16-9-2014 22:00	17-9-2014 00:30	2,5 hour	**E22**	17-9-2014 15:00	17-9-2014 23:00	8 hour
D24	14-9-2014 22:00	15-9-2014 00:30	2,5 hour	**E24**	19-9-2014 15:00	19-9-2014 23:00	8 hour
D25	15-9-2014 22:00	16-9-2014 00:30	2,5 hour	**E24**	18-9-2014 15:00	18-9-2014 23:00	8 hour
D26	15-9-2014 01:00	15-9-2014 03:30	2,5 hour	**F02**	1-1-2014 00:01	31-12-2014 23:59	8759,97 hour
D27	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**F03**	27-1-2014 00:00	13-4-2014 23:59	1847,98 hour
D27	16-9-2014 01:00	16-9-2014 03:30	2,5 hour	**F03**	17-9-2014 21:00	18-9-2014 05:00	8 hour
D28	15-9-2014 03:30	15-9-2014 06:00	2,5 hour	**F03**	18-9-2014 21:00	19-9-2014 05:00	8 hour
D29	16-9-2014 03:30	16-9-2014 06:00	2,5 hour	**F03**	19-9-2014 21:00	20-9-2014 05:00	8 hour
D31	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**F04**	30-7-2014 02:00	30-7-2014 05:00	3 hour
D31	17-9-2014 01:00	17-9-2014 03:30	2,5 hour	**F05**	27-1-2014 00:00	13-4-2014 23:59	1847,98 hour
D43	15-9-2014 15:00	16-9-2014 05:00	14 hour	**F05**	15-9-2014 21:00	16-9-2014 05:00	8 hour
D43	15-9-2014 15:00	16-9-2014 05:00	14 hour	**F06**	16-9-2014 21:00	17-9-2014 05:00	8 hour
D44	17-9-2014 03:30	17-9-2014 06:00	2,5 hour	**G03**	16-9-2014 15:00	17-9-2014 05:00	14 hour
D46	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**G03**	17-9-2014 15:00	18-9-2014 05:00	14 hour
D48	17-9-2014 22:00	18-9-2014 00:30	2,5 hour	**G03**	7-9-2014 18:00	26-9-2014 18:00	456 hour
D51	21-9-2014 22:00	22-9-2014 00:30	2,5 hour	**G04**	29-7-2014 22:00	30-7-2014 02:00	4 hour
D52	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**G06**	10-3-2014 21:00	11-3-2014 05:00	8 hour
D52	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**G06**	11-3-2014 21:00	12-3-2014 05:00	8 hour
D52	18-9-2014 01:00	18-9-2014 03:30	2,5 hour	**G06**	12-3-2014 21:00	13-3-2014 05:00	8 hour
D54	18-9-2014 03:30	18-9-2014 06:00	2,5 hour	**G06**	27-7-2014 21:00	28-7-2014 06:00	9 hour
D55	19-9-2014 03:30	19-9-2014 06:00	2,5 hour	**G06**	29-7-2014 15:00	30-7-2014 05:00	14 hour
D56	5-1-2014 00:00	23-3-2014 23:59	1871,98 hour	**G06**	30-7-2014 15:00	31-7-2014 05:00	14 hour
D56	18-9-2014 22:00	19-9-2014 00:30	2,5 hour	**G08**	10-3-2014 21:00	11-3-2014 05:00	8 hour
D57	19-9-2014 01:00	19-9-2014 03:30	2,5 hour	**G08**	11-3-2014 21:00	12-3-2014 05:00	8 hour
E02	19-9-2014 21:00	20-9-2014 06:00	9 hour	**G08**	12-3-2014 21:00	13-3-2014 05:00	8 hour
E03	1-1-2014 00:01	31-12-2014 23:59	8759,97 hour	**G08**	27-7-2014 21:00	28-7-2014 06:00	9 hour
E04	15-9-2014 21:00	16-9-2014 05:00	8 hour	**G08**	29-7-2014 15:00	30-7-2014 05:00	14 hour
E04	16-9-2014 21:00	17-9-2014 05:00	8 hour	**G08**	30-7-2014 15:00	31-7-2014 05:00	14 hour
E04	18-9-2014 21:00	19-9-2014 05:00	8 hour	**G09**	10-3-2014 21:00	11-3-2014 05:00	8 hour
E07	1-1-2014 00:01	26-1-2014 23:59	623,97 hour	**G09**	11-3-2014 21:00	12-3-2014 05:00	8 hour
E08	28-7-2014 21:00	29-7-2014 05:00	8 hour	**G09**	12-3-2014 21:00	13-3-2014 05:00	8 hour
E08	29-7-2014 21:00	30-7-2014 05:00	8 hour	**G09**	13-3-2014 21:00	14-3-2014 05:00	8 hour
E08	30-7-2014 21:00	31-7-2014 05:00	8 hour	**G09**	14-3-2014 21:00	15-3-2014 05:00	8 hour

Table 36: closed VOPs

Appendix H Quick scan

For more results, contact the author.

July	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	126	117	128	122	123	124	122
	116	101	108	109	110	117	104
reductie p.d.	10	16	20	13	13	7	18
met memory	127	123	132	123	127	127	128
	117	105	111	111	112	120	108
	10	18	21	12	15	7	20
Sep	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	126	123	119	130	119	100	123
	112	106	108	115	104	88	107
reductie p.d.	14	17	11	15	15	12	16
met memory	131	126	124	134	124	104	132
	117	109	111	119	110	88	113
reductie p.d.	14	17	13	15	14	16	19
Jan	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	126	123	122	124	117	113	116
	114	114	114	117	105	108	105
reductie p.d.	12	9	8	7	12	5	11
met memory	130	127	131	128	118	121	123
	119	118	121	121	105	114	112
reductie p.d.	11	9	10	7	13	7	11
March	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	125	127	121	126	118	124	126
	118	117	108	117	114	118	112
reductie p.d.	7	10	13	9	4	6	14
met memory	130	132	130	130	124	130	131
	123	122	117	121	120	124	115
reductie p.d.	7	10	13	9	4	6	16

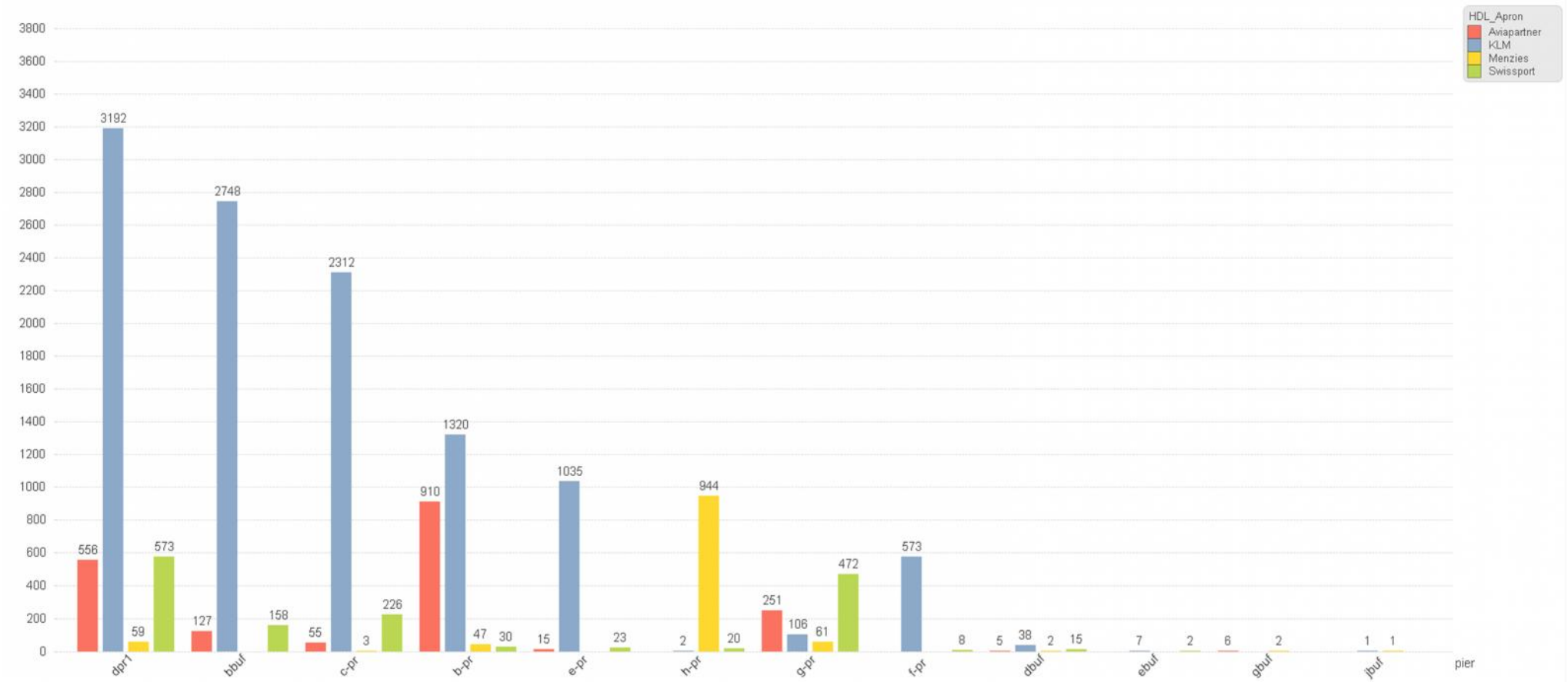


Figure 38: Overview of handlers per pier at Schiphol

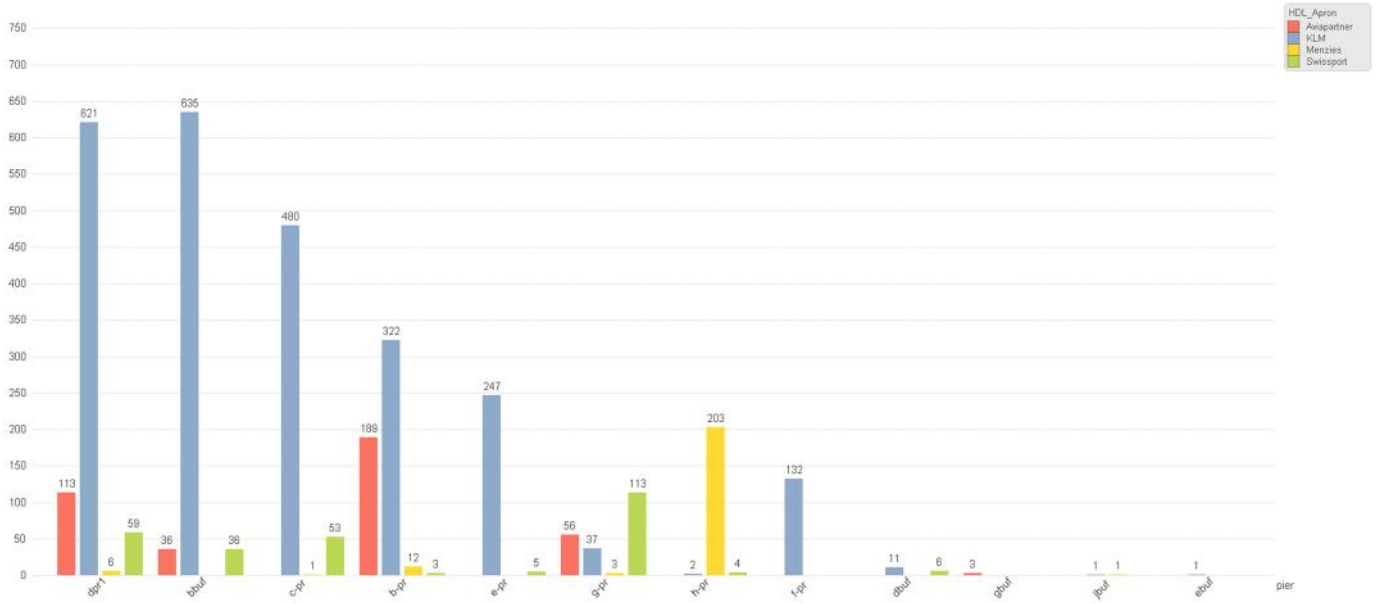
Appendix H.1 Chosen weeks 2014

In consultation with an AAS expert on flight data the following weeks in 2014 were chosen:

- January (13-19 January)
- March (10-16 March)
- July - Augustus (28 juli-3 Augustus)
- September (15 – 21 September)

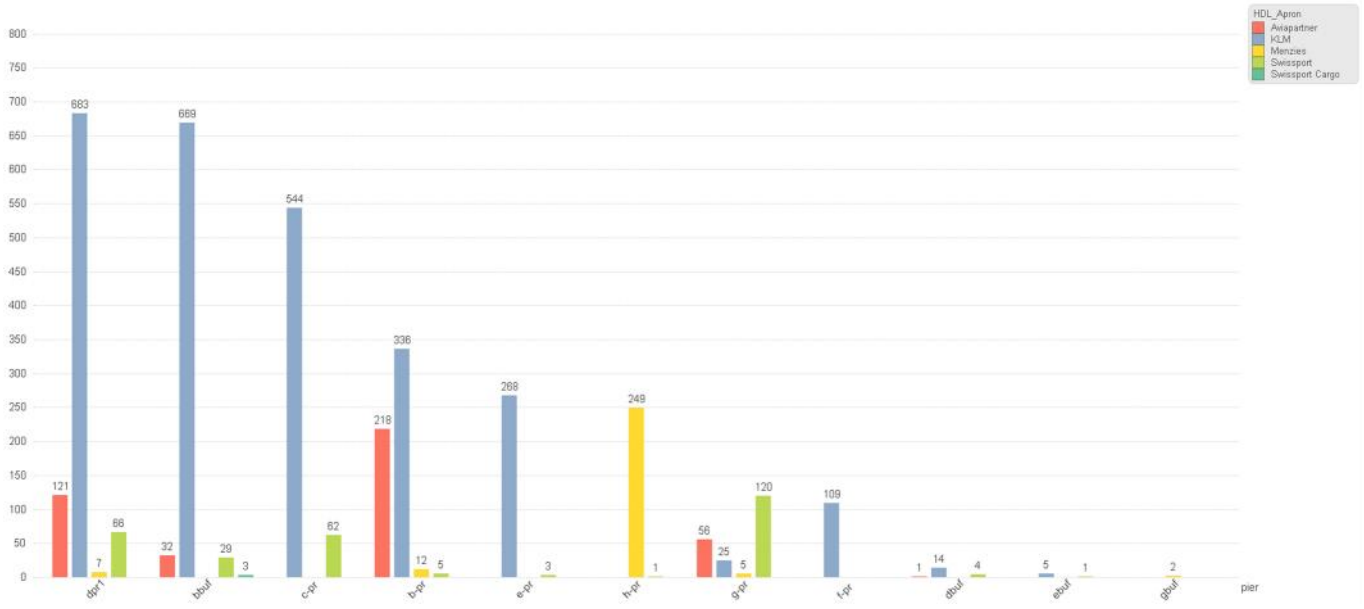
January

The handlings per ground handler per pier are shown for January



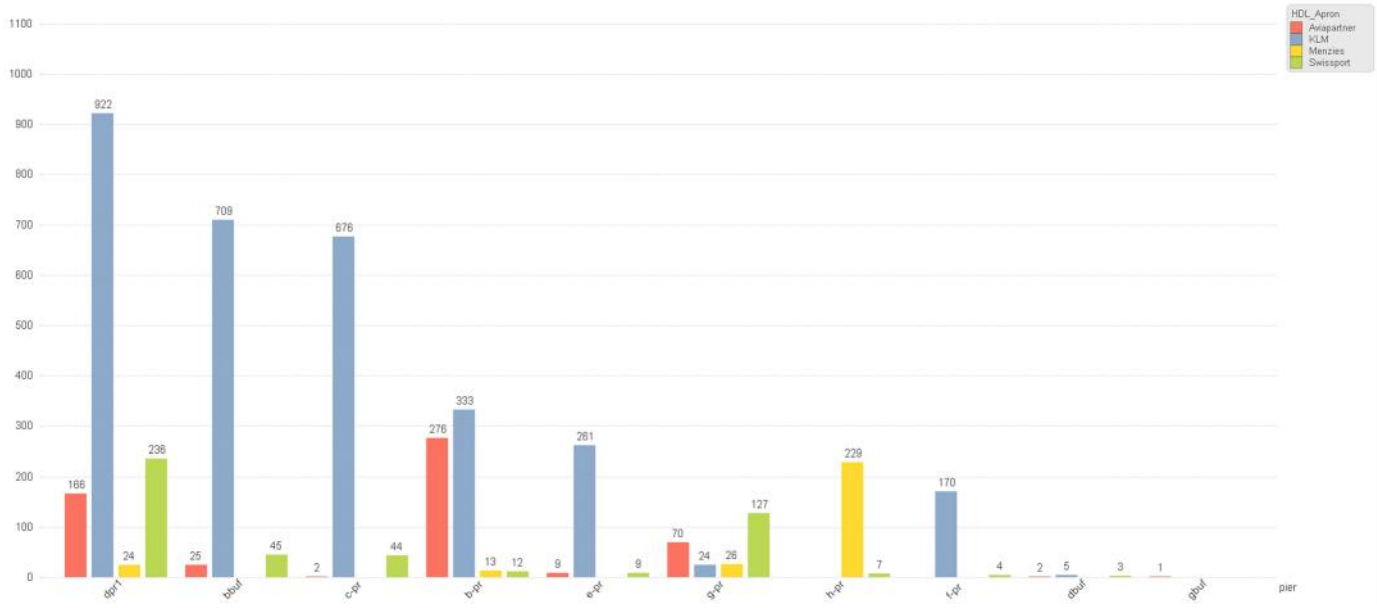
March

The handlings per ground handler per pier are shown for March.



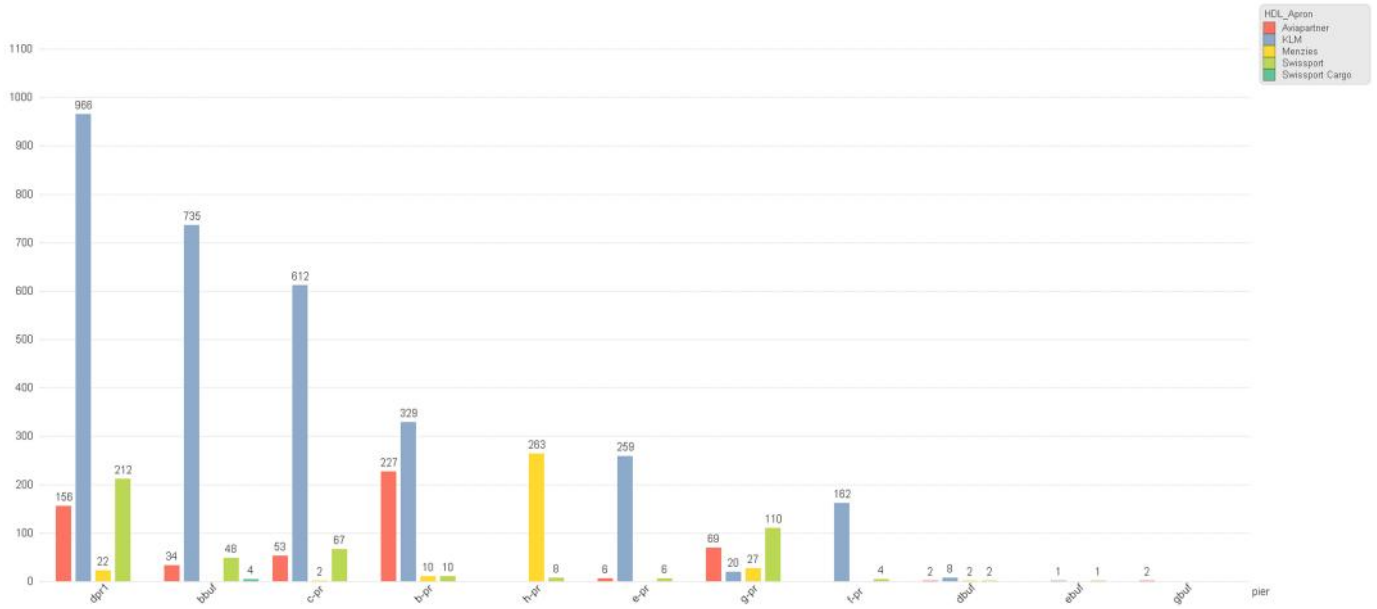
July - August

The handlings per ground handler per pier are shown for July – August.



September

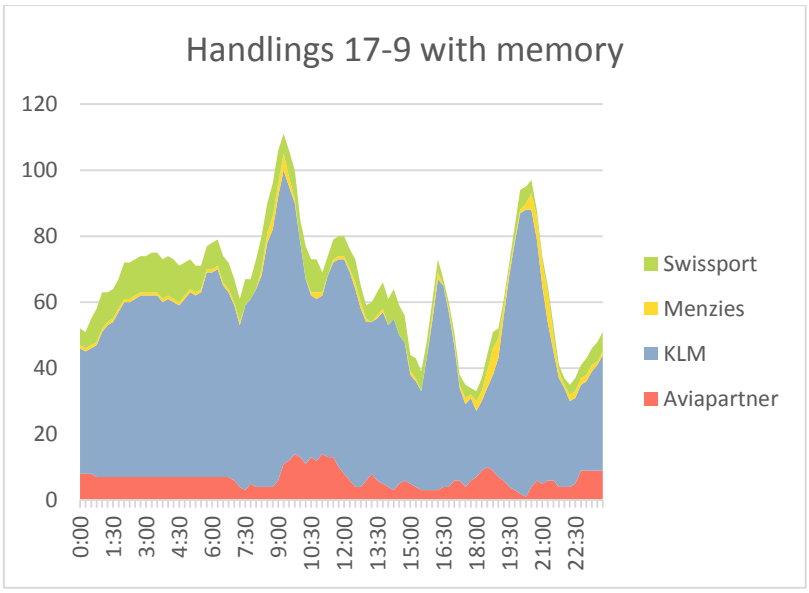
The handlings per ground handler per pier are shown for September.

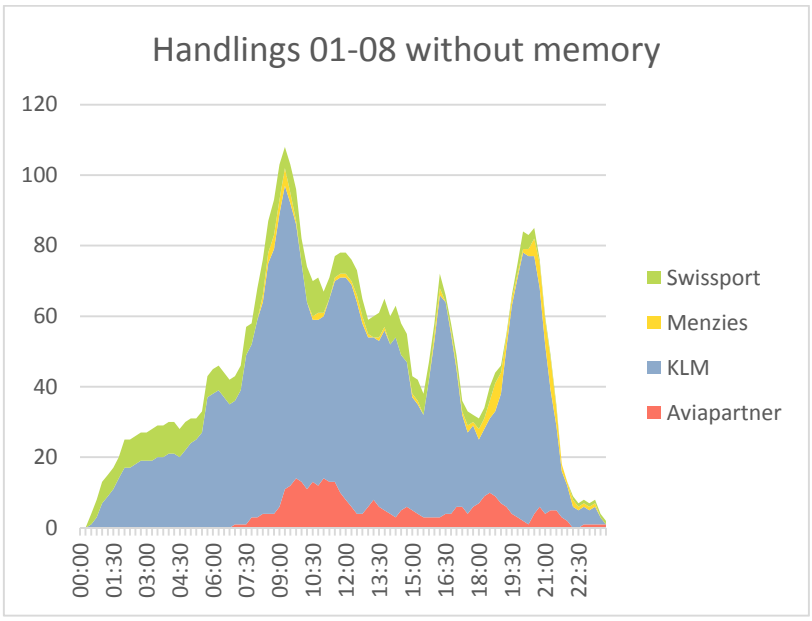


Appendix H2 Example: Model with & without memory

Below gives an example of the difference between a model with and without memory. There are small differences, since none of the models is a real representation of reality both the models are taken into account. For the model with memory this means that stairs are used during whole the night and mainly a part of the morning, while the stairs are probably not been used all the time. Thereby the flight leaves at the same day of arrival, while actually the flight leaves the next day. Due to model complications and limitations this is impossible to implement and since the quick scan is used for a first view not worth the investment. Besides since this is done for every day, so eventually it is averaged.

The model without memory starts each day with a clean sheets, so flights arriving in the evening and leaving the next morning, are not taken into account that next morning. Every day at 0:00 the model starts from zero and counts the incoming and outgoing flights on that day. Therefor the morning peak is sometimes lower than the actual peak. There are peak differences between the two models, but not to a very large extent. So both models have its advantages, but the truth lies midway. The 17th of September 2014 is taken as example date.



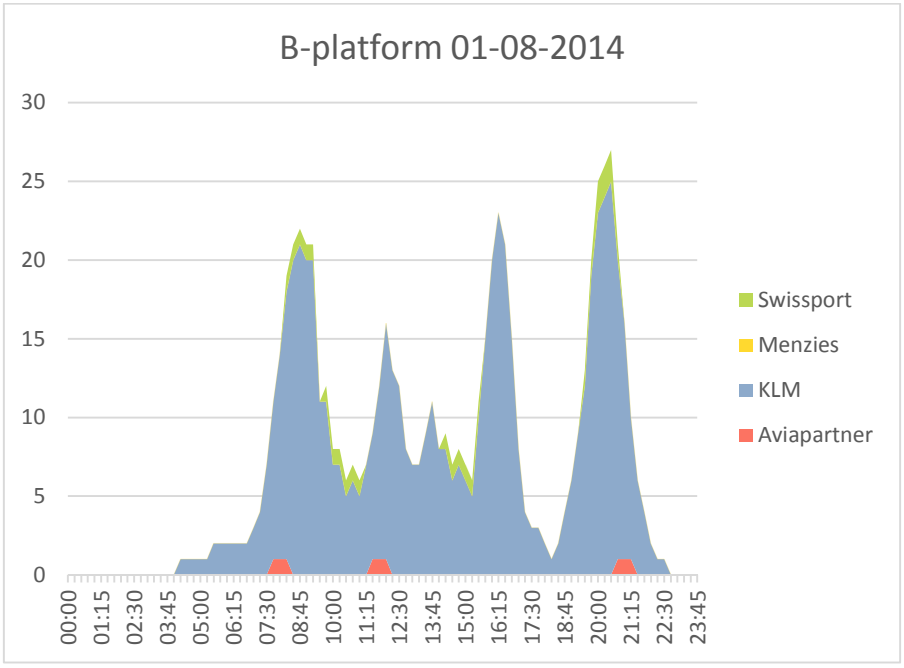


	With memory	Without memory
Totale max	124	119
Max piek	111	108
Potential reduction	**13**	**11**

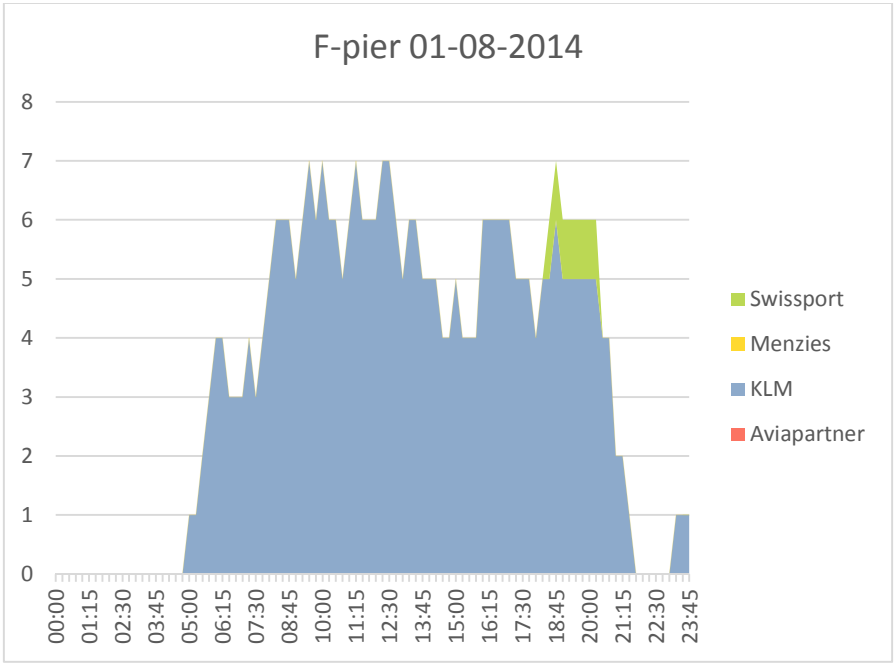
Appendix H.3 Piers dominated by handler

In this appendix the results for the piers which are dominated by a ground handler, more than 90% of the flights handled by one handler, are given. The date is the same as in the main part, 01-08-2014.

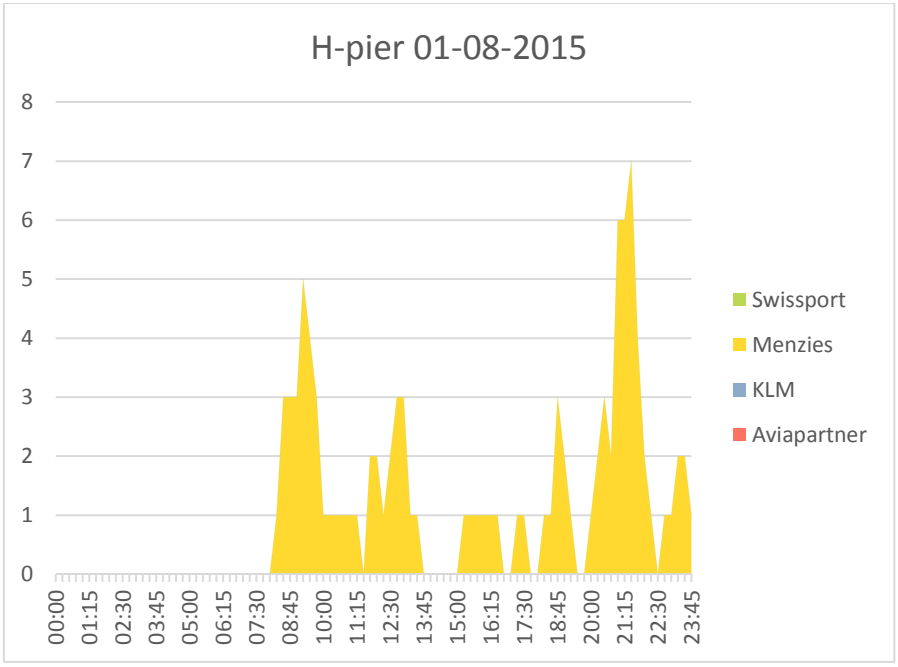
B-platform



F-pier



H-pier


H-pier 01-08-2015
8
7
6
5
4
3
2
1
0
00:00
01:15
02:30
03:45
05:00
06:15
07:30
08:45
10:00
11:15
12:30
13:45
15:00
16:15
17:30
18:45
20:00
21:15
22:30
23:45
Swissport
Menzies
KLM
Aviapartner

Appendix I Validation form extrinsic & intrinsic motivation

Based upon the motivation scale, the questions for measuring the motivation for attending the workshop are made.

Motivation scale

Items	Factors			
	1	2	3	4
Intrinsic motivation				
Because I think that this activity is interesting	0.91			
Because I think that this activity is pleasant	0.90			
Because this activity is fun	0.89			
Because I feel good when doing this activity	0.83			
Identified regulation				
Because I am doing it for my own good		0.77		
Because I think that this activity is good for me	0.31	0.60		
By personal decision		0.57		
Because I believe that this activity is important for me		0.52		
External regulation				
Because I am supposed to do it			0.85	
Because it is something that I have to do			0.75	
Because I don't have any choice			0.69	
Because I feel that I have to do it			0.58	
Amotivation				
There may be good reasons to do this activity, but personally I don't see any				0.83
I do this activity but I am not sure if it is worth it				0.74
I don't know; I don't see what this activity brings me				0.55
I do this activity, but I am not sure it is a good thing to pursue it				0.54
Eigenvalues	5.70	2.63	1.33	0.73
Explained variance	35.60	16.40	8.30	4.50

Figure 39: Scale for motivation (Guay et al., 2000)

Appendix J MCA

Criteria & Decision identification

Following the conclusions of Chapter 3 and 4, it is clear that the effects of equipment pooling on several indicators have to become known or at least clear. The actors have indicated several important aspects. Due to time restrictions and the progress of the process, a limited list of the criteria which are important have been identified, see Table 37. Aspects like the juridical, specifications of the equipment and allocation of the costs will not be taken into account. It is acknowledged that those aspects are eventually essential for the definite implementation. However in this early stadium of creating motivation along the actors, those aspects add no value and can only hinder the progress of the process.

Criteria	Short description
Availability	The availability of ground handling equipment when equipment is requested
Cost Reduction	The cost reduction realized through the implementation of Equipment Pooling
Movements at airside	The amount of movements of ground handling equipment at airside
Safety	The real and perceived safety at airside
Sustainability	The effect of the chosen alternative on the environment

Table 37: List of criteria

After identifying the criteria the question pops up what affects those criteria. There is no fixed design or concept of equipment pooling for the ground handling sector in aviation. So there are many issues, see Table 38, on which the involved parties have to make a decision about when equipment pooling is considered. Several choices have to be made to develop an equipment pooling alternative. After the interviews and a consultation round with experts of AAS, options for each issue are developed.

Issues	Short description
Equipment owner	The real owner of the ground handling equipment, also responsible for new investments
Pool director	The director is responsible for the coordination, invoicing and maintenance of equipment.
Location of the Equipment	The location at airside where the equipment will be placed and where ground handlers can pick up and return the equipment.
Equipment Types	There are a lot of equipment types. The involved parties have to make a decision for which equipment type the pool is applied
Track & Trace Service	This is an extra investment, but provides information about location and performances of the equipment, results in less misuse and unscheduled maintenance
Electrification	This is also an extra investment, results in less emission and lower fuel costs. However the investment costs are high.

Table 38: List of issues of which decisions have to be made

Decision making method

There are a lot of options to choose of and those choices affects the criteria. The importance of each criteria differ per actor. Ground handlers are really focused on cost reduction and availability, since a dearth of available equipment can result in high fines of the airlines or even contract termination. But for instance AAS AA is focused on improvements of safety and the availability of equipment plays a less important role. So besides making choices about the concerned issues, the involved parties also have make an assessment on which criteria they found most and/or less important. So in other words they have to give the criteria a factor of importance.

Calculating the results of all possible choices and the corresponding weights give over 50.000 alternatives. This requires an enormous calculating capacity and then the extra adjustments which have to be made when different types of equipment are chosen have not be taken into account. The different objectives of the companies must be achieved to their maximum, which inevitably leads to trade-offs. Since equipment pooling requires collaboration, the trade-offs are even harder to make. This because the actors have to agree upon the trade-offs. Probably this will result in negotiations with giving and

taking (de Bruijn & ten Heuvelhof, 2008). To be able to make a well thought decision, firstly a Multi Criteria Decision Analysis is developed. In a Multi Criteria Analysis, MCA, the selection of the best alternative is not a straightforward. A lot of outcomes are possible and the group can choose autonomous. By giving weights to the criteria the participants can give several criteria more importance. A real trade-off and relative comparison can be made.

For the MCA the quick scan provides information about the possible cost reductions. Since the exact numbers are missing for a lot of options, the MCA is filled in, ranked from 1 to 5. Where a 1 stands for a real bad performance on that criterion, a 5 stands for good results for that criterion.

The results of the quick scan are a detailed MCA and some insights in the availability and potential of equipment pooling. To calculate the alternatives, the selected scenarios of the workshop will be leading. Those scenarios or alternatives will be described later in more detail and with more quantitative substantiation.

Assumption MCA: Based upon the results and the characteristics of other equipment assumptions, the scores of the other equipment types on the indicators is based on this case and expert knowledge.

VERIFICATION & VALIDATION MCA

The MCA was verified during a session with AAS and DUT experts. Besides, several tests with the MCA were performed to verify the analysis. The MCA is validated by experts of AAS and will be validated during the workshop and later when calculating the results for the chosen scenarios.

In the MCA an estimation of the influence of transaction costs and the realization of an equipment pooling are made. So that eventually a more well sophisticated decision about equipment pooling can be made. In the MCA also issues like the ownership, director and importance of every criterion is taken into account. For instance when availability is far more important, the relative benefits of the cost reduction by implementing an equipment pool reduces to a large extent.

ASPECTS NOT INCLUDED:

1) Short term vs long term. So implement immediately or implement over a certain time span.
2) VOP design/lay-out
3) Liability
4) Allocation of costs

Equipment Eigenaar

	Availability	Cost reduction	Movements	Safety	Sustainability
All GHs	3	2	2	3	3
One GH	2	3	3	3	4
ES company	3	4	4	5	4
All ES companies	4	5	3	4	5
Third party	3	4	4	5	2
No equipment pooling	5	1	1	2	2

Pool regisseur

	Availability	Cost reduction	Movements	Safety	Sustainability
All GHs	3	1	3	4	1
One GH	2	3	4	3	4
ES company	3	3	4	3	4
All ES companies	4	5	3	3	3
Airport	3	2	5	5	5
Third party	4	4	4	4	3
No equipment pooling	5	3	2	1	3

Opstellocatie Equipment

	Availability	Cost reduction	Movements	Safety	Sustainability
VOP	5	3	5	5	3
Pier	3	5	3	4	4
Whole airport	2	3	3	4	4
Central point	2	4	1	4	4
Decentral points	4	2	2	3	4
Oude situatie	4	2	3	2	2

Equipment types

	Availabiltiy	Cost reduction	Movements	Safety	Sustainability
Loaders	2	3	3	4	4
Dolly	3	5	4	2	2
Stairs	4	4	3	3	4
Blocks	5	2	4	4	3
Baggaetrekkers	2	4	2	4	4
Ongemotoriseerd	2	4	3	3	2

Extra Services

	Availability	Costs	Movements	Safety	Sustainability
Track & Trace	4	2	4	4	4
Geen Track & Trace	2	4	2	2	2
Electrification	2	2	3	4	5
Geen elektrification	4	5	3	2	3

Appendix K Workshop Design

This is the workshop design of the workshop of the 2nd of July 2015. During the workshop representatives of different companies, see Table 39, were present and the concept of equipment pooling was handled during this workshop.

This design will elaborate on the content, participants, purpose and scientific basis of the workshop. First the content of the workshop, which consists of several rounds, will be described. Then an overview of the participants will be given. The requisites, planning and other issues are described in the third part. The scientific basis and background is given in the last, fourth, part.

Content of the workshop

The workshop will consist of eight rounds. For an overview see **Fout! Verwijzingsbron niet gevonden.**. In the first rounds an introduction about equipment pooling in other sectors and at AAS will be given. Then an elaboration on the context of the workshop will be made. The different rounds of the workshops will be described in the following sections.

Short Description workshop rounds

Round 1: Introduction

First the introduction presentation is given by the workshop leader, in this case the writer of this thesis. The goal of the workshop is presented and some side information about equipment pooling and what the participants can expect during the workshop. Also the participants get the opportunity to express their expectations and concerns.

Round 2: analysing the problem

Based upon the role and case descriptions a short analysis of the problem is made. An open discussion will take place.

Round 3: searching for criteria

This round consists of several propositions. This is done to see what kind of problems the participants experience at airside or experiencing according to their role description. The propositions are a bit provocative to assure that the participants will react upon this and will give their true opinion and specify which criteria are the most important for them when talking about equipment pooling and collaboration.

Round 4: develop scenario

The list of criteria corresponds probably to a large extent to the criteria of the developed Multi Criteria Analysis. The participants are obliged to collaborate and together have to come up with one scenario, accepted by all. Besides giving weights to the criteria, the participants also make decisions about the owner of the equipment, director and technological innovations like Track & Trace system and electrification of the equipment.

Round 5: results scenario

The outcomes of the MCA are calculated and the results are given to the participants. Based on the results the participants think about preconditions before this ‘dream scenario’ can be implemented. Then a presentation, which will be given to the other group, about their chosen equipment scenario is made.

Round 6: Giving presentations

The groups give a presentation about the results and the choices of their scenario.

Round 7: Comparing & real situation at AAS

The most important differences and similarities are identified. Then a discussion will take place in which the situation at AAS is discussed. Important is to discover whether there is room for further decision making process or if the sector agrees upon further analysis about equipment pooling.

ROUND 8: WHAT'S NEXT

In this last round the next steps are discussed. So who is going to do what and what the participants can expect from AAS and the thesis writer.

EXTENSIVE DESCRIPTION OF THE WORKSHOP

Preparation

Beforehand, the participants will receive information including the agenda and the goals of the workshop. Thereby they will already receive some information about the cases they are going to solve. So they can prepare for the workshop, have some knowledge and can think of the right approach, see also Planning. Because all the participants have a busy agenda, it is naïve to think they will read everything and prepare in a sufficient way. So the information will also be provided during the workshop and the roles they are assigned to, will be elaborated on during the workshop.

Preface: expectations & reservations workshop (10 min)

Before the workshop will start, the participants will get the opportunity to talk about their expectations and reservations of the workshop. The expectations, goals and reservations will be written on a flip-over to see during the feedback session, round 6, which goals are achieved and if the reservations are taken away.

Voorbespreking: ventileren doelen & reserveringen ten opzichte van (10 min) (Flip-over)

Introduction: equipment pooling (10 min)

After a period of conducting interviews with most of the participants, in which I was able to get a good and useful insight in the world of ground handling.

Today it is going about equipment pooling. Since I know the concerns about the equipment pooling, some examples of concerns, this day will be dedicated to form a widely supported image about equipment pooling.

The concept of equipment pooling is known by a lot of sectors. The oil sector, healthcare sector already embraced this concept and implemented it widely.

So first, let's start with the healthcare sector

HEALTHCARE SECTOR

In the healthcare sector there are several known examples of equipment pooling. There is a pool of suppliers of healthcare products. The one supplier which is the nearest to a client, can deliver the products. This reduces the amount of movements and even in the fleet.

In hospitals beds and surgery rooms are often shared. The utilization rate is increased and hospitals are closer to a break-even point in terms of finances.

OIL SECTOR

Oil giants like Shell, Total and GDF Suez decided to share their resources regarding employment transportation and deliver supplies to the oil platforms. The pool is called the SNS pool, which stands for Southern North Sea pool, and the marine company Peterson manages the pool. So instead of all having ships and helicopters, which were capital intensive and underutilized, Peterson can deploy the equipment in an efficient way with high quality ships and helicopters

SHARING ECONOMY

Not only the corporate and services sector is looking at initiatives to use resources efficiently. Also the private sector, citizen to citizen is transforming. The world is transforming to a more and more shared economy. Cottages, gardening tools and even pets, you can share/lease them from others if they do not need this or if they want to earn some money back from their investment.

Gisteren bleek nog uit een onderzoek van ING dat steeds meer huishoudens deelnemen aan de shared economy. En dit aantal gaat enkel toenemen, van een half miljoen huishoudens nu naar 1 miljoen huishoudens aan het eind van dit jaar. Over een paar jaar zelfs doorgroeien naar 2,5 miljoen.

In Amerika zijn ze inmiddels zo ver doorgeslagen dat je de mens trouwste vriend, de vrolijke viervoeter kan leasen. Schijnt zeer succesvol te zijn, maar ja daarvoor is het Amerika, waar de heart attack burger wordt gepromote in plaats van gezond voedsel, en waar je in sommige staten geen eens verkleed mag als krokodil en op voorschriften staat dat je niet mag vliegen met je batmancape.

AVIATION

Let's go back to the sector we are part of: the aviation sector. Also here equipment pooling is already piloted and/or further implemented.

SPARE PARTS

This form of equipment pooling uses the hub network optimal. The main activities of the home carrier, including the maintenance and spare parts for all different aircraft, are situated on the hubs. This has everything to do with economy of scale etc. However when there is some failure or parts have to be replaced at other airports, those home carriers have a problems. Other than on its hub, there are not sufficient parts present in the stock on other airports. So several airlines have integrated their spare part system, including KLM and Lufthansa, into one covering network where airlines can use the supply of the home carrier at the relevant airport.

ENGINEERING SERVICES

Airlines need reserve engines for their aircrafts. Engines cost millions of euros, so often after calculations a number of integers with rest value for the minimum available reserve are the result. However this is a really costly expenditure. KLM ES had offered an engine pool in which airlines could share their inventory together and KLM was able to meet the demand of the airlines.

How it worked: Airlines placed all their engines in one pool, possible quality, often correlated with the years of active service or building year, where dealt with via cost variation.

Was for the time being a successful equipment pool.

CODESHARE AGREEMENTS

The best known concept of pooling in the aviation. Airlines sign agreements to share costs and benefits on routes. They do not share equipment, though to be able to provide a widespread network with high frequency, they share tickets and clients can buy tickets on planes which are owned and operated by the other airline. For example Delta-KLM. Codeshare agreements have been one of the most beneficial initiatives in the airline industry.

EQUIPMENT POOLS IN THE GROUND HANDLING SECTOR

So let's focus on the ground handling sector. There have been some pilots which are still used, and some initiatives just started:

Heathrow is an airport which experiments with equipment pooling. Since last September there is the Heathrow Staircase pool. TCR manages a stair pool at Heathrow. Via a system which keeps records of data and a good overview. TCR is looking for expansion possibilities at Heathrow but also at other English airports.

Schiphol: GPU pool and stair pool at the H-pier. GPU pool, owned by KES. A simple card system, which keeps records of who used the GPU for how long. This data is stored and connected to an easy invoicing system. All who I have spoken with are content with this system. Stair pool H-pier, owned by KES as well. Mainly Menzies uses this pool, since most of the flight handled at the H-pier, are handled by Menzies. Almost the same system as for the GPU pool, with a card system. Also successful, however not really used by other ground handlers.

- There have been some attempts of AAS to pool equipment at other areas of the airport. However this has been blocked several times by the sector and when third parties would be the party responsible for the exploitation and responsibility, GHs found this out of proportion.
- So when AAS took the responsibility, the pilots resulted in no realization and so no improvements. As example, the stairs at the U-platform, AAS took the responsibility however most of the equipment is not used or ground handlers did not agree on the terms.

Context today

This time we will take a different approach and for that approach we will need your expertise and input. The next one and a half hour the group will be split into two groups.

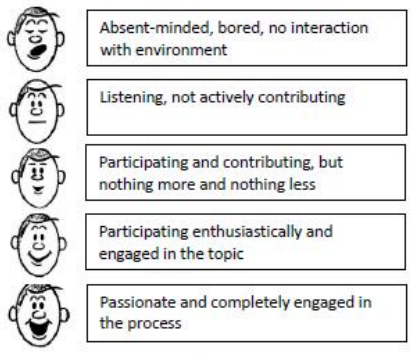
Increase creativity & Avoid group think

In smaller groups, the workshop is more intensive and interactive. Thereby it will be interesting to see if the results of the two groups differ. By using two workshop groups the possibility of group think reduces.



From a scientific perspective and for the purpose of my research question the groups, one controlling group and one test group will be formed. It is of utmost importance to separate them. The two groups will have a workshop in two separate parallel sessions. During this part of the workshop the groups will stay in two different rooms. So, the distinction between control and testing group can be assured. Thereby; no interaction can take place and interference between the two groups will be precluded. Otherwise there is a possibility of biased groups which can influence each other.

Here the motivation 1 test is explained. We use the scale of (Lange, 2010), to test several times during the workshop how motivated the participants are during the workshop. Here, the motivation in the workshop is measured. By explaining the method and what they can expect now, prevents the participants of being surprised and helps the progress of the workshop. It also avoids questions when they receive the scale.



Parking list for issues

During the workshop pending issues which are nog going to be dealt with during the workshop will be written on a large paper. During the Next Steps Round and during the feedback of the workshop, we will come back to the list and if necessary base an action plan upon it. Important issues, but also issues which can slow down the workshop or have a negative impact on the wished result, will not be neglected and the participants will have the feeling of being heard.

Content differentiation of the groups

The content of the two groups will be presented in a different form. For both the main goal is to come with a form of equipment pooling or with a shared agreement about the benefits and concerns of equipment pooling. Also it is important that they acknowledge and see that collaboration pays off.

From this point, 2 groups are formed. Role-play group is the test group or in other words the gamification group. Control group is the control group or in other words the traditional group.

The justification of separating and use two different approaches will be explained as that one group will look at a situation (Role-play group) and the other one to a new to develop project (Control group). This is a different approach however it will be interesting if they come up with the same conclusions and recommendations.

Role-play group – Role-play group: context

We will depart to Flydon Airport. This airport is situated near the capital Flydon of Great Axdon. This airport handles over 65 million passengers a year. Over there, a new area of the airport is exploited. Terminal 4 will be developed in the north-west of the airport area. Terminal 4 is an expansion of the current VOPs and other operations at the airport. The airport is searching for solutions to reduce the amount of equipment and movements at airside. The current situation puts a continuously pressure on safety, space and costs. Today the different parties come together to discuss the possibilities to reduce this and increase safety. So I'm glad and happy to see that so many of you could come to this meeting to talk about the future of Flydon airport. There is pressure of upcoming legislation to organize the processes at airside efficient.

Role-play group - Roles involved

Depending upon the number of participants in Role-play group, several roles can be assigned to the team members. In this way people will be able to identify themselves with another kind of actor, so instead of being a private ground handler normally, being a department of the airport authority during the workshop. Below short descriptions of the roles can be found.

Role 1: Home carrier ground handler: Tulip Airways Aircraft Services.



INSTRUCTIE

Je bent vertegenwoordiger van de grondafhandelaar Tulip Airwas Aircraft Services. Tulip Airways is de home carrier van Flydon Airport. Tulip Airways Aircraft Services handelt alle vluchten van Tulip Airways af en van verscheidene partners van Tulip Airways.

Tulip Airways is een grote luchtvaartmaatschappij, voor wie Flydon Airport de hub is. Meer dan 60% van alle afgehandelde vluchten op Flydon zijn vluchten van Tulip Airways. Tulip Airways, TA, heeft veel dochterondernemingen, zoals een engineering service.

TA Aircraft Services is een afdeling van TA. Alles binnen de bedrijfsvoering is gericht op het afhandelen van vluchten van TA. Dit moet zo efficiënt, effectief en in overeenstemming met andere afdelingen zoals gate control en catering. Het hoofddoel van TA Aircraft Services is niet om winst te maken, maar ervoor te zorgen dat TA elke dag volgens het rooster kunnen vliegen. Het grote competitievoordeel van TA

Aircraft Services is dat hun moederonderneming een luchtvaartmaatschappij is, waardoor werk verzekerd is. Het grote volume van de dagelijkse operaties draagt bij aan kostenreducties en efficiëntie vergrotingen.

DOEL

In overeenstemming met de hoofddoelen ben je vandaag naar het overleg gekomen om te kijken wat er mogelijk is in combinatie met de andere afhandelaren. Daarnaast geniet het je voorkeur als Flydon Airport een actieve rol gaat spelen. Het grote volume aan dagelijkse vluchten zorgt ervoor je bedrijf 1 concept wil, zodat dat binnen de bedrijfsvoering valt in te passen.

Role 2: Beta Ground Handling

INSTRUCTIE

Je bent vertegenwoordiger van de grondafhandelaar Beta Ground Handling. Beta Ground Handling is een van de drie grote afhandelaren op Flydon Airport. Beta Ground Handling, Beta, is een multinational met verscheidene kantoren over de wereld op andere luchthavens. Ze proberen hun vloot te optimaliseren door hun netwerk te gebruiken. Flydon airport is een belangrijke markt voor Beta. Ze handelen de vluchten van de relatief grote vakantievluchten maatschappij. Daarnaast zijn verscheidene buitenlandse netwerkcarriers een klant van Beta. Reductie van de kosten en zo efficiënt mogelijk werken met de beschikbare middelen zijn de hoofddoelen van Beta op Flydon.

Beta wil graag de mogelijkheden onderzoeken naar equipment pooling. Dit kan namelijk resulteren in lagere kosten, lager risico op investeringen en minder veiligheidsrisico's. Het afhankelijk zijn van andere maatschappijen is een zorg van Beta en ze vragen zich af hoe de andere grondafhandelaren hierin staan.

DOEL

Het is belangrijk om erachter te komen hoe de andere grondafhandelaren tegenover equipment pooling staan. Voor de rest is het belangrijk om te weten wie de eigenaar van het equipment wordt, omdat je binnenkort budget hebt om al dan wel al dan niet te investeren in nieuw materieel.

Role 3: International Aviation Handling (IAH)

INSTRUCTIE

Je bent vertegenwoordiger van de grondafhandelaar International Aviation Handling. International Aviation Handling, IAH, is een van de drie grote afhandelaren op de luchthaven. Flydon is een belangrijke markt voor International Aviation Handling. Met verscheidene andere kantoren op luchthavens door heel Axdon, heeft IAH tegenwoordig een groot netwerk tot haar beschikking. Nieuw materieel voor meerdere stations wordt door de holding in 1 keer gekocht.

IAH handelt de vluchten van een grote low cost carrier af. Daarnaast zitten ook sommige netwerkcarriers en vakantievluchtmaatschappijen bij hen. Door equipment te leasen van zowel TAGES als MLE kan IAH zich focussen op de uitvoer van het afhandelen. IAH ziet veel mogelijkheden in VOP gebonden materieel als materieel voor de equipment pool.

DOEL

Doordat IAH twee grote nieuwe netwerkmaatschappijen uit het buitenland heeft gecontracteerd, is de interesse van IAH in equipment pooling groot geworden. Dit mede doordat IAH nu voornamelijk op Terminal 1 zit en voor de twee nieuwe klanten naar Terminal 4 moet.

IAH is benieuwd hoe de hoge veiligheidseisen door iedereen gedragen gaan worden en wie verantwoordelijk voor de pool wordt. Een andere partij die de pool gaat managen baart zorgen omdat er dan onduidelijkheid over de prijzen kan komen.

Role 4: Tulip Airways GSE (TAGES)

Je bent vertegenwoordiger van de GSE Tulip Airwas Aircraft GSE, kortweg TAGES.

TAGES is een dochter van Tulip Airways, met zijn eigen juridische status en financiële afdeling. De meeste reparaties en onderhoudsverzoeken komen van TA. TA is daardoor hun grootste klant. Het hoofddoel van TAGES is om pro-actief in plaats van re-actief onderhoud te plegen. Winst maken is niet het belangrijkste van TAGES. TAGES heeft al enkele ervaring met een pilot op het gebied van vliegtuigblokken. Ze willen echter meer commerciële activiteiten binnenhalen en equipment pooling past hierbij in het rijtje.

DOEL

De zorg van TAGES is hoe er met materieel om wordt gegaan, wat ook gerelateerd is aan veiligheid. Een duidelijke regie is noodzakelijk om tot een succes te komen. Dit zal ook voor betere garantie voor de beschikbaarheid van het materieel zorgen.

Role 5: MLE

Je bent vertegenwoordiger van de ground support equipment company MLE. MLE is een private onderneming die verantwoordelijk is voor het onderhoud en verhuren van materieel. Ze leasen steeds meer equipment aan grond afhandelaren.

MLE is net begonnen op Schiphol en kijkt naar mogelijkheden om het marktaandeel te vergroten. Daarbij is het eigenaarschap van equipment een aantrekkelijke optie. Hiermee kan een grotere markt worden gecreëerd en treden er efficiëntie voordelen op, zoals goedkopere inkoop. MLE biedt zowel ongemotoriseerd als gemotoriseerd equipment aan. Ze werken op basis van dat de klant betaalt per tijdseenheid gebruik. Mochten de grondafhandelaren specifieke vragen hebben dan kijkt MLE naar oplossingen. Ze hebben een relatief jonge vloot, daardoor wel iets hogere kosten voor de afhandelaren. Echter de beschikbaarheid kan daardoor beter worden gegarandeerd.

DOEL

Het is van belang te weten te komen hoe je de grondafhandelaren van dienst kan zijn en om hun zorgen ten opzichte van equipment pooling weg te nemen al dan niet mee te nemen.

Notificatie – gedurende de workshop

MLE heeft geïnvesteerd in een Track & Trace systeem. Deze bijeenkomst is de mogelijkheid om het aan de man te brengen

Role 6a: Flydon Airport – airside management

- AIRSIDE MANAGEMENT

Je bent vandaag vertegenwoordiger van Flydon Airport – Airside Management. Het gebrek aan ruimte op airside is elke dag een uitdaging voor Airside Management, AM. AM wil de hoeveelheid grondafhandelingsmaterieel verkleinen om zo een beter overzicht te krijgen van wat er gebeurt op airside, om de veiligheid te verhogen en om vrijgekomen ruimte te kunnen gebruiken voor andere doeleinden. Verschillende initiatieven zijn voorgesteld. Equipment pooling heeft een van de grootste potenties. Equipment pooling is een lang gekoesterde wens om te integreren op de luchthaven.

Echter de luchthaven kan equipment pooling niet in haar eentje succesvol maken. De hulp van de grondafhandelaren is essentieel, maar ook derde partijen zijn nodig om een goed gestructureerde pool te organiseren.

DOEL

Vandaag ben je gekomen om vanaf het begin een actieve rol te nemen in het proces om een goed georganiseerde equipment pool te realiseren. Vandaag niet gekomen om eigenaar te worden van het equipment te worden, maar de infrastructuur op equipment pooling aan te passen. Waar het kan wil je financieel helpen om de infrastructuur te verbeteren, denk hierbij aan de VOP inrichten, inrichten van opstelplaatsen voor equipment etc., zolang iedereen hier maar gebruik van kan maken. Echter investeren in equipment is geen optie.

Mocht iedereen te lang blijven twijfelen, dan kan je ervoor kiezen regisseur te worden. Dit betekent wel dat equipment pooling voornamelijk in het teken van veiligheid moet staan.

De directie heeft het als speerpunt doorgevoerd dat initiatieven die duurzaamheid vergroten gesteund worden. Je kan kiezen om financiële incentive te geven als de andere spelers voor elektrificatie van het materieel kiezen.

Role 6b: Flydon Airport- Enforcement & Authority

- HANDHAVING AIRSIDE

Je bent vandaag vertegenwoordiger van Flydon Airport, afdeling Handhaving Airside. Je controleert op airside op iedereen de opgestelde luchthavenregels volgt. Naast de officiële autoriteiten, zoals de politie, is Handhaving Airside, HA, de enige partij die de autoriteit heeft om partijen te verplichten de regels te volgen of anders sancties in te stellen.

HA heeft de laatste tijd een toegenomen intensiteit van de voertuigbewegingen op airside opgemerkt. Dit heeft in verschillende incidenten geleid. Door deze incidenten en de voorspellingen van groei in het aantal vluchten en passagiers is HA erg bezorgd over de veiligheid op airside. Initiatieven die het aantal voertuigbewegingen reduceert en verantwoordelijkheden duidelijker laat zien zullen gesteund worden daar HA.

DOEL

Je zit hier vandaag om te kijken hoe veiligheid wordt gewaarborgd. HA heeft niet alle expertise betreffende grondafhandeling. Toch is de uiteindelijke stem die HA heeft groot omdat de luchthaven

grote waarde hecht aan HA. Duidelijkheid over wie verantwoordelijkheid draagt is belangrijk voor een gemakkelijkere handhaving.

NOTIFICATIE:

De directie van Flydon heeft aangekondigd dat controles ten opzicht van het volgen van de airsideregels strikter worden end at chaos op de VOPs niet meer getolereerd is. De boetes op overtredingen worden verhoogd en na meerdere overtredingen kan de vergunning om vluchten af te handelen worden ingetrokken. De directie heeft jou gevraagd om eerst te kijken of er draagvlak bestaat om überhaupt de veiligheid te vergroten..

OUTPUT ROUND 1:

The participants are informed and are given the opportunity to ask questions if there are any questions about the intention of the case or still unclear aspects.

Role-play group - Round 2: Analysing problem

In this round the teams are formed. The teams are arranged beforehand in consultation with Schiphol Group PMA.

Content of this round: Teams will consist of four persons and in those teams the different roles will be assigned. After they have read their role description, they are going to analyse the problem further.

In teams they will analyse the problem further and find out what the most important factors are, which influence the problem. Questions to answer:

H1: Equipment pooling is only a financial matter. Once the financial business case is clear, a decision is easy to make.

H2: Regarding my company, sustainability plays no role, if it costs money

H3: Equipment pooling increases safety. Since safety is the most important aspect, we have to implement equipment pooling.

H4: Equipment pooling has to potential to decrease the pressure on space at airside

H5: An efficient use of equipment and increased safety can only be accomplished when the airport becomes owner of the equipment and takes a leading role.

Factors which they think are important but are not included in the workshop design will be written on a paper. These factors will come back during the discussion and next round phase.

Output: problem analysis & assigned roles

Role-play group - Round 3: Develop Scenarios and initiatives

The different problem analyses will be discussed shortly

In teams they have to develop scenarios and initiatives about equipment pooling.

Content of this round: During this round the groups will work separately to come up with a scenario in which following questions can and must be answered.

Question: Come up with scenarios and initiatives in which the following is dealt with:

1) Who is going to be the equipment owner?
2) Who is going to be the director of the pool?
3) Which equipment (stairs, blocks, etc.) for equipment pooling?
4) Where will the equipment be situated?
5) What kind of extra/additional services?

For these questions they can choose several options. They can also think about a the impact of their choices on the political sensitivity/risks. Just like the distinction between fixed and variable costs. Not

investing in equipment results in lower risks in investments, but probably result in some higher overall costs etc. etc.

Airports role: The airport will not own equipment. The airport can financially support some initiatives, by adapting the infrastructure to the right standards. Or by organize airside in such way, that equipment pooling is optimized.

Output: one preferred scenario per group

Role-play group - Round 4: Results of chosen scenario

The scenarios will be used as input for the MCA. The groups have some time for a break.

Content of this round: There are some variables which can be changed before the calculations are done and so different outcomes of the different scenarios can be expected. Each calculation will be done via the Excel file. The criteria have to be determined by the groups, but first need to be identified:

The criteria are calculated based upon 2 days of 2014 at Schiphol or on basis of experts opinions. Each group receives the outcomes of the scenarios presented on a screen.

Output: Present the results and outcomes with all groups. Show them the scenarios of the other teams and the corresponding results.

Role-play group - Round 5: Give advice about the to-choose option

With the results of the several scenarios the groups have to make an assessment about which scenario they will choose. They have to give a short presentation about their chosen scenario to each other.

Content of this round: They have to motivate their choice for the scenario. This can be shortly done based upon the results and the criteria. After they have presented the results to each other, the groups will discuss which scenario they will choose. They will also make a presentation for the Control group.

Output: the groups choose one scenario, this will be probably the scenario with highest potential benefits. Or do they choose the current situation in which nothing will be pooled and everyone continue with its business as usual, with low margins and fierce competition.

After this round they get a short break of 5 minutes. Only to get a drink and if needed the ability to go to the toilet.

Control group: Traditional group (5-10 min movement)

This group will have to go to another room for their separate part of the workshop.

The workshop leader: **Marleen Velthuis.** She will be leading this group, which is going to discuss equipment pooling on basis of some hypotheses.

Control group - Introduction (10 min)

Content of this round: Currently during daily operations, safety and availability are often at stake. With continuously changing lay-outs of VOPS, piers and roads, it is hard to catch up with these changes. This endangers the safety of everyone at airside. On top of that, Schiphol has a lack in space. Other than its competitors like Dubai, Istanbul or Frankfurt, Schiphol is limited to its borders and has less space to expand or initiate plans for new to build projects. This results in a continuous pressure on the ability to cope with this the lack of space. Due to this lack, all activities in handling aircrafts have to take place at a relatively small surface. In comparison with Fraport where at each VOP equipment for as well NaBo as WiBo is placed.

A-pier

As we all know, AAS is busy developing the new A-pier in the south west. This pier will contain 10 VOPs, for as well NaBo & WiBo aircrafts. The A-pier is far away from the rest of the operations, especially from the northern piers, like the F, G and H-pier. A mix of ground handlers is expected. So they will have to use the same VOPs. This new area will be open to innovative ideas and ideas which deal with current bottle necks and problems at airside. It is clear that the current daily operations are not desired and sufficient to deal with the increasing capacity and that it will be hard to integrate the new pier in existing

operations. Therefor a new allocation of needs is necessary. Also the equipment of the ground handling operations have to be reconsidered. Equipment pooling gives us an opportunity to assure high quality standards and less equipment and congestion on the airside roads. A lot of equipment is not made for transportation but for doing tasks at location.

Control group - Round 1: Identify problem & identify current bottle necks (15 min)

After the introduction presented by Marleen, the group will discuss and have to come up with the problems which they think arise are already present. Marleen can push the group towards a problem statement or main question which looks like:

Question today which will stand central:

How to deploy the equipment for handling aircrafts at the A-pier efficiently, preventing the current bottle necks, without decreasing safety at airside and availability of the equipment?

Control group - Round 2: Discussion about some hypotheses (20 min)

The intention of this round is to provoke the participants and get them out of their comfort zone. By stating hypotheses, a good intensive discussion is expected. The goal of this round is to identify the decision factors.

H2: Equipment pooling is only a financial matter. Once the financial business case is clear, a decision is easy to make.

H2b: Regarding my company, if it costs money sustainability is out of question.

H3: Equipment pooling increases safety. Since safety is the most important aspect, we have to implement equipment pooling.

H4: Equipment pooling has to potential to decrease the pressure on space at airside

H5: An efficient use of equipment and increased safety can only be accomplished when the airport becomes owner of the equipment and takes a leading role.

Output: List of important aspects

Control group - Round 3: Scenario development (15 min)

So now we have created common understanding and identified most important aspects for equipment pooling to cover. For what scenario can we think of in which equipment pooling is beneficial. Problems with this can be addressed.

See the same tables as Role-play group has.

Come up with scenario in which equipment efficiency increases and safety improves.

After dream scenario has been sketched, under which circumstances everyone agrees.

Control group - Round 4: Prepare short presentation (10 min)

After the scenario development, the group is told, that they have to prepare a short presentation with the outcomes of this session. So they can give this presentation to Role-play group.

Round 6: Compare results & discussion

The two groups will come together and they will give each other a short presentation with the most important outcomes of the session. After the short presentation, everyone will return to their normal function and can speak on their own behalf, then a short guided discussion will take place.

Content of this round:

The two groups give a short presentation, approximately between the 3-5 minutes, about their key findings of their part of the workshop. The key findings will be written on a paper, or digital. Based upon the key findings a discussion will be started.

The discussion will be guided. So that the results we want to achieve will be achieved. Similarities and differences will be addressed . The key question during the discussion is: Is there enough support to continue with equipment pooling?

It is also important to create a buy-in. So when the participants agree, based upon shared objectives and shared benefits, equipment pooling will have enough support and reason to continue with. It provides also some space to investigate some unknowns further. After this, together with the participant logical steps to take are discussed and identified.

Side note: The discussion will partly be improvised, since the outcomes are unknown on beforehand.

Round 7: What's next

The discussion is finished. Now it is important to talk about further steps.

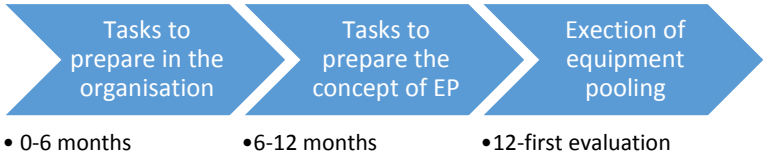
Content of this round: It is really important to think about how to continue and not fall back into normal operational work. We have created a dialogue and showed them the results and possibilities of equipment pooling. But what's next? Often after workshops, people just continue their daily operations as usual. This is not the desired outcome Schiphol wants and probably everyone else. So we have to think about further steps. Since we agreed upon shared benefits, we can talk about new appointments and other further steps.

Pending issues which are going to be handled during further steps will be categorized, by answering the following questions:

1) Who?
2) What?
3) Where?
4) When ?
5) Why?

Before the workshop, it is important for Schiphol to have agreed upon an initial time schedule in which broad terms the deadlines in time are presented. This is useful in assigning tasks and show the participants perspective.

This initial time plan will be sketched in front of the participants and the tasks will probably be classified in the following blocks:



The beautiful aspect about workshops is that its outcome is often unknown. But this is also its weak point, since it is difficult to anticipate upon the outcome of the workshop. Improvisation during this round in which next steps are described, is key.

For myself and what I will deliver: I will send the participants a feedback document of this session after my holidays, in the week of 27 July to 2nd of August.

Outcome: A clear time path with assigned tasks to different participants. Also clarity about the process and what who can expect when.

Round 8: Evaluation of the workshop

This is the last round of the workshop and is of value for the workshop itself. Herein a discussion about the added value and the process of the workshop itself will take place.

Content of this round: everyone gets the possibility to give their opinion about this workshop.

Participants, location and content

A list of the participants of the workshop is shown below, see Table 39.

Naam	Bedrijf	Extra info
Erik Waatjes	Schiphol Group	Role-play group
Herman Homma	KLM	Role-play group
Jaap Weerdmeester	Aviapartner	Role-play group
Jasper Verberne	TU Delft	Workshop leader
John Spanjaard	Schiphol Group Airport Authority	Role-play group
Maaike Arwert	KLM BTS	Role-play group
Marleen Velthuis	Schiphol PMA	Workshop leader Control group
Michel van Hal	SPS	Control group
Michiel Heikens	KLM	Role-play group
Onno Hompe	Swissport	Control group
Pascal Schaafsma	KLM AS	Control group
Patrick Lasten	KES	Role-play group
Paul Langedijk	KLM GSE	Control group
Paul Schmitz	SPS	Role-play group
Rob Spijker	TCR	Control group
Rolf van de Velde	SPS	Control group
Sanne Patijn	Schiphol PMA	Control group
Ton Opdam	Schiphol Group – A gebied	Control group

Table 39: list of participants

Extra remark:

Menzies was unable to attend the workshop due to an internal audit and company visits abroad. In follow up events it is important that Menzies will be present, so they will not be excluded.

Planning

In this section, the planning of the workshop is given

Date	To-do
16-6-2015	Sending invitations to participants
29-6-2015	Sending all the necessary information to the participants 1. Program 2. Exact location 3. Information about the case

Table 40: important dates with related to-do

The agenda of the workshop taking place on the 2nd of July is given in Table 41.

Location: OT gebouw Begane grond kamer 0119 - Jan van Rijszaal

Start	Subject	Duration
13:45	Doors open	15 min
14:00	Introduction: goals & overview EP	15min
14:15	Context & possible questions	10 min
14:25	Round 1: forming groups & analysing problem	20 min
14:45	Round 2: Develop scenarios	35 min
15:20	Round 3: Results & break	25 min
15:45	Round 4: Advice	20 min
16:05	Short Break	5 min
16:10	Round 5: Discussion & what's next	30 min
16:45	Round 6: Evaluation	15 min
17:00	End of the workshop	

Table 41: Agenda of the workshop

Appendix L Questionnaire

For the questionnaire a Likert scale is used. The Likert scale is a proven concept used a lot in researches. A qualitative analysis can be done using the Likert scale.

Enquête Equipment Pooling Premeting: Het eerste deel vragen is geformuleerd om een baseline te creëren voor de methodologie van mijn onderzoek aan de TU Delft.	
Q1	Naam
Q2	Bedrijf: *
Q3	Geslacht
Q4	Leeftijd *
Q5	Hoogst afgeronde opleiding *
S1	Ik houd van het spelen van spellen *
S2	Ik houd van een spelelement tijdens het werk *

Enquête Equipment Pooling Premeting De volgende vragen gaan over de deelname van de workshop. Het zijn stellingen waarbij u aan kan geven in welke mate u het eens/oneens bent met deze stelling. De vraag die centraal staat: Waarom neem ik deel aan de workshop?	
S1	Ik zie het nut in van het deelnemen aan de workshop Equipment Pooling *
S2	Ik verwacht dat het interessant is *
S3	Ik weet het niet, ik zie niet wat het mij brengt *
S4	Ik word geacht hieraan deel te nemen *
S5	Ik vind deelname aan de workshop leuk *
S6	Ik doe wel mee, maar ik weet niet zeker of het het wel waard is *
S7	Ik verwacht dat het belangrijk voor mij is *
S8	Ik moet aan deze workshop deelnemen *
S9	Ik heb er persoonlijk voor gekozen *

Enquête Equipment Pooling Voormeting: De volgende vragen hebben betrekking op equipment pooling. Het zijn stellingen waarbij u aan kan geven in welke mate u het eens/oneens bent met deze stelling.	
S1	Ik ben overtuigd van het nut van equipment pooling
S2	Equipment pooling is alleen volgens de theorie beloftevol
S3	Ik ga anderen overtuigen van het nut van equipment pooling dat het het afhandelingsproces beter stroomlijnt
S4	Samenwerken met andere partijen om het afhandelingsproces efficiënter te maken levert uiteindelijk minder op dan apart blijven te opereren
S5	Equipment pooling bevordert de veiligheid op airside
S6	De afhankelijkheid van andere partijen met equipment pooling ervaar ik als een groot risico
S7	Het ruimtegebrek op de luchthaven kan gedeeltelijk worden opgelost door middel van equipment pooling
S8	De afname van veiligheidsrisico's op airside is bepalend voor de uiteindelijke acceptatie van equipment pooling
S9	Equipment pooling vermindert de beschikbaarheid van equipment
S10	Equipment pooling is financieel aantrekkelijk
S11	Ik heb vertrouwen in de realisatie van equipment pooling op de luchthaven

Enquête Equipment Pooling Nameting: De volgende vragen hebben betrekking op equipment pooling. Het zijn stellingen waarbij u aan kan geven in welke mate u het eens/oneens bent met deze stelling.	
S1	Ik ben overtuigd van het nut van equipment pooling
S2	Equipment pooling is alleen volgens de theorie beloftevol
S3	Ik ga anderen overtuigen van het nut van equipment pooling dat het het afhandelingsproces beter stroomlijnt
S4	Samenwerken met andere partijen om het afhandelingsproces efficiënter te maken levert uiteindelijk minder op dan apart blijven te opereren
S5	Equipment pooling bevordert de veiligheid op airside
S6	De afhankelijkheid van andere partijen met equipment pooling ervaar ik als een groot risico
S7	Het ruimtegebrek op de luchthaven kan gedeelteltijk worden opgelost door middel van equipment pooling
S8	De afname van veiligheidsrisico's op airside is bepalend voor de uiteindelijke acceptatie van equipment pooling
S9	Equipment pooling vermindert de beschikbaarheid van equipment
S10	Equipment pooling is financieel aantrekkelijk
S11	Ik heb vertrouwen in de realisatie van equipment pooling op de luchthaven

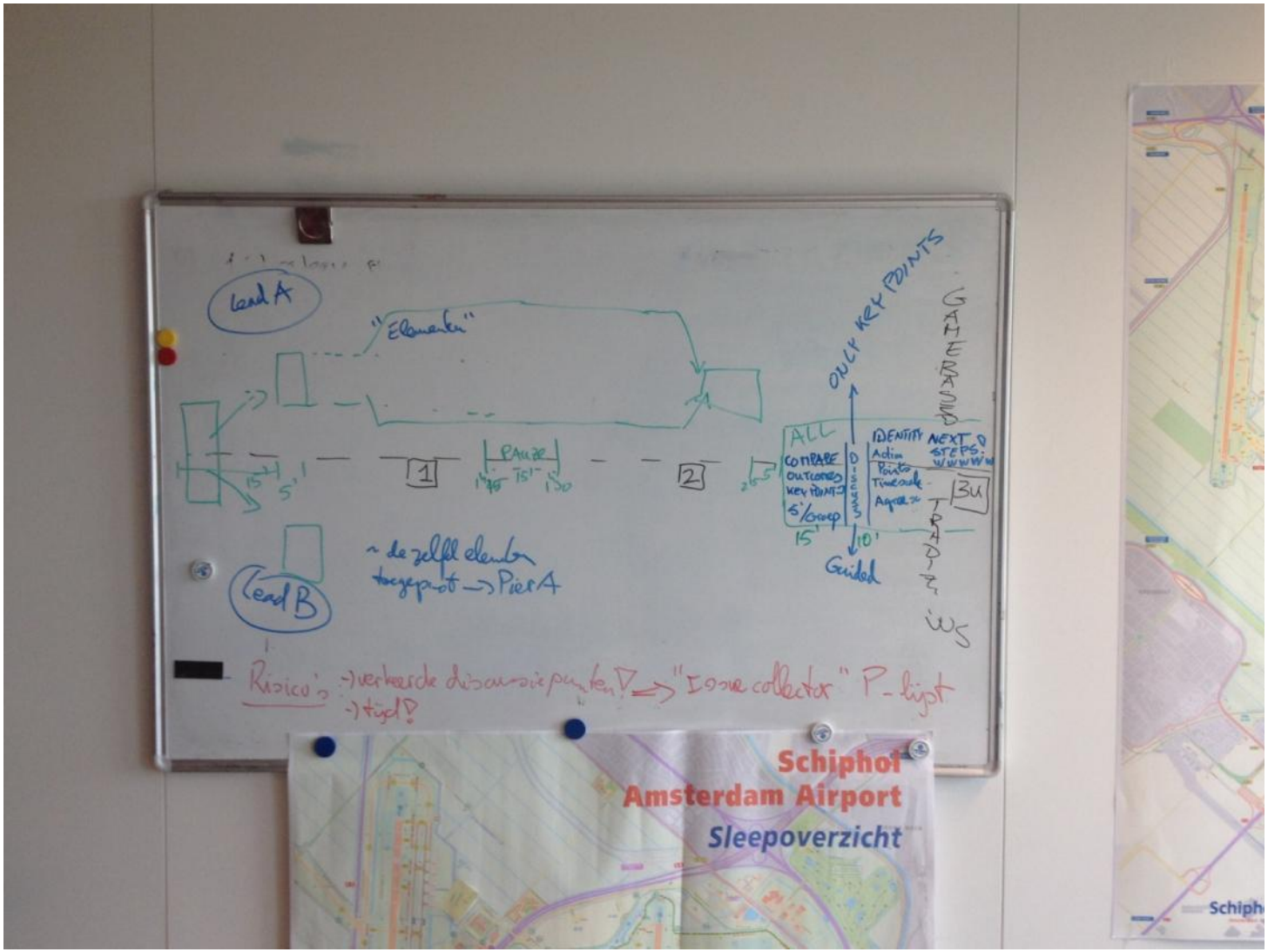


Figure 40: result of consultation with IBM expert

Appendix M Results

MOTIVATION TO ATTEND THE WORKSHOP

Question	N	Mean	Std. Deviation
Intrinsic			
Ik verwacht dat het interessant is - intrinsic	15	3,93	,594
Ik vind deelname aan de workshop leuk - intrinsic	15	3,73	,799
Amotivation			
Ik weet het niet, ik zie niet wat het mij brengt - amotivation	14	2,29	,825
Ik doe wel mee, maar ik weet niet zeker of het het wel waard is - amotivation	15	2,47	1,060
Identified Regulation			
Ik heb er persoonlijk voor gekozen – identified regulation	15	4,00	1,134
Ik verwacht dat het belangrijk voor mij is – identified regulation	15	3,80	,775
Ik zie het nut in van het deelnemen aan de workshop Equipment Pooling - intrinsic	15	4,13	,743
External regulation			
Ik moet aan deze workshop deelnemen – external regulation	15	2,07	1,280
Ik word geacht hieraan deel te nemen – external regulation	15	2,53	1,506

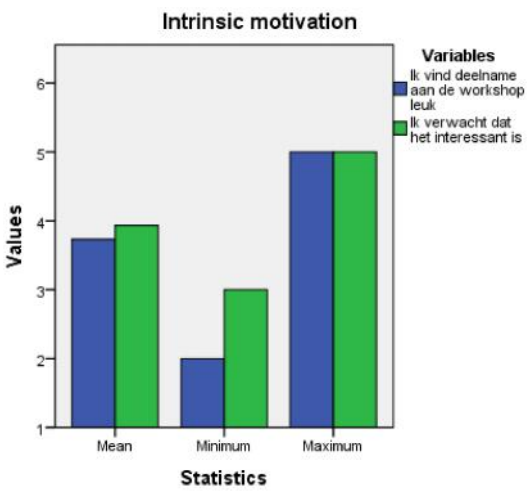


Figure 41: Score Intrinsic motivation participants

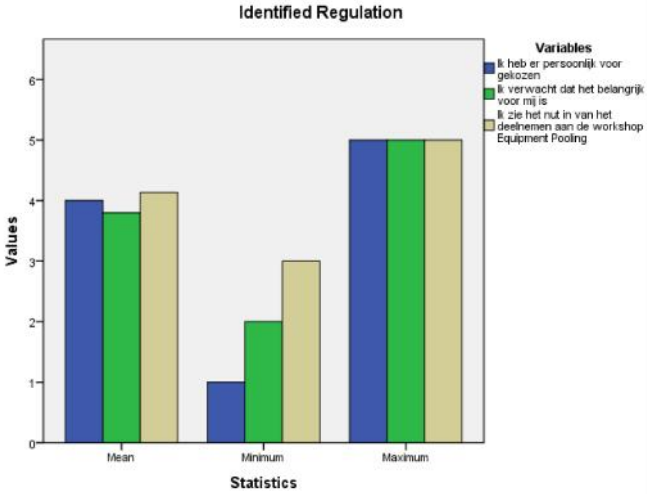


Figure 42: Score identified regulation participants

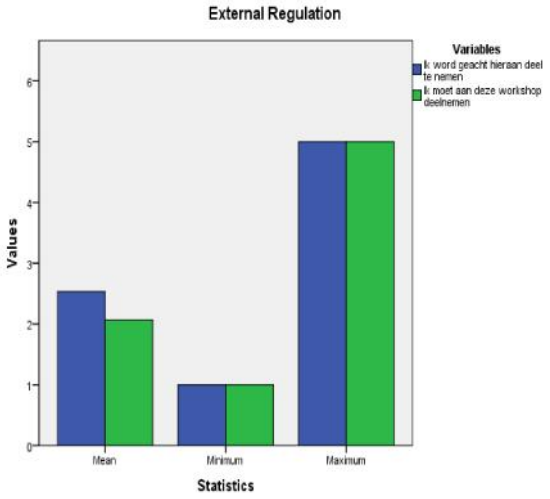


Figure 43: Score external regulation participants

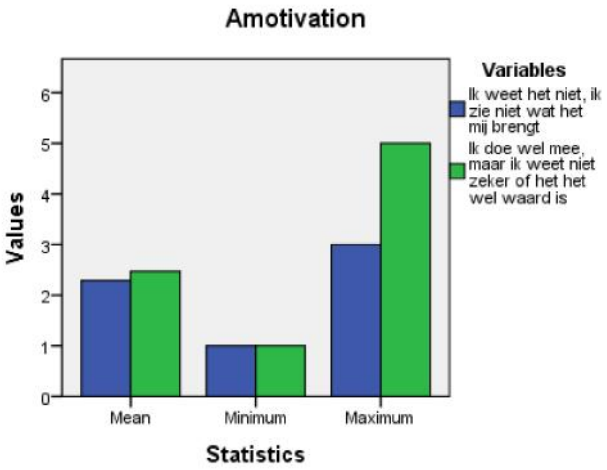


Figure 44: Score amotivation participants

ROLE-PLAY GROUP: MOTIVATION DURING THE WORKSHOP

Participant	1st measurement	2nd measurement	3rd measurement
Participant 1	4	4	4
Participant 2	2	3	2
Participant 3	4	5	4
Participant 4	4	4	4
Participant 5	3	4	4
Participant 6	3	4	3
Participant 7	4	3	n/a[12]

Table 42: Overview of the motivation results for Role-play group during the workshop

CONTROL GROUP: MOTIVATION DURING THE WORKSHOP

Participant	1st measurement	2nd measurement	3rd measurement
Participant 8	5	4	4
Participant 9	4	5	4
Participant 10	4	3	4
Participant 11	4	5	4
Participant 12	4	4	4
Participant 13	n/a	n/a	n/a
Participant 14	4	4	4

MEASURE MOMENTS

Two of the measurements took place when the groups were separated and one during the plenary session. The first measurement was after the propositions round. The second measurement was done after the development of the scenario round. And during the last plenary session the last and third measurement was done.

[12] Due to commitments Participant 7 had to leave during the workshop, before the plenary session.

COMPARISON OF THE ATTITUDE BEFORE AND AFTER WORKSHOP

A comparison of the attitude of the participants before and after is presented, see Table 43. The attitude of the participants towards equipment pooling declined significantly at two points; the financial attract ability and the feasibility and realisation of equipment pooling at AAS. It is remarkable to see that the workshop have given an insight in that collaboration is beneficial and to improve processes at airside collaboration is needed.

Propositions: total	Measure moment	Mean	Significance	Retain/ reject hypothesis
Q1: I am convinced about the benefits of equipment pooling	1	3,57	,212	Retain
	2	3,21		
Q2: Only from a theoretical perspective equipment pooling is promising	1	2,79	,710	Retain
	2	2,71		
Q3: I am going to convince other about the benefit of equipment pooling that the ground handling process is streamlined in a better way	1	3,00	,271	Retain
	2	2,71		
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	3,07	,039	Reject
	2	2,36		
Q5: Equipment pooling improves safety at airside	1	3,43	,094	Retain
	2	2,79		
Q6: I experience the dependency on other actors, because of equipment pooling as a high risk	1	3,43	,755	Retain
	2	3,29		
Q7: The lack of space at airside can be solved partially by means of equipment pooling	1	3,93	,013	Reject
	2	3,21		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	2,79	,331	Retain
	2	2,50		
Q9: Equipment pooling decreases the availability of equipment	1	2,57	,873	Retain
	2	2,50		
Q10: Equipment pooling is financially attractive	1	3,36	,034	Reject
	2	2,93		
Q11: I am confident about the realization of equipment pooling at AAS	1	3,29	,005	Reject
	2	2,50		

Table 43: the score of the whole group before and after the workshop

Propositions: Control group	Measure moment	Mean	Significance	Retain / reject hypothesis
Q1: I am convinced about the benefits of equipment pooling	1	3,33	,785	Retain
	2	3,17		
Q2: Only from a theoretical perspective equipment pooling is promising	1	3,33	.157	Retain
	2	2,67		
Q3: I am going to convince others about the benefits of equipment pooling that the ground handling process is streamlined in a better way	1	3,00	,414	Retain
	2	2,67		
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	2,33	,655	Retain
	2	2,17		
Q5: Equipment pooling improves safety at airside	1	3,00	,102	Retain
	2	2,33		
Q6: I experience the dependency on other actors, because of equipment pooling as a high risk	1	3,33	,257	Retain
	2	2,67		
Q7: The lack of space at airside can be solved partially by means of equipment pooling	1	3,50	,096	Retain
	2	2,50		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	2,00	,317	Retain
	2	1,67		
Q9: Equipment pooling decreases the availability of equipment	1	2,50	,783	Retain
	2	2,33		
Q10: Equipment pooling is financially attractive	1	3,33	,564	Retain
	2	3,17		
Q11: I am confident about the realization of equipment pooling at AAS	1	3,17	,102	Retain
	2	2,50		

Table 44: Score of Control group (A-pier)

Propositions: premeasurement	Group	Mean	Significance	Retain / reject hypothesis
Q1: I am convinced about the benefits of equipment pooling	1	3,75	,282	Retain
	2	3,33		
Q2: Only from a theoretical perspective equipment pooling is promising	1	2,38	,142	Retain
	2	3,33		
Q3: I am going to convince others about the benefit of equipment pooling that the ground handling process is streamlined in a better way	1	3,00	0,950	Retain
	2	3,00		
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	3,63	,043	Reject
	2	2,33		
Q5: Equipment pooling improves safety at airside	1	3,75	,282	Retain
	2	3,00		
Q6: I experience the dependency on other actors, because of equipment pooling as a high risk	1	3,50	,950	Retain
	2	3,33		
Q7: The lack of space at airside can be solved partially by means of equipment pooling	1	4,25	,181	Retain
	2	3,50		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	3,38	,081	Retain
	2	2,00		
Q9: Equipment pooling decreases the availability of equipment	1	2,63	,852	Retain
	2	2,33		
Q10: Equipment pooling is financially attractive	1	3,38	,755	Retain
	2	3,17		
Q11: I am confident about the realization of equipment pooling at AAS	1	3,38	,662	Retain
	2	2,50		

Table 45: the premeasurement scores of Role-play group and 2 separately

Propositions: post-measurement	Group	Mean	Significance	Retain / reject hypothesis
Q1: I am convinced about the benefits of equipment pooling	1	3,25	,662	Retain
	2	3,17		
Q2: Only from a theoretical perspective equipment pooling is promising	1	2,75	1,000	Retain
	2	2,67		
Q3: I am going to convince others about the benefit of equipment pooling that the ground handling process is streamlined in a better way	1	2,75	1,000	Retain
	2	2,67		
Q4: Collaboration to improve the efficiency in the ground handling process benefits to a smaller extent than continuing to operate separately	1	2,50	,662	Retain
	2	2,17		
Q5: Equipment pooling improves safety at airside	1	3,13	,181	Retain
	2	2,33		
Q6: I experience the dependency on other actors, because of equipment pooling as a high risk	1	3,75	,142	Retain
	2	2,67		
Q7: The lack of space at airside can be solved partially by means of equipment pooling	1	3,75	,059	Retain
	2	2,50		
Q8: The eventual acceptation of equipment pooling depends on a significant decrease in safety risks.	1	3,13	,008	Reject
	2	1,67		
Q9: Equipment pooling decreases the availability of equipment	1	2,63	,662	Retain
	2	2,33		
Q10: Equipment pooling is financially attractive	1	2,75	,491	Retain
	2	3,17		
Q11: I am confident about the realization of equipment pooling at AAS	1	2,50	1,000	Retain
	2	2,50		

Table 46: the post-measurement scores of Role-play group and 2 separately

Interviewee	Company	Date
Erik Waatjes	Schiphol Group	28-08-2015
Herman Homma	KLM	30-07-2015
Jaap Weerdmeester	Aviapartner	30-07-2015
Maaike Arwert	KLM	07-09-2015
Marleen Velthuis	Schiphol Group	24-08-2015
Onno Hompe	Swissport	31-08-2015
Pascal Schaafsma	KLM	25-08-2015
Paul Schmitz	S-P-S Group	25-08-2015
Rob Spijker	TCR	31-08-2015
Ton Opdam	Schiphol Group	27-08-2015

Table 47: the group of interviewees

General findings

The interviews gave a better understanding of participants attitude and opinion about a role-play or existing situation. For even more information about the interviews, contact the author.

'Act of genius'

The participants in the role-play were all surprised by the fact that they had to play a role. Though it was founded to be challenging, very interesting and like someone said an act of genius. Like participants said they were forced to 'het loslaten van vaste straatjes', 'uit hun normale harnas gehaald' and 'aangezet tot creatief denken over zo'n soort vastgeroest onderwerp'.

Strategic behaviour

Strategic behaviour was seen in both groups, to a smaller extent in the role-play group. But also there participants noticed strategic behaviour, because like one said they knew that they would have a plenary session in which the participants were a bit afraid that once they said something in favour or against equipment pooling during the role-play round, this would automatically result in the same opinion during the plenary session.

New insights

New insights in each other were gained during the workshop. To look from others perspective during the role-play and the obligation to cooperate with each other, members of both groups increased their insights. This results in more understanding between the players in the ground handling sector. Especially in the role-play the need to co-operate to make things more efficient at airside became clear.

Out of your comfort zone

It can be difficult for the participants to switch suddenly between their normal job and the appointed role. Giving them more time to adjust and more incentives will enlarge the effect of the role-play. A group where almost everybody knows each other is perfect for a role-play, since you are only willing to step out of your comfort zone, in other words playing a role, if you are in a familiar environment.

Conclusions after interviews

After conducting several interviews a few conclusions can be drawn

1) A stuck and long-discussed subject such as equipment pooling can be provided with new energy and new perspectives by playing a role-play.
2) The participants of the role-play have gained several new insights in each other, despite the fact that they already know every stakeholder for a long time.
3) A more trustful relationship is built between the actors during the workshop.
4) The overall willingness to cooperate at airside increases, in a large extent by using a role-play, to a smaller extent by having the existing situation.
5) The workshop needs to be adjusted on some aspects. These aspects are the role description, the drawn situation, in this case it was Flydon Airport, and more incentives so participants are used to their roles.
6) Both groups acknowledge the added value of having a workshop to force something on subjects like equipment pooling. The role-play group see such workshops as worth repeating in the future, where in Control group more doubts exists on whether a workshop is the right format.

It can be difficult for the participants to switch suddenly between their normal job and the appointed role. Giving them more time to adjust and more incentives will enlarge the effect of the role-play. A group where almost everybody knows each other is perfect for a role-play, since you are only willing to step out of your comfort zone, in other words playing a role, if you are in a familiar environment.