Amsterdam Airport Schiphol doing a case study about creating Key Performance Indicators for measuring the processes of the Ground Handlers

Final Report

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<th>Description</th>
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<tbody>
<tr>
<td>ACN</td>
<td>Air Cargo Netherlands</td>
</tr>
<tr>
<td>GH</td>
<td>Ground Handler</td>
</tr>
<tr>
<td>FF</td>
<td>Freight Forwarder</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicators</td>
</tr>
<tr>
<td>SMART</td>
<td>Specific, Measurable, Achievable, Relevant &amp; Time Phased</td>
</tr>
<tr>
<td>IATA</td>
<td>The International Air Transport Association</td>
</tr>
<tr>
<td>TIACA</td>
<td>The International Air Cargo Association</td>
</tr>
<tr>
<td>CSQ</td>
<td>Cargo Service Quality</td>
</tr>
<tr>
<td>OTM</td>
<td>On Time Performance</td>
</tr>
<tr>
<td>ATA</td>
<td>Actual Time of Arrival</td>
</tr>
<tr>
<td>RCF</td>
<td>Received Cargo from Flight</td>
</tr>
<tr>
<td>NFD</td>
<td>Notification for Delivery</td>
</tr>
<tr>
<td>DLV</td>
<td>Delivered to the Customer</td>
</tr>
<tr>
<td>RCS</td>
<td>Received Cargo from Shipper</td>
</tr>
<tr>
<td>DEP</td>
<td>Shipment Departed on Flight</td>
</tr>
<tr>
<td>SPL</td>
<td>Schiphol</td>
</tr>
</tbody>
</table>
Preface

This report is written by M. van Iersel as part of the Graduate Internship (research) at Royal Schiphol Group in cooperation with Air Cargo Netherlands (ACN). This research will be my final thesis for the University of Applied Sciences (Aviation Operations). The research during my graduating thesis is about benchmarking the Key Performance Indicators for the ground handlers to create an overview of their processes. Ferry van der Ent (Royal Schiphol Group) and Ben Radstaak (ACN) will guide me during this research. During this research I will visited different companies that are relevant for this research. Most of the important stakeholders that are relevant for this research are the Ground Handlers (GHs), Freight Forwarders (FFs), Airlines, Transport Companies and Customs of Schiphol Airport.

The motivation of the interest of graduating at Royal Schiphol Group is the complex field the airport is finding itself in. The Cargo Supply Chain encounters different problems in certain processes. There is enough room for improvement and that is challenging. The companies that will be involved during this research are the largest companies of the Aviation Industry, it will be a challenging internship and it will be a positive addition for my connections in the world of Aviation.

Max van Iersel

*Amsterdam, October 2018.*
Management Summary

The Cargo Supply Chain of Amsterdam Schiphol Airport is a complex chain with a different stakeholders. To realize an efficient operating in the Cargo Supply Chain a lot of stakeholders have to work together to accomplish this. During this research the Royal Schiphol Group wanted to get a clear view of the processes of the GHs. Currently Schiphol doesn’t have the data and insight information of the GHs processes. The objective of the research is to determine the Key Performance Indicators for the performance index of the GHs operation that will create a better insight of the GHs bottlenecks.

The stakeholders of Schiphol are interviewed in order to facilitate data collection and in-depth information around the topic. Over 35 different stakeholders are interviewed and involved to define the right KPIs for the index. By the draft of the KPIs certain steps are important to pursue. During this research the SMART method is used to define useful KPIs.

During the interviews with the stakeholders of Schiphol Airport it became clear that in general all GHs are facing the same problems. The problems were focused on; On Time Performance, Manpower, Communication and Congestion at the terrain. It also became clear that all 100% of the stakeholders were interested in a KPI index of the GHs performance.

The following table summarizes the most important KPIs (based on the GHs performance) according to the interviewed stakeholders:

<table>
<thead>
<tr>
<th>KPIs</th>
<th>Freight Forwarders</th>
<th>Ground Handlers</th>
<th>Airlines</th>
<th>Transport Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Availability (OTM)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Waiting times trucks (OTM)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Gate in till gate out (OTM)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of damaged goods (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>% of goods that endure claims (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Sharing (Quality)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Innovation (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualified Employees (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnaround time aircraft (OTM)</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

These KPIs were mentioned by the involved stakeholders. It became clear that certain KPIs that are mentioned above can’t be defined as a KPI because they aren’t “SMART” or relevant for this performance index. The following KPIs didn’t make it into the final index:

- % of damaged goods of total number of goods/
- % of goods that endure claims
- Information Sharing
- Innovation
- Qualified employees / Manpower
- Turnaround time aircraft

The KPIs that did make it and give a clear view of the current bottlenecks of the GHs are:

- On Time Performance of Freight Availability (Through put time of general cargo)
- Gate in – Gate out. The time the trucks are present at the terrain of the Ground Handler.
- From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line).

The measurability and the trustworthy outcome of the data of the KPIs is important. That’s why two Information Platform Companies were involved. The KPIs that are shown above are divided into different KPIs for an even better insight of the operation. The companies are able to measure certain KPIs with their available data (milestones). The following KPIs that are sown below are the final researched KPIs for the performance index:

- Actual Time of Arrival (ATA) till Received Cargo from Flight (RCF)
- Received Cargo from Flight (RCF) till Notification for Delivery (NFD)
- Notification for Delivery (NFD) till Delivered to the Customer (DLV)
- Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)
- Gate in till Gate out
- From truck entering the line at the Ground Handler till – gate in Ground Handler

Not all shown KPIs are perfect and there are certain limitations and possibilities for the stakeholders to influence the outcome of the KPIs. The figure below shows the conditions of the SMART method, this indicates the value of the KPIs.

<table>
<thead>
<tr>
<th>KPI</th>
<th>Specific</th>
<th>Measurable</th>
<th>Achievable</th>
<th>Relevant</th>
<th>Time phased</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATA till RCF</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>RCF till NFD</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>NFD till DLV</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>RCS till DEP</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Gate in till Gate out</td>
<td>+</td>
<td>+/-</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Entering line till gate in</td>
<td>+</td>
<td>-</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

The outcome of the KPIs are important to norm. It is important to determine the acceptable and unacceptable duration of certain processes at the GHs. Without a norm you can’t make demands towards the stakeholders. The current norm is formulated by the input of the GHs. The average norm in minutes is shown below:

<table>
<thead>
<tr>
<th>KPI</th>
<th>Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATA till RCF</td>
<td>300 m</td>
</tr>
<tr>
<td>RCF till NFD</td>
<td>360 m</td>
</tr>
</tbody>
</table>
To summarize the conclusion, there is a demand for a Key Performance Indicators index within Schiphol’s Community and there are different well defined and measurable KPIs that can add value and create a better insight of the bottlenecks of the GHs. Not all KPIs are perfect but the KPIs can contribute with reducing / eliminating the bottlenecks of the GHs because Schiphol can control the GHs more with the data outcome of the KPIs.

The recommendation for the Royal Schiphol Group is that they should first schedule a meeting with the Landside Pickup and Delivery group from the Smart Cargo Mainport Program (SCMP) to establish clear norms for the KPIs. Currently the norms are still an average of the input of stakeholders. After the norms are clear they should use the results of the research and start calculating the KPIs in cooperation with the Information Platform Companies. If you can’t measure it, you can’t improve/manage it (Drucker, sd).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NFD till DLV</td>
<td>1080 m</td>
</tr>
<tr>
<td>RCS till DEP</td>
<td>180-1440 m</td>
</tr>
<tr>
<td>Gate in till Gate out</td>
<td>120 m</td>
</tr>
<tr>
<td>Entering line till gate in</td>
<td>0-240 m</td>
</tr>
</tbody>
</table>
1. Introduction

1.1 Background Information (Royal Schiphol Group)

The background information of the company of my supervisor during my thesis, this party fulfil a major role during this research.

1.1.1 Royal Schiphol Group

Royal Schiphol Group is an aviation company with an important social mission. Their mission is to optimally connect the Netherlands to the rest of the world, in order to contribute to prosperity and well-being in this country and elsewhere (Group, 2018). Many parties are involved in Schiphol. Schiphol provides infrastructure and facilities for departing, arriving and transferring passengers and cargo. The processes that this involves are carried out by a vast number of parties (Group, Amsterdam Schiphol Airport, 2018). The ambition of the Royal Schiphol Group is to develop Schiphol into Europe’s Preferred Airport. By accomplishing this ambition strategies are made.

The strategy of the Schiphol Group that is most relevant for this research is the “Schiphol Cargo Strategy”. This research is contributing with the strategy of the Schiphol Group on different connecting points, including the following strategy points;

- Push for transparency & data exchange within supply chain.
- Improve ground operation, reduce throughput time and minimize volatility
- Contribute in attracting and maintain distribution centers
- Promote Schiphol as location for forwarders consol centers

This strategy is divided it in different strategic priorities. This is shown in Appendix A. Four key strategic decisions are prioritized of Figure 1. (2,4,7 and 8). The other strategic points are not relevant for this research.
1.1 Problem Statement

Amsterdam Airport Schiphol encounter bottlenecks in the processes of cargo supply chain. The cargo supply chain includes different stakeholders (Freight Forwarders, Airlines, Ground Handlers, Transport Companies and Customs) that are part of the chain and are able to influence the operational processes. The main focus of this research is the operation of the Ground Handlers (GHs). This figure shows the certain components were airports get judged on by the Aviation Industry, many of these components are based on the GHs operation (Handling, Warehouse capacity and Trade Facilitations). That’s the reason why it’s important to focus on the GHs because it’s important to improve the quality of the ground operations.

![Quality of Ground Operations](image)

The added value that will be created consist out of better insight of the processes, identify the most important issues and measuring facts with data. Currently Schiphol doesn’t have the data and insight information of the GHs processes. Schiphol isn’t able to compare their performance with other airports and therefore they can’t distinguish themselves based on the quality of certain processes.

The KPIs will be able to measure the processes of the GHs. KPIs are an effective instrument for this performance index because with KPIs you can decide what the problems areas are (bottlenecks) and increase potential for operational improvements for the GHs of Schiphol Airport. The involved stakeholders already have their own KPIs with their own data, the reason that an external party (Schiphol Group) also wants to define and measure the KPIs is to create trustworthy identical data. It’s better that an outside party will measure the KPIs (in co-operation with the stakeholders) because that will result in a reliable outcome. Besides that, the Schiphol Group uses the performance index to see if they achieve their objectives, the overall operation of the GHs need continues improvement for better competitiveness.

The performance index is focused on the GHs processes because they are the centre of the operation *Appendix B*. The most bottlenecks arises at the GHs of Schiphol Airport, the waiting times of the trucks are too long, not enough qualified employees and warehouse capacity issues (Versleijen, 2017). During meetings between the Royal Schiphol Group and the stakeholders it became clear that the congestion and waiting times are currently the main issues of the GHs at Schiphol. The performance index could contribute with analysing the processes and bottlenecks. By improving certain processes, the major current
bottlenecks; waiting truck times (congestion) and capacity problems can be improved. It’s important to create KPIs that will give an indication of the current bottlenecks. If this will be reached the bottlenecks will be insightful and that will contribute with eliminating the bottlenecks/improving the certain operations. All stakeholders can profit if the congestion, capacity problems and throughput times of the GHs will be reduced.

1.2 Objective

The objective of the research is to determine the Key Performance Indicators for the performance index of the Ground Handlers operation that will create an insight of the Ground Handlers bottlenecks.

This objective will be reached by researching the potential KPIs in cooperation with the Schiphol’s stakeholders of the cargo supply chain. The relevant stakeholders are the stakeholders that are capable of influencing the processes of the GHs. If they are capable of influencing the processes that automatically implies that they are also influencing the data and outcome of the KPIs.

1.3 Research Question and Sub Questions

The main research question that will be answered in this thesis is formulated as follows:

- Is there support from Schiphol’s Community for a performance index of the Ground Handlers and which KPIs should be monitored to create added value for the stakeholders?

To realize the answer on the main question a research has to take place and that will be done in combination with research question. The research questions include theoretical and empirical questions. After answering the research questions, a conclusion can be made.

- What is the current situation of the Ground Handlers performance at Schiphol Airport and what are their most important processes?
- Are the involved stakeholders interested in a performance index of the ground handlers and are they willing to measure the KPIs?
- What are the feasible KPIs for the performance index?
- How can the KPIs be measured and is the outcome and data trustworthy?

1.4 General Cargo

During this research the focus is on the general cargo and not for example; pharmaceuticals, perishable goods or live animals. This kind of cargo shipments require special procedures. These kind of shipments will not be taken into account during this research because their throughput time can vary. This will make it hard to compare the data and outcome of certain KPIs.
2. Literature Review

In the literature review three subjects will be discussed.

2.1 Key Performance Indicators

The goal of defining the KPIs of the stakeholders are to create an overview of KPIs that can result in global standards performance index. The measurement of performance is important because it identifies current performance gaps between current and desired. Carefully selected key performance indicators identify precisely where to take action to improve performance. (Weber, 2005)

The areas you choose to measure should relate directly to the core activities of your business (Aviation Industry). Due to this, KPIs will differ depending on your specific business type, operations and industry. Although businesses in the same industry will not necessarily utilize the same indicators, KPIs for all organizations should (business, 2018):

- be tied into the overall business objectives and goals;
- measure areas directly influencing the business' ability to succeed;
- indicate areas requiring further action

For your KPIs to be useful, you will need to be able to measure them over time. KPIs should allow you to set measurable and achievable goals for improving core business activities. By the draft of KPIs certain steps are important to pursue. The SMART is an abbreviation for the five conditions of a good KPI (SMART, 2018):

1. Specific – *It has to be clear what the KPI exactly measures.*
2. Measurable – *The KPI has to be measurable to define a standard or norm.*
3. Achievable – *Every KPI has to be measurable to define a standard value for it.*
4. Relevant – *The KPI must give more insight in the performance of the organization in obtaining it’s strategy.*
5. Time phased – *It is important to express the value of the KPI in time.*

The key to creating effective KPIs is as much art as science. Organizations that create KPIs with the following 9 characteristics are likely to deliver high-impact KPIs (Eckerson, sd):

1. Sparse: The fewer KPIs, the better.
2. Drillable: Users can drill into detail.
3. Simple: Users understand the KPIs.
4. Actionable: Users know how to affect outcomes.
5. Owned: KPIs have an owner or someone who manages the KPIs.
6. Referenced: The data behind the KPIs must be clear, available and accurate.
7. Correlated: KPIs must be linked to each other.
8. Aligned: KPIs don’t undermine each other.
9. Balanced Financial and non-financial KPIs must be used.
2.1.2 Airport Performance

The main process is defined as the airfreight operation that takes place at the airport. From flight approaching the airport till the FFs picking up the freight at the GHs warehouse and vice versa. It’s important that the KPIs will tackle certain processes in the operation that are dealing with issues. If the bottlenecks can be defined as a KPI, you can measure it and analyse the problem of the process.

The total performance of the airfreight process depends on different stakeholders.

![Airfreight Performance Diagram]

Figure 3. Total performance of the Airfreight process.

The figure above shows that the performance of the airfreight process depends on many factors. That means that the outcome of the KPIs also depends on the performance of the different stakeholders in the cargo supply chain (Damme, 2014).

The most important performance areas of the airport and their stakeholders are Speed, Cost, Growth Opportunities, Airside Network, Safety and Technological Developments. The key performance areas include different key performance indicators, the following areas with the different indicators examples were formulated in an previous research (Laaken, 2007):

**Speed**

- Turn-around time Full Freighter
- Punctuality arriving/departure flights
- Reaction time on phone calls / mail contact
• Throughput time ground handlers warehouse

Cost

• Landing fees
• Environmental contribution
• Handling Costs
• Occupancy rate warehouse

Growth Opportunities

• % Availability slots
• Maximum number of arrivals and departures per hour
• Number of aprons available

Airside Network

• Number of destinations per continent
• Frequency per continent
• Capacity per continent

Safety

• Certification employees ground handlers
• Amount of handled dangerous goods without safety issues
• % Customs checks at warehouses

Technological developments

• % participating E-Freight companies
• % Customs declarations digital
• % participating e-Link companies

There are lot of different kind of performance indicators, every stakeholder in the cargo supply chain got their own indicators and their own operation. There is always room for improvement, with improving the use of data and increasing the information sharing the quality of the chain can be improved significantly. The parts from the performance areas that are important for this research are (Laaken, 2007):

• Turn-around time Full Freighter
• Punctuality arriving/departure flights
• Throughput time ground handlers warehouse
• Certification employees ground handlers
• Amount of handled dangerous goods without safety issues
• % Customs checks at warehouses
• % participating E-Freight companies
• % Customs declarations digital
• % participating e-Link companies

These Key Performance Areas can be important because they are part of the operation of the GHs.

2.2 The International Air Transport Association (IATA) – Cargo iQ

Cargo iQ is an IATA interest group with the mission of creating and implementing quality standards for the worldwide air cargo industry. Cargo iQ developed a system of shipment planning and performance monitoring for air cargo based on common business processes and milestones. The Cargo Supply Chain includes different milestones, certain milestones of Cargo iQ will also be used during this research to define KPIs. The milestones are part of the following Master Operating Plan and chain of Cargo iQ:

![Air Cargo Industry Master Operating Plan](image)

Figure 4. Air Cargo Industry Master Operating Plan

These IATA milestones are also used by Information Platform Companies like Cargonaut and SmartLOXs (IATA, 2018).

2.3 The International Air Cargo Association (TIACA) - CSQ

The International Air Cargo Association (TIACA) pilots new Cargo Service Quality tool for terminals and airports. This tool allows forwarders to rate and review the service quality they receive at participating hubs.

The tool incorporates a four-step process: Benchmarking, Assessment, Improvement, and Excellence — as a way of raising the cargo service standards.

Cargo terminals registered to take part in the pilot will be rated by forwarders on several factors including process, technology, facilities, regulators, and general airport infrastructure, amongst other variables.

“The CSQ tool will benefit the worldwide air cargo community by improving visibility and facilitating global standards, and TIACA is pleased to be at the forefront of such an exciting
development,” said Steven Polmans, TIACA Vice Chair and Head of Cargo and Logistics at Brussels Airport Company, who backed the scheme.

The initiative aims to provide airports and cargo terminals with the business insight to optimize their investments and identify areas where processes and service delivery can be improved (TIACA, 2018).

This tool is based on qualitatively data. The results that will be realized by this tool is based on perception and measurable facts like KPIs. This tool can be used to indicate certain aspects that aren’t possible to define as KPI.

3. Methodology

In this part the background of the method is explained that is used for this research.

3.1 The scope of the research

There is room for improvement for Schiphol, currently there are certain processes in the cargo supply chain that aren’t going fluently. That means that bottlenecks arise, to improve these bottlenecks the processes needs to measured. The bottlenecks needs to be tackled with certain KPIs to realize a better insight of the bottlenecks. To actualise the KPIs different steps need to be taken. The global thread of this research will be formulated by using a diagram with the important components and steps that are necessary to generate potential KPIs:

The common thread of this research is shown in the diagram, this are the important steps to undergo for creating the KPIs. During the chapters of this research these subjects will be treated to achieve the final conclusion of benchmarked KPIs.
3.2 Interviews stakeholders Schiphol

The stakeholders of Schiphol are interviewed in order to facilitate data collection and in-depth information around the topic. In this part all interviews will be substantiated. Different stakeholders are interviewed, the following stakeholders are interviewed:

- Five - Ground Handlers
- Eleven - Freight Forwarders
- Three - Airlines
- One - Transport Company
- Two - Information Platform Companies
- Customs

2.2.1 Interview Game

During the phase 1 and phase 2 interviews at the FFs the interview starts with the “Interview Game” where the person of the FFs needs to divide 20 points between the five GHs of Schiphol Airport (the outcome of the points isn’t that relevant). During phase 1 it is based on the overall performance of the GHs and during phase 2 it is based on certain KPIs, those KPIs are formulated by the input of phase 1. The point dividing part is based on the perception of the FFs. The interview game will contribute by the following aspects:

- Which GH is performing well (or underperforming) based on the FFs perception
- The general perception of the FFs
- Insight of the processes and bottlenecks of the GHs
- Control tool for the interview questions (comparing the interview game with the interview questions for reliability of the answers)

The most important reason for the interview game is to let the interviewed stakeholders be focused on the subject. It’s a conversation technique to turn on the focus of the interviewed person.

![Figure 5. Judging Alignment (Five Ground Handlers)](image)

2.2.2 Interview Questions

This part will include the substantiation of how the output of the interviews contributed with answering the research and sub questions. For every stakeholder there is a different
approach and different questions. During phase 1 certain information is gathered and during phase 2 the KPIs get tested (benchmarked by using the gathered information of phase 1).

**Phase 1**
The global purpose of the phase 1 interviews at the stakeholders are as follows, gathering the information about:
- Are the stakeholders interested and willing to participate with this KPI index
- The current bottlenecks and issues of the Ground Handlers operation
- Discussing the relevant KPIs

**Phase 2**
The global purpose of the phase 2 interviews at the stakeholders are as follows, gathering the information about:
- Monitoring the potential KPIs
- The data that is required to measure the KPIs
- The limitations of the KPIs

Different subjects were discussed during the interviews with the stakeholders, to create an overview of the subjects that were discussed. The table below shows the different subjects that were discussed at certain stakeholders.

<table>
<thead>
<tr>
<th>Interview subjects and stakeholders</th>
<th>Freight Forwarders</th>
<th>Ground Handlers</th>
<th>Airlines</th>
<th>Transport Company</th>
<th>Information Platform Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>The important capabilities of the GHs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Current Situation with the stakeholders</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Congestion at the GHs for the truckers</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>The bottlenecks in the operation (export and import)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The benchmarked KPIs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>On what way is the performance index going to</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Help the GHs operation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Measurability and trustworthiness of the KPIs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The position as agent between the FFs and GHs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Availability of data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Financial investment stakeholders to realize the performance index with KPIs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The most relevant KPIs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

For the comprehensive explanation about the reason that certain stakeholders are interviewed and involved during this research is shown in Appendix C.

**Analysing the global input of the stakeholders**

It’s important that the output (data and information) of the stakeholders will be compared to create a performance index that is conducive for all involved stakeholders. By doing this you will determine the common threads and bottlenecks. This will be important to determine the right KPIs.

It’s also important to address how the stakeholders can influence the performance of the GHs. This will be explained during the research.

**Fishbone Diagram**

A fishbone diagram, also called a cause and effect diagram, is a visualization tool for categorizing the potential causes of a problem in order to identify it’s root causes. This diagram will contribute with an effective overview of the cause and effect (of the GHs issues/bottlenecks).

**SMART**

This method will be used for defining and formulating the KPIs for the Performance Index. This is explained in the Literature Review and used during this research.
4. Research Framework

In the research framework the results will be formulated and discussed. The framework is divided in four different chapters.

4.1 The current situation of the ground handlers operating at Schiphol Airport

In this part the stakeholders of Schiphol’s Cargo supply chain will be formulated. For this research the most important stakeholders of the supply chain are the GHs. The global cargo supply chain will be formulated in this chapter. The impact of the Government and Customs will be explained in the chapter 4.4. Besides the supply chain the issues will be discussed, the processes of the GHs that are dealing with issues will be transformed in KPIs (if possible). If you measure the issues/bottlenecks, you can try to improve the processes. This will be done in chapter 4.3.

4.1.1 The Cargo Supply Chain of Amsterdam Airport Schiphol

In the figure below the global cargo supply chain of Schiphol is formulated. For a clear picture of the figure see Appendix D The chain is divided in 14 steps, the most important stakeholders are included. For this research the most important processes and steps are 8, 9 and 11. These processes are connected with the operation of the GHs at Schiphol Airport.

Figure 6. The Cargo Supply Chain – Swimlane (Visio)

4.1.2 The stakeholders

In this part the influence of the stakeholders on the GHs performance will be explained. The following three stakeholders will be formulated and introduced to create an insight of Schiphol’s Cargo Supply chain, these stakeholders have the most impact on the congestion, capacity issues and global processes of the GHs.

- Freight Forwarders
- Airlines
- Transport Companies
**Freight Forwarders**

A forwarder is the organizer for shipping the cargo. The FFs are responsible for the transportation of goods between one destination to another. FFs companies specialise in arranging the whole process for their shippers. From the storage to the shipping of their freight. There are over hundred FFs that are involved in the cargo supply chain of Schiphol.

During the interviews at the GHs it became clear that some issues that arise at the GHs are partially the fault of the FFs. Some examples of the most important issues are:

- **Congestion (capacity issues)**
  Most FFs are delivering the goods at the same moment of the week. This results in congestion and capacity problems for the GHs. The peak moments are hard to handle for the GHs. The FFs can also deliver in the weekends but most of the time they deliver at Mondays and Fridays what results overcapacity.

- **Financial part (payment FFs)**
  The GHs are lacking on their financial part. The GHs are dealing with underpayment in their opinion. This results in temporary employees because they don’t have the capital to hire qualified employees.

The knock-on effect will always be a problem in the cargo supply chain. If something in the chain will not operate effectively, other stakeholders in the chain will be impacted indirectly.

**Airlines**

An airline is a company that offers air transport for both passengers and cargo. The FFs book their shipments on one of the airlines operating at Schiphol. The certain flight and conditions will be discussed between the FFs and airlines. After that is arranged the airline will deliver the FFs freight to their destination. Some examples of the most important issues of the airlines are:

- **Delayed Flight / Cancelled Flights**
  The most important bottleneck of the airline is if the airline cancels certain flights or if flights get delayed. This will impact the total throughput time of the freight. Freight will stand still in the warehouses of the GHs and that results in extra cost and capacity problems for the GHs warehouses.

**Transport Companies**

A transporter is a company specialised in the transport of goods. They form an important link in the cargo supply chain. The link is between the FFs and GHs. The main issue of the Transport Companies is the congestion of trucks. The problem of congestion is an important issue for the GHs. This problem impacts all stakeholders in the chain. The truckers are
waiting and creating congestion at warehouses and roads. The congestion is a common issue in Schiphol’s cargo supply chain.

4.1.2 The Ground Handlers processes and bottlenecks
Ground handlers receive the cargo from forwarders, build up unit load devices and load/unload the airplane, break down unit load devices and ensure the transfer of the incoming cargo to the forwarder (ACN, Ground Handlers, 2018).

There are currently five GHs active at Schiphol Airport. The GHs that are operating in Amsterdam are shown in Appendix E.

All GHs have different operations, procedures, warehouse terrains, locations and the GHs provide their service to different airlines. During the interviews it became clear that there is still enough room for improvement at the GHs. The global processes of the GHs are divided in export and import. This is shown in the chain below:

![Figure 7. The Ground Handlers processes – Swimlane (Visio)](image)

In this figure some of the problems the GHs are dealing with are formulated below the processes written in print. If these problems can be tackled with KPIs it would create added value KPIs because the KPIs will then give a better insight of the problems. The bottlenecks are starting when the trucks are arriving in line in front of the GHs warehouse till the truck leaving the warehouse (gate in).

It quickly became apparent that in general all GHs are facing the same problems. In this part the most important bottlenecks and problems will be formulated that were defined by the input of the interviewed stakeholders. To summarize the most important problems according to all the stakeholders the following fishbone diagram is created:
These areas are also important to define the final KPIs for the performance index. To improve the operations of the GHs the bottlenecks should be measured to try to improve the processes. If you can’t measure it, you can’t improve/manage it (Drucker, sd).

All these issues of the GHs are resulting in bottlenecks for the stakeholders, the following bottlenecks arise. One issue can indirectly create and impact another issue of the processes. To summarize the most important are shown below:

**On Time Performance/Congestion Terrain**
The waiting truck times are too long at the GHs warehouses. The fact that the GHs are having manpower problems indirectly results in long waiting times for the trucks. If the GH doesn’t have enough manpower to handle the truckers effectively it can result in longer waiting times for the trucks because trucks have to wait longer than normally. This will result in a knock-on effect and can also result in congestion on the terrain.

**Manpower**
The attitude of certain employees at the GHs can arise because they aren’t qualified for the job. It’s hard for employees to get qualified employees and that results in accepting employees that aren’t qualified. The GHs are also having issues with planning right amount of employees for certain peak moments, this results in a shortage of employees during certain periods.

**Communication**
The On Time Performance can also be influenced by the inefficient information sharing of the GHs. Truckers arrive too early at the warehouse because the GH didn’t share the right information about the availability of freight.

4.2 The engagement of the stakeholders concerning the KPI index
During the research different stakeholders were involved to create and define the KPIs for the index. The following stakeholders participated:

- Ground Handlers
- Freight Forwarders
- Airlines
- Transport Company
- Information Platform Companies
- Customs

The different stakeholders and companies all have their own vision and needs but it became clear that the stakeholders are interested in an index that creates trustworthy data and facts.

All interviewed stakeholders (100% of the interviewed stakeholders) are interested in the performance index but the outcome of the measured KPIs should be trustworthy and it should add value for the Schiphol Community.

The stakeholders are also willing to measure and/or invest in systems to measure the KPIs. The most data that is required for the performance index is measured by information platform companies like Cargonaut because they are an external company. This is because the stakeholders explained that if the companies will measure the KPIs by themselves it isn’t trustworthy anymore.

To create an efficient and added value index all stakeholders need to be involved, the performance of the GHs can be impacted by different stakeholders. This is because the stakeholders explained that every stakeholder has a different vision and needs. That means that the KPIs also can be affected by the performance of other stakeholders in Schiphol’s Cargo Supply Chain. All stakeholders can have their contributions, for example the transport companies are starting a pilot with tracing their truckers to analyse their locations and throughput time (Route42, 2018). This can also be interested for an On Time Performance/throughput time KPI.

4.3 The potential Key Performance Indicators

There are different performance areas in the cargo supply chain so also at the GHs of Schiphol. The performance areas can be divided into different KPIs. It’s important to understand that a KPI requires perfect clarification to create added value with the KPI. Based on the interviews and research different KPIs can be defined. In this part the potential KPIs will be defined and explained.

The following performance areas are mentioned and used for defining the researched KPIs:

- On Time Performance (OTM)
- Quality

During the interviews different KPIs are mentioned and benchmarked, in this part the potential KPIs are shown and divided in performance areas. The input of the stakeholders resulted in plenty of KPIs, some KPIs were not even related to the GHs performance but the
airlines, some KPIs can’t be defined as a KPI and so on. In this part the different KPIs will be discussed of the stakeholders input.
The following table summarizes the most important KPIs (based on the GHs performance) according to the interviewed stakeholders:

<table>
<thead>
<tr>
<th>KPIs</th>
<th>Freight Forwarders</th>
<th>Ground Handlers</th>
<th>Airlines</th>
<th>Transport Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Availability (OTM)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Waiting times trucks (OTM)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Gate in till gate out (OTM)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of damaged goods (Quality)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>% of goods that endure claims (Quality)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Information Sharing (Quality)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Innovation (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Qualified Employees (Quality)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnaround time aircraft (OTM)</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

The table shows that certain KPIs are mentioned by varies stakeholders and some KPIs are only mentioned by one stakeholder. All stakeholders have a different vision and needs. The nine KPIs will be briefly formulated below:

- Freight Availability (Import) – From aircraft landing (on blocks) at the airport till freight ready for pick up for the FFs (in minutes).
- Waiting times trucks (Import & Export) – From truck entering the line at the GH (in front of the gate) till gate (the total time the truck is present at the terrain).
- Gate in till gate out (Import & Export) – The total time the trucks are present at the terrain of the GHs warehouse.
- % of damaged goods – The total number of damaged goods in relation to the total number of goods (%).
- % of goods that endure claims – The total number of goods that endure claims in relation to the total number of goods (%).
- Information Sharing – The total number of incorrect information sharing by the GHs (%).
- Innovation – The total investment in innovation by the GHs (in €).
- Qualified Employees – The total number of well-trained employees at the GHs (%).
- Turnaround time aircraft – The total time period an aircraft occupies a stand or gate at the airport (on blocks till off blocks aircraft).

During the research it became clear that certain KPIs that are mentioned above can’t be defined as a KPI, in the next chapter (4.3.1) the KPIs that didn’t make it into the final index will be discussed.

4.3.1 The fallen Key Performance Indicators
That means that some of the KPIs of the stakeholders input aren’t part of the KPI overview shown above, the following “KPIs” didn’t make it:

- % of damaged goods of total number of goods/% of goods that endure claims
- Information Sharing
- Innovation
- Qualified employees / Manpower
- Turnaround time aircraft

These “KPIs” can’t be defined as a KPI but it are important aspects according to the stakeholders. The CSQ of TIACA (explained in the Literature Review) can possibly get an insight of these bullet points.

**% of damaged goods of total number of goods/% of goods that endure claims**

During phase 2 of the interviews it became clear that this KPI isn’t fair towards the GHs. Most of the time when the goods are damaged it isn’t even the fault of the GHs. GHs are working with different airlines and the airlines have different procedures. It can for example already be damaged by the airlines before it enters the warehouse. As you can see in Appendix B, the cargo supply chain is long. Before the goods are entering the GHs warehouse at Schiphol, different operational steps have taken place. These steps can impact the freight in any way, shape or form. This KPI will be excluded from the next phase of this research. Besides that, the KPI isn’t fair towards the GHs, the GHs do have the information about the % of damaged goods but they are not willing to share the data. That means that this KPI can’t be measured as well.

**Information Sharing**

Communication is the key to success. If there is a lack of communication in the chain it can result in unnecessary bottlenecks. Sharing of correct information is important to create an effective and efficient operation.

This KPI isn’t part of the final benchmarked KPIs because currently this isn’t possible to measure with a KPI because there is no data available to use for measure this KPI. Stakeholders do use surveys to measure these kinds of points that are shown above. This will give a company the perception of what the status is of their performance on these points.

**Innovation**

Innovations are important to optimize and change your processes. The GHs are still lacking in innovations. There are some new innovations though, for example the kiosks of Swissport. This pilot project has become a new concept implemented by Swissport. This kiosk concept will share information with the trucker about the dock and the trucker can skip the Cargo Office. There is still room for improvement, the main issues are:

- It’s hard for GHs to adapt to new innovations
- Lacking behind in innovations

This KPI isn’t part of the final benchmarked KPIs because currently this isn’t possible to measure with a KPI because there is no data available to use for measure this KPI. The GHs
are not willing to share the information about how much they invest in innovation or other data that can be used to measure this KPI.

**Qualified Employees / Manpower**

The capacity of manpower is a major problem for the GHs of Schiphol Airport. This is one of the most important improvement points for the GHs according to the interviewed stakeholders. The main issues are:

- The lack of qualified employees (not well trained employees)
- Planning the right number of employees for an effective operation
- Temporary employees (result in low quality service)

This KPI isn’t part of the final benchmarked KPIs because currently this isn’t possible to measure with a KPI because there is no data available to use for measure this KPI. This KPI is hard to measure because GHs are not sharing data about their employees, temporary employees and work schedules.

**Turnaround time aircraft**

This KPI isn’t part of the final benchmarked KPIs because it is more based on the performance of the airlines and not the GHs. This KPI is also only mentioned by the airlines and not by any other stakeholders.

4.3.2 The Key Performance Indicators

There are many different stakeholders, all with different interests and needs. It’s important to analyse the input of the stakeholders and benchmark the relevant KPIs that will create an efficient overview of the GHs. During phase 1 different KPIs were benchmarked. These KPIs are defined based on the stakeholders input. All stakeholders were in agreement about these KPIs because they will give the best insight of the current bottlenecks of the GHs. The following KPIs are benchmarked:

- On Time Performance of Freight Availability (Through put time of general cargo)
- Gate in – Gate out. The time the trucks are present at the terrain of the Ground Handler.
- From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line).

4.4 The Key Performance Indicators for the Performance Index

The final KPIs for the performance index will be discussed in this part. After a long journey of interviewing the relevant stakeholders, analysing the input of the stakeholders and eliminating the KPIs that are currently not measurable. The benchmarked KPIs of Phase 1 will be discussed and formulated. The focus will be on the measurability and the trustworthy outcome of the KPIs.

If you can’t measure it, you can’t improve it (Drucker, sd). After all interviews with the stakeholders of the cargo supply chain and benchmarking the KPIs, the information platform companies (Cargonaut & SmartLOXS) needed to be involved. During this interviews the KPIs were discussed and formulated on a different way. The measurability and the trustworthy
outcome of the data of the KPIs was an important topic because different stakeholders have influence on the outcome. Both companies provide measurements and data, the companies are explained below.

4.4.1 The involved Information Platform Companies

The Information Platform Companies are involved for their available data (milestones) (as explained in the Literature Review). The background information of the two involved companies are shown below:

**Cargonaut**

Cargonaut describes itself as:

“As orchestrator of information flows to and from Schiphol, Cargonaut facilitates parties in the cargo supply chain with accurate, complete, timely and reliable information needed for seamless airport operations. With a focus on quality and reuse of information, smart airports facilitate transparency, predictability and transparency of cargo supply chains. By knowing in advance what cargo to expect, airport communities and individual companies can improve airport handling processes and accelerate or create entirely new processes (Cargonaut, 2018).”

**SmartLOXS**

SmartLOXS describes itself as:

“SmartLOXS stands for smart logistics and access as a service. SmartLOXS develops, supplies and manages collective access control systems, which in addition to security a smooth cargo handling is ensured. With the SmartLOXS systems you can control who, when, where and what can be done from your own workplace, while the system management is carried out by SmartLOXS. This saves you considerably on your IT costs. We call this unique concept Security as a service.”

4.4.2 The Final Benchmarked KPIs

During the interviews it became clear that some KPIs can be divided into parts and some KPIs aren’t measurable after all because stakeholders aren’t willing to share certain data that is necessary for measuring certain KPIs. The benchmarked KPIs will be explained and formulated (and maybe divided into different KPIs). The limitations and impact of the stakeholders of the KPIs will be discussed after the elaborations of the KPIs.

A. On Time Performance of Freight Handling - Import

During the interview at Cargonaut it became clear that this KPI needed to be adjusted into “On Time Performance of Freight Handling”. This is because Cargonaut can measure the process when the goods are taken out of the aircraft till the transmission of goods into the truck (1 step further than Freight Available). The division of the KPI are as follows:

- Actual Time of Arrival (ATA) *till* Received Cargo from Flight (RCF)
- Received Cargo from Flight (RCF) *till* Notification for Delivery (NFD)
- Notification for Delivery (NFD) *till* Delivered to the Customer (DLV)
**-Actual Time of Arrival**  
Actual Time of Arrival (ATA) is the notification from the Central Information system Schiphol (CISS) that the aircraft is ready to unload. The CISS sends an electronic message to the system of Cargonaut.

**-Received Cargo from Flight**  
Received Cargo from Flight (RCF) is the notification from the GH that the shipment is officially in their possession (acceptance of the FFs freight by the GH). This data/information will be send to Cargonaut and the FFs.

**-Notification for Delivery (NFD)**  
Notification for Delivery (NFD) is the notification of the GH that the shipment is ready for pick up (the FFs can pick up the goods).

**-Delivered to the Customer**  
Delivered to the Customer (DLV) is the notification of the GH to Cargonaut that the shipment is transferred into the truck of the customer.

**KPI - Actual Time of Arrival (ATA) till Received Cargo from Flight (RCF)**  
On block time of the aircraft (ready for unloading) till the freight is officially accepted by the GH (and in their possession).

**KPI - Received Cargo from Flight (RCF) till Notification for Delivery (NFD)**  
The shipment is officially in the possession of the GHs till the notification of the GH towards the FF that the shipment is ready to pick up.

**KPI - Notification for Delivery (NFD) till Delivered to the Customer (DLV)**  
The shipment is ready for pick up till the FF is picking up the goods and the freight will be transferred into the truck.

![Figure 9. Cargonaut – Available Information in the chain (SPL)](image)

*Figure 9. Cargonaut – Available Information in the chain (SPL)*

*Figure 3.* will create a better view of the chain with the aspects of the KPIs. These KPIs will give insight of the throughput time of the goods at the GH. The time of the process of
getting the freight out of the aircraft till warehouse and the process of “the freight arrived in warehouse” till delivered to the customer (goods in the truck of the customer at the dock). The outcome, integrity and data used is reliable for these KPIs (Smit, 2018). Currently NFD is marked red because the data is not complete. However, Cargonaut is almost finished with a pilot that will result in complete data for the milestone NFD as well (Smit, 2018).

B. Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP) - Export

With this KPI the time of the goods in the warehouse will be measured, will the goods be loaded for the scheduled flight or are there any delays. The KPI will be explained below:

- Received Cargo from Shipper
Received Cargo from Shipper (RCS) is the notification to Cargonaut that the GHs accepted the goods of the FFs.

- Shipment Departed on Flight
Shipment Departed on Flight (RCS) is the notification to Cargonaut that the aircraft is off blocks.

KPI - Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)
The time between the acceptance of the FFs goods by the GH till the aircraft is off blocks (the aircraft pushes back).

C. Gate in till Gate out. The time the trucks are present at the terrain of the Ground Handler. - Export

Gate in till gate out is an interesting KPI that can be measured by both Cargonaut and SmartLOXS. Both companies have their own manner to measure this process.

Gate in till Gate out – Cargonaut
Gate in till gate out can be measured by the companies that are using e-Link. e-Link is described below:

“e-Link supports and improves the export acceptance process. With e-Link you can monitor the complete process of your shipment before, during and after acceptance and steer accordingly. e-Link provided the opportunity to deliver shipments without an ACN receipt and to drive immediately to the dock and skip the documentation office when the shipments meet the determined conditions (with the use of the CAN pas) (ACN, e-Link, 2018).”

All GHs are able to receive e-Link companies but only 30% of the FFs are currently using e-Link. This is a small percentage of the total number of shipments. In Figure 4 the e-Link milestones are shown with the orange arrows. The monitoring points for this KPI are HA and EN.

- HA= Gate in (trucker enters the terrain of the GHs warehouse)
- EN= Gate out (truckers leaves the terrain of the GHs warehouse)
The trucker needs to sign in with their ACN pas at both measuring points (HA and EN) to gain all data that is required to measure the KPI (time of the truckers at the terrain).

Figure 10. Cargonaut - Gate in (HA) till Gate out (EN)

Gate in till gate out - SmartLOXS

SmartLOXS measures the gate in till gate out with card(id) scans of the truckers. A small part (one truck) of the data logs of the truckers entering and leaving the GHs warehouse are shown below. The extensive datasheet is shown in Appendix G with more data logs.

<table>
<thead>
<tr>
<th>teller</th>
<th>datum</th>
<th>term_id</th>
<th>reader_name</th>
<th>card_id</th>
<th>t_parem01</th>
<th>person</th>
<th>comp_id</th>
</tr>
</thead>
<tbody>
<tr>
<td>102342474</td>
<td>2018-10-10 09:43:51</td>
<td>589</td>
<td>KLM Cargo Speed Gate Out links laag</td>
<td>196973</td>
<td>10978679</td>
<td>147754</td>
<td>1186098</td>
</tr>
<tr>
<td>102340752</td>
<td>2018-10-10 09:11:32</td>
<td>27</td>
<td>KLM Cargo 3N TRUCK LAAG</td>
<td>196973</td>
<td>10978679</td>
<td>147754</td>
<td>1186098</td>
</tr>
</tbody>
</table>

In this example of 10-10-2018 the trucker is entering the terrain at 09:11:32 and leaving at 09:43:51, this means that the truck as in totally 32 minutes and 19 seconds on the terrain. This is the way that the gate in till gate out can be measured.

D. From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line). - Export

The gate in can be measured by both Cargonaut and SmartLOXS. The challenge of this KPI is to measure the point that the truckers are entering the line in front of the GHs warehouse (before gate in). Currently there is no solution to measure this point. However, during the interview at a transport company, it became clear they are currently busy with setting up a pilot with Route42. Route42 is a tracing company, this company will monitor and track the location of the trucks (using the trucks GPS systems). The two large transport companies, r.nagel and Jan de Rijk implementing this pilot.
Currently this KPI isn’t measurable but for further purpose and development this pilot can contribute for measuring the waiting times of trucks.

4.4.3 Review of the KPIs
The review of the KPIs that are shown below are formulated in the Literature Review (3). It’s important to underpin the fact that the benchmarked KPIs are meeting the criteria for the organization (Schiphol Group).

- be tied into the overall business objectives and goals;
- measure areas directly influencing the business’ ability to succeed;
- indicate areas requiring further action

The most important bottleneck is the congestion at GHs. The measure areas of the KPIs are linked with the most important bottleneck (congestion). The KPIs directly able to contribute with the ability to succeed in improving the bottleneck.

The KPIs will indicate the areas of improvement, by improving these processes the main goal can be accomplished (reducing the congestion). This can be accomplished by making demands to the GHs (by Schiphol) if they aren’t performing well. To emphasize what their bottlenecks are and how they should improve it. If the bottlenecks will be reduced, the congestion will be reduced.

Keep your KPI SMART, the following conditions are important to exactly indicate the value of the KPIs:

1. Specific
2. Measurable
3. Achievable
4. Relevant
5. Time phased

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<td>-</td>
<td>+/-</td>
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</table>

+ = Completely  +/- = Semi  - = Currently not

The figure shows that some KPIs that not everything is fully present. The KPIs have their limitations and can be impacted by stakeholders that will be explained in the next chapters.

Organizations that create KPIs with the following 9 characteristics are likely to deliver high-impact KPIs:
1 Sparse: ✓ Six KPIs in total.
2. Drillable: ✓ All six KPIs can be measured on a strategic, tactical and operational level.
3. Simple: ✓ The KPIs are defined together with the stakeholders (FFs, GHs, Airlines and Transport Companies).
4. Actionable: ✓ How the KPIs can be influenced is clear (clear milestones).
5. Owned: ✓ KPIs are managed by Cargonaut, SmartLOXS and Schiphol Group.
6. Referenced: ✓ The data of the KPIs are clear and accurate for the stakeholders of SPL.
7. Correlated: ✓ The KPIs create an overview of the linked chains of the GHs.
8. Aligned: ✓ The KPIs don’t undermine each other and are aligned (supply chain).
9. Balanced: X There are only non-financial KPIs used for this index.

Most of the characteristics are present (89%) for the performance index of this research. That means that the KPIs are likely high-impact KPIs.

4.4.4 The limitations of the KPIs
In this part the limitations of the KPIs will be discussed. In the SMART table of chapter 4.4.3 you can see that not every condition is graded with a +, that’s because there are limitations. This will be explained below:

**Gate in till Gate out.**
This KPI can be measured on two different ways. The way of Cargonaut and SmartLOXS. Both possibilities will be discussed in this part.

**Cargonaut – gate in till gate out**
As explained earlier Cargonaut can measure this KPI with the use of e-Link. Only 30% of the total number of shipments that are processed by the use of e-Link. The international companies that are using e-Link is scarce as well. Measuring this KPI with e-Link will currently not create a representative picture of the gate in till gate out process.

**SmartLOXS – gate in till gate out**
As explained earlier SmartLOXS measures this KPI by using card(ids). SmartLOXS can measure 100% of the truckers that enters the GHs warehouses. The bottleneck of this KPI is the gate-out measure point. During certain moments (especially peak moments) at the GHs the leaving gateway won’t be closed. The GHs are doing this to increase speed of the outgoing trucks. This means that the truckers can leave the terrain of the GHs without using their card(ids). Normally when a trucker wants to leave the terrain, he needs to scan his card to open the gate. That means that SmartLOXS will only receive the datalogs of the gate in moment of the trucks and not the gate out moment. This happens if the gate out of the GHs warehouse is opened for an uncertain time.

**From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line).**
Currently the moment that the truck enters the line of truckers can’t be measured however as explained before trucker companies are starting pilots with tracing companies. If these
pilots are going to work out this can be interesting for future. SmartLOXS gate in data is trustworthy, complete and representative. This means that currently this KPI can’t be measured but after a certain period of time this maybe will be possible.

4.4.5 The impact of the stakeholders
The performance of a GH not only depends on their own manpower, processes and operation. There are many stakeholders involved in Schiphol’s Cargo supply chain, many of them can impact the performance of the GHs. In this part will be explained how the stakeholders can impact the outcome of the KPIs of the GHs performance.

**Notification for Delivery (NFD) till Delivered to the Customer (DLV)**
This KPI can result in a mispresent outcome of the KPI. The FFs are responsible of picking up the freight. The Delivered to the Customer (DLV) moment will be decided by the FFs and not the GHs. This can create an unfair representation of the operation of the GHs. In this case the FFs can also be responsible for the long throughput time of the goods.

**Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)**
This KPI can result in a mispresent outcome if the cargo is standing still in the GHs warehouse because the flight is delayed or cancelled. A delay or cancelation of the flight will impact the through put time of the cargo.

**Gate in till Gate out.**
This KPI can be impacted by the GHs itself. Some GHs are operating on the same terrain. Menzies, Swissport (Terminal 9) and WFS. It’s more difficult to compare the outcome of the gate in till gate out data because the truckers are mixed at the terrain. For example, the truckers that are coming for Menzies can create congestion for the truckers of Swissport. This means that the outcome of the KPI can be negative for Swissport even though they aren’t responsible for that. KLM Cargo and dnata have their own terrain so that makes it easier to compare.

**From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line)**
Congestion is a major issue for the chain. Waiting lines for trucks results in congestion and obstructions. There are moments that the trucks waiting in line at GH 1, create an obstruction (blocking the road) for the truckers that have to go to GH2. However, this problem is rare, GHs are using second line parking facilities to eliminate this problem. Truckers are waiting at the parking facility until there is room for them.

4.4.6 The impact of Customs
The way Customs influences the flow of goods at the GHs:

- On the completion of physical checks. If a check can be performed quickly, the check time will be limited.
- In addition, the availability of the right documentation of freight is also an important factor.
If, for example, an inspection document or an import license required for the goods by legislation is not available. Customs will normally stop the shipment. This shipment won’t be transferred until the relevant documentation is available and has been assessed by Customs. Customs is constantly striving to keep the logistics (flow-through) of goods at the GH as fast as possible. At the same time, sometimes the chain will be interrupted by the customs if necessary.

An example:
When goods within the European Union are in free circulation (the holder of the goods can freely dispose of them) and they are transported by air from Milan to Schiphol, Customs has that intra-Union transport movement. Normally the shipment won’t be interrupted in this case. If, on the other hand, it concerns goods brought into the European Union from outside the European Union, the shipment will be checked.

Goods are selected for a check, mainly based on risk profiles, samples, and physical observations. Algorithms will also play a role in this. The selection of goods for an inspection will take place to research the following points:

- Do the goods correspond to the statements made for those goods in declarations and other documentation? (Are the types and quantities correct, are there no other goods?)
- Can the goods be present on the territory of the European Union / Netherlands?
- Is the correct amount of import duties paid for the goods?

The customs certainly influences the supply chain and therefore also the KPIs. The throughput time of goods can be way longer than expected because of the inspection of the Customs (Kamp, 2018).

4.4.7 The norm for the KPIs
The outcome of the KPIs are important to norm. The KPIs that are explained before are measuring certain throughput times. The throughput time in the warehouse, airside process, terrain and outside the terrain of the GHs. The KPIs will measure the duration of certain processes at the GHs. It is important to determine the acceptable and unacceptable duration for the certain KPIs. Without a norm you can’t make demands towards the stakeholders. With cooperation of five GHs of Schiphol Airport an average norm is defined for KPIs. The input of the GHs varies about the timeframe of the processes (KPIs). The average duration of the KPIs will be explained below:

*Actual Time of Arrival (ATA) till Received Cargo from Flight (RCF)*
This duration depends on if the freight is lose or bulked. For lose freight it is around 500 minutes and for bulked freight is around 240 minutes. This also depends on which airline the GH is working with, every airline has his own Service Level Agreement (SLA) and different timeframes. KLM Cargo GHA for example, aims to do it in 120 minutes.

*Received Cargo from Flight (RCF) till Notification for Delivery (NFD)*
The goods should be ready for pick for the FFs after 360 minutes.
Notification for Delivery (NFD) till Delivered to Customer (DLV)
The FFs have 1080 minutes to pick up the goods before the storage fee will be applied. This KPI is a process of the GHs but is measuring more the on time performance of the FFs.

Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)
The GHs want the shipments 24 hours before Estimated Time of Departure (ETD). There are different shipments, for example priority shipments can be delivered 2-3 hours before departure.

Gate in till Gate out.
The average norm of the trucks duration at the terrain of the GHs are 120 minutes.

From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line)
This can varies extremely. During peak moments it can take hours but outside peak moments it can take 0 minutes. Currently GHs are analysing the waiting truck times to get an better insight of this process.
5. Conclusion

This research aimed at benchmarking the KPIs that are required to create an efficient overview of the GHs processes. During the interviews it became clear that the stakeholders are interested in a performance index. The most important processes to get a better insight of are the bottlenecks of the GHs. The bottlenecks needs to be improved and if these bottlenecks can be measured it will be easier to improve it. To accomplish this, different companies were involved that are relevant for the operation of the GHs. During the research different KPIs came up, it became clear that currently certain KPIs / processes can't be defined as a KPI or aren’t relevant for this index. These processes are shown below:

- % of damaged goods of total number of goods / % of goods that endure claims
- Information Sharing
- Innovation
- Qualified employees / Manpower
- Turnaround time aircraft

The certain points are important considered by the stakeholders and shouldn’t be forgotten. The most important KPIs due to the stakeholders are based on the speed of the GHs processes. This can automatically have impact on the cost of the operation. The KPIs that were benchmarked in cooperation with the stakeholders are:

1. Actual Time of Arrival (ATA) till Received Cargo from Flight (RCF)
2. Received Cargo from Flight (RCF) till Notification for Delivery (NFD)
3. Notification for Delivery (NFD) till Delivered to Customer (DLV)
4. Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)
5. Gate in till Gate out
6. From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line)

The measurability of the KPIs is an important discussion. For measuring the KPIs two Information Platforms are involved; Cargonaut and SmartLOXS. As explained before it became clear that the first five KPIs are already measurable but to a certain height and percentage (with trustworthy data). The fifth KPI is currently not measurable yet but with the new pilots of Transport Companies the KPI can be realized in the near future. Between the first four KPIs there are certain limitations that are explained. Different stakeholders are also able to influence the outcome of certain GHs processes (KPIs).

The norms of the KPIs are very important to define. Without a norm you can’t make demands towards the stakeholders (mainly focussed on the GHs). Currently the GHs gave with different timeframes for the KPIs. To implement this KPI index the norms should be very clear to add value for Schiphol’s Community.

To summarize the conclusion, there is a demand for a Key Performance Indicators index within Schiphol’s Community and there are different well defined and measurable KPIs that can add value and create a better insight of the bottlenecks of the GHs. This can contribute with reducing / eliminating the bottlenecks of the GHs because Schiphol can control the GHs more with the data outcome of the KPIs.
6. Recommendation

During the interviews it became perfectly clear that there is demand for a performance index with KPIs. All involved stakeholders were interested and enthusiastic but is it currently possible to realize a performance index that will create added value for Schiphol’s Community. The following recommendations are made:

1. Schedule a meeting with the Landside Pickup and Delivery group from the Smart Cargo Mainport Program (SCMP) to establish clear norms for the KPIs. Currently the norms are still an average of the input of stakeholders.
2. Use the results from the research and start to calculate the first five KPIs:
   - Actual Time of Arrival (ATA) till Received Cargo from Flight (RCF)
   - Received Cargo from Flight (RCF) till Notification for Delivery (NFD)
   - Notification for Delivery (NFD) till Delivered to Customer (DLV)
   - Received Cargo from Shipper (RCS) till Shipment Departed on Flight (DEP)
   - Gate in till Gate out
   This should be done in cooperation with the involved Information Platform Companies Cargonaut and SmartLOXS. This can be done by a new graduation student or an employee of the Royal Schiphol Group.
3. The sixth KPI:
   - From truck entering the line at the Ground Handler till – gate in Ground Handler (Truck waiting in line)
   Schedule a meeting or contact the Transport Companies of Schiphol about their new pilots with Route42. This can result in the data that is required for measuring the last (sixth) KPI of the GHs Performance Index. This won’t immediately result in the most complete outcome of the KPIs data but the outcome can be interested to analyse.
4. After the KPIs are measured a dashboard should be created for an effective overview of the KPIs. 100% of the involved stakeholders mentioned that a dashboard is the most clarifying tool.
5. Update and remeasure the KPIs on a monthly basis. After a year of measurements and data it will clearly show the GHs progression or regression of their processes.
Bibliography


Route42. (2018). Retrieved from https://route42.nl


Appendix

**Schiphol Cargo has identified the following strategic priorities**

In response to ongoing challenges and opportunities, Schiphol Cargo is considering various initiatives for its future development; four key strategic decisions are prioritized.

<table>
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<th>“No-brainers”</th>
<th>“Strategic priorities”</th>
<th>“Nice to have innovative options”</th>
</tr>
</thead>
<tbody>
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<td>1. Strengthen airport capacity to reach target growth</td>
<td>Explore possibility to use narrowbody capacity</td>
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<tr>
<td>2. Explore new opportunity for Schiphol (cargo)</td>
<td>2. Improve quality of cargo operations</td>
<td>Develop Smart and Secure Trade Link with customs (SSTL)</td>
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<td>3. Contribute to marketing strategy of attracting distribution centers</td>
<td>3. Define a robust approach to 3rd party handling capacity and fee</td>
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<td>4. Support development of forwarder consolidation centres around Schiphol</td>
<td>5. Enhance data exchange and transparency, unified information platform</td>
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<tr>
<td>6. Strengthen internal collaboration with non-cost and non-rate departments</td>
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Initiatives to address current challenges | Strategic (long-term) initiatives to grow | Standalone additional value initiatives

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**Appendix A Schiphol Cargo Strategic priorities**

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**Scope: e-freight documents**

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**Appendix B Cargo Supply Chain**
“Freight Forwarders

The eleven largest FFs are interviewed for this research, this is because they have the most impact on the processes of the GHs.

Phase 1
During phase 1 the following subjects were discussed:
- The important capabilities of the GHs
- The most relevant KPIs
- Current Situation with the GHs and airlines
- The bottlenecks in the operation (export and import)
The input of the FFs will contribute to get a better insight of the processes and problems of the GHs. This information is used to research what (inefficient) processes can be measured (with KPIs) to create an overview of the GHs operation.

Phase 2
During phase 2 the following subjects were discussed:
- The benchmarked KPIs realized by phase 1
- What KPIs should be added by the current benchmarked KPIs
- On what way is the performance index going to help the GHs operation
- How the KPIs can be measured and how trustworthy is the data
The input of the FFs will contribute to get a better overview of the relevant (and measurable) KPIs for the performance index. This information is used to establish and adjust the KPIs that were found during phase 1.

Ground Handlers

All five GHs of Schiphol Airport are interviewed to create a realistic overview of the different kind of operations and warehouses.

Phase 1
During phase 1 the following subjects were discussed:
- The important capabilities of the GHs
- Current Situation with the FFs and airlines
- The bottlenecks in the operation (export and import)
The input of the GHs will contribute to get a better insight of the processes and problems of the GHs. This information is used to research what (inefficient) processes can be measured (with KPIs) to create an overview of the GHs operation.

Phase 2
During phase 2 the following subjects were discussed:
- The benchmarked KPIs realized by phase 1
- What KPIs should be added by the current benchmarked KPIs
- On what way is the performance index going to help the GHs operation
- How the KPIs can be measured and how trustworthy is the data
The input of the GHs will contribute to get a better overview of the relevant (and measurable) KPIs for the performance index. This information is used to establish and adjust the KPIs that were found during phase 1.

**Airlines**

The airlines are the agents between the FFs and GHs. They are operating as intermediary. During the interviews at the airlines the following subjects were discussed:

- The important capabilities of the GHs
- Current Situation with the FFs and GHs
- The most important KPIs
- The position as agent between the FFs and GHs

The input of the airlines will contribute to understand how the airlines are able to influence certain processes and performance of the GHs. A cancelled flight can have impact on the outcome and data of the KPIs.

**Transport Companies**

*One Transport Company is interviewed to understand the connection between the FFs and GHs. The Transport Company can also be important for supporting the measurement of certain KPIs.*

During the interviews at the transport companies the following subjects were discussed:

- The important capabilities of the GHs
- Current Situation with the GHs
- The most important KPIs
- Measuring the following KPI “From truck entering the line at the GH till Gate-in GH”
- Congestion at the GHs for their truckers (pick-up and delivery, import/export)

The input of the transport companies contribute to see if their perception is similar to the FFs perception. The transport companies are transporting to freight towards the GHs, they have a clear sight about the current congestion problems.

**Information Platform Companies**

*The most known information platform companies are interviewed because they possess the most data for the cargo supply chain of Schiphol Airport.*

During the interviews at the information platform companies the following subjects were discussed:

- Availability of data
- How to measure the KPIs
- Financial investment stakeholders

The input of the information platform companies will result in a realistic overview of which KPIs are measurable and which aren’t. During these interviews it’s get clear that certain KPIs aren’t measurable at all or are currently not measurable.”

Appendix C Interview subjects
Appendix D The Cargo Supply Chain of Amsterdam Schiphol Airport
• KLM Cargo GHA
• WFS
• Menzies
• Swissport
• dnata

Appendix E The Ground Handlers of Schiphol Airport

Appendix F The operation of the Ground Handler
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Appendix G Data logs KLM Cargo - SmartLOXS