

# OPERATIONS OPTIMIZATION: VALUE ENGINEERING ASSIGNMENT

**AE-4441**

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## **Abstract:**

This is a report of value analysis of different growth scenarios of the KLM flights going through Schiphol International Airport over the next 15 years. The growth scenarios considered are 10%, 30% and 50% of 2013's scenario. Multiple tasks have been divided into each of the section. This is explained in the Introduction Section. At the end of this report, we have the inferences based on the analysis performed. In the inferences, we have provided our views on all the three growth scenarios and also a valid justification. It is also advised to note that "current year" in this report refers to the year 2013.

## **1. Introduction:**

In this assignment, we are required to perform Value Analysis for growth scenarios 10%, 30% and 50% over the next 15 years for the KLM flights going through Schiphol International Airport. The main premise of the work is the analysis of different scenarios of growth of the KLM fleet.

In the Literature Review, we provide an insight of how we approached in gathering necessary information. We have also presented relevant data as and when necessary. This section mainly deals with the documentation of survey and data gathered by us.

In the next section, Methodology, we have explained in detail, what are the steps that we have followed to perform the analysis. This section also includes some assumptions mentioned within it, just before it is used. All the assumptions made in such a way that they are not too divergent from the reality.

Results and Inferences are provided in the next section. Here, we have concluded our analysis' findings.

## 2. Literature Review:

To analyse the growth in KLM flights taking off from Schiphol airport, specific data regarding the number of flights operated by KLM and transavia from Schiphol airport approximately in a year had to be obtained. This data was obtained from ‘Schiphol Group Annual Report 2013<sup>[1]</sup>’.

Various means were exploited to find the most appropriate data. Annual Financial Reports of KLM and Schiphol were studied.

**Table 1 - Air Transport Movements 2013 through Schiphol airport**

Sl No.	Airline	Total number of flights through Schiphol (2013)
1.	KLM	215,670
2.	Transavia	27,462

The total fleet composition of KLM, the fleet distribution among long haul, medium haul, Transavia and cargo and the ATC and other handling charges was obtained from the report ‘Full Year 2013 Results, Air France-KLM’ published on 14<sup>th</sup> February 2014<sup>[2]</sup>. This data was important for value analysis, and to extrapolate the growth in fleet by comparing it with the growth in flights. The total number of increase in fleet composition is split across long haul, medium haul, Transavia and cargo and this is also divided across owned and leased. A consolidated table showing the fleet composition of KLM is shown in the table below.

2013 Scenario									Constant Aircraft Distribution				
KLM	Aircraft	KLM	Transavia	Owned	Finance Lease	Operating Lease	Total	In Operation	Type	Aircraft Distribution	Owned	FL	OL
	Long Haul	66	0	19	23	24	66	66	Long	0.5641	0.28788	0.34848	0.36364
	Medium Haul	47	30	8	21	49	78	77	Med	0.4017	0.10256	0.26923	0.62821
	Cargo	4	0	3	5	5	13	4	Cargo	0.0342	0.23077	0.38462	0.38462
	Total	117	30	30	49	78	157	147					
Air France	Aircraft		Transavia										
	Medium Haul		11										
	Total Transavia		11										
Schiphol Traffic by KLM				Traffic/ No of Plane									
215670				1843.33									
Schiphol Traffic by Transavia		Ratio of KLM in Transavia		Traffic by Transavia		Traffic/ No of Plane							
27462		0.731707317		20094		669.8							

**Figure 1 - Consolidated Fleet Composition of KLM (2013)**

A rough estimate of the number of passengers travelling through Schiphol airport for the year 2013 was acquired from ‘Facts & 2013 Figures’ published by Schiphol group<sup>[3]</sup> and was found to be 52.6 million. This data was needed to extrapolate the growth of passengers at Schiphol airport for the three different scenarios considered.

As the number of flights increased through Schiphol airport as indicative of the three different growth scenarios, new aircrafts had to be bought or leased to accommodate the

passengers and improve connectivity. Apart from the provided aircraft data, new future generation aircrafts were added for long haul and medium haul which would be available by the year 2028. These new generation aircrafts such as Airbus A350 series, Boeing 787 Dreamliner series and Boeing 737 MAX series are more fuel efficient, reduce CO<sub>2</sub> emission and noise compared to previous generation aircrafts making them more environmental friendly. The aircraft data was obtained from Airbus and Boeing official website. The table below shows the new aircraft added and the relevant parameters of each aircraft.

**Table 2 - Aircraft Specifications**

Type	Seats	Speed [km/hr]	Range [km]	MTOW [T]	Entry into service	Acquisition cost [M\$]
Boeing 737 MAX 9	180	842	6658	88	2018	113.3
Boeing 737 MAX 7	140	842	7038	72	2019	87.7
Boeing 737 MAX 8	162	842	6704	82	2017	106.9
Airbus A350-1000	387	903	14800	308	2017	347
Airbus A350-900	314	945	15000	258	2015	295
Airbus A350-800	270	945	15400	248	2016	260
Boeing 787-9	280	1041	15400	252	2011	257
Boeing 787-10	330	1041	12964	252	2011	297

The Royal Dutch Airlines and Schiphol airport in Amsterdam have taken extraordinary measures to contain noise generated by aircrafts, reducing the carbon footprint, recycling of waste, improving local air quality, biodiversity and saving energy as much as possible. The various measures taken by KLM are extensively detailed in the ‘Corporate Responsibility Report 2013’<sup>[12]</sup> published by Airfrance-KLM. KLM is committed to reducing the fuel consumed by its airplanes by making use of cleaner fleet, new generation aircraft for future fleet expansion, making use of bio fuels to reduce CO<sub>2</sub> emission. KLM and Alders table parties’ advice the Dutch government on a new regulatory and enforcement system for noise abatement procedures. Apart from this KLM has committed to recycling the waste produced during flights by 100 percent. Another important step taken by KLM to reduce carbon footprint is by making use of electrical equipment’s on the ground, minimizing use of APU by making use of external sources.

Schiphol, on the other hand, has also taken similar measures to improve quality around the airport. Schiphol also imposes heavy fines for aircraft not following noise abatement norms.

### **3. Methodology:**

#### **The Initial Step:**

To implement the various growth scenarios of 10%, 30% and 50% for KLM flights over the next 15 years, relevant data was needed and had to be collected from various sources. The air movements of KLM through the Amsterdam Airport Schiphol in 2013 was found to be 215670<sup>[1]</sup>. This number is increased by 10%, 30% and 50% respectively for different growth

scenarios over a period of 15 years. Increasing the number of flights per year will directly affect the fleet of the airline. Therefore, our next step was to increase the airline's (KLM) fleet. These calculations are done using excel sheets which have been provided with this report. Based on the given data, we took an approach where we also decided to make the following assumptions while extrapolating the fleet data.

- We have strictly only considered the KLM fleet and also that part of transavia's fleet that is provided by KLM.
- The involvement of Air-France has been completely neglected.
- After increasing the flights by a certain percentage, all the other relevant data was directly extrapolated with the same percentage from the given information.
- The percentage distribution of fleet among bought and leased aircrafts for long-haul flights, medium-haul flights, transavia flights and cargo flights continues to stay in the same proportions for the next 15 years.
- None of the subsidiaries of KLM have been considered.
- We have also assumed that the user demand also increased simultaneously as the number of flights increase.

The following figures give the information on the extrapolated data. We can also see the number of required aircraft to be bought or leased for all the three growth scenarios.

<b>2028 Scenario (10 % Growth Rate)</b>							Rate Multiplier	1.1
<b>KLM</b>	Aircraft	KLM	Transavia	Owned	Finance Lease	Operating Lease	Total	
	Long Haul	73	0	21	25	27	73	
	Medium Haul	52	33	9	23	53	85	
	Cargo	4	0	1	2	2	4	
	<b>Total</b>	<b>129</b>	<b>33</b>	<b>31</b>	<b>50</b>	<b>82</b>	<b>162</b>	

Constant Aircraft Distribution				
Type	Aircraft Distribution	Owned	FL	OL
Long	0.5641	0.2879	0.3485	0.3636
Med	0.4017	0.1026	0.2692	0.6282
Cargo	0.0342	0.2308	0.3846	0.3846

Extrapolated Distribution of the Aircraft to be Bought or leased				
KLM	Transavia	Own	FL	OL
7	0	2	2	3
5	3	1	2	4
0	0	0	0	0
<b>Total</b>	<b>3</b>	<b>3</b>	<b>4</b>	<b>7</b>

Schiphol Traffic by KLM	Traffic/ No of Plane
237237	1843.33

Type	To be bought or leased
Long	7
Med	8
Cargo	0
<b>Total</b>	<b>15</b>

Schiphol Traffic by Transavia	Ratio of KLM in Transavia	Traffic by Transavia	Traffic/ No of Plane
30208	0.731707317	22103.4146	669.8

Figure 2 - Extrapolated Fleet Composition of KLM with 10% growth (2028)

<b>2028 Scenario (30 % Growth Rate)</b>							Rate Multiplier	1.3
<b>KLM</b>	Aircraft	KLM	Transavia	Owned	Finance Lease	Operating Lease	Total	
	Long Haul	86	0	25	30	31	86	
	Medium Haul	61	39	10	27	63	100	
	Cargo	5	0	1	2	2	5	
	<b>Total</b>	<b>152</b>	<b>39</b>	<b>36</b>	<b>59</b>	<b>96</b>	<b>191</b>	

Constant Aircraft Distribution				
Type	Aircraft Distribution	Owned	FL	OL
Long	0.5641	0.2879	0.3485	0.3636
Med	0.4017	0.1026	0.2692	0.6282
Cargo	0.0342	0.2308	0.3846	0.3846

Extrapolated Distribution of the Aircraft to be Bought or leased				
KLM	Transavia	Own	FL	OL
20	0	6	7	7
14	9	2	6	14
1	0	1	0	0
<b>Total</b>	<b>9</b>	<b>9</b>	<b>13</b>	<b>21</b>

Schiphol Traffic by KLM	Traffic/ No of Plane
280371	1843.33

Type	To be bought or leased
Long	20
Med	23
Cargo	1
<b>Total</b>	<b>44</b>

Schiphol Traffic by Transavia	Ratio of KLM in Transavia	Traffic by Transavia	Traffic/ No of Plane
35701	0.731707317	26122.6829	669.8

Figure 3 - Extrapolated Fleet Composition of KLM with 30% growth (2028)

2028 Scenario (50 % Growth Rate)						Rate Multiplier	1.5
KLM	Aircraft	KLM	Transavia	Owned	Finance Lease	Operating Lease	Total
	Long Haul	99	0	29	35	36	99
	Medium Haul	71	45	12	31	73	116
	Cargo	6	0	1	2	2	6
	Total	176	45	42	68	111	221

Constant Aircraft Distribution				
Type	Aircraft Distribution	Owned	FL	OL
Long	0.5641	0.2879	0.3485	0.3636
Med	0.4017	0.1026	0.2692	0.6282
Cargo	0.0342	0.2308	0.3846	0.3846

Extrapolated Distribution of the Aircraft to be Bought or leased				
KLM	Transavia	Own	FL	OL
33	0	10	12	12
24	15	4	10	24
2	0	2	0	0
59	15	16	22	36

Schiphol Traffic by KLM	Traffic/ No of Plane
323505	1843.33

Type	To be bought or leased
Long	33
Med	39
Cargo	2
Total	74

Schiphol Traffic by Transavia	Ratio of KLM in Transavia	Traffic by Transavia	Traffic/ No of Plane
41193	0.731707317	30141.2195	669.8

Figure 4 - Extrapolated Fleet Composition of KLM with 50% growth (2028)

KLM is one of the world's leading airliner<sup>[8]</sup>. Over the past few years there has been a growing concern about the environmental effects of jet engine emissions and also the noise generated by these engines. With the stringent noise abatement measures in place at Schiphol airport, KLM, being the home carrier based at Schiphol, through its climate action plan<sup>[12]</sup>, is taking initiative to improve the current fleet, operational efficiency by making use of sustainable bio fuels along with other measures. KLM has also invested approximately 3 billion euros to improve KLM fleet to meet the stringent noise abatement norms. According to 'Corporate Social Responsibility Report 2013' published by Airfrance-KLM<sup>[12]</sup>, KLM has saved around 9 million litres of jet fuel (28000 tons of CO<sub>2</sub> emission saved) and by 2015 it aims to reduce the fuel consumption by 44 million litres. Since 2000, KLM has been successful in reducing noise generated by aircraft engines by 35% even with an increase in air traffic movements by 14% and plans to reduce noise generated to a greater extent.

Fleet selection for future expansion plays a very instrumental role in achieving the above mentioned goals. New generation aircrafts such as Airbus A350, Boeing 787 Dreamliner, Boeing 737 MAX series etc. are highly efficient, generate less noise all contributing to a cleaner environment. Also with the use of robust and efficient state of the art systems, the use of fully-electrical three-axis flight controls, reduced mechanical parts, having only 2 hydraulic circuits instead of 3 (Airbus 350 series), the use of carbon fibre reinforced plastic all play a significant role in reducing maintenance required, improving safety, low fuel burn, and more resistance to corrosion making them highly reliable. More importantly they contribute heavily in improving the value of the airline fleet. As the number of flights increase, new aircrafts have to be bought and for that purpose, new generation aircrafts are chosen. The split of these aircrafts between owned and leased has been done by simple extrapolation from the current year till 2028, i.e. the split has been done in the exact same proportion as that of the current fleet of owned and leased aircrafts. The family of new generation aircrafts chosen for future fleet expansion are shown in the Table 2. It is assumed that these aircrafts will be in operational service by the year 2028. The figure below shows the selection of aircrafts for future fleet expansion as indicative of the increase in number of flights.

\*\*All costs in million euros

10% Growth				
	Quantity	Type of Aircraft	Acquisition Cost	Total Cost
Long Haul (7)	2	Boeing 777-300ER	320	640
	2	Airbus A350-800	260	520
	1	Airbus A350-900	295	295
	2	Airbus A330-300	245	490
Medium Haul (8)	5	Boeing 737 MAX 7	87.7	438
	2	Boeing 737 MAX 8	106.9	213.8
	1	Boeing 737-900	95	95
			<b>Total Cost</b>	2691.8

30% Growth				
	Quantity	Type of Aircraft	Acquisition Cost	Total Cost
Long Haul (20)	5	Boeing 787-9	257	1285
	7	Airbus A350-800	260	1820
	5	Airbus A350-900	347	1735
	3	Boeing 777-300ER	320	960
Medium Haul (23)	8	Boeing 737-700	75	600
	2	Boeing 737-900	95	190
	4	Boeing 737 MAX 7	87.4	350.8
	5	Boeing 737 MAX 9	113.3	566.5
	4	Boeing 737 MAX 8	106.9	427.6
Cargo (1)	1	Airbus A330	222	222
			<b>Total Cost</b>	8156.9

50% Growth				
	Quantity	Type of Aircraft	Acquisition Cost	Total Cost
Long Haul (33)	4	Boeing 787-10	297	1188
	7	Airbus A350-800	260	1820
	7	Airbus A350-900	295	2065
	7	Airbus A350-1000	347	2429
	4	Boeing 787-9	257	1028
	4	Boeing 777-300ER	320	1280
Medium Haul (39)	9	Boeing 737 MAX 7	87.7	789.3
	9	Boeing 737 MAX 8	106.9	962.1
	9	Boeing 737 MAX 9	113.3	1019.7
	9	Boeing 737-700	75	675
	3	E190	40	120
Cargo (2)	2	Airbus A330	220	440
			<b>Total Cost</b>	13816.1

Figure 5 - Flight Acquisition Costs for all Scenarios

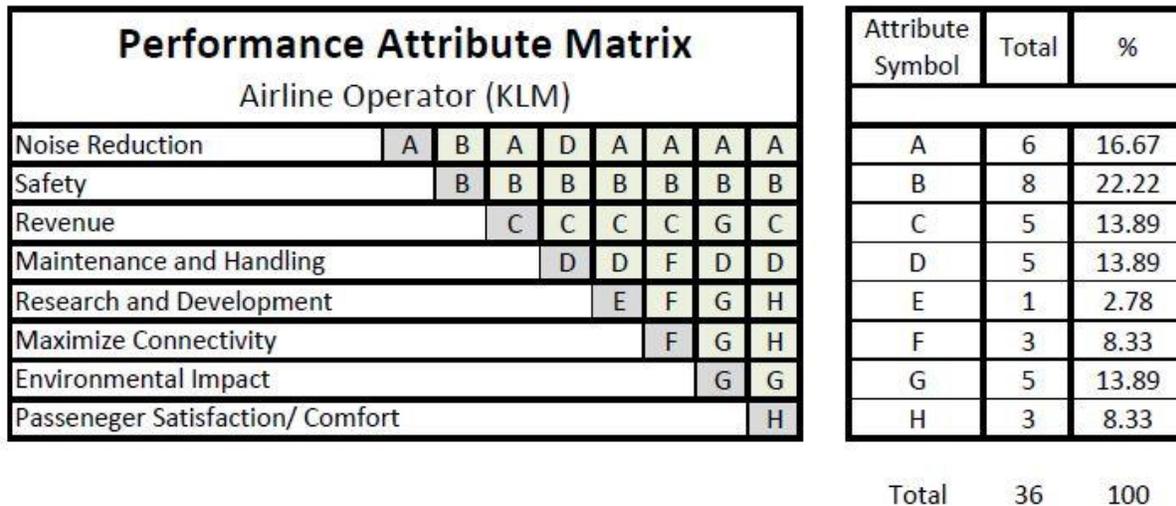
It is important to note from the table above that the selection of fleet for 2028 is done primarily based on their entry into service since this report concerns analysis of growth for year 2028. In the table above it is to be noted that certain aircrafts which are already in operational service are included keeping cost factor in mind. Future generation aircrafts cost significantly higher than current generation aircrafts.

Next step was to turn towards the stakeholders and evaluate their condition in the given scenarios. To do this, we constructed performance attribute matrices for each stakeholder. We took an approach where the opinions of all the team members were taken into account after a

significant amount of discussion and this collective data was used to form performance attribute matrices. The various value drivers based on our opinion for various stakeholders have been enumerated below.

**Value drivers for Stakeholder 1: Airline (KLM)**

- Noise reduction
- Safety
- Revenue
- Maintenance and handling
- Connectivity
- Research and Development
- Environmental impact
- Passenger satisfaction



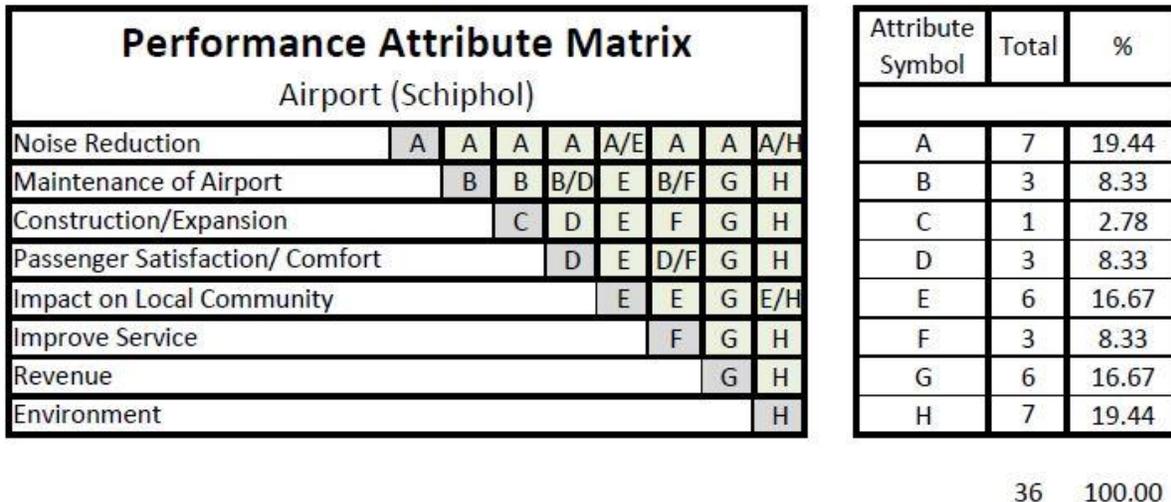
**Figure 6 - Performance Attribute Matrix (KLM)**

As it can be seen from the above table, safety is the paramount value driver for KLM. Safety takes priority over every other value driver for KLM as an airline operator and this will continue to be the case for any growth scenario that might take place in the future and hence it has been given a weightage of about 22%. Noise reduction and revenue are the other important value drivers, after safety. KLM goes to extraordinary lengths to make sure that it invests in aircrafts which are more efficient, cleaner in terms of emissions and quieter so as they do not contribute much towards noise pollution<sup>[12]</sup>. Each of these value drivers have been given an approximate weightage of 17%. Maximizing connectivity and providing maximum destinations for travel has been given a weightage of about 14% which is closely followed by maintenance and handling of aircrafts and equipment. Maintenance is an important parameter and KLM has been voted “MRO of the year” more than once<sup>[9]</sup>. MRO is essential when it comes to airlines and this has been given a weightage of around 11%. Passenger satisfaction and environmental impact

take an equal stand and have both been given a weightage of about 8% whereas research and development has only been given a weightage of 3% when compared to other value driver for airline as a stakeholder.

**Value drivers for Stakeholder 2: Airport (Schiphol Amsterdam Airport)**

- Noise reduction
- Maintenance and handling
- Construction
- Passenger satisfaction
- Impact on local community
- Increased service
- Revenue



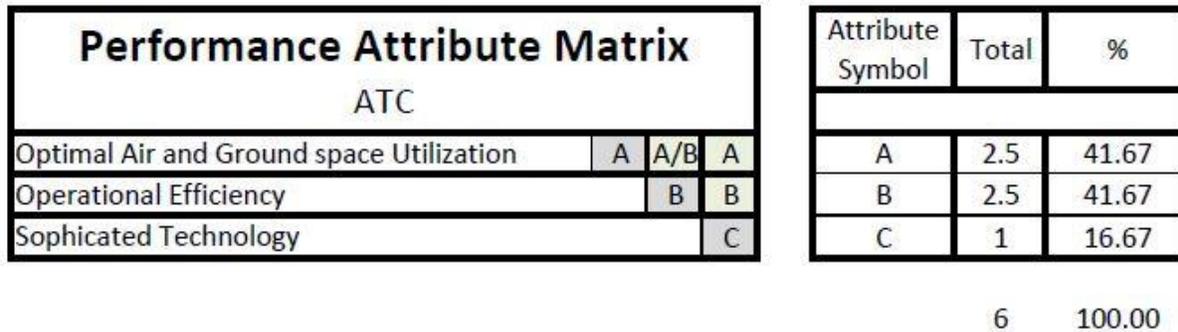
**Figure 7 - Performance Attribute Matrix (Schiphol Airport)**

When it comes to Amsterdam Airport Schiphol, the two most important value drivers for them as a stakeholder will be noise reduction and the environmental impact. Schiphol is known for the FANOMOS system which is implemented around the airport for noise monitoring purposes. Schiphol also charges an airline if its aircrafts make excessive noise and offers discounts to airlines with quieter aircrafts<sup>[1]</sup>. Since Netherlands is one of the most pro-environment and environmentally conscious countries, Schiphol also takes a great deal of care when it comes to environmental impacts. Therefore, these two parameters have been given an equal weightage of about 19%. It was found that Schiphol cares a great deal about how it affects the local community around the airport. Soundproofing the local community’s houses, building of recreational parks that aim at dispersing sound and having a local community contact centre (Bas) are few of the measures Schiphol has taken to work towards increasing the comfort level of

the local community<sup>[14]</sup>. Also, revenue is an inevitably important value driver. Hence, around 17% has been assigned to each of these value driver. It is important that the people who pass through Schiphol every day are happy and have a pleasant experience. Passengers have voted Schiphol airport as Europe's best airport on many occasions<sup>[18]</sup>. Keeping this in mind, passenger satisfaction has been given a weightage of about 8% along with maintenance of the airport. Schiphol also strives hard to improve its services for its passengers as can be seen from the hi-tech systems which were implemented in 2012 for baggage handling<sup>[16]</sup> hence, giving this value driver also a weightage about 8%. Relative to all other value drivers, expansion of the airport obtains a weightage of only about 3%.

**Value drivers for Stakeholder 3: Air Traffic Controller (ATC)**

- Optimal airspace utilization
- Operational efficiency
- Sophisticated technology



**Figure 8 - Performance Attribute Matrix (ATC - LVNL)**

When it comes to the Air Traffic Control, the main agenda is to optimize air and ground space utilization. Along with this, the control centres also aim to maximize operational efficiency<sup>[6]</sup>. Keeping this in mind, the abovementioned two value drivers have been given an equal weightage of about 42%. Lastly, aiming to obtain sophisticated technology, while essential, gets the remaining weightage of about 17%.

**Value drivers for Stakeholder 4: Local Community around the Airport**

- Noise reduction
- Connectivity
- Environmental effects
- Real estate
- Employment
- Health and safety
- Local traffic

Performance Attribute Matrix							
Local Community							
Noise Reduction	A	A	A	A	A	A/F	A
Connectivity	B	C	D	E	F	F	G
Environmental Impact		C	C	C	C/F	C	
Real Estate			D	E	F	F	G
Employment				E	F	F	E
Health & Safety					F	F	F
Local Road Traffic Reduction							G

Attribute Symbol	Total	%
A	6.5	23.21
B	1	3.57
C	5.5	19.64
D	2	7.14
E	4	14.29
F	6	21.43
G	3	10.71

28 100

Figure 9 - Performance Attribute Matrix (Local Community)

The local community living around an airport will have concern of its own. More than anything else, people residing around the airport will be concerned with how the airport and its functionality can affect them in terms of health, environment and other connected aspects. The noise that an aircraft creates, especially while it takes off and lands, can be exceptionally high. A Boeing 737 before landing can create a sound level of 97 dB which can cause damage by an exposure of just 8 hours<sup>[15]</sup>. Therefore, noise reduction is one of the major concerns of the local community which leads to its weightage being 23%. Health and safety and environmental impact follow closely and have a weightage of around 21% and 20% respectively. Having a major airport in the vicinity and its expansion can open doors for increased employment. This can potentially benefit the local community and has been given a weightage of over 14%. But it's important to keep in mind that airport expansion will lead to more passengers passing through Schiphol on daily or yearly basis. Hence, local traffic reduction has a weightage of almost 11%. As airport expands, the value of the property around it will change and usually, this change will be towards the higher side. As this too affects the local community, it has been given a weightage of about 7%. Lastly, the local community is least concerned about what kind of connectivity is provided by the airlines or from/to the airport as it is important to remember that not the whole of the local community will be passengers.

**The Next Step: Value Matrix and Cost Estimation for Each Stake Holder**

After fabricating all the performance attribute matrices, the next step is to build the value matrices for different stakeholders. A value matrix is used for value based analysis. Every value driver is rated for its performance. This rating is done for the current scenario (baseline concept) and also for all the future (growth) scenarios.

### **Value Matrix for Stakeholder 1: Airline (KLM)**

For KLM, as discussed before, obtaining cleaner, quieter and efficient aircrafts is of paramount importance. KLM, the Royal Dutch Airlines, is the flag carrier airline of the Netherlands and it operates from Schiphol as its hub<sup>[4]</sup>. Netherlands being the so pro-environment, KLM has always believed in investing majorly in a quieter fleet and it's prudent to believe that as their growth rate increases, so will their efforts to maintain its quiet fleet. Hence, in our opinion, although the noise reduction rating currently is a 6, it is bound to linearly increase as the growth continues. It is however interesting to note that KLM has been actively trying to reduce noise footprint around airports and local community with a series of measures as mentioned in 'Operational measures taken by KLM to limit noise pollution' report by KLM<sup>[10]</sup>.

Going through many of KLM's annual reports, it became clear to us that safety is KLM's top priority. Therefore, safety has a rating of 8 but we also believe that safety will increase over the next 15 years for all the scenarios. When it comes to revenue, KLM suffered losses in 2010 but it has now been making profits and also aims to have significant reduction in its debts soon<sup>[4]</sup>.

Value Matrix														
Airline Operator (KLM)														
Attribute	Attribute Weight	Year & Growth Rate	Performance Rating										Rating	Total Performance
			1	2	3	4	5	6	7	8	9	10		
Noise Reduction	16.67	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	100.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	116.67
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	133.33
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	150.00
Safety	22.22	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	8	177.78
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	9	200.00
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	10	222.22
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	10	222.22
Revenue	13.89	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	5	69.44
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	6	83.33
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	6	83.33
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	7	97.22
Maintenance & Handling	13.89	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	8	111.11
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	9	125.00
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	125.00
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	125.00
Research and Development	2.78	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	2	5.56
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	3	8.33
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	4	11.11
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	4	11.11
Maximize Connectivity	8.33	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	50.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	58.33
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	66.67
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	75.00
Environmental Impacts	13.89	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	9	125.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	9	125.00
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	125.00
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	8	111.11
Passenger Satisfaction/ Comfort	8.33	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	7	58.33
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	8	66.67
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	75.00
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	75.00

Overall Performance Scenarios	Total Performance	% Change	Total Cost Billion Euro	Value Index	% Value Improvement
2013 (Baseline Data)	697.22	N/A	0.93	750.20	N/A
2028, 10% Growth	783.33	86.11	1.02	766.23	16.03
2028, 30% Growth	841.67	58.33	1.21	696.63	-69.60
2028, 50% Growth	866.67	25.00	1.39	621.68	-74.95

Figure 10 - Value Matrix (KLM)

2013	
Attribute	Million Euro
Noise Reduction	-600.00
Revenue	
Maintenance and Handling	-106.00
Research and Development	-0.01
Maximize Connectivity	-206.00
Environmental Impact	-17.37
Passenger Satisfaction/ Comfort	0.00
<b>Total</b>	<b>-929.38</b>

Figure 11 - Value Matrix Cost Calculation (KLM)

Also, in 2013, KLM was able to save 9 million litres of fuel which directly leads to a lot of saving in expenditure<sup>[12]</sup>. This prompted us to give a rating of 6 but with an obvious increase over the next 15 years. As mentioned before, KLM has been voted as MRO of the year more than once. This shows us that when it comes to maintenance activities, KLM is one of the best as hence we have given a performance rating of 8 which eventually increases to 9 over the next 15 years in case of growth. We found that KLM does not really work much towards R & D but believes more in real start-ups<sup>[5]</sup>. This is why the performance rating is just 2 and increases steadily to 5 over time. Maximizing connectivity obtains a rating of 6 because KLM has about 140 travel destinations which is not a very high number as compared to other airlines. As fleet increases with different growth scenarios, it is believed that so will the connectivity and hence the rating increases to 9 eventually with 50% growth in flights. As we know, KLM gives very high priority to the environmental impacts that the airline might have and it has taken quite a few measures to reduce negative consequences. These measures include 9 million litres of fuel saving in 2013, 100% inflight sustainable catering products, reduction in NOx emissions, 17% increase of separated and recycled catering etc<sup>[12]</sup>. This leads to a high performance rating of about 9. Customer relations are at the heart of KLM business<sup>[12]</sup>. A performance rating of 7 initially which increases to 9 over the years.

### **Value Matrix for Stakeholder 2: Airport (Schiphol Amsterdam Airport)**

The FANOMOS noise monitoring system and the local community contact centre (Bas) for noise are few of the measures that Amsterdam Airport Schiphol has taken to enable noise reduction around the airport. Schiphol is also finances soundproofing the local community's houses. This causes the performance rating to be a constant of 9 for all scenarios.

Schiphol has also been voted Europe's best airport more than once and with its constantly increasing passengers, it's safe to give it a rating of 9 or above. As the number of passengers increases yearly, expansion of the airport is inevitable. Future plans include several new gate houses and hotels<sup>[1]</sup>. Keeping all this in mind a rating of 8, which goes up to 10 is marked. Being voted Europe's best and with its high levels of maintenance, passenger satisfaction is bound to be high with a rating of 9 and above. As we know, Schiphol works towards the impact that it has on the local community, regarding noise, environment or expansion-wise. But there are always certain scenarios in which not everyone can be satisfied. A rating of 7 is given which will increase to 8 or 9 over the years depending on various growth scenarios because with higher growth scenarios, Schiphol will have to make more efforts to reduce the negative impacts on the local community.

Value Matrix														
Airport (Schiphol)														
Attribute	Attribute Weight	Year & Growth Rate	Performance Rating										Rating	Total Performance
			1	2	3	4	5	6	7	8	9	10		
Noise Reduction	19.44	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	9	175.00
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	9	175.00
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	9	175.00
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	9	175.00
Maintenance of Airport	8.33	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	9	75.00
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	10	83.33
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	10	83.33
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	10	83.33
Construction/Expansion	2.78	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	8	22.22
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	9	25.00
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	9	25.00
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	10	27.78
Passenger Satisfaction/Comfort	8.33	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	9	75.00
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	9	75.00
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	10	83.33
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	10	83.33
Impact on Local Community	16.67	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	7	116.67
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	8	133.33
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	8	133.33
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	9	150.00
Improve Service	8.33	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	4	33.33
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	6	50.00
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	8	66.67
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	8	66.67
Revenue	16.67	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	7	116.67
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	8	133.33
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	9	150.00
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	10	166.67
Environment	19.44	2013 (Baseline Data)	1	1	1	1	1	1	1	1	1	1	8	155.56
		2028, 10% Growth	2	2	2	2	2	2	2	2	2	2	8	155.56
		2028, 30% Growth	3	3	3	3	3	3	3	3	3	3	9	175.00
		2028, 50% Growth	4	4	4	4	4	4	4	4	4	4	9	175.00

Overall Performance Scenarios	Total Performance	% Change	Total Cost (Billion Euros)	Value Index	% Value Improvement
2013 (Baseline Data)	613.89	N/A	1.39	443.24	N/A
2028, 10% Growth	675.00	61.11	1.52	443.06	-0.18
2028, 30% Growth	716.67	41.67	1.80	398.04	-45.02
2028, 50% Growth	752.78	36.11	2.08	362.35	-35.69

Figure 12 - Value Matrix (Schiphol Airport)

Attributes	In M Euro
Noise Reduction	400
Depreciation & Amortization	322
Impairment	17
Financial Incom & Expenses	95
Corporate IT	46
Investment	310
Employee Benefits	186
Other Operating Expenses	9
<b>Total</b>	<b>1385</b>

Figure 13 - Value Matrix Cost Calculation (Schiphol Airport)

It is seen that Schiphol strives hard to have a constant improvement in its services and to keep its customers happy. Hence, we see an almost linear increase in rating. As expansion is bound to happen with increased number of flights and higher number of passengers, revenue will increase over the years with increasing growth scenarios. SO, there's a linear increase in the performance ratings. We have already established how Netherlands is one of the most pro-environment nations. Subsequently, Schiphol is also one of the most environmentally conscious airports and take steps to keep the negative environmental impacts under control. Hence performance ratings of 8-9 have been given.

**Value Matrix for Stakeholder 3: Air Traffic Controller (ATC)**

Value Matrix														
ATC														
Attribute	Attribute Weight	Year & Growth Rate	Performance Rating								Rating	Total Performance		
			1	2	3	4	5	6	7	8			9	10
Optimal Air and Ground space Utilization	41.67	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	8	333.33
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	8	333.33
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	7	291.67
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	7	291.67
Operational Efficiency	41.67	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	250.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	291.67
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	333.33
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	8	333.33
Sophisticated Technology	16.67	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	100.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	116.67
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	133.33
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	150.00
Overall Performance Scenarios	Total Performance	% Change	Total Cost (Million Euro)	Value Index	% Value Improvement									
2013 (Baseline Data)	683.33	N/A	165.61	4.13	N/A									
2028, 10% Growth	741.67	58.33	182.17	4.07	-0.05									
2028, 30% Growth	758.33	16.67	215.29	3.52	-0.55									
2028, 50% Growth	775.00	16.67	248.41	3.12	-0.40									

Figure 14 - Value Matrix (ATC - LVNL)

2013	
Attribute	Million Euro
Operating Expenses	161.20
Financial Expenses	4.41
<b>Total</b>	<b>165.61</b>

**Figure 15 - Value Matrix Cost Calculation (ATC - LVNL)**

When it comes to the ATC at Amsterdam Airport Schiphol, the optimal air and ground space utilization, though well and adequate now, is bound to get less optimal as the number of flights increase by 30% or above. This is why the respective performance rating goes down from 8 to 9 because airspace cannot be increased. Operational efficiency needs to increase as growth occurs and hence, the performance rating increases along time. When it comes to sophisticated technology, it will linearly increase with all the scenarios because with higher workload, more advanced equipment will have to be employed.

**Value Matrix for Stakeholder 4: Local Community around the Airport**

As expansion occurs, with respect to the airline or the airport, the local community around the airport will have more cons than pros. Despite all the efforts taken by the airport and the airline to minimize the adverse effects on the people who reside close to the airport, increase in the level of discomfort is unavoidable. This is the reason the performance rating linearly decreases for value drivers such as noise reduction, environmental impacts, health and increase in the local traffic. While it's true that the airline and the airport finance the soundproofing of residents homes, KLM makes an effort towards having a cleaner and quieter fleet and Schiphol aims at having a cleaner and quieter environment, there is only so much they can go.

Value Matrix														
Local Community														
Attribute	Attribute Weight	Year & Growth Rate	Performance Rating										Rating	Total Performance
			1	2	3	4	5	6	7	8	9	10		
Noise Reduction	23.21	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	5	116.07
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	6	139.29
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	7	162.50
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	7	162.50
Connectivity	3.57	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	7	25.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	8	28.57
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	32.14
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	32.14
Environmental Impacts	19.64	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	117.86
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	137.50
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	157.14
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	8	157.14
Real Estate	7.14	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	7	50.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	8	57.14
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	64.29
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	64.29
Employment	14.29	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	6	85.71
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	100.00
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	8	114.29
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	128.57
Health & Safety	21.43	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	8	171.43
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	8	171.43
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	9	192.86
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	9	192.86
Local Road Traffic Reduction	10.71	2013 (Baseline Data)	1	2	3	4	5	6	7	8	9	10	7	75.00
		2028, 10% Growth	1	2	3	4	5	6	7	8	9	10	7	75.00
		2028, 30% Growth	1	2	3	4	5	6	7	8	9	10	6	64.29
		2028, 50% Growth	1	2	3	4	5	6	7	8	9	10	5	53.57

Overall Performance	Total Performance	% Change
Scenarios		
2013 (Baseline Data)	641.07	N/A
2028, 10% Growth	708.93	67.86
2028, 30% Growth	787.50	78.57
2028, 50% Growth	791.07	3.57

Figure 16 - Value Matrix (Local Community)

With growth rates of 30% and 50%, performance ratings are bound to go down. On the brighter side, performance ratings go up in terms of the increased connecting caused by increased fleet, also the increased value of real estate caused by airport development and finally the higher levels of potential employment opportunities for the locals as expansion takes place.

The costs incurred due to these changes are not specific for any of the scenarios considered. It was found that, estimating the expenditure of the local communities to overcome their problems was quite random. It depends on factors such as funds provided by the

government, or the sponsorship by Schiphol Airport itself, or any other investors. Since, this can't be predicted, we chose to leave the part of calculation of costs for local community.

#### 4. Results:

We find the following results for each of the stake holder.

	Stake Holder							
	KLM	% Change	Schiphol	% Change	ATC	% Change	Local Community	% Change
2013	697.22	N/A	613.89	N/A	683.33	N/A	641.07	N/A
10% Growth	783.33	86.11	675.00	61.11	741.67	58.33	708.93	67.86
30% Growth	841.67	58.33	716.67	41.67	758.33	16.67	787.50	78.57
50% Growth	866.67	25.00	752.78	36.11	775.00	16.67	791.07	3.57

Figure 17 - Total Performance of all Stake Holders for all Growth Scenarios

The positive rate of change indicates that the total performance has increased. Now consider the cost incurred by each of these stake holder.

	Stake Holder Costs (Billion Euro)					
	KLM	Value Index	Schiphol	Value Index	ATC	Value Index
2013	0.93	750.20	1.39	443.24	0.17	4126.26
10% Growth	1.02	766.23	1.52	443.06	0.18	4071.36
30% Growth	1.21	696.63	1.80	398.04	0.22	3522.42
50% Growth	1.39	621.68	2.08	362.35	0.25	3119.85

Figure 18 - Total Cost Incurred and Value Index for all the Stake Holders

It is clearly seen that the costs incurred are higher for each scenario. This indicates the estimate of the total amount of money that the stake holder will be spending towards achieving their goal or meeting the minimum standards.

#### 5. Conclusions:

Today, we are witnessing the emergence of new aircraft that produce very less noise, and generate less pollutants. A step towards acquiring and having a complete fleet with such kind of greener, technologically advanced next generation aircraft leads to a more sustainable growth. At the same time, we must also acknowledge the fact that, such plans require very high investments.

A close look at the two tables above indicates the adverse effects on the stake holders for the increase of KLM's flights passing through Schiphol. In our analysis, we have considered safety and environmental effects as the two main priorities. Considering this, the list of aircraft we came up with adds cost to the airliner, KLM. We not only see that the costs incurred are high, but also that the value index is decreasing for each scenario for each of the stake holder (This includes the costs due to expansion, maintenance, repairs, etc..).

Our conclusion is that, increasing the number of flights in turn creates a chain reaction of activities which demand other stake holders to keep-up with each others demands. Though this isn't a competition, the stake holders are responsible to be able to accommodate new ideologies, technologies and match with other stake holders progress.

It is seen that KLM and Schiphol, though are expanding their operations, they are trying desperately to keep their growth as environment friendly as possible. This leads for great measures that have high costs incurred. Hence, it can also be concluded that the most affected stake holders would be KLM and Schiphol. ATC is affected the next, who need to update their technologies to handle the traffic. And local communities are at the last due to the fact that they are supported always by the government in having a most viable place. In turn, it is the airport which bears this responsibility for the improvement of viability of the local areas. Although such measures are taken, the local communities are affected in ways incomparable with the airliner or the Airport<sup>[17]</sup>.

## 6. References:

- [1] 'Schiphol Group Annual Report 2013', Schiphol Group.
- [2] 'FULL YEAR 2013 RESULTS', Airfrance-KLM.
- [3] 'Facts & 2013 Figures', Schiphol Group.
- [4] KLM Royal Dutch Airlines Annual Report 2013, KLM
- [5] 'KLM does little to R & D',  
<http://cxo.nl/outsourcing/85024innovatiedirecteurklmstartupsessentieelvooronzerd>
- [6] 'Joint ATM System 2020 Perspective on the future Dutch ATM system', Roland Berger Strategic Consultants
- [7] 'JAARVERSLAG Luchtverkeersleiding Nederland 2012', Verantwoording Aan De Minister Van Infrastructuur En Milieu
- [8] 'Number 1 on the DJSI for the 10th Time', <https://klmtakescare.com/en/content/number-1-on-the-djsi-for-the-10th-time>
- [9] 'AFI KLM E&M Voted MRO Of The Year by Airline Economics',  
[http://www.aviationpros.com/press\\_release/11297408/afi-klm-em-voted-mro-of-the-year-by-airline-economics](http://www.aviationpros.com/press_release/11297408/afi-klm-em-voted-mro-of-the-year-by-airline-economics)
- [10] 'Operational measures taken by KLM to limit noise pollution', PDF with 'KLM on Schiphol' on KLM Corporate website
- [11] 'Employment figures at Schiphol continued to improve in 2012',  
<http://www.schiphol.nl/B2B/RouteDevelopment/NewsPublications1/RouteDevelopmentNews/EmploymentFiguresAtSchipholContinuedToImproveIn2012.htm>
- [12] 'Corporate Social Responsibility Report 2013', Airfrance-KLM
- [13] 'The social and economic impact of airports in Europe', Airports Council International Europe
- [14] 'Schiphol Takes Community Engagement To The Next Level',  
<http://casper.aero/index.php/news/recentnews/62schipholnoiselab>
- [15] 'Flight Noise & Population affected by Noise',  
[http://www.airportmediation.org/jart/prj3/armcc\\_airportmediation/main.jart?rel=en&contentd=1308527916062&reservemode=active](http://www.airportmediation.org/jart/prj3/armcc_airportmediation/main.jart?rel=en&contentd=1308527916062&reservemode=active)

[16] 'Amsterdam Airport Schiphol, Haarlemmermeer (AMS/EHAM), Netherlands',  
<http://www.airport-technology.com/projects/amsterdam-airport-schiphol/>

[17] 'Noise and disturbance reduction', Schiphol Group  
<http://www.schiphol.nl/NoiseAndDisturbanceReduction.htm>

[18] 'Passengers again vote Schiphol 'Europe's best airport'', Schiphol Group  
<http://www.schiphol.nl/Travellers/News/PassengersAgainVoteSchipholEuropesBestAirport1.htm>

[19] 'Amsterdam Schiphol Airport Passenger Reviews and Customer opinions', Skytrax Air  
Travel & Review [http://www.airlinequality.com/Airports/Airport\\_forum/ams.htm](http://www.airlinequality.com/Airports/Airport_forum/ams.htm)