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From Carpet Sellers to Cargo Stars.

Analyzing the management strategies of air cargo carriers.

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Abstract

1. Objective

This paper analyses and compares the strategies of air cargo carriers. Therefore, a typology of management strategies for both combination and full cargo airlines is being developed, in which the various strategy choices within the strategic framework of the respective air cargo carriers are being explained in more detail.

2. Data/Methodology

The typology is being developed through the gradually built up results of a research on strategy typologies through a K-means Cluster Analysis on a data set. These data have been collected for both the indicators and key performance indicators of a representative sample of 47 air cargo carriers. The scope of this research encompasses belly-hold and full freighter cargo carriers (or a combination of these), while the integrators have been excluded of the scope.

3. Results/Findings

The results of this research generate a typology of seven representative clusters of air cargo carriers' strategy models, each with their own characterizing features. Striking differences and similarities are being highlighted and explained. The final part of this paper addresses the key issues and questions on the management strategies of each of the typology groups. Moreover, both the strategic rationales and the driving factors behind these choices are further elaborated for a number of air cargo carriers within each typology group. To conclude, the influence of the strategy choices on the air cargo carriers' financial results is being defined and critically assessed.

4. Implications for Research/Policy

While some research has been done on passenger airlines strategy, the strategies of air cargo carriers have hardly been researched. The use of a cluster analysis to group the strategy models of a number of air cargo carriers is also a novel feature of this research. The findings suggest the clear existence of different strategy models and the differing degree of focus on air cargo strategy development and deployment among the air cargo carriers' population.

1. INTRODUCTION

This paper deals with the management strategies of air cargo carriers. It focuses on the key indicators constituting the building blocks of a global strategic framework for air cargo carriers, encompassing both belly-hold and full freighter cargo operators (or a combination of these). The integrators have been excluded of the scope of this paper.

Air cargo is a major mode by which the globalized world moves its valuable consumption goods and manufacturing components. Through its role in the supply chain, it facilitates worldwide economies and their international trade. It has also proven to be an effective way of connecting mainly Asian labor with some European and North American consumption markets. With time-definite international transactions materialized in an increasingly globalized and complex supply chain, with enhanced production flexibility and with speed characterizing much of the new economy, air cargo will undoubtedly play an increasingly vital role in the global economy. The last decades, global export growth has consistently outpaced production growth and global air freight growth has outpaced GDP growth, despite recessions and other set-backs to air transport[1].

The global air cargo industry represented in 2012 about 70 billion $ in direct revenue (IATA, 2013) and substantially more in related supply chain services. Therefore, this industry can nowadays be judged as a mature industry, where strategy is being drafted far beyond the basic entrepreneurial framework in which an emerging industry tends to operate.

Table 1 below, enumerating the Top 25 of FTK's performed in 2010 (IATA, 2011) by airlines, shows that 22 out of the 25 positions are taken by combination (passenger and cargo) carriers. Positions 1 and 2 are occupied by integrators (Fed Ex and UPS). The only full cargo airline in this Top 25 taken by full cargo airlines is Cargolux on position 10.

Noteworthy is that 61.28% of the world traffic is being transported by the twenty three regular combination carriers, while the Top 25 air cargo airlines represent a 76.09% share of the world's total freight traffic. The merger between Delta airlines and Northwest, and Continental and United will further consolidate this picture. Freighters are extensively used by these airlines, as 53.24% of the top 25 air cargo airlines' cargo loads are being transported by a freighter aircraft. About 14.8 percent points of the world's total is being transported by the two integrators FedEx and UPS, and only about 2.8 percentage points by the full freighter company Cargolux.

[1] The outbreaks of the Asian and Russian currency crisis, SARS, the events following the 9/11 terrorist attack, the recent monetary crisis and resulting worldwide recession

Rank	Airline	FTK (million FTK)	% of world FTK	% tons by freighter	Rank	Airline	FTK (million FTK)	% of world FTK	% tons by freighter
1	Federal Express	15.741	8,99%	100%	14	KLM	3.698	2,11%	0%
2	UPS Airlines	10.194	5,82%	100%	15	Asiana Airlines	3.400	1,94%	68%
3	Cathay Pacific	9.587	5,47%	56%	16	China Eastern	3.245	1,85%	44%
4	Korean Air	9.542	5,45%	70%	17	Delta Airlines	3.152	1,80%	0%
5	Emirates	7.912	4,52%	20%	18	China Southern	3.083	1,76%	14%
6	Lufthansa	7.427	4,24%	47%	19	Qatar Airways	3.040	1,74%	29%
7	Singapore Airlines	7.000	4,00%	35%	20	LAN Airlines	2.956	1,69%	62%
8	China Airlines	6.410	3,66%	86%	21	Thai Airways	2.894	1,65%	5%
9	EVA Air	5.166	2,95%	66%	22	Japan Airlines	2.849	1,63%	23%
10	Cargolux	4.901	2,80%	100%	23	Qantas Airlines	2.589	1,48%	14%
11	Air France	4.738	2,70%	27%	24	American Airl.	2.552	1,46%	0%
12	British Airways	4.498	2,57%	20%	25	United Airlines	2.502	1,43%	0%
13	Air China	4.223	2,41%	34%					
					TOP 25 Scheduled		70.972	76,09%	53.24%
Source : Own calculations with IATA WATS data -2011					Total Scheduled		175.170	100	50.88%

Table 1 : Leading 25 Air Cargo Carriers – Total FTK (2010)

In addition, this introduction puts forward some strategic considerations on the air freight value proposition which is the justification for using air freight and the business model of air cargo carriers. A good understanding of this framework is a prerequisite to understand the context and framework in which air cargo carriers operate, and to be able to analyze the key drivers behind management strategy development of air cargo operators.

When drafting a management strategy, the value proposition of the air freight model needs to be taken into account at all times. Compared to surface modes air freight offers a faster speed and a greater reliability. A shift in modes will take place if the value proposition changes due to a shift in price or perceived level of service. While recent inventory strategies tend to favor air freight, a shift from air to surface can for instance occur when high air cargo fuel charges lead to a shift to trucking and ocean services for less time critical freight. Noteworthy in this respect is the consensus among air cargo executives that, apart from the mainly IATA driven e-freight developments and the mainly manufacturer driven introduction of new technology aircraft, the air cargo product lacks recent service and productivity innovations (Air Cargo Management Group, 2011).

Directly resulting from this air freight value proposition, the customer's rationale for using air freight needs to be clarified and defined in order to build an overall strategy which sustains this rationale. The

main reason why a customer selects air freight is its speed and reliability, allowing him to respond rapidly to shifts in demand and this on a global scale on a 24 hours basis. For the customer, this generates cost savings as far as the inventory levels and stock-out risks are concerned. Generally goods with a high value per kg and higher value perishable goods (flowers, fish) move by air. Less than 2% of total international freight tonnage, representing 36% of total value of trade value, travels as air freight (figures of 2011) (Des Vertannes, 2012).

A distinct feature of the air cargo industry is that its business model differs significantly from the air passenger business model. However, these models are often mixed in one single airline entity as about half of the world's air cargo is moved in the belly-hold of passenger aircraft. Therefore, the network planning and operations for half the capacity are dictated by demands of the passenger market (Kadar and Larew, 2004, p. 3-9).

In a first chapter the indicators are being defined and set for the most significant key and supporting variables within the strategic framework of air cargo carriers. The second chapter of this paper shows the results of a K-means Cluster Analysis on the data which have been collected for the above mentioned variables for a representative sample of 47 air cargo carriers. The third chapter presents a typology of seven representative clusters of air cargo operators' strategy models as a direct output of this Cluster Analysis. The final chapter elaborates further on the range of strategy models. Striking differences and similarities are being highlighted. Interesting is to observe in which cluster and on what basis each of the individual airlines from the sample is situated.

2. KEY INDICATORS OF MANAGEMENT STRATEGY

The figure below provides an overview of the influencing variables for each part of the management strategy (Dewulf , Vanelslander and Vandevoorde, 2010). Management choices and decisions on the set of influencing variables define the features of the respective product, market and network strategy.

Figure 1 : Influencing variables in the development of a management strategy

The following set of influencing variables determines the product strategy of an air cargo operator: product differentiation, yield management, route network, customer relation management, environment and alliances. The impact on the management strategy of choices on each of these variables will be further explained below. Product differentiation is a very important variable in this area. Air cargo was traditionally seen as a by-product of passenger transport. Pricing was based on marginal cost, and no separate cargo division took responsibility for sales and operations. The last decade this has changed considerably as a number of operators consider air cargo increasingly as a revenue enhancing product, often differentiated through innovative marketing. Therefore, marketing concepts for time-definite products, high value goods, cool chain products and livestock often differentiate the basic cargo product.

Closely related to product differentiation is yield management. Product differentiation is used as a means to increase revenue per ATK. A close monitoring of available and booked capacity on each route on each direction on a specific period can increase revenues per ATK significantly.

Route network development is also closely related to yield management. Adding a route on the network not only increases revenues on this particular route, but also creates additional connections for other routes, and therefore increases the total revenue and yield potential of the entire network.

A well performing Customer Relation Management (CRM) creates short term customer satisfaction and a long term commitment from the customer. A strong CRM, where personal attention to the customer is provided, and the build-up of an extensive sales force are costly structures to set up and maintain. However, a long term relationship with the customer, often contractually agreed for a longer term, is beneficial for both yield and capacity management planning. Therefore, the larger air cargo operators such as Lufthansa Cargo, Emirates Sky Cargo, AF-KLM Cargo and BA Cargo have separate and dedicated sales teams to market their cargo products and fill up capacity. Some customers are attracted to creating an environmentally friendly image and business attitude and require an environmentally friendly cargo product. CO_2 off-set programs and environmentally friendly aircraft are used to differentiate the cargo product from competitors. As it is the case with the CRM programs discussed above, the larger cargo operators tend to be more involved with this kind of product differentiation.

Another set of influencing variables determines the development of a market strategy for an air cargo operator: capacity management, competitive market behavior, hub choice, route network, relationship with integrators, the usage of E-portals, and alliances. A crucial part in the market strategy is a performing and outstanding capacity management. Adjusting capacity to the demand on routes enhances revenues and yields. Additional capacity at the right price can also attract demand. However air cargo operators can do little in the aggregate sense to influence demand for their services (Air Cargo Management Group, 2006, p. 21), mainly because the demand for air cargo transportation is a derived demand from external factors. Management's skill to calibrate the mix between short term

spot capacity availability and long term capacity contracts with customers is another crucial factor. Therefore, capacity and yield management go hand in hand and are both crucial decision parameters on which a strategy is to be developed.

A tool to protect and defend yield and capacity management on a certain route or network is the competitive behavior versus direct competitors. This can be done by adapting the price, enlarging the capacity on a route or enhancing the product for the customer., Predatory pricing, although restricting competition and illegal in a number of countries, can be used to undermine profitability on routes where and when a new entrant starts selling capacity. Route network development and the location choice of hubs are other major elements to build a coherent market strategy.

The relationship with integrators has always been a difficult balance between competing with them by offering an up-market door-to-door product (through vertical alliances), similar to the product offered by integrators, and caring for them as important customers.

The usage of E-portals creates transparency for the customers, and facilitates booking capacity. Moreover, it provides a fast and transparent way to sell excess spot capacity for the operator. Therefore, the connection to an E-portal, and the adequate usage of it for capacity management should be taken into account while determining a market strategy.

A final set of influencing variables that determine the development of a network strategy are: unit cost structure, fleet management, airport choice, hub choice, route network, frequencies and alliances.

The set-up and build-up of a network, with its determining variables, is a major driver for the cost structure of an air cargo carrier. Fleet choice, and especially the introduction of full freighter operations, has a significant impact on capacity and unit cost for air cargo operations. Important decisions for the management strategy development are where to locate a hub, which markets to serve at which frequency, and which airports to operate within these markets.

Alliances are a common theme in management strategy development and are omnipresent in the product, market and network strategy. A number of theoretical drivers for cargo alliances can be identified, similar to the drivers for passenger alliances. However, up to now success with cargo alliance formation has been very limited. Most initiatives such as the WOW cargo alliance and Jade Cargo International, a joint venture between Lufthansa and Shenzhen airlines, have failed due to mistrust among and sub-optimalization of capacities and revenues from partners. The only alliance which works reasonably well within the general ‘big 3’ alliance frameworks (One World, Star Alliance and Sky Team) is the Skyteam Cargo alliance. However, alliances created for a specific purpose and cemented in a joint venture tend to work better. A typical example of this is Aerologic, a joint venture created between Lufthansa and DHL to perform long haul cargo air transport mainly on behalf of DHL, and Shanghai Airlines Cargo International, a joint venture between EVA Airways and Shanghai Airlines, to serve the large and fast growing Chinese air cargo market.

A number of indicators will be selected for the most significant key and supporting variables in the above mentioned management strategy framework. The red-marked influencing variables can be measured by an appropriate numeric indicator. The tables 2 and 3 below propose for each marked variable a key indicator. The numeric indicators set out in the table are self-explanatory. Data are available, however scattered, through both IATA and ICAO publications, and annual reports of the respective airlines.

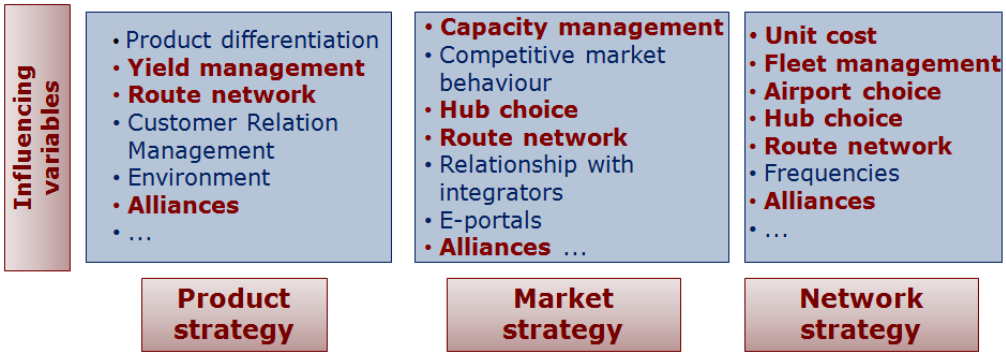

Figure 2 : Key variables to be measured by an appropriate numeric indicator

Key variable	Key indicator	Output
Operating revenue	Operating revenue	USD
Operating cost	Operating cost	USD
Operating profit/loss	Operating profit/loss	USD
ATK	Available Ton Kilometers for combi and freighter a/c	Number
RTK	Revenue Ton Kilometers for combi and freighter a/c	Number
Kilometers Flown	Kilometers Flown for combi and freighter a/c	Km
Hours Flown	Hours Flown for combi and freighter a/c	Hrs
Tons Carried	Tons Carried for combi and freighter a/c	Tons
Aircraft Departures	Aircraft Departures for combi and freighter a/c	Number
Member of an Alliance	Member of Sky Team, Star Alliance, One World, Preparatory stage or none	SKY/STAR/ONE/ PREP/NONE
Hub performance	Metric tons at main hub Ranking of hub in the world	Tons Number
Passenger Aircraft	Number of passenger aircraft in service	Number
Freighter Aircraft	Number of freighter aircraft in service	Number
Employees	Number of employees in service (FTE's)	Number

Table 2 : Numeric indicators for influencing variables

As most key variables within a strategic framework are not 'pure' and might be influenced by a number of other sub-variables, the choice of the proxy variable and its key (performance) indicator can be debated. However, as the meaning of the key variable and the respective output are rather straightforward, the proposed choice of a key (performance) indicator is at least very approximate to rank its values and distinguish output among air cargo operators.

Key variable	K(P)I	Output
Operating revenue	Operating revenue/ATK	Number
Operating cost	Operating cost/ATK	Number
Operating profit	Operating profit/ATK	Number
Productivity	ATK/employee FTK/employee	Number Number
Yield management	Operating revenue/RTK and /ATK	USD
Capacity management	Weight load factor for PAX and freighter a/c	%
Route network	Avg. length transport (FTK/Tons carried) for pax and freighter a/c	km
Fleet management	% of tonnage transported by freighter a/c	%
Route network	Average stage length (Km flown/number of departures)	km

Table 3 : Numeric Key Performance Indicators for influencing variables

3. RESEARCH METHODOLOGY

To build a sound typology of air cargo carriers, a substantial data set is mandatory. Given the above mentioned heavily consolidated landscape of air cargo carriers, the top 25 international air cargo carriers of 2010 (Table 1) are to be included in the data set (Table 4). However, the scope of this research excludes integrators such as UPS and Fed Ex. Due to inconsistencies in the air cargo data for United Airlines, following the merger with Continental airlines, United Airlines has also been excluded from the data set. In addition, the data set is enlarged to include an additional 25 air cargo carriers, randomly chosen from each continent from the TOP 100 air cargo carriers, based on FTK.

Data have been collected for this representative sample of 47 international cargo airlines from the IATA World Air Traffic Report 2010 (IATA, 2011), World Airline Report 2010 (Air Transport World, 2011), annual reports and data supplied by the respective airlines. This sample represents 130 841 million scheduled FTK's, or 74.69% of the 175 170 millions of scheduled FTK performed worldwide. Data of 2010 are considered to be more stable than the 2008 (Q4) and 2009 (full year) data

which are heavily impacted by the recent crisis. 2011 data, however not fully available at this very moment, show again an inconsistent pattern on a month-by-month basis.

In order to cluster the airlines into a number of respective groups of airlines, a K-means Cluster Analysis (with iterations) has been performed. PASW Statistics 18 (SPSS) has been used for this purpose. The Cluster Analysis has been executed with 5, 6 and 7 clusters.

Airline	IATA	Airline	IATA	Airline	IATA	Airline	IATA
Aeroflot	SU	CAL Cargo Airlines	5C	EVA Air	BR	Nippon Cargo Airlines	KZ
Air Canada	AC	Cargolux	CV	Garuda Indonesia	GA	Philippine Airlines	PR
Air China	CA	Cathay Pacific Airways	CX	Gol airlines	GO	Qantas Airways	QF
Air France	AF	China Airlines	CI	Gol!	GO	Qatar Airways	QR
All Nippon Airlines	NH	China Eastern Airlines	MU	Iberia	IB	SAS	SK
American Airlines	AA	China Southern A/L	CZ	JAL	JL	Saudi Arabian A/L	SV
Asiana Airlines	OZ	Continental Airlines	CO	Jet Airways	9W	Singapore Airlines	SQ
Atlas Air	5Y	Delta Airlines	DL	KLM	KL	South African Airways	SA
Avianca	AV	El Al Israel Airlines	LY	Korean Air	KE	SWISS	LX
bmi	BD	Emirates	EK	LAN Airlines	LA	Thai Airways	TG
British Aiways	BA	Ethiopian Airlines	ET	Lufthansa	LH	Turkish Airlines	TK
Brussels Airlines	SN	Etihad Airways	EY	Malaysian Airlines	MH		

Table 4 : Representative sample of 47 airlines

The initial Cluster Analysis with 5 clusters resulted in a generally logical airline distribution among the different clusters. There were no missing cases in the clusters, all 47 airlines were positioned in a cluster.

Cluster 1 consists of large prime operators, generating both premium passenger traffic and cargo flows. Cluster 2 groups the smaller airlines, operating more like an entrepreneur. The two very large US airlines are grouped in Cluster 3. Cluster 4 gives a relatively diverse image, with both large Asian and large airlines such as Air Canada and KLM present in this cluster. Additional Cluster Analysis (see further below) with more clusters will demonstrate that this group will be split. Cluster 5 is more consistent with member airlines operating from a large regional hub and with both a strong regional and long haul network. Only Cargolux looks like the odd one out in the group, and compared to the other full cargo carriers in Cluster 2. Reasons for this will be further explained below.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Air France	Avianca	American Airlines	Air Canada	Jet Airways
British Airways	bmi	Delta Airlines	Air China	China Airlines
Continental Airlines	EVA Airways		Cathay Pacific	Gol
China Southern Airlines	Ethiopian Airlines		JAL	Iberia
Emirates	Etihad Airways		Korean Air	LAN
Lufthansa	Gulfair		KLM	Swiss
Qantas	El Al Israel Airlines		China Eastern	Malaysia Airlines
	Philippine Airlines		ANA	Asiana
	South African Airways		Singapore Airlines	Qatar Airways
	Brussels Airlines		Thai Airways	SAS
				Saudi
	CAL Cargo Airlines			Turkish Airlines
	Atlas Air			
	Nippon Cargo Airlines			Cargolux
	Polar Air Cargo			
	Volga Dnepr Airlines			

Table 5 : Result of a Cluster Analysis with 5 clusters

A K-means Cluster Analysis with 6 clusters, using the same data set, shows very stable and similar results in Table 6. The additional cluster 6 divides the 'problematic' cluster 4 further into two more logical parts. Cluster 6 consists now of strong Asian passenger and cargo operators Air China, JAL, China Eastern airlines and ANA, originally located in cluster 4. EVA airways migrated from cluster 2 to cluster 5 which is more logical group to be part of. This airline is a strong player operating from Taiwan and operates both a good regional feeder network and long haul flights for passengers and cargo.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Air France	Avianca	American Airlines	Air Canada	Jet Airways	Air China
British Airways	bmi	Delta Airlines	Cathay Pacific	EVA Airways	JAL
Continental Airlines	Ethiopian Airlines		Korean Air	China Airlines	China Eastern
China Southern Airlines	Etihad Airways		KLM	Gol	ANA
Emirates	Gulfair		Qatar Airways	Iberia	
Lufthansa	El Al Israel Airlines		Singapore Airlines	LAN	
Qantas	Philippine Airlines		Thai Airways	Swiss	
	Brussels Airlines			Malaysia Airlines	
				Asiana	
	CAL Cargo Airlines			South African Airways	
	Atlas Air			SAS	
	Nippon Cargo Airlines			Saudi	
	Polar Air Cargo			Turkish Airlines	
	Volga Dnepr Airlines				
				Cargolux	

Table 6 : Results of a Cluster Analysis with 6 clusters

Table 7 shows the results of a K-means Cluster Analysis with 7 clusters, using the same data set. This calculation generates no surprising results. The clusters remain very stable, while the new cluster 7 is being formed by a migration of three airlines from cluster 4 and two from cluster 5. The new cluster 7 is a cluster with key indicators and key performance indicators situating between cluster 4 and 5. The

migration from Korean Air, Thai Airways and Turkish Airlines, is due to less performing indicators compared to the former group member of cluster 4. On the contrary, the migration from cluster 5 to the new cluster 7 is due to generally better performing indicators than its former group members of cluster 5. This is not considered to be an enhancement of the typology model, as a homogenous group of Asian airlines with a similar management strategy is being split due to operational performance differences in the output.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Air France	Avianca	Air China	Air Canada	Jet Airways	American Airlines	Iberia
British Airways	bmi	JAL	Cathay Pacific	China Airlines	Delta Airlines	Korean Air
Continental Airlines	Ethiopian Airlines	China Eastern	KLM	Gol		Qatar Airways
China Southern Airlines	Etihad Airways	ANA	Singapore Airlines	EVA Airways		Thai Airways
Emirates	Gulfair			LAN		Turkish Airlines
Lufthansa	El Al Israel Airlines			Swiss		
Qantas	Philippine Airlines			Malaysia Airlines		
	Brussels Airlines			Asiana		
				South African Airways		
	CAL Cargo Airlines			SAS		
	Atlas Air			Saudi		
	Nippon Cargo Airlines					
	Polar Air Cargo					
	Volga Dnepr Airlines			Cargolux		

Table 7 : Results of a Cluster Analysis with 7 clusters

A comprehensive study of the data set reveals that the airlines 'on the move' in the Cluster Analysis with 6 and 7 clusters have a different charter output pattern. While the data of the aircraft being chartered in for the execution of scheduled flights are being counted as scheduled flights, the charter flights executed for third parties or other airlines are included in the operational data. This in fact distorts the operational parameters and resulting key performance indicators. Therefore, in order to fine tune the group of clusters, the same Cluster Analysis with 7 clusters is being repeated but excluding the data related to charter flights. Table 8 below shows the results of the above mentioned exercise.

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
British Airways	Avianca	Iberia	Jet Airways	Air Canada	American Airlines	Air France
Continental Airlines	bmi	Korean Air	China Airlines	Cathay Pacific	Delta Airlines	Emirates
China Southern Airlines	Ethiopian Airlines	Qatar Airways	Gol	KLM		Lufthansa
Qantas	Etihad Airways	Thai Airways	EVA Airways	Singapore Airlines		
	Gulfair	Turkish Airlines	LAN	Air China		
	El Al Israel Airlines	ANA	Swiss	JAL		
	Philippine Airlines		Malaysia Airlines	China Eastern		
	Brussels Airlines		Asiana			
			South African Airways			
	CAL Cargo Airlines		SAS			
	Atlas Air		Saudi			
	Nippon Cargo Airlines					
	Polar Air Cargo					
	Volga Dnepr Airlines		Cargolux			

Formed a separate cluster before

Table 8 : Results of a Cluster Analysis with 7 clusters (excluding data related to charter flights)

A new cluster group has now been formed in cluster 7, with three airlines -Air France, Emirates and Lufthansa- originating from cluster 1. This is mainly due to the relative higher importance of cargo versus passenger traffic in the output parameters. The original cluster 7 is being divided over two clusters. ANA joins cluster 3, and Air China, JAL and China Eastern Airlines join cluster 5. The latter are being regrouped in cluster 5 mainly due to its higher yield and better operational output parameters. The clusters being proposed will be used as a template for building a typology of air cargo carriers' strategies in the next chapter.

Table 9 below shows the calculated Final Cluster Centers for the K-means Cluster Analysis (PASW 18, SPSS with iterations) with 2010 data, excluding the operational data for charter operations, from the same sample of 47 airlines. These data will be used to identify and explain the respective clusters' characteristics and associated management strategies of the group members of the respective clusters.

Final Cluster Centers

	Cluster						
	1	2	3	4	5	6	7
OPREVENUE	$11,100,218	$1,553,645	$8,912,586	$4,194,875	$12,951,144	$26,962,500	$22,553,287
OPCOST	$10,510,341	$1,330,856	$8,338,975	$3,836,043	$11,069,753	$25,700,000	$23,938,524
OPPROFITLOSS	$589,877	$70,212	$573,610	$212,467	$1,102,407	$1,262,500	$1,070,058
OPPROFITATK	,030361121	,001593435	,040783363	,027115104	,067103755	,029406207	,037077089
OPREVENUERTK	4,610060517	4,887289782	4,138013169	3,448683786	3,800538866	9,379244646	3,406969344
OPREVENUEATK	,579354367	,603805248	,689848996	,629460974	,815068547	,676487682	,853752937
OPCOSTATK	,548993231	,461453475	,649065601	,607531591	,748475771	,647081474	,816675848
KKMFLOWNSCH	718307	71110	323087	203090	461014	1488909	720425
ACDEPSCH	400983	59194	174846	138123	233325	760844	424357
HRFLOWNSCH	1094974	122866	508636	318259	693239	2283925	1115897
PAXSCH	48136770	4121686	24034807	15124854	30864157	98643890	44856814
FRTONSCH	579369	164139	765502	481767	936070	476764	1165468
KRPKSCH	111038028	6800234	53630997	28690568	78176991	234435293	132834964
KASKSCH	138053570	9081325	71885490	37947333	97717588	284069216	165710427
PAXLFSCH	,80	,74	,75	,76	,80	,83	,80
KPTKSCH	11008657	671519	4836016	2616847	7213989	21302503	12671171
KFTKSCH	2880958	1124697	3344722	2301622	4584615	2852519	6693061
KMTKSCH	149448	7397	75203	26731	148572	182560	195714
TOTALKTKSCH	14039063	1671777	8255941	4940339	11947176	24337581	19559946
KATKSCH	19225357	2522695	12928283	7006727	16663143	39465242	26783385
WEIGHTLFSCH	,74	,65	,64	,70	,71	,62	,73
KKMFLOWNFREIGHTER	11090	11498	24503	20902	28731	0	36644
ACDEPFREIGHTER	2325	2573	8153	4820	6773	0	8119
HRFLOWNFREIGHTER	14813	14582	51840	27819	37670	0	48930
FRTONSFREIGHTER	83627	134574	313582	260502	391284	0	341855
KFTKFREIGHTER	783504	968037	1629043	1932761	2160880	0	2373207
KMAILTKFREIGHTER	1136	586	5765	6398	10107	0	19732
TOTALKTKFREIGHTER	784356	968532	1634807	1937560	2170987	0	2392938
KATKFREIGHTER	1137622	1329370	2059997	2595885	2909060	0	3361282
WEIGHTLFFREIGHTER	,68	,64	,75	,69	,74	,00	,70
PAXAC	291	27	124	89	183	670	310
FREIGHTERS	2	7	8	7	7	0	9
PROCUSEFREIGHTER	,12	,52	,31	,31	,27	,00	,31
EMPLOYEES	30864	3544	17693	12418	21752	72496	67675
ATKPEREMPLOYEE	816	1824	795	761	902	545	550
FTKPEREMPLOYEE	126	1089	199	269	250	40	136
ALLIANCEMEMBERS	2	4	2	3	2	3	3
METRICTONSHUB2009	674376	827646	1072458	683920	1810472	571023	1956574
RANKHUB2009	72	59	29	58	14	30	7
FTKFTCPAXAC	5113	1921	4200	3889	4297	5981	5845
FTKFTCFREIGHTER	8170	3661	3949	2593	4282	0	6928
AVGSTGLGTHPAXAC	1956	886	2125	1640	2515	1968	2311
AVGSTGLGTHFREIGHTER	4199	3013	2082	4305	3602	0	4574

Table 9 : Final Cluster Centers of a Cluster Analysis with 7 clusters (data related to charter flights excluded)

4. . TYPOLOGY OF AIR CARGO OPERATORS

Dewulf, Meersman and Van de Voorde (2011a) distinguished a typology of five air cargo management strategies, based on empirical deduction and clustering of data for a number of indicators and key performance indicators for a sample of 50 international cargo airlines. Similarities and differences in the values of each of the indicators compared to the average of indicators of the total population on the data set have demonstrated that the sample could empirically be divided in a typology of five groups, each with their characterizing features. Based on this research and the results of the Cluster Analysis in Tables 8 and 9, a typology of management strategies of 7 groups of air cargo carriers can be built.

Table 10 below gives a typology of air cargo carriers and the main characteristics of each cluster group of airlines. Seven main clusters are being defined: *Carpet Sellers*, *Basic Cargo Operators*, *Strong Regionals*, *Huge Americans*, *Large Passenger Wide-body Operators*, *Premium Cargo Operators* and *Cargo Stars.*

	E.g.	Ethiopian, Brussels	Korean Air, ANA	Saudi, EVA	Delta Air	Qantas	Cathay, SIA	Lufthansa
	Typology	Carpet Sellers	Basic Cargo Operators	Strong Regionals	Huge Americans	Large PAX WB Operators	Premium Cargo Operators	Cargo Stars
Financials	TOT Operating Revenue	Lowest	Medium	Low	Highest	Medium	Medium	High
Financials	TOT Operating Profit	None	Medium	Low/Medium	Highest	Medium	High	High
Financials	Oper. profit/ATK	$0,0016	$0,0408	$0,0271	$0,0294	$0,0304	$0,0671	$0,0371
Product Strategy	Product diff.	Basic Product	Basic Product	Medium Range	Medium range	Medium Range	Broad Range	Broad Range
Product Strategy	Oper. Rev./ATK	$0,6038	$0,6898	$0,6295	$0,6765	$0,5794	$0,8151	$0,8538
Product Strategy	Yield	Low	Medium	Low/Medium	Medium	Low	High	High
Market Strategy	Weight LF	65%	64%	70%	62%	74%	71%	73%
Market Strategy	Capacity Mgt	Low	Low	Medium	Lowest	Highest	Medium	High
Market Strategy	Usage of Hub	Small hub	Strong regional	Small hub	Medium size	Varies	Main hub	Main hub
Market Strategy	Stage length (km) PAXac	886	2125	1640	1968	1956	2515	2311
Market Strategy	Stage length (km) FRac	3013	2082	4305	0	4199	3602	4574
Network Strategy	Unit Cost/ATK	$0,6022	$0,6491	$0,6075	$0,6471	$0,5490	$0,7485	$0,8167
Network Strategy	Unit Cost	Low	Medium	Low	Medium	Lowest	High	Highest
Network Strategy	Avg Fleet size	34	132	96	670	293	190	319
Network Strategy	Freighter usage %ATK	0%/100%	31%	31%	0%	12%	27%	31%
Network Strategy	Km (000) by FRac	0/11498	24503	20902	0	11090	28731	36664
Network Strategy	Avg dist 1 ton PAXac (km)	1921	4200	3889	5981	5113	4297	5845
Network Strategy	Avg dist 1 ton Frac (km)	3661	3949	2593	0	8170	4282	6928

Table 10 : Typology and main characteristics of cluster groups

5. MANAGEMENT STRATEGIES WITHIN THE TYPOLOGY

This chapter provides a more in depth overview of the management strategies within the typology. Each airline cluster has got its own characterizing features, and similarities and differences in product, market and network strategy. Striking differences and similarities are being highlighted. Interesting is to observe in which cluster and on what basis each of the individual airlines from the sample is situated.

To the *'Carpet Sellers'* cluster group belong air cargo carriers such as Ethiopian Airlines, Gulfair, and Brussels Airlines, but also full cargo carriers such as Polar Air Cargo and Nippon Cargo Airlines. These carriers tend to be smaller carriers each focusing on a niche. Ethiopian Airlines has indeed the strategy to focus on an African network, complemented with freighter cargo flights in and out of Africa. Gulfair and Brussels Airlines are regional passenger carriers with a limited but geographically focused long haul network. Relatively small cargo-only airlines such as Polar Air Cargo and Nippon Cargo Airlines also belong to this group. Their small size enables them to be flexible where and when needed in their specific niche. Cluster group member Volga-Dnepr airlines focuses on charter flights with Antonov 124's and scheduled flights with Boeing 747's, mainly with outsized or difficult-to-handle cargo loads.

Carpet Sellers are being characterized by their small size, generating a modest total operating revenue compared to the other cluster groups. Total operating profits are very low, with an average of 0.16 USD cents per ATK (all figures for 2010), while the other cluster members enjoy significantly higher operating profit margins, ranging from 2.71 USD cents (Strong Regionals) to 6.71 USD cents (Premium Cargo Operators) per ATK.

As far as the Carpet Sellers' Product Strategy is concerned, revenues per ATK are on average 60.38 USD cents , while the 'Premium Cargo Operators' cash in an average of 81.51 USD cents and the 'Cargo Stars' an average of 85.38 USD cents per ATK. This yield is low compared to the other clusters. However, yield/ATK figures are even worse, taken into account the relative shorter stage lengths of this cluster's passenger and freighter aircraft, as longer stage lengths tend to generate lower yields/ATK. Revenue is generated by offering a basic standard cargo product, hardly differentiated and aims, mainly capacity driven, 'to fill up the aircraft', hence the name of the cluster 'Carpet Sellers'. Cargo departments at passenger and combination airlines in this cluster are often small departments, attached to the passenger sales teams. Cargo sales departments at the freighter-only airlines within this cluster are of course more dedicated to cargo. The small size of the company, the point-to-point traffic network structure, the lack of sufficient in- and outbound connections and the fixed capacity of the routes being flown generate a capacity instead of yield driven attitude within the

sales teams. However, due to their flexibility, short-term opportunities can occasionally be seized, resulting in ad-hoc higher yields on particular occasions.

The above mentioned sales efforts and pricing structure generate a weight load factor of 65% which is on the low side compared to the better performing 'Strong Regionals', 'Large Passenger WB Operators', 'Premium Cargo Operators' and 'Cargo Stars'. However, given the operational constraints mentioned before, the 65% weight load factor still is higher than the 'Basic Cargo Operators' (64%) and 'Huge Americans' (62%). Interesting to note is that the weight load factor of the 'Basic Cargo Operators' is almost identical to the 'Carpet Sellers', but that the latter manages to achieve a 68.98 USD cents revenue per ATK while the 'Carpet Sellers' only manage to raise 60.38 USD cents revenue per ATK.

'Carpet Sellers' operate from a small freight hub with limited in- and outbound connecting freight possibilities. Therefore, the airlines have to adapt their strategy to this limitation. Focus is on playing out some advantages of a small hub such as the congestion-free environment and the availability of ample space for logistical activities. The latter attracts other logistical players that can interconnect and focus on niche markets. The small hub of the 'Carpet Seller' is mainly used by passenger aircraft, used for regional operations (note the very short average stage length of passenger aircraft of 886 km), combined with niche long haul destinations. 'Carpet Sellers' perform either passenger or freighter operations. Freighter-only operators in this cluster operate a relatively short average stage length of 3013 km, implying multiple stops for freighter operations originating from these hubs. This has an adverse effect on the yield and cost structure.

The cost figures, however, are incomplete for this cluster as a number of important airlines in this cluster, such as Etihad Airways, Gulfair, CAL Cargo Airlines and Polar Air Cargo do not supply any cost data and are missing in the data set. However, the average cost can be calculated by using the complete data set on the operating profit. Operating costs per ATK are at 60.33 USD cents per ATK. This is on the lower side of the spectrum compared to the other cluster groups, however, still higher than the Basic Cargo Operators (54.90 USD cents/ATK) but lower than the Premium Cargo Operators (74.85 USD cents per ATK) and the Cargo Stars (81.67 USD cents per ATK).

'Carpet Sellers' are relatively small in fleet size, with an average of 34 aircraft in their fleets. Freighter- only companies within this cluster fly an average of 11.498 million km with their freighter aircraft, similar to the 'Large Wide Body PAX operators', while other cluster members who are operating freighters fly double or treble these distances. Noteworthy in the network strategy is also that the average distance 1 ton travels on a passenger aircraft (1 921km) is by far the lowest when compared to the other cluster groups. Set off against the short stage lengths of the passenger aircraft,

one could deduct that the longer haul routes are mainly used for cargo sales. The average distance 1 ton travels on a freighter aircraft is 3 661 km, which is more in line with the averages on the other clusters, however on the lower side. As stated above, due to the small freight hub the airline operates from, multi stops and 'milk round flying' are necessary to fill up available freighter capacity.

The *'Basic Cargo Operators'* cluster consists of medium sized carriers such as Korean Air, Qatar Airways, ANA and Turkish Airlines. The airlines in this cluster generate an average operating profit of 4.08 USD cents per ATK, which is the highest but one compared to the other clusters. Although the weight load factor is on the lower side (64%), the operating revenue of 68.98 USD cents per ATK and the operating cost of 64.91 USD cents per ATK are at a competitive level compared to the other cluster groups. Although product differentiation is limited, and mainly focuses on pushing volume in a fast and reliable way through its extensive route network, the carriers within the cluster manage to achieve higher revenues per ATK compared to their colleagues in the other clusters. Only the 'Premium Cargo Operators' and ' Cargo Stars' achieve higher yields through a broader product differentiation range with respectively 81.51 and 85.38 USD cents per ATK. Yields are obviously more important than filling up capacity 'at any price', which is a basic component of the pricing strategy. Therefore, this is one important feature which differentiates them from the 'Carpet Sellers'' pricing strategy.

The airlines in this cluster operate from a strong regional cargo hub such as Seoul, Doha, Tokyo or Istanbul. This hub location generates some additional traffic on the routes of the concerned home carrier. Freighter produced ATK's (31% of total) is on the same level as the 'Strong Regionals', 'Premium Cargo Operators' and 'Cargo Stars'. The mix of passenger and freighter aircraft is used to balance, reinforce and expand the network originating from the medium sized hub. Remarkable here in the summary of the output of the Cluster Analysis in Table 10 is the specific mix of a relatively long stage length of the passenger aircraft (4 200 km) and the relatively short stage length of the freighter aircraft (2 125 km)[2].

With an average size of 132 aircraft, the airlines in this cluster are important airlines in their geographical area, however, still regional players compared to the airlines in most other clusters. The airlines in the clusters 'Premium Cargo Operators', the 'Large PAX Wide Body Operators' and the 'Cargo Stars' are significantly larger than the airlines in the cluster 'Basic Cargo Operators' with an average of respectively 190, 293 and 319 aircraft, hence generating more connections and frequencies.

[2] Al Baker summarized the strategy of Qatar Airways with the statement "We have a clear strategy to develop our passenger side of the airline to key business and leisure destinations worldwide. Similarly, we are building our cargo operation to key markets around the world using Doha as a hub" (Airliner World, 2011), which is in line with what is observed in the cluster characteristics.

The deployment of freighter operations is therefore mandatory for the 'Basic Cargo Operators' to offset some of these disadvantages.

Some relatively small carriers, with an average of 96 aircraft, such as GOL, Swiss, Saudi and EVA Airways can be categorized in the cluster *'Strong Regionals'*. These airlines operate a strong short and medium haul network from a second tier passenger and cargo hub (Zürich, Taipei, Riyadh, ...). This network is supplemented with a long haul network, fed by the short and medium haul routes. While all efforts are being done to differentiate both the passenger and cargo product, yields tend to be at the lower end of range, with airlines within the cluster generating average operating revenues of 62.95 USD cents per ATK. The fact that the airline operates from a small hub and needs to use to its full extent the hub-and-spoke system to fill up available capacity generates additional Ton Kilometers for every shipment, hence lowering revenue/ATK. A 70% load factor is relatively high compared to the two previously discussed clusters, but still lower than most of the other cluster groups. The cargo generated to and from the home base is not sufficient to fill up capacity. Significant efforts are being made by these teams to attract cargo from outside the typical home base catchment area. Therefore, 'Strong Regionals' typically have at their disposal well equipped, regionally embedded and well trained cargo sales staff.

Due to the relative competitive disadvantageous position discussed above, 'Strong Regionals' have to be both service and cost focused. Apart from being service focused through product differentiation and service excellence, 'Strong Regionals' tend to be rather cost focused, generating ATK's at an average cost of 60.75 USD cents. Thanks to these low costs, airlines in this cluster group generate average operating profits of 2.71 USD cents/ATK, which is a good performance compared to the other cluster groups' operating profits. Noteworthy at the network build-up is the high freighter usage of 31% with long stage lengths for the freighter operations transporting the main cargo loads from the home base to other large hubs, while regional incoming and outgoing freight tends to be on the belly loads of the passenger aircraft. However, the key indicator showing the average distance 1 ton travels on a passenger aircraft demonstrates that the bulk of the cargo is being transported on the long haul passenger routes.

The fact that Cargolux belongs to the 'Strong Regionals' cluster could raise eyebrows as it feels like the odd one out among its cluster 'colleague' group members. Although the commercial strategy of Cargolux is similar to its peers within the group, operational set up is at first sight not similar. However, a regional hub and spoke system is created by trucking routes operating under a Cargolux

flight number and airway bill.[3]. Moreover, the operational specificities of Cargolux' route network through flying medium haul distances with its 14 Boeing 747's through successive patterns of round-the-world hobs ('milk-round flying') are very similar to the flight output mix of the other members of this cluster. Similarly, Cargolux operates from Luxemburg city, a small regional hub. Moreover, another explaining factor for its membership of the 'Strong Regionals' is that Cargolux' yield, through a well-thought product and pricing differentiation strategy, is higher than the full cargo airlines in the 'Carpet Sellers' cluster, but lower than the combination carriers in clusters 'Premium Cargo Operators' and 'Cargo Stars'.

The strategy model of two important *'Huge Americans'* American Airlines and Delta Airlines justifies the construction of a single cluster. Airlines in this cluster have an average of 670 passenger aircraft which is by far the highest number among the clusters. High operating revenues and a vast ATK output, combined with a medium high yield of 67.65 USD cents/ATK, similar to the 'Strong Regionals', and reasonable average operating profits of 2.94 USD cents/ATK generate high total operating profits.

The air cargo market in the home market USA is heavily dominated by integrators Fed Ex and UPS, operating a dense worldwide ground and air network. Therefore, domestic air cargo is not a focus product for American Airlines and Delta Airlines who tend to focus on passenger transport. The weight load factor of 62% is on the low side, and is more seen as a very lucrative by-product of the belly capacity of the regular passenger route network. However, both American Airlines and Delta Airlines realize this and employ fully fledged regional cargo sales teams centrally and at their outstations. In addition, AA Cargo and Delta Cargo offer a differentiated product portfolio. Observing the average stage length of the passenger aircraft of 1 640 km, and the average distance 1 ton of cargo travels on a passenger aircraft, it can be concluded that air cargo travels mainly on the longer haul international routes, where more wide body aircraft are employed, and where less direct competition from the integrators is encountered. Freighters are not employed in the network of the 'Huge Americans'.

The other American carrier in this sample, Continental airlines, is due to operational differences not part of this cluster group, but is part of the 'Large Passenger Wide-body Operators', which will be further explained below. Continental Airlines is before its ongoing merger with United Airlines, still only about half the size of American Airlines or Delta Airlines. It operates a more internationally stretched network, employs more wide body aircraft, and operates with a longer average stage length. Moreover, it has a higher weight load factor of 73%.

[3] ATK's produced by road transport under a Cargolux flight number are not included in the dataset

A fifth cluster group is identified as the *'Large Passenger Wide-body Operators'*. Well known, on a worldwide basis operating airlines such as British Airways, China Southern Airlines and Continental Airlines belong to this group. These airlines are large operators as they employ on average 293 aircraft, a significant share of these are wide-body aircraft. Empirical research demonstrated that these operators have a vast cargo capacity in their wide-body belly holds, which are professionally and aggressively sold on the air cargo market. The average weight load factor of this group is with 74% the highest among the group clusters. However, the off-set is that the yield of 57.94 USD cents per ATK is the lowest within the clusters' range. In order to sell the capacity being produced professional cargo sales teams are operating from the headquarters and at regional sales offices. Product differentiation is being applied, differentiating on a number of express, cool chain, life stock products and oversized goods, similar to the differentiation being applied by the 'Strong Regionals' and 'Huge Americans'.

Both the sizeable long haul network and the intensive usage of a high number of wide body aircraft generate a very competitive average unit cost of 54.90 USD cents per ATK. The low yield, combined with the low average unit costs result in average operating profits of 3.04 USD cents per ATK. Remarkable are the very long average distances a ton is being transported on passenger and freighter aircraft (5 113 and 8 170 km respectively). Taken into account the 'normal' stage lengths of the passenger aircraft, it can be concluded that the cargo is mainly transported on the long haul wide body aircraft. Freighter aircraft are used for only 12% of the tonnage capacity, which is mainly to balance loads on the network and supply additional ad hoc capacity on a number of routes. In addition, the significant difference between the average stage lengths of the freighter aircraft and the average distance 1 ton flies on a freighter aircraft demonstrates the relatively low weight load factor (around 50%) of the freighters, reinforcing the observation that freighters are mainly used to balance the loads on the network.

The *'Premium Cargo Operators'* cluster is a cluster that stands out because of its high operating profits of 6.71 USD cents / ATK. Well known medium sized passenger and cargo carriers such as Singapore Airlines, China Eastern Airlines, KLM and Cathay Pacific are part of this cluster. The high operating profits are mainly being generated by a combination of a high yield of 81.51 USD cents per ATK and a high weight load factor of 71%. One of the key success factors of this winning combination of a high weight load factor and a high yield is the usage of Revenue Management Systems (RMS), previously only used for passenger yield management. However, these RMS are now increasingly being introduced in the cargo sales of these airlines for capacity forecasting and allotment planning, and demand forecasting and optimal pricing. All of these airlines in the cluster are known to use RMS for cargo capacity planning and pricing to some extent.

The key indicators of this cluster are similar to the ones in the cluster of the 'Basic Cargo Operators' as they are both very similar in size and operational route performance parameters. However, 'Premium Cargo Operators' operate from a major cargo hub thereby attracting and supplying additional forwarders' traffic in the airlines' network. The airlines of this cluster fly from a major cargo hub such as Singapore, Shanghai, Amsterdam or Hong Kong. This fact, the usage of RMS and the broader range of high yield products being offered generate a significantly higher yield of 81.51 USD cents per ATK compared to 68.98 USD cents per ATK generated by the 'Basic Cargo Operators'. The higher operational costs of 74.85 USD cents per ATK are partly caused by the higher operational costs incurred due to operating out of a major hub and the higher costs associated with offering higher yield products to their customers.

ATK's are being produced by a balanced mix of belly hold (73%) and freighter capacity (27%). Remarkable is the high average stage lengths of the passenger aircraft (2 515 km), indicating that the gravity of the networks of these airlines is on the longer haul routes.

A final cluster can be named the *'Cargo Stars'*, with as sole members within this cluster the large passenger and cargo carriers Lufthansa, Emirates and Air France[4]. When the highest operating profits per ATK among the clusters would be taken into account, the previously discussed cluster 'Premium Cargo Operators' would be called the 'Stars'. However, due to fact that the 'Cargo Stars' are almost double in size, generate an even higher yield and their cargo departments operate as independent Business Units, this cluster was awarded the name 'Star'.

High operating revenues of 85.38 USD cents per ATK and high weight load factors of 73% indicate that cargo strategy is a major part of their overall yield management at these clusters' airlines. Indeed the mentioned airlines created their own branded cargo division, producing independently the freighters' capacity and selling the cargo capacity of their respective sisters' airlines. These divisions have a fully fledged management structure managing their own P&L environment, where they are fully responsible for the revenues and costs of the division, creating full transparency on the profit contribution of the cargo division. Often the freighter aircraft are being operated by this entity, however, with the pilot crew hired in from the sister airline. A number of products (express, cool chain, life stock, etc…) are being offered to enhance the yield. Moreover, often warehousing, trucking, and associated 3PL activities are being offered by the cargo division.

[4] Up to now, AF en KLM still report separate operational output data, and have separate, however closely working together, operational departments. Plans are being developed at Air France under the 'Transform' plan to merge the cargo departments of Air France, KLM and Martinair into one single operating entitity.

The more expensive operating environment at the main hubs generates a high unit cost of 81.67 USD cents per ATK. Operating from a main hub, such as Frankfurt, Dubai or Paris, freighters are intensively used with an average of 36.6 million km a year and transport about 31% of the tonnage. Remarkable is also the very high average stage length (4 574 km) of the freighter aircraft and the very long distance a ton of cargo is being transported on a freighter aircraft (6 928 km). This demonstrates that the gravity of the transported cargo is on the longer haul sectors for both passenger and freighter aircraft. Operating profit is at 3.71 USD cents per ATK, lower than the 'Premium Cargo Operators' and 'Basic Cargo Operators', but higher than the operating profits at the other cluster groups.

CONCLUSION

This paper dealt in the first chapters with the management strategies of air cargo carriers and more specifically focused on the definition of a typology of management strategies for both combination and full cargo airlines. Building blocks of the global strategic framework of air cargo carriers were grouped into a product, market and network part of the overall management strategy. Subsequently, indicators and key performance indicators have been identified and defined for the most significant key and supporting variables in the above mentioned management strategy framework. This paper explained the gradually built up results of a research on strategy typologies through a K-means Cluster Analysis on the data of 2010 which have been collected for these indicators and key performance indicators for a representative sample of 47 air cargo carriers.

The final chapter of this paper presented the final results of this research which generated a typology of seven representative clusters of air cargo operators' strategy models. The following typology of strategy models was identified: the Carpet Sellers, the Basic Cargo Operators, the Strong Regionals, the Large Wide Body PAX Operators, the Huge Americans, the Premium Cargo Operators and the Cargo Stars, each with their own characterizing features and similarities and differences among them. Interesting was to observe in which cluster and on what basis each of the individual airlines from the sample of 47 air cargo carriers were situated. Striking differences and similarities were being highlighted. Moreover, both the strategic rationales and the driving factors behind some strategic choices were further elaborated for a number of air cargo carriers within each typology group.

While some research has been done on passenger airlines strategy, the strategies of air cargo carriers have hardly been researched. The use of a cluster analysis to group the strategy models of a number of air cargo carriers is also a novel feature of this research. Our findings suggest the clear existence of different strategy models and the differing degree of focus on air cargo strategy development and deployment among the air cargo carriers' population.

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