Airport Cargo Logistics and Economic Outcome of Supply Chain: An Empirical Analysis

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***Abstract*— The International Air Transport Association (IATA) forecasted that The United Arab Emirates (UAE) would have the third largest international air cargo market in the world by 2018 Handling airport cargo in and along with the integrated supply chain has therefore become increasingly challenging in a competitive environment, particularly in Abu Dhabi. In this context, the purpose of the study is to examine competitive advantage and the influence of five key factors including: price sensitivity; cost leadership; airport charges; provision of unique product and services; and the development of airport facilities.**
Methodology – A link to an online questionnaire was sent to 168 airport logistics executives, resulting in 102 respondents sharing their views on the importance of each of these factors and their impact on competitive advantage in the context of airport cargo logistics. A convenience sampling method was used and the statistical software PLS was employed.
Findings – Through the application of various statistical analyses, all of the five factors (the independent variables) were positively correlated to competitive advantage (the dependent variable) indicating support for the conceptual framework and hypothesis. Managerial Implications – Managers need to understand the impact of and the relationship between each of the five factors, and acknowledge that designing, developing and delivering on all the constructs, as per the requirements of stakeholders, are vital to achieving competitive advantage. Originality – Due to lack of empirical research work in airport logistics, particularly in the UAE, this study will make a valuable contribution to adding to the body the evidence in this field and to the strategic debate on how best to achieve competitive advantage within airport cargo logistics.

Keywords— *Cargo logistics, Competitive advantage, Cost leadership, Airport charges, Product and service, Abu Dhabi, UAE*

1. Introduction

Air cargo forms a significant part of global trade and a sustainable, safe and profitable supply chain is fundamental to the industry's success [11]. Air cargo logistics is intricately integrated in a value chain which, when managed effectively, can lead to competitive advantage [7]. It is generally agreed by world trade and international business analysts that the carriage of cargo and freight via air offers comparative economic advantage over other modes of transport [24]. Furthermore, it has been evidenced that the air cargo industry can impact positively on a country's growth rate and GDP returns [13].

The United Arab Emirates (UAE) was predicated to achieve the third largest international air cargo market in the world by 2018 by the International Air Transport Association (IATA) [22]. According to the IATA [11], Middle Eastern carriers' freight volumes increased 11.2% year-on-year in December 2016 and capacity increased by 5.9%. This contributed to an annual increase in demand of 6.9% in 2016 – the second fastest growth rate of all the regions.

Air cargo traffic is heavily affected by operating characteristics, logistics stream and economic conditions [25]. The landscape of logistics in UAE is expected to grow at an annual compound growth rate of 5.7 per cent from 2015 until 2020. This growth is attributed to advances in infrastructure, rail network, Abu Dhabi Expo 2020, and commercial engagements with Asia and sub-Sahara markets [23].

According to Emirates SkyCargo, the freight division of Emirates, continues to lead the international air cargo industry by winning the 'Best Air Cargo Carrier- Middle East' award at the

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2016 Asian Freight, Logistics and Supply Chain (AFLAS) event.

The UAE's logistics industry will be supported by ongoing economic diversification, growing domestic demand, development of multimodal transportation, and the implementation of new technologies. Furthermore, the sector has played an important role in the country's sustained economic growth [23].

2. Literature Review

2.1 Price Sensitivity

Currently, the 'freehand' given to the airline and airport' industry has sparked a price war in which lower prices and costs are used as a means of attracting and retaining customers. This results in some key operators in the industry working collaboratively as a group which share similar characteristics in terms of their price offerings when compared with the wider industry as a whole. From empirical research, it is evidenced that price is the very first factor that attracts customers [5].

Examples of using price are illustrated by the creation of 'Free Zones' in Abu Dhabi which offer discounts for shippers, which subsequently benefits the logistical chain and delivers competitive advantage in the value chain [6]. It is therefore expected that customers would give due consideration to pricing and would base decisions about which airports they choose to include in their logistical chain based on this factor. Based on the above discussion, the following hypothesis has been developed:

H1: There exists a positive relationship between lower prices offered by an airport and the volume of customers it succeeds in attracting that leads to competitive advantage.

2.2 Cost leadership

Cost has always remained a crucial part of the airline cargo industry throughout history. Without any doubt, low-cost business models have been proven to be successful throughout the entire business community [16]. The impact on total cost of the airport cargo operation is complex issue [19]. For instance, the airport cargo sector in Abu Dhabi strives to achieve cost effectiveness, hassle-free commercial transactions and business processes; however, the low cost carrying rates vary from one route to another. In particular, cost appears to be more of a factor in the case of long distance transportation, whereas this is not the case for short distances. On these grounds, various airlines have offered low cost services for some of the routes. It is worthwhile to note that there are only a limited number of these prime routes where such services are being offered. Airports supporting such routes have had to adapt and respond to this and also operate a low cost model in order to be part of the chain. Such airports become 'hotspots' and ultimately benefit by increasing their market share of customers over time. Under such circumstances, marketing and other promotional efforts by the airports are not as important as they automatically tend to attract customers simply because of the competitive edge they possess over others [4].

This is in essence a differentiation strategy which tends to attract a customer base and allow airports to compete effectively in the industry. However, not all airports are in a position to adopt such a strategy and only a handful of airports are able to take advantage of this opportunity [9]. Ultimately, airports which are successful in managing business operations, and are able to exploit the cost leadership factor, tend to attract more customers. From the above discussion, the following hypothesis is framed:

H2: Cost leadership of the airport is positively correlated with customer attraction that leads to competitive advantage.

2.3 Airport charges

Each airport operating in the industry follows a separate business model in order to cover its costs and increase its revenue. One of the ways in which is does this is through the implementation of airport-handling charges. Airport charges are fees levied on aircraft operators in connection with the landing, parking and other services offered to the operator including security charges, aerobridge charges, passenger service charges and passenger safety fees. Each airport uses its own mechanisms to determine how airport handling charges are defined. Similarly, airport handling charges are also influenced by customers who will use charges to inform their decision making regarding which airports to use [21].

It has been revealed that airports have improved the flow of customers when a reduction in airport handling charges is made. This is the core foundation on the basis of which the costing mechanism operates. However, airport-handling charges are not the only factor. There are many additional factors such as night curfews, freight forwarders, and other airport charges which influence the decision-making process [3]. A review of the literature demonstrates the relationship between the airport charges offered by the airport and the customer attraction created as a result. This relationship helps to attract a large customer base. In a study conducted by Ref [15], it was concluded that airport charges are one of the key factors that contribute to customer attraction. Based on the above discussion, the following hypothesis has been proposed:

H3: There exists a positive relationship between low airport charges offered by the airports and the customer attraction that leads to competitive advantage.

2.4 Provision of unique products and services

Advances in airport logistics technology have influenced the development of services to improve the efficiency of the airport in terms of luggage management, aircraft, and so forth [18]. Air cargo has established extended and yet integrated services, such as 'ground linked', characterized by door-to-door service from shipper to customer, as opposed to 'airport-to-airport' [2]. Like all other businesses, airports also offer certain non-financial benefits, which may attract its potential customers. For instance, an airport might offer priority services to its loyal customers or to customers whose load exceeds a specific weight limit.

As a result, the customers benefit through saved time and money. In addition, they would also benefit in terms of transit time. Such unique products and services help to develop and maintain a high level of customer loyalty which then influence the carriers to shift their custom to specific airports only. The mutual benefits to be obtained through this form of working can lead to competitive advantage for both parties, but requires careful planning, monitoring and strategic decision-making. This discussion leads to the formulation of the following hypothesis:

H4: Provision of unique products and services are positively related to the number of customers that leads to competitive advantage.

2.5 Development of airport facilities

For airports to operate facilities effectively, concerned members of an alliance support each other to manage competition [20]. Their management needs to minimize any revenue related risks, through a detailed analysis of data, competition through airport charges, and customizing services. The facilities for airport transport directly generate employment and increases economic advantages but require a, dynamic strategic planning and adaptive policy approach [12, 14]. With the passage of time, certain airports have developed facilities that ultimately help facilitate the smooth flow of operations from the customer's perspective. Such airport facilities prove to be a strong marketing triggering factor to help build competitive edge by airports. However, the development of such facilities is not an easy task and requires significant effort. This effort is needed to fully understand customers' needs and requirements, the changing dynamics of the market, changes in the technological layouts and the ultimate demands of the customers. All these factors combine together to compel airports to develop and adopt measures through which optimal services can be provided to the carriers.

These airport facilities are not only a requirement anymore but an added advantage that can help airports attract good carriers. Although the operations at airports can be wholly under the control of the airport authorities, these operations contribute to the overall system followed by the individual carriers. The ratio of this contribution may be small but the impact can be high. No carrier can risk the working of the entire system on the basis of this minor factor. Therefore, before establishing the relationship with the airports or group of airports, careful analysis of the airport facilities is made. One imperative fact that needs to be considered in this relationship is that this it must not be seen as a short-term relationship but instead as one which may last for many years and in some cases many decades as well. This relationship will be strengthened with the passage of time and with the careful partnership working between both parties. Based on the above discussion, the following hypothesis has been developed:

H5: Airport facilities are positively related to customer satisfaction that leads to competitive advantage.

On examining the current literature, it has been found that there are limited studies carried out on airport cargo logistics and its economic outcomes in the UAE. Therefore, this study helps to fill the research gap.

3. Research methodology

3.1 Population, sampling, sampling technique and data collection

This study has been conducted in the cargo sector of Abu Dhabi International Airport, UAE. Senior executives of different departments in the cargo sector were the participants of the study. The study used an online survey where the views of 102 executive respondents were analyzed asking for their perspective of the relative importance of each of the factors on competitive advantage. The frequency distribution profile of the respondents showed that 54 percent were female while 46 percent were male. The majority of the respondents (42%) were in the age range between 41 to 50 years of age. Respondents' degree qualifications included a Bachelor (54%), Master (42%) and others (4%). From the ethnic perspective, Arabs comprised 75%, followed by South Asians that comprised 16%, and others 9% of the study sample respectively.

3.1.1 Conceptual model

Figure 1 illustrates the theoretical framework used in this study depicting the relationship of the independent variables of price sensitivity, cost leadership, airport charges, provision of unique product and services, development of airport facilities; with competitive advantages as the dependent variable.

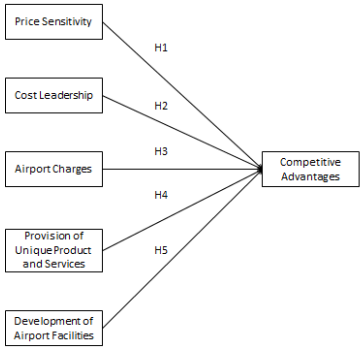

Figure 1. Conceptual Framework

3.2 Data analysis and results

3.2.1 Convergent validity

For convergent validity (see Table 1), support is provided by factor loadings, which all exceed the 0.70 level. Furthermore, the composite reliability is greater than the recommended minimum value of 0.70 for every construct, and the AVE is greater than the lower bound of 0.50 in all cases [8]. In order to check the sampling adequacy, Kaiser-Meyer-Olkin (KMO) test was conducted. Since the values in table 1 are greater than 0.60, it has been concluded that fitness of data is good.

Table 1. Internal reliability and convergent validity of the constructs

Construct	Variable	Alpha Coeff	Item-total correlation	KMO	Factor loading	C.R1	AVE2
Price Sensitivity	PS1	0.862	0.788		0.856	0.829	0.735
	PS2		0.798		0.864		
	PS4		0.772	0.682	0.852		
Cost Leadership	CL1	0.844	0.902		0.844	0.881	0.707
	CL2		0.880		0.842		
	CL3		0.744	0.724	0.836		
Airport Charges	AC1	0.798	0.746		0.888	0.826	0.684
	AC2		0.778		0.798		
	AC3		0.822	0.748	0.782		
Products and Services	PS1	0.838	0.904		0.746	0.913	0.646
	PS2		0.850		0.846		
	PS3		0.876		0.822		
	PS4		0.772	0.781	0.798		
Airport Facilities	AF1	0.872	0.726		0.786		
	AF2		0.816		0.822	0.861	0.714
	AF3		0.844		0.878		
	AF4		0.766	0.802	0.890		
Competitive Advantage	PA1	0.822	0.736		0.952		
	PA2		0.716		0.944	0.804	0.824
	PA3		0.824	0.828	0.822		

C.R[1] Composite Reliability

[2]AVE, Average Variance Extracted.

3.2.2 Discriminant Validity

Results further show that the Average Variance Extracted (AVE) value for each construct is greater than its Maximum Shared Variance (MSV) and its Average Shared Variance (ASV) [8]. Furthermore, the square root of the AVE of every construct is greater than all the correlations between that construct and all other constructs (see Table 2). Thus, discriminant validity is achieved because the measures of the constructs in the model are robust.

Table 2. Discriminant validity of the constructs and bivariate correlations of latent constructs

Construct	MSV[1]	ASV[2]	1	2	3	4	5	6
Price Sensitivity (1)	0.216	0.119	**0.857***					
Cost Leadership (2)	0.184	0.151	0.092	**0.840**	*			
Airport Charges (3)	0.338	0.181	0.397	0.307	**0.827***			
Products and Services (4)	0.328	0.144	0.464	0.141	0.474	**0.804***		
Airport Facilities (5)	0.318	0.212	0.475	0.307	0.590	0.590	**0.845***	
Competitive Advantage (6)	0.186	0.141	0.195	0.298	0.281	0.110	0.202	**0.908***

[1]MSV, maximum shared squared variance; [2]ASV, average squared variance; *square root of AVEs (1-6)

As shown in Table 3, all estimates are positive and significantly different from zero (the p-value is 0.00 in all cases), so that the associated hypotheses are accepted.

The results indicate that the expected causal links between unobserved variables are statistically different from zero.

Table 3. Hypotheses, path coefficients, and results

Hypotheses	Relationships		b[1]	SE[2]	CV[3]	p
H1	Price Sensitivity	→ Competitive Advantage	0.211	0.020	10.272	0.000
H2	Cost Leadership	→ Competitive Advantage	0.196	0.024	7.546	0.000
H3	Airport Charges	→ Competitive Advantage	0.284	0.022	12.623	0.000
H4	Products and Services	→ Competitive Advantage	0.450	0.032	13.157	0.000
H5	Airport Facilities	→ Competitive Advantage	0.318	0.021	15.416	0.000

b[1], estimates; [2]SE, standard error of the regression weight; [3]CV, critical ratio value for regression weight.

There is a positive association between price sensitivity and competitive advantage (β = .211). Price sensitivity places a greater emphasis on logistics cost and time efficiency when routing shipments via an airport. Air cargo provides a reliable and fast "just-in-time" logistics service for high-value and perishable export goods in the global free trade environment.

There is a positive association between cost leadership and competitive advantage (β = .196). The cost leadership approach aims to place the firms amongst the lowest cost producers. This is realized by reducing costs, such as low cost inputs, low distribution and location costs, by offering a standardized product, and by achieving high volume of sales and economies of scale.

There is a positive association between airport charges and competitive advantage (β = .284). Air Cargo landing fees can vary dramatically among airports. Based on an airport's financial status and capital improvement programs, substantial adjustments to the landing fees may be required to attract new business and to sustain on a long-term basis. Moreover, aircraft parking fees also needs to be considered for airports to charge airlines for aircraft stays beyond the free parking period. There is a strong correlation between products and services and competitive advantage (β = .450). To stay ahead in the business, firms must find innovative ways to introduce new products and services in order to improve their operational income. Furthermore, improving the cargo firm's ability to offer competitive products and services that customers want; when and where they want them.

There is a positive correlation between airport facilities and competitive advantage (β = .318). There should be an ongoing airport master plan for future air cargo facilities and necessary land should be allocated to air cargo facilities, especially at those airports facing difficulties with finding additional land adjacent to airport sites to accommodate huge numbers of cargo services in the future.

Table 4 shows the result of multiple regression analysis and it is conducted to determine the independent variable(s) contributions to regression weights. The conceptual model with all five predictors produced R^2 = .822, the larger the better, and indicates significant positive regression weights. Furthermore, the proposed conceptual framework with all five predicators influence the dependent variable of competitive advantage. Thus, this test ensures the goodness of fit [1].

Table 4. Multiple Regression results – Model Summary

R Value	R Square	Adjusted R Square	Standard Error Estimation	F Value
0.901	0.822	0.811	2.3756	98.720

Intercepts (Constants)		Unstandardized Coefficients		Standardized Coefficients (B)	t Value
		B	Std. Err		
Price Sensitivity	-3.691	0.566	0.057	0.729	9.936
Cost Leadership	-3.810	0.509	0.066	0.439	7.759
Airport Charges	-1.819	0.173	0.040	0.226	8.003
Products and Services	0.148	0.270	0.077	0.201	4.006
Airport Facilities	-2.764	0.191	0.064	0.162	2.621

Dependent Variable: Competitive Advantage

4. Limitations and future research

Firstly, due to time constraints, the data collected and analyzed was from a limited number of respondents and within the confines of one organisation. However, for future research, the sample size would benefit from being increased in order to get a wider range of perspectives.

Secondly, whilst this study provides rich information, results and analysis, and key findings for the given constructs, a modified model may benefit from being developed so that related constructs can be investigated. Thirdly, although efforts were taken to ensure the validity of the responses from the key respondents, there is still room to strengthen the meticulousness of the study.

The final limitation deals with geographical focus on Abu Dhabi alone; hence the results cannot be generalized for other airports or markets. For future research, the study could focus on small and medium sized airports in other areas and investigate the implementation of cargo practices as compared with larger scale airport cargo industries.

5. Managerial implications

As air cargo has become increasingly integrated and sophisticated in managing cargo operation, airport facilities, and ancillary services; today's managers find themselves at the interstation of challenges in making decisions on multi-modal operation in supply chain industries [7]. In this context, such decision makers need rich and reliable data and empirically investigated findings, which is not easily available in locations such as Abu Dhabi. Therefore, this study, with its robust conceptual framework, sound review of the literature, and empirical analysis provides a valuable resource for decision makers. The five variables: price sensitivity, cost leadership, airport charges, provision of unique product and services, and development of airport facilities are rigorously studied, and their relationship with the dependent variable have been tested, which were all found to be positively related. This implies that cargo firms need to acknowledge the various socio-commercial dimensions of all of these factors and gain tactical and strategic insights into them in order to formulate timely plans and focused strategies.

Thereafter, each of the factors needs to be examined to establish the extent to what role and how much impact they may have on achieving competitive advantage. Also, along with this framework, managers need to understand the economic or commercial outcome from the whole operation. This article covers how efficient and effective handling of air cargo can generate economic gain from revenue management, airport charges, timely delivery, flexible airport facility, economic scale, and labor supply and provides details on the inputs required to make more effective decisions to achieve competitive advantage within air cargo logistics in an increasingly challenging environment [10].

6. Conclusion

From the discussion above, it is clear that today's airport cargo logistics have become increasingly integrated and sophisticated to handle cargo flow efficiently and cost effectively in a competitive environment. This study was empirically carried out employing a strong research design and statistical methodology examining the relationship between independent variables of price sensitivity, cost leadership, airport charges, provision of unique product and services, and the development of airport facilities; with the dependent variable of competitive advantage. Findings show that all five independent variables are positively correlated with the dependent variable, which confirms support for the conceptual framework and hypothesis. This finding is also supported by several other studies which also strongly indicate that the airport cargo logistics plays a significant role in influencing the economic outcome of the supply chain operation.

The cargo industry has huge impact on the overall economy, through its own operational engagements and by acting as an enabler for related industries. The economic benefits can be direct, indirect, and catalytic and can be derived from airport charges, transactions, and other commercial or social deals. This study identifies a number of implications for managers working within air cargo, the airport authority, the airport supply chain and other related fields managers, relating to their understanding of the interdependence and interplay of various factors in this study on competitive advantage. The findings from this study can help support managers to adopt the right strategies and take the right decisions to generate maximum revenues leading to the achievement of competitive advantage in airport logistics.

Finally, the findings from the study additionally support the view that the air cargo industry must also strive to improve its competitiveness through the use of digital technologies which can drive efficiency and lead to customer satisfaction to attain and retain further competitive advantage.

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