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B2B E-MARKETPLACES IN THE AIRLINE INDUSTRY: A STUDY ON PROCESS DRIVERS AND PERFORMANCE INDICATORS

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1. Introduction and Theoretical Background

In recent years, a growing number of companies in many industry sectors have decided to include e-Business as an integral part of their strategy to enhance competitive advantage. The airline industry, having always been a great instigator and guarantor for innovative changes, is one of the industries where developments in ICT in general have proven to be an inevitable factor of success.

The airline industry is continuously challenged to move into more sophisticated stages of corporate evolution, that have also further encouraged an accelerating use of the Internet and information and communication technology (ICT). Liberalisation processes, falling barriers of entry, mergers and consolidations as well as alliances have led airlines to incorporate adequate innovative measures regarding the achievement and maintenance of competitive advantage. In this sense the diffusion of the Internet on a global and pervasive scale has created new scenarios of action. These new computer technologies allow economic actors in the airline industry to answer the change brought about by liberalisation, globalisation, and the resulting hyper-competition of the competitive environment (Jarach, 2002). However, so far, ICT has revolutionised the Airline Industry mostly in terms of Business-to-Consumer developments in terms of CRS (Computer Reservation System) and nowadays public online booking portals. Besides interactions with their customers to sell their tickets and services, airlines also rely heavily on external partners to guarantee smooth operations. For example, airlines are customers of airframe manufacturers, component, spare parts and catering suppliers, airports, air control systems and other authorities to obtain landing slots, docking gates, informing about arrivals and departures, declaring flight paths, etc. More and more suitable extranets and inter-organisational systems (IOS) are developed to facilitate the interaction of airlines with the respective service providers, suppliers and authorities. Especially, e-Procurement has become a major player in recent ICT developments. As airlines regularly purchase products and services, such as fuel, aircraft components and spare parts, catering and inflight supplies, B2B applications may allow them to benefit from cost savings and efficiency. Operations can be streamlined and thus turnaround times at airports can be reduced, which is a major factor of an airline's operational costs. Clarity of information and efficiency in the supply chain is critical for both controlling costs and delivering service (Buhalis, 2004).

Among recent innovative developments are B2B e-Marketplaces, which have been hypothesised to optimise procurement processes and to add significant value in airlines' supply chains.

An e-Marketplace is facilitated by information technology, where numerous buyers and suppliers get together to seek information and to buy and sell goods and services at a fixed or dynamic price, which is determined in accordance with the rules of the exchange. (Bakos, 1998; Choudhury et al., 1998; Koch, 2002; Sculley et al., 1999, Senn, 1996).

According to IBM et al. (2000), e-Marketplaces built upon a shared Internet-based infrastructure could provide firms with a platform for:

1. Core business transactions that have the potential to automate and simplify the requisition-to-payment process online, together with procurement, customer (relationship) management, and marketing/selling;
2. A collaborative network for product design, supply chain planning and optimisation, as well as fulfilment processes;
3. Transparent product information that is aggregated into a universal classification and catalogue structure;
4. An environment where sourcing, negotiations, and other trading processes such as auctions can take place online and in real time;
5. An online community for publishing and exchanging industry news, information, and events.

The evaluation of the take-up and benefits of current B2B e-Marketplace systems in the aviation industry as well as the measurement of comparative capability can make a contribution to identify new strategic business opportunities or developments made possible by an improved ICT infrastructure. Therefore, this paper aims to explore adoption drivers and the value creation of B2B e-Marketplaces.

2. Research Questions

Companies involved in e-Marketplaces can be studied from both the seller's and buyer's point of view. This paper investigates the latter. With B2B, both the online penetration and the value retained by the airlines are expected to be at least twice the level realised by developments in B2C (Airline Business, 2000). A set of research questions in their own individual contexts can help assessing this proposition and identify e-Marketplace adoption drivers and enables. These questions can be postulated and grouped as follows:

Environmental Context & Firm Size.

- *Are External competitive pressures positively related to e-Marketplace adoption of airlines?*
- *Is the use of e-Marketplaces dependent on an airline's strategic classification, its firm and fleet size?*

Technological Context.

- *Is e-Marketplace implementation positively related to an airline's overall ICT sophistication?*
- *Is the adoption of e-Marketplaces among airlines positively related to the overall number of Internet services used?*

Joint Procurement and Buying Power.

- *Do airlines involved in alliances / partnerships use B2B e-Marketplaces more than airlines that are not involved in alliances / partnerships?*
- *Is the extent of resource and information sharing positively related to e-Marketplace adoption among airlines?*
- *Do airlines involved in e-Marketplaces have a higher integration level of joint procurement than airlines that are not?*

Outsourcing.

- *Is the extent of outsourcing positively related to the adoption of e-Marketplaces among airlines?*

Performance Indicators.

- *Is B2B e-Marketplace adoption positively related to the overall*

performance and satisfaction with the procurement practices of an airline?

- *Does the use of e-Marketplaces have a positive effect in terms of reducing purchase order costs of an airline?*
- *Can a reduction in purchasing process costs and in procurement product prices exceed the investment costs for the use of e-Marketplaces?*
- *Is the use of B2B e-Marketplaces positively related to an airline's overall business performance?*

3. Data Collection

The data collection for this study was carried out in the form of an in-depth questionnaire survey addressing senior procurement personnel at 300 airlines around the globe. Stratified random sampling was employed, based on the airline size of the entire passenger airline population which constitutes, according to Flight International (2004), approximately 1200 airlines. The world air transport market is very concentrated and half of the world's fleet is operated by just the 17 large airlines (Airlines Gate, 2001). Almost 70% of world airline revenue is generated by just 100 airlines (Sahi, 2004). According to Flight International (2004), the world airline industry consists of 65% of airlines with 10 aircraft or less, 17% with a fleet of 11-20 aircraft, 13% with a fleet of 21-50 aircraft, and just 5% with a fleet over 51 aircraft. Strata were developed to ensure that all participating airlines are adequately represented in the target sample. Therefore, the target sample was divided into four sectors based on airline fleet size (from 1-10; 10-20; 20-50; 50 and more). Out of each size group, 75 airlines were selected randomly. 88 responses were received representing a response rate of 29.3%. Figure 1 outlines the sample characteristics and distributions.

4. Discussion of Key Findings

Environmental Context & Firm Size. The survey data verify that regional, scheduled and charter airline groups experience highly competitive pressures to reduce their cost levels. Interestingly, low cost airlines tend to report lower competitive pressures from the business context ($p=<0.1\%$, $F=15.71$). Low cost airlines report a slight increase in passenger numbers and overall profits, while regional scheduled and charter airlines are tending to experience an overall decline in performance. These results might be attributable to the continued rise in the number of new-entrant low cost airlines, the after-effects of overcapacities in the 1990s as well as additional costs incurred due to increased terrorist threats. It has further been investigated whether or not increased competitive pressures are related to an increased e-Marketplace adoption. However, results reveal that there is not a significant relationship ($p=85.1\%$, $F=0.02$). The decision to implement an e-Marketplace might not be completely attributable to the current environmental situation, but rather be seen as a long-term investment and a means of facilitating procurement as well as reducing procurement related costs. Besides economic and financial benefits, Lenz, Zimmermann and Heitmann (2002) confirm that soft aspects like partnership and the use of extended services come more and more into attention when making the decision to use an e-Marketplace.

Use of a B2B e-Marketplace can be determined by either financial participation in terms of ownership and/or by the use of this means in the procurement of different commodities. The survey results indicate that 25% of survey respondents are involved financially in an e-Marketplace, with scheduled airlines showing the highest penetration at 68%, followed by low cost airlines with 23%. Overall, 65% of airlines report using e-Marketplaces for procurement operations. Again, in the group of full service airlines, e-Marketplace adoption is the highest with 82%, followed by low cost airlines with 79%, regional airlines with 50% and finally charter airlines with 27% ($p=<0.1\%$; $chi2=19.73$). Low cost airlines show a low financial involvement in terms of ownership, but high adoption rates. This might be due to the fact the low cost airlines avoid all unnecessary risks, try to be as flexible as possible and tend to outsource everything except their core business activities. Charter airlines show the least interest in using an e-Marketplace. This might be due to the fact that a large proportion of them are vertically integrated in tourism companies that dictate decisions in strategic procurement and might not see their charter affiliates as their core business as seats are mostly filled with their own package holiday passengers. Thus, the need to reduce costs and facilitate processes might not be that apparent.

The use of e-Marketplaces clearly increases with the total number of an airline's employees ($p=<0.2\%$; $F=10.3$), the number of employees in purchasing ($p=<0.1\%$; $F=14.4$) and the fleet size ($p=<0.9\%$; $F=7.2$). According to Lehmann (1985), the size of a firm can influence its level of innovation. Palvia and Chervany

		Number	Related Percentage
Total Airline Population		1200	
Survey Target Sample		**300**	
Fleet Size of Population	10 aircraft or less		65%
	11-12 aircraft		17%
	21-50 aircraft		13%
	51 aircraft and more		5%
Distribution of Population	Full service/Regional		60%
	Charter		15%
	Low fares		25%
Responses/Response Rate		**88**	**29.3%**
Fleet Size of Sample	10 aircraft or less		18%
	11-20 aircraft		23%
	21-50 aircraft		29%
	51 aircraft and more		30%
Distribution of Sample	Regional		12%
	Full service		44%
	Charter		22%
	Low Fares		32%

Figure 1: Airline Response Breakdown

(1995) argue that larger firms are more willing and capable of taking the risk of adopting new technologies. Hadaya (2004) confirms that a firm's size is positively related to its level of use of B2B e-Marketplaces.

Technological Context. A significant relationship between e-Marketplace implementation and an airline's overall ICT sophistication was found (p=3.5%; F=4.51). There was also a very significant dependence between the adoption of e-Marketplaces and the number of Internet services used (p=0.26%; F=9.75). Hence, the survey confirmed technology competence as an e-Marketplace adoption driver for airlines. The findings coincide with the view of Barratt and Rosdahl (2001), who regard the use of customised services as a key area of technology competence.

Joint Procurement and Buying Power. The survey results also suggest that airlines involved in strategic alliances or other partnerships tend to exhibit greater levels of use of B2B e-Marketplaces (p=3.7%; F=4.37). Jarach (2002) argues that sophisticated e-Procurement applications can generate competitive improvements for firms because of the sharing of information and the planning of joint activities. Strategic alliances have become increasingly important elements in a firm's portfolio of strategies and are viewed as a source of competitive advantage in the airline industry (Suen, 2002). However, surprisingly, the extent of resource and information sharing is not related to e-Marketplace adoption (p=80.2%; F=0.05). Apparently, the involvement in strategic alliances and e-Marketplaces alone does not necessarily lead to a higher level of resource and information sharing.

Moreover, airlines involved in e-Marketplaces do not take advantage of joint procurement tools to a greater extent than non-adopters of e-Marketplaces (p=75.3%; F=0.10). Academic research focused on economies of scale among airlines and a major conclusion was that above a certain, very low level, economies of scale do not exist to a significant extent (e.g. Caves, Christensen, Tretheway, 1984; Crane, 1944; White, 1979; Xu and Windle, 1994). For low cost items and those with a high rate of consumption, such as aircraft fuel and in-flight catering supplies, the level of product price reductions available to a group of airlines would be similar to that available to individual airlines. This is because the demand from individual airlines would be significant for capacity in the supply chain, allowing little room for further discounts for larger customers. However, substantial discounts may be available for large orders of high cost items such as aircraft and maintenance spares and components. The holding of aircraft spares can significantly increase an airline's cost level, not only through the initial purchasing process but also through administration charges and storage costs. When optimising the process of procuring a part, as well as administration and storage, savings could be made through the more efficient use of resources. While an e-Marketplace can be seen as an intermediary for realising those joint-purchasing benefits by enabling aggregate buying (Christiaanse and Kumar, 2000), the awareness and adoption for electronic joint purchasing is still rather low among airlines and not well integrated.

Outsourcing. Outsourcing is predominantly employed in maintenance related areas. The level of outsourcing is highly dependent on an airline's strategic orientation (p=<0.1%; F=6.11). Low cost airlines show a much higher extent of outsourcing (X_{LC}= 3.17) than their full service (X_{FS}= 2.31), charter (X_C= 2.18) and regional airlines (X_R= 2.54) counterparts[1]. In most of the cases, in order to minimise their own labour costs and focus on the core business, low cost airlines have outsourced the maintenance of their aircraft and with it, the procurement of respective materials. A.T. Kearney (2004) has published a report on current maintenance, repair and overhaul (MRO) activities, which states that since airlines are trying to lower costs and gain operational cash which is bound in a huge amount of spare parts, many have abandoned their in-house MRO capabilities and facilities. Since 2001, the outsourcing of MRO services has increased by about 10%. Airlines with a high number and diverse kind of fleet may not fully benefit from outsourcing. For example, an airline would require short turnaround times, while this would mean a higher utilisation of staff and higher costs for a provider. The survey data suggests no significant dependence between the extent of outsourcing and the adoption of e-Marketplaces (p=70.7%; F=0.14). Outsourcing cannot be regarded as a process driver or as a side-effect of e-Marketplace adoption.

Performance Indicators. Overall, B2B e-Marketplace adoption is positively related to the overall satisfaction and performance of an airline's procurement management and practices (p=0.7%; F=7.58). For example, e-Marketplaces can reduce search costs. Office supplies and spares and repairs are areas with the greatest potential for saving search costs, followed by tools and ground support equipment (see Figure 2).

Mean Values / Spend Categories	Reduction of Search Costs	Time Efficiency Enhancement	Order Process Facilitation	Inventory Level Reduction	Supplier Transparency	Reduction of Product Prices
Powerplants	3.15	2.92	2.71	2.22	2.63	2.84
Spares and Repairs	4.11	4.04	3.73	3.74	3.70	3.99
Maintenance	3.15	2.95	2.88	2.31	2.95	3.08
Fuel	2.88	2.65	3.02	1.83	2.73	3.14
Interiors	3.46	3.45	3.52	3.08	3.38	3.46
Catering	3.16	3.06	3.11	2.54	3.03	3.42
Tools/GSE	3.92	3.82	3.62	3.42	3.61	3.81
Office Supplies	3.97	3.94	3.90	3.67	3.83	4.23
TOTAL	3.48	3.35	3.31	2.86	3.24	3.50

Figure 2: Performance Indicators by Airline Spend Categories

[1]All means in this paper are based on a scale from 1 = not at all to 5 = totally.

Materials, spares and repairs represent the most frequent commodities to be procured via e-Marketplaces while fuel tends to be purchased to a much lesser extent using such platforms. Use of e-Marketplaces to facilitate order processes, overall efficiency enhancement and a greater degree of transparency of suppliers is reported for office supplies, followed by the categories of spares and repairs, interiors and tools/GSE. Analysis reveals that survey participants see B2B e-Marketplaces as a tool to reduce their inventories in certain categories (e.g. spares and repairs). These inventory reductions have increased the reliance of airlines on suppliers of new, used and overhauled parts and products. This is also true for office supplies and tools/GSE. A limited potential for product price reductions by the use of e-Marketplaces was found for fuel, maintenance services and powerplants.

The survey data confirms that the use of e-Marketplaces has a positive effect on the reduction of purchase order cost ($p=4.8\%$; $F= 4.0$). Jarach (2002) confirms that a web interface can generate two types of advantage: (1) greater effectiveness due to the possibility of shorter buyer search times and due to the possibility of reducing supplier response times, thus simplifying the planning stage of the airline offer; (2) greater efficiency, as B2B online negotiations also allow other actors, that are not part of the usual supplier network to participate in the process with a product or service offer, thus resulting in economies of variety and considerable savings in management. Most respondents further indicated that the achieved reduction in purchasing process costs and product prices exceed the investment costs for the implementation and use of an e-Marketplace ($Chi2=21.21$, $p=0.03\%$), and that those savings achieved occur slightly more in processing rather than product costs. Intangible benefits include the ability to improve and introduce commodity and vendor management, reduce turnaround times, enhance visibility of price changes, and improve spending controls and employee compliance.

Given these benefits from e-Marketplace adoption, the use of e-Marketplaces, however, is not positively related to an airline's overall performance ($p=66.2\%$; $F=0.20$). While it could be confirmed that e-Marketplace adoption can be advantageous in terms of performance indicators in procurement, a direct link to the overall airline performance (e.g. increase in passenger numbers, profit) could not be established. However, a positive relationship could be identified between the ICT sophistication within an airline organisation and the overall airline performance. Overall airline performance is dependent on a variety of other business and strategy factors (e.g. unexpected environmental factors such as terrorist attacks or health risks such as SARS).

5 Concluding Remarks

There are significant deviations in some areas in terms of e-Marketplace use and perceptions within the different airline groupings. The survey findings reflect the volatility in both the airline industry and the global economy. Competitive pressures are increasing within and between different strategically oriented groups of airlines. The contingency model (figure 3) summarizes findings from the survey.

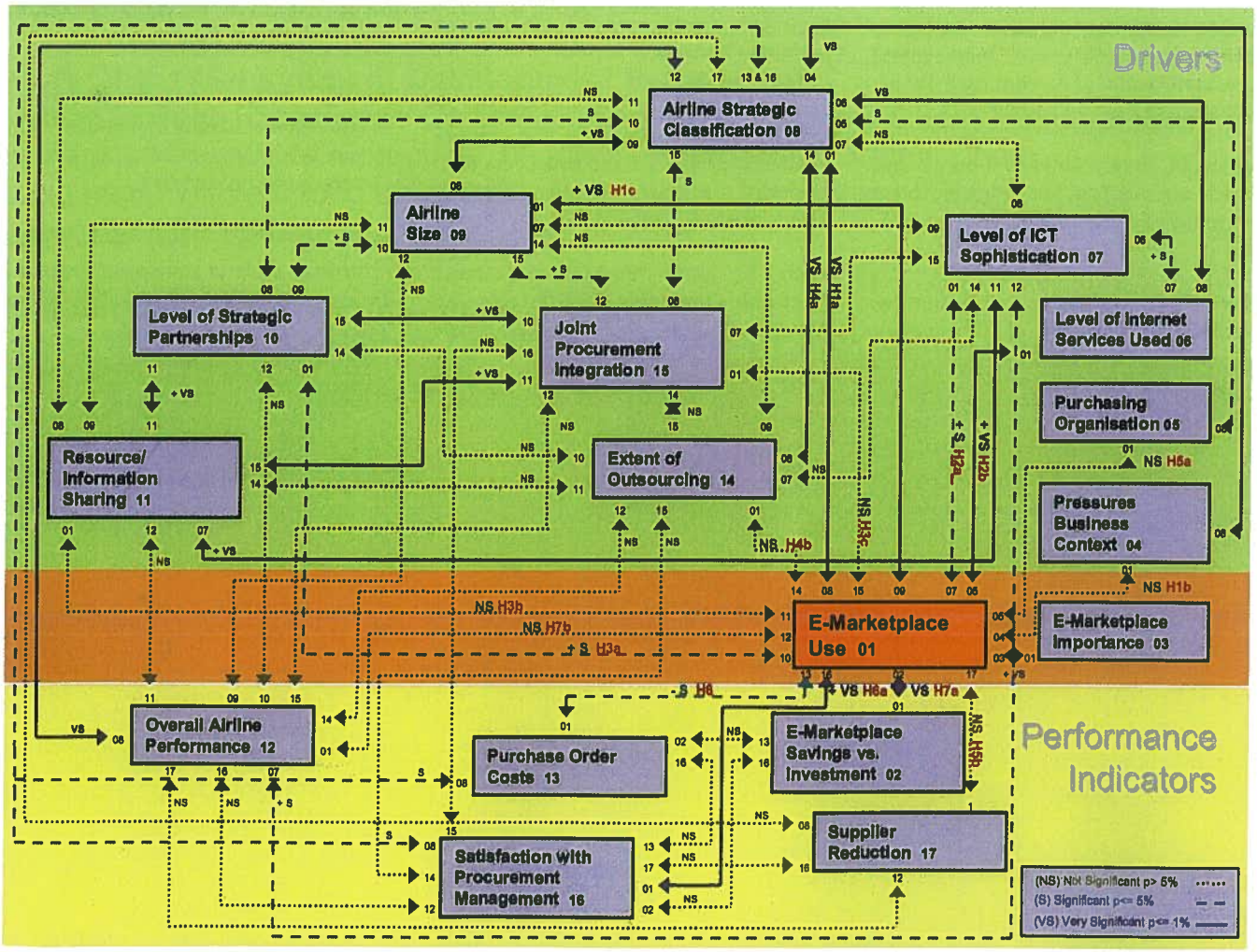

Figure 3: Contingency Model

To conclude, in a highly competitive industry such as the airline industry margins on any individual customer / passenger are continually being squeezed. In sustaining profitability, the focus will need to be on lowering the cost base. The total cost base of a typical airline consists of almost 50% of attributable to material costs. This is arguably a key element of the cost base, which warrants at least as significant attention as total or division employee numbers. E-Marketplaces appear to offer a tool for contributing significantly to the reduction of this element of an airline's cost base.

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