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The Impact of Business-to-Business e-marketplaces as Extended Media in the Procurement Supply Chain of Airlines

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ABSTRACT

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 Information and Communication Technology (ICT) in general have proven to be an inevitable factor of success.

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. However, while e-Marketplaces have been analysed in more detail from an institutional perspective, very limited research has been undertaken to date in exploring the e-Marketplace adoption drivers and performance indicators, particularly from a diffusion-of-innovation (DOI) and innovation-organisation-environment (IOE) viewpoint.

To address these issues, this research establishes a contingency framework and hypotheses are then developed that are subsequently subjected to empirical testing through quantitative methods. Methodological triangulation has been employed to address weaknesses and bias of using a single research method. Thus, extensive qualitative and quantitative data were collected by means of two survey instruments aiming at airlines (response rate 29%) and e-Marketplaces (response rate 65%). In addition, two explorative case studies were developed to qualitatively interlink the survey findings from both an e-Marketplace adopter and a non-adopter perspective.

Results confirm that e-Marketplaces have gained momentum in the airline industry, following the typical S-curve pattern of technology adoption. As expected, e-Marketplaces have secured a relatively high degree of diffusion, with 65% of airlines already having used an e-Marketplace of some sort and 25% being financially involved in terms of ownership.

Factors affecting the adoption of e-Marketplaces were investigated. The airline's strategic classification has an impact on e-Marketplace adoption. 82% of full service

airlines have adopted e-Marketplaces, followed by low-cost airlines with 79%, regional airlines with 50% and finally charter airlines with 27%. There is also a significant divide between large and small airlines, the latter of which often adhere to more traditional forms of purchasing. Other drivers or strategic 'stimuli' for e-Marketplace adoption in the airline industry include the extent of strategic partnerships, the level of overall ICT sophistication and the level of Internet services used.

In contrast to theoretically derived expectations, pressures from the business context, the level of resource/information sharing, the extent of outsourcing and joint procurement integration, and the purchasing organisation centralisation/decentralisation could not be confirmed as adoption drivers.

In terms of performance indicators, this study confirms that e-Marketplace use is positively related to the overall satisfaction with an airline's procurement practices and processes. Results suggest that e-Marketplaces do reduce search cost of airlines, mostly in the area of spares and repairs, tools/GSE and office supplies. Other benefits illustrated by the study typically occur in the facilitation of order processes, a higher transparency of suppliers, reduced inventories, product price reductions and a reduction in purchase order costs.

Savings from e-Marketplace adoption, which occur more in process costs rather than product costs, tend to exceed the investment costs. However, results indicate that e-Marketplace adoption does not have a direct impact on overall airline performance, but on operational effectiveness and efficiency. The results also suggest that while the e-Marketplace diffusion level is relatively high among airlines, many airlines still make only rudimentary use of all offered services. There are still a number of challenges ahead for e-Marketplace implementation, such as further supplier integration, training and education of staff or the development of further e-Marketplace services, as the technology is often not yet ready to support the range of airline requirements.

The primary contribution of the study is to provide an original starting point for a more structured focus to improve understanding of the adoption process and value creation of B2B e-Marketplaces. This foundation will allow for for further investigation.

GLOSSARY

AOG	Aircraft on Ground
ARINC	Aeronautical Radio Inc
ASM	Available Seat-Miles
ASP	Application Service Provider
ATK	Available Tonne-Kilometres
B2B	Business-to-Business
B2C	Business-to-Consumer
BSP	Business Service Provider
CAB	Civil Aeronautics Board
CRS	Computer Reservation System
CSP	Computer Service Provider
DOC	Direct Operating Costs
DOI	Diffusion of Innovation Theory
ECML	Electronic Commerce Modelling Language
EBPP	Electronic Bill Presentment and Payment
EDI	Electronic Data Interchange
FAI	First Article Inspection
FFP	Frequent Flyer Programme
GDS	Global Distribution System
HDML	Handheld Device Markup Language
ICT	Information and Communication Technology
ILS	Inventory Locator Service
IOE	Innovation-Organisational-Environmental Framework
IOS	Inter-Organisational Information System
IOC	Indirect Operating Costs
IOR	Inter-Organisational Relationships
MRO	Maintenance, Repair and Overhaul
PDE	Private Digital Exchange
PFO	Part Fabrication Order
PNR	Passenger-Name-Record
PO	Purchase Order
RFQ	Request for Quotation
RJ	Regional Jet

SSL	Secure Sockets Layer
SET	Secure Electronic Transactions
SITA	Societe Internationale de Telecommunications Aeronautiques
SMEs	Small and Medium Sized Enterprises
TACO	Travel Agent Commission Override Programme
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TCE	Transaction Cost Economics
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
WML	Wireless Markup Language

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I. INTRODUCTION TO THE STUDY

1.1. Introduction and Research Background

"It is not the strongest of the species that survives, not the most intelligent, but the one most responsive to change."

- Charles Darwin -

Many people would agree that this statement made by the evolutionary scientist Charles Darwin can also be well transferred to other sciences that have to cope with ongoing processes of transformation. The airline business is one of the most competitive industries within the economic environment, at least from a regional point of view (Jarach, 2002). Moreover and as a consequence, the airline industry is a particular case in point incorporating as it does distinctive industry features that are linked with continuous change. Evidence of this can be found when considering e.g. liberalisation and deregulation issues, where those airlines that survived were those that were able to adapt the fastest to certain environmental changes in business terms.

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). But does Darwin's statement really apply to any kind of changes that occur within a business environment or is the price to pay for change too high in order to remain on a successful path? There are obviously doubts whether or not ICT or e-Business strategies can add real value to certain kind of business practices. However, both business managers and academic researchers increasingly realise that the power and properties of ICT can be leveraged in several ways across functional domains, and that selling online to customers constitutes only a fraction of the potential possibilities engendered by e-Business (Wu, Mahajan and Balasubramanian, 2001).

Indeed, ICT has become increasingly important in the Business-to-Consumer (B2C) and Business-to-Business (B2B) strategies in recent years in the airline industry, with the latter representing a more recent phenomenon. Distribution and collaboration with partners is perhaps one of the most critical areas of ICT contribution. ICT is equally important in operations management and thus contributes to the optimisation of procedures and processes (Buhalis, 2004). Also many airlines, especially low-cost carriers, rely to a great extent on ICT for displaying their availability and for communicating and transacting with their clientele. As a consequence, the use of the Internet as a sales channel for tickets was promoted as highly promising in the 90s (e.g. Roy and Filiatrault, 1998). It has received significant attention from researchers. However, at that time, limited academic research has been published about the potential of ICT-supported B2B practices. In the late 90s, B2B e-Business became more and more the focus of firms' strategies, while simultaneously a relatively large number of B2B e-Marketplaces emerged. Christiaanse and Markus (2003) argue that B2B e-Marketplaces have the potential to affect company and supply chain performance and thus alter industry structure. This research focuses on the emergence of such e-Marketplaces in the airline industry. The airline industry, with its interesting history of various internal and external changes, is one of the industries where developments in information and communication technology have been an inevitable factor of success.

A B2B 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 (Bakos, 1991; Bakos, 1997; Bakos, 1998; Choudhury et al., 1998; Koch, 2002; Senn, 1996). Laseter et al. (2001) define an e-Marketplace as a *"forum that leverages the Internet to facilitate commerce among businesses including a wide range of entities — from independent or pure-play dot-coms financed by venture capital, to industry consortia backed by pooled funds, to private networks created by individual companies."*

E-Marketplaces are infomediaries, which are defined as web-based market makers that use the Internet to bring together buyers and sellers in special markets, charging commissions for the products they help move (Malik, 1999). Kuglin and Rosenbaum (2001) define these markets as networks for the exchange of goods and services between sellers and buyers. In broad terms, an e-Marketplace is a website at which multiple suppliers and multiple buyers can undertake business transactions via the Internet (Nathan, 2001). The unique feature of a B2B e-Marketplace exchange is that it brings, in a virtual sense, multiple buyers and sellers together in one central marketplace and thus enables them to buy and sell from each other at a fixed or dynamic price which is determined in accordance with the rules of the exchange (Sculley et al., 1999). The term e-Marketplace is used throughout this study as a referral to B2B e-Marketplaces, if not otherwise stated.

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 collaboration network for product design, supply chain planning and optimisation, as well as fulfilment processes;
3. Transparent product information that is amassed into a universal classification and catalogue structure;
4. A setting 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.

According to Gill and Wu (2001), however, after an initial hype, B2B e-Marketplaces have gained little momentum in industry so far and their failure rate has been very high. Applied research, predominantly carried out by consulting organisations at the turn of the millennium regarding the potential of B2B e-Marketplaces demonstrated that in many cases promises made by e-Marketplace operators were overvalued. Due to the lack of revenues they generated many had to cease operations or merge with other industry players. It is predicted that only a few e-Marketplaces will survive in each industry by succeeding to reach a critical mass of participants, and the right variety of products and services to cover the needs of the particular industries (Oesterle and Fleisch, 1999). This process is already underway with a high level of consolidation and specialisation tendencies among aviation B2B e-Marketplace portals, resulting in many airline companies being initially very reluctant to use e-Marketplaces in procurement.

Based on this knowledge, questions emerge such as what have been the major set-backs to e-Marketplace implementation and what is the potential contribution of e-Marketplaces in the aviation industry in view of the main change drivers? So far, very limited academic research has been undertaken in exploring the adoption drivers and the value creation of B2B e-Marketplaces, nor has any academic researcher explored such models in-depth in the aviation industry.

1.2. Rationale of the Study and Research Questions

While anecdotal accounts of e-Business advances are not difficult to find in the popular press, there is a clear need to bring a more structured, theoretical focus to bear towards understanding the adoption process and value creation of B2B e-Marketplaces. Daniel et al. (2004) note that, in contrast to the lack of academic studies, numerous articles have appeared in the business and trade press on e-Marketplaces (e.g. Chan, 2001; Nairn, 2000) and a number of reports have been published on the topic of e-Marketplaces by consultancies and software vendors (see, for example, Bonno, 2001; Laseter et al., 2001).

Some of this pertinent literature has dealt with identifying the impact and benefits associated with e-Marketplaces. With undoubtful contribution to theory (Kioses et al., 2006), much of this work has *"heavily relied on case studies and anecdotes, with few empirical data to measure Internet-based initiatives or gauge the scale of their impact on firm performance, partly because of the difficulty of developing measures and collecting data"* (Zhu et al., 2004).

According to Kendall et al. (2001), there is a paucity of research in identifying issues that may assist managers in the use of the Internet for business purposes in an international context, particularly in the field of B2B e-Marketplaces. Very few academic research efforts exist in this special field (e.g. Wu, Mahajan and Balasubramanian, 2001) and several issues remain unanswered. While more modern *"literature has identified the participation levels, adoption patterns, and benefits of Web-based systems as important research areas"* (Galbreth et al., 2005) and *"explicitly seeks to explain the motivations and behaviour of firms using electronic markets"* (Rask and Kragh, 2004), *"empirical research on the adoption of e-Marketplaces has been limited"* (Joo and Kim, 2004), despite the growing interest and attention from researchers and practitioners (Kioses et al., 2006).

The airline industry is a very competitive environment where procurement plays an important strategic role (Neil and Purchase, 2004). Airlines procure a broad array of goods and services in different areas such as engineering, fuel, in-flight accessories, catering, as well as computer and in-flight entertainment equipment. Furthermore, airlines have been using ICT and EDI standards to support the procurement of goods and services for more than 40 years. For example, a consortium of major airlines, manufacturers, suppliers and repair agencies developed the airline industry's own EDI protocol called SPEC2000, which is used predominantly for procurement and repair transactions for aircraft maintenance. The majority of spare parts orders are placed using SPEC2000 e-Commerce standards, which are widely accepted in the airline industry. Thus, these standards are deeply embedded in most of the industry's e-Procurement systems. In addition to EDI, rudimentary electronic markets have been in existence for many years. For example, Inventory Locator Service (ILS) started in 1979 to provide a portal where sellers could list their parts inventory and repair shops could list their capabilities accordingly. Moreover, the airline industry differs from other industries, as it is a sector that is in many operational aspects still controlled by government regulations. Such regulations, especially in the area of safety and quality, ensure that procurement is a task, which is critical to the success of the organisation and documented to follow government guidelines (Neil and Purchase, 2004).

Research has not been undertaken in the airline industry into how procurement processes are altered in view of the increasing implementation of ICT and e-Marketplace technology. While the general terms B2B e-Commerce, e-Business and e-Marketplaces were discussed at a high managerial level in the airline industry, the subsequent downturn of the ICT economy, competitive pressures, not only caused by September 11, the war in the gulf region and SARS, but also because of inefficiencies and high costs, have forced the industry to focus on costs and cost management much more than they had before. This in turn leads again to the question whether or not it is B2B developments in terms of e-Marketplaces that the aviation industry should concentrate on in order to reduce costs and remain competitive.

Thus, there is a recognised need for more empirically grounded research to increase our understanding of the value creation potential of B2B e-Marketplaces in the procurement supply chain of airlines and to determine whether or not firms have incorporated B2B e-Marketplaces in their daily procurement routine and to what extent. This may help identify the impact of e-Procurement strategies via B2B e-Marketplaces in procurement value chains. The airline industry is experienced in ICT implementation and is also very competitive. Procurement practices are an important aspect of overall business performance (Neil and Purchase, 2004), which makes the airline industry an interesting case on which to conduct the research. Therefore, fundamental research questions have been identified to illustrate the point of departure as follows:

(1) ***How can the value creation potential of e-Marketplace enabled procurement processes be grounded in academic literature?***

(2) ***What is a categorisation of B2B (aviation) e-Marketplaces and how have they evolved?***

(3) ***Which firms (strategic airline groups) have implemented B2B e-Marketplaces with regard to strategy and segmentation and what is their future potential?***

(4) ***What are the major e-Marketplace adoption enablers and drivers?***

(5) ***Can e-Marketplaces enabled procurement processes have a positive effect on competitiveness (of an airline) and what are the implications for the concept of competitive advantage?***

The analysis of the first two research questions sets out from a theoretical perspective and will be addressed in the literature review and by a survey aimed at B2B e-Marketplace portals. The latter three research questions will be investigated empirically on a quantitative basis by developing hypotheses that will be subsequently tested through a survey aimed at airlines. Questions (3) to (5) will be further qualitatively addressed in two case studies assessing adopters and non-adopters of e-Marketplaces. These latter three empirical research questions can be grouped into two main categories for hypothesis testing, which are as follows:

(a) Identification of e-Marketplace adoption enablers and drivers;

(b) Investigation of e-Marketplace procurement value chain performance indicators and their impact on competitiveness.

An in-depth literature review will contribute to the building of theory and relevant hypotheses. The empirical findings will be derived from two case studies and surveys. Within this original research approach, the integration levels of B2B digital e-Marketplaces in procurement processes and operations can be identified and the feasibility of e-Marketplaces analysed. The evaluation of current adoption of B2B e-Marketplace systems in the aviation industry as well as the measurement of comparative capability can make a contribution to identifying new strategic business opportunities made possible by an improved ICT infrastructure. The following paragraph outlines the overall structure of the study.

1.3. Structure of the Study

The overall goal of the research is to determine factors influencing adoption of e-Marketplaces as an example of an innovation adopted within the airline sector. This is based on testing a series of hypotheses derived from a variety of literature streams and theories, such as:

- Theories of Innovation Adoption
- Environmental View
- Resource-Based View
- Transaction Cost and Strategic Network Theory
- Turbulent Markets / Hypercompetition
- E-Marketplace developments and strategic use
- Background to Airline Industry Developments and Classifications

As information and communication technology is an enabler of e-Business and subsequently of e-Marketplaces, an exploration of its potential in creating value, and the value of e-Business itself, is required before turning to consideration of the more specific areas for investigation in this research. The aim is to set a framework of theoretical principles before exploring the potential of e-Marketplaces in general and in the airline industry in particular. This must extend beyond academic literature on B2B e-Marketplaces, which to date is still limited (e.g. Barrat and Rosdahl, 2001; Holzmüller and Schlüchter, 2002; Timmers, 1998; 1999).

A sound theoretical analysis is necessary to explore whether or not e-Marketplaces have the potential to add value to procurement (in the aviation industry). A theoretical discussion of a categorisation and classification of e-Marketplace models seems crucial to assess the question which models are likely to succeed in the aviation procurement supply chain and how airlines can benefit. In order to be able to set a foundation for the overall research hypotheses, one must critically analyse the value creation process of e-Business in general and within the airline industry in particular, and thus the various concepts and models of creating competitive advantage. A strong combination and integration of strategic management theory is required, as no single paradigm can holistically explain the value creation process of e-Business in general (e.g. Amit and Zott, 2001). Therefore, a critical review of the literature on competitive advantage in terms of strategic management and e-Business is vital to elaborate on the feasibility of e-Marketplace research in conjunction with procurement processes within the airline industry. This is presented in the second chapter (see Figure 1).

Chapter 3 is complementing these theories by discussing B2B e-Marketplace concepts in more depth. It includes a discussion on e-Marketplace classifications, value creation, early developments and evolution, as well as adoption challenges. Consideration of the above mentioned theories within the wider transport literature is further required as strategic decisions are made in the context of environmental issues of an industry. This contextual link will be presented in the fourth chapter.

This multi-perspective literature framework is needed to develop appropriate hypotheses within the specific research enquiry of the study. A strong contextual link between strategic management, ICT and the aviation industry is therefore required.

Hypotheses developed from the literature review and the methodology are presented in the fifth chapter. The sixth and seventh chapters cover the empirical results of two surveys among international airlines and e-Marketplaces, while the eighth chapter presents original findings by two explorative case studies from an adopter and non-adopter perspective. A discussion of the results is presented in the ninth chapter, which also covers the linkages between case study and survey results. This chapter also includes contributions from the study, its limitations and the recommendations for further research. Finally, some conclusions are drawn in the tenth chapter.

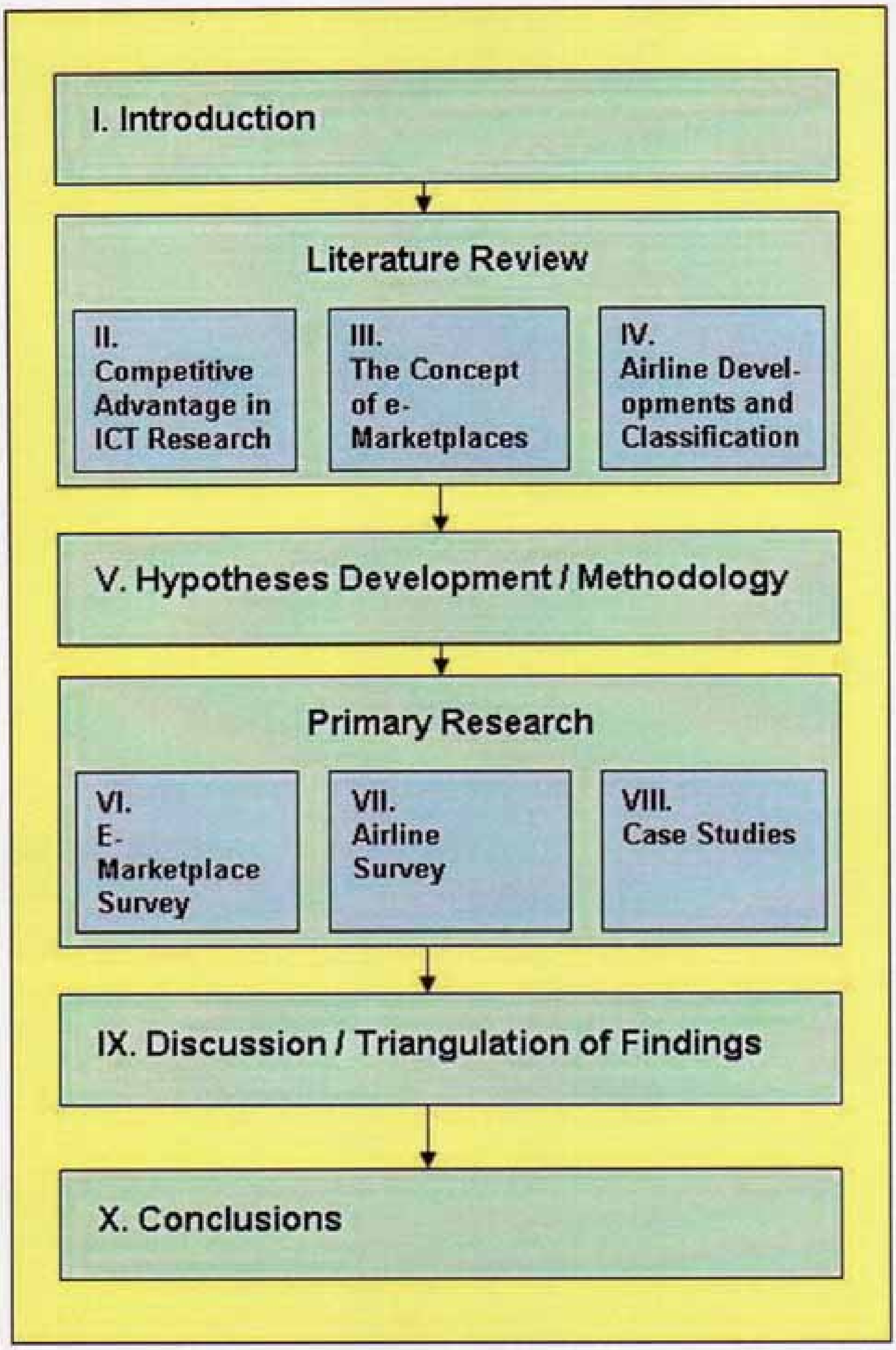

Figure 1: Structure of the Study

II. THEORETICAL PERSPECTIVES OF COMPETITIVE ADVANTAGE IN ICT RESEARCH

2.1. Introduction to Competitive Advantage

One of the fundamental objectives in strategic management research is the investigation of performance levels among companies. Thus, the indicator for differences in a company's performance is based on the concept of competitive advantage, which is one of the most enduring themes in the strategic management literature (Fahy and Hooley, 2002). Ansoff (1965) and Porter (1980) have pioneered this concept.

The literature background suggests that investigation of more than one theoretical stream is required to explain the value creation potential for procurement by means of ICT, and in particular by B2B e-Marketplaces. No theory emerged as a potential candidate for the role of unified ICT research (Barkhi and Sheets, 2001). As such, research into e-Marketplaces requires to draw from several theoretical approaches in order to holistically describe the potential of value creation and subsequently the achievement of (sustained) competitive advantage.

As an e-Marketplace is an innovation that can have a positive impact on competive advantage, when adopted by a firm, more knowledge is clearly needed. Innovation, technology advances, and competitive advantage are connected by complex and multidimensional relationships (Lengnick-Hall, 1992). Lengnick-Hall (1992) further notes that demands for organisational innovation and technological advantage have become central components of competitive strategy for many companies (Buffa, 1984; Butler, 1988; Miller 1989) as they are facing more and more serious competitive challenges due to the rapid pace and unpredictability of technology change (Ansoff, 1988). According to Lengnick-Hall (1992) the link between innovation and competitive advantage rests on the following factors:

- Innovations that are hard to imitate are more likely to lead to sustainable competitive advantage (e.g., Clark 1987; Porter, 1985).
- Innovations that accurately reflect market realities are more likely to lead to sustainable competitive advantage (e.g., Deming, 1983; Porter, 1985).

- Innovations that enable a firm to exploit the timing characteristics of the relevant industry are more likely to lead to sustainable competitive advantage (e.g., Betz, 1987; Kanter, 1983).
- Innovations that rely on capabilities and technologies that are readily accessible to the firm are more likely to lead to sustainable competitive advantage (e.g., Ansoff, 1988; Miller, 1990).

Competitive strategies often determine a firm's need for successful innovation (Lengnick-Hall, 1992). Performance maximising strategies emphasise technology and product advances as a key to competitive advantage. Similarly, cost minimising strategies emphasise process technology innovation to decrease the total costs of production (Utterback and Abernathy, 1975).

Schumpeter (1934) first introduced the concept of innovation as in new products, new methods of production and new markets and sources of supply. In terms of ICT and competitiveness, several authors have expanded the examination of the value of IT in reducing a company's cost base and/or increasing its revenues to how IT can become a source of sustained competitive advantage (Mata, Fuerst and Barney, 1995). One of these theories is known as the create-capture-keep-paradigm, which mainly focuses on the role of IT-based customer switching costs as sources of sustained competitive advantage (e.g. Clemons, 1986; Clemons and Kimbrough, 1986; Feeny and Ives, 1990). The early mover paradigm (e.g. Dos Santos and Peffers, 1995; Harrison and Waite, 2005; Lambkin, 1988, etc.) further supports this reasoning by highlighting sustained technical leadership, pre-emption of market positions, access to resources and cost and/or differentiation advantages. The adoption of an innovation can therefore be of significant importance to achieve competitive advantage.

Gengatharan and Standing (2004) argue that research on ICT adoption and diffusion use theories and models such as the diffusion of innovation theory (Rogers, 1995), the technology acceptance model (e.g. Davis, 1989), the theory of planned behaviour (e.g. Ajzen, 1985), the structuration theory (e.g. Giddens, 1994), and/or the institutional theory (e.g. Grewal et al., 2001). However, these models neglect the wider aspects of value creation by the adoption of ICT strategies.

In order to understand the factors behind value-creation in e-Business, Amit and Zott (2001) concluded that a range of different theories have to be used and integrated. However, strategic management literature is very fragmented and large. To be able to capture the factors of e-Business value creation, Amit and Zott (2001) propose five dominant overarching perspectives: the environmental view and value chain analysis (e.g. Porter, 1985) (see section 2.3.), the resource-based view (e.g. Barney, 1991) (see section 2.4.), the strategic networks theory (e.g. Dyer and Singh, 1998) (see section 2.5.), transaction cost economics (e.g. Williamson, 1975) (see section 2.5.) and Schumpeterian innovation, which already forms part of section 2.2. (e.g. Schumpeter, 1934). As such, a relatively broad-based assessment of strategic management theories can reveal in more detail how value is specifically created as part of the process of improving competitive advantage. Therefore, an outline of each of the specific theories is presented in the following sections. A more recent important strategy theory addresses hypercompetition (e.g. D'Aveni, 1994) and competitive advantage in turbulent markets (see section 2.6.), which is further included in the following review.

This review process is important in identifying the theory applicability to B2B e-Marketplace research, e.g. the strategic use of ICT, e-Marketplace evolution, classifications, adoption / diffusion models of e-Marketplaces, and aviation specific e-Marketplace developments.

2.2. Innovation Theory and Impact on Competitive Advantage

2.2.1. The "Create-Capture-Keep" Paradigm

In the early 20th century, Schmpeter already stressed out the role of the entrepreneur as the driver for innovation, as well as, at a later stage, the role of large companies as further main drivers of innovation. Hypercompetition, which will be elaborated in more detail in section 2.6., can be traced back to Schumpeter's (1934) thoughts on 'creative destruction'.[1] Central for this Austrian school is that it emphasises destructive creativity for finding and levering from temporary market unbalance that creates strategic windows where excess rents can be made. This perspective characteristically emphasises the importance of exploitation of temporary arbitrage opportunities in technology markets and entrepreneurial discovery. According to Dos Santos and Peffers

[1] http://www.minotstateu.edu/econ/drhuenneke/schumbiz.html

(1995), it is well accepted that a firm can earn higher return by seizing new lucrative opportunities early (Schumpeter, 1976).

Innovation has been defined as the *"(...) adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organisation"* (Damanpour, 1991). According to Rogers, *"an innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption."* The most viable strategy for both generating and sustaining a competitive advantage has become one of both continuous innovation and corporate renewal (Merrifield, 2000). Porter and Stern (2001) argue that, in the past, firms focused on reducing costs and improving quality to gain a competitive advantage. Today, however, companies must be able to innovate at the global frontier and create and commercialise a stream of new products and processes that shift the technology frontier, progressing as fast as their rivals catch up.

Innovation is therefore generally considered to be one of the key drivers of corporate success (e.g. Cardozo et al., 1993) and there is a well-established stream of literature that examines the advantages accruing to pioneering firms (see, for example, Robinson and Fornell, 1985; Lieberman and Montgomery, 1988; Kerin et al., 1992)

According to Patterson et al. (2003), one area of innovation is ICT adoption, as it has the capacity to impact organisational structure, firm strategy, communication exchange, operational procedures, buyer-supplier relationships, and bargaining power (e.g. Bowersox and Daugherty, 1995; Lewis and Talalayevsky, 1997). ICT adoption may also increase organisational productivity, flexibility, and competitiveness (e.g. Cash and Konsynski, 1985) and stimulate the development of interorganisational networks (e.g. Daugherty et al., 1995).

Technological leaders in ICT may reap first mover benefits, such as reputations for technical leadership, preemption of market positions, favourable access to scarce resource, and cost or differentiation learning curve advantages, which may result in competitive advantages for the firm. Therefore, investments in ICT innovations should be expected to provide firms with higher returns (Dos Santos and Peffers, 1995).

According to Harrison and Waite (2005), early adopters of ICT can gain an advantage through early adoption, in the same sense that early entrants into a market can gain advantage (Lambkin, 1988). Early adopters are companies that have gained advantages by action. They are likely to be forward thinking, and are less likely to be inhibited by the ICT demands placed on companies by moving to the web (O'Keefe et al., 1998). Indeed, the goals and motivations for being an innovator or first adopter can have a significant impact on the decision of whether to adopt and when. Such goals might be to achieve competitive advantage or protect strategic position (Bass, 1980; Johannessen et al., 1999) often promoted by the desire for the organisation to become superior to competitors and to serve customers better or meet the demands of customers better (John and Davies, 2000).

Clemons (1986) focused on ICT-based customer switching costs as a potential source of sustained competitive advantage, also better known as "create-capture-keep" paradigm (see also Clemons and Row, 1987; Feeny and Ives, 1990). Lieberman and Montgomery (1988) argue as well that early movers may be able to pre-empt resources of certain kinds providing barriers to the duplication of accruing advantages.

Arni (2003) notes that sustaining a competitive advantage through ICT typically requires leveraging on unique resources, such as industry expertise or local market know-how in order to lock-in the installed base by building significant switching costs (Clemons and Row, 1987). The study of the strategic implications of switching costs has emerged as an active field in economics with the work of e.g. Farrell and Shapiro (1987), Klemperer (1986) and von Weizsaker (1984).

Switching costs are created when customers make investments that are specific to a very particular ICT supplier, when the switching to another supplier requires new specific investments and when the redeployment of a specific investment has the effect of destroying much of the value created by that investment. With the creation of such switching costs, ICT suppliers can easily increase the price, reduce the level of service or extract other additional value out of their customers (Barney et al., 1995).

According to Bakos (1991), firms connected to a specific ICT system (such as an e-Marketplace) may face substantial technological and organisational costs if they decide to switch to an alternative system. ICT may create substantial switching costs because of sunk investments in hardware, software, user training, and organisational changes, as well as non-technology barriers such as trust in organisational partners or long-term contracts (e.g., Bakos and Treacy, 1986; McFarlan, 1984). A good example of a firm that has attempted to use ICT switching costs in such a manner was American Airlines with its computer reservation system (CRS) Sabre (Borenstein, 1989; Copeland and McKenny, 1988).

Analytic models of switching costs therefore usually predict aggressive behaviour of early movers, who try to build a locked-in customer base that can be subsequently exploited. The larger the switching costs, the fiercer the competition to recruit uncommitted users and the larger the proportion of system benefits. Bakos (1991) also argues that, on the other hand, the ability of switching costs to create early mover advantage is mitigated by technological progress when technology facilitating access to competitive systems becomes available or when the changeover to a new generation of the technology offers an opportunity to switch to a new intermediary.

According to Bakos (1991), large investments in sunk and fixed costs are required to develop ICT systems (such as e-Marketplaces). These costs can raise barriers to entry (Spence, 1979) and can offer advantage to early movers (Fundeberg and Tirole, 1985). Incumbent firms may overinvest in the beginning and keep investing sufficiently to discourage new entrants (Bernheim, 1984). Traditionally, the final outcome in such competition based on strategic investment is determined by the underlying economies of scale, which typically favour established entrants (Coursey, et al., 1984), and by the uncertainty about technological and demand characteristics (Arvan, 1986). Bakos (1991) further notes that the dominance of American's Sabre and United's Apollo in the market for airline reservation systems illustrates the significance of strategic investment (see also section 3.2.1). These systems are profitable, yet their underlying technology could certainly be duplicated by a sophisticated intermediary. The saturation of the existing market, the relatively low marginal costs enjoyed by the existing players, and the possibility of a retaliatory response create enough uncertainty about the benefits of entry to deter new systems and limit the aspirations of marginal players (Bakos, 1991).

While getting some support in literature, the early mover and the "create-capture-keep" paradigm, has also been the object of criticism (Barney et al., 1995; Malone et al., 1989). The first criticism covers the argument that customers are usually able to anticipate the risk of being captured by a supplier of ICT. As an example, many travel agencies have found that using a particular airline's "back-end" ICT applications, such as accounting services or travel reporting, can create significant switching costs and tie them to the reservation system of that airline. Sabre and Apollo previously required travel agencies to use a system with fixed functionalities for connection. As a consequence, many travel agencies developed their own back-end ICT applications, thereby enhancing its ability to interact with several different reservation systems (Barney et al., 1995; Clemons, 1986; Feeney and Ives, 1990; McFarlan, 1984). The use of such advanced so called workstations makes it easier for travel agencies to convert data from one airline system to another, thus facilitating the ability of agencies to change systems they use at will.

Secondly, ICT suppliers that do exploit their customers gain a reputation of being untrustworthy which can be devastating for any following businesses. Thirdly, the number of options to obtain ICT has increased over time. Barney et al. (1995) argue that the only way for customer switching costs being a source of competitive advantage is if the ICT is absolutely unique, if it is absolutely essential to customers' business operations, if there are currently no other suppliers of the ICT, and if it is very unlikely that there will be any additional suppliers on the ICT in the near future.

Harrison and Waite (2005) therefore argue that the extent to which adoption of an innovation can yield a competitive advantage is relatively short-lived. As the innovation becomes more widespread, competitive advantage diminishes and innovation becomes a necessary competitive requirement. According to Dos Santos and Peffers (1995), in a competitive market, even if an innovative ICT application enables a firm to reduce costs or increase product value, it may not provide a long-term compettive advantage if competing firms can introduce similar, or highly substitutable applications.

The need for innovation leads to imitation (Bradley and Stewart, 2003). Hence, the organisational goals or motivations for adopting an innovation and the subsequent use or implementation of the innovation may change over time according to adopter categories and a diffusion process.

2.2.2. Adoption and Diffusion of ICT Innovations

Drawing on earlier work on the adoption of hybrid seeds and agricultural technology by US farmers in the 1940s, Rogers (1983) highlighted the role of social networks as crucial determinants of innovation adoption. He identified how the pressures of uncertainty over the outcome, unknown risks and lack of information raised the importance of social and occupational networks as sources of information. As more network peers adopt a given innovation, communication concerning the risks and outcomes increases within the networks until a critical mass of network members is reached when the dissemination and demonstration effects gather their own momentum and the adoption of the innovation is a success (Gray, 2003).

Even prior to that, a threshold is reached when a sufficient number of network peers have adopted the innovation to convince a larger number of other members to adopt. The stronger the ties between network members, the faster and more trusted the communications between them so the diffusion effects are likely to be much faster (Granovetter, 1978). This describes the adoption patterns of an extremely wide ranges of different products and services, including seeds, medicines and consumer goods as well as ICT innovations such as e-Marketplaces (Gray, 2003).

In this context, Rogers (1995) defines adoption as *"(...) the decision to make full use of an innovation as the best course of action available"*, while diffusion refers to the spread over time of an innovation within the unit or to other units. Diffusion is a dynamic process that features pioneer users, followers, and also a number of non-adopters. Various theories have been suggested to explain technology adoption and diffusion in general. For example, Gengatharen and Standing (2004) note that research on adoption of ICT and e-Commerce use the popular theories and models such as the diffusion-of-innovation theory (Rogers, 1995), the technology acceptance model (e.g. Davis, 1989), the theory of planned behaviour (e.g. Ajzen, 1985), the structuration theory (e.g. Giddens, 1994) or the institutional theory (e.g. Grewal et al., 2001). Various models were developed due to the complexity of IOS adoption. *"Diffusion among organisations presents special challenges because, unlike individuals, they are complex human aggregates with various decision centres and are endowed with traditions, values, and procedures that impede or enhance the decision adoption process."* (Pennings, 1987)

The following table summarises these most influential research theories in terms of their key constructs and identifies IOS studies, which use them (modified from Gengatharen and Standing, 2004). These theories and how they relate to this research will be taken up again in the sections 3.4. and 5.2.

Theory	Core Constructs	Sources (Examples)
Diffusion of Innovation Theory (DOI). DOI throughout organisation & adoption by single users. Innovation-Organisational-Environmental (IOE) Framework.	5 broad factors affect adoption: Innovation factors (i.e. relative advantage, compatibility, complexity or ease of use, trialability, observability & communicability). Individual , Task, Environmental and Organisational factors.	Rogers (1995), Tornatzky and Fleischer (1990), Iacovou, Benbasat and Dexter (1995), Cragg and King (1993), Thong and Yap (1995), Bouchard (2003), Cavaye and Cragg (1995), Chwelos et al. (2001), Crook and Kumar (1998), Grover (1993), Hart and Saunders (1997), Hope et al. (2001), Ranganathan et al. (2001), Williams (1994), Teo et al. (1995), Koch (2003).
Theory of Planned Behaviour (TPB). Intention/behavioural model-general theory of behavioural decision making.	An "active deliberate decision process within constraints of social expectations and limited resources" (Harrison et al., 1997). Perceived behavioural intention is a function of attitude, subjective norm and perception that one has the ability and resources to perform the behaviour.	Ajzen (1985), Harrison, Mykytyn and Riemenschnieder (1997), Taylor and Todd (1995).
Technology Acceptance Model (TAM).	The intention to use new ICT is determined by two beliefs, perceived usefulness of ICT and perceived ease of use. Includes social norms, which are likely to have a greater effect on perception & behaviour when a user does not have first hand experience of ICT.	Dasgupta et al. (2002), Davis, Bargozzi and Warshaw (1989), Lederer et al. (2000), Venkatesh and Davis (2000), Igabria, Zinatelli, Cragg and Cavaye (1997).
Unified Theory of Acceptance and Use of Technology (UTAUT)	4 core determinants of intention & usage: a) Performance expectancy, b) Effort expectancy, c) Social influence, d) Facilitating conditions. 4 moderators: Gender (moderator to a, b & c), Age (moderator to all 4 determinants), Experience (moderator to b, c & d), Voluntariness of use (moderator to social influence).	Venkatesh, Morris, Davis and Davis (2003). In many cases, the decision to adopt ICT / e-Commerce is dependent on an individual's (CEO, owner) attitude and experience.
Structuration Theory	Distinction between the individualist, structuralist and interactive process as the main drivers for the diffusion process. Action and structure operate as a duality, simultaneously affecting each other.	Giddens (1984), Slappendel (1996).
Institutional Theory	Firms face coercive, normative	Grewal et al. (2001), Teo, Wei and

Inter-Organisational Relationships (IOR)	and mimetic pressure to adopt ICT. Set of six determinants of the formation of IORs: Necessity, asymmetry, reciprocity, efficiency, stability and legitimacy	Benbasat (2003), DiMaggio and Powell (1983), Meyer and Rowan (1977), Oliver (1990).

Table 1: Theoretical Frameworks Used to Examine ICT / E-Commerce Adoption

Source: Modified from Gengatharen and Standing, 2004, Regional E-Marketplaces: Towards a Unified Theoretical Framework for Assessing Facilitators and Inhibitors of Success, at: http://is.lse.ac.uk/asp/aspecis/20040051.pdf.

In Roger's seminal research the process is detailed through which innovations move from one population to another and the role of key factors in the individual decision to adopt is discussed. He emphasises that these factors are only relevant after informative contact with the innovation (see Henriksen, 2003). Rogers recognises that the innovation decision process plays a vital role in the process leading to acceptance or rejection of an innovation. The explicit motivators for the organisational adoption are described by a set of variables, which can be related to most technological innovations. ICT studies on adoption and diffusion of innovations in organisations often refer to Roger's innovation theory.

According to Rogers (1995), five innovation attributes are typically identified as being important for rapid innovation diffusion:

- *Relative advantage – the extent to which the innovation is perceived to have significant advantages over current alternatives.*
- *Compatibility – the degree to which the innovation is seen as being consistent with past practices, current values and existing needs.*
- *Complexity – the extent to which the innovation can readily be understood and easily implemented.*
- *Trialability – new ideas that can be tried out at low costs before wholesale adoption are more likely to be taken up.*
- *Observability – the degree to which the use and benefits of the innovation are visible to others, and therefore act as a further stimulus to uptake by others.*

Clarke (1999) notes that the ***diffusion-of-innovation theory*** is concerned with the manner in which a new technological idea, artefact or technique, or a new use of an old one, migrates from creation to use. Fichmann (1992) notes that the more well-established adoption and diffusion generalisations are:

- *Some potential adopters are more innovative than others, and can be identified as such by their personal characteristics (cosmopolitanism, level of education, etc.);*
- *The adoption decision unfolds as a series of stages (flowing from knowledge of the innovation through persuasion, decision, implementation and confirmation) and adopters are predisposed towards different kinds of influence (e.g., mass market communication versus word-of-mouth) at different stages;*
- *The actions of certain kinds of individuals (opinion leaders and change agents) can accelerate adoption, especially when potential adopters view such individuals as being similar to themselves; and*
- *The diffusion process usually starts out slowly among pioneering adopters, reaches "take-off" as a growing community of adopters is established and the effects of peer influence kick-in, and levels-off as the population of potential adopters becomes exhausted, thus leading to an "S-shaped" cumulative adoption curve. Diffusion illustrated as an exponential curve is related to interactive communications media, such as e-Marketplaces, where adoption becomes more and more attractive when more adopt it. The gravity model predicts diffusion based on a function of the population size of an area and the distances of that area from other centres of populations (Attewell, 1992).*

In general, diffusion-of-innovation theory posits a user's technology adoption decision is a rational choice based on technology characteristics. However, a criticism of this model is that it is an overly simplified representation of a complex reality. Lieven and Gino (2004) for example note that most ICT innovations experience a fast, but short peak of initial market enthusiasm, but few of them can recover from a backsliding following that initial peak. Thus, if interpreting this recovery as a second peak in the adoption curve, the traditional perception of the adoption curve needs to be revised to a double peaked curve instead of the traditional bell-shaped curve.

Tornatzky and Fleischer (1990) extend the diffusion-of-innovation theory and suggest that the diffusion process is a more multifaceted process, which has to be viewed from different angles such as the environmental context, the organisational context, and the innovation context. A firm's particular industry and organisational factors may impact a technology's benefits, which, in turn, affect the firm's adoption decision (Julien and Raymond, 1994; Premkumar and Ramamurthy, 1995). The technological context describes both the existing technologies in use and new technologies relevant to the firm, while the organisational context refers to descriptive measures about the organisation such as scope, size, and managerial structure. The environmental context is the arena in which a firm conducts its business, i.e. its industry, competitors, and dealings with government (Tornatzky and Fleischer, 1990).

In their ***innovation-organisational-environmental (IOE) framework***, Tornatzky and Fleischer (1990) use the factor approach, which examines a cross-section of firms in an attempt to isolate significant characteristics governing adoption (Henriksen, 2003). This is opposed to the longitudinal approach, which is the process approach. The process approach is of help in understanding the dynamics of complex phenomena. It focuses on activities related to social change rather than technical activities (Kwon and Zmud, 1987) and provides explanations in terms of the sequence of events leading to an outcome (Langley, 1999). While most diffusion studies employ either a process or a factor approach events leading to an adoption-decision within a firm, the decision to apply the factor approach will however not necessarily completely exclude the process-oriented approach. In fact, according to Kurnia and Johnston (2000), factor and process based approaches complement one another.

The ***Technology Acceptance Model (TAM)*** is an example of a theory working with the process approach (Davis et al., 1989; Davis, 1989). TAM aims at explaining the determinants of ICT acceptance across a broad range of end-user technologies and user populations. It is hence an explanatory theory of individual behaviour and draws upon the Theory of Reasoned Action (TRA) which was proposed by Ajzen in 1988. Ajzen had taken the relationships between personality traits, behaviour and attitude into consideration while he was developing the theory and proposed that personality traits must have some indirect influence on a person's behaviour (Ajzen, 1988).

TAM is a behavioural and psychological approach to examine how individuals use ICT once it has been adopted by an organisation. Acceptance moves from a positive attitude towards using, via the intention to use, towards actual systems usage. The term 'socio-technical system' has become widely applied to a mix of theoretical positions in ICT adoption and diffusion, including TAM (Dillon and Morris, 2000). This term describes the complex nature of large human-machine organisational systems and the integration of human and organisational factors with the work of technology development and implementation (Emery and Trist, 1960).

TAM predicts that perceived 'usefulness' and perceived 'ease of use' are the two determinants for an individual to accept a new technology (Fielt et al., 2005). The idea is that factors that influence behaviour, such as user characteristics and system design, do so indirectly through attitudes and subjective norms. TAM is primarily a predictive tool, which proves restrictive when seeking motives for specific observed behaviours (Green, 2005). The underlying assumption of TAM is that beliefs concerning '*ease of use*' and '*usefulness*' are always the principal determinants of any use decision (Mathieson, 1991). This arises problems in situations where other variables besides '*ease of use*' and '*usefulness*' predict intention. Another major factor affecting the validity of TAM relates to the cultural background of users. Culture affects people's behaviour in a variety of ways that can have an influence on the implementation of technology. Green (2005) cites Straub et al. (1997) that conducted an investigation into the adoption of email at three different airlines in the United States, Switzerland and Japan. The results obtained from the US and Switzerland were fairly consistent. However, the Japanese study did not validate TAM. According to Green (2005) this may have been because cultural tendencies in Japan may limit e-mail use due to greater uncertainty avoidance and power distances between organisational hierarchical levels. Straub et al. (1995) further notes that much TAM-related research has so far relied heavily on subjective usage measures, thereby creating a falsified impression of the relationships between TAM constructs. Furthermore, research subjects may adopt different behaviours depending on their perception of their role in the study as well as that of the researcher (Ngwenyama, 1991).

With regard to the above criticism, more flexible models such as the ***Theory of Planned Behaviour (TPB)*** do exist, but that flexibility comes at the expense of being far more complicated to apply to real-life situations (Green, 2005). The Theory of Planned Behaviour also draws upon Aizen's Theory of Reasoned Action. TPB posits that individual behaviour is driven by behavioural intentions where behavioural intentions are a function of an individual's attitude toward the behaviour, the subjective norms surrounding the performance of the behaviour, and the individual's perception of the ease with which the behaviour can be performed (behavioural control) (Taylor and Todd, 1995).

Although Ajzen has suggested that the link between behaviour and behavioural control should be between behaviour and actual behavioural control rather than perceived behavioural control, the difficulty of assessing actual control has led to the use of perceived control as a proxy (Eagly and Chaiken, 1993). Literature surveys further indicate that in the efforts of understanding the drivers of acceptance, researchers sometimes needed to choose a favoured model from many competing models as well as appropriate variables across models (Venkatesh, Morris, Davis and Davis, 2003). Venkatesh et al. (2003) therefore proposed the ***Unified Theory of Acceptance and Use of Technology (UTAUT)*** that include TAM, TPB and other models in order to get an integrated view of user acceptance.

UTAUT aims to explain user intentions to use ICT and subsequent usage behaviour. The theory holds that four key constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are direct determinants of usage intention and behaviour (Venkatesh et. al., 2003). Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behaviour (Venkatesh et. al., 2003). Green (2005), however, argues that due to the development of UTAUT being fairly recent, it has yet to be adopted and validated by a significant number of studies at this stage. Furthermore, UTAUT, like TAM, is a predictive model of human behaviour, and, as such, is likely to share some of the same limitations of TAM outlined above.

Other researchers have viewed the diffusion process from a ***structuration*** point of view (Giddens, 1984) and thus distinguished between the individualist, structuralist and interactive process as the main drivers for the diffusion process (Slappendel, 1996). Giddens (1984) defines structure as *"rules and resources recursively implicated in social reproduction; institutionalised features of social systems have structural properties in the sense that relationships are stabilized across time and space"*. Structure *"exists only as memory traces, the organic basis of human knowledge ability, and is instantiated in action"*.

Giddens (1984) argues that action and structure operate as a duality, simultaneously affecting each other. Thus social structure is viewed as being created by human agents through their actions, while the actions of humans in social contexts serve to produce, and reproduce, the social structure. Johnston and Gregor (2000) operationalised this theory in the IOS context, arguing that the activities of a firm can be both constrained and enabled by industry structure. The structure of an industry can be understood by mapping the relationships between firms. Joseph (2006) notes that structuration theory has been applied to several areas, such as technology and information systems (e.g.

Orlikowski, 1992; DeSanctis and Poole, 1994; Dillard and Yuthas, 1997; Walsham and Han, 1991), strategic management (Whittington, 1992) and accounting (Macintosh and Scapens, 1990, 1991). In IS literature, the theory is mainly used for understanding the adoption of IOS and ICT. According to Joseph (2006) Orlikowski and Robey (1991) developed a 'structuration theory of technology' model based on four influences that work simultaneously in the interaction between technology and organisations: (a) information technology is the outcome of human actions, being developed and maintained by humans, and required to be used by humans to be effective; (b) information technology mediates human action and in the process facilitates and constrains actions (dual influence); (c) as information technology is built and used in a particular social/institutional context, agents are influenced by the institutional properties of their situation; (d) technology can influence institutional structures by either reinforcing them or transforming them. Thus, this theory is rather applicable to technology cultures. The focus of this framework is on information technology, and how information technology is created, used, and becomes institutionalised within organisations, and how it is shaped by the everyday actions of the users and social settings. Criticism for this theory comes from the IS discipline as it neglects the question why things are 'so and not otherwise' (Archer, 1996). Furthermore, Gidden's theory does not directly address technology. Rose (1998) notes that the 'lack of specificity' about the technical details of information systems (Monteiro and Hanseth, 1996) means that the researcher may investigate the social actions around the technology, offer broad theorising, or start borrowing or inventing theoretical concepts in order to fill the gaps.

Institutional theory attends to the deeper and more resilient aspects of social structure. It considers the processes by which structures, including schemas, rules, norms, and routines, become established as authoritative guidelines for social behaviour. It inquires into how these elements are created, diffused, adopted, and adapted over space and time; and how they fall into decline and disuse (Scott, 2004). Under the 'institutional economics' category, transaction cost analysis is also applied. TCE takes transaction rather than commodity as the unit of analysis for assessing governance structures (of which markets and hierarchies are the leading alternatives). In conducting a transaction, a firm searches the market to the extent that the cost of additional searching is less than the expected benefit from the search. A firm should decide whether to buy or produce by comparing the co-ordination costs to the production costs. The adoption of e-Marketplaces is expected to increase transaction efficiency by reducing co-ordination costs and increasing monitoring capabilities.

Institutional and economic models of technology adoption and diffusion also relate to epidemic effects (Koellinger and Schade, 2003). Epidemic effects relate to endogenous learning as a process of self propagation of information about a new technology that grows with the spread of that technology. Epidemic models in general assume that the diffusion of new technology is like that of an infectious disease. Non-adopters adopt a new technology when they come into contact with adopters and learn about the new technology. Over time, the number of users increases, leading to an increased probability of any given non-adopter learning about the technology. This increases the rate of diffusion. As more people adopt, the number of non-adopters declines, which decreases the rate of diffusion. This pattern of diffusion leads to the common S-shaped curve on the rate of technology diffusion with respect to time.

While the adoption of an innovation can have a positive impact on competitive advantage (as discussed in later sections), it is also the environmental view that needs a discussion in this context.

2.3. Environmental View in the Context of Competitive Advantage and ICT

Very early studies of competitive advantage were rooted firmly in historical analyses and careful qualitative research. This work could be interpreted as suggesting that competitive advantage was a complex phenomenon that depended crucially on the active presence of superior leadership (Andrews, 1971; Selznick, 1957; Chandler, 1962). The study of strategy was thus the study of what general managers or leaders should do and it was generally assumed that doing these things would make a difference: firms with better leaders would make better choices and ultimately do better than their competitors. Porter turned this paradigm on its head (Porter, 1980).

In transforming the study of imperfect competition into the analysis of competitive advantage, Porter (1980) shifted the focus of strategy research outward, towards the analysis of the firm's microeconomic environment. The value chain, as will be outlined in more detail in the airline literature chapter 4., was first introduced by Porter (1985)[2]. In this model, ICT is not a primary activity, but it is a part of supporting activities. Bliemel, Fassot and Theobald (1999) call the transformation of the physical value chain a 'virtual value chain'.

The virtual value chain developed with a more complex environment of many enterprises. Especially, the increasingly fast development of technology with its impacts on virtually all industry sectors contributes considerably to increase environmental unpredictability. The business environments of many organisations have by and large encountered a steady intensification of their variability. This in particular causes the analysis of the environment to be more difficult and further adds to the uncertainty that an organisation faces as the future becomes gradually more unpredictable (Camponovo and Pigneur, 2004). For example, the rapid development of the Internet may have increased the dependency of firms on ICT. Simultaneously, the benefits of ICT to corporations are expanding from those concerned with low-level operations to strategic decision making.

Porter's environmental approach yielded tools for understanding why some firms (and industries) were likely to be more profitable than others. His five forces analysis is essentially a structural map of the underlying economics of an industry which advocates that the essence of strategy formulation is relating a company to its environment structure of the industry in which it competes: a map of the degree to which competitors, entrants, substitutes and vertical bargaining power exert pressure on the margins of a firm in a particular industry. The aim of a company's strategy should then be to find an advantageous position in its sector where it can best protect itself from these competitive forces or can manipulate them in its favour (Camponovo and Pigneur, 2004).

Porter (2001) argues that there are several ways for companies to achieve competitive advantages through the use of ICT technologies. According to him, many of the companies that succeed will be the ones that use the Internet as a complement to

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[2] There are several definitions of the term 'value chain' besides Porter's (1985) value chain framework approach (see Ansari and Bell, 1997; Cokins, 1996; Cox, 1996, Cristopher, 1998; Cronin, 1995; Day, 2000; Hines, 1994; Rayport and Sviokla, 1995).

traditional ways of competing. Those that understand the trade-offs between the Internet and traditional approaches can so create truly distinctive strategies (Porter, 2001).

In order to determine how ICT enabled strategies create value, several fundamental factors that determine profitability need to be looked at (Porter, 2001): industry structure, which determines the profitability of the average competitor and sustainable competitive advantage, which allows a company to outperform the average competitor. The concept of sustained competitive advantage is the idea that some forms of competitive advantage are very difficult to imitate and can therefore lead to persistent superior economic performance (e.g. Amit and Schoemaker, 1993; Barney, 1991; Porter, 1985; Wiggins and Ruefli, 2002).

A firm operating in an industry in which there are substantial returns to scale coupled with opportunities to differentiate, that buys from and sells to perfectly competitive markets and that produces a product for which substitutes are very unsatisfactory, is likely to be much more profitable than one operating in an industry with few barriers to entry, and a large number of similarly sized firms who are reliant on a few large suppliers and who are selling commodity products to a few large buyers (Cockburn, Henderson and Stern, 2000).

A large number of authors have acknowledged the importance to get a detailed and methodical perception of an organisation's environment and have further documented that the co-alignment between an organisation's strategy with its external environment plays a crucial part in its continued existence and success (Camponovo and Pigneur, 2004). Systems theory explains organisations as complex open systems which are simultaneously part of and interdependent with a much larger system which is overall referred to as its environment (Boulding, 1956). Thus, an organisation relies on its environment in order to acquire the input resources and capabilities that are necessary and required by the organisation's processes. It also depends on its environment when trying to place the resulting products and services and at the same time making a profit from the transformed value-added. This interdependence causes the necessity of each organisation to adapt itself to the current environmental conditions and go along with its evolution if it wants to survive and evolve.

At the same time, an organisation has without doubt a certain effect on its environment by means of its actions and can undertake certain measures to shape the conditions to its advantage (Camponovo and Pigneur, 2004). In strategic management theory the co-alignment between the organisation's strategy and the environment is similarly a concern, where environmental analysis is perceived as a preliminary activity of the strategy formulation process of a company, aiming to provide relevant information to decision-makers in order to position the organisation favourably in its environment (Aguilar, 1967).

In the airline industry, most research has focused primarily on evaluating a firm's opportunities and threats in its competitive setting in order to analyse the environmental circumstances that promote high firm performance levels (e.g. Barrett, 1999; Francis et al., 1999; Lijesen, Nijkamp and Rietveld, 2002; Veldhuis, 1997). These environmental models of competitive advantage are based on two assumptions. First, these models assume that organisations within a sector or a strategic group are alike in terms of the strategically relevant resources that they manage and the strategies they follow (Porter, 1981). Second, these models presume that any resource heterogeneity that may develop in a sector or group will be very short lived because the resources that organisations utilise to realise their strategies are highly mobile (Barney, 1991). The condition of an industry, where organisations possess identical resources, suggests that these organisations have the same amount and variety of strategically relevant physical, human, and organisational capital. Consequently, there is no strategy that could not be implemented by any one of the other organisations in this sector. Therefore, within the same sector, it is impossible for organisations to build a sustained competitive advantage. An exception to the assumption represents the existence of 'barriers of entry'. In this case, organisations within a specified industry sector or group that are completely homogenous may be capable to attain a sustained competitive advantage in comparison to organisations that are not in their industry sector or group if there are strong entry or mobility barriers (Barney, 1991).

Porter (2001) notes that ICT such as the Internet have an impact on industry structures. New industries and new online pricing mechanisms such as online auctions and digital e-Marketplaces have been created. However, the greatest impact has been to enable the reconfiguration of existing industries that had been constrained by high costs for communicating, gathering information, or accomplishing transactions. That is why

Porter (2001) argues that the five forces model is important to determine how the economic value created by any product, service, technology, or way of competing is divided between companies in an industry and their customers, suppliers, distributors, substitutes, and potential new entrants. Figure 2 outlines in more detail how the use of ICT, such as the Internet and B2B e-Marketplaces, can influence industry structure and the competitive equilibrium.

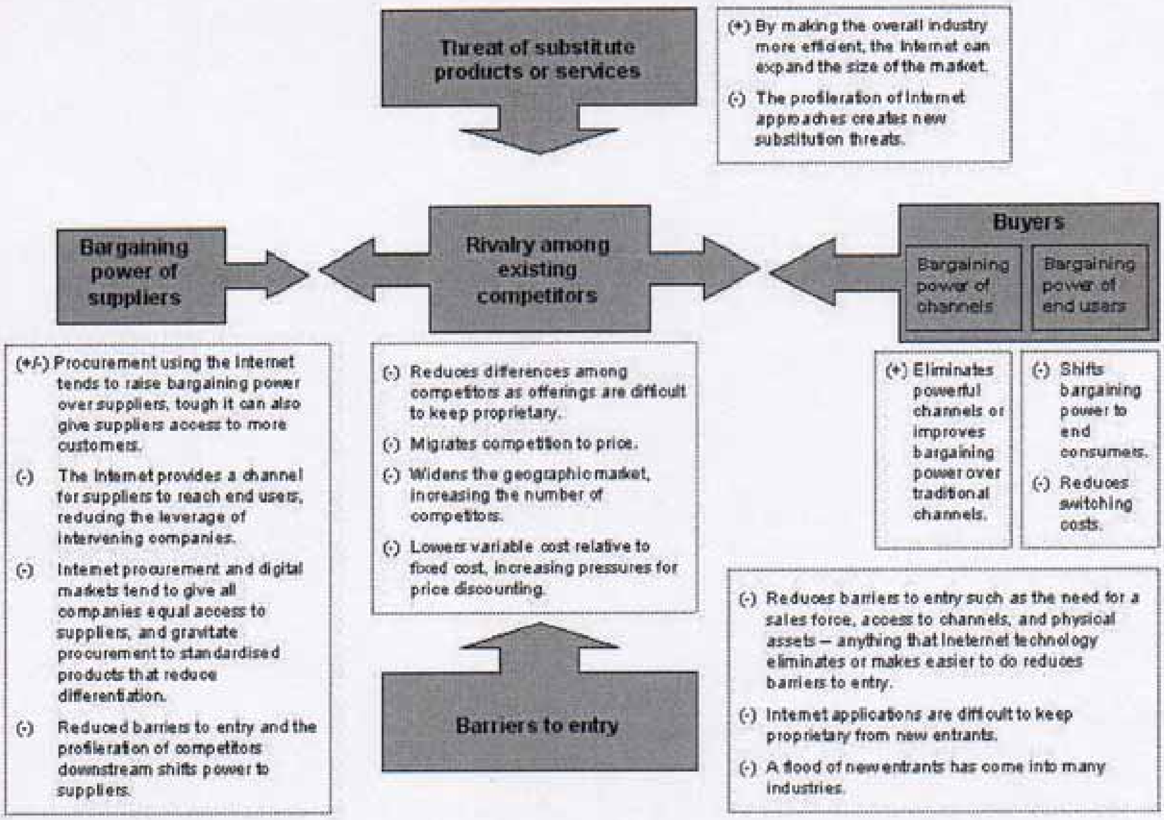

Figure 2: Internet Influence on Industry Structure
Source: Porter, M.E., 2001, Strategy and the Internet, Harvard Business Review.

Porter (1980) furthermore identifies three fundamental generic competitive strategies that are employed within an industry: cost leadership, differentiation and focus on a narrow competitive scope within an industry, emphasising either cost or differentiation within that narrow competitive scope (Porter, 1985). How effectively a firm applies these three generic strategies determines its competitive advantage. According to Porter (1985), *"competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering and supporting its product."* Therefore *"a systematic way of examining all the activities a firm performs and how they interact is necessary for analysing the sources of competitive advantage ... A firm gains competitive advantage* *by performing the strategically important activities more cheaply or better than its competitors."*

When applied to ICT, competitive advantage should be understood at the specific operational activity, rather than by examining the impact of the entire company's ICT (Porter, 2001). According to him, the Internet affects operational effectiveness and strategic positioning in different ways. With the Internet, it is harder for companies to sustain operational advantages, but at the same time it also opens new opportunities for achieving or strengthening a distinctive strategic positioning. By fast and effectively providing real-time information, the Internet has the potential to facilitate improvements throughout the entire value chain, across almost every company and industry. Because the Internet is an open platform with common standards, companies can often use its benefits with much less investment than it was required to capitalise on precedent generations of ICT. However, simply improving operational effectiveness alone does not provide a competitive advantage. Companies can only acquire advantages if they are able to reach and maintain higher levels of operational effectiveness than their competitors, which is an exceptionally difficult attempt even taking the best of circumstances into account as competitors tend to copy best practices quickly. Thus, best practice competition in the long run leads to competitive convergence, which means that many companies competing with the same things in the same ways. As it becomes harder to sustain operational advantages, strategic positioning becomes more important (Porter, 2001).

This implies that ICT such as the Internet or e-Marketplaces can help create value within the environmental view. However, Porter's environmental view needs to be complemented by the resource-based view of the firm (e.g. Andrews, 1971; Ansoff, 1965; Barney, 1991; Hofer and Schendel, 1978; Rumelt, 1984). For example, while environmental analyses seem to suggest that competitive advantage arose from technological factors, such as economies of scale, or from unique assets, the resource based view emphasised the idea that these technologies or market positions reflect internal organisational capabilities, such as the ability to develop new products rapidly, to understand customer needs profoundly, or take advantage of new technologies cheaply. While the environmental view focuses attention on external industry structure, the resource-based view directs towards the argument that internal capabilities and investments provide the instruments and tools to shape this external environment (Cockburn, Henderson and Stern, 2000).

2.4. Resource-Based View

The resource-based view cannot rely on the same assumptions of the environmental view as it outlines the linkages between an organisation's internal characteristics and performance (e.g. Penrose, 1958; Rumelt, 1984; Wernerfelt, 1984). The resource-based view of the firm instead uses two alternate assumptions in analysing sources of competitive advantage: (1) resources and capabilities of competing firms may differ (resource heterogeneity) and (2) differences may be long lasting (resource immobility) (Barney, 1991).

The resource-based model of the firm analyses the implications of these two assumptions for the analysis of sources of sustained competitive advantage (Barney, 1991). In brief, the resource-based view depicts companies as a collection of resources and capabilities required for product or market competition (Dehning and Stratopoulos, 2003). Barney (1991) defines resources as physical capital, human capital and organisational capital that are owned and/or controlled by a firm and that can be used to develop and implement strategies. In turn, capabilities reflect the ability of a firm to combine these resources to achieve superior performance (Teece et al., 1997).

Not all resources and capabilities of an organisation hold the potential of sustained competitive advantage. To have this potential, a firm resource must have four characteristics: (a) it must be valuable, in the sense that it exploits opportunities and/or neutralises threats in a company's environment, (b) it must be rare among a firm's current and potential competition, (c) it must be imperfectly imitable, and (d) there cannot be strategically equivalent substitutes for this resource that are valuable but neither rare or imperfectly imitable (Barney, 1991). The resource-based view has therefore also become a popular perspective for explaining sustainable competitive advantage in ICT and e-Business (Barney, 1991; Barney et al., 1995; Clemons, 1991; Clemons and Row, 1991; McFarlan, 1984). Resource-based theory has also been suggested as a meaningful theoretical framework for pursuing competitive advantages through the development of inter-organisational systems (IOS) in value chain activities because of the required diffusion of new technology assets (Angeles and Nath, 1998;

Kumar and Crook, 1999; Rasheed and Geiger, 2003). Clemons (1991) and Clemons and Row (1991) have used the resource-based view as approach to understanding the relationship between ICT and sustained competitive advantage.

The impact of resource heterogeneity and immobility on competitive advantage can be found in the following model. Here the three questions of (1) value of a particular resource or capability, (2) heterogeneous distribution of a particular resource or capability, and (3) imperfect mobility of a particular resource or capability are outlined.

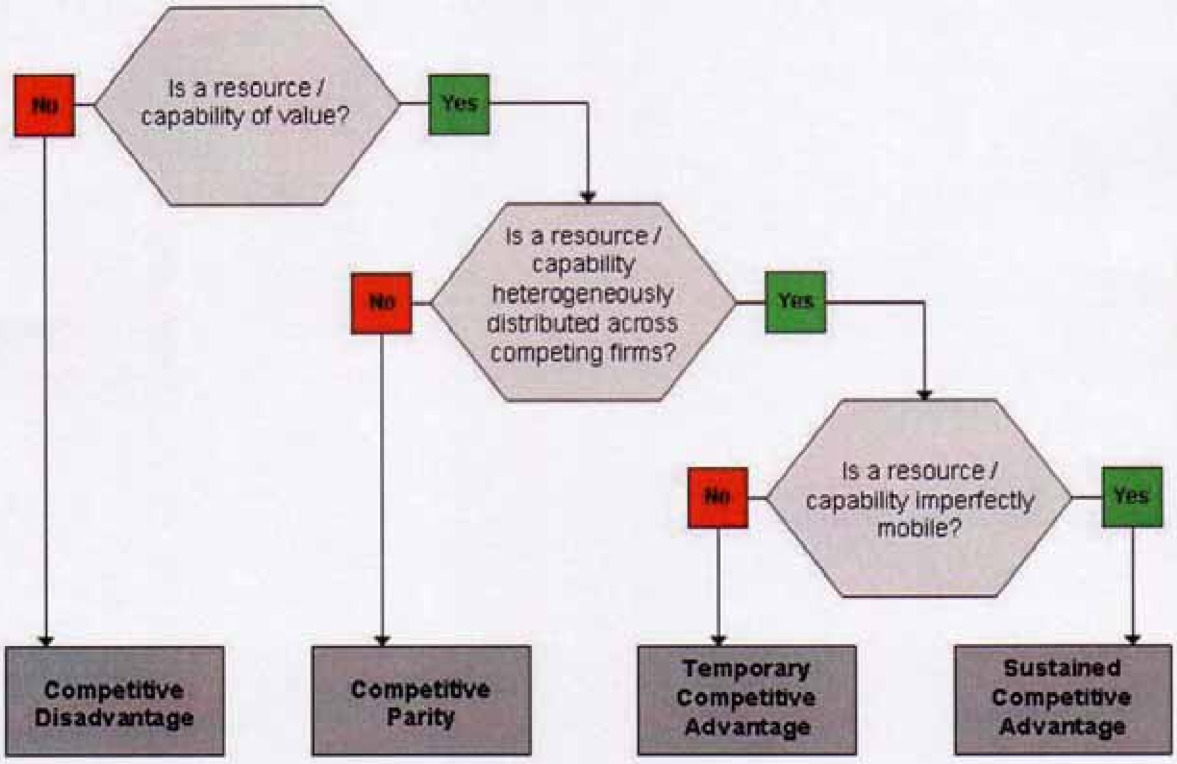

Figure 3: Resource Based-Model of Competitive Advantage
Source: Barney, J.B., Fuerst, W., Mata, F., 1995, Information technology and sustained competitive advantage: a resource-based analysis, MIS Quarterly, 19, 4.

With the model above, it is possible to examine the ability of ICT to generate (sustained) competitive advantages. Barney et al. (1995) have identified five specific attributes of ICT as sources for sustained competitive advantages for firms: (1) customer switching costs, (2) access to capital, (3) proprietary technology, (4) technical ICT skills, and (5) managerial ICT skills. The first of these, the customer switching costs, has already been researched as not to be a source of sustained competitive advantage in all but some unusual circumstances (see section 2.2.1). McFarlan (1984) has suggested that the capital needed to develop and apply ICT is a source of sustainable competitive advantage. Two kinds of uncertainty can be considered as the major sources of risk in ICT investments, technological uncertainty and market uncertainty. Technological uncertainty can be described as the risk that an ICT investment may not meet its expected performance targets in a timely way. According to McFarlan (1984) sources of technological uncertainty include: (1) failure to obtain the anticipated ICT results, (2) higher than anticipated implementation costs, (3) longer than anticipated implementation time, (4) technical performance below what was anticipated, and (5) incompatibility of the developed ICT with selected hardware and software.

As an example, in their early stages, computer reservation systems (CRS) developed in the airline industry were characterised by high levels of technological uncertainty. Their development required the solution of a number of unforeseen problems, which reflected the technological limitations and scarce experience available at the time (see Copeland and McKenny, 1988). Market uncertainty, on the other hand, reflects risks related to the customer's acceptance of new ICT products and services. However, having access to capital for ICT investments is not likely to be a source of competitive advantage. Not all investments are large in size and risky and as a consequence several firms might have access to the capital. As risks of investments are not distributed heterogeneously in this case, capital can only be a source of competitive parity (Barney et al., 1995). Secondly, ICT that can be kept proprietary has also been researched as potential source of competitive advantage (see Porter, 1980).

Most of research undertaken, however, indicates that it is very difficult to keep a firm's proprietary technology secret. Therefore, it is unlikely that proprietary technology is a source of sustained competitive advantage (Barney et al., 1995). According to Copeland and Kenny (1988), a firm's technical skills may be a third possible source of sustained competitive advantage. Technical skills refer to the know-how needed to build ICT applications using the available technology and to operate them to make products or provide services (Capon and Glazer, 1987). However, technical skills are usually not sources of sustained competitive advantage as these skills are valuable, but usually not heterogeneously distributed across firms. Even when they are heterogeneously distributed across firms, they are typically highly mobile. Capon and Glazer (1987) have identified a second set of skills, the managerial skills. To define it in terms of ICT, managerial skills include the management's ability to conceive of, develop, and exploit

ICT applications to support and enhance other business functions. Managerial skills are valuable, heterogeneously distributed and imperfectly mobile. Therefore, when managerial ICT skills cannot be written down, codified, or transferred at low cost or without significant loss of richness and understanding, those managerial skills may be a source of sustained competitive advantage (Barney et al., 1995). As an example, the managements' understanding for the potential of ICT to be a source of competitive advantage was vital for American Airline's ability to develop Sabre (Copeland and McKenny, 1988).

Resource-based theory, however, as it relates to using ICT to establish a sustainable competitive advantage has been equivocal. Particularly, the resources involved in web-based e-Commerce may not be a source of competitive advantage. Resources in this technical context may only be viewed as a temporary source of competitive advantage or a source of competitive parity. For example, except for managerial ICT skills, Barney et al. (1995) conclude that ICT cannot be a source of sustainable competitive advantage. Because ICT resources are mobile and imitable, firms can only expect to have a temporary competitive advantage, and should view ICT as necessary to maintain competitive parity (Rasheed and Geiger, 2003). Moreover, the notion that the search for the source of value-creating resources and capabilities should extent beyond the boundaries of the firm presents a novel perspective for the resource-based view (Gulati, 1999). Thus, two other theories that describe sources of value creation and the achievement of competitive advantage are the transaction cost and strategic network theory.

2.5. Transaction Cost and Strategic Network Theory in ICT Research

While the resource-based view focuses on factors that enable firms to gain competitive advantage, Transaction cost theory concentrates on costs that are associated with conducting exchanges between two entities. Transaction costs can be defined as the costs of planning, adapting, executing, and monitoring the completion of a specific task (Williamson, 1983). Freebairn (1995) defines them as the costs of collecting and evaluating information about alternative exchange options, of bargaining the conditions of exchange transactions and of enforcing exchange contracts. The primary objective of transaction cost economics (TCE) is to understand how variations in certain basic characteristics of transactions lead to the diverse organisational arrangements that govern trade in a market economy. The organisational arrangements that have been of primary interest include the internal organisation, the determinants of the boundaries between firms and markets, and the properties of contractual arrangements between buyers and sellers of goods and services (Joskow, 2000). Transaction costs introduce a wedge between the value of goods and services exchanged between buyers and sellers.

The key conceptual move to TCE is to describe firms not in neoclassical terms (as production functions), but in organisational terms (as governance structures). The basic insight of TCE is to recognise that in a world of positive transaction costs, exchange agreements must be governed, and that, contingent on the transactions to be organised, some forms of governance are better than others (Boerner and Macher, 2001). Among areas in which TCE has begun making important contributions to strategy is in understanding the performance implications of relationship-specific investments and organisational form (see Silverman, 1998). TCE is concerned with the organisation of transactions of goods or services between stages of activity, and yield propositions about which organisational forms are appropriate for which types of transactions (Coase, 1937; Williamson, 1985). This perspective explains which structural form should be used for organising a given transaction. *"A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins"* (Williamson, 1989).

TCE explains the choice of the most efficient governance form given in a transaction that is embedded in a specific economic context (Amit and Zott, 2001). Therefore, it is also relevant for ICT literature (e.g. Christiaanse and Markus, 2003). Tasks are believed to be a function of three underlying dimensions: (1) asset specificity, which means the degree to which transactions are supported by transaction specific investments, (2) transaction frequency and efficiency, and (3) the uncertainty surrounding the transaction. High asset specificity, low transaction frequency and high uncertainty equate to high transaction costs and are associated with vertically integrated (or hierarchical) transaction governance. Conversely, low asset specificity, high frequency, and low uncertainty result in lower transaction costs and are associated with arm's-length market relationships (Christiaanse and Markus, 2003).

In recent times, academics have started to research the way in which ICT can reduce transaction costs and risks (see Clemons and Row, 1992; Dyer, 1997). Dewett and Jones provide an overview on the literature which has repeatedly accounted for the decrease of transaction costs within firms due to information technology deployment (Dewett and Jones, 2001). This is likely to increase efficiency in multinational companies, eventually leading to globally distributed value chains within firms (Zaheer and Manrakhan, 2001). According to Arni (2003), external transaction costs are also likely to decrease since the Internet lowers seller search costs by allowing sellers to communicate product information cost effectively to potential buyers, and by offering sellers new ways to reach buyers through targeted advertising (Bakos, 2001). On the other hand, by analysing the influence of the Internet on buyer-supplier relations, there is also evidence that costs of locating new suppliers have significantly decreased (Barua, Ravindran et al., 1997).

ICT has three potential effects on the cost of transacting with external parties: the communication effect, which means efficient information flow, the brokerage effect, which means improved matching of buyers' needs with sellers' offerings; and the integration effect, which means tightened process coupling (Malone, Yates and Benjamin, 1987). However, transaction cost theory neglects power relationships among firms, which can influence the structure of inter-firm transactions (Christiaanse and Markus, 2003), particularly in the airline industry. There, the strategic network theory is also needed to explain competitive advantage by ICT and relevant in understanding the value creation of e-Businesses.

While the transaction cost theory focus upon the single transactions, network theory introduces time and seeks to optimise the series of transactions between companies (Bolseth, 2002). Networks can be defined as two or more firms which, due to the intensity of their interaction, constitute a subset of one or several markets (Thorelli, 1986) and are possibly the most efficient form of organisation for today's economic circumstances (Miles and Snow, 1984). Jarillo (1988) defines strategic networks as long-term purposeful arrangements among organisations that allow those firms in them to gain or sustain competitive advantage in comparison to their competitors outside the network. Strategic networks are furthermore differentiated from vertical integration by the relative independence of participating firms.

Networks can be also defined as stable inter-organisational ties, which are strategically important to participating firms and may take the form of strategic alliances, joint-ventures, long-term buyer-supplier partnerships, and other ties (Gulati, Nohria and Zaheer, 2000). Strategic alliances can be part of networks. Gulati (1998) defines strategic alliances as voluntary arrangements between firms involving exchange, sharing, or co-development of products, technologies, or services. They can occur as a result of a wide range of motives and goals, take a variety of forms, and occur across vertical and horizontal boundaries. Yoshino and Rangan (1995) and Gomes-Casseres (1996) add to define an alliance as a co-operative venture between firms situated on the continuum between markets and hierarchies, which is distinguished by several characteristics: independent firms; horizontal or vertical relationships; relationships that are not solely transactional; partners bring resources, share risks but have limited control; and incomplete contracts.

Therefore, strategic network theory expands transaction cost theory to explain the emergence of long-term relationships among firms in terms of the reduced transaction costs enabled by network collaborations. Beyond other questions, the issue of how value is created in such networks has been extensively researched in the past. The configuration of the network in terms of density and centrality has been considered as an important determinant of network advantages, such as access, timing and referral benefits. Also the size of a network and the heterogeneity have been argued to have a positive effect on the availability of valuable information to the participants within that network. Other sources of value creation in strategic networks include shortened time to market, enhanced transaction efficiency, reduced asymmetries of information, and improved co-ordination between the firms involved in an alliance (see Amit and Zott, 2001).

Alliances are voluntary, inter-firm agreements aimed at achieving competitive advantage for all partners involved (see Das and Teng, 2000). Initially, research on alliance performance was conducted from a transaction cost or traditional industrial organisation theory perspective (e.g. Porter, 1985). Firms were considered to be individual, self-fulfilling units (Williamson, 1975, 1991) that prefer going alone over cooperative agreements (Contractor and Lorange, 1988). These studies generally viewed alliances as single transactions pursued to overcome market failure. The insights generated by these studies refer mainly to critical aspects in the dyadic relationship (Duysters et al., 1999). For instance, choice of governance structure (Williamson, 1985) and partner fit (Geringer, 1991; Medcof, 1997) have been found to have a significant impact on the quality of the relationship between the partners and therefore can be seen as a critical determinant of alliance performance.

Competition plays an important role in determining the strategic position undertaken by firms. Alliances improve the strategic position of firms in competitive markets by providing resources from other firms that enable them to share costs and risks in product design, production, marketing, or distribution. Forging an alliance enables a firm to focus resources on its core skills and competencies while acquiring other components or capabilities it lacks from the marketplace. Such resources give firms to sustain business downturns and other setbacks, and ensure more even and predictable resource flows (Ohmae, 1989). Firms form alliances to gain access to capabilities and resources that are essential to pursue their goals, but that are least in part under the control of other organisations in their environment (Gulati and Garigulo, 1999). The need for forming strategic alliances can stem from two domains: (1) uncertainties posed by the external environment and (2) internal need for building up resources and capabilities (Ranganathan and Lertpittayapoom, 2002).

Oliver (1990) integrates much of this stream of literature into six generalisable determinants of relationship formation (necessity, asymmetry, reciprocity, efficiency, stability, and legitimacy) and applies them to the prediction of interorganisational relations.

- Necessity: firms enter relationships to meet necessary legal or regulatory requirements.
- Asymmetry: firms enter relationships to exercise power or control over another organisations or its' resources.
- Reciprocity: firms enter relationships to pursue common goals.
- Efficiency: firms enter relationships to improve their internal input/output ratio.
- Stability: firms enter relationships to respond to environmental uncertainty.
- Legitimacy: firms enter relationships to appear in agreement with the prevailing norms (Oliver, 1990).

According to Bolseth (2002), the characteristic features of ICT as a digital intermedium technology can support and create new network structures. ICT and e-Business can contribute to tighten the relationships among the actors in a strategic network as well as between the firms and their customers. In turn this can result in more efficient material and information flows and a tighter integration in the value chain. The transaction costs for the different actors can be reduced. In addition ICT can open up possibilities for relationship building which might have a great strategic impact related to production of personalised customer adapted products and services.

Evans and Wurster (2000) proclaim that there are the three dimensions "reach", "rich" and "affiliation", to analyse value creation and competition in virtual networks. Affiliation indicates that the purpose of the company strategy is to achieve closer relationships to other network members, where closer relationships may be attained through customer loyalty. Richness means information, and especially the extended access to information, when doing e-Business, indicates and represents the possibilities of a new competitive advantage. The company strategy should therefore try to use richness, such as customer information and product information, to deepen relationships and build brand loyalty. Reach indicates that e-Business implies more ways of reaching the market and customers. For product suppliers, reach denotes that retailers may become unnecessary in the sales and the distribution structures. Reach nonetheless also implies a risky exposure to comprehensive comparison, and the company strategy should therefore try to avoid such comparison by keeping the pricing structure opaque or less transparent (Bolseth, 2002).

Virtual networks are facilitated by the explosion of bandwidth and connectivity brought about by developments in Internet technology (Evans and Wurster, 1999), which has also implications for rapid change, collaboration rather than competition, complexity, uncertainty, technological discontinuity and the need for managing and exploiting knowledge assets (Fahy and Hooley, 2002).

2.6. Competitive Advantage in Turbulent Markets / Hypercompetition

The rise of virtual networks and the Internet has led some academics to go as far as to question whether the fundamentals of strategy are still relevant in an era of unpredictable, technology-based competition. For example, Pitt (2001) argues that *"existing models of strategy are less useful because they were developed in and for a time of less turbulent change"*.

Industries are increasingly finding themselves in a position characterised by globalisation, turbulence and complexity, paralleled with advancements in ICT (Fahy and Hooley, 2002). The product life cycles have become shorter, while this trend has been accompanied by a progressive fall of the available time-to-market for products (Brown and Eisenhardt, 1997).

Research work on high technology industries accentuates the necessity for rapid and exible innovation, responsiveness and the development of dynamic capabilities (e.g. D'Aveni, 1994; Teece et al., 1997). Research has thus identified the need for a more dynamic method to strategy. Researchers started to focus on high-velocity environments and to emphasise the continuous change that characterises them (e.g. Brown and Eisenhardt, 1997; Hamel, 2000). They emphasise speed and adaptability suggesting that 'motion' may be a more important determinant of success than 'sustainability' (Fahy and Hooley, 2002).

Eisenhardt and Martin (2000) argue that the resource-based view breaks down in high-velocity contexts because the competitive advantage achieved by the current resource pool becomes unpredictable. In this respect, D'Aveni (1994) created the term 'hypercompetition' and developed a radical critique of the sustainability of competitive advantage.

D'Aveni (1994) defines hypercompetitive behaviour as the process of continuously generating new competitive advantages and destroying, obsoleting, or neutralising the opponent's competitive advantage, thereby creating disequilibrum, destroying perfect competition, and disrupting the status quo of the marketplace.

Factors such as more aggressive action-reaction patterns among rivals and more frequent emergence of new technologies may contribute to increased competitive pressures. However, hypercompetition is not a dichotomy per se, but a continuum in which industry sectors exhibit varying degrees of hypercompetitive behaviour (D'Aveni, 1994). According to Knudsen (2002), the concept of sustainable competitive advantage cannot be found in a hypercompetitive environment. In order to be competitive in the long-term, an organisation must combine a chain of unsustainable competitive advantages. Competitive advantage is continuously transformed and improved through competence-generating strategic processes of comprehension and deftness (McGrath, MacMillan and Venkatraman, 1995).

Eisenhardt (1989) argues that opportunities arise and disappear in brief time-periods in high velocity environments and outcomes from advantageous decisions taken in one time period can be put at risk easily in the next. Organisations that aim to secure sustainable competitive positions have to change and continually renew and build up new competitive advantages. This allows the organisation to prevent imitation from competitors and to maintain its successful position. As a result a series of short-term and temporary competitive advantages in a dynamic competitive pattern are created. D'Aveni (1994) thus outlines that organisations need to prepare for hypercompetition in an entirely different way, focusing on creating disruption, seizing the initiative, and creating a series of temporary advantages.

Hypercompetition assumes increased instability and advocates the creation of more flexible organisational boundaries and strategies (Amit and Zott, 2001), as well as competitive advantage based on exploitation of short-term opportunities that are arising from greater environmental uncertainty. The dynamic capabilities perspective on strategy (e.g. Eisenhardt and Martin, 2000; Teece, Pisano and Shuen, 1997) suggests that continually successful businesses emphasise entrepreneurships, adaptability to unstable and quickly changing markets, and competent management of fluid assets and dynamic capabilities. Agile organisational designs are being emphasised, such as team-based organisations or competency-based organisations, that effectively manage new product development.

These approaches are often implemented in the context of modified organisational forms enabled by ICT, such as networks, strategic alliances and virtual organisations (e.g. Hammer and Champy, 1993). Through e-Business operations, companies are able to develop more widespread external relationships, as the availability of timely and accurate information permits organisations to co-ordinate inter-organisational activities in real-time (Auramo, 2005; Bowersox and Daugherty, 1995).

E-Business allows business processes that improve operational flexibility (Lee and Whang, 2001) and, according to Bowersox and Daugherty (1995), companies can thus improve their competitiveness by responding quicker to the changes in customer demand. E-Business enhances the possibilities of managing multiple customer relationships more effectively, as it is easier to manage the different customer segments (Christopher, 2000). According to Frohlich and Westbrook (2002), they can also benefit both from increased speed in information transfer and from the more streamlined business processes (Vakharia, 2002).

According to Patterson et al. (2003), the ever-expanding capabilities of ICT with the concomitant reduction in investment costs allow capital and information to flow almost instantly throughout many parts of the world. Furthermore, as consumers have become more discriminating and demanding (Ellinger et al., 1997), product life cycles have been shortened, forcing firms to contract time to commercialisation (Lovelace et al., 2001) and provide higher levels of customer service and customised products. Consequently, most industries and firms have entered this hypercompetitive marketplace characterised by an increase in competition, uncertainty, and complexity. In this business environment, innovation of organisational processes and products is a major business challenge (Tornatzky and Fleischer, 1990) and critical for firm success (D'Aveni, 1994).

2.7. Theoretical Implications for E-Marketplace Adoption and Competitive Advantage

Thus far, this review has considered information and communication technology and its potential for strategic advantage. The review has covered the main approaches to competitive advantage in literature. It can be argued that ICT (such as the adoption of e-Marketplaces), has the potential to enhance competitive advantage. For instance, as outlined in previous sections, ICT based applications enabling electronic integration among a set of firms could potentially change the basis of competition in a marketplace (Venkatraman, Zaheer and Akbar, 1990). However, in Porter's value chain model, ICT is not a primary activity, but it is a part of supporting activities. Nevertheless, Porter and Millar (1985) emphasise that ICT can create value by supporting differentiation strategies. The key to using it most effectively is by integrating Internet initiatives into a company's overall strategy and operations so that they 1) complement, not cannibalise, established competitive approaches and 2) create systematic advantages that competitors can not copy (Porter, 2001).

In determining the value creation of e-Business, Amit and Zott (2001) observed that new value can only be created by the way in which transactions are enabled. In brief, these authors developed a model of the sources of value creation in which the value creation potential depends on four interdependent dimensions: efficiency, complementarities, lock-in, and novelty. They also acknowledge that the overall concept of e-Business and its subset e-Commerce can help firms gain competitive advantage, a feature acknowledged by a variety of authors (e.g. Amit and Zott, 2001; Lee, Cho and Lee, 2002; Phan, 2003; Rasheed and Geiger, 2003; Zott, Amit and Donlevy, 2000). However, academic literature to date has addressed the central issues of e-Business only to a limited extent and so far no unified theoretical model has been developed in capturing the unique features of this phenomenon (Amit and Zott, 2001).
As outlined in previous sections, most research in strategic ICT has focused on the ability of ICT to add economic value to a company by either reducing a firm's costs or differentiating its products or services (Amit and Zott; 2001; Barney et al., 1995; Bakos and Treacy, 1986; McFarlan, 1984; Porter and Millar, 1985) and thus to be able to gain (temporarily or sustained) competitive advantage over direct competitors or to achieve competitive parity (e.g. Dehning and Stratopoulos, 2003; Feeny and Ives, 1990).

The rise of the Internet has led some academics to go as far as to question whether the fundamentals of strategy are still relevant in an era of unpredictable, technology-based competition. However, others have argued to the contrary, with traditionalists such as Porter (2001) claiming that, because of the impact of the Internet, the basic rules of strategy are now more rather than less important.

In addition, ICT and its potential to enhance competitive advantage is also reaffirmed in less known strategic management approaches, such as organisational learning and knowledge-based theory (Conner and Prahalad, 1996; Grant, 1996; Lei et al., 1997), the dynamic capability view (Eisenhardt and Martin, 2000; Mahoney, 1995; Teece et al., 1997), the strategic grid (McFarlan and McKenney, 1983), the strategic opportunity matrix (Benjamin et al., 1984),or trigger-input-process-output model (Ives and Vitale, 1988).

Hedman and Kalling (2002) argue that, for the purpose of better understanding of the ICT economic context, it would be valuable to integrate all the different theories and frameworks into one model, i.e. a so called business model. The business model concept has recently become popular within IS, e-Business, management and strategy literature. However, the concept is often used independently from theory, meaning model components and their interrelations are relatively obscure. Furthermore, there is still no commonly accepted theoretical definition[3]. Porter (2001) criticises the business model concept, claiming that the definition of 'business models' is 'murky' and that the concept excludes important variables such as the industrial forces. Therefore, the concept of the business model was not used in this study.

As there is no unified accepted theory of business strategy, it was however important to review the main approaches in literature. Consideration of available theories and models should help to inform an understanding of the value-creation potential of e-Marketplaces in procurement processes of the aviation industry. As the study focuses on the adoption of e-Marketplaces and the resulting performance indicators, this suggested that the literature on DOI, IOE, Create-Capture-Keep Paradigm, Environmental and Resource-Based View, Transaction Cost and Strategic Network Theory as well as Hypercompetition and their impact on competitive advantage should provide the focus of the review (see Table 2 below). TAM, TPB, UTAUT, structuration and institutional theory are not employed in this study as they are difficult to evaluate empirically. Moreover, they represent theories of behavioural scieneces on an individual's technology adoption decision, which have limited relevance in the wider context of adoption decisions of organisations.

[3] Three major strands of articles that use the term "business model" in different ways can be identified. The first is to simply use the term "business model" without any definition of the term; e.g. as can be found in a large number of articles in the popular business press. The second is consultants and academic authors who try to define a "business model", and the third are articles with taxonomies and classifications of different types of "business models" (see http://www.wireless.kth.se/AWSI/LCI/publication_files/Business%20Model%20Defintion%20submit%20IJEC%20Apr04.pdf).

Theory	Core Idea	Applicability of Presented Theories to e-Marketplace Research
Theories of Innovation Adoption		
Create-Capture-Keep Paradigm	Creation of switching costs	**Strengths:** • Widely regarded theory. **Weaknesses:** • Anticipation of risks / untrustworthiness • Switching costs can only be a source of competitive advantage if ICT is unique.
Diffusion of Innovation (DOI) Theory Innovation-Organisational-Environmental (IOE) Framework	Migration of an innovation from creation to use Three aspects of a firm's context influencing the innovation adoption process: organisational context, technological context, and environmental context	**Strengths:** • Defines the pattern of diffusion of an innovation through a population. • Focuses on five elements: (1) the characteristics of an innovation which may influence its adoption; (2) the decision-making process that occurs when individuals consider adopting a new idea, product or practice; (3) the characteristics of individuals that make them likely to adopt an innovation; (4) the consequences for individuals and society of adopting an innovation; and (5) communication channels used in the adoption process. • Solid theoretical basis • Consistent empirical support • Extension of DOI Theory by viewing innovation diffusion within different contexts. **Weaknesses:** • Stringent assumptions of the model • Patterned closely after original diffusion research that dealt with adoption behaviour of individuals and not organisations.
Theory of Planned Behaviour (TPB).	Link between attitudes and behavior (Extension of Ajzen and Fishbein's theory of reasoned action)	**Weaknesses:** • The difficulty of assessing actual control has led to the use of perceived control as a proxy. • Difficult to evaluate empirically as it is complicated to apply to real-time situations. • Reduced ability to make general statements. • Has limitations for understanding drivers of acceptance. **Strengths:** • Provides useful information for the development of communication strategies. This theory is also used in evaluation studies.
Technology Acceptance Model (TAM).	How users come to accept and use a technology (Extension of Ajzen and Fishbein's theory of reasoned action)	**Weaknesses:** • Predictive tool • Research into specific behaviour is restrictive (perceived ease of use and perceived usefulness). • Explanatory theory of individual behaviour. • Neglects cultural background of users • Difficult to evaluate empirically dues to subjective usage measures. **Strengths:** • Explanation of determinants of ICT acceptance across user populations.
Unified Theory of Acceptance and Use of Technology (UTAUT)	Aims to explain user intentions to use an IS and subsequent usage behaviour.	**Weaknesses:** • Predictive model of human behaviour. • Shares same limitations of TBP and TAM outlined above. **Strengths:** • Theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain ICT usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a combined theory of planned behaviour/technology acceptance model, model of PC utilisation, innovation diffusion theory, and social cognitive theory). • Integrated view of user acceptance.
Structuration Theory	Reconciles theoretical dichotomies of social systems	**Weaknesses:** • General theory of the social sciences; in its original formulation, ST pays little attention to technology. • Rather applicable to technology cultures • Neglects question why things are 'so and not otherwise' • Lack of specificity about technical details of information systems. **Strengths:** • Informs how technology is created, used and becomes institutionalised.
Institutional Theory	Considers the processes by which structures, including schemas, rules, norms, and routines, become established as authoritative guidelines for social behaviour	**Weaknesses:** • Generic theory of the social sciences. **Strengths:** • Considers the processes by which structures become established as authoritative guidelines for social behaviour. It inquires into how these elements are created, diffused, adopted, and adapted over space and time; and how they fall into decline and disuse.

IS Theories		
Environmental View	Analysis of the firm's microeconomic environment	**Strengths:** • Addresses value creation • Co-alignment between organisation's strategy with external environment. **Weaknesses:** • Theory based on the economic situation in the eighties. • Does initially not account for digitalisation, globalisation and deregulation.
Resource-Based View	Based on the concept of economic rent and the view of the company as a collection of capabilities	**Strengths:** • Internal capabilities and investments provide the instruments to shape the external environment. • Dominant approach to strategic management. **Weaknesses:** • Does not address value creation. • Does not address environmental factors.
Transaction Cost Theory	Transaction cost refers to the cost of providing for some good or service through the market	**Strengths:** • Widely regarded theory, in particular to sourcing decisions. • Distinction between markets and hierarchies. **Weaknesses:** • In practice the separation of production and transaction costs is often difficult • Neglects 'power' as an important role in decision-making • Reputation and trust are not considered.
Strategic Network Theory	Introduces time and seeks to optimise the series of transactions between companies	**Strengths:** • Explains the emergence of long-term relationships among firms and of how value is created in such networks. • Addresses value-creation. **Weaknesses:** • Does not address directionality, structural equivalence and intensity.
Hypercompetition	Business is shifting dramatically from slow-moving stable oligopolies to an environment characterised by a quick-strike mentality	**Strengths:** • Addresses the dynamics of competition **Weaknesses:** • Ignores that competition and co-operation can co-exist (co-opetition)

Green shaded theories have been found applicable for this research while grey shaded theories have been found as to be difficult to evaluate empirically and are as such not considered.

Table 2: Applicability of Presented Theories for ICT / E-Marketplace Research

From the literature review it can be concluded that the impact of ICT on competitive advantage is significant. However, *"the real challenge is not technology (adoption) per se, but the ability to adapt to take advantage of its emerging functionality"* (McKenny, 1995). According to the IDRC (1996), as more and more firms successfully adopt and implement ICT applications, the comparative competitive advantages derived from the adoption of these applications may very well disappear if firms do not stay ahead. For firms that lag behind, ICT adoption becomes merely a question of survival. ICT provide support for everyday business operations and activities and are also needed in the diverse decision-making processes. They also play a major role in achieving and maintaining or improving strategic advantages (Neo, 1988).

Delbaere (2002) explain that while ICT cannot provide effective knowledge management on their own, they can greatly enhance an organisation's ability to communicate between departments / units and to manage the flow of information and knowledge on a larger scale than in the past. Technology has also opened up the communication channels between buyers and suppliers, allowing them to become much more connected than before. Whereas technology has not necessarily affected the content of the information, it has dramatically increased its communication and availability (Delbaere, 2002). IDRC (1996) argues that ICT adoption as such is a necessary but not sufficient condition for increased productivity, key competitive and strategic benefits, and stronger financial and export performance. For example, e-Marketplaces may enlarge and encourage dynamic networking. Theory therefore suggests that adoption of ICT and e-Marketplaces will generate value and lead to competitive advantage.

In a virtual value chain information itself is turning into a critical factor in the creation process of competitive advantage in firms (Vanharanta and Breite, 2003). In terms of e-Marketplaces, value added is the benefit accruing to parties involved. Some key determinants identified are market reach, lower prices, lower process and operations cost, industry best practices and market value, in conjunction with existing determinants such as industry structure and firm strategy (O'Reilly and Finnegan, 2002). This will be discussed in more detail in the following chapter.

The innovation under consideration is B2B e-Marketplaces. This is the subject of the literature review in the following section. Its specific implications and applications to the airline industry are considered in chapter 4.

III. THE CONCEPT OF E-MARKETPLACES

3.1. Introduction

This chapter is complementing the above mentioned theories by discussing B2B e-Marketplace concepts in more depth. Computer reservation systems in the airline industry have been depicted as one of the first developments of an e-Marketplace and are thus presented as an example of an early e-Marketplace concept. From the 1980s the industry recognised the potential of e-Business strategies. A separate section is discussing developments and definitions within the scope of e-Business. An outline of the general concept of e-Procurement is further necessary to set the scene for discussing e-Marketplaces and their evolution and characteristics. This leads on to explore the before-mentioned adoption and diffusion models of e-Marketplaces in more depth. This section further takes on implementation challenges, adoption factors and potential value creation of e-Marketplaces. Classification models as well as ownership and particpation structures are subsequently outlined. The last section of this chapter outlines the e-Marketplace service evolution, which has gone through several phases. E-Marketplaces have evolved from simple matchmaking services focused on transactions and e-Commerce to knowledge providers (Raisch, 2001).

3.2. Historical Developments and Strategic Use of ICT

3.2.1. Early Developments towards Computer Reservation Systems

The antecedents to e-Marketplaces lie in the domain of inter-organisational systems, which is a field born over four decades ago with systems such as computer reservation systems in the airline industry (Monteiro and Macdonald, 1996; Pemberton et al., 2001). Airlines have been strongly investing in ICT since the 1950s, as the introduction of commercial jet engines, cabin pressurisation, and improved navigational aids transformed air travel. As demand in travel increased since then, airlines developed internal communications and commercial infrastructure to coordinate the activities of staff, aircraft, and passengers. Thus, airlines have pioneered the introduction of ICT as they realised the need for efficient, quick, inexpensive, and accurate handling of their inventory to communicate with travel agencies and other distributors. These developments included the first B2B electronic information exchanges and industry-wide electronic marketplaces. SITA (Societe Internationale de Telecommunications

Aeronautiques) and ARINC (Aeronautical Radio Inc.) were among the world's first Business-to-Business systems. They used Teletype messaging for communicating electronically among the airlines. SITA and ARINC are still used to date and employ message pass-through capabilities the airlines developed to transmit information on passengers' travel itineraries and payments (Smith et al., 2001). However, two of the most difficult information processing problems the airlines faced were (1) keeping track of the number of seats sold on a growing number of flights and (2) communicating remaining seat availability to geographically dispersed reservation agents. There were simple manual systems in use that maintained seat inventories for a given flight at its point of departure.

Reservation agents were free to book space on a flight after confirming seat availability posted on large display boards in each reservations office. After selling a seat, an agent sent a one-way booking message via telephone or teletype to the reservations office in the flight's originating city. Upon receipt of the booking message, a clerk decreased the count of available seats for the flight from an inventory maintained in a loose-leaf folder. When the number of available seats for a flight dropped below a specified level, a "stop-sale" message was sent to all reservations offices for posting on the available boards. In addition to the availability of seats for a flight, the airlines' reservation function required a second type of information, called the passenger-name-record (PNR). Upon confirming the sale of a seat, a reservation agent noted passenger-specific information on a PNR card. This data was subsequently transmitted, either by telephone or teletype, to the flights originating city. As the departure date for a flight neared, the reservations office in the originating city reconciled the seat inventory with the card file of PNRs. Frequent data inconsistencies led to flight under/overbookings and to the deterioration of both customer service levels and utilisation of aircraft capacity. During the 1950s, availability boards were replaced by magnetic drum memories, which held seat inventories in the reservation offices. While availability memories improved the accuracy of the seat inventories, they did not capture passenger data, and reconciliation problems remained due to the inability to link passenger records to seat records.

American Airlines well predicted that the coming types of passenger jets would only exacerbate the operating difficulties and increase the reservation cost per passenger (Copeland and McKenny, 1988). Airlines tried to solve the problem using available technology; the solutions tended to be expensive and barely adequate. In 1953, American Airlines and IBM began working together on the problem. After five years, they formed a partnership to develop the first CRS, which were among the earliest examples of e-Commerce. Computerised reservation services contain information about an airline's schedule, availability, fares and fare rules, for which reservations can be made or tickets may be issued (Findlay and Nikomborirak, 1999). In 1962, American Airlines and IBM implemented the Sabre system, which was the first real-time business application of computer technology. It represented an automated system with complete passenger records available electronically to any agent connected to the Sabre system. At that time, American Airlines processed an average of 26,000 passenger-reservation transactions per day and the average time to file a reservation decreased from 45 minutes to three seconds. This jump in efficiency allowed airlines to handle the growth in demand for air travel that occurred in the 1960s (Smith et al., 2001). Through improved product distribution and customer service, CRS have transformed airline marketing through yield management and frequent-flyer programs. CRSs, particularly American Airlines' Sabre and United Airlines' Apollo, have frequently been cited as examples of the successful use of information and communication technologies for strategic purposes. Academic literature provides evidence that suggest that the carriers that have invested in such systems have been able to use them, in conjunction with other operating and marketing strategies, to achieve competitive advantage. Several studies and reports have been undertaken which, on the basis of careful observation, documentation, and analysis using microeconomic and other theories, concluded that the CRSs have had important competitive impacts (e.g. Smith et al., 2001).

With respect to operating strategy, CRSs are believed to have enabled their owners to achieve comparative advantages by (1) achieving gains in productivity, with corresponding reductions in labour costs, and (2) exploiting economies of scale and scope. CRSs allow maintaining and providing more accurate, comprehensive information and services with respect to flights, seat availability, reservations, ticketing and boarding passes with improved efficiency. CRSs have also generated additional direct revenues for their owners, through booking fees from airlines, the sale of new products and services to travel agencies, and the sale of market data from system databases. With respect to market strategy, the CRS owners are thought to have increased their air transportation market shares at the expense of competitors and thereby earned substantial incremental revenues by (according to Banker and Johnston, 1995):

(a) Improving travel agent productivity and imposing switching costs on travel agencies via minimum use and liquidated damage clauses, thus enhancing their bargaining power over their distribution channels:

(b) Manipulating the way in which information is provided via preferential screen displays (display bias) and thereby diverting passengers from other airlines to their own;

(c) Exploiting the halo effect, which means the tendency of travel agents to book more flights with the carrier owning their primary CRS;

(d) Analysing market and fare data from the CRS databases to support yield management.

The past dominant positions of the two main US airlines, American Airlines and United Airlines, can be recognised as the result of simultaneous evolutionary processes of developments in information technology and the air transport industry. In the beginning, the main motivation was to lower clerical costs. But soon later it became obvious that counting accurately the numbers and names of passengers for each flight became vital to conduct airline operations efficiently. This information obtained through the reservation processes was utilised to administer passenger service requirements and aircraft load factors as well as to prepare for additional requirements such as baggage, catering and fuel. Eventually, the marketing potential that these CRS inherited came to lead airline's retail distribution channels. The CRS's expanding scale and scope influenced developments in both software and hardware and was affected by the regulation and deregulation of the domestic airline market. Over time, these systems went from being useful to being essential assets for airlines (Copeland and McKenny, 1988). Early CRS have evolved into global distribution systems (GDSs). While CRSs may help individual airlines to sell and manage their own seats, the GDS consolidates information from many airlines, allowing travel agents, businesses, and individuals to shop in a single electronic marketplace. They were expanded to include hotel, rental car, and destination products and services. In brief, by consolidating product information from many airline suppliers, global distribution systems create a marketplace with transparent information regarding schedules and fares (Smith et al., 2001). By the mid-1980s airlines used customer shopping data to calibrate traveller demand-and-choice models, analysed multi-channel product distribution strategies with simulation, and practised dynamic pricing through yield management (Smith et al., 2001).

3.2.2. Evolution of E-Business and E-Commerce

From the 1980s on, the need for organisations to take a strategic approach to manage investments in information technology gained significant attention (Bakos and Treacy, 1986; Earl, 1988; Henderson and Venkatraman, 1992; McFarlan, 1984; Porter and Millar, 1985). Much of this work is influenced by Porter's models of competitive strategies (Porter, 1980) and by researchers beginning to describe the strategic potential of ICT (Parsons, 1983; Benbasat, 1990). However, one of the first industry players that have used the concept "e-Business" was IBM in 1997. E-Business has generally been pioneered by computing companies, where demand is constantly changing and products have to have a very short delivery time due to the up-to-date nature of their products. E-Business is an integrated approach for the transaction and execution of all business processes of a company over the Internet. IBM defines e-Business as follows: *"A secured, flexible and integrated approach in order to offer various companies values through the combination of systems and procedures and so being able to manage the core business procedures with the simplicity and penetration of Internet technology"* (Amor, 2000).

From a business perspective, the principles of e-Business focus on seamless integration between the customer and the company, between internal and customer-facing systems, and between the company and its suppliers and partners (O'Connell, 2000). In brief, e-Business may offer several advantages such as global accessibility and penetration, tighter relationships, reduced costs, reduced change of the medium or shorter reaction times. E-Business may be regarded as a composite of the entire commerce cycle, from awareness to product research, comparison, selection, supplier sourcing, transactions, fulfilment, and post-sales support. In a physical sense, e-Businesses are brick-and-mortar businesses that are linked online (O'Connell, 2000). Successful e-Business demands that companies collaborate and co-operate as much as it demands the installation of new hardware and software (Richmond, Power and O'Sullivan, 1998).

In 2004, the OECD concisely defines e-Business as *"automated business processes (both intra-and inter-firm) over computer mediated networks"*. This definition makes clear that e-Business is more than e-Commerce (which focuses on commercial transactions between companies and their customers, be it consumers or other companies), as well as that it includes processes both within a company and between companies. The OECD definition implicitly indicates that the main objective and focus of e-Business is in business process automation and integration – and the impacts thereof. In comparison to e-Commerce, Kalakota and Robinson (2000) also see e-Business in a broader scope. According to them, e-Business, in addition to encompassing e-Commerce, includes both front- and back-office applications.

E-Commerce is therefore a subset of e-Business and is the term used to describe Internet-based electronic transactions including EDI, bill payment order processing, electronic funds transfer, video conferencing, electronic forums and bulleting boards, fulfilment, customer interaction, etc. (O'Connell, 2000; Beam, Segev and Shanthikumar, 1996). By most accounts, e-Commerce is a means of conducting transactions that, prior to the evolution of the Internet as a business tool in the mid-1990s, would have been completed in more traditional ways: telephone, mail, facsimile, proprietary electronic data interchange systems, or face-to-face contact (O'Connell, 2000).

Beam et al. (1996) argue that e-Commerce refers to the buying and selling process of product and services, and the transfer of funds, through public or private digital networks. It includes all types of inter-company and intra-company business interactions, transactions and functions such as marketing, advertising, sales, support, recruiting, research & development, administration and corporate communication. E-Commerce can be differentiated into Business-to-Consumer (B2C), Intra-Business and Business-to-Business (B2B) (see Figure 4).

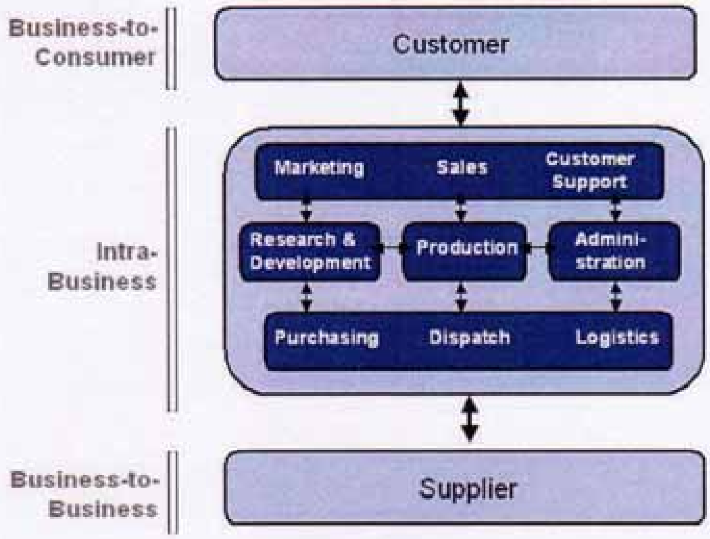

Figure 4: E-Commerce Classification
Source: Roland Berger & Partners, 1999, Success factors in electronic commerce, Frankfurt/Main.

According to Timmers (1999), e-Commerce includes electronic trading of physical goods and of intangibles such as information. This encompasses all the trading steps such as online marketing, ordering, payment, and support for delivery. It includes the electronic provision of services, such as after-sales support or online legal advice, as well as electronic support for collaboration between companies, such as collaborative design (Timmers, 1999). Roland Berger & Partners (1999) have identified six success factors of e-Commerce in Figure 5.

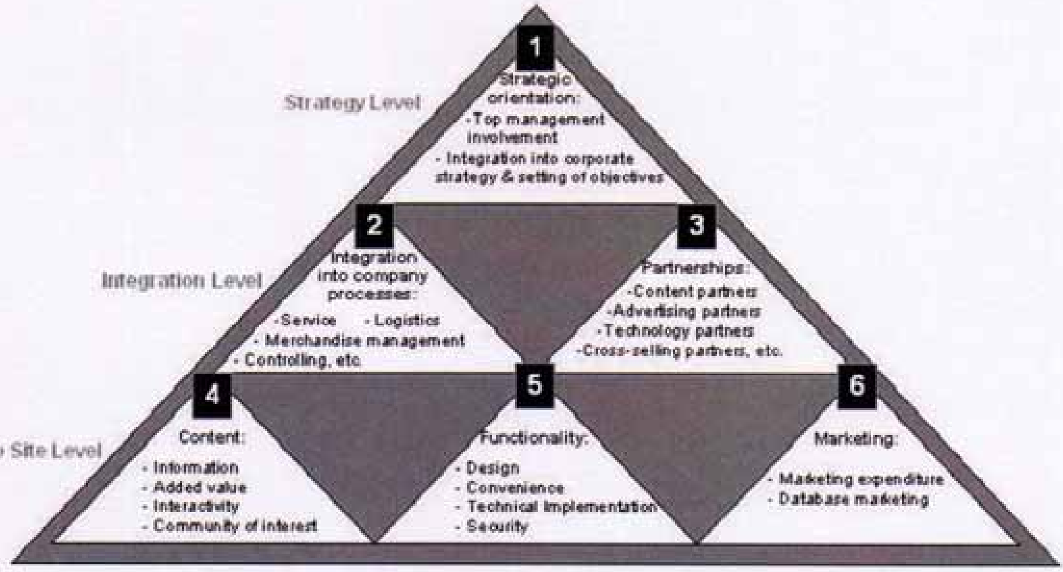

Figure 5: E-Commerce Success Factors
Source: Roland Berger & Partners,1999, Success factors in electronic commerce, Frankfurt/Main.

Early developments in B2B e-Commerce were based on point-to-point data transaction provided by EDI as well as centralised data aggregation provided by services like Sabre as explained in Figure 6. EDI is a B2B e-Commerce system that has been existing in the airline industry for over 20 years, but it has limitations preventing its widespread adoption (e.g. Angeles and Nath, 1998; Chatterfield and Yetton, 2000; Clark and Stoddard, 1996; Mukhopadhyay, Kekre, and Pokerney, 1998; Rasheed and Geiger, 2003).

EDI systems exchange information in standardised formats via computers across private networks without any human interference. EDI systems may facilitate transactions to be electronically recognised, authenticated and validated. EDI systems are in general not appropriate for dynamic procurement environments where many buyers and sellers of an ample array of goods and services are involved, because of the fact that those systems rely heavily on the execution of repetitive and identical transactions.

Mostly businesses with well-defined trading relationships use EDI and enterprise resource planning to create point-to-point interfaces with each other. Such a system is useful for transactions involving replenishment orders for direct production goods tied to a previously negotiated contract. However, it is expensive to implement and therefore it is outside the reach of all but the largest companies. A substantial part of the cost of building that system is the expense of setting up a physical network that allows all of these remote forms to communicate with the focal company and in licensing the software to its suppliers (Sculley et al., 1999). EDI is therefore used by no more than about 50,000 enterprises in Europe and 44,000 in the USA in all sectors. This represents not even 1% of the total number of companies (Timmers, 1999).

	B2B Electronic Commerce Systems		
	EDI	Sabre	Internet
Electronic transactions	Yes	Yes	Yes
Aggregated information	No	Yes	Yes
Speedy installation	No	No	Yes
Low cost access	No	No	Yes
Rich media support	No	No	Yes
Open marketplaces	No	Partial	Yes
Web of marketplaces	No	No	Yes

Figure 6: B2B Electronic Commerce Systems
Source: Roland Berger & Partner GmbH London, 2000, B2B Platforms, Market Report.

Whereas EDI or other closed systems (i.e. application-to-application technology) traditionally favours multinational companies, the low entry costs for Internet based trading systems may allow a variety of companies to communicate electronically with suppliers (i.e. person-to-person and person-to-application interactivity), irrespective of their size. For example, a manufacturer may find it easier to add new suppliers at any time to the Internet network and to have a two-way dialog with the suppliers – which represents a progression in supply chain management (Richmond, Power and O'Sullivan, 1998).

The widespread adoption of intranets, extranets and the acceptance of the Internet as a business platform have created a basis for B2B e-Commerce that offers the possibility for companies to streamline complex processes, lower overall costs and enhance productivity. While B2B e-Commerce solutions often automate or change workflows or supply-chain processes that are essential to a firm's operations, they often require integration with a firm's existing information systems. This process can be complex, time consuming and expensive. Consequently, implementation of a B2B e-Commerce solution represents a non-trivial commitment by the firm, and usually the costs of switching such solutions are high (Timmers, 1999). In brief, there are four main reasons why the Internet has galvanised e-Business in the supply chain: low entry cost; fast return on investment; protection of existing investment because EDI can be integrated with web technologies; and ease of connectivity (Richmond, Power and O'Sullivan, 1998). B2B e-Marketplaces may enable a many-to-many relationship between buyers and suppliers. Buyers and suppliers can leverage economies of scale in their trading relationships and access a more liquid marketplace. Sellers may find buyers for their goods and buyers find suppliers with goods to sell (Raisch, 2001).

The Internet as a medium may enable companies to administrate goods in a more strategic way by providing a communication structure where buyer and supplier can work together more closely without losing control over the costs. Often the introduction of e-Marketplaces does not request much supplementary software and hardware and is therefore a good alternative for EDI that not all companies are willing to afford (Amor, 2000). While e-Marketplaces may have some similarities with CRSs, the fragmentation and complexities of the aviation industry and the still existing paper-based procurement processes may create a need for e-Business solutions such as e-Marketplaces that bring together buyers and sellers of aviation parts and products.[4]

This does not only include spare parts, but also machinery and equipment, maintenance, catering and cabin, as well as many other items and services. The acquisition of these goods and services typically involves considerable co-operation between various departments and human resources within a firm. Quite often the procurement process is not organised in the most efficient and effective way. As the focus of this study is based on the procurement supply chain in the airline industry and its integration with e-Marketplaces, these concepts require a more detailed explanation.

3.3. The Concept of E-Procurement and E-Marketplaces

3.3.1. Definitions

Timmers (1999) defines e-Procurement as "electronic tendering and procurement of goods and services". Telgen (1998) and Roland Berger & Partner (2000) even claim that there is a "revolution through electronic purchasing". Presutti (2003) argues that e-procurement is a technology solution that facilitates corporate buying using the Internet. It has the power to transform the purchasing process in a way that it pervades all of the steps identified. Buyer and seller share information in real-time to build specifications that add value to the resulting product. The resulting improved communication helps to minimise design complexities and avoids building in unnecessary costs into the

[4] see http://www.eyeforaerospace.com/pics/whitepapers/partsbase.doc

specification. This becoming increasingly crucial because of shrinking product life cycles and consequently the competitive advantage that comes from reduced time-to-market (Presutti, 2003). Davila et al. (2003) note that e-Procurement technologies - including e-Procurement software, B2B auctions, B2B market exchanges, and purchasing consortia - are focused on automating workflows, consolidating and leveraging organisational spending power, and identifying new sourcing opportunities through the Internet.

Benefits sought include having a wider choice of suppliers, which is expected to lead to lower cost, better quality, improved delivery, reduced cost of procurement. Electronic negotiation and contracting and possibly collaborative work can further enhance time and cost savings and convenience. For suppliers, benefits may include more tendering opportunities, possibly on a global scale, lower cost of submitting a tender, tendering in parts that may be better suited for smaller enterprises, or collaborative tendering. The main source of income is reduction of cost (Timmers, 1999). Given this background, Table 3 shows a growing potential for procurement over the Internet.

Industry / Year	*1997*		*1999*		*2001*		*2003*	
Aerospace & Defense	864	0.5%	6,553	3.5%	25,633	13.6%	38,205	20.3%
Computing & Electronics	8,729	1.8%	50,379	8.2%	229,108	29.2%	395,302	39.3%
Construction	85	0.0%	1,651	0.1%	6,975	0.4%	28,610	1.4%
Consumer Goods	672	0.1%	2,946	0.3%	12,722	1.1%	51,915	3.8%
Food & Agriculture	50	0.0%	3,029	0.2%	13,019	0.8%	53,648	3.0%
Heavy Industries	12	0.0%	1,319	0.2%	4,678	0.6%	15,811	1.8%
Industrial Equipment & Supplies	88	0.0%	1,266	0.1%	4,520	0.4%	15,699	1.2%
Motor Vehicles	1,464	0.2%	9,254	0.9%	53,219	4.3%	212,925	14.7%
Paper Products & Office Equipment	561	0.1%	2,859	0.3%	14,269	1.4%	65,192	5.6%
Petrochemicals	2,087	0.2%	10,327	1.0%	48,001	4.0%	178,311	13.5%
Pharmaceutical & Medical Equipment	234	0.1%	1,431	0.3%	8,514	1.7%	44,117	7.8%
Shipping, Warehousing	505	0.2%	2,887	0.9%	15,408	4.5%	61,552	17.2%
Utilities	3,221	0.7%	15,406	2.9%	62,896	10.6%	169,545	25.8%
TOTAL	18,570	0.2%	109,308	1.0%	498,962	4.0%	1,330,831	9.4%

Note: Dollar figures in million: percentage of industry trade

Table 3: Inter-Company Trade of Hard Goods over the Internet (U.S. B2B Sales)
Source: O'Connell, B., 2002, B2B.com – Cashing-in on the Business-to-Business E-Commerce Bonanza, Adams Media Corporation, Holbrook.

Essig and Kärner (2001) explain that formulating an e-Procurement strategy typically requires several steps. First, purchasing should define its strategic goals, based on the focal company's overall long-term vision. Next would be an analysis of the environment's chances and risks, the company's sourcing capabilities, and its strengths and weaknesses concerning e-Commerce. Once these activities were performed, an e-Procurement strategy can be formulated, approved, and executed. Goods and services purchased electronically should be selected carefully during the chances/risks and strengths/weaknesses phase. An important role for the selection is the degree of digitalisation regarding products as well as processes and transaction partners (see Figure 7) (Essig and Kärner, 2001).

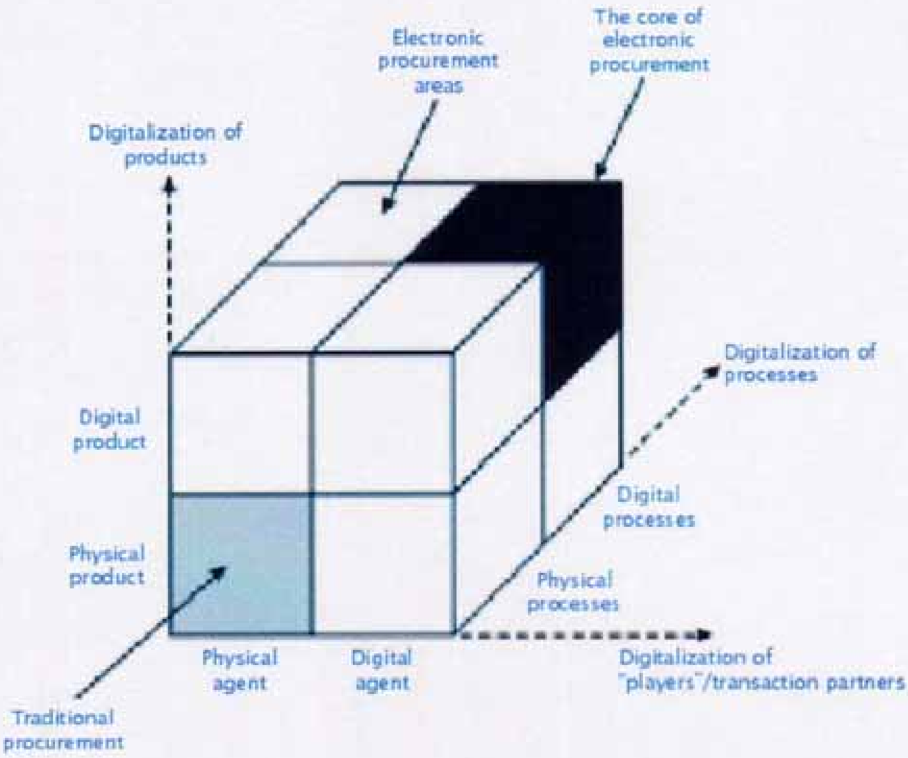

Figure 7: The E-Procurement Cube

Source: Essig and Kärner, 2001, Buyer-Driven Electronic Marketplaces: Developing Business Models for an Integrated E-Procurement Strategy, PRACTIX, CAPS Research, 5.

This thesis covers e-Procurement from an e-Marketplace point of departure. For example, buy-side e-Procurement systems may also include browser-based self-service front ends to ERP and legacy purchasing systems. Corporate procurement may aggregate a diversity of supplier catalogues into a single universal catalogue and enable end-user requisitioning from the desktop, facilitating standard procurement for the organisation and cutting down on maverick purchasing. Purchases that are made through this system can be linked to the back-office ERP or accounting system in order to e.g. decrease operating costs from the transactions or avoid potential bookkeeping errors. Buying organisations may be required to set up and maintain catalogues for each of their suppliers, which is very costly and technically demanding for most medium- and small-sized businesses.

E-Marketplaces can be designed to support e-Procurement processes, as they are based on web-based ICT and a high level of digitalisation. For example, they can help reduce the cost of gathering purchasing information through quickly identifying trading partners and market pricing. The automation and management of procurement operations by e-Marketplaces may enable cost savings in major areas: For example, procurement-related operating costs can be reduced through automation of manual procurement and accounts payable processes. Increased purchasing control may reduce spending by routing transactions to approved suppliers with negotiated volume discounts. Inventory and associated holding costs can be reduced through the integration of strategic suppliers into internal planning, manufacturing and distribution processes. External spending with suppliers may be decreased through strategic sourcing and the consolidation of buyer power across departments or even across enterprises for better pricing and terms. The ubiquity and ease of use of the Internet means that increasingly inexpensive computing power and telecommunications are the weapons that allow Internet-based trading networks to challenge traditional procurement mechanisms (Sculley et al., 1999). The creation of e-Marketplaces may offer a wide range of opportunities, such as automated transactions, expanded offerings to buyers as well as reduced transaction costs.

E-Marketplaces have evolved from IOS (Reimer, 1996). However, a number of fundamental differences exist between IOS and e-Marketplaces. IOS are defined as information and communication, technology-based systems that extend beyond an organisation's legal boundaries and link otherwise independent organisations together (Cash and Konsynski, 1985). In an IOS information processing is the only phase conducted electronically as interaction exists predominantly between application to application. In an e-Marketplace, all interaction phases are conducted electronically (O'Reilly and Finnegan, 2002).

3.3.2. E-Marketplace Evolution and Characteristics

The origins of e-Marketplaces in Europe date back to 1996, when British Telecom became one of the first organisations to establish a Private Digital Exchange (PDE) called BT Trading Places. However, it was soon recognised that it was too early on in the evolution of e-Business for the e-Marketplace concept to work with success and so the BT's PDE was withdrawn. By 1998, the concept of e-Marketplaces was becoming more widely accepted and, indeed, in 2001, BT decided to re-launch BT Trading Places as a fully fledged, true e-Marketplace. However, it wasn't until the latter half of 1999 that there was a worldwide rapid growth in the number of e-Marketplaces being developed (Nathan, 2001).

In their early evolutionary stages they were meant to present a new business models initially focusing on the matchmaking of buyers and sellers including the support of customers, products and services. The promise of revenues generated through the use of e-Marketplaces has fuelled significant investment from the public and private capital markets. B2B e-Marketplaces can offer participants transaction facilitation in terms of e.g. catalogues, auctions, exchanges, communities, etc. It may also provide industry news, or value-added services such as fulfilment, settlement, and quality assurance to name just a few. For example, e-Marketplaces may help aggregate purchasing power by establishing a compelling environment that draws in new members or by providing a rich array of means for members to connect with each other (Hagel and Armstrong, 1997).

As an Internet-based service, e-Marketplaces link supply and demand. According to Essig and Kärner (2001), four major business fields can be distinguished for e-Marketplaces. "*Connection*" concentrates on the physical and information-oriented possibility to exchange information. "*Context*" business deals with classifying and systematising information. The "*commerce*" model concentrates on enabling and supporting business transactions, by building up the commercial frame. Last but not least, "*content*" is the major element of an e-Marketplace. It includes all information necessary for the buying decision, such as catalogues or supplier data (Essig and Kärner, 2001).

E-Marketplaces have been in the public focus since 1999 with the commercialisation of B2B e-Commerce (Koch, 2002). However, this concept was already discussed in academic literature as electronic markets years before (e.g. Bakos, 1991; Malone, Yates and Benjamin, 1987). The first work on B2B e-Marketplaces was driven by the recognition that advances in technology would allow multiple buyers and sellers to link together via electronic communication networks. Research in the early stages included the description on how B2B e-Marketplaces function, their impacts and anticipated benefits.

Work in this area began when Malone et al. (1987) predicted that with the presence of electronic communication technologies, electronic markets would become the favoured mechanism for co-ordinating material and information flows among organisations. This phenomenon is known as the electronic markets hypothesis, which speculates that electronic markets will lower communication costs, enable electronic aggregation of demand and supply, and enhance a firm's ability to more closely co-ordinate their economic activity. Equally, Bakos (1991) points out that increased communication is likely to reduce sellers' profits and increase buyer welfare. The electronic brokerage effect states that electronic communication technologies can enable the establishment of technologically capable intermediaries, which can replace traditional middlemen and reduce transaction costs (Koch, 2002). Within this stream, academic research proposes that electronic markets will reduce the extent of usage of brokers by buyers (Choudhury et al., 1998).

In a later stage, Bakos (1998) researched the functions of electronic markets as matching buyers and sellers, facilitating transactions, providing institutional infrastructure, aggregating product information, price discovery, and providing procurement and industry specific expertise (Koch, 2002). In academic literature, benefits of B2B e-Marketplaces have been often described with regard to products, price, and transaction costs (e.g. Bakos, 1998). In terms of products, e-Marketplaces allow increased personalisation and customisation of product offerings. They further allow aggregation and dis-aggregation of information based product components and they can lower the search costs (e.g. for buyers trying to shop for products) as well as the communication costs (e.g. for sellers trying to communicate information about their products).

B2B e-Marketplaces may also change the microstructure of markets as they allow buyers to make offers and electronically negotiate prices. Since electronic markets have the ability to track information on customers via data warehousing and data mining, they facilitate customised pricing. They may further facilitate increased information sharing and communication between buyers and sellers as they enable price discrimination, thereby reducing the cost of executing orders, which may include decreased costs in logistics, transportation, distribution, inventory and payment systems (Koch, 2002).

A Boston Consulting Group report (2001) outlines sources of value creation for B2B e-Marketplace exchanges, which are aggregation, process automation, transparency/auctions, lower marketing and sales costs, lower transaction costs, lower inventory costs, lower cycle time and improved asset utilisation. Furthermore, sources of value creation were divided into value shift activities and value creation activities.

Other research posits however that the introduction of electronic brokerage systems may transform direct search markets into brokered markets (Lee and Clark, 1996a). The electronic integration effect predicts that electronic communication technology will enable suppliers and buyers to use ICT to create joint processes (Koch, 2002). Due to these processes, electronic markets may become more like electronic hierarchies. Since electronic communication technology enables sharing databases and integrating physical and electronic processes, their implementation will be customised to the buyer-supplier relationship (physical, human, and time). This increased integration will lead to hierarchical rather than market relationships (Malone, Yates and Benjamin, 1987). According to Bailey and Brynjolfsson (1993), electronic markets may decrease the number of suppliers. Information technology increases the importance of non-contractible investments by suppliers (e.g. quality, responsiveness, innovation). When these investments become important, companies will employ fewer suppliers.

Meanwhile, empirical evidence suggests that neither the predictions of the "move-to-the-market" (Malone et al., 1987) nor of the "move-to-the-middle" hypothesis (Clemons et al., 1993) has been fulfilled. Rather most companies organise their external relationships and transactions in various "mixed mode operations" ranging from arm's length to almost hierarchical arrangements (Holland and Lockett, 1997).

Further research has been undertaken using mathematical modelling to show that reduced search costs in a differentiated market with heterogeneous buyer tastes and seller product offerings impact market equilibrium, resulting in increased efficiency, possibly lower prices, and increased seller competition (Bakos, 1997; Koch, 2002). Electronic markets can lower prices in commodity markets and in markets with differentiated products if the system supports selection with price information. Equally electronic markets can lower the inventory levels maintained by buyers (Choudhury et al., 1998). However, Tumolo (2001) states that there is the danger that e-Marketplace-enabled procurement may get poor product performance, especially when buying critical parts or components.

All in all, recent academic work has mainly included the emergence of B2B e-Marketplaces in view of their potential benefits (e.g. Barrat and Rosdahl, 2001; Brunn, Jensen and Skovgaard, 2002; Hempel and Kwong, 2001; Holzmüller and Schlüchter, 2002; Ordanini and Pol, 2001; Pavlou, 2002; Wang, Wang and Tai, 2002). Klueber et al. (2000) believe however that it is essential to research the entire value chain in order to evaluate e-Marketplaces. This also includes the adoption process of e-Marketplaces at the firm level.

3.4. Adoption and Diffusion Models of E-Marketplaces

3.4.1. Introduction and Value Creation

Adoption studies include analysis of the decision to e-Marketplace implementation and implementation challenges (Koch, 2002). Malone et al. (1987) investigated the different motives of buyers and suppliers for getting involved in electronic markets. Suppliers typically join e-Marketplaces to generate a differentiation from competitors, while purchasing organisations try to increase their number of alternative suppliers and improve their ability to compare alternatives. Choudhury et al. (1998) investigated that buyers mainly use e-Marketplaces for the purchase of products that are low in asset specificity and complexity of description. Moreover, Dai and Kauffman (2000) explored the motivations for buyers for e-Marketplace participation. According to them, the buyer's decision whether or not to use an electronic marketplace for procurement is a function of: desired gains from potential lower search costs and operation costs, the importance of information sharing between suppliers, the level of competition in the supplier market and the desired levels of supplier relationship specific investments.

Senn (1996) posits that organisations will participate in electronic markets because of opportunities to create a product, deliver a service, or get in touch with potential customers. Booz Allen & Hamilton (2001) argue that the emergence of B2B e-Marketplaces may e.g. increase market and value chain transparency, automate transactions along the value chain, and disintermediate steps in the value chain (described in Figure 8). Disintermediation refers to bypassing of traditional retail channels for direct selling by web-based companies (O'Connell, 2000).

	Scale and Spend Aggregation	Market and Value Chain Transparency	Transaction Automation	Disintermediation
Definition	Bundling of purchasing volume to benefit from economies of scale in: - Sourcing - Logistics - Supply Chain Management	Creating visibility along and between previously disconnected value chains	Facilitation and streamlining of existing transaction processes	Use of e-Marketplace to eliminate elements of the existing value chain
Benefits	- Increased leverage in negotiations - Lower material costs - Lower transaction costs	- Increased market efficiency resulting in better supplier-buyer matches - Access to new markets	- Transaction cost reduction - Reduced inventories	- Reduction of sales and procurement costs for involved parties - Increased speed and quality

Figure 8: Value Creation of E-Marketplaces
Source: Booz Allen & Hamilton, 2001, The e-Marketplace Revolution: Creating and Capturing the Value in B2B e-Commerce.

The benefits of e-Marketplace operations are potentially more substantial in industries which are fragmented, susceptible to demand shocks and lacking a streamlined distribution infrastructure. According to O'Connell (2000), benefits are more likely to flow when products are relatively standardised, traded in high volumes and low values and perishable (Nathan, 2001). This may impact the e-Marketplace implementation level within an industry sector. Sculley et al. (1999) argue that the lower Internet cost of getting connected, irrespective of geographical distance, enables fragmented buyers and sellers to find each other (global reach) and that automated trading and anonymity can eliminate many market inefficiencies. Centralised markets generate trading and pricing information (Sculley et al., 1999).

B2B e-Marketplaces may provide information and capabilities to drive decisions across the entire purchasing process (McKinsey, 2000). E-Marketplaces may increase market transparency and contribute to a further integration of separate geographic markets; further they may provide access to wider geographic markets and offer the possibility of more customers. In addition, e-Marketplaces may allow a reduction in transaction costs and an improvement of inventory management. Therefore, benefits from B2B e-Marketplaces may stem from lasting improvements in supply chain cost drivers, driven by increased information and functionality. Early adopters can exploit information benefits of B2B e-Marketplaces to capture revenue opportunities and to reduce invoice and other operating costs within their organisations. However, adopting B2B e-Marketplaces may require a significant time investment in terms of acquiring/ building capabilities, implementing new technologies and changing one's organisation according to the learning curve. Early involvement also allows participants to "set the rules" for the B2B e-Marketplace, rather than inheriting established rules. Figure 9 also highlights potential opportunities for firms that adopt e-Marketplaces at an early stage.

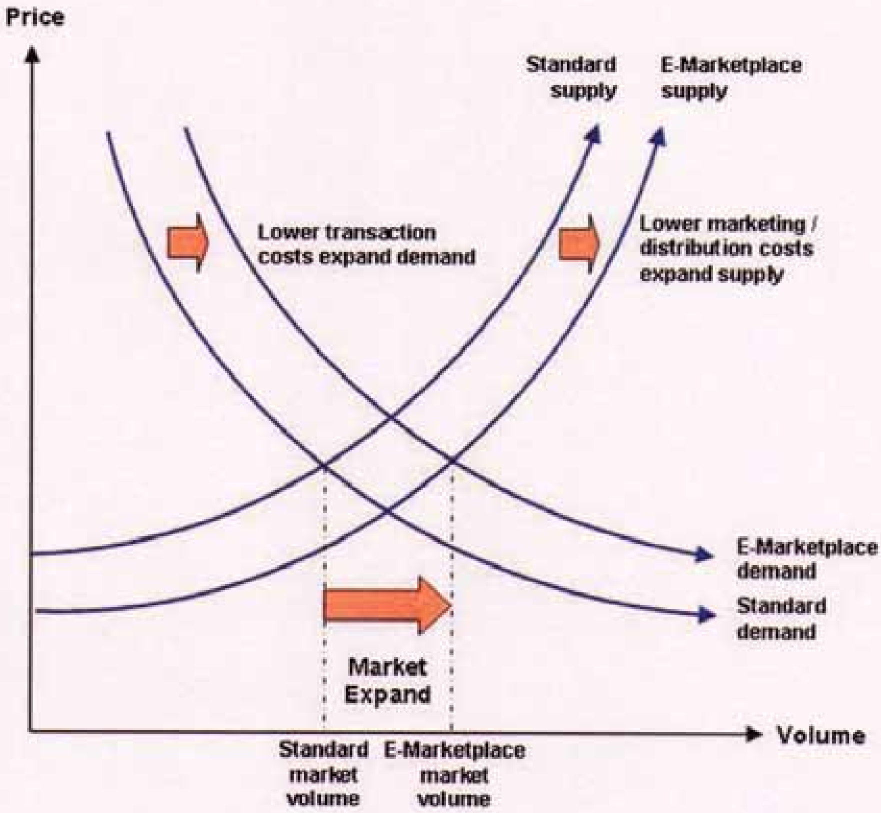

Figure 9: Market Expansion in an e-Marketplace
Source: Hagel and Armstrong, 1997, Net Gain – Expanding markets through virtual communities, Harvard Business School Press, Boston, Massachusetts.

E-Marketplaces can have significant competitive effects. Nevertheless, the quantification of presented benefits is currently difficult and many claims as to their size are comprised of qualitative judgements and estimates (Nathan, 2001). Clearly, more research is required. According to McKinsey (2000), more than half of B2B e-Marketplaces focus on providing only short-term value to participants. Therefore, organisations have been very reluctant in implementing a B2B e-Marketplace and a strong consolidation among e-Marketplaces took place. Firms became more rigorous in their assessment of potential e-Business models. Nevertheless, in contrast to the public perception, e-Marketplaces have gained momentum (B2B Expert Group, 2003).

3.4.2. Implementation Challenges

Several authors (e.g. Lee and Clark, 1996a; Memishi, 2001; Tumolo, 2001) have discussed electronic market implementation challenges. These include e.g. revenue schemes, attaining critical mass, guaranteeing promises, and integration with existing company systems. Lawrence (1997) defined three categories of barriers. These she termed company, personal and industry barriers. Company barriers, found by Lawrence, included low level of technology use within the business, limited financial and technical resources available, organisational resistance to change and lack of perceived return on investment. Barriers categorised as personal included lack of information, management preferring conventional approaches to business practice and inability to see the adoption advantages. Industry barriers included some respondents believing that the industry, as a whole was not ready for e-Business technology.

These barriers also led to a significant concentration and consolidation process of e-Marketplaces. The following figure highlights the rise and fall of e-Marketplaces over a 4 year period. Thus, starting in 1999, and accelerating rapidly through 2000, the focus of B2B attention was very firmly on those e-Marketplace initiatives that seemed to be capable of exploiting information and communication technology to alter the balance of power in trading relationships, developing interaction strategies and examining procurement processes (Geppert, 2001). Harrington (2001) reports that, while over 1,600 B2B e-Marketplaces had been launched or announced by the beginning of 2001 in all industry sectors, by May of 2001 over 400 e-Marketplaces had terminated their operations and many e-Marketplaces never materialised. Similarly, a study from Wharton School revealed that of 1,500 B2B e-Marketplaces in 2000, only 700 still existed in 2002 (Thong, 2005).

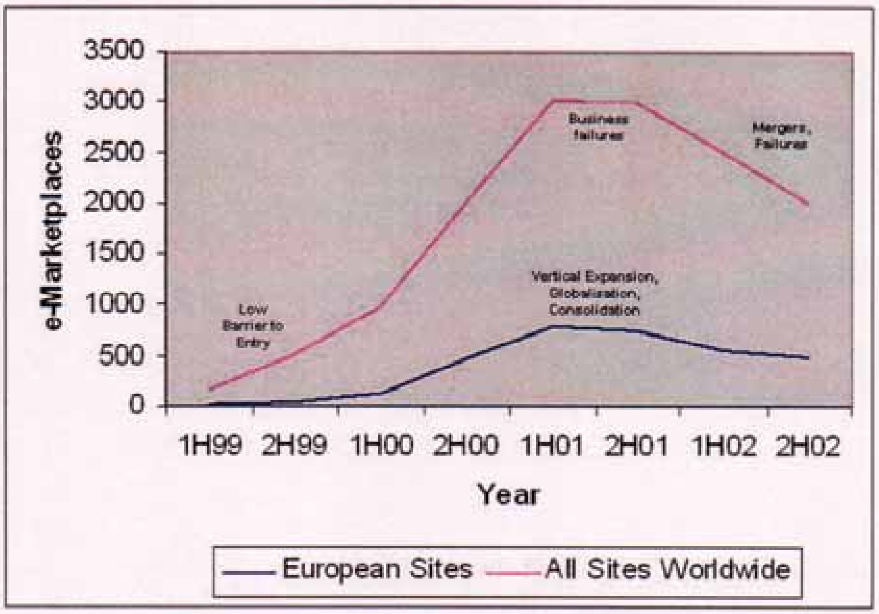

Figure 10: E-Marketplace Consolidation
Source: Geppert, L., 2001, E-Marketplaces: New models, http://www.deeds-ist.org/Downloaddocs/GL-Paper.pdf

Hsiao (2003) notes that the organisational barriers for e-Marketplace adoption include, for example, perceived ease of use, perceived benefits, lack of training, resistance to change, management commitment, and intention to use in order to predict the possibility of ICT rejection (e.g. Iacovou et al., 1995; Premkumar and Ramamurthy, 1995). Kendall et al. (2001), in an e-Commerce survey of Singapore, also explain the importance of users' perceived receptivity of technological features. Furthermore, failed adoption often resulted from the integration of inter-firm business processes, because most companies have unique processes for managing their supply chains that may not be fully compatible with the processes of their partner companies (Lee and Clark, 1996a).

A Boston Consulting group report (2001) cited that e-Marketplaces depending on transaction fees or commerce services for revenue will not survive. Revenue generating services would come from collaboration activities support. Lee and Clark (1996a) posited the need for product rating standards and a trusted third party for product evaluation. Memishi (2001) cited a lack of uniform data description standards explaining that most organisations will want to participate in multiple exchanges and the different ways of describing products must be standardised. B2B e-Marketplaces also need to determine how to seamlessly integrate transactions made over the exchange with the organisation's existing information systems (Tumolo, 2001).

E-Marketplace research also examined usage patterns. However, there is a lack of research covering usage patterns and evaluation where organisations measure the impact of their electronic market because many organisations are still trying to implement their e-Marketplaces (Koch, 2002). Memishi (2001) reported that the general consensus is that it is going to take several years to resolve implementation issues associated with e-Marketplaces. The explosion of attempts to form B2B e-Marketplace and the recent large failure rate of these attempts raise questions about when and why e-Marketplace formation succeeds (Nickerson and Owan, 2002). Moreover, industry observers reported that in 2001 only about 100 B2B e-Marketplaces handled any genuine transactions (Cronin, 2001). Such a large and rapid failure rate raises questions to investigate about when B2B-based exchanges create value and who captures it (see Borenstein and Saloner, 2001; Kauffman and Walden, 2001).

As outlined in previous sections, B2B e-Marketplaces can create value by reducing search costs and increasing the average number of bidders, which facilitates buyers capturing more value than is created by the B2B exchange because it reduces supplier profit margins. However, the widespread failure of B2B e-Marketplace formation efforts indicates that supplier participation is not assured and thus should not be assumed. Indeed, without sufficient supplier incentives to participate, attempts to form a B2B e-Marketplace will fail. Thus, supplier participation must be central to a theory of B2B e-Marketplace formation (Nickerson and Owan, 2002). Network externalities create an early mover advantage (Katz and Shapiro, 1985) because early movers enjoy the opportunity to build a larger installed base.

3.4.3.E-Marketplace Adoption Factors

The motivation for e-Marketplace participation for suppliers as well as buyers is closely linked to the perceived outcome of participation and not only in terms of the benefits of joining an e-Marketplace, but also in terms of possible consequences of not joining (Rask and Kragh, 2004). Hence, the central issue is why organisations decide to buy and/or sell goods or services on e-Marketplaces. Buyers use e-Marketplaces to find new and alternative suppliers and even though many suppliers initially decide to participate in e-Marketplaces because they are asked to do so by existing customers, they also use e-Marketplaces to look for new customers. When expressing their motives for engaging in e-Marketplace activities, buyers tend to be pro-active and planning oriented, whereas suppliers are driven by external forces (Rask and Kragh, 2004).

E-Marketplaces are a complex innovation that involves several actors, functions, and levels of organisations. The theory of adoption and diffusion of technology innovations provides the best explanatory factors for understanding the spread of e-Marketplace.

A number of factors including the number of potential buyers / suppliers or supplier heterogeneity in production costs and entry costs influence the optimal connection fees and critical mass achieved by e-Marketplaces. Entry cost heterogeneity, as well as production cost heterogeneity, is likely to be related to technological conditions among the suppliers like the rate of technological advance or the diversity of alternative technologies because technology may vary in the time and cost needed to evaluate the manufacturability of procured products. Heterogeneity also may be related to the age of the supplier industry because a wide range of alternative but competing technologies is usually present in young industries. Yet another source of heterogeneity in suppliers' entry costs is geographic dispersion. Broad geographic dispersion implies that some suppliers may have high communications costs and hence high entry costs. Moreover, the more dispersed suppliers are the more likely it is that some have high entry costs because of language difficulties. Without shared information about the value of products to the buyers and about the supplier cost distribution, an e-Marketplace will not be able to determine the optimal subsidy and thus is doomed to failure (Nickerson and Owan, 2002).

A significant value of an e-Marketplace to its members hinges on their ability to connect with others and on aggregating a critical mass of members of interest to relevant advertisers and suppliers. In the example of the Sabre reservation system in the travel industry, as more and more airlines and travel agents become involved in Sabre, the benefits to existing partners increase through greater opportunities to buy or sell products in a greater market and share industry information among interested partners (Christiaanse and Venkatraman, 2002).

Further to that, Tumolo (2001) cited critical mass as a hurdle for organisations trying to implement B2B e-Marketplaces. Lee and Clark (1996a) explain that firms adversely affected by electronic markets are expected to resist implementing the system and thus prevent achievement of critical mass. The guarantee that products purchased over the exchange will be the right product delivered at the right time is also an implementation challenge for e-Marketplaces.

A critical mass of members unleashes a series of other opportunities, e.g. the opportunity to aggregate usage profiles of members. A critical mass of usage profiles is essential for driving the member profile dynamics, with its reinforcing effects on advertising and transaction activity. Usage profiles help to draw the commercial participants into the e-Marketplace and the resulting increase in advertising and transaction activity not only helps to enrich the usage profiles but also starts to generate member transaction profiles. E-Marketplace can then learn which members are online purchasers and how they are segmented in terms of the kinds of products and services they buy. Hagel and Armstrong (1997) argue that this information in turn helps to accumulate the information necessary to build up a critical mass of transactions occurring within the e-Marketplace (see Figure 11).

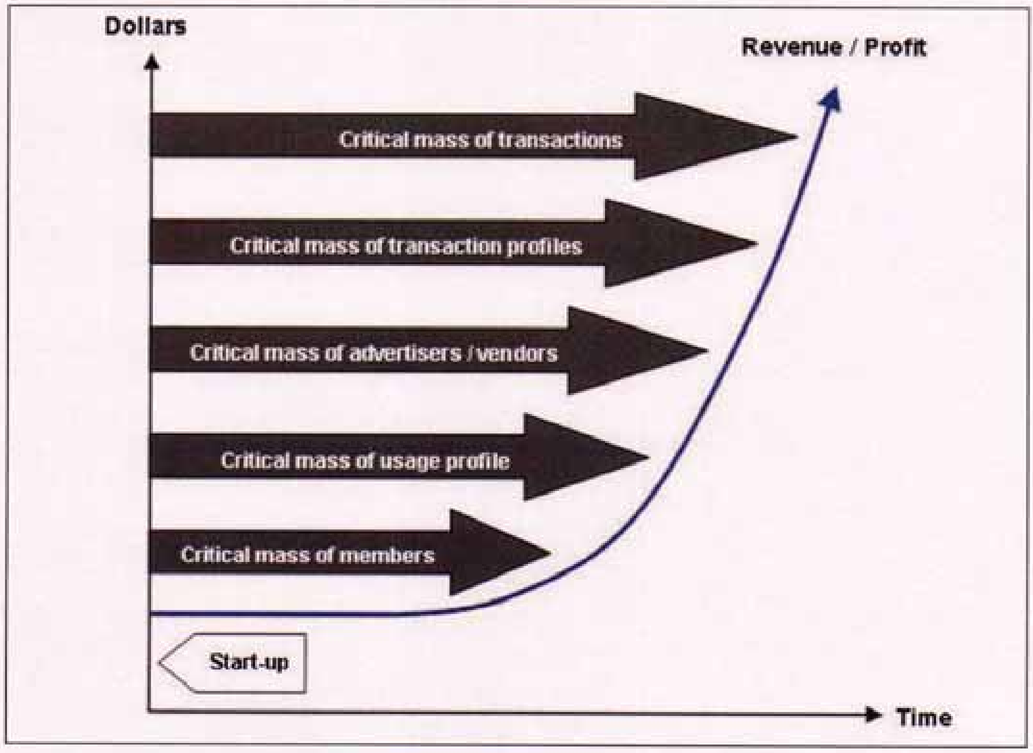

Figure 11: Critical Mass for E-Marketplaces
Source: Hagel and Armstrong, 1997, Net Gain – Expanding markets through virtual communities, Harvard Business School Press, Boston, Massachusetts.

For example, consortia-operated marketplaces can offer a positional advantage since companies share the ownership while also being active participants in the market, thus assuring reasonable transaction volume. The value of being part of a large network of firms offers direct and indirect network externality effects (Katz and Shapiro, 1985).

To date, the majority of the research on overall IOS adoption (e.g. Cragg and King, 1993; Iacovou et al, 1995) has tended to focus on the technical or organisational factors underpinning adoption. For example, Teo et al. (1995) investigate factors affecting an organisation's EDI adoption intention using a survey. Factors investigated come from innovation diffusion theory and include relative advantage, compatibility, complexity, observability, trialability, and risk (operational and strategic). The authors find present adoption intention dependent on complexity, operational risk, and strategic risk. Low complexity, low operational risk, and low strategic risk are associated with high present adoption intention. Future adoption intention is contingent upon complexity, observability, and strategic risk.

3.4.4. Variables Covered in Current E-Marketplace Adoption Models

ICT adoption research often refers to the DOI model (Rogers, 1995) and IOE framework (Tornatzky and Fleischer, 1990), while other socio-technical models such as TAM, TPB, UTAUT or structuration theory are less employed. Reasons may include that, although there is plenty of evidence for significant relations between behavioural beliefs and attitudes toward the behaviour, between normative beliefs and subjective norms, and between control beliefs and perceptions of behavioural control, the exact form of these relations is still uncertain. For example, the interpretation of organisational change in the structuration model is difficult to evaluate empirically. Giddens (1994) has stated in several of his works that, *"... structuration is not intended as a concrete research programme and that the principles are essentially procedural and do not supply concepts useful for the actual prosecution of research"* (Jones, 1999). This approach, despite providing deeper understanding, contributes in a limited way to cumulative knowledge development. Kurnia and Johnston (2000) recognise this limitation which they term *"reduced ability to make general statements"*. However, from an institutional perspective, e-Marketplaces were quite extensively analysed by e.g. Bakos (1998), Clark and Lee (1999), Kambil and van Heck (2002). A main function of electronic Marketplaces is the provision of an institutional infrastructure (Bakos, 1998). The marketplace institution aims at facilitating and safeguarding the efficient execution of market transactions (Clark and Lee, 1999).

A study analysing B2B e-Marketplace participation incentives (Fath and Sarvary, 2001) uses a dynamic model in which entry and exit depends on the relative surplus enjoyed by both buyers and suppliers. With no switching cost, they identify two stable equilibria: low participation and high participation; and a set of unstable equilibria in which any deviation from the set evolves to one of the two stable equilibria. Nickerson and Owan (2002) developed a general theory of e-Marketplace formation in that it endogenises both the participation in the B2B e-Marketplace and the participation in individual auctions within and outside the exchange.

Grewal et al. (2001) use the previously discussed transaction cost theory and institutional theory to investigate e-Marketplace participation of firms. In their investigation, they classify firm participation into exploration, expert, and passive states. Exploration firm participation involves firms learning how to do business in the marketplace. Expert firm participation involves firms believing they have successfully reengineered their business processes to function effectively in the electronic market. In this state, firms have substantial knowledge about their e-Marketplaces and procedural knowledge of doing business in the market. In the passive state, firms carry out virtually no business on the electronic market, but continue to maintain a market presence. Grewal et al. (2001) explored that e-Marketplace participation depends on organisational motivation and ability. Achieving the expert state requires firms to emphasise efficiency, emphasise information technology capabilities, and de-emphasise legitimacy motives. The authors conceptualise legitimacy motivations as firms entering the e-Marketplace to jump on the bandwagon, mimic others, and/or establish an image of being technologically proficient (see Koch, 2003). Grewal et al. (2001) link e-Marketplace adoption to efficiency motivations. However, Grewal et al. (2001) investigated only one type of electronic market in a single industry, therefore their results may have limited generalisability.

Critical success factors for e-Marketplaces identified in both the business and academic literature are critical mass or liquidity (Brunn et al., 2002), strategic partnering in B2B marketplaces (Lenz et al., 2002), identification and recruitment of experts or key players who will motivate others to join (Grewal et al., 2001), provision of value-added services, provision of revenue streams, trust and privacy.

While e-Marketplaces are analysed in more detail from an institutional perspective, studies from an DOI perspective (Rogers, 1995) and IOE viewpoint (Tornatzky and Fleischer, 1990) are rather rare (e.g. Hadaya, 2004; Koch, 2003; Lee and Clark, 1996b; Joo and Kim, 2004). This is surprising, as there is a wide body of knowledge about adoption drivers for EDI and B2B e-Commerce. In fact, the grouping of explanatory variables into three clusters, the environmental, the organisational, and the technological is a familiar and accepted model in adoption and diffusion literature in IOS.

For example, Ranganathan et al. (2001) use a literature review, interviews, and a survey to develop a list of forty-six B2B application deployment facilitators and inhibitors. The authors measure B2B application deployment as the extent the following goals are fulfilled: improved customer service, better inventory control, lower marketing and distribution costs, reduced cycle time, better supplier relationships, increased competitive advantage, and reduced operation costs. The authors find the following factors facilitate B2B application deployment: top management support, organisational change, strategy-related project management, valuation, internal information technology environment, collaboration, external information technology environment, and external business environment.

Koch (2003) categorised variables significantly influencing adoption and diffusion of EDI, B2B e-Commerce and e-Marketplaces within the IOE framework. In Table 4, the identified adoption drivers for EDI and B2B e-Commerce are shown according to Koch (2003), while the e-Marketplace adoption drivers were further complemented by the author's literature review.

Independent Variable	Category	No. of Studies Focusing on		
		EDI	B2B E-Commerce	B2B E-Marketplaces
Collaboration	Environmental	1	1	
Uncertainty	Environmental	1	2	1
External expertise utilisation	Environmental	1	1	1
External pressure	Environmental	10		1
Implementation support	Environmental	4	1	
Nature of suppliers and customers	Environmental	1		
Timing of project start up	Environmental		1	
Trade organisation support	Environmental	1		
Trust	Environmental	1	1	
User involvement	Environmental		1	
Valuation	Environmental		1	
Need (perceived)	Organisational	1		
Readiness	Organisational	1	1	
Technology awareness	Organisational	1	1	
Adoption decision (proactive)	Organisational	1		
Culture supporting innovation	Organisational	1	1	
Duration of project (longer)	Organisational	1		
Evaluation procedures	Organisational	1		
Firm size	Organisational	2		2
Goals, strategy, and vision (consistent and clear)	Organisational	1	3	
Information systems staff skill	Organisational		1	
Innovativeness	Organisational		1	
Integration into core business activities	Organisational	1	1	
Leadership	Organisational		1	
Management of project	Organisational		2	
Managerial thinking (creative)	Organisational		1	
Marketing and promotion	Organisational		1	
Organisational change	Organisational		1	1
Resource intensity	Organisational	1		
Risk	Organisational	2		1
Team composition	Organisational		1	
Top management support	Organisational	5	3	
Data security	Technological		1	
Observability	Technological	1		
Relative advantage (incl. perceived)	Technological	9	2	3
Technology (compatibility)	Technological	2		
Technology (convenience)	Technological		1	
Technology (cost)	Technological	2		
Technology (current, infrastructure)	Technological	2	3	
Technology (ease of use)	Technological		1	
Technology (satisfaction)	Technological		1	
Technology (social disturbance)	Technological		1	
Technology (stability)	Technological		1	
Technology performance	Technological		1	

Table 4: Categorisation and Frequency of Significant Independent Variables by Study Type and Technology Type

Source: Modified from Koch, A., 2003, Business-to-Business Electronic Marketplaces: Membership and Use Drivers, PhD Thesis, Texas University, and Complemented

The table demonstrates that there are only few studies that research e-Marketplace adoption drivers from a DOI and IOE perspective. For example, Lee and Clark (1996b) use four B2B e-Marketplace case studies and throughput growth rate to measure adoption. They find increased efficiency and effectiveness in information gathering, contract formation, and trade settlement drive B2B e-Marketplace adoption. Lee and Clark (1996b) identify the following adoption barriers: uncertainty describing electronic products; risk doing business in a new way that may not attract a critical mass of buyers and sellers; and change resistance associated with replacing large investments in existing infrastructure.

Koch (2003) was able to identify that different organisations achieve different B2B e-Marketplace use levels and propose several factors affecting an organisation's e-Marketplace use. This is based on interviews, participant observations, and external data from buyers and sellers participating in three B2B e-Marketplaces. Koch (2003) posits that perceived relative advantage drives e-Marketplace membership. If the e-Marketplace offers a relative advantage that is currently realisable to "in-power" organisations, these organisations will become members and then encourage their business partners to join. An environment change is also a motivating driver of e-Marketplace membership. An environment change facilitates membership if organisations view marketplace membership as a means of dealing with the environment. Some organisations participate in B2B e-Marketplaces because their competitors are and they feel they have to participate to remain competitive. Koch (2003) recommended that further survey research investigating the adoption factors would be beneficial.

Joo and Kim (2004) found that external pressure and organisational size have positive relationships with organisational adoption of e-Marketplaces. Hadaya (2004) also examined e-Marketplace adoption factors and found that pressure exercised by consultants and other experts is by far the most significant variable. They seem to play the role of opinion leaders and change agents by providing information and advice about the innovation to firms, inciting them to adopt his new type of electronic platform, also providing them technical support during the implementation process. Complexity of sophisticated e-Commerce implementations is negatively and significantly related to the future level of use of e-Marketplaces. A firm's past experience in e-Commerce ultimately affects its future strategy. The level of dependence towards key suppliers and the level of collaboration with key suppliers combined with the fact that the variable 'procurement realised by e-Commerce' is significant in Hadaya's research, seem to indicate that firms will use e-Marketplaces to transact, to optimise the coordination of their activities and to collaborate with key suppliers in order to strengthen their ties with the latter. Hadaya (2004) further notes that the variable pressure exercised by competitors is negatively and significantly related to the future level of use of e-Marketplaces. This result is explained in such a way that more and more firms that are not threatened by the e-Commerce strategy of their competitors are willing to join the same e-Marketplace with them, or still develop one in partnership with them. The size of the firm strongly influences the future level of use of e-Marketplaces.

Overall, B2B e-Marketplace adoption and diffusion investigations were found to be rare, particularly from a DOI and IOE perspective. The field can benefit from further investigations in this area, as these frameworks are widely spread in prior technology diffusion studies and have proven to be effective. The frameworks are particularly beneficial in exploratory research with pre-hoc studies (prior to widespread adoption of an innovation) (Nelson and Shaw, 2005).

3.5. E-Marketplace Classification Models

Research in B2B e-Marketplace also includes case study work on the effects of electronic markets on intermediaries (e.g. Bailey and Bakos, 1997; Chircu and Kauffman, 2000) and several categorisations of the different types of B2B e-Marketplaces (e.g. Boston Consulting Group, 2001; Dai and Kauffman, 2001; Kaplan and Sawhney, 2000; Memshi, 2001; Tumolo, 2001; Yoo, Choudhary and Mukhopadhyay, 2001). B2B e-Marketplaces either execute a particular purchasing process activity for the customer or enable the customer to better perform a specific function through improved information and tools. By viewing B2B e-Marketplaces in this functional way, buyers can identify very specific differences in B2B e-Marketplaces (McKinsey, 2000; Sculley et al., 1999). While each model is unique, some B2B e-Marketplaces may have elements of two or more models (McKinsey, 2000).

3.5.1. Introduction to Models Used

The most basic form of active trading is the ***'post and browse' approach***. This is primarily a structured, and in many cases sophisticated, bulletin board on the web, where authorised members of the exchange can post expressions of interest to buy or sell or exchange goods or services. This is a suitable mechanism for very fragmented markets with non-standardised products because each contract is quite different and requires one-on-one negotiation. These markets have the goal of moving the industry towards more standardised contracts which can then be traded in a more automated manner (Sculley et al., 1999). In this model, the price is negotiated for each transaction through a one-on-one negotiation. This model is essentially similar to an Internet-based meeting room, but because the e-Marketplace pre-qualifies users before they are authorised to post or to respond to postings on the bulletin board, it is a private members' room into which only certain types of people are allowed. Just like a private members' room, the post and browse function creates a virtual community, which is a group of people who are interested in buying or selling a particular product and who can make a connection through the bulletin board. Most post and browse systems provide a main screen that lists members' postings by one or more categories and allocates each posting a unique number. Around this basic match-making functionality, the e-Marketplace can provide other services in order to attract new users and to support existing users of the system, including methods for members to communicate with each other in order to respond to a posting or negotiate the terms of a deal, product and post-trade information, document management services, security and privacy (Sculley et al., 1999).

Aggregators primarily combine demand within and across buying enterprises and then use this combined market power to achieve lower prices from suppliers (McKinsey, 2000). It is a one-stop shopping venue for procurement by companies that come together to reduce the purchase price of a product by demand aggregation (also referred to as 'power buying'). The aggregator streamlines purchasing by aggregating the product catalogues of many suppliers in one place and in one format. Economic value comes from the fact that aggregators are the most focused of all B2B e-Marketplace models. Their primary role is to help customers reduce the price paid on a product or service by combining purchased volume across buyers and increasing competition among suppliers.

By exploiting the unique nature of the Internet, a B2B exchange's online centralised trading space facilitates the connection of inter-company networks among buyers and sellers and the generation of "dynamic pricing" (by contrast to fixed pricing). Dynamic pricing enables a gathering of the entire potential buy and sell orders at any particular time and lets those competing offers set the highest price or the price which maximises the amount sold.

Chan, Simchi-Levi and Swann (2000) provide the following insights on the impact of dynamic pricing on supply chain performance:

- Dynamic pricing has a significant impact on profit when capacities are tight and there is variability in either demand or capacity.
- Dynamic pricing is a useful lever to cope with the Bullwhip Effect and reduce variability both in sales and production schedules.
- A significant profit potential may be attained with only a few price changes.
- For a given supply chain, average price in dynamic pricing strategies is typically below the best fixed-price strategy.

Dynamic pricing also applies to ***auctions***. Auctions are a pricing model in which multiple buyers or sellers bid competitively on a contract. This may be a good mechanism for liquidating surplus as it enables a wide range of potential buyers to bid competitively for the products at below-market prices (Sculley et al., 1999). Electronic auctions offer an electronic implementation of bidding mechanisms also known from traditional auctions. Suppliers can put products up for sale and let potential multiple buyers increase the bid price. The bidding occurs over a fixed time. Auctions tend to lead to an increase in the price bid as time extends and the close of the auction approaches. They can facilitate market pricing in particular for items that are unique and differentiated, but which are relatively simple to describe and understand

As companies use seller-driven auctions more frequently as their standard way of liquidating surplus goods, they are able to move surplus inventory more quickly and thus reduce overall inventory holding costs (Sculley et al., 1999). Typically auctions are not restricted to this single function of price setting, as they may also offer integration of the bidding process with contracting, payments and delivery. Benefits for suppliers and buyers can be increased efficiency and time savings, global sourcing, reduced surplus stock, better utilisation of production capacity, and lower sale overheads (Timmers, 1999). Technology may however not always fully support automated business negotiations such as auctions. This is largely due to difficulties representing specific product attributes and negotiator preferences. However, research on component based e-Commerce and the adoption of XML as well as common business languages is likely to result in an architecture which will incorporate negotiations more easily. For over 20 years now, automated auctions have been determining the real-time price of commodities in the financial markets. The development of secure transactions, the spread of easy-to-use web browsers and point-and-click technology, cost advantages of electronic implementation, and the growing Internet population have all contributed to the rise of more online auctions (Beam et al., 1996).

In ***reverse auctions***, the auction format is inverted, with buyers specifying the items they want and multiple sellers competing for the buyer's business in a downward price auction (Sculley et al., 1999). Buyers post a listing for an item or service. The buyer may specify a particular purchase and allow suppliers to bid on it. Typically, the lowest bid wins a reverse auction according to the requirements set by the buyer. The attraction of this format for B2B transactions is that it can substantially reduce a company's procurement costs. However, it can only work for items that can be clearly described to the sellers and for which there are plenty of potential suppliers (Sculley et al., 1999). This approach favours buyers, especially if there are multiple sellers able to offer items that come close to meeting the buyer's requirements. Access to information is a key determinant of bargaining power in any commercial transaction. If one party gains access to more information, that party tends to be able to extract more value from transactions than a party with access to less information. Suppliers typically use information to target the most attractive customers for their products or services and to engage in price discrimination. Therefore, reverse auctions have the potential to drive a major shift in power from vendor to customer and, in the process, to shift the capture of surplus economic value from vendors to customers. The following figure represents a classic microeconomics supply and demand curve, with straight horizontal line at the intersection of supply and demand representing the market price in a standard customer-vendor relationship (Hagel and Armstrong, 1997). The impact of virtual e-Marketplaces in shifting surplus value from vendors to customers is illustrated, when the market price is tracking the supply curve more closely. This may reflect the increasingly auction-like environments likely to prevail in e-Marketplaces as reverse markets take hold.

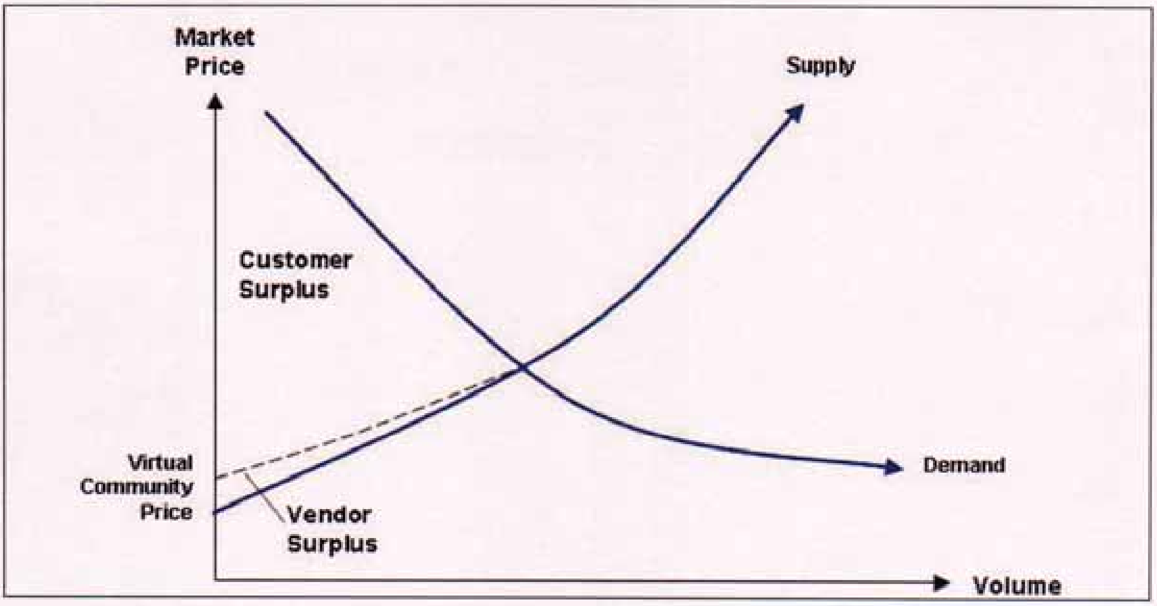

Figure 12: E-Marketplace Supply and Demand Curve
Source: Hagel and Armstrong, Net Gain – Expanding markets through virtual communities, Harvard Business School Press, Boston, Massachusetts, 1997.

Also emerging are ***exchanges*** that can automatically match buyers and sellers on a continuous basis and thus create real-time, dynamic pricing. Exchanges are centralised markets for standardised or commodity-like products. Competitive bidding between multiple buyers and sellers, with automated matching of orders, creates an efficient price-setting mechanism on-line (Sculley et al., 1999). In effect, such systems are continuous two-way auctions where the seller offers to sell and the buyer offers to buy. The bid and ask offers either have a fixed price or a market pricing. The system checks when an order is received to see if it can immediately matched against an equal, but opposite, order already in system. If it cannot be matched, the new order is stored in the system awaiting an equal and opposite offer to arrive. Automated exchanges can be useful for highly standardised or commoditised products with high liquidity (Hagel and Armstrong, 1997). As with securities markets, the more competing buyers and sellers that can be brought together in one place, the more liquid a market becomes and the more efficient the price-setting mechanism is. This can create a self-reinforcing mechanism whereby the sellers are attracted to the market with the most potential buyers and the increase in sellers makes that market space more attractive to more buyers, resulting in more transactions in the market.

Trading hubs are sites that build buyer and seller communities for multiple industries that have not yet embraced the Internet themselves in a specific exchange. Sellers are given virtual storefronts to advertise their products and buyers are attracted by news, product specification information, product reviews and product recommendations. Trading hubs can be purely horizontal in that they try to support all the buyers and sellers in many different industries. Alternatively, they can be diagonal in that they specialise in supporting a specific type of buyer or seller, or a specific type of product category across multiple industries. Trading hubs may provide an auction sale mechanism for large items with infrequent sales or an auction procurement process for aggregated small buyers (Sculley et al., 1999).

Electronic catalogues aggregate product information from a variety of suppliers and can be integrated into legacy systems. Early electronic catalogues resembled their paper counterparts, often presenting pages of product displays with little cross-indexing or additional information. The next generation of electronic catalogues provided capabilities far beyond sales and marketing such as customer support, order processing, customer feedback, and search processes. Smart and virtual electronic catalogues bring together heterogeneous product databases into a searchable, annotated listing of product announcements. Electronic catalogues are an important part of the automated supply chain; hence, the ability to negotiate electronically is becoming increasingly important (Beam, Segev and Shanthikumar, 1996). This model may work well for the sale of low-priced items that are bought frequently, but in small quantities. Accordingly, it does not make sense to negotiate the price on every trade. The price of products on a catalogue aggregator tends to be fairly static, which means prices are as stated in the supplier's catalogue. Catalogue aggregators can expand their offering by enabling a procurement manager to issue a request for quotations to a short list of suppliers through the web-site, for large orders or items, which are not standardised (Sculley et al., 1999). Roland Berger & Partner (2000) summarise some of these distinctive e-Marketplace models in Figure 13.

B2B Platform	Auction	Exchange	Catalogue
Description	Provides a venue for the purchase and the sale of unique items such as excess inventory, used capital equipment, discontinued goods, perishable items, etc.	Industry spot market for commodity products	Aggregate a multitude of products and services from multiple suppliers to provide a one-stop shopping site for buyers and a low cost distribution channel for suppliers.
Pricing	Dynamic Competitive bedding drives pricing up in favour of seller in traditional auctions Drives prices down in favour of buyer in reverse auctions	Dynamic Bid-ask market moves pricing up and down based on supply and demand	Static Support individual pricing agreements between specific buyers and sellers Prices pre-determined
Buyer benefits	Easier means by which to find unique products and services Discounted prices Broader selection Lower prices through competitive seller bidding in reverse auctions	Venue to fulfil immediate purchase needs	Reduces procurement process costs and inventory costs Expands potential supplier base Easy product comparison based on multiple dimensions (price, quality, service, availability, etc)
Seller benefits	Sellers attract more bidders for more competitive bidding and higher selling prices Cut out liquidation brokers Increased inventory turnover	Venue to offload excess capacity at market price	Lower cost of sales New sales channel and revenue streams Lower process costs Improved customer satisfaction
Revenue sources	Percentage of gross transaction value Ad revenue from supplier Supplier listing fee	Percentage of gross transaction value Membership fees	Percentage of gross transaction value Product listing fees from suppliers Ad revenue from suppliers

Figure 13: Marketplace Models

Source: Roland Berger & Partner GmbH London, 2000, B2B Platforms, Market Report.

According to McKinsey (2000), there are furthermore ***transaction facilitators***, which primarily transact and execute the purchase. These B2B e-Marketplaces improve purchase order efficiency and automate back-end financial management (payables, receivables) systems. Transaction facilitators generally focus on reducing complex, paper-based transactions between buyers and sellers. When tailored to a specific industry / type of purchase, these tools can be valuable in reducing transaction costs, dispute costs resulting from errors, and other operating costs. In general, they provide limited functionality in selecting products or creating more market efficiency, and therefore have little impact on other financial components (McKinsey, 2000).

Project/specification managers primarily specialise in design and planning support. These B2B e-Marketplaces provide tools to plan and manage complex projects/processes for customers. They provide collaboration tools to help increase speed to market and improve decision-making on product development, ultimately improving potential revenues. They also help reduce the invoice price of purchased goods and services by helping buyers determine what to buy. They generally, however, play a minimal role in actually reducing the product purchasing prices. Finally, project / specification managers play an important role in helping customers reduce other operating costs (McKinsey, 2000).

Supply consolidators identify the relevant supply base and conduct the purchasing transaction. They also help to design and plan the purchase, and to establish the terms of purchase. These B2B e-Marketplaces bring together product offerings of many suppliers to increase buyer options. Supply consolidators provide access to a fragmented base of suppliers that are either difficult to reach off-line or are so numerous that individual online tools are ineffective. This type of e-Marketplace provides the resources to identify, and in some cases, qualify suppliers. Leading examples of this model provide in depth product information and parametric searches across suppliers to identify best options for the buyer. Like the project / specification manager, the supply consolidator provides information and tools that help customers reduce overall price by better determining what to buy, not necessarily by lowering the price paid to a particular supplier. For example, a B2B e-Marketplace can help engineers compare specifications across multiple components to evaluate potential substitutes for an input to a computer. While the B2B e-Marketplace may not be directly involved in reducing the price of that component, the information provided helps to make more effective cost-quality trade-offs, which may improve the total invoice cost (McKinsey, 2000).

Liquidity creators establish the terms of purchase. These B2B e-Marketplaces create liquid, dynamic markets for commodity products traded between many buyers and sellers. Where most effective, they provide liquidity for products that were previously too low-volume or non-standard to warrant off-line exchanges. They provide suppliers with a ready market for their product and buyers with a steadier source of supply. By improving market efficiency, liquidity creators can help customers both reduce purchase price as well as decrease lost revenues. To reduce purchase prices, liquidity creators provide real-time price transparency across a wide base of suppliers, enabling customers to compare prices. Liquidity creators - particularly those that operate on the spot market - also provide tools for customers to access hard-to-find parts. For example, one airline was able to reduce the days of grounded aircraft through more efficient access to repair and replacement parts through a B2B e-Marketplace. The more efficient turn-around helped reduce cumulative days of grounded aircraft by more than half, saving over $10 million in lost revenue (McKinsey, 2000).

3.5.2. Participation Focus / Ownership

B2B e-Marketplaces have different user groups, many of whom have different objectives and/or interests. These user groups include owners, shareholders, suppliers, buyers or procuring companies, brokers or other forms of intermediaries, government, data vendors or service providers. Since multiple user groups can access an e-Marketplace, it has typically some form of membership structure to determine who is permitted to have access and what type of access users have. This membership structure may be as simple as a subscription agreement, which a potential user has to complete in order to sign on. At the other end of the scale, the membership may include a full set of trading membership rules and trading regulations, which require new members to be pre-vetted and approved by the e-Marketplace. In such cases, the rules will cover the initial requirements for obtaining membership, the obligations assumed by the member, the on-going compliance requirements to be met by the member, and the system requirements for members. The initial requirements for obtaining membership of the e-Marketplace usually covers appropriate criteria such as creditworthiness and capital of the firm, proper regulatory controls within the firm or relevant experience of the staff. Regulating who has access to the market and how they can operate within the market can be a key element of a B2B e-Marketplace's value proposition (Sculley et al., 1999). Given this background, Nathan (2001) further identifies four types of e-Marketplaces (see Figure 14).

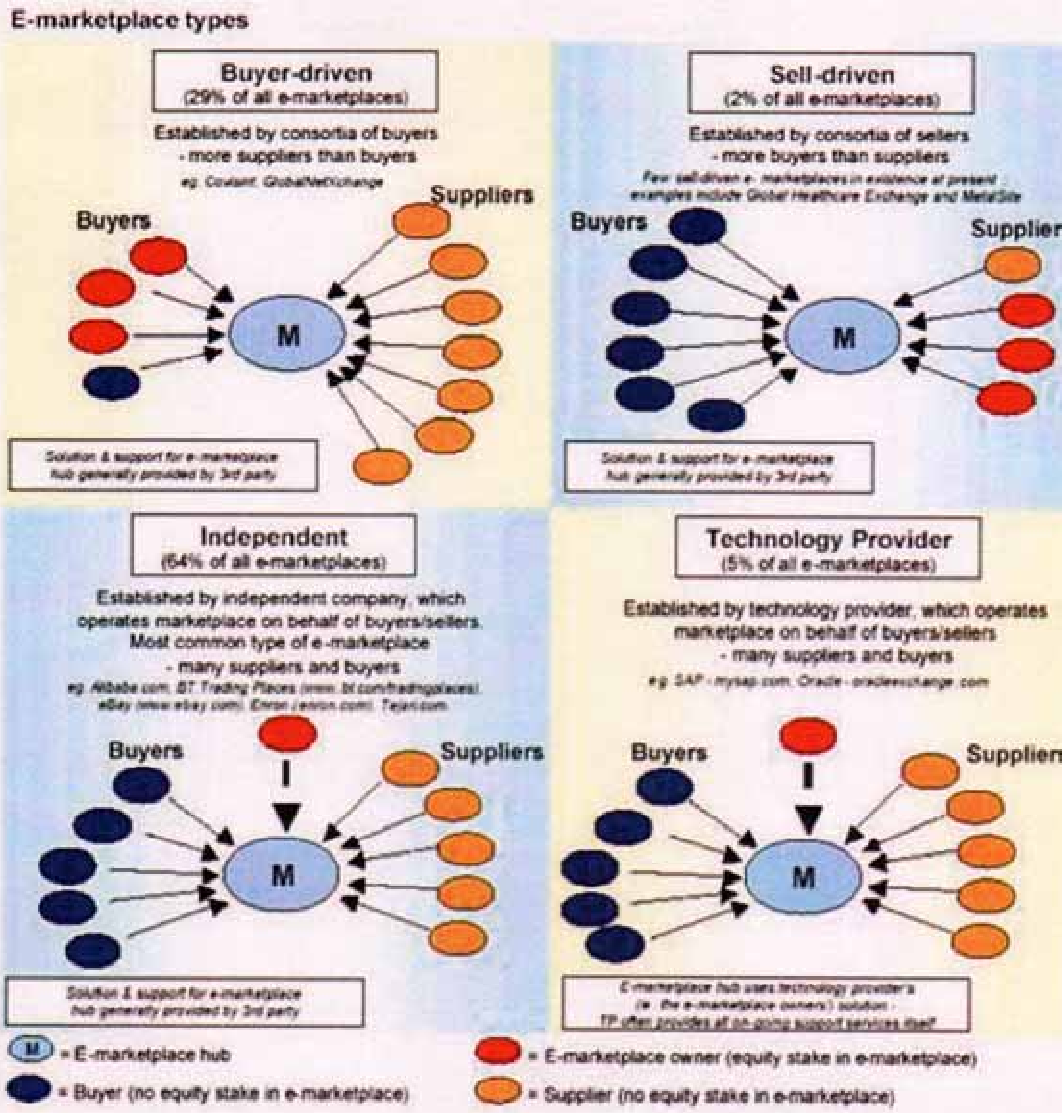

Figure 14: Participation Focus of E-Marketplaces

Source: Nathan, 2001, e-Marketplaces: New challenges for enterprise policy, competition and standardization, Workshop Report, Brussels.

Buyer-driven e-Marketplaces are established by a consortium of organisations in order to procure products from their suppliers via the Internet (Nathan, 2001). Industry-sponsored consortium e-Marketplaces are jointly developed and owned by two or more industry incumbents, sometimes including a blend of industry-specific buyers, suppliers, and distributors. Industry-sponsored marketplaces can also address industry standards (systems or data) as they comprise a forum of multiple industry players. New trading members may be required to buy an ownership stake in the e-Marketplace. The owners can therefore design the market to their own particular advantage and profit. In particular, they can limit membership through restricting who buys a stake or by limiting the number of stakes available. A critical factor is that all other user groups may be disadvantaged by the owner's anti-competitive practices. This also applies to sell-driven e-Marketplaces, which are set up by a consortium of suppliers that are looking to sell their products online via the e-Marketplace.

An alternative approach is independent e-Marketplaces which are established by organisations, whose main motivation is to obtain revenues through operating the marketplace on behalf of buyers/sellers. These e-Marketplaces are therefore public and "neutral", often funded by venture capitalists, as these providers are not taking part in the transaction itself, because they are only providing infrastructure and tools for it. Under this model, the application for a membership or ability to trade on the e-Marketplace is not restricted to an ownership stake and new memberships are made on a non-discriminatory basis. This means that a member does not have to own a stake, but rather has a license to trade and to use the facilities of the e-Marketplace. This licence may be transferable by a member, or the e-Marketplace may insist that new members join the exchange directly so that membership rights are non-transferable. An advantage of this approach may include the ability to balance the competing interests of each user group, while it can take a significant time to get all these potentially disparate groups work together (Sculley et al., 1999).

Therefore, companies have to decide whether they (1) become a client of an existing e-Marketplace run by other buyers, suppliers, and/or neutral businesses, (2) build their own buyer-driven marketplace with exclusive usage for internal clients (internal buyer-driven e-Marketplace), or (3) build their own buyer-driven marketplace with access to external clients also (open buyer driven e-Marketplace). The decision typically depends on the available resources. For example, building up own corporate e-Marketplaces makes sense only with a minimum of purchasing power; otherwise, suppliers and buyers are unlikely to accept the e-Marketplace (Essig and Kärner, 2001).

Nickerson and Owan (2002) further argue that the success of a B2B e-Marketplace largely depends on the ability to subsidise suppliers selectively. Such ability is likely to depend on the ownership of the B2B e-Marketplace. If the B2B e-Marketplace is managed by a third party, selecting suppliers in a discriminating way may not be feasible because of asymmetric information. The e-Marketplace would face higher cost of assessing product values and supplier costs than individual buyers that have amassed knowledge from past dealings. In addition, since participating buyers have an incentive to distort their private information in order to increase the number of bidders at other parties' cost, choosing the optimal price and the optimal number of "subsidised" suppliers should be difficult for such B2B e-Marketplaces. On the other hand, consortium exchanges and, even more so, private exchanges, should be able to implement price discrimination at a lower cost because information is less asymmetric and information distortion incentives are diminished for consortium and eliminated for private B2B exchanges.

By contrast, when assuming that there are some economies of scale for the information technology infrastructure of a B2B e-Marketplace, public ownership may offer lower cost for buyers than consortium or private ownership. Thus, there is a trade-off between the ability to subsidise selectively and economies of scale. More public e-Marketplaces would be established in the industries where products are mostly standardised while consortium or private exchanges are likely to be formed in the industries where product innovation is rapid and products have to be customised (Nickerson and Owan, 2002).

Figure 15 reveals that e-Marketplaces can be further classified into vertical ones (focused on supplies for one branch) and horizontal ones (dealing with goods and services needed in various branches, e.g. office supplies). Vertical B2B e-Marketplaces typically have a very high level of industry specific expertise in order to gain widespread acceptance and credibility quickly within their chosen market space. Sculley et al. (1999) believe that only industry-specific sites will be successful and will gain widespread adoption within that industry. Once a community has developed in a horizontal trading hub, it may migrate to a B2B e-Marketplace that is run by experts with specialist knowledge in that vertical and which is specifically tailored for that market. In such cases the horizontal trading hubs will come to act as catalysts or incubators for subsequent specialist B2B e-Marketplace. Diagonal trading hubs specialise in supporting a specific type of buyer or seller, or a specific type of product category across multiple industries.

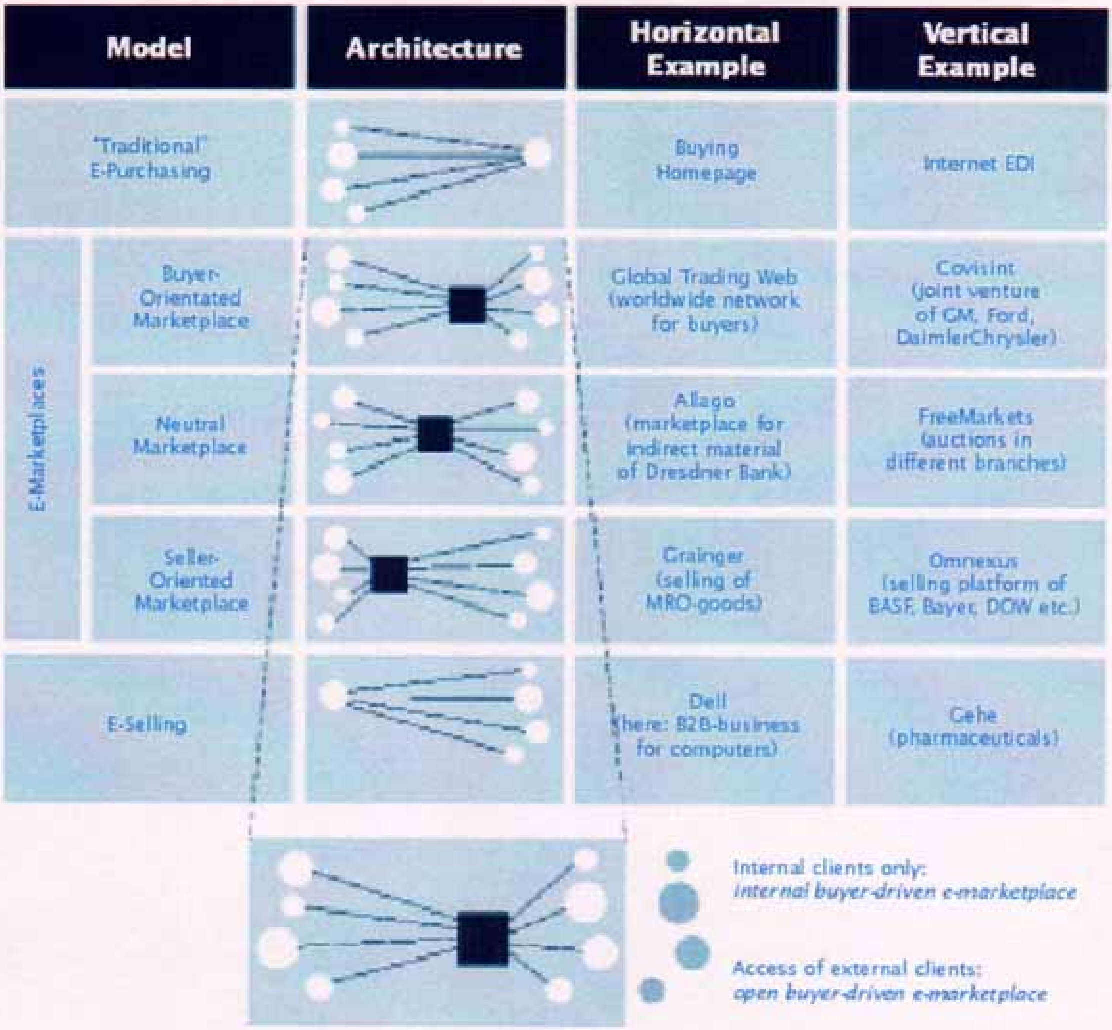

Figure 15: Types of e-Marketplaces

Source: Essig and Kärner, 2001, Buyer-Driven Electronic Marketplaces: Developing Business Models for an Integrated E-Procurement Strategy, PRACTIX, CAPS Research, 5.

3.6. E-Marketplace Service Evolution

According to Raisch (2001), e-Marketplaces go through several phases of evolution and will evolve from simple matchmaking services focused on transactions and e-Commerce. In the first phase, commodity exchanges and e-Marketplaces focus on the buying, selling, and trading of commoditised products and services. The products and services that best fit this category include those that can achieve a standardised global pricing level and that have mature globalised product distribution and service delivery systems in place (Raisch, 2001). The initial concept was about to bring together buyers and sellers through a relatively passive matchmaking system. Such a still rudimentary model works fine for well-branded, well-defined commodity products and services. Thong (2005) notes that e-Marketplace services are one of the most important factors in brining success to e-Marketplaces. The term 'functions' are used in this thesis with the same meaning as 'services'.

Schneiderbauer and Fainsilber (2002) note that first generation e-Marketplaces decrease only purchase price, while price comprises are only one element of overall value in the supply chain. Moreover, the spot-price, one-time transaction may not even be the best method of reducing vendor costs. Finally, most of first generation e-Marketplaces would use off-the-shelf technology platforms to implement a simple market mechanism. According to Raisch (2001), the next phase of evolution would be based on providing value-added services that support the transaction. This spawns the transformation of e-Marketplace from a central matchmaker into a value-added service provider. These e-Marketplaces provide value-added services to support their customers with transaction support services, as well as enable the customer-driven creation of customised products and services. This is achieved through either the customised configuration of the delivered product or services and/or the hybrid integration of products and services into new value delivered to the customer in the form of combined products and service offerings into custom solutions. This type of new value creation through a combination of digital and physical value delivery systems is now more feasible than in the pre-internet economy. Figure 16 reveals that value-added services also come in the form of services that facilitate the transaction such as financial settlement, in-transit insurance, escrow services, warehousing, and e-logistics (Raisch, 2001).

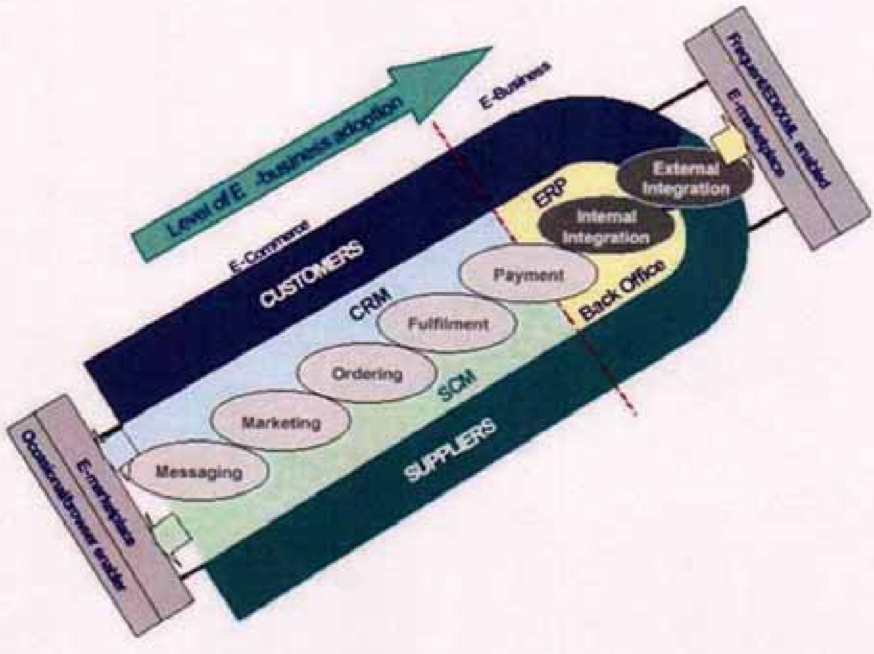

Figure 16: Access to e-Marketplaces by Stage of E-Business Adoption
Source: Nathan, 2001, e-Marketplaces: New challenges for enterprise policy, competition and standardization, Workshop Report, Brussels.

A new line of e-Marketplace businesses may then emerge as digital markets move into becoming knowledge providers. The development and availability of knowledge tools for knowledge workers creates the building blocks for global knowledge exchanges and the global knowledge network to become a reality (Raisch, 2001). The capture and use of information that flows through the value chain of any industry is a critical component to successfully solving industry pain points and creating new value propositions. Raisch (2001) further argues that the next evolutionary stage for e-Marketplace would be the integration of the transaction exchange, the value-added services, and the knowledge services into value trust networks that would add secure collaboration to the member communities. E-Marketplaces could provide an integration point for business process, people and technology, as well as products and services. These new value trust networks can come together to support industry value chains. E-Marketplaces could provide a combination of interoperability and trusted relationships that would forge the foundation of new global innovation. They may weave enterprises, marketplaces, industries, and individuals together into empowered and productive digital workgroups (Raisch, 2001).

Therefore, given this background, B2B e-Marketplaces may be based on more than matchmaking of buyers and sellers and the search for the best price. According to Nathan (2001), long-term revenue opportunities lie in the value-added services and in the information and knowledge gathered around the supply and demand flow. E-Marketplaces may then evolve from simple matchmaking of buyers and sellers into digital work environments in which industry and supply chain collaboration can occur, e.g. in co-operative design and development, marketing support, collaboration on production scheduling and assistance with e-business system development (Nathan, 2001). Figure 17 shows the range of service that can be provided by e-Marketplaces.

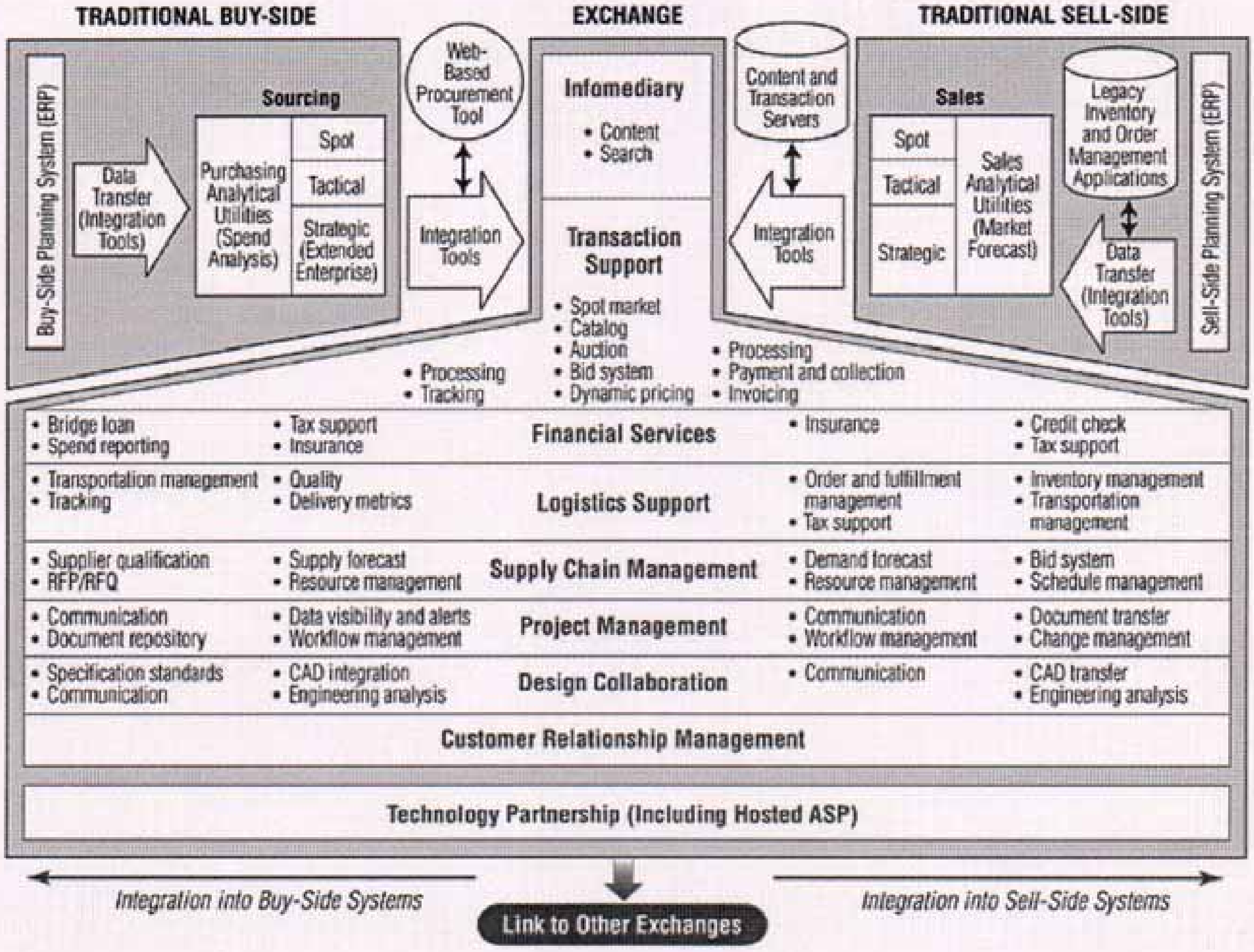

Figure 17: E-Marketplace Structure and Services
Source: Booz Allen & Hamilton, 2001, The e-Marketplace Revolution: Creating and Capturing the Value in B2B e-Commerce.

For the provision of services, many e-Marketplaces typically charged in their early stages transaction fees. Transaction fees typically require a critical mass of customers in order to generate profits. Therefore, e-Marketplaces have even called out transaction revenues as a core element of their business plans and integrated a range of other fees. Subscription (or membership) fees, for example, are one-time joining fees that can be charged when an e-Marketplace registers a new member. This fee can be a lump sum payable in advance each year, or a monthly subscription fee for use of the system. B2B e-Marketplaces may waive this fee for a certain period to encourage early membership (Sculley et al., 1999). An annual maintenance fee for retaining the membership can also be charged. There are also usage fees, which cover a charge based on the number of hours of usage or the number of pages accessed or some combination of the two. E-Marketplaces also have the option of charging users for content delivery fees or information selling. Other fees may include permission marketing fees for banner advertising and other extended listing services. Software licensing fees may be billed to other e-Marketplaces, which are not directly competitive (Sculley et al., 1999). Specific fees for other value-adding services might also be charged, e.g. for a notification service when specified vendor products are offered for sale at predetermined prices.

However, an extensive range of costs and a low number of provided services were among the reasons why e-Marketplaces had to consolidate. Many e-Marketplaces did not have a system up-and-running that is producing revenue, or delivering savings for its customers. E-Marketplaces proved to be capital intensive and complex. This e-Marketplace consolidation and evolution in particular in the airline industry is presented in the following section. It also includes details why this particular industry was selected for this research.

IV. BACKGROUND TO AIRLINE INDUSTRY DEVELOPMENTS AND TO AIRLINE CLASSIFICATIONS

4.1. Introduction

Consideration of the above mentioned theories within the wider transport literature is required to outline the case in the airline industry in particular. Major issues and historical developments affecting strategic decisions in the airline industry environment, as well as developments that have enabled airlines to achieve competitive advantage in particular environments will therefore be outlined in this section. This link is very relevant as strategic decisions are made in the context of environmental issues of an industry (see Porter, 1980; 1985).

The airline industry has undergone a series of radical changes in recent decades. The first major shift was certainly the introduction of the jet engine in the 1950s, which was followed by the diverse processes of liberalisation in many parts of the world. In brief, the deregulation process first took place in the USA during the late '70s and early '80s More details in relation to the deregulation process in the airline industry are provided in appendix E.

Take-up in Europe of similar liberalisation processes was followed by a severe competitive price war caused by rapidly falling barriers of entry, mergers and consolidations as well as alliances. This, in turn, has led airlines to incorporate adequate innovative measures regarding the achievement and maintenance of competitive advantage.

Environmental changes, such as deregulation/liberalisation, privatisation, severe economic downturns and the recent threats caused by terrorism have greatly influenced strategic measures of airlines. In recent years, one can observe the emergence of a gap evolving in distinct business models: e.g. the full service carrier or the low-cost carrier. However, the airline industry itself remains highly regulated, with several variations around the globe.

Burgeois and Eisenhardt (1988) have described the airline industry as a high velocity environment, where there is sharp and discontinuous change in demand, competitors, technology, and regulation, overlapped with continuous dynamism or volatility. They argue that in this kind of environment, strategic decision making is problematic because of these dramatic changes and because of the difficulty of predicting the significance of a change. Imitation approaches may result in failure, as competitive positions change quickly and thus opportunities fade. Distinctive characteristics of the airline industry include (1) few firms having (2) substantial market share, with (3) differentiated and/or homogeneous products, and (4) high barriers to entry. These traits lean toward an oligopoly market structure (Vo, 2002).

In this sense the diffusion of the Internet on a global and pervasive scale has created new scenarios of action, whereby financial transactions and the functions of senior managers, institutions and the whole business community are planned and implemented with the aid of digital technology. 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).

So far, ICT has revolutionised the airline industry mostly in terms of Business-to-Consumer developments concerning CRS and nowadays public online booking portals. American Airlines was the first airline to develop a computerised reservation system in co-operation with IBM in order to prevent an uncontrolled escalation in costs that would result from its manual reservations system when jet travel began (Copeland and McKenny, 1988). The expansion of CRSs to travel agencies created additional economies of scope because of that more capabilities can be included in the system; such capabilities include those that are common in most industry global distribution systems today. These help reserve rental cars and hotel rooms by taking advantage of online booking web sites (Duliba, Kauffman and Lucas, 1999).

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 airports, air control systems and other authorities to obtain landing slots, docking gates, informing about arrivals and departures, declaring flight paths, etc. Airlines also interact with a number of organisations that provide handling services at airports, including maintenance, refuelling, baggage handling, load and despatch, lounge provision, catering and cleaner services. More and more suitable extranets and inter-organisational systems are developed to facilitate the interaction of airlines with the respective service providers, suppliers and authorities. E-Procurement in particular 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 in-flight supplies, B2B applications, such as e-Marketplaces, 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). As such, the airline industry with its distinctive characteristics provides a very good setting in which to research e-Marketplace adoption and performance indicators. Its value chain and distinctive procurement processes are appropriate for e-Business and e-Marketplace integration, which will be highlighted in the following sections.

4.2. Aviation Industry Value Chain and Procurement Processes

The airline industry is a sector with very high barriers of entry for any company in the value chain as national politics dictate many of the relationships and organisational structures. However, not only those developments alone have contributed to that conservative approach to any business change, but also the fact that it is a very high technology industry. In order to ensure the quality and certifications necessary and required by many federal aviation authorities to ensure safety, the aviation and aerospace industry differs from other sectors, as there are very high barriers to entry due to certification requirements. Many projects are of high technical complexity and risk and are quite frequently collaborative between risk sharing partners. Sometimes, projects have long life cycles that can extend out to 50 years including ongoing modification, rebuilding and re-engineering.

Furthermore, products are manufactured in low volume with unique design modification and option configuration status and quite often require individual configuration history, modification tracking for certification as well as full trace ability for parts and materials. Mostly, the product is sold under a requirement for full life support with in-service modifications and upgrades and vendors almost invariably supply initial maintenance packages including both spares and support. Finally, at the top of the value chain the industry has become highly consolidated with almost no competition (Chan, 1998). The pyramid in Figure 18 represents this supply chain with the aircraft manufacturers at the top, supported by each lower level in turn (Department of Trade and Industry, 2000).

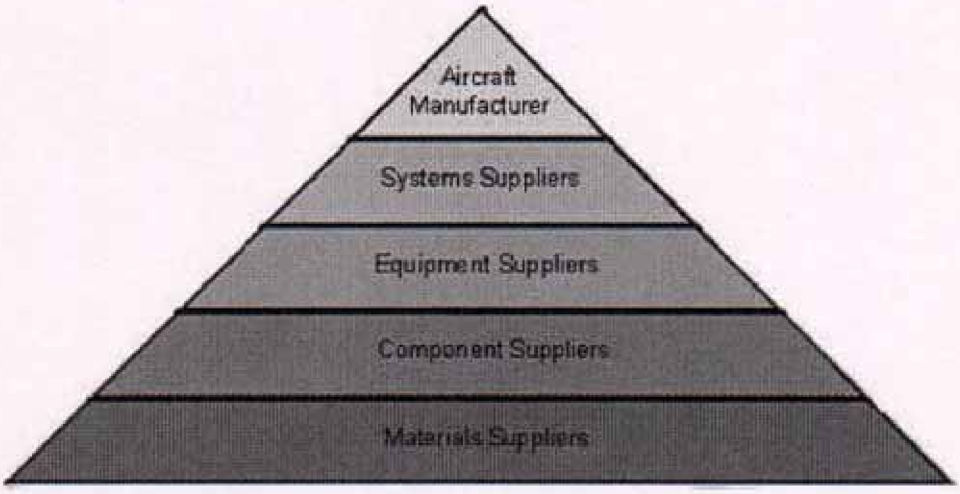

Figure 18: The Manufacturing Value Chain in the Aviation Industry
Source: Derived from Department of Trade and Industry, 2000, A study of the impact of e-Business on the UK aerospace sector.

The companies in the figure above can be classified as follows:

- Prime contractors (aircraft manufacturers): These are manufacturers that bear the responsibility for the overall aircraft design and integration, including airworthiness certification and direct contractual relationships to supply aircraft to customers[5].
- Systems suppliers: These are manufacturers holding the design authority for aerospace systems design and contractual relationships with primes for the integration of equipment into complete aerospace systems. Engine manufacturers are also included in this category although some of them may have direct contractual relationships with customers.
- Equipment suppliers: These are manufacturers with design authority of aerospace equipment and contractual relationships to supply equipment to systems suppliers or primes.
- Component suppliers: Manufacturers of either bespoke aerospace components to the designs of primes, systems and equipment suppliers, or standard components to external specifications.
- Material suppliers: these are manufacturers, processors and stockists of raw material for conversion into aerospace components and products, by 1-4 manufacturers.

[5] Customers are referred to legal owners, operators or leasing companies

Only a small number of relatively large companies occupy the upper levels, whereas a much greater number of companies occupy the other levels of the pyramid. The airline industry is characterised as a high variety but low volume industry. Usually, in many cases, production is made to order, where every item can be customised. The total procured volume of many items can remain relatively low with only 20-500 units a year. Also, there is often a lack of vertical integration as costs and the level of complexity involved in development of aircraft are very high (Stienen, 1999). The airline supply chain consists of multiple layers of companies, which by themselves can again be involved in several supply chains. The structure of supply chains is furthermore ever changing and can therefore be considered more as a dynamic network rather than a static, vertical structure of singular relationships (Stienen, 1999).

The Massachusetts Institute of Technology (MIT) defines "supply chain" as the flow of materials, information and funds between different parties or organisational functions (Metz, 1998). A single-stage supply chain, typically representing a single organisation, incorporates a range of material flow functions (receiving, processing, distributing and delivering), a complex array of information processing and decision making functions (based on information flows from customers, suppliers and internal functions), and functions for handling incoming and outgoing funds. Materials flow in one direction, funds flow in the other direction, and information flows in both directions between all functions. A total or full supply chain concept consists of several networked companies, that all have the same basic objective: *"to fully meet customer requirements"* (Vanharanta and Breite, 2003). Aitken (1999) defines the supply chain as *"a network of connected and interdependent organisations that are mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users."*

While the terms 'supply chain' and 'value chain' are often used interchangeably in literature, notable differences exist. Porter's (1985) value chain describes the full range of activities that are required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use (Kaplinski and Morris, 2000). Porter (1985) defines the value chain as follows:

"A company's value chain is a system of independent activities that are connected by linkages. Linkages exist when the way in which one activity is performed affects the cost or effectiveness of other activities."

Linkages in the value chain are essential as they illustrate how one single activity affects various other activities, therefore being an important source of value adding and competitive advantage, particularly when it is considered that one value chain competes with another value chain (Porter, 1985).

Porter (1985) distinguished two important activities of the value chain: primary activities and supporting activities. He drew the distinction between the different stages of the process of supply (in-bound logistics, operations, out-bound logistics, marketing and sales, as well as after sales service), the transformation of these inputs to outputs, and the support services to accomplish a task (strategic planning, human resource management, technology development and procurement). Horizontally interdependent activities, which produce added value for customers, the costs of these activities and how these activities produce the profit margin for the company, are examined in the value chain analysis (Vanharanta and Breite, 2003). Operational efficiency and effectiveness is vital in the value chain, which is illustrated in Figure 19 for the airline industry.

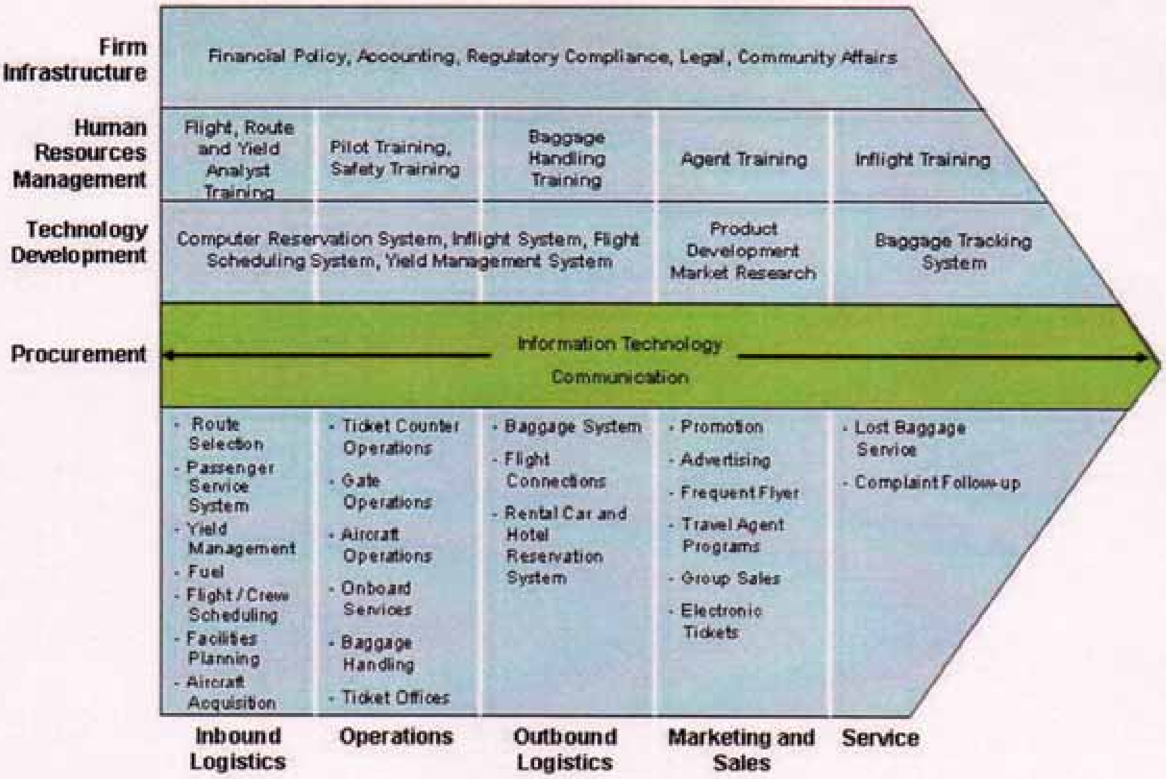

Figure 19: Airline Industry Value Chain

Source: Modified from Middleton, C., 2004, ITM700 Course Information: Fall 2004, School of Information Technology Management, Ryerson University, Toronto, Canada, at: www.ryerson.ca/~cmiddlet/700/overheads/700week6.ppt

Given the value chain in the airline industry, procurement strategies vary in certain parts from those of other industries. The spare parts industry is a particular case in point. Airlines use a variety of practices to procure spare parts to favourable prices and conditions. Such practices include analysing prices, procuring competitively through (reverse) auctions, utilising catalogues, negotiating long-term service agreements, such as 'power-by-the-hour' or 'cost-per-landing', purchasing new surplus or reconditioned parts, etc. In particular, balancing the need to maintain minimum inventory with the need to avoid an AOG situation due to the unavailability of spare parts is one of the key challenges airlines are facing (GAO, 1999).

From an airframe manufacturers point of view, there has been a trend to increasingly demand from suppliers to fund development costs from overhead. Also the adoption of single sourcing in the power systems and avionics area and the reduction of suppliers in the component area have been associated with a shift of procurement policies to a sort of preferred supplier system. There is a shift toward high levels of supplier involvement in long-term agreements and fixed-price contracts. Even in areas in which multiple sourcing is adopted as a strategy, i.e. components, a slight reduction of suppliers may be observed. In this area, however, single sourcing would be too risky and the purchasing requirements for the same item or very similar items usually been split among several suppliers (Paliwoda and Bonaccorsi, 1994).

Product liability is another issue within the aviation industry. Each supplier is normally responsible for the performance of its own component or piece of equipment. A performance fault would typically lead to both economic and non-economic sanctions to the supplier, which, according to the damages sustained, will include a criminal or civil action, commercial penalty and thus a loss of further supplies and a loss of reputation with customers and within the whole industry. Procurement of complete systems typically emerges out of an existing, long-established, and satisfactory relationship between the customer and the supplier (Paliwoda and Bonaccorsi, 1994).

For example, in large airframe companies and their respective airline customers, each plant has its own purchasing department, which is responsible for all items that actually go into the aircraft. The level of autonomy of each plant in making purchasing decisions is generally high, so it is not uncommon for a supplier to agree on different prices for the same product with different plants within the same division. At the divisional level, there is a movement toward the purchase of common requirements for all sites, where a committee consolidates these requirements. General agreements are negotiated at the divisional level, and purchasing entities operate under the umbrella of these agreements. While this is not an easy process from an organisational point of view, the centralisation and pooling of requirements should lead to the standardisation of specifications, in the sense that each department should adopt the same specifications as much as possible (Paliwoda and Bonaccorsi, 1994).

Negotiating discounts on the regular selling price of a product through purchasing in large quantities is one of the fundamental features of economies of scale. Thus, airlines and other organisations may benefit from large quantity ordering by obtaining cost reductions through the subsequent scale economies achieved both in production and distribution. Manufacturers and suppliers also benefit from this effect by being able to offer the same good or service to other potential clients forming a consolidation, thereby expanding their customer base and becoming more secure and stable.

Due to strategic sourcing initiatives like this, Carr and Pearson (2002) note that, since the mid-1980s, the strategic role of the purchasing function has received considerable attention. As firms recognised the importance of purchased inputs to their products, the purchasing function's role in the area of strategic planning has increased in importance. Purchasing is more and more recognised in the airline industry as a strategic resource for reaching high quality levels, fast delivery, and cost savings. Strategic purchasing is defined as the process of planning, evaluating, implementing, and controlling highly important and routine sourcing decisions (Carr and Smeltzer, 1997). The purpose is to direct all activities of the purchasing function toward opportunities consistent with a firm's capabilities in order to achieve its long-term goals. Thus, a strategic purchasing function can help to increase a firm's ability to be competitive. If purchasing has an integrative role in the firm's strategic planning process, then the purchasing function can be characterised as a strategic function (Reck and Long, 1988). It is against this background that it can be argued that the use of e-Business facilitates and increases the efficiency of strategic purchasing and supply chain operations in the airline industry.

4.3. The Need for E-Business Adoption in the Airline Industry

As previously outlined, airlines were one of the early adapters of ICT with the introduction of general rudimental B2B e-Business concepts (such as SITA[6]) and implementing appropriate ICT solutions now represents a major challenge. In a study on the impact of e-Business on the UK aerospace sector carried out by the British Department of Trade and Industry (2000), potential benefits and difficulties of e-Business opportunities were researched. E-enabled sales, procurement, maintenance and spares management all have a great potential to generate benefits without a significant high degree of difficulty and are most likely to be the focus of companies e-Business initiatives illustrated below in Figure 20 (Department of Trade and Industry, 2000).

[6] SITA (Societe Internationale de Telecommunications Aeronautiques) and ARINC (Aeronautical Radio Inc.) have been one of the world first business-to-business systems. These systems have used teletype messaging for enabling airlines to communicate electronically among each other. To date, they still utilise message pass-through resources to transmit information on passengers and payments.

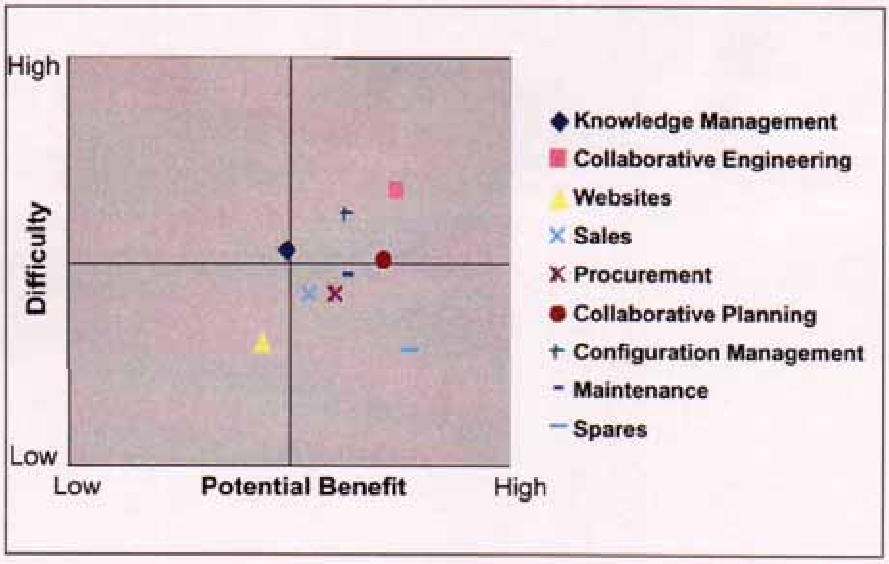

Figure 20: Potential Benefits and Difficulties of E-Business Opportunities
Source: Department of Trade and Industry, 2000, A study of the impact of e-Business on the UK aerospace sector.

The same study suggests major drivers for the adoption of e-Business (see Figure 21). The majority (84%) of companies surveyed in the UK aerospace sector identified customer and sales related drivers. 71% of their participants also believed that e-Business would allow them to manage their suppliers better and achieve greater responsiveness from their supply chain. Finally, more than half of the companies (55%) identified cost savings including transactional cost savings, purchase price reduction, efficiency savings and inventory reduction as a key driver to adopt e-Business. However, cost savings play a more important role (77%) within companies at the highest levels of the value chain, such as aircraft manufacturers and airlines themselves. Reductions in development costs and in development time were not considered as key drivers with an overall percentage of only 5%. Figure 21 shows that there was a clearer identification of the revenue and cost benefits compared to benefits related to project initiation (Department of Trade and Industry, 2000).

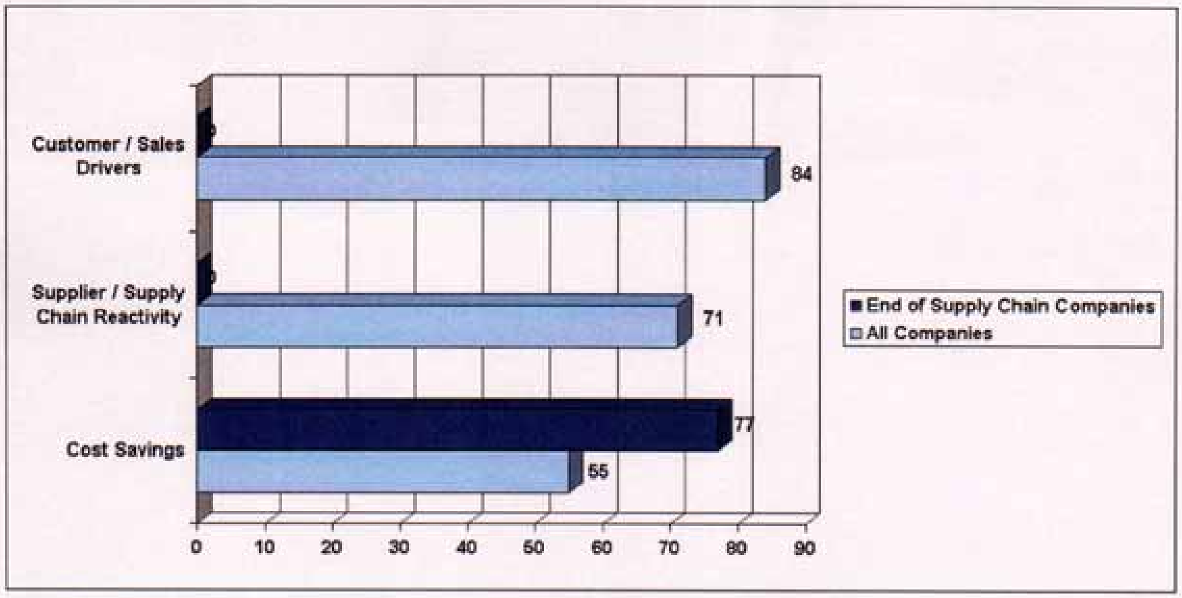

Figure 21: Drivers for the Adoption of e-Business
Source: Department of Trade and Industry, 2000, A study of the impact of e-Business on the UK aerospace sector.

A study undertaken by Airline Business and SITA (2000) came to a similar conclusion. Their survey results suggest that the introduction of Internet technologies is mostly driven by the promise of revenue and cost gains (see Figure 22). About 75% of all carriers surveyed identified securing competitive advantage as the single key driver for the use of ICT.

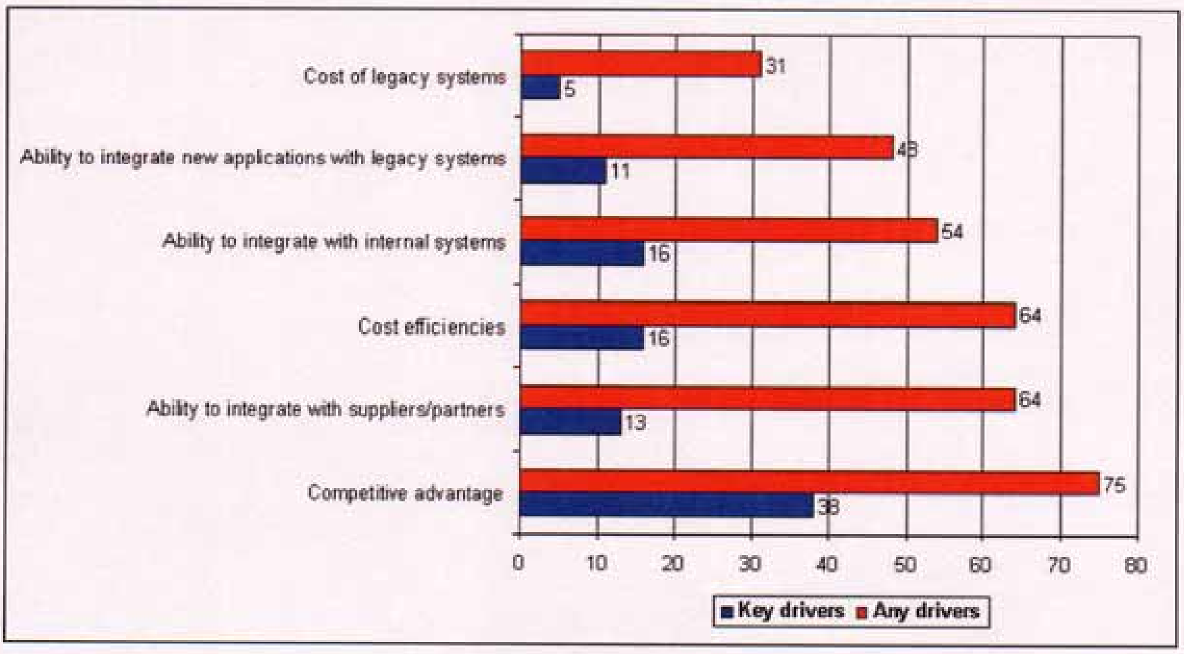

Figure 22: Drivers for the Adoption of ICT
Source: Airline Business, 200, IT trends survey.

This study has also revealed that, until 2000, only 30% of airlines had created B2B e-Commerce applications with suppliers (Airline Business, Aug. 2000). A large majority of these companies were operating only in traditional engineering areas led by links to aerospace manufacturers, spares and maintenance providers. According to the aforementioned survey, half of the carriers surveyed had planned to establish B2B links in the future. Indeed by 2003, 56% of airlines were using e-Commerce applications to undertake B2B transactions (Airline Business, Aug. 2003). B2B opportunities may prove to be more exciting than B2C in the airline industry. To illustrate this proposition, airline ticket distribution may offer significant cost savings - approximately up to 30% (Airline Business, Aug. 2000). However, most airlines compete away much of the benefit and only 30% of global travel sales are likely to be online within the next five years. With B2B, both the online penetration and the value retained by the airlines are expected to be at least twice the level as B2C (Airline Business, Aug. 2000).

Increases in travel and the number of aircraft contribute to an increased demand for aircraft parts and products. In addition, as the age of the world fleet of aircraft increases, demand for new, used and overhauled aircraft parts and products are likely to increase. Historically, airlines have attempted to control the majority of aviation parts and products inventory. Airlines are now trying to reduce the size of their parts inventories in an effort to reduce inventory carrying costs. These inventory reductions can increase the airlines' reliance on suppliers of new, used and overhauled parts and products, many of which may be difficult to obtain from manufacturers on a timely basis, if at all. If airlines demand time responsive inventory procurement processes, responsibility for inventory storage and handling should shift to suppliers. However, suppliers of aviation parts, components and other products are often widely distributed geographically and the specialised and complex nature of aviation parts and products makes it difficult for a buyer to locate and acquire a desired part or product that may be needed urgently.

As such, buyers often search for a specific part or product to meet the parameters for a specific aircraft at a particular location. To do that, they may have to spend a considerable amount of time examining multiple paper catalogues and other information from different suppliers to identify the most appropriate part or product. After locating the desired part or product, buyers usually place orders by telephone, fax, or e-mail and typically must place orders with multiple suppliers in order to obtain parts or products related to a single aircraft.

Many orders for aviation parts or products were typically handled through internal, paper-based processes that require manual preparation, written approval by purchasing managers and manual order tracking, and billing and reporting across multiple departments within an organisation. These paper-based procurement processes are traditionally complex, cumbersome and time-consuming. Traditional purchasing methods also present a number of challenges to sellers trying to reach buyers of aviation parts and products. Due to the high cost of printing and distributing paper catalogues, sellers have difficulties in cost-effectively managing frequent updates and distribution of time-sensitive information. These catalogues can be difficult to search and limited in their ability to provide depth of product and seller content. Sellers who are small in size may have limited resources available to support the growing challenge of marketing and selling to the highly fragmented worldwide market for aviation parts and products.

But it is not only the traditional spare parts supply chain that needs expansion. In addition, the integration of the in-flight supplies and catering supply chain is a complicated business involving a multitude of suppliers and other variables. Linking the members of the in-flight supply chain to each other as well as to airlines is highly complex. In order to react to external environmental changes and changing load factors, airlines' catering plans need to be highly flexible, e.g. in terms of service scheduling, galley planning and menu specifications. In a situation of a sudden radical change in plans communications have to be made to a large number of service providers and suppliers. Being able to quickly adapt to the changes in the industry's economic environment and thus quickly implement changes necessary translates to significant savings for an airline. Further to that, an airline with a global network of destinations and global stations often bears the problem of high inventory levels of in-flight materials and equipment as in certain situations airlines cannot rely on their suppliers. Vast geographic dispersion of operations, a variety of suppliers and manual communication processes all increase the risk that airline operations may not happen as planned. Similarly, the timely procurement of other commodities and product groups along the airline value chain are affecting an airline's performance and competitiveness.

On the other hand, conventional ICT systems have limitations preventing their widespread adoption. Two methods currently used in the aviation industry are conventional EDI and Enterprise Purchasing Software Systems. Because EDI systems rely on the execution of repetitive identical transactions, they are generally not well suited to dynamic procurement environments involving many buyers and sellers of a wide variety of goods and services. By contrast, some suppliers and airlines have developed Enterprise Purchasing Software Systems designed to improve the coordination of the purchasing function across large enterprises. However, both EDI systems and Enterprise Purchasing Software Systems can be expensive to license and/or install and may require users to pay ongoing maintenance and/or transaction fees. Due to the expense and complexity of these systems, they are generally unsuitable for all but the largest organisations.

The expansion of the Internet and associated ICT changed the way businesses and consumers interact, communicate information and conduct business transactions. Given this increase, the Internet has grown from a means of mainly distributing information to a medium that facilitates complex business-to-business communications and transactions. In response to increasing pressures to lower their cost base, decreasing inventories and improving sales and marketing productivity, companies are ever more considering the possibilities to substitute their paper-based transactions with more efficient e-Commerce solutions.[7] According to Lufthansa, e-Business will grow constantly in the procurement process through electronic media, as it offers one of the greatest potential savings.[8] Significant cost reduction is frequently cited as the increased transparency of the markets, joint purchasing volumes and the restructuring of the corporate relationships between the suppliers and the buyer. Expanded and more sophisticated use of ICT on the buy side of an operation has the potential to cut 20-40% of procurement process costs (Feldman, 2000).

This fragmentation and complexity of the aviation industry and the current paper-based purchasing processes may create a need to use B2B e-Marketplace portals that seamlessly brings together buyers and sellers of aviation products.

4.4. Airline Industry Specific E-Marketplace Developments

Starting from 1998 on with the establishment of 56 e-Marketplaces in total in the airline industry, there has been significant press coverage about the important role that B2B e-Marketplaces would have in reshaping supply chain activities in the airline industry.

[7] http://www.eyeforaerospace.com/pics/whitepapers/partsbase.doc
[8] http://www.lufthansa.com/dlh/de/htm/k_themen/e_business/beschaffung.html

The consensus among analysts and industry experts was that these consortia would be "the next big thing" in the B2B landscape, and would provide the much needed liquidity and industry-specific expertise that had been lacking in the e-Marketplaces. However, in mid 2000, the aviation e-Marketplace industry had begun to experience a shakeout that was predicted beforehand by many industry analysts. For example, the Financial Times reported in 2001 that suppliers are reluctant to sign up to aviation e-Marketplaces created by the prime contractors. The primary objective of e-Procurement was perceived to be a reduction in the purchase price, therefore forcing pressures on supplier margins, which were therefore reluctant to participate in e-Marketplaces. E-Marketplaces had for example difficulties in gaining traction due to challenges in building out their technology, difficulty in convincing buyers to place transaction volume over the exchange, and difficulty convincing suppliers that the e-Marketplaces would not obstruct customer relationships or commoditise their products. It was recommended that industry should forget about the promise of large savings from B2B e-Marketplaces and instead use the portals to manage collaboration on existing programs (Nickerson and Owan, 2002, cite Odel, 2001).

According to a study of Forrester Research (2000), e-Marketplaces in the aviation industry showed differences regarding the competitive position (reaching from very low to dominant market position) and the functionality supplied (a majority of e-Marketplaces had a lack of functionality and services). Sculley et al. (1999) claim that although it is the technology of the Internet that is making B2B e-Marketplaces possible, they are primarily business applications and not technological innovations. The real long-term value of a B2B e-Marketplace to its users would be greatly enhanced if it is tailor-made for the specific market in which it operates – and this requires the exchange to be designed primarily from a business perspective rather than a purely technological one (Sculley et al., 1999). This is particularly important in the aviation and aerospace industries, where most products are characterised by a high level of precision and where trade is bound on very special and precise quality requirements. The use of Internet-based e-Procurement solutions in this industry sector may therefore vary from other sectors, as for example the sale of aircrafts, certain spares and repairs is subject to considerably stronger reglementations. Figure 23 shows that e-Marketplaces need to provide data not just on the part, its location, and its owner, but on the condition of the part as well (new, refurbished, or requiring repair).

Industry	Airline	Automotive	Packaged goods
Pain point	Airlines must have the right part in the right city at the right time to repair planes without having to cancel flights, requiring thousands of parts in dozens of cities "just in case"	Auto manufacturers depend on multiple tiers of suppliers, demand forecasts historically have moved through the supply chain tiers in linear fashion – from one supplier to the next, getting distorted at each step, which precipitates extra inventory holding and expediting of orders all along the chain	Packaged goods companies and retailers need to work closely to ensure that goods do not stock-out while managing inventory levels, promotion plans, and sending/receiving orders
Resolution	Spare parts visibility – transparency to inventories of other airlines, distributors, and manufacturers	Simultaneous, multitier demand forecasting	A collaborative planning, forecasting, and replenishment tool which automates the process

Figure 23: Using E-Marketplaces to Address Industry Pain Points
Source: CAPS Research, McKinsey & Company, 2001, E-Commerce Exchanges – Making informed Decisions. Applying Best Practices.

As a consequence, e-Marketplaces in the aviation industry sector have to assure for example an adequate qualification of its participating suppliers. However, due to the strong heterogeneity of goods in this market segment, Forrester Research (2000) has forecasted that the market share of products being traded on e-Marketplaces will not even reach 50% of total online trade in this sector. Nevertheless, Forrester Research (2000) identified that cost reductions would be possible through enhanced efficiency and through improvements regarding services within the supply chain of this large market. For example, the airline industry holds approx. 50 billion euros in spare parts inventory to ensure that the right part for any of the many types of planes in use is available when needed for routine maintenance or between scheduled flights, wherever the plane might be.

The inventory is held at manufacturers, distributors, and at the airlines, in multiple geographic locations. To reduce the likelihood of delayed and cancelled flights, the airlines stock the parts they may need for repairs in multiple regions that reflect their primary routes. Ensuring that the right part is in the right place at the right time is complicated by variation in the time to failure of a part, variation in the types of parts on different types of aircraft (and even on different planes of the same model), changes in aircraft schedules and routes, changes in fleet composition due to retirement of older aircraft and other factors. Airlines resolve situations where a spare part is required quickly by using brokers or by calling other airlines with similar fleets to find the needed part. An inventory visibility tool developed by e-Marketplaces has the potential to reduce industry costs significantly, by facilitating the finding of the right part faster for unscheduled maintenance, reducing the administrative costs of finding the right part, and reducing required inventory levels. It also may have an impact on the revenues of the airline and customers' view of the airline's service, as planes grounded for maintenance can be repaired more quickly, reducing delayed and cancelled flights. However, the technology and the collaboration between competing airlines required to deploy this tool may not be easily achieved.

Based on this background, Figure 24 identifies the aviation industry value chain incorporating potential e-Marketplace platforms. All different transactions within the manufacturing and non-manufacturing entities are shown in mutual interaction. To simplify the model, the organisations are represented as operating at a single level in the value chain and are supplying to the respective higher levels. However, in practice, though mainly having a principle role within the value chain, many subjects operate at and supply to more than one level. Furthermore, each of them is engaged to a greater or lesser extent in both original manufacturing and in maintenance, repair and overhaul (MRO) activities.

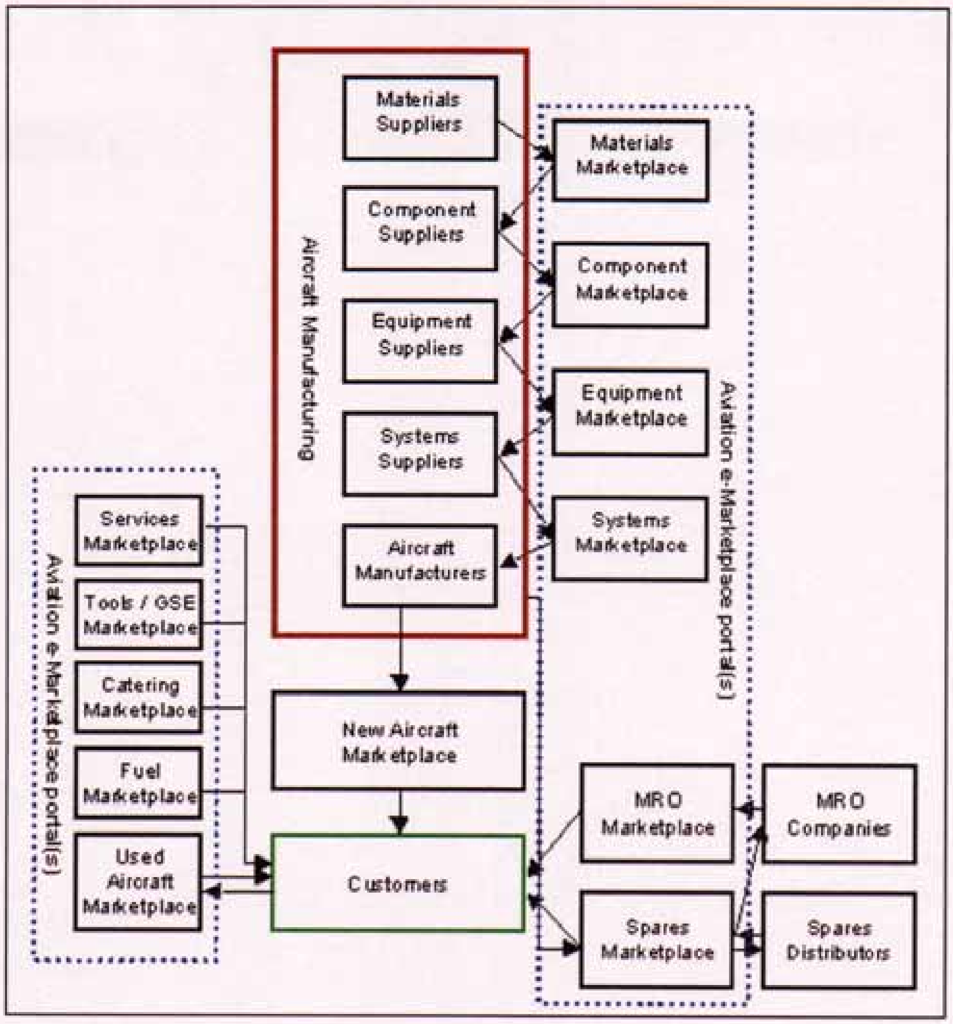

Figure 24: Aviation Industry Value Chain
Source: Derived from Department of Trade and Industry, 2000, A study of the impact of e-Business on the UK aerospace sector.

As illustrated in Figure 24, transactions occur in both directions between the industry subjects. The arrows represent the direction of flow of goods and services. Within this value chain, individual commercial transactions occur in a marketplace at specific transaction points. There are physical and/or virtual interfaces that permit buyers and sellers to engage in commercial activity. An e-Marketplace can host many physical and/or virtual transaction points, but it will tend to be structured according to the characteristics of the goods and services being traded, and the requirements of the principal buyers and sellers (Department of Trade and Industry, 2000).

Therefore, e-Marketplaces in the airline industry can be categorised according to orientation including particular features, as well as ownership:

- Airline driven: e-Marketplaces around airline (alliances).
- Manufacturer driven: e-Marketplaces established by manufacturers also being able to provide online support.
- Part-broker driven: e-Marketplaces mainly allowing customers to buy parts and components online.
- External player driven: companies that have already created e-Marketplaces in other industries and are now spreading over to the aviation industry.
- Neutral: e-Marketplaces that are none of the above.

Choudhury et al. (1998) show that electronic markets in the aircraft parts industry can improve purchasing efficiency for airlines. However, they study only one individual e-Marketplace which produces no price information, only location information. They argue that this, nevertheless, is important to airline firms that wish to maintain their aircraft fleets for maximum availability for carrying passengers. So they must know which suppliers have parts that are needed for aircraft maintenance, and where those parts are located in the national supplier inventory system. The authors show that airline firms balance purchases to not only receive the best spot price, but also to facilitate long-term relations, which can reduce coordination costs over time.

They also argue that e-Marketplaces should make it easier and faster for buyers to locate suppliers, thereby lowering the lead times, and also increase the probability that a buyer will be able to locate a supplier who has the needed part in stock, thereby lowering the uncertainty in the lead times. The net effect should, therefore, be a reduction in the buffer stocks and hence lower average inventory levels.

A further step in the B2B process is to move from an aggregation mode to a collaborative effort, with airline buyers pushing information downstream to suppliers, allowing the suppliers to achieve savings that can flow back to the airline (Feldman, 2000). This process has already been developed in the late 1990s, with airline-, parts-broker, neutral and manufacturer-sponsored B2B e-Marketplaces emerging. For the airlines, B2B e-Marketplaces are an opportunity to use their leverage as major buyers to squeeze savings from suppliers and sell their own excess inventory. However, there is a lack of academic research and empirical data regarding the rise of B2B e-Marketplaces within the airline industry, the adoption drivers and the performance indicators.

That is why it is also important to set these more recent advances in the airline industry within their broader foundations to understand the complexity of the industry and the problems and challenges airlines have to deal with. Further major prior developments that have affected airlines' strategic decisions need to be considered in the literature review as well. These encompass key developments shaping the industry in recent years, such as the nature and extent of competition, brand differentiation strategies and airline alliances. These environmental and strategic developments provide a distinct framework for researching the value creation potential and adoption drivers of B2B e-Marketplaces in the airline industry and require explanation explained in more depth in the following in order to conclude the literature review.

4.5. Globalisation and Airline Alliances: A Response to Enhanced Competition

A trend towards globalisation is noticeable in the airline industry, which is mainly due to liberalisation and deregulation processes around several parts of the world, leading to various strategies promoting global competitiveness (e.g. Ehmer, 2001; Janic, 1997; Oum, Wit and Yoshida, 2001). With these deregulative measures, the advent of sophisticated ICT such as e-Marketplaces, the limitations for international growth and the need to continuously strive for a state of competitive advantage, one of the most meaningful developments have been the formation of strategic alliances (e.g. Agusdinata and Klein, 2002; Fan et al., 2001; Kale, Dyer and Singh, 2001; Morrish and Hamilton, 2002; Oum, Yu and Zhang, 2001; Suen, 2002). Since then, alliance strategy in various forms has dominated the airline landscape. Strategic alliances which allow capacity sharing can be seen as a substitute for multi-national consolidation among airlines when direct merger or takeover is restricted by bilateral agreements, which specify that an international airline must be under substantial ownership and effective control of its home country nationals (Findlay and Nikomborirak, 1999).

Strategic alliances are defined as a long term, explicit contractual agreement pertaining to an exchange or combination of some of a firm's resources with a competitor (Burgers, Hill and Kim, 1993). Gaining a competitive advantage in a given marketplace via the procurement and construction of a defined set of competencies is critical to commercial success and longevity (Adler, 1966; Hamel and Doz, 1998). Strategic alliances are voluntary arrangements between firms involving exchange, sharing, or co-development of products, technologies, or services (Gulati, 1998). Alliances can be classified into three categories namely (1) joint-venture, (2) minority alliances, and (3) contractual alliances (Gulati and Singh, 1998). Another categorisation scheme focuses on the nature of relationship among partners, grouping alliances as mutual service consortia, joint-venture, and value-chain partnerships (Ranganathan and Lertpittayapoom, 2002).

Literature suggests that the most common types of drivers that influence the propensity of firms to enter into strategic alliances are turbulence in markets, resource constraints, market uncertainty, globalisation of the industry, fast technological change, economies of scale, prior involvement in strategic alliances, risk sharing, and consolidation of market position (Bennett, 1997; Glaister, 1996; Lorange and Roos, 1991). Competitive forces also play a critical role in strategy formulation in organisations. All these factors can be grouped into two broad categories – firm characteristics and environmental characteristics – that mostly influence the propensity of firms to enter into strategic alliances (Varadarajan and Cunningham, 1995). In a broad sense, an organisation's environment consists of actors and forces outside the firm, which affect the company's attitudes, actions and outcomes (Kotler et al., 2001).

Airlines operate in a global ICT enabled environment that is characterised as diverse, knowledge-rich and unstable (Achrol, 1991). The challenges of globalisation mandate a requirement to form alliances as key elements of strategy (Ohmae, 1989). Organisations such as airlines are increasingly recognising that an individual firm is insufficient to deal with rapid changes in the environment. Uncertainty concerning product markets, changing barriers to foreign trade and investment, technological volatility, market turbulence, and rapidly changing economies of scale have all been proposed as contributors to environmental uncertainty and linked to increased cooperative behaviour between firms (Devlin and Bleackley, 1988; Harrigan, 1988; Forrest, 1990; Hagedoorn and Schakenraad, 1994). Organisations may employ strategic alliances to improve and acquire capabilities for expanding their market reach, customer base and purchasing power (Ranganathan and Lertpittayapoom, 2002).

Often the alliances give the partners access to resources that might not otherwise be available to them. This may include access to technologies, access to capital, access to raw materials or natural resources, and access to information (Hamel, Doz and Prahalad, 1988; Ohmae, 1989). A strategic alliance partner may be able to provide access to extensive distribution channels, access to new markets, access to ICT and access to advanced supplier networks (Lei and Slocum, 1991). In the airline industry, alliances offer the opportunity to expand network and market presence without having to expand the existing fleet. Code sharing, which is a particular form of alliance, allows an airline to circumvent (1) the capacity constraints and foreign investment restrictions in the bilateral agreements and directly or indirectly provide services to new destinations or to cities the airline serves with less frequency. It further allows an airline to (2) circumvent barriers to airport facilities by taking advantage of the partner airlines superior access, as well as (3) to gain incumbency advantages the partner airline has in terms of access to travel agents, corporate sales and (4) to negotiate power vis-à-vis external suppliers (Findlay and Nikomborirak, 1999).

When alliance partners have complementary target markets, the alliance participants are more likely to consider the alliance to be a success. When alliance partners are not direct competitors, but still have some synergies between their target markets, participants may benefit from the agreement. In alliances where firms are direct competitors, opportunism is more likely to be a concern. This can also be reinforced by findings where alliances in the travel industry are often more successful when partners have complementary target markets (Finney, 2002). Organisational relationships are dynamic, as they may contain situations of both positive and negative aspects. According to an environmental perspective competitors are firms with identical customers, products and markets (Laine, 2002).

When competitors co-operate there is a continuous tension between competition and co-operation. A concept used to describe these types of relationships is co-opetition (Nalebuff and Brandenburger, 1996), which means that two firms can co-operate with a particular field of business, e.g. purchasing. Alliances exist on two conflicting levels: firms work together while competing at the same time (Hamel, Doz and Prahalad, 1998). Co-operation among competitors has led to increased competitiveness (Dana and Vignali, 1999).

In literature, several reasons have been identified to explain why airlines aim to co-operate with each other (see Kleymann, 2002). One of the major drivers is customer expectations towards seamless travel to a maximum number of points across the globe. Similarly, defence mechanisms consolidating an airline's position through traffic feed from an allied partner or passive by sheltering from competition are further drivers. Furthermore, a single airline has, to some extent, influence over its immediate task environment, but relatively less leverage over the larger general environment. The alliance, if acting as a representative of its members, is likely to have more negotiating power vis-à-vis external suppliers. Another important driver identified includes economies of density. These occur when unit costs decrease as the volume provided increases at a fixed network size. One can distinguish between link density, which is related to the load factors on a flight or city pair, and network density, which measures the efficiency of fleet utilisation over the entire network or a set of routes. Economies of scope occur when unit costs decrease as multiple products are produced. Alliances offer airlines the opportunity to reap economies of network size or scope even though they do not physically expand the number of points they serve themselves. Possible sources of these economies are codeshares, a broadening of the marketing presence through joint branding, and access to well-distributed frequent flyer programmes (Kleymann, 2002).

The first airline alliances arose in the U.S. domestic airline industry. A number of domestic carriers sought to achieve cost savings and to better utilise capacity through the operation of joint venture services and code sharing. Since then, alliances have expanded into other airline markets as well as between countries, regions and on a global basis (Nunes, Farago and Travis, 1997). Alliances may be simple, co-ordinating just one element of operations. Alternatively, airlines may enter into complex large-scale alliances. Success in strategic alliances is dependent on multiple factors. These include clarity of strategic goals, commitment of resources, commitment of management, realisable cost savings, compatibility of product service standards, similarity of corporate styles, and, in the airline industry, complementarity of route networks.

There is a wide variance however in an airline's willingness or ability to enter different levels of integration, and these differences in the tightness of links are likely to define the structure of airline alliance groups as they approach maturity. An airline alliance is likely to become a network with different levels of integration between its members. According to Kleymann (2002), it is possible to distinguish three positions within an alliance. At the heart of the alliance, a small number of partners, called full members, co-operates tightly, possibly even relinquishing some authority to a joint steering board. The agreements between these full members are likely to be fully multilateral and exclusive. The full members are supported by the second tier members. These are typically affiliated feeders which collaborate more tightly with one of the full members, possibly also through equity ties, than with the others. The distinction between full members and second-tiers is hierarchical as second tier members do not have the same power within the alliance, but they receive density and scope benefits. Lastly, there is the sphere of contributors, which co-operate within the alliance on a route-to-route basis or even with airlines from different alliances. They seek co-operation based purely on single codeshares (Kleymann, 2002). All three types of alliances are structurally distinguished by the different levels of interconnectedness, or tightness of coupling, between their members.

There are four prominent factors determining the differences in the tightness of coupling. These are regulation, passenger expectations, uncertain competitive environment and internal resistance. The two main factors which positively influence the tightness of co-operation between alliance members are passenger expectations of a seamless network and the increased uncertainty of operating in a deregulated environment. However, the next two factors work against tight co-operation between partner carriers. Within airline management there is a large reluctance to give up independence and to relegate decision-making to some entity outside the company. Even though managers may consciously favour an alliance membership, they are likely to put their own airline's interests above those of the alliance, thereby working against integration. Regarding the regulatory environment, on the one hand, there is a strong resistance to approving alliances which would dominate a certain market or a certain hub airport. This has a negative effect on the tightness of member coupling, as it can prevent codeshares and joint pricing. But regulation also has an impact on customer expectations as well as on the airlines' requirements for environmental control. The opening of markets has changed what customers expect from air travel. Moreover, the mere fact that strong regulatory forces govern air transport is inducing airlines to co-operate with each other in order to maximise their influence on regulators (Kleymann, 2002).

All in all, behavioural factors such as trust and commitment are found to be important drivers of alliance performance (e.g. Kanter, 1994; Lorange and Roos, 1990; Young-Ybarra and Wierseman, 1999). These factors can collectively be referred to as relational advantages (Dyer and Singh, 1998). In particular, collaboration-specific rents (Madhok and Tallman, 1998), relational rents (Lane and Lubatkin, 1998), common benefits (Khanna et al., 1998) and relational capital (Kale et al., 2000) can result from these advantages. In the airline industry, beyond e.g. the co-ordination of schedules and fares, strategic alliances further aim at cost reductions through the possibility of joint procurement opportunities in a strategic network approach (enabled by ICT). Such multilateral alliances can be viewed as a collection of sub-networks (i.e. derivative networks according to Gudmundsson and Lechner, 2002). Such a network is a collection of business sub-units with a particular function containing their own specific network of partnerships, including multilateral alliance partners. These networks are created in functional areas within service businesses that have developed quite independent objectives and structures to react to business externalities such as competitive forces. In some instances, they are prime candidates for spin-offs, to become separate profit centres or be outsourced (Gudmundsson, Boer and Lechner, 2002).

More recently, airlines involved in strategic alliances and various other partnerships have studied intensively the potential of such joint procurement possibilities and have taken measures in creating consortia-led e-Marketplaces as mediators for aggregating demand and to facilitate transactions. In the airline industry, there is a variety of potential areas in which the possibility of obtaining discounts arises through joint purchasing. Substantial discounts may be available for large orders of high cost items such as aircraft and maintenance spares and components. Holding of aircraft spares also significantly raises an airline's cost level, not only through the initial purchasing process but also through administration charges and storage fees. 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. Already, many airlines pool their holdings of spares in an effort to reduce duplication and other wastage (McPherson, 1998).

Airline collaboration can lead to improved supply chain management, where B2B e-Marketplaces play a significant role as mediators. For example, quite a large number of airlines collaborate at the back end of their spare parts supply chain in the Air Transport Association's "AIRS" network (airline inventory redistribution system, a part of the ATA Spec 2000 Marketplace) to sell or exchange their surplus spare parts. The collaborating carriers use the AIRS network to buy and sell their excess stock. As a positive effect, they thereby re-allocate important capital away from non-working assets that can be used otherwise. Another example can be found at the front end of an airline spare parts supply chain. What can be observed there is that most major airlines and a majority of their worldwide suppliers and service companies collaborate in an open B2B e-Marketplace exchange, such as for example ILS. It's a system where new and refurbished spare parts stocks are displayed in a searchable real-time format and can be accessed by sellers and buyers worldwide. A similar system is existing as the ATA's Spec 2000 Marketplace. For vendors, the potential for an increased business volume by a better transparency of the market can create significant value, especially when they can respond to lucrative urgent parts situations when carriers have planes parked on the ground incapable to fly due to the lack of a particular replacement part. Whenever an AOG alert is communicated among carriers, they are paradoxically supporting one another directly by selling or temporarily borrowing critically needed parts (Kelly and Mitchell, 2001). These examples demonstrate that (virtual) collaboration alliances are taken up among airlines, despite or even because of increasing competition and cost pressure.

4.6. Airlines and Their Strategic Approaches

Another important driver is the strategic approach of airlines. The airlines' challenge is sustaining and creating profits in the face of stronger competition and product homogenisation. Opportunities are in managing customer relationships, controlling costs and applying new technology. Deregulation has left the industry with airlines pursuing various strategies, which are traditionally classified by airline type in literature. In the context of this research, a further classification of airline types based on sources of competitive advantage is required. However, there are several approaches to classification. One is grouping airlines according to their network characteristics (see Kleymann, 2002). According to this classification, there are short to medium-haul airlines, based around one or two main hubs and possibly several secondary hubs within their respective home region. They may operate limited long-haul services and while some of these intercontinental operations may be high-yield and generate significant revenue, they often constitute a relatively small part of overall operations. With long-haul operators, intercontinental flights constitute a fairly high proportion of their total flight operations and revenues. Some airlines can be found in this category due to the geopolitically remote location of their home. Transcontinental connectors aim to serve the whole world; they operate to several continents and have the capability to link two continents through their home hub on a third. They also often operate dense local networks, but these do not necessarily constitute their primary goal. The role of a transcontinental connector requires a centrally located home base. Most transcontinental connectors also have short to medium-haul operations. Another more commonly used classification system includes the distinction of major scheduled, low-cost, charter and regional airlines, which is described in more detail in the following. These four airline groupings have distinctive characteristics and therefore it is vital to consider their differences for the study of e-Marketplace adoption and its performance impact.

4.6.1. Major Scheduled Airlines

Major scheduled (or network) airlines typically focus on both long and short-haul routes and mainly operate with a large fleet of diverse aircraft and with linkages to code-share agreements or alliance memberships. After deregulation processes took gradually place, these major scheduled airlines shifted their route systems from point-to-point to hub-and-spoke systems, whereby they built up major connecting hubs at what had been formerly origin and destination (O&D) airports (Poole and Butler, 1999).

As competition has become more fierce among major scheduled airlines, due to overcapacity problems and several serious external crisis (e.g. Sept. 11, war in Iraq, SARS), they are implementing strategic changes on their short-haul networks, mainly in the form of lower fare structures and softer travel restrictions (Borghetto, Berthelot and Gibbons, 2002). Minimisation of complexity and infrastructure costs (e.g. airport and handling charges) makes it however virtually impossible for long-haul or hub airlines to match the cost bases of low cost, point-to-point airlines on short-haul routes. The complexities of a long haul transfer network produce inevitable additional layers of cost (e.g. due to mixed fleet structure, higher maintenance costs, complex pilot training, lower asset turn, crew overnight stays).

Major scheduled airlines typically try to create a competitive advantage by means such as reputation and information spillovers as well as marketing devices. One of the best known marketing devices in the airline industry are frequent flyer programmes (FFPs) which is an airline programme for the accumulation of air mileages in exchange for awards, such as free travel, accommodation or gifts. FFPs have been effective in attracting repeat business, especially from the most lucrative group of customers, the business travellers (Borenstein, 1989). They are recognised as inducing brand loyalty and are argued to be particularly beneficial to a dominant carrier in that area. If an airline serves more routes and has more flights from a city, then the majority of a local resident's future flights are more likely to be on that airline than on any other and that airline is likely to serve a wider variety of payoff destinations from the city, destinations that are particularly attractive prizes to be awarded as FFP bonuses (Borenstein, 1991). However, one key to loyalty inducement from FFPs seem to be the extensiveness of the airline's route network. A similar programme as FFPs typically used by major scheduled airlines are travel agent commission override programmes (TACOs) that may have comparable effects. Similarly to FFPs, TACOs pay bonuses in terms of increased commissions to travel agents that generate some specified level of revenues for the airline and so are able to effectively attach travel agents to certain airlines. Such a programme, however, only works in an environment of imperfect information, to the extent that the principal cannot fully monitor the travel agent. As with FFPs, the airline offering the most opportunities for building up revenues and offering the most valued set of bonuses will be the most effective in inducing loyalty through a TACO programme (Borenstein, 1989).

There is also substantial evidence that an airline with a dominant share of the traffic of an airport has a competitive advantage on routes that include that airport. According to Borenstein (1991), an airline can sustain competitive advantage by carrying a large share of traffic originating at one airport and so being able to attract a disproportionate share of the traffic on any particular route from that airport. At very busy airports, airlines with large scale operations may be able to inhibit potential competitors' abilities to obtain facilities necessary. However, due to downturns in industry and increased competitive pressures, many scheduled airlines have to bear with new cost structures and are furthermore incorporating new pricing and service strategies. While major scheduled airlines aim to differentiate themselves in first and business class offerings in order to gain better market shares in that sector, economy fares and services focus more and more on the strategies of low-cost airlines.

4.6.2. Low-Cost and Low-Fare Airlines

A further strategy, that airlines have employed are those of low-cost, no-frills services. Low-cost airlines have effectively taken advantage of the post-deregulation environment and have gained cost advantages due to the use of uncongested and less busy airports (which charge lower costs), very limited in-flight service that would be free of cost for the passenger, less personnel in the air and on the ground, by travelling only on a point-to-point basis on predominantly short-haul routes and by avoiding cargo transportation. Turnaround times on the ground are kept to a minimum, thus maximising revenue generating air time (Anonymous1, 2003). Travel agents and their computer reservation systems are typically avoided. Moreover, low-cost airlines, in most cases, use only one type of aircraft (e.g. B737, A320) in order to have a high degree of crew flexibility, higher personnel to aircraft ratios, fewer stand-by crews and training needs, lower maintenance costs and modification requirements. Technical operations, such as maintenance or even the procurement functions, are typically outsourced to third party providers that can often provide the service at a lower price due to scale effects. Savings may also come from having one class of passenger and more seats.

Other cost reduction strategies include the non-provision of executive lounges or free catering services or the encouragement of Internet bookings. This can cut out travel agents and provide savings in distribution costs, as well as a significant amount on sales promotions and other supporting material (Anonymous2, 2003). Passengers are also charged for using credit cards, where other scheduled airlines absorb such costs. Target routes of low-cost airlines are destinations for short city breaks, which often attract a completely new passenger group. However, low-fare airlines take actively advantage of pulling away passengers and traffic from charter airlines. As a result, many routes that have formerly been only served by charter airlines are now strongly competitive and often the low-fare airlines have achieved to push their competitors out of the market. At a similar low-cost basis, charter airlines are operating at hub airports and non-hub secondary airports. The latter are obviously target markets for low-cost operators.

A genuine low-cost airline is defined as an airline that keeps costs down and passes on some of these savings to the passenger. More and more low-fare airlines that have started offering low fares, but while cost-reduction programmes are in process, the actual cost base has not yet changed that significantly. For example, this could be an airline, which attempts to re-brand itself into a low-cost operation, such as a charter, regional and scheduled airline that is trying to enter the low-cost sector. However, quite often, certain aspects of the mainline operation, such as business class and frequent flyer programmes remain. Problems can arise in such a case with the variety of aircraft types and their potential unsuitability to low-cost operations. For example, a regional aircraft is not as effective in terms of seat-mile costs as a B737 or A320. Furthermore, corporate culture and current staff contracts are very hard to change overnight. Another category of low-cost airlines are those which have been spun off from a mainstream airline. Most of those operate separately and autonomously from the parent company. For example, it may create substantial problems when pilots are flying under the same terms and conditions as the mainstream airline (Anonymous2, 2003).

While Southwest has pioneered the low-cost strategy in the USA 30 years ago (Anonymous1, 2003), subsequent models, refined or extended, have been based on this pioneering strategy. However, the type of business philosophy has not changed much throughout its three decades of operation. Low costs enable airlines to charge low fares and low fares stimulate traffic in the marketplace. That traffic is served by additional capacity, which promotes economies of scale to gain yet lower costs (Anonymous2, 2003). In terms of destinations, low-cost airlines typically take advantage of secondary and tertiary airports, which may offer (sometimes illegally) subsidies for airline attraction. Typically, it is only one significant low-cost airline in and out of such an airport and therefore it has a far greater control over what happens on the ground (with improvements in e.g. turnaround time, delays). For example, while a scheduled airline may operate a certain aircraft for seven to eight hours a day, a low-cost airline is typically utilising its aircraft almost twice that much, which means twelve to thirteen hours (Anonymous2, 2003).

All in all, it is possible to distinguish two major low-cost approaches. The first approach is focused on the development of new destinations and needs access to low-cost secondary airports. On many routes, this strategy avoids direct competition with traditional airlines, as the target traffic base is different. In most cases, such a strategy stimulates completely new traffic volume out of and into secondary airports. The second business model is slightly different. While generating similar traffic simulation effects this model appears more focused on existing O&D (Origin and Destination) markets and business traffic. This means that such a low-cost strategy has to achieve a cost base below the main incumbents and compete traffic through strong price advantages. Flying out of mainline airports means a higher cost base, but also better yields (Borghetto, Berthelot and Gibbons, 2002). For the classification purpose of this study, the terms low-cost and low-fare are used interchangeably in this thesis. The question of definitions is not likely to be resolved readily and the best course is to adopt a pragmatic view, while recognising that this view may require adjustment over time.

4.6.3. Charter Airlines

Since the 1960s, charter airlines have accounted for a significant proportion of air transport activity, mostly as a result of being able to carry their passengers at a significant lower cost than scheduled airlines. An analysis undertaken by the UK Civil Aviation Authority in the late 1970s revealed that the costs of a charter airline in carrying a passenger were between 50-60% lower than for a scheduled airline operating at the same route (Williams, 2001). Research has revealed that the combination of larger aircraft, longer flight sectors, greater aircraft and crew utilisation and higher load factors provides the typical charter airline with significantly lower costs per passenger carried than its (low-cost) scheduled counterparts (Williams, 2001). Important to note is that like their scheduled counterparts, also traditional charter airlines are recently forced to adopt more severe competitive measures in order to cope with a recessive business environment. As a result, two strategic business models can be identified: the fully integrated carrier, which means that many charter airlines have teamed up with large tour operators, and the independent charter operator, trying to sell capacity to tour operators while operating seat-only sales respectively. During the 1990s, the tour-operating sector underwent considerable consolidation of both a vertical and horizontal nature. Also the volatility of the charter market and its poor image with travellers led many tour operators to set up their own in-house airlines.

Most European charter airlines now form part of vertically integrated organisations incorporating a tour operator, travel agency chain, airline and, more often, hotels and providers of ground transportation. However, according to Michael Frenzel, CEO of TUI AG, in this changing competitive environment, charter airlines have to bear comparison with the cost structures of low-cost airlines (Manager Magazin, 2003) since their low-cost counterparts are actively aiming to pull away customers on certain routes in the charter sector. According to Williams (2001), charter airlines are especially vulnerable to low-fares airlines on flight sectors up to 2.5 hours of flight time, particularly with regard to customers who wish to purchase flights only. The seat-only traffic is becoming more and more popular among holiday travellers and charter airlines have responded to this new demand with seat-only offers. At present, around 20% of seats are promoted as seat only proportion. Figure 25 provides an overview on the distinctive differences between low-cost, scheduled and charter airlines.

Features	Low-Cost Airlines	Scheduled Airlines	Charter Airlines
Direct Sell	X	(X)	
Extensive Outsourcing	X		(X)
High Density Seating	X		X
In-flight catering		X	
Pre-bookable Seats		(X)	X
Point-to-Point Traffic	X		X
Hub Traffic		X	
Seat Assignment		X	X
Secondary Airports	X		(X)
Short Haul Focus	X	X	X
Long Haul Focus		X	(X)
Short Turnarounds	X		
Single Aircraft Type	X		
Single Class Cabin	X		

Figure 25: Key features of Low-Cost Airlines vs. Scheduled and Charter Airlines
Source: Derived from Williams, 2001, Will Europe's Charter Carriers be replaces by no-frills scheduled airlines?, Journal of Air Transport Management, 7.

4.6.4. Regional Airlines

Regional airlines provide service on short and medium haul routes, often connecting smaller communities with larger cities. They are quite often under codeshare agreements with major carriers. Regional airlines may further operate flights under the brands of the major carriers and the major carriers market the regionals' flights as their own. There is a substantial heterogeneity in whether or not regional airlines are fully owned by a major airline for which they operate. Furthermore, several major airlines own fully or partially some of their regional partners while also contracting with others. From the perspective of the major scheduled airlines, the passengers that regional airlines transport to their hubs provide important feeder traffic for the mainline routes that the carriers themselves serve out of their hubs. The routes that major airlines have their regional counterparts serve on their behalf are typically low-density routes which require only small aircraft - such as turboprops (9-68 seats) and, more recently, regional jets (30-100 seats) (Januszewski, 2005).

Regional airlines can not only be differentiated by the routes served, but also by the aircraft used. The idiom "regional jet" (or RJ) refers to a particular type of small sized jet aircraft, which basically began entering scheduled services in 1997. Before that, regional airline had only the option of operating turboprop aircraft. One of the first manufacturing companies to enter the RJ market was Bombardier, with 50-seat to 70-seat versions of the Canadair Regional Jet, along with Embraer (Poole and Butler, 1999).

Due to current overcapacity problems, an inadequate pricing power has emerged in the regional sectors and thus most long-haul major scheduled operators have low-return profiles (Borghetto, Berthelot and Gibbons, 2002). Due to these competitive tendencies, airlines in secondary markets have or are either in the process of restructuring into regional airlines with high-frequency services with a regional jet fleet, or are acting as a feeder to absorb passengers into the fleet of the major hub airline (Borghetto, Berthelot and Gibbons, 2002). This development is increasing in importance. Boeing forecasts that one of the fastest-growing areas for airlines over the next ten years will be point-to-point routes that are overlying hubs. This prediction is resulting in a high demand of regional jets (Poole and Butler, 1999).

Regional airlines are expected to bring along further major changes in the passenger airline marketplace by using modern regional jets. The initial field of operation of regional airlines is to serve as feeders to the hubs of major airlines. In that market niche, modern RJs are proving to be more popular than small turboprop aircraft which they are replacing successively. Modern RJs further offer low seat-mile costs for medium length routes. Its direct operating cost (per seat-mile) is lower than that of a comparably sized turboprop for routes longer than about 400 miles. Furthermore, the ability to serve such distances economically with jet airliners creates the option of adding smaller cities and more frequent services to the spokes of hubs. But the use of RJ also opens up a new market for point-to-point services that are served by either existing regionals or by another generation of new-entrant airlines, applying a kind of low-cost model to a much smaller aircraft size. If current low-fare airlines can profitably offer point-to-point services between city pairs in B737s or A320s, similarly airlines are also able to offer profitable service between many other city-pairs in jetliners of 30 to 70 seats (Poole and Butler, 1999).

4.6.5. Summary of Strategic Approaches

There are a number of sources how airlines can position their strategy. For example, aircraft size can have a profound effect on an airline's unit costs. In most cases, the larger the aircraft, the lower will be its direct operating costs per passenger kilometre. Other characteristics of an aircraft affecting operating costs include aircraft utilisation, range, fuel consumption, capital charges and maintenance requirements.

Labour productivity is considerably influenced by the extent to which a carrier outsources its activities and by the nature of the product it offers to its customers. The low-fare, scheduled and charter airlines have much in common in terms of the products they supply, but wide differences are apparent with respect to the degree of outsourcing that occurs. The long established charter operators and scheduled airlines often undertake their maintenance in-house, whereas the low-fare companies have mainly outsourced this activity. Therefore, the labour forces of the integrated charter airlines are producing around three times the level of output of a low-fare airline. Distribution costs are virtually non-existent for the vertically integrated charter airline, as sales and promotion activities are undertaken by the tour operator parent company. By contrast, the low-fare and scheduled airlines need to expend a sizeable proportion of their resources to notify the public of their services. The lower distribution costs associated with Internet selling has proved an attractive option for the low-fare scheduled airlines – the majority of bookings are typically made over the Internet.

Administration and finance expenses are typically lowest for the integrated charter airlines, as many of the tasks usually included under this category are undertaken by the tour operator parent company. Similar sized low-cost airlines and independent charter airlines face much of the same levels of expenditure on general administration and finance, while scheduled airlines generally have a higher cost base (Williams, 2001).

Cost and cost drivers may vary between airlines and may be something special and individual to each of them. However, similarities exist and additional details for airline costs and economics are therefore provided in Appendix F. As e-Marketplaces have the potential to have a significant impact on strategy, value creation and lower cost, a detailed explanation within the airline industry context was therefore required.

4.7. Conclusions from Current State of Academic Research

Several theories were considered that set the scene for developing overall research streams and definitions of hypotheses. ***The aim of the literature review was to set a framework for exploring the potential of e-Marketplaces in air transport as an example of an innovation within a specific industry sector.*** This has embraced consideration of a variety of theories on innovation adoption and diffusion, strategic management literature, literature on B2B e-Marketplaces and their role within a competitive sector – the air transport industry.

Recent developments in ICT such as e-Marketplaces may have significant implications for the operation, structure and strategy of airlines. ICT can contribute towards efficiency, productivity and competitiveness improvements of both inter-organisational and intra-organisational systems. Well-managed ICT can generate value for organisations. According to Buhalis (2004), technology has revolutionised e.g. business functions, external environment monitoring, communicating with partners and with consumers at large.

The work on B2B e-Marketplaces is mainly based on the electronic markets hypothesis (e.g. Bakos, 1991; Bakos, 1997; Malone et al., 1987). Specific to the airline industry, little or no account is taken regarding B2B e-Marketplace developments of particular airlines and their partners/suppliers. Research so far has only been undertaken on the effects of ICT on supplier-distributor relationships in the US airline industry (Christiaanse, 1994), procurement practices of airline alliances (McPherson, 1998) and alternative material supply strategies for aerospace subcontractors (Stienen, 1999). While the literature review has sought to inform an understanding of B2B e-

Marketplace value creation, adoption drivers, classifications, evolution and aviation specific developments, it also points to gaps in the research stream.

While e-Marketplaces are analysed in more detail from an institutional perspective, studies from an DOI perspective (Rogers, 1995) and IOE viewpoint (Tornatzky and Fleischer, 1990) are rather rare (e.g. Hadaya, 2004; Koch, 2003; Lee and Clark, 1996b). This is surprising, as there is a wide body of knowledge about adoption drivers for EDI and B2B e-Commerce. In fact, the grouping of explanatory variables into three clusters, the environmental, the organisational, and the technological is a familiar and accepted model in adoption and diffusion literature in IOS.

This field of research can benefit from further investigations, as these previously mentioned frameworks are widely spread in prior technology diffusion studies and have proven to be effective (Nelson and Shaw, 2005). To close this gap, investigation of e-Marketplace adoption variables specific to the airline industry can build on earlier research. This research will focus on the process drivers and performance indicators of e-Procurement through e-Marketplaces, for instance encompassing maintenance and engineering goods and services, fuel, catering and cabin services, airport support services as well as general procurement in the airline industry.

Weller (2000) notes that the types of e-Marketplaces that develop in a given industry will depend on the complexity and frequency of transactions, the extent of industry concentration and the relative power of buyers and suppliers. Deployment of B2B e-Marketplaces has the potential to enable more efficient and frictionless flow of information, goods, services and payments between businesses (Bakos, 1991). Through building liquidity and addressing inefficiencies in B2B supply chains, facilitating transactions and improving business processes, these virtual markets provide a value proposition in the aviation industry.

Porter and Stern (2001) argue that, in the past, firms focused on reducing costs and improving quality to gain a competitive advantage. Today, however, companies must be able to innovate at the global frontier and create and commercialise a stream of new products and processes that shift the technology frontier, progressing as fast as their rivals catch up.

E-Marketplaces can have significant pro-competitive effects. Nevertheless, the quantification of presented benefits is currently difficult and many claims as to their size are comprised of qualitative judgements and estimates (Nathan, 2001). While anecdotal accounts of e-Business advances are not difficult to find in the popular press, there is a clear need to bring a more structured, theoretical focus to bear towards understanding the adoption process and value creation of B2B e-Marketplaces. Clearly, more research is required.

Fichman (1999) recommends that in the absence of a general theory of innovation researchers should develop theories of the middle range, i.e. theories tailored to specific classes of technologies, and/or to particular adoption contexts. The methodology developed to address these emerging implications is considered in the following chapter on research design.

V. RESEARCH DESIGN: THE KEY ISSUES FOR INVESTIGATION AND IMPLICATIONS FOR RESEARCH METHODOLOGY

5.1. Introduction

The aim of this research is to determine factors influencing the adoption of e-Marketplaces as an example of an innovation adopted within the airline industry sector and to research, by determining performance indicators, whether or not the adoption has enabled adopting airlines to achieve performance improvements.

The research area of e-Marketplaces itself does not have a unified or definitive and comprehensive theoretical framework upon which facilitators and inhibitors of e-Marketplaces can be evaluated. Therefore, a range of applicable theory for e-Marketplaces needed to be identified and incorporated into a framework addressing adoption drivers and performance indicators. By viewing e-Marketplaces as a technological innovation (Rogers, 1995) and examining the contexts in which e-Marketplaces are adopted (Tornatzky and Fleischer 1990), influences of contextual airline industry specific adoption driver and performance related factors need to be further incorporated ind such a framework. Since the emergence of B2B e-Marketplaces constitutes a relatively new phenomenon and theories and constructs have not yet been developed well enough, but constructs and theories exist in related IS research areas, this research draws from both explanatory and exploratory approaches. Thus, the building of constructs and hypotheses needs to be based on original theoretical considerations from the literature review in combination with using items and scales from previous research.

Testable hypotheses are built as outlined in the following sections. To gain access to the required data this research uses multiple data gathering techniques, which includes both quantitative and qualitative methods. Two survey instruments for both airlines and e-Marketplaces were designed and two case studies conducted. The reason for two surveys is to measure and compare both perceptions and requirements among airlines and e-Marketplaces. The employment of surveys and case studies follows Mangan et al. (2004) who argue that, while the majority of logistics research is primarily populated by quantitative research viewed through a positivist lens, supply chain management research also uses more frequently qualitative methodologies. The trend in management research generally is increasingly to use methods and approaches which provide a middle ground between the contrasting positivist and phenomenological paradigms and perspectives (also confirmed by Keen, 2004). This multi-approach of surveys and case studies was adopted for this study, as illustrated in Figure 26.

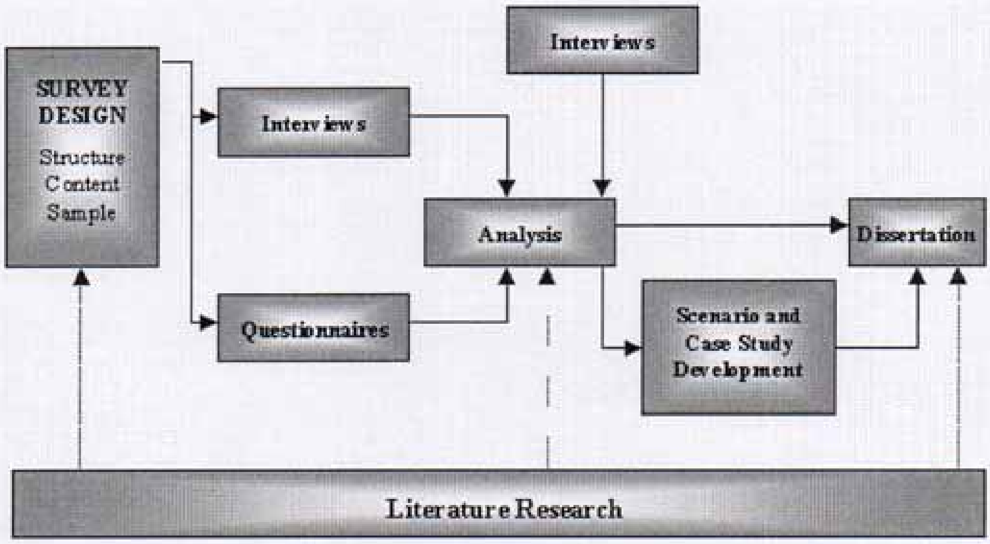

Figure 26: Research Methodology

By using both surveys and case studies, the decision to apply the factor approach will however not completely exclude the process-oriented approach (as described in section 2.2.2.), as both approaches complement one another. The collection of both quantitative and qualitative data is directed towards the development of an analytical framework that can facilitate interpretation of findings and enhance research validity. The details of the hypotheses construction and the research design are highlighted in the following sections.

5.2. Hypotheses Development

As outlined in the introduction, testable hypotheses are postulated within the scope of two major streams, which are: (a) E-Marketplace adoption enablers and drivers and (b) e-Marketplace procurement value chain performance indicators and their impact on competitiveness.

(a) Hypotheses development towards the identification of e-Marketplace adoption enablers and drivers.

For purposes of this study, the DOI and IOE frameworks were identified to be the most appropriate starting points (see sections 2.2.2. and 3.4.. in particular).
These frameworks have proven to be effective in prior technology and ICT diffusion studies. An extensive review of the literature on adoption and diffusion of IOS and EDI has resulted in a number of possible explanatory factors and models for adoption. However, as outlined in the literature review, there is a lack of research on e-Marketplaces from these perspectives.

According to Fahy and Hooley (2002), a theme that is common to all that has been written about the new economy is that it is a different kind of environment and that to succeed in it companies must re-evaluate their strategies and the fundamental tenets of competitive advantage. In particular it is important to re-examine the the environmental, organisational and technological dimensions. To date there has been a tendency among researchers to take an either/or perspective whereas this study attempts to link the three dimensions in order to give an integrated explanation of the nature of competitive advantage in the e-Marketplace environment.

Therefore, there is a good potential to empirically analyse new adoption variables specific to the airline industry and build an original framework. The development in the airline industry introduce additional significant constructs (like the level of outsourcing; level of joint purchasing), which are not dealt with by existing theoretical frameworks. It is therefore proposed that an integrated theoretical framework can be created. The author focuses the research on a parsimonious model (as recommended by Joo and Kim, 2004), including technological, environmental, and organisational contexts (see section 3.4..) specific to the airline industry (see chapter 4.) that were deemed relevant in the e-Marketplace adoption context.

Other socio-technical models such as TAM, TPB, UTAUT or structuration theory are not employed in this study, as they are difficult to evaluate empirically (section 2.2.2.). Kurnia and Johnston (2000) recognise this limitation, which they term "reduced ability to make general statements".

To start with this analysis, it is important to investigate whether or not the use of e-Marketplaces and their importance is increasing among airlines. The dependent variable, e-Marketplace adoption by airlines is determined by a binary measure:

adopters or non-adopters. Organisations are classified as adopters if they decided to use e-Marketplaces or have been procuring through e-Marketplaces.

According to Patterson et al. (2003), a number of authors have defined adoption in a variety of ways and have distinguished between adoption, diffusion, initiation, development, implementation and use. While recognising these legitimate distinctions, the author has chosen to use adoption in the broadest sense so that it encompasses "the generation, development, and implementation" of technologies (as proposed by e.g. Damanpour, 1991). Furthermore, according to Patterson et al. (2003), supply chain managers do not distinguish between stages of the adoption process and attempting to clearly tease out these distinctions in a survey to test the model would result in an unwieldy and complex set of survey questions that may confuse respondents.

The research can provide a first indicator into which direction the airline industry and its e-Marketplaces are evolving. In more detail, questions about e-Marketplace perceptions and experiences can determine the reception of e-Marketplaces within the industry. This inquiry also includes the analysis perceived obstacles or barriers to e-Marketplaces. Beyond that, one should also examine the level of investment into e-Marketplaces among airlines.

Classifying e-Marketplaces and identifying their functionality seems to be fundamental for a better understanding of their potential value. The survey of e-Marketplaces offers opportunity to analyse the categorisation and the functionality of e-Marketplaces in the airline industry. As outlined in the literature review in section 3.5., researchers and analysts have identified different types of B2B e-Marketplaces according to different impacts (e.g. Barratt and Rosdahl, 2001; Berryman et al, 2000; Dai and Kauffman, 2001; Sculley et al., 1999). Lee and Clark (1996a) differentiated virtual platforms that supported decentralised market structures with direct interactions among buyers and sellers, from those supporting centralised market structures like broker, dealer, or auction platforms. Similarly, Shaffer and Simon (1996) introduced two primary categories of B2B e-Commerce, namely supply-chain-oriented B2B and e-Marketplace-centric B2B. Berryman et al. (2000) classify e-Marketplaces by control structure positing three types of seller-controlled, buyer-controlled, or neutral e-Marketplaces. Bakos (1997) focused on traded product types and ownership structure, whereas Soh and Markus (2002) focused on product attributes (complexity versus standardisation of product description), product cost, and fragmentation of buyer or supplier base.

According to Blodget and McCabe (2000), the notion of the categorisation of e-Marketplaces derives from the aggregation of a number of integrated business services and functionality (see section 3.6.), enabled and delivered via the Internet. The model behind e-Marketplaces aims to facilitate the introduction of new efficiencies and new ways of selling and purchasing products and services (e.g. Reilly and Block, 1997; Timmers, 1998). Consequently, classifying e-Marketplaces and identifying the characteristics and functionality of existing models in the aviation industry is fundamental for the better understanding of their nature, future strategic relevance and implications for procurement processes.

E-Marketplaces in the airline industry can be classified with regard to ownership and control structures (airline, manufacturer, parts broker, external player or neutral player driven; see section 3.5.) and in terms of services provided (e.g. auction and exchange software, catalogue management, order acceptance and tracking, mechanism for requesting quotes and proposals, payment capabilities, among others; see section 3.6.). The diffusion of these classifications is assessed by surveys and case studies.

The aim is also to research the degree of diversity in terms of products and services offered on various B2B aviation e-Marketplaces as well as the volume of participants and the ratio of buyers and suppliers. A multiple product e-Marketplace can only be efficient when significant elements of the aviation industry value chain gather in one or few several e-Marketplaces, allowing several concepts and software standards to work together. Possible groupings of e-Marketplaces will be identified in order to verify the applicability of various product and service groupings into a multiple product e-Marketplace, or to identify product and service groupings that cannot be fully integrated in such an e-Marketplace. A further method of data gathering will be to collect secondary literature (e.g. annual reports, brochures, websites) and elaborate on case studies in order to analyse the more qualitative aspects, such as the investigation of ways and processes to interlink and integrate multiple markets. It has to be explored if airlines procure in different multiple e-Marketplaces in order to satisfy their needs for different products and services and service offerings.

Research in case studies is required to enrich quantitative testing from the surveys. Qualitative research, designed to observe social interaction and understand the individual perspective, provides insight into what people's experiences are, why they do what they do, and what they need in order to change. Case studies can reveal qualitative indicators in which way the use of e-Marketplaces and the number of services are related. This integrative procedure enables to investigate the evolution and categorisation of aviation e-Marketplaces in terms of control structure and functionality.

At the same time, it is important to explore which types of airlines (e.g. low-cost vs. regional airlines; see section 4.6.) have adopted e-Marketplaces, thereby strongly contributing to a theory generation process of scope and scale of aviation e-Marketplaces. Building on this knowledge, it was concluded that it would be worthwhile to investigate whether or not the use of e-Marketplaces is highly depending on an airline's environment, its strategic orientation and its size.

Environmental Context & Firm Size. An industry's competitive dynamics, and how a firm competes within it, has a great influence on the firm's strategic decisions (Porter, 1987). The need to develop and sustain a competitive advantage in the marketplace is one of the most powerful drives for successful business strategies. Since deregulation airlines are facing increased competitive pressure in the marketplace. According to Joo and Kim (2004), competitive pressure from the external environment refers to the level of e-Marketplace capability of the firm's industry and, more importantly, capability of its competitors (see section 2.3. in particular).

Environmental uncertainty refers to the complex, little known, and turbulent nature of the environment within which an organisation functions. Kimberly and Evanisko (1981) have found a positive relationship between competition and innovation adoption. As more competitors become e-Marketplace capable firms, they may be more inclined to adopt an e-Marketplace in order to maintain their own competitive position. Nelson and Shaw (2005) found that in the current business climate (where co-opetition is evolving towards the industrial-group level) perceived pressure on a firm to adopt IOS standards is felt from the entire industry.

Cavaye and Cragg (1995) find mixed results for competitive pressure as an ICT development facilitator. The authors define competitive pressure as the extent industry leaders are implementing the system and the implementing organisation's realisation they need to implement a similar system to remain competitive. However, several EDI studies (e.g. Chwelos et al., 2001) link varying external pressure definitions to EDI adoption.

Joo and Kim (2004) found that competitive pressure seems to be the key in determining the overall level of external pressure to adopt e-Marketplaces because firms are more inclined to adopt e-Marketplaces in order to maintain their own competitive position, as more competitors become e-Marketplace-capable. Firms who are first movers in deploying IOS in industry tend to derive more advantages (see section 2.2.1.) and in order to realise these gains, there is significant pressure for them to diffuse the systems quickly, both internally and externally (Rangatan et al., 2002). Peer pressure from industry and other competitors may also force firms to deploy web-based applications faster (see e.g. hypercompetition in section 2.6.). The fact that the value of business-to-business supplier networks and marketplaces is a function of the critical mass of partners participating (Sawhney and Parikh, 2001), has also increased the pressure on firm in competitive settings to undertake rapid roll-out of their SCM applications before their competitors. Therefore, it is worth investigating:

> ***H1a: E-Marketplace adoption of airlines is highly dependent on external competitive pressures.***
>
> This hypothesis is tested by an analysis of variance using a six-item scale with a Cronbach's alpha of 0.78.[9] Factor loadings for this six-item scale ranged from 0.309 to 0.898, suggesting strong convergent and discriminant validity.[10]

The resource-based view of the firm emphasises core competencies as possible sources of competitive advantage. Porters 5 forces model suggests that companies have to find a equilibrium to best position themselves in the marketplace. This results in cost or differentiation strategies of firms or towards a focus of a narrow scope. Strategic group

[9] The following questions in the airline survey instrument address the testing of H1a: Do you own or participate in an e-Marketplace? Have you experienced pressures from business context (to reduce cost; decline in passenger numbers; decline in overall profits; increased concentration in the supplier markets; decline of turnover; decrease in passenger load factor).

[10] Computation of coefficient alpha assumes a unidimensional and reflective factor, therefore assessment of convergent and discriminant validity has also to be addressed (see in Figure 173 in appendix D). Nunnally (1978) propounded the minimum factor loadings of 0.30 criteria as a guideline for considering an item to be part of a factor. All items loaded highly on the appropriate factors and the results suggest that convergent and discriminant validity are applicable for this latent reflective construct. The assessment of convergent and discriminant validity is provided in the appendix.

types in industries can be identified based on similarities in firm size, technology, customers, or products and services in terms of price, features and quality, among other elements (Gulati, Nohria, and Zaheer, 2000). Due to mobility barriers, strategic group boundaries are difficult for firms to traverse. These boundaries have been used to explain discrepancies in firm behaviour and performance within industries (Caves and Porter, 1980; Cool and Schendel, 1988). After several waves of deregulation (see appendix E), it is possible to observe generic airline strategies and groupings, i.e. full service airlines, charter airlines, regional airlines and low-cost airlines (see section 4.6.). Although there is no distinct universal classification of airlines, this categorisation is widely accepted and used in industry (e.g. Schneiderbauer and Fainsilber, 2002) and academic research (e.g. Buhalis, 2003) alike. However, due to competitive measures, distinctions between those groupings are increasingly being blurred; examples of this are full service or charter airlines currently going through a fundamental change to the low-cost model while seeking to retain the customers' perception of a similar quality service. Nevertheless, in order to understand the competitive structure of the industry, it is valuable to attempt classifying airlines according to their competitive strategies. This enables the identification of any strategic group differences with regard to e-Marketplace adoption and usage, thereby strongly contributing to a theory generation process of scope and scale of aviation e-Marketplace use.

> ***H1b: The use of e-Marketplaces is highly dependent on an airline's strategic classification.***
>
> This hypothesis is tested by a chi-square test using a four-item multiple choice question.[11]

It is further important to investigate whether or not the use of e-Marketplaces is depending on an airline's firm size. Therefore, e-Marketplace ownership and participation can be set in contrast with an airline's strategic orientation to classify usage frequency and involvement of airline types. When having tested hypothesis H1b, the classification of strategic usage patterns are fundamental in testing those patterns according to firm size (in terms of number of employees in total, number of employees in purchasing, and fleet size).

[11] The following questions in the airline survey instrument address the testing of H1b: Do you own or participate in an e-Marketplace? The company's strategy focuses on the following business models.

Previous research, regardless of the measures used to evaluate size and adoption, has consistently indicated organisational size positively correlates with technology adoption (e.g. Rogers, 1990; Dawe, 1994; Germain, 1993). It is theorised that larger organisations have the financial and technology resources to invest in new technologies and absorb the associated risk (e.g. Grover and Goslar, 1993). Furthermore, large organisations may have slack capacity to devote to adopting and implementing new technologies as well as to enjoy the benefits of economies of scale from adoption. Thus, larger organisations are expected to possess the financial resources and risk capacity necessary for new technology investments and will be associated with greater levels of supply chain technology. Alternatively, smaller organisations are more likely to be innovative because of the flexibility afforded by smaller size and fewer levels of bureaucracy (Patterson et al., 2003). Case studies can provide qualitative data in which way the use of e-Marketplaces is related to firm and fleet size. The following hypotheses further address these issues.

> ***H1c: The use of B2B e-Marketplaces is highly dependent on firm and fleet size.***
> This hypothesis is tested by an analysis of variance using three numeric variables.[12]

Furthermore, it is important to analyse whether or not airlines that have adopted e-Marketplaces are competent and sophisticated in ICT overall and in the use of Internet services. Cragg and King (1993) showed that lack of technical knowledge and resources inhibit technology adoption in small firms.

Technological Context. The most basic considerations in new technology adoption are costs to transition to new technology and advantages (or benefits) materialisation from the new technology introduction; the greater the advantage is perceived compared to the current method, the more probable an organisation will adopt the new technology (see section 2.2.2. in particular) . This perception, in the context of e-Marketplace adoption, can be operationalised as the relative advantage factor (Joo and Kim, 2004). Relative advantage is not the same as awareness. While awareness is mainly concerned with the reception of information about e-Marketplaces, relative advantage captures the extent of agreement with the claimed benefits relative to the adopter's local conditions. While awareness is a precondition of forming a belief, it is the latter that drives an adoption decision. E-Marketplaces constitute technological innovations with a unique paradigm, owing to significant complementarities, which extend to e.g. ICT-infrastructure, organisation or know-how of employees (see chapter 3). Therefore, it can be expected that the adoption of e-Marketplaces provides positive externalities to the adoption of other e-Business technology in a firm (Koellinger and Schade, 2003). It is worth exploring whether or not the overall ICT sophistication of an airline and the number of Internet services used (e.g. online request for quotations, search for new suppliers) impact its e-Marketplace adoption decision.

H2a: E-Marketplace implementation is highly dependent on an airline's overall ICT sophistication.

This hypothesis is tested by an analysis of variance using a four-item scale with a Cronbach's alpha of 0.92.[13] Factor loadings for this four-item scale ranged from 0.825 to 0.871.

H2b: The adoption of e-Marketplaces among airlines is highly dependent on the overall number of Internet services used.

This hypothesis is tested by an analysis of variance using a three-item scale. Cronbach's alpha is not applicable for this formative scale.[14]

Joint Procurement and Buying Power. Similarly, 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. In recent developments in the airline industry, a rising number of airlines involved in strategic

[12] The following questions in the airline survey instrument address the testing of H1c: Do you own or participate in an e-Marketplace? What is the total number of employees? What is the number of personnel in purchasing? What is your total fleet size?

[13] The following questions in the airline survey instrument address the testing of H2a: Do you own or participate in an e-Marketplace? Level of agreement with: Your company used the full potential of ICT to facilitate procurement. Your ICT infrastructure enables you to share viable information with partners. Your ICT infrastructure enables you to share viable information with suppliers. Your company has interlinked the full supply chain with ICT systems.

[14] Formative items are treated differently from reflective items with an unidimensionality assumption. Following the logic specified by Cohen et al. (1990), formative indicators are not assumed to be correlated as they do not measure the same underlying phenomenon. Such constructs are specified as summative indices (Barclay et al. 1995), in contrast to reflective constructs whose indicators covary by definition and are analysed through techniques such as principal components or factor analysis to identify underlying dimensions. Reliability is therefore not a meaningful concept when applied to formative constructs (Cohen et al., 1990). The following questions in the airline survey instrument address the

alliances, as well as co-operations managed by holding companies can be observed (see section 4.5.). Strategic alliances have become increasingly important elements in a firm's portfolio of strategies and are viewed as a source of competitive advantage (Suen, 2002), as outlined in the strategic network approach. The airline industry was one of the first industries to adopt the concept of alliances.

In prior research, however, on competitive advantage, firms have been primarily viewed as autonomous individuals striving to achieve competitive advantage through either external industry sources (Porter, 1980; see section 2.3.) or through internal capabilities and resources (Barney, 1991; see section 2.4.). Organisations were not aware of the power of the networks of relationships and strategic alliances in influencing their conduct and performance (Gulati, Nohria and Zaheer, 2000; see section 2.5.). By viewing horizontal forms of co-operation as one entity in the airline industry, the fleet expands considerably. When putting together the purchasing power of such entities, one can identify potential cost savings in procurement (see section 4.2.). Operationally, airlines can co-operate across a wide range of activities. Oum, Park and Zhang (2000) defined 11 areas of joint or co-ordinated activities[15], including joint-maintenance and joint procurement of fuel or other supplies. As the base facilities and headquarters of airlines embedded in strategic co-operations are quite often located all over the world, an e-Marketplace can be seen as intermediary for realising those joint-purchasing benefits by enabling aggregate buying, which means that multiple buyers can aggregate their spend in one basket, reducing the price through purchasing larger quantities. When considering the fact that co-operation in network relationships can lower total costs of various activities, e-Marketplaces can be understood as participants in collaborative supply networks, also called dynamic supply webs (Christiaanse and Kumar, 2000). The cost of material input accounts for about between 35% up to 57% of total costs at airlines, thus being the most important component (Oum, 1998). In the absence of market fragmentation, a larger customer base for a specific product can increase collective buying power. Thus, evidence of the above is tested through the following hypotheses:

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testing of H2b: Do you own or participate in an e-Marketplace? Do you use the Internet: to search for new suppliers; to get more detailed or complete information about suppliers; to request quotations.

[15] These 11 areas include: co-ordination in ground handling, joint use of ground facilities, shared membership for FFPs, flight code-sharing or joint operation, block space sales, co-ordination of flight schedules, exchange of flight attendants, joint development of systems or systems software, joint advertising and promotion, joint-purchase, joint-maintenance.

H3a: Airlines involved in alliances or partnerships use B2B e-Marketplace more than airlines that are not involved.

This hypothesis is tested by an analysis of variance using a five-item scale. Cronbach's alpha is not applicable for this formative scale.[16]

H3b: E-Marketplace adoption is highly dependent on the extent of resource and information sharing among airlines.

This hypothesis is tested by an analysis of variance using an eight-item scale with a Cronbach's alpha of 0.85.[17] Factor loadings for this eight-item scale ranged from 0.527 to 0.867.

H3c: Airlines involved in joint procurement have a higher implementation level of e-Marketplaces than airlines that are not involved.

This hypothesis is tested by an analysis of variance using a nine-item scale. Cronbach's alpha is not applicable for this formative scale.[18]

Forming alliances shows positive signs of opening up to collaboration with other airlines, also in view of corporate joint purchasing. It is vital to investigate the degree of B2B e-Marketplace involvement of airlines that are participating in strategic alliances, resource/information sharing and joint procurement. This also applies to outsourcing activities of airlines.

Outsourcing. New information technologies, such as wide-area and transparent communication through the Internet, shared database infrastructures, Internet auctions, and Internet search and document display capabilities, suggests that traditional intermediaries can be replaced by more efficient e-Businesses pursuing disintermediation strategies (e.g. Benjamin and Wigand, 1995; Young and Johnston, 2000; see section 3.4.). The term disintermediation can be defined as the alleged move

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[16] The following questions in the airline survey instrument address the testing of H3a: Do you own or participate in an e-Marketplace? The company's strategy is to be involved in the following partnerships: Strategic alliances; Codesharing partnerships; Shares in other airlines; Airline group holdings; Procurement Consortia.

[17] The following questions in the airline survey instrument address the testing of H3b: Do you own or participate in an e-Marketplace? Your company jointly shares with partners: IT systems; Purchasing tools; Office space of facilities; Suppliers; Company products; Product prices; Purchasing Tools, Purchasing Procedures.

[18] The following questions in the airline survey instrument address the testing of H3c: Do you own or participate in an e-Marketplace? Your company jointly procures with partners: Aircraft; Powerplants; Spares and repairs; Maintenance services; Fuel; Tools / GSE; Interiors; Catering and inflight supplies; General expenses.

towards shorter value chains in electronic marketplaces. Intermediaries have been known to add significant costs to the value chain, thus suppressing the profit margins of producers while at the same time resulting in higher final prices for end users. The introduction of a third party that acts as a "certification agent" (Timmers, 1998) can create the necessary trust by assuring quality and creating a de facto standard. However, Maddox (1998) argues that the role traditional middlemen are playing is changing. The e-Marketplace itself would be the middleman mainly to provide information, but also to facilitate contact between buyers and sellers. Information itself becomes the intermediary between buyers and sellers (Maddox, 1998).

Advanced uses of ICT and the evolution of e-Marketplaces can be hypothesised to reduce the transaction cost for producers (see section 2.5.), thus enabling them to internalise activities that have to be purchased from intermediaries in a traditional market and resulting in a redistribution of profits within the value system (Giaglis, Klein and O'Keefe, 1999). Although transaction costs are difficult to measure in practice and transaction cost analysis neglects some relevant aspects of business dealings, such as timeliness, risk and continuity, Young and Johnston (2000) argue that it is nevertheless applicable in the analysis of e-Business models. From this perspective, intermediation can be seen as a competitive strategy based on reducing transaction costs (Casson, 1996). However, intermediaries, instead of disappearing, can re-emerge in e-Marketplaces.

E-Marketplaces potentially facilitate the direct matching of buyers and sellers, and as a result traditional intermediaries may be reduced or even eliminated, leading to disintermediation (e.g. Gates, 1995; Gellmann, 1996). Therefore, the use of 'traditional' middlemen, such as wholesalers or agents, can be reduced, as an e-Marketplace can act as a virtual intermediary and facilitator between airlines and suppliers. Also, the growth of information networks is allowing the interconnection of diverse markets. As an example, what were once proprietary networks like American Airline's 'Sabre', United Airlines' 'Apollo' or EDI platforms are now becoming a part of the integrated network milieu. The argument is that e-Marketplaces can integrate market centres of buyers and suppliers and thus increase the size of the overall market (Grover and Ramanlal, 1999) and outsourcing tendencies. Thus, it is worth investigating the following:

H4a: The extent of outsourcing is highly dependent on an airline's strategic orientation.

This hypothesis is tested by an analysis of variance using an eight-item scale. Cronbach's alpha is not applicable for this formative scale.[19]

H4b: E-Marketplace adoption among airlines is highly dependent on the extent of outsourcing.

This hypothesis is tested by an analysis of variance using an eight-item scale. Cronbach's alpha is not applicable for this formative scale.[20]

Moreover, the assessment of an airline's procurement strategy and organisation can further indicate and verify findings of strategic implications in the use of e-Marketplaces.

Organisational Procurement Context. Organisational structure has also been considered an important factor to technology adoption (Williams, 1994). At a centralised approach, decisions are taken at the most senior or central level of a purchasing organisation, while at a decentralised approach, decisions are taken at a lower and more distributed level. Purchasing organisations can also be decentralised, but centrally co-ordinated. In such a case decisions are taken both at senior and lower levels, either separately or in an integrated manner. According to Patterson et al. (2003), previous research has provided ambiguous results with some studies indicating positive effects of a centralised organisational structure (i.e. concentration of decision-making) on technology adoption while others have shown negative relationships (Gatignon and Robertson, 1989). Pierce and Delbecq (1977) suggest centralisation may reduce conflict between organisational units and foster innovation adoption (see section 2.2.2.). In support of this proposition, Ettlie et al. (1984) found that organisations with a centralised structure were more likely to adopt new technologies. However, organisations that have adopted a flatter, more decentralised structure would be expected to have adopted more innovative and cutting edge technology in order to

[19] The following questions in the airline survey instrument address the testing of H4a: On which business models does you company strategy focus? Your company's strategy is to outsource: Powerplants; Spares and repairs; Maintenance services; Fuel; Tools / GSE; Interiors; Catering and inflight supplies; General expenses.

[20] The following questions in the airline survey instrument address the testing of H4b: Do you own or participate in an e-Marketplace? Your company's strategy is to outsource: Powerplants; Spares and repairs; Maintenance services; Fuel; Tools / GSE; Interiors; Catering and inflight supplies; General Expenses.

enhance communication and coordination within the organisation as well as with supply chain members (Bowersox and Daugherty, 1995).

A further goal in the procurement organisation is to select and manage a supply base capable of providing performance advantages in product cost, quality, technology, delivery, or new product development. However, most of the buyer-supplier relationships were traditionally based on the 'arms-length model', in which a buyer and a seller tend to view each other as adversaries competing for larger shares of the resources rather than as a cooperating member of an overall supply chain (Helper and Sako, 1995; see section 4.2.). This adversarial emphasis requires that firms establish bargaining power over their counterparts, influencing the relative distribution of wealth between them (Barragan et al., 2003). Ansari and Modarress (1994) argue that an important area for purchasing and suppliers to be integrated is in the firm's product development process. The act of participating in cross-functional teams and providing proactive support for the product development process is an indication of purchasing and supplier involvement in the firm (Carr and Pearson, 2002). Effective integration of suppliers into the product value/supply chain is a key factor for some manufacturers in achieving the improvements necessary to remain competitive. Therefore, a variety of firms have reduced the number of suppliers and started to develop more collaborative relationships (i.e. the move to the middle hypothesis developed by Clemons et al., 1993; see section 2.2.). Therefore, it is worth investigating:

H5a: E-Marketplace implementation is highly dependent on an airline's procurement organisation strategy.

This hypothesis is tested by an analysis of variance using a three-item multiple choice question.[21]

H5b: The adoption of e-Marketplaces is positively related to a decrease in the number of suppliers.

This hypothesis is tested by an analysis of variance using a two-item scale. Cronbach's alpha not applicable for this formative scale.[22]

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[21] The following questions in the airline survey instrument address the testing of H5a: On which business models does your company strategy focus? Is your corporate purchasing operation centralised, decentralised or decentralised, but centrally co-ordinated?

[22] The following questions in the airline survey instrument address the testing of H5b: Do you own or participate in an e-Marketplace? Has your company increased the number of suppliers? Has your company decreased the number of suppliers?

This theory generating process is very relevant for an understanding of process enablers and drivers for e-Marketplaces in the airline industry. New variables specific to the airline industry were developed to further analyse e-Marketplace adoption from a DOI and IOE perspective. After having established this understanding, it is further crucial to analyse the effect of e-Marketplaces on an airline's competitiveness.

(b) Hypotheses development towards the identification of e-Marketplace procurement value chain performance indicators and their impact on competitiveness.

The use of information and communication technology may have created increased industry competition, reduced technology costs, and increased interconnectivity of technology through open architectures in the past. Complementing these trends with infrastructures like the Internet, the consequences are more effective markets (Grover and Ramanlal, 1999). Such reasoning can be found through transaction cost economics, where information technology decreases co-ordination costs, i.e. searching for suppliers, information seeking, negotiating contracts, between buyers and sellers. This is making market structures more viable and as a consequence is reducing supplier's abilities to create monopolistic rents (see Bakos, 1991; Grover and Ramanlal, 1999; Gurbaxani and Whang, 1991; Malone, Yates, and Benjamin, 1987). Transaction cost economics identifies transaction efficiency as a major source of value creation, as enhanced efficiency reduces costs. Young and Johnston (2000) suggest to research and analyse transaction costs in three ways: the stage of the transaction where they occur, which party they affect, and whether they relate to information processing or physical product handling. Such value creation can derive from the attenuation of uncertainty, complexity, information asymmetry, and small-numbers bargaining conditions. Also, reputation, trust and transactional experience can lower the cost of idiosyncratic exchanges between firms (Amit and Zott, 2001; Williamson, 1975, 1979, 1983).

Transaction costs include direct costs (see section 2.5.), such as the time needed to search for customers or suppliers, the time needed for the communication with those counterparts to execute a transaction, the costs for travel and meetings, the costs for processing information on paper documents, as well as the costs of production and inventory management (Lucking-Reiley and Spulber, 2001). With ICT, firms can also reduce indirect costs, such as the costs of adverse selection, moral hazard, and hold-up.

Similar to the proposed ability of reducing transaction costs, e-Marketplaces may speed up procurement processes and make them more efficiently.

The ability of ICT to match buyers and sellers, reduce search costs, share information, and compare products, may alleviate market imperfections, resulting in more effective markets (Bakos, 1991). The use of e-Marketplaces has the potential to improve procurement processes and thus reduce order costs through advanced software standards. For example, it can diminish the amount of paperwork and link the various decision-making employees electronically in order to reduce approval time. Beyond that, Barrat and Rosdahl (2001) have emphasised the potential of B2B e-Marketplaces in reducing a companies search costs.

Due to the lack of transparency of aircraft spare part inventory locations (see section 4.2.), airlines often face very high costs for such an AOG resolvement part. In obtaining and processing this information, buyers face search costs. Choudhury et al. (1998) argue therefore that AOG purchases are qualitatively different in nature from routine purchases. Each AOG purchase is typically for a different item, because while there are thousands of parts on an aircraft that can cause an AOG, any single part is likely to cause an AOG very infrequently. Further, by its very nature, an AOG occurs because an airline was unable to anticipate a need for a part and therefore does not have it in stock. This would make it virtually impossible for an airline to plan ahead or establish long-term relationships for AOG purchases. In addition, because of the very high cost of a grounded aircraft, it is critical to find the needed part as fast as possible. As a result, even buyers who normally prefer to purchase from the OEM sector are often forced to turn to the surplus sector. Thus, AOG purchases lend themselves to spot e-Marketplaces, according to Choudhury et al. (1998).

Orders for aviation parts or products are typically handled through internal, paper-based processes that require manual preparation, written approval by purchasing managers and manual order tracking, and billing and reporting across multiple departments within an organisation. The current paper-based procurement processes can be complex and time-consuming. Traditional purchasing methods also present a number of challenges to sellers trying to reach buyers of aviation parts and products. Due to the high cost of printing and distributing paper catalogues, sellers cannot cost-effectively manage frequent updates and distribution of time-sensitive information. These catalogues require high transaction costs to search and are limited in their ability to provide depth of product and seller content. Smaller suppliers may have limited resources available to support the growing challenge of marketing and selling to the highly fragmented worldwide market for aviation parts and products. These costs include the opportunity cost of time spent searching, as well as associated expenditures such as driving, telephone calls, computer fees, magazine subscriptions, etc. Typically, suppliers exploit these search costs by raising their prices, and thus enjoy higher profits. It is hence also relevant to examine e-Marketplaces markets for their potential of reduced transaction costs by looking at commodities (Picot et al., 1998).

A differentiation of products and services that airlines procure (e.g. spares and components, power-plants, catering, ground services and equipment, fuel) is required to analyse the potential reduction of purchasing processing costs. The use of e-Marketplaces is expected to result in the improved buyers' ability to search for products and supplier specifications, which can be displayed in the same format and type of product information of multiple suppliers. It is also questioned which products are traded the most on e-Marketplaces and why and which e-Marketplace types are preferred.

The potential ability of e-Marketplaces to reduce transactions costs for airlines can also significantly affect competition. For example, lower buyer search costs in e-Marketplaces can promote price competition among suppliers. This effect is most dramatic in commodity markets (Bakos, 1998). At the same time, transaction cost theory has limitations in analysing e-Marketplaces (Christiaanse and Markus, 2003). It overemphasises communication and brokerage effects to the expense of integration effects. Transaction cost theory neglects the influence of pre-existing and extended supply-chain relationships among transacting firms, which might also favour network over market relationship (see section 2.5.). Also, low ICT costs improve customer access to this product (Grover and Ramanlal, 1999).

Market effectiveness may be characterised in terms of the division surplus between buyers and suppliers, where more effective markets are characterised as those that benefit the consumer. In contrast, markets are least effective under perfect price discrimination. By charging the maximum amount each buyer is willing to pay along the entire demand curve, suppliers extract total consumer surplus, thereby making markets least effective (Grover and Ramanlal, 1999; Varian, 1984). Due to the geographic dispersion of aviation suppliers and the rather complex nature of aviation products and services, accessibility may be a challenge for procurement professionals in the airline industry. For example, buyers often search for specific parts or products to meet the parameters for a specific aircraft at a particular location. This may include spending a significant amount of time, e.g. examining multiple paper catalogues or placing orders from a variety of different suppliers. The use of e-Marketplaces has the potential to result in improved search capabilities, which results in a higher transparency of markets, and thus lower product prices. Therefore, the construct 'overall performance and satisfaction with procurement management' was constructed in the survey of airlines to address the aforementioned theories. Hypotheses can be stated as follows:

> ***H6a: The overall performance and satisfaction with the procurement practices of an airline is highly dependent on e-Marketplace adoption.***
>
> This hypothesis is tested by an analysis of variance using a seven-item scale with a Cronbach's alpha of 0.87.[23] Factor loadings for this seven-item scale ranged from 0.335 to 0.839.

> ***H6b: The use of e-Marketplaces has a positive effect on a reduction of purchase order costs of an airline.***
>
> This hypothesis is tested by an analysis of variance using one numeric variable.[24]

One part of transaction costs is related to information processing costs and the resulting efficiencies or inefficiencies in procurement processes. To analyse procurement process costs within airlines and research the potential of B2B e-Marketplaces in minimising them, a detailed analysis of airline specific goods and services will be carried out. Efficiency levels of sourcing and procurement are a further indicator in determining obstacles and advantages of B2B e-Marketplaces. Quantitative measurable savings (e.g. paper reductions, labour reductions, etc.) also indicate performance levels of e-Marketplaces. The effect of e-Marketplace enabled procurement processes on inventory

[23] The following questions in the airline survey instrument address the testing of H6a: Do you own or participate in an e-Marketplace? How satisfied are you with: Your procurement processes? The current level of your search costs? The current time efficiency level? Your order process efficiency? Your inventory management? Your supplier transparency? Your product purchasing prices?

[24] The following questions in the airline survey instrument address the testing of H6b: Do you own or participate in an e-Marketplace? What are your purchase order costs?

will be also analysed in this respect. For example, aircraft availability has to be maximised at peaks and maintenance fitted into times when the planes are not required for commercial activities (Clarke, 1998; Ghobbar and Friend, 2002). As with many other goods, demand for air transport varies with time. There are variations in daily, weekly, and annual demand, leading to peaks at popular times. For example, a charter airline would experience its peaks during the summer months, and therefore schedule heavy maintenance to the less busy winter times. However, the usage patterns of many parts is unpredictable, and estimating future demand is done by considering available maintenance contract information and by looking at scheduled maintenance plans, with some companies preparing manual forecasts for expensive parts (rotables/repairables).

Forecasting of parts is generally category dependent, due to parts being defined either as life limited (predictable) or condition-monitored (unpredictable). Such forecasts are generally based on usage patterns such as flying hours or past parts demand, or the number and type of checks planned for every aircraft, and the fleet size. Traditionally, the majority of aviation parts and products inventory has been controlled by airlines. However, they are now realising the benefits of reduced inventory carrying costs by decreasing the size of their parts inventories. On the other hand, these inventory reductions intensify the reliance of airlines in particular on suppliers of new, used and refurbished parts and products that are difficult to obtain on a timely basis, if at all. If airlines demand procurement processes that ensure a time responsive inventory, responsibility for storage and handling of inventory must shift to suppliers.

Bakos (1998) argues that e-Marketplaces improve information sharing between buyers and sellers, helping to lower the cost of logistics and promoting quick, just-in-time deliveries and thus reduced inventories. Most airlines, that perform at least the line maintenance (A-Check, B-Check, P-Check, C-Check[25]) at their own in-house facilities,

[25] P-Check: Every aircraft is checked every day in its "P" (Pattern) check. The aircraft is visually inspected and its maintenance log book is checked for entries and maintenance needs. The "P" check can be performed overnight or during downtime during the flight day. It averages approx. two man-hours.
A-Check: They are performed roughly once a week, after approx. 60 flight hours. It averages 10-20 man-hours.
B-Check: The "B" check is done approximately once a month (roughly 300 - 500 flight hours). A "B" check requires approximately 100 man-hours on narrow-body aircraft and approximately 200 - 300 man-hours on wide-body aircraft.
C-Check: The "C" check is a very thorough type of maintenance work. The airframe — virtually the entire aircraft — goes through an exhaustive series of checks, inspections and overhaul work. Its frequency and man-hours needed highly depends on the aircraft type.

must hold a certain amount of spare parts in their own inventories, based on projected annual flying hours. This is required by the large airframe and engine manufacturers. Also when new types of aircraft are introduced, the airframe and engine manufacturers provide a spares provisioning list. However, in many cases, airlines do hold more inventory than required, due to reasons such as avoiding AOG situations and also due to the fact that there is often still a huge amount of parts available that cannot be used anymore because of changes in the fleet type. In such cases, there is often an inventory overload, which binds a significant amount of money that could be used elsewhere otherwise. Also many parts have a shelf life that cannot be used anymore after a certain amount of time. To reduce inventories, airlines need reliable means of managing their inventories and sourcing missing parts quickly. Airlines not only source parts, they also sell their excess inventory of former or even current fleets. Research is decisive to explore in which way e-Marketplaces can improve the dilemma of spare parts inventory. It is vital to investigate how inventory levels react to more efficient sourcing and selling capabilities and more efficient procurement and selling processes. Market transparency, low search costs, higher search efficiencies and improved information can all have a positive effect on inventories.

Further implications for strategic management and competitive advantage can be assessed at this point of analysis. In this study, it is very relevant to research whether or not the total savings in procurement processes and product prices achieved by airlines by e-Marketplace use can exceed the investment costs. Approaches similar to the total cost of ownership in purchasing have been advocated in the strategic management literature as means of understanding total costs throughout the supply chain. The total cost of ownership theory (e.g. Carr and Ittner, 1992; Ellram, 1993; Harriman, 1928; Jackson and Ostrom, 1980) is a complex approach, that measures costs in the purchasing process and procurement product price, among other elements such as research and qualification of suppliers, transportation, inspection, rejection, replacement, disposal costs or downtime caused by failure.

The benefits of e-Procurement as described by Kalakota and Robinson (2000) fall into two major categories; effectiveness and efficiency. Effectiveness benefits include increased control over the supply chain, proactive management of key procurement data, and higher quality purchasing decisions within organisations. Efficiency benefits include lower procurement costs, faster cycle times, reduced maverick or unauthorised buying, more highly organised information, and tighter integration of the procurement function with key back-office systems.

Little is known about successful approaches in B2B e-commerce on the net (Timmers, 1999). Bagchi and Watson (2002) indicate that characteristics of e-Marketplaces that affect the generation of revenue are the number of members, transaction volume, number of product types, scope for expansion into related industries, scope for vertical integration, and the number of website page views. The revenue models of e-Marketplaces represent the investment costs for airlines (see section 3.6.). These costs channels can include license fees, professional services, transaction fees, advertising fees, payment for supply chain savings, and subscription or membership fees. Some costs are based on some combination of these channels. A detailed analysis of these investment costs is required by the surveys and case studies. Overall cost savings in purchasing process costs and procurement product prices can be related to ICT and e-Marketplace implementation costs. However, there are many dimensions to measure the value and potential savings by using ICT enabled e-Marketplaces. It can produce value in different ways, some tangible and others intangible. Besides the quantitative approach however, it is also essential to provide qualitative data to the benefits and drawbacks of e-Marketplace enabled procurement processes to airlines by both surveys and case studies. To realise value from e-Marketplace procurement, the intangibles and soft factors such as enhanced decision making capabilities and improved buyer-seller contacts must be considered as well (Forrer and Anderson, 2001).

Popular theories in strategic management, based on industrial organisation economics (Porter, 1980; 1985; see section 2.3.) and the resource-based view of the firm (Barney, 1991; see section 2.4.) state that factors that sustain competitive advantages generate superior economic performance that persists over time. On the other hand, historical economic theories such as neoclassical economics and the work of the Austrian school of economics (Jacobsen, 1992; Schumpeter, 1942; see section 2.2.1.) as well as the hypercompetitive model (D'Aveni, 1994; see section 2.6.) of strategic management predict that temporal dynamics, resulting from factors such as imitation, entry, and the introduction of substitutes, will erode almost all competitive advantages, thus preventing superior economic performance from persisting. However, whatever the theoretical framework, a common link in most of the theories of competitive advantage is a focus on firm performance as the dependent variable (Wiggins and Ruefli, 2002). Therefore, it should also be analysed whether or not the use of e-Marketplace has any positive effect on the overall airline performance (e.g. increase in passengers, turnover).

H7a: A reduction in purchasing process costs and in procurement product prices can exceed the investment costs for the use of e-Marketplaces.

This hypothesis is tested by a chi-square test using a one item-scale.[26]

H7b: An airline's overall business performance is highly dependent on the use of B2B e-Marketplaces.

This hypothesis is tested by an analysis of variance using a four-item scale with a Cronbach's alpha of 0.87.[27] Factor loadings for this four-item scale ranged from 0.759 to 0.851.

At the same time, the satisfaction with e-Marketplaces and the future potential can be assessed by both surveys and case studies. The research design and the testing of developed hypotheses can make an original contribution to a theoretical discussion of the e-Marketplace process drivers and the implications for airline competitiveness. Table 5 summarises the contingencies used in this study and their theoretical background.

[26] The following questions in the airline survey instrument address the testing of H7a: Do you think that the savings achieved in processing and product costs exceed the investment costs?

[27] The following questions in the airline survey instrument address the testing of H7b: Do you own or participate in an e-Marketplace? Your company experienced: A strong increase in passenger numbers; A strong increase in overall profits; An increase in turnover; An increase in the passenger load factor.

Context	Contingencies	Theoretical Background
Environmental Context	**Pressures Business Context** ▪ Increased pressure to reduce costs ▪ Decline in passenger numbers ▪ Decline in profits ▪ Increased concentration in supplier markets ▪ Decline in turnover ▪ Decrease in passenger load factor	Innovation Theory (Sec. 2.2.2.) Environmental View (Sec. 2.2.3.) Hypercompetition (Sec. 2.2.6.) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Deregulation in the Airline Industry (Appendix E)
Organisational Context	**Strategic Classification of Airline** ▪ Scheduled Regional ▪ Scheduled Intercontinental ▪ Charter ▪ Low-Cost	Innovation Theory (Sec. 2.2.2.) Environmental View (Sec. 2.2.3.) Resource-Based View (Sec. 2.2.4.) TCE and Strategic Network Theory (Sec. 2.2.5.) Hypercompetition (Sec. 2.2.6) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Airlines and Strategic Approaches (Sec. 2.4.6.) Airline Costs and Economics (Appendix F)
	Firm and Fleet Size ▪ Total number of employees ▪ Number of personnel in purchasing ▪ Total fleet size	Innovation Theory (Sec. 2.2.2) Environmental View (Sec. 2.2.3) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Airlines and Strategic Approaches (Sec. 2.4.6.) Airline Costs and Economics (Appendix F)
	Alliance Involvement ▪ Strategic alliances ▪ Codesharing partnerships ▪ Shares in other airlines ▪ Airline group holdings ▪ Procurement consortia **Extent of Resource and Information Sharing** ▪ IT systems ▪ Purchasing tools ▪ Office space of facilities ▪ Suppliers ▪ Company products ▪ Product prices ▪ Purchasing tools ▪ Purchasing procedures **Joint Procurement Integration** ▪ Aircraft ▪ Powerplants ▪ Spares and repairs ▪ Maintenance services ▪ Fuel ▪ Tools / GSE ▪ Interiors ▪ Catering and inflight supplies ▪ General expenses	Innovation Theory (Sec. 2.2.2) TCE and Strategic Network Theory (Sec. 2.2.5) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Airlines and Strategic Approaches (Sec. 2.4.6.) Globalisation and Airline Alliances (Sec. 2.4.5.) Deregulation in the Airline Industry (Appendix E) Airline Costs and Economics (Appendix F)

Table 5: Contingencies Used and Theoretical Background

Context	Contingencies	Theoretical Background
Organisational Context	**Extent of Oursourcing** ▪ Powerplants ▪ Spares and repairs ▪ Maintenance services ▪ Fuel ▪ Tools / GSE ▪ Interiors ▪ Catering and inflight supplies ▪ General expenses	Innovation Theory (Sec. 2.2.2) TCE and Strategic Network Theory (Sec. 2.2.5) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Globalisation and Airline Alliances (Sec. 2.4.5.) Airlines and Strategic Approaches (Sec. 2.4.6.) Airline Costs and Economics (Appendix F)
	Procurement Organisation ▪ Centralisation ▪ Decentralisation **Number of Suppliers** ▪ Increase ▪ Decrease	Innovation Theory (Sec. 2.2.2) TCE and Strategic Network Theory (Sec. 2.2.5) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.) Globalisation and Airline Alliances (Sec. 2.4.5.) Airline Costs and Economics (Appendix F)
Innovation Context	**Level of ICT Sophistication** ▪ Use of full potential of ICT to facilitate procurement. ▪ ICT infrastructure enables sharing of viable information with partners. ▪ ICT infrastructure enables sharing of viable information with suppliers. ▪ Interlinkage of full supply chain with ICT systems.	Innovation Theory (Sec. 2.2.2) Strategic Network Theory (Sec. 2.2.5) Strategic Use of ICT (Sec. 2.3.1.) Concept E-Procurement / E-Marketplaces (Sec. 2.3.2.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.)
	Level of Internet Services Used ▪ Search for new suppliers. ▪ Get more detailed or complete information about suppliers. ▪ Request quotations.	Innovation Theory (Sec. 2.2.2) Strategic Use of ICT (Sec. 2.3.1.) Concept E-Procurement / E-Marketplaces (Sec. 2.3.2.) E-Marketplace Adoption Models (Sec. 2.3.3.) E-Marketplace Classification Models (Sec. 2.3.4.) E-Marketplace Service Evolution (Sec. 2.3.5.) Aviation Industry Value Chain (Sec. 2.4.2.) E-Business and E-Marketplace Adoption in Airline Industry (Sec. 2.4.3. and 2.4.4.)
Performance Indicators	**Satisfaction with Procurement Management** ▪ Procurement processes ▪ Current level of search costs ▪ Current time efficiency level ▪ Order process efficiency ▪ Inventory management ▪ Supplier transparency ▪ Product purchasing prices **Purchase Order Costs** **E-Marketplace Savings vs. Investment** **Overall Airline Performance** ▪ Increase in passenger numbers ▪ Increase in overall profits ▪ Increase in turnover ▪ Increase in passenger load factor	Innovation Theory (Sec. 2.2.2) Environmental View (Sec. 2.2.3) Resource-Based View (Sec. 2.2.4) TCE and Strategic Network Theory (Sec. 2.2.5) Hypercompetition (Sec. 2.2.6) Strategic Use of ICT (Sec. 2.3.1.) E-Marketplace Adoption Models (Sec. 2.3.3.) Aviation Industry Value Chain (Sec. 2.4.2.) Airline Costs and Economics (Appendix F)

All contingencies were developed on the basis of the literature review, but partly modified to ensure content validity and airline industry focus. As described in the following chapters, all scales were extensively pretested, validated and exhibit high reliabilities. The scale 'external competitive pressure' was derived from Copeland and McKenney (1988) and Rozemeijer (2000). The strategic classification of airlines into scheduled regional, scheduled intercontinental, charter and low-cost is predominantly based on the review of Sec. 4.6.

Firm size is operationalised as the number of employees (as done by e.g. Kimberly and Evanisko, 1981). In DOI studies, the size of a firm has been used as a proxy for organisational complexity, slack resources, specialisation, and scale (Tornatzky et al., 1983). To increase validity and reliability within the airline industry context, two more variables ('number of personnel in purchasing' and 'total fleet size') were included by the author.

The scales covering 'alliance involvement', 'extent of resource and information sharing', 'joint procurement integration' and 'extent of outsourcing' had to be created specifically for this research. This was mainly done in consideration of the strategic network theory (Sec .2.5.), the aviation industry value chain (Sec. 4.2.), globalisation and airline alliances (Sec. 4.5.) and airline costs and economics (Appendix F).

The organisational structure of procurement has been recognised as an important factor to technology adoption (Williams, 1994). The scale was derived from previous work (e.g. Gatignon and Robertson, 1989; Patterson et al., 2003) and modified to the e-Marketplace context. Supplier reduction was included in consideration of Clemons et al. (1993). The level of ICT sophistication was adapted from NITL (2000), while the level of Internet services used was derived from Stockdale and Standing (2004) and the review of the e-Marketplace service evolution (Sec. 3.6.)

The performance indicators were derived from Ramaswamy (1992) and mofidied to reflect the airline industry focus. Ramaswamy recommends the use of operational indicators since these are more likely to directly reflect benefits as they are defined at the operational level where competitive advantage is built. Furthermore, operational measures are less likely to be manipulated.

Figure 27 illustrates the proposed hypotheses. The drivers within the IOE framework (left hand side) represent the independent variables for the dependent variable e-Marketplace adoption. This is reversed, when e-Marketplace adoption becomes an independent variable for the dependent variables in terms of performance indicators and supplier reduction (right hand side).

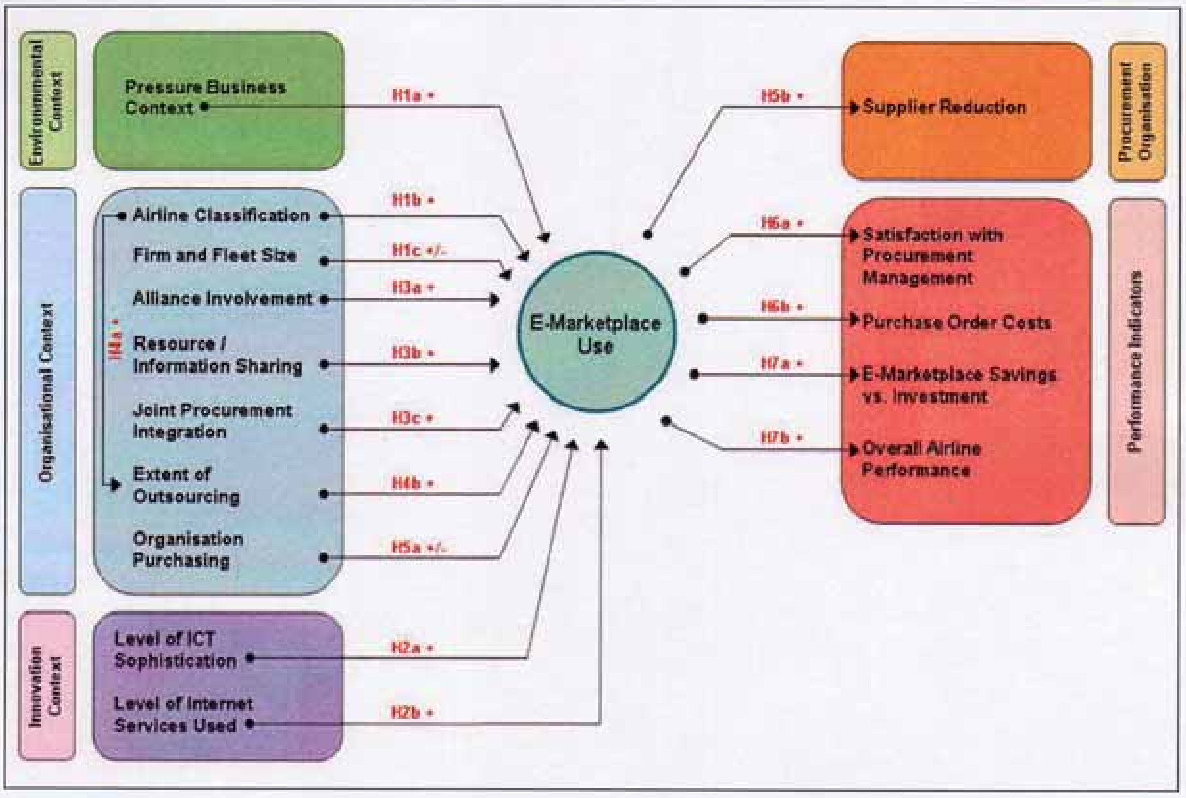


Figure 27: Proposed Hypotheses Model

In addition to the above hypotheses model, a more detailed contingency model with the main inter-correlations can be constructed (see Figure 28).

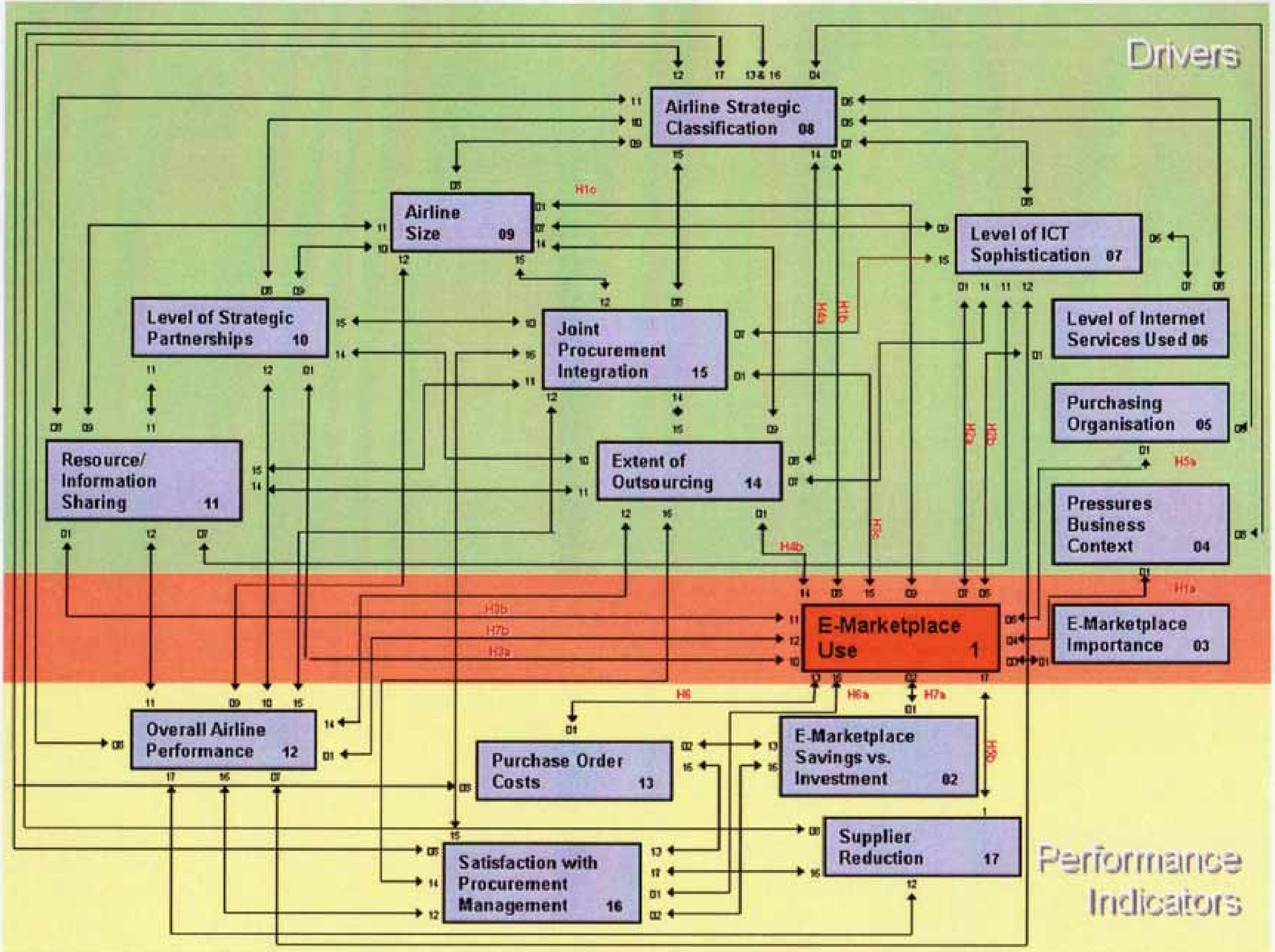


Figure 28: Proposed Contingency Model

For confirmed significant hypotheses, further tests were performed in the results sections by the inclusion of the two control variables 'firm size' and 'airline strategy' to see if original relationships still remain valid after the control variables are taken into account. Inclusion of such control variables is in line with prior research (e.g. Boeker, 1992; Harrison et al., 1988; Wiersema and Bantel, 1992), which typically covers number of employees, firm age and ownership variables.

The details of the data collections techniques, i.e. two surveys and two case studies, are presented in the following sections.

5.3. Data Collection Techniques

5.3.1. Methodological Triangulation

Methodological triangulation, using quantitative and qualitative methodologies, increasingly provides multidimensional insights into many management research problems and has therefore been employed for this study. Triangulation refers to the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings. In the literature on triangulation in the social sciences, it is typically Webb et al. (1981) who are attributed with the first use of the term itself:

"Once a proposition has been confirmed by two or more independent measurement processes, the uncertainty of its interpretation is greatly reduced. The most persuasive evidence comes through a triangulation of measurement processes."

This early thinking and writing was soon to be taken up in research methods textbooks (e.g. Denzin, 1970), thus reinforcing the use of triangulation as a legitimate technique within the social sciences research. Denzin (1970) thereby distinguishes different triangulation typologies:

1. *Data triangulation*, which entails gathering data through several sampling strategies, so that slices of data at different times and social situations, as well as on a variety of people, are gathered.
2. *Investigator triangulation*, which refers to the use of more than one researcher in the field to gather and interpret data.

3. *Theoretical triangulation*, which refers to the use of more than one theoretical position in interpreting data.
4. *Methodological triangulation*, which refers to the use of more than one method for gathering data.

For this study, data and methodological triangulation was applicable in order to add a sense of richness and complexity to the study and, as such, enhance the credibility and validity of the research (Knafl and Breitmayer, 1989). Massey and Walford (1999) argue for a holistic type of triangulation where all the "gaps" are plugged by each successive method/data source. Triangulation enables the researcher to elicit data and suggest conclusions "to which other methods would be blind" (Jick, 1983).

Therefore, the surveys for airlines and e-Marketplaces were mainly used for quantitative analysis and the case studies were conducted as a complementary approach to illustrate qualitative e-Marketplace examples. Weinreich (2003) confirms that, ideally, researchers use quantitative and qualitative data to give an accurate representation of the issues under investigation.

Despite the integration of qualitative elements, the overall study is oriented toward the positivistic end of the spectrum. Myers (1997) cites Orlikowski and Baroudi (1991), who suggest categories based on the underlying research epistemology, mainly: positivist and interpretive. Myers (1997) argues that these research epistemologies are two philosophically divergent approaches. In social research practice these distinctions are often blurred (e.g. see Lee, 1989).

Positivist studies attempt to test theory in order to improve the predictive comprehension of phenomena. In logical positivism experimental methods and quantitative measures are generally used to test hypothetical generalisations (Patton, 1990). According to Weinreich (2003), quantitative research employs methods that are embraced from physical sciences which are generally designed to warrant objectivity, generalisability and reliability. These research techniques include ways to randomly select a research sample from the whole research population in an unbiased manner, as well as statistical techniques that are employed to test predetermined hypotheses concerning relationships between particular variables. Quantitative research is well suited to establish cause-and-effect relationships, but this paradigm may collapse when the phenomenon observed is complex to measure or quantify (Weinreich, 2003). A weakness of the quantitative research approach is the fact that it decontextualises human behaviour in a way that removes the event from its real world setting and ignores the effects of variables that have not been included in the model.

Qualitative research is typically more directed towards the view that science is subjectively determined and "lived experience". Quantitative research, on the other hand, is more often identified with the view of science as objective fact or truth. Therefore, elements of phenomenological (interpretive) inquiry have also been employed to understand phenomena in context-specific airline industry settings. Interpretive studies attempt to comprehend phenomena through the meanings that individuals allocate with them. Interpretive research methods aim to produce an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context (Walsham, 1993). Interpretive research is not predefined by dependent and independent variables. It focuses on the intricacy of human sense making in certain circumstances (Kaplan and Maxwell, 1994).

Qualitative methods may help better comprehend any phenomenon which is not yet very well researched or explored. These methods are also useful in gaining new perspectives on a given phenomenon or in obtaining more in-depth information which may be difficult to achieve by quantitative methods (Strauss and Corbin, 1990). Therefore, qualitative methods are very suitable where a situation cannot be adequately interpreted or described, or where the variables need an initial identification for (potential) later quantitative testing.

"The word qualitative implies an emphasis on processes and meanings that are not rigorously examined or measured (if measured at all), in terms of quantity, amount, intensity, or frequency. Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry ... In contrast, quantitative studies emphasise the measurement and analysis of causal relationships between variables, not processes. Inquiry is purported to be within a value-free framework" (Denzin and Lincoln, 1994).

Quantitative and qualitative research methods are employed with both, deductive and inductive approaches (see Table 6). Known theory is the basis for deductive research, which subsequently tests theory by offering evidence against or for a pre-specified hypothesis. Inductive research is based on observations, typically in order to make a contribution to theory or develop new hypotheses. The study has elements of both deductive and inductive research, as the surveys and case studies were developed simultaneously. The case studies also helped in the process of hypotheses formulation, which were then tested rigorously by the airline survey.

Before conducting any large-scale quantitative research, ABMRC (1989) suggests that a qualitative segment of research is carried out. The main purpose of this proposition is to comprehend motivations and attitudes of the study objects. This applies especially to a relatively unknown market or subject. As such, the findings of the qualitative study can provide valuable input to the quantitative phase in terms of the line and tone of questionning, and the overall structure and content of the quantitative research (ABMRC, 1989). Marsland et al. (2000) state that a broad shallow study which provides good 'representativeness' in combination with one or more deep narrow studies is favourable. Sieber (1979) confirms that qualitative data can contribute to quantitative research by the ability to outline situations in more depth that the more broad quantitative data cannot address.

Concepts usually associated with quantitative method	Concepts usually associated with qualitative method
Type of reasoning	
Deduction	Induction
Objectivity	Subjectivity
Causation	Meaning
Type of question	
Pre-specified	Open-ended
Outcome-oriented	Process-oriented
Type of analysis	
Numerical estimation	Narrative description
Statistical inference	Constant comparison

Table 6: Distinctions between Quantitative and Qualitative Methods
Source: Casebeer, A.L, Verhoef, M.J., 1999, Combining Qualitative and Quantitative Research Methods: Considering the Possibilities for Enhancing the Study of Chronic Diseases, at: http://www.phac-aspc.gc.ca/publicat/cdic-mcc/18-3/d_e.html

While quantitative approaches are characterised as having breadth and qualitative approaches as having depth, a key can be to combine the breadth of one and the depth of the other (e.g. McGee, 2000). In the early 1980s, it was recognised that there are interfaces where the two approaches can benefit from each other, leading in turn to an improved quality of information, which is required for intelligent decision-making at the various stages of development projects and programmes (Marsland et al., 2000). In particular, qualitative data can be used to complement quantitative methods by clarifying the language used in quantitative surveys, by confirming hypotheses or by explaining unexpected results (Chung, 2000). This study uses therefore primarily quantitative data (two surveys) but also employs qualitative results (two case studies) to help interpret or explain the quantitative findings.

5.3.2. Survey Designs

Two surveys were required to illustrate two different perspectives: from an airline point of view in terms of value creation as a customer and from an e-Marketplace point of view as value creation provider. The e-Marketplace survey seeks explicit information on e-Marketplace features in order to group them into separate classifications. Due to the rather low population of e-Marketplaces in the airline industry, a rigorous hypothesis testing was not attempted for this survey analysis. This testing was therefore solely employed for the airline survey.

Stratified random sampling as a probability-based method was employed for the airline survey to increase the overall sample representativeness. This approach was used to ensure that each airline grouping was proportionally sampled. Non-probability methods such as snowball, quota or convenience sampling were avoided, as they are typically regarded as 'inferior' to probability methods because they provide no statistical basis upon which the representativeness of the sampling method can be evaluated.

The census survey for e-Marketplaces and the stratified sample survey for airlines were extensively pre-tested and piloted with a group of industry executives and subject area experts. This was to ensure question completeness, efficiency, relevancy, and format appropriateness. Pre-testing also helped to ensure wording understandability, interpretation consistency, logical sequencing, and overall positive impression from the look and feel of the surveys. The respondents provided valuable feedback and qualitative comments on the topic that led the author to further refine and improve the survey. Such exercises reduce the probability of item misinterpretation, affirm the appropriateness of the target respondent, and facilitate assessment of the validity of the content of each construct and the practical relevance of variables chosen in the study. Small pilot studies were then conducted for both surveys. The feedback proved that the surveys were sound. This process was used to decrease measurement errors that could stem from poor question wording or questionnaire design or some other aspects. The following figure illustrates the measures used to improve the validity and reliability of the surveys. Further details are provided in the data collection sections 6.1 and 7.1.

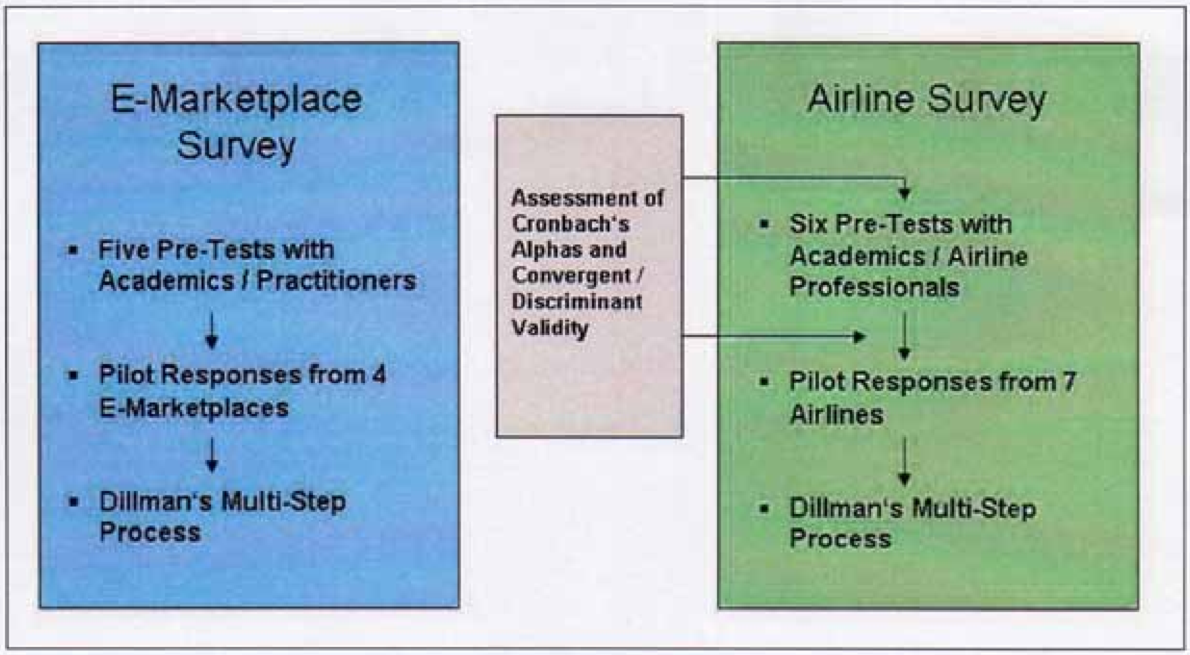


Figure 29: Adopted Measures to Improve Survey Validity and Reliability

Dillman's (2000b) multi-step process of 'Tailored Design' was followed for both surveys, which includes the personalisation of the cover letter and repeated follow-ups, in order to achieve high response rates and minimise the potential influence of non-response bias. Dillman (1978) initially recommended in his 'Total Design Method' a precise schedule of four contacts (1st week, questionnaire sent, second week, thank-you/reminder postcard sent, 4th week, a replacement questionnaire sent, and 7th week a replacement questionnaire sent to non-respondents by certified mail).

However, as Dillman (2000b) admits, the Total Design Method had some shortcomings, such as its one-size-fits-all character. Therefore, Dillman (2000a) introduced the aforementioned new paradigm called Tailored Design, which expands the previous method to account for and take advantage of recent developments that affect the conduct and success of surveys e.g. mixed-mode considerations for data collection.

Dillman's main recommendations were followed in the survey designs, such as making the questionnaire interesting and respondent-friendly and establishing trust by identifying with a legitimate or known organisation or group. The author also tried to make the questionnaire as brief as possible to avoid low response rates. Dillman (2000b) further recommends that a long data collection period designed on the basis of distant deadline dates and widely separated mailing dates will achieve better co-operation. This approach was incorporated as well in the survey data collection (e.g. the data collection timeframe was about 15 months for the airline survey).

Multiple mailings of questionnaire and reminders were used to improve response rates. Dillman (2000b) argues for four to five carefully-timed contacts that support one another through their wording and timing. This process started with a short personalised e-Mail that pre-notified and introduced the coming survey. As proposed by Dillman (2000b), multiple follow-up approaches such as emails with links to the online questionnaires, postal and phone surveys were used in combination to improve results quality (Smith, 1997) and sample representativeness (Yun and Trumbo, 2000; Swoboda et al., 1997). Electronic surveys are becoming increasingly common and research comparing electronic vs. postal surveys is starting to confirm that electronic survey content results may be no different than postal survey content results, yet provide strong advantages of speedy distribution and response cycles (Yun and Trumbo, 2000; Swoboda et al., 1997).

In total, the e-Marketplaces and airlines were contacted at least five times via e-mail and postal mail. Yun and Trumbo (2000) confirm Dillman (2000b) that using multiple modes of survey delivery generated a higher response rate than using one method alone. Non-respondents were finally contacted up to three times via phone, as Dillman recommends this as a final effort. To increase the response rates, a free mailing of the results was also offered. Dillman's Tailored Design Method proved to be effective, as response rates of 65% for the e-Marketplace survey and 29% for the airline industry could be achieved. The full details of the data collection are individually outlined for each survey in sections 6.1. and 7.1.

There are also some limitations common to survey research, which include the usage of a single respondent per firm, the use of perceptual data, and self-selection of responses. For example, while most surveys rely on a single respondent (as in this study), there is a small number of surveys that use multiple respondents within each unit investigated (see Donk and Vaart, 2005).

Some of the questions used in the surveys are attitudinal likert scales, for which participants may base answers on feelings towards the subject or may answer according to what they feel is expected of them as participants. As with any survey, each respondent may interpret questions on the survey differently from others respondents, generating data that may be skewed due to user perceptions. Respondents often also do not share sensitive information in a survey format. The surveys also mainly report observations at one point.

The author is aware of these limitations in using surveys as a data collection technique and discussed at length, for example during the pre-tests and piloting of the survey, how to minimise this outcome. However, it also has to be recognised that these limitations can never be completely eliminated.

5.3.3. Case Studies

To extend the knowledge and understanding about the adoption drivers of e-Marketplaces and its impact on performance indicators the author concluded that surveys would not suffice but the more uncharted territory of case study methods would give greater scope to the research.

Voss et al. (2002) argue that case studies have consistently been one of the most powerful research methods in operations management. The case study approach has a long history within management studies (e.g. Gummesson, 1988), as well as in the social sciences more generally (e.g. Barnes et al., 2003). Case studies can help reduce the gap between what academics are assuming and the real condition of operations management, which led to growing disparities between advice in operation management research and workable answers for managers (McCutcheon and Meredith, 1993).

The strength of the case study approach is its ability to obtain a rich data set by conducting an in-depth study of an organisation. According to Cohen and Manion (1989), data from case studies is drawn from practices and experiences and therefore is strong in reality. As such, case studies can be a catalyst for change because they reflect real experience and may be seen as more accessible or persuasive.

Therefore, for the qualitative part of the study, two multiple explorative case studies were analysed, as a single case study may only represent a unique or extreme case (Yin, 1994). This was done to increase the construct validity and external validity, which is more difficult to attain in a single case study (Yin, 1994). A multiple case design is more demanding than a single case and it permits introduction of more reliable models (Bourgeois and Eisenhardt, 1988).

Qualitative research methodologies, such as case studies, provide the researcher with the perspective of target audience members through immersion in a culture or situation and direct interaction with the people under study. Case studies are particularly qualified in new research areas, where existing theory is rather inappropriate to explain complex phenomena (Yin, 1994). Since the literature on adoption drivers of B2B e-Marketplaces and its impact on performance indicators is very limited, qualitative interviews are considered appropriate in generating new insights.

Rogers (1995) notes that DOI research has been criticised for its pro-innovation bias and that there exists a need for researchers to *"see an innovation through the eyes of their respondents."* The use of case studies can capture the 'social actors' points of view (Blaikie, 2000). Generally, when a qualitative contextual picture of a certain situation is needed, and when it is necessary to get in-depth insights into this phenomenon, case studies are appropriate (Bryman and Burgess, 1999). Case studies also facilitate the capture of the 'processural view' of e-Marketplace adoption and capture some degree of longitudinal data through participants' recollections (Bryman, 1988).

According to Arni (2003), the case study approach has also an advantage in its less standardised nature of data collection, so that the process is much more open and the researcher is more flexible in approaching the object under study in terms of choice of instrumentation, participants and tools of analysis since the contact usually takes place over a longer period of time and is very interactive.

In case studies, many how and why questions can be employed in order to identify the importance of factors affecting e-Marketplace implementations. There is little control over the behavioural events and the issue in investigation is a contemporary one (Yin, 1994). According to O'Brien (2001), there is therefore also a need to *"retain the ideals of researcher objectivity, and the researcher as passive collector and expert interpreter of data."* Case studies are typically rich with detail and give insights into participants' experiences of the world. They may be epistemologically in harmony with the reader's experience (Stake, 1978).

For example, qualitative questions can be asked in areas and topics where a survey questionnaire would not be appropriate. Yin (1994) named six sources of evidence for data collection: documentation, archival records, interviews, direct observation, participant observation, and physical artefacts. Not all sources of evidence have to be used in every case (Yin, 1994). The methods used for collecting data are typically selected with regard to the suitability of the task (Bell, 1992). For this research, direct observation, participant observation and physical artefacts were not relevant, as they are related more closely to direct sociological investigation.

The author started with an analysis of documents and archival records. Their validity was cautiously reviewed in order to avoid incorrect information or data being included in the case study. According to Yin (1994), there might be a danger of this occurrence in the case that the researcher is inexperienced and mistakes some document data for unmitigated truth. The potential for over-reliance on documents as evidence is a typical concern in case studies.

Open-ended interviews were further used for the two case studies (by contrast to the very structured surveys), looking for processes and patterns that explain "how and why" questions (Keen, 2004). The interviewees were encouraged to speak freely from their knowledge and experience within the e-Marketplace industry. The case studies aim to illustrate the findings of the quantitative analysis with real life examples and to provide useful input for further analysis. Therefore, they were open-ended and designed to elicit detailed, concrete stories about the subject's experiences and to allow respondents maximum freedom of expression.

Neuman (2000) appraises the importance of open-ended questions:

- They permit an unlimited number of possible answers.
- Respondents can answer in detail and can qualify and clarify responses.
- Unanticipated findings can be discovered.
- They permit adequate answers to complex issues.
- They permit creativity, self-expression, and richness of detail.
- They reveal a respondent's logic, thinking process, and frame of reference.

The purpose of such interviews is not to conclusively test hypotheses but to help the researcher understand the experiences of the participants and the conclusions the participants themselves have drawn from them. In-depth qualitative interviews are most appropriately used when a rich, detailed, holistic picture is needed of people's experience and how they interpret it and when the study is exploratory in nature. Due to the lack of previous research on e-Marketplaces in the airline industry, this study employs descriptive and explorative case studies (according to the classification of Yin, 1994).

A descriptive case study seeks to outline the context of a research event and presents a picture of its specific details, while exploratory case studies elaborate a well-grounded picture of occurrences, develop tentative theories and frame questions for further research (McCutcheon and Meredith, 1993). Galliers (1992) indicates that when the state of knowledge in a field is at an early stage of investigation, a need exists for the research purpose to focus on 'discovery' and 'theory-building', and be 'exploratory' in nature. Yin (1994) explains that explanatory case studies are designed to build causal investigations, thereby raising doubts about existing theories. Explanatory case studies could not be used for this particular research, because theory and constructs in the literature to e-Marketplaces are not yet designed well enough.

In-depth interviews facilitated a process of discovery as each interview built upon previous findings to generate and pursue a new set of questions. The interviews left considerable room for interviewees to volunteer information and describe their own experiences. A total of 18 open-ended interviews were conducted over a 15-month period, aiming to gather as much information as possible about e-Marketplaces from an adopter and non-adopter perspective. The use of multiple interviewees in each organisation not only affords greater depth and breadth of data, but also overcomes the problems of unreliability associated with the use of single respondents (Bowman and Ambrosini, 1997).

These open-ended interviews were based on the theoretical framework developed from the literature, to focus and bound the work (Miles and Huberman, 1994). They addressed issues such as the impact of e-Marketplaces on airlines regarding structure, relationships and ways of working. The interview questions were also aimed at discovering how airlines manage their e-Procurement operations and how they were adapting their operations to incorporate these initiatives. In addition, the readiness of an airline (in terms of ICT infrastructure, business processes and organisation) to adopt e-

Marketplaces or the products feasible for e-Marketplace procurement was for example assessed. The key factors driving the implementation of e-Marketplaces are analysed, such as the level of awareness, as well as the impact on performance indicators. The case studies sometimes also intentionally differentiate in context, thereby emphasising and documenting the diversity and complexity in the field of e-Marketplaces. However, there are also limitations to case studies in that sometimes they can become very complex and all the variables and cause/effect relationships appear to be relevant. It is important here to point out certain variables but not to get 'bogged down' with them.

Case studies are traditionally criticised for their lack of standards. Voss et al. (2002) note that one of the challenges of the method is the need to exercise care in attempting to draw generalisable conclusions from a limited set of cases. However, Stake (1995) argues that the information generated by case study approaches would frequently resonate with a large cross-section of readers and thereby facilitate a greater comprehension of a phenomenon. The case research methodology was chosen because it fulfils the objectives of the research, can provide rich data and new insights into an area with a low level of theory and is appropriate to the nature of the problem. McCutcheon and Meredith (1993) argue that embracing a field investigation technique such as case studies is bound to make the individual researcher, and the field in general, richer and better prepared to solve real operations management problems.

As such, the two case studies are appropriate means to cross-check insights from the quantitative research and to explore the social realities behind the identified trends. In this way, it is possible to obtain a level of breadth, based on statistical analysis, which can add to the depth obtained during the qualitative phase of the research. The depth data enables the researcher to access the meanings and interpretations that managers place on the organisational actions and decisions. Further methodological details to the case studies are presented at the case study introduction in section 8.1.

5.3.4. Consideration of Other Research Methods

Instead of defending or even ignoring a particular research paradigm, it is more instructive and well feasible to regard quantitative and qualitative methods as part of a continuum of common research techniques. These research techniques are all appropriate in dependence of the research objective (Fielding and Schreier, 2001). That is why the author shares the belief that combining quantitative and qualitative research methods in the same research project effectively adds more depth (e.g. Patton, 1990; Strauss and Corbin, 1990). For example, Russek and Weinberg (1993) argue that by utilising both qualitative and quantitative data, their research turned out results that neither method could provide alone. That is why the research design comprising both surveys and case studies was selected. While other data collection approaches were evaluated as well, they were not chosen due to the following reasons:

Ethnography was not employed for this study due to its time-consuming observation processes and its lack of abilities to make broader generalisations. In this mode, researchers live among and take part in the daily activities of people, reconstructing their interactions and activities in field notes taken as soon as possible after their occurrence (Goetz and LeCompte, 1984). In ethnography, as in no other form of investigation, the researcher is the instrument of data collection and analysis (Wolcott, 1975). The researcher usually spends a considerable amount of time in the field. The experience of spending time in the field of research and the fieldwork notes themselves become an important addition to other data gathering techniques. Myers (1997) notes that in case study research interviews and documentary materials are primarily and preferably employed, by comparison to participant observation.

This also applies to grounded theory, which is not widely employed in ICT and supply chain management research as well due to its extensive coding techniques (e.g. Strauss and Corbin, 1990). One of the main criticisms to this method is that it lacks foundation for the relationships between the categories developed. Usually, these relationships are based in conceptual arguments and the experience of the researcher, and the data in some cases is insufficient or does not support at all these relationships or "do not account for social influences on the experiences of respondents" (Benoliel, 1996).

Archival analysis and history methods as primary research method are also unsuitable as the characteristics of the studied industry is changing very fast and as such up-to-date information and data is vital (Yin, 1994). Action research, on the other hand, would have been useful as a complementary methodological approach due to its intervention opportunities. However, it could not be applied because the researcher could not motivate any airline to become involved in their decision making processes and had no control over events to bring about change.

For quantitative research in this field, experiments or simulations were not very appropriate as the number of relevant variables would be greater than could be controlled for. This is due to the complex interactions that take place between human agents with conflicting views and interests in decision making processes, which would be difficult to predict. For example, Cronbach (1975) argues that simulations are not capable to consider all interaction effects that occur in social settings. An experiment is not suitable as it requires control over behavioural events. Experiments are generally used when an investigator can manipulate behaviour directly, precisely and systematically (Yin, 1994).

Therefore, the selection of surveys and case studies was regarded as the best methodological triangulation option. Mangan et al. (2004) confirm that methodological triangulation, using quantitative and qualitative methodologies, can yield greater insights than would have been the case if a single research methodology had been employed. The details of the individual data collection techniques and the results are presented in the following sections.

VI. RESULTS FROM E-MARKETPLACE SURVEY ANALYSIS

6.1. Introduction: Data Collection and Sample Representativeness

The objective of the following survey dedicated to aviation e-Marketplaces is to provide and outline the present state of development. The survey examination aims to offer insights into e-Marketplace drivers and provides a baseline for a categorisation. Data was only obtained from B2B e-Marketplace portals especially addressing the airline and aviation industry as to limit the number and range of different strategic approaches in this field. Thus, this industry sector has its own business rules and features as outlined in the literature review that these aviation e-Marketplace have to address in particular. Therefore, contacted e-Marketplaces had to focus on airline specific products and services, e.g. MRO parts and services, airport services, in-flight services or fuel.

To collect the data required for this survey, a population of 55 e-Marketplaces and service providers dedicated to the airline and aviation industry could be identified mainly from two established databases in 2001, namely the Eye-for-Aerospace e-Marketplace Directory as well as the Berlecon Research e-Marketplace Directory.[28] These databases were selected as they represented the most comprehensive listing of e-Marketplaces by industry sectors, as only e-Marketplaces in the airline and aerospace industry categories were used for this research. Other databases did not distinguish between industry sectors. 36 aviation e-Marketplaces were listed in the Berlecon Research Database whereas 52 e-Marketplaces were listed in the Eye-for-Aerospace e-Marketplace Directory. The two databases were overlapping for 35 e-Marketplaces. The listings were complemented into one single spreadsheet and duplicate listings were deleted.

To identify the population and to reduce potential non-coverage-errors, the author further conducted Internet searches and checked other e-Marketplaces. Two more e-Marketplaces could be identified in the airline industry and added, which were not included in the two databases.

To conduct the survey, a questionnaire (see appendix A) has been created addressing the issues already outlined in chapter 5. Five pre-tests with academics and practitioners led

[28] Databases: www.eyeforaerospace.com and www.berlecon.de.

to slight modifications of the survey instrument in e.g. question wording, elimination of several questions. 10 e-Marketplaces were contacted for a pilot survey and the feedback from 4 e-Marketplaces demonstrated that the survey instrument was sound.

The piloting results were complemented by the main survey, which was conducted by firstly sending an electronic survey invitation letter. As a next step, the e-Marketplaces were electronically contacted again (up to at least five times when there was no response) with a link to the online questionnaire.[29] In order to receive a reasonable response rate, the author decided to follow Dillman's (2000b) multi-step process, employ several modes of data collection and to conduct several follow ups since it has been statistically verified that the number of follow-ups can significantly influence response rates (Sheehan, 2001). Yun and Trumbo (2000) found that using multiple modes of survey delivery delivered a higher response rate than using one method alone. Therefore, non-respondents were finally contacted up to three times via phone.

As already outlined above in previous chapters, in the years 1998-2000, the airline industry could see a tremendous rise in numbers of new e-Marketplaces entering the market, mostly driven by high expectations of the e-Procurement potential in this industry. Not surprisingly, the industry could see many failures, bankruptcies as well as mergers and consolidations within the e-Marketplace world over the coming two years. Initially, the population of active aviation e-Marketplaces represented 55 portals. However, due to consolidation and shakeout within the e-Marketplace businesses across many sectors, only 26 e-Marketplaces could be identified as active aviation portals, whereas the rest of them ceased their operations fully (17 e-Marketplaces) or changed their business focus in another direction or industry (12 e-Marketplaces). Increased competitive pressures and the need to achieve critical mass and liquidity have contributed to this rapid shakeout and consolidation among B2B e-Marketplace portals. Out of the 26 actively trading e-Marketplaces, 17 returned the survey, which is a total response rate of 65% (see Figure 30). 13 responses were received via e-mail / online questionnaire and the other 4 responses via telephone.

[29] The questionnaire was set up online in order to facilitate the data entry and increase efficiency of data collection.

	Number	Related Percentage
Initial population of aviation portals	**55**	
Number of portals that ceased operations	17	30.9%
Number of portals active in other sectors	12	21.8%
Number of active aviation portals [AAP]	**26**	**47.3 %**
Responses/Response Rate	**17**	**65%** [of AAP]

Figure 30: Total E-Marketplace Survey Response Rate

Typically, e-Mail response rates of 20% or lower are not uncommon in research (e.g. Witmer et al., 1999). In terms of average response rate, Sheehan (2001) reported a mean response rate of 37%. Therefore, the achieved response of 65% rate can be viewed as very satisfactory.[30] However, the main focus of the e-Marketplace survey is not on hypotheses testing as outlined in the research design, but on exploring major trends and process drivers within the aviation e-Marketplace sector.

Most questionnaires were completed by the CEOs (30%), vice presidents (50%) and general management level (20%) of e-Marketplaces. This result shows that those e-Marketplaces that participated have taken the questionnaire as serious attempt of research as the questionnaires were filled out by senior management. However, as most companies tend to still employ a small number of employees (see results in next sections), there are certainly only a few number of people within the institution with the expertise of thoroughly considering and filling out such a detailed survey.

Obtaining general information on participating e-Marketplaces in terms of foundation, size or the country of origin was essential in order to provide some e-Marketplace background information in the airline industry and to check the sample's representativeness of the population. Literature suggests that the emergence of B2B e-Marketplaces in the airline industry is a relatively new phenomenon. This was confirmed by the survey findings. 13 e-Marketplaces were established between 1998 and 2001, while only two e-Marketplaces have longer roots back in serving the industry with parts and supplier locating services that mainly took place during that time via

[30] Due to the low population number of active e-Marketplaces in the airline industry, the sampling error is 23.8% with a confidence level of 95% and therefore within expected and acceptable parameters.

BTX, fax and phone. These companies have subsequently adapted their services to online standards.

This result indicates that there is still an evolutionary phase and a relatively young generation of e-Marketplaces in operation within the aviation industry. The feedback from the survey non-response suggests that a high level of e-Marketplace consolidation has been taking place in the airline industry, when comparing the initial number of e-Marketplaces being active at beginning of this research and the number of current portals being active.

Given that it takes on average about 15 months (see Figure 31) for an e-Marketplace to become operational, a rudimentary e-Marketplace system seems to be at least relatively easy to implement and maintain. However, the feedback also suggested that e-Marketplaces start to specialise on core competencies and specific business activities instead of rather broad general services. It can therefore be expected that functionalities and services might still considerably change in years to come to better-fit customer needs. This question will be elaborated in more detail when comparing requirements of customers with the actual and current e-Marketplace features in the next chapter of this study.

Mean = **15.35** Std deviation = **12.92**
Division into 4 classes of the same amplitude

Less than 10	**4**	**23.5%**
From 10 to 19	**9**	**52.9%**
From 20 to 29	**3**	**17.6%**
30 and more	**1**	**5.9%**
Total	**17**	**100.0%**

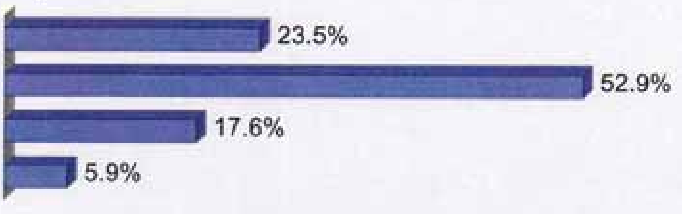


Figure 31: Time for E-Marketplace to Become Operational (in Months)

The impression of most e-Marketplaces still being in an evolutionary process may be strengthened when analysing the number of people employed. E-Marketplaces employ on average 57 people (standard deviation 47.22). Most of e-Marketplaces employ either less than 20 people (31.3%) or more than 100 people (31.3%). This result reveals that there are both quite small and quite large e-Marketplaces in operation. This existence of a variety of small e-Marketplaces may also explain why so many of survey participants hold their posts in higher positions.

Mean = **56.63** Std deviation = **47.22**

Less than 20	5	31.3%
From 20 to 39	2	12.5%
From 40 to 59	3	18.8%
From 60 to 99	1	6.3%
100 and more	5	31.3%
Total	**16**	**100.0%**

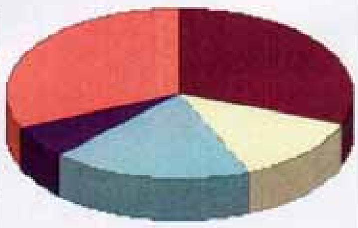


Figure 32: Number of Employees in E-Marketplaces

Survey participants mainly came from the United States (64.7%), followed by Germany (17.6%) and Great Britain (11.8%). One respondent was located in Brazil. The results show that the United States are clearly leading in terms of e-Marketplace numbers. The sample can be compared to the study of Lenz et al. (2002). They contacted the worldwide population of 507 B2B e-Marketplaces and 248 participated in their survey. They found that the United States has the highest number of e-Marketplaces and Germany is the country where most e-Marketplaces in Europe have their headquarters.

The sample is highly representative when comparing this result to the original database of e-Marketplaces, which have been operational in the year 2000/2001. Out of 55 e-Marketplaces, 45 were based in the USA, 3 in the UK, 3 in Germany and just 1 in Hong Kong, Singapore, France and Canada (see Figure 33). The UK and Germany have achieved to establish a small number of sound aviation e-Marketplaces.

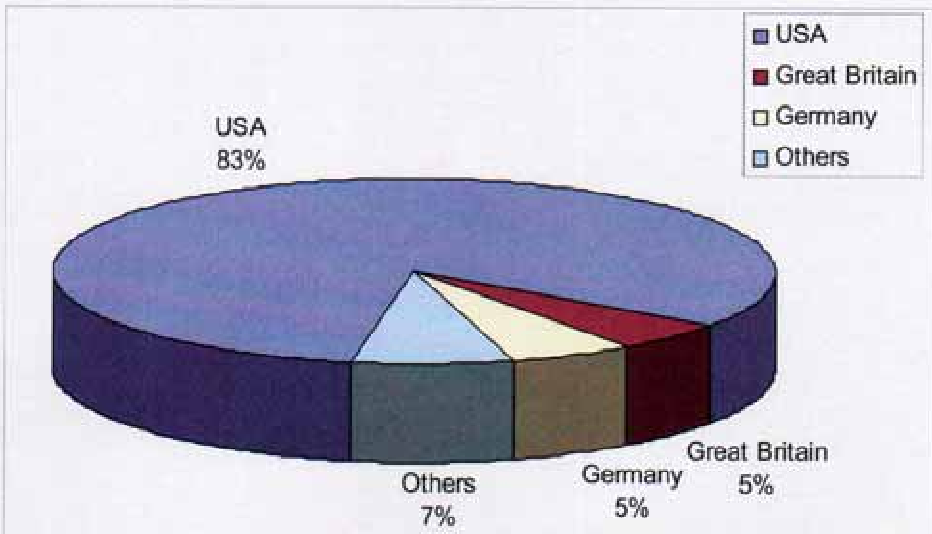


Figure 33: E-Marketplace's Country of Origin (Survey Database in 2000)

An alternative route to non-response and sample representativeness was also assessed by comparing between the early and late respondents (Armstrong and Overton, 1976). The sample was therefore split into the first eight and the last nine respondents and analysed for the variables 'strategic e-Marketplace approach', 'type of airline participation', 'e-Marketplace ownership by airline' and 'level of joint purchasing'. No significant differences at the 5%-level occurred, suggesting that the sample is representative (see Figure 122 in appendix B).

The following sections outline which e-Marketplace categories types are present in serving the airline industry and which types of airlines are actively taking part in procuring through such means.

6.2. E-Marketplace Categories in the Airline Industry

There are essentially two types of online exchanges: vertical and horizontal e-Marketplaces. Vertical e-Marketplaces bring sellers together within a particular industry or commodity area, focussing on specific services or commodities. A horizontal e-Marketplace crosses industries where they offer similar applications and commodities to buyers and sellers across multiple diverse industries. In order to distinguish e-Marketplace strategies the survey sought information whether participants operate a horizontal or a vertical e-Marketplace, or a combination of both.

Horizontal e-Marketplace	1	6.3%
Vertical e-Marketplace	12	75.0%
Vertical and Horizontal e-Marketplace	3	18.8%
Total	**16**	**100.0%**

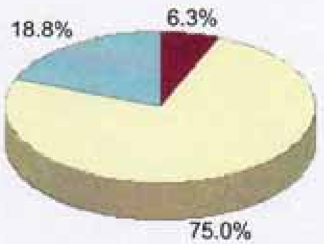


Figure 34: Types of E-Marketplaces in the Airline Industry

The results reveal that there is a definite trend within e-Marketplaces in the airline industry: 75% of survey participants indicated operating a vertical exchange, followed by a mix of vertical and horizontal (19%). A horizontal e-Marketplace is less likely to serve clients in the airline industry (6%). These results may be attributed to the unique features of the airline industry, where many commodity groups are of complex technological nature and unique in their scope. Airline industry characteristics include complex optimisation processes and decision support systems within the supply chain. Another reason is that vertical e-Marketplaces are the dominant form of exchanges in the B2B area.

After having established e-Marketplace types in terms of business sector focus, it was further investigated whether the surveyed e-Marketplaces focus on a particular customer framework (see Figure 35).

Neutral intermediary	14	73.7%
Buyer-centric	2	10.5%
Seller centric	1	5.3%
Industry consortia led exchange	2	10.5%
Total	19	100.0%

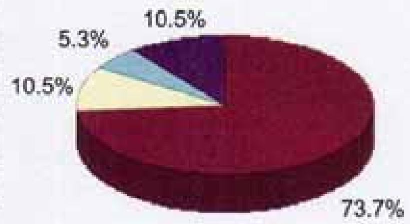


Figure 35: Differentiation of Airline E-Marketplaces

The majority (74%) of surveyed e-Marketplaces classify themselves as neutral intermediaries, which means that they do not employ a particular buyer or seller focus. Only 11% cited operating a buyer-centric and equally 11% an industry consortium led exchange, followed by the remaining 5% that operate a seller-centric e-Marketplace. This result highlight that most e-Marketplace providers have identified the dual needs of their customers (buyers and sellers). Neutral intermediaries in particular attempt to provide both buy-side and sell-side services in order to create a win/win situation for both parties involved. Neutral markets usually form where there is fragmentation on both sides of the transaction, i.e. many buyers and many suppliers. In this respect, e-Marketplaces facilitate suppliers in realising benefits of leveraging many-to-many electronic connections to a global airline customer base. In turn, airlines may be able to reduce the inefficiencies in their supply chain environment that are created by the different channels of communication between airlines and their suppliers. The majority of airline e-Marketplaces apparently also have adopted a neutral focus to achieve a critical mass of participants.

The result that only 5% of airline e-Marketplaces are supplier-driven may be explained in such a way that suppliers try to avoid duplicating their own websites. Apparently the e-Marketplace focus is more on the buy-side than on the sell-side, as 11% of e-Marketplaces target their activities directly to buyers. E-Marketplaces may hope to gain more immediate liquidity from the purchase needs of airlines. This argument may be also applicable for industry consortia, which e-Marketplaces use rather rarely however (11%).

Similarly strategic approaches of e-Marketplaces can be classified in several categories: General aviation e-Marketplaces vs. specialised e-Marketplaces and airline-to-airline e-Marketplace vs. supplier-to-airline e-Marketplaces. General e-Marketplaces typically trade a broad array of commodities and services within a vertical and horizontal market. In contrary, specialised e-Marketplaces focus on a distinctive product or product group to be traded on the platform, such as GSE, catering supplies, etc. For example, airlines and suppliers may benefit from commercial and technical procurement tools, strategic sourcing capabilities, AOG resolvement or repair services. However, e-Marketplaces not only exist in bringing together airlines and respective commodity suppliers, but can also focus on exclusively linking airlines with each other in order to offer excess inventory or list their inventories that may be available for purchase or for borrowing.

General aviation e-Marketplace	10	31.3%
Specialised (one product group) aviation e-Marketplace	3	9.4%
Airline-to-Airline e-Marketplace	10	31.3%
Supplier-to-Airline e-Marketplace	9	28.1%
Total	32	100.0%

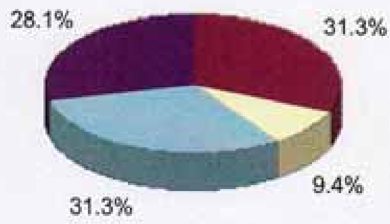


Figure 36: Categorisation of Aviation E-Marketplaces

Figure 36 shows that the majority of airline e-Marketplaces focus on a variety of products groups, while highly specialised (one product group) e-Marketplaces are rather rare. Another very interesting finding includes that e-Marketplaces do not necessarily concentrate their activities on the airline-supplier relationships. Typically, e-Marketplaces offer both airline-to-airline and airline-to-supplier communications. In the sample, there were two e-Marketplaces that solely support airline-to-airline communication to e.g. pool or exchange aircraft related material, maintenance or ground support, while there was only one e-Marketplace that focuses entirely on the airline-supplier relationship.

6.3. Airline and Supplier Involvement in E-Marketplaces

4.3.1. Airline Participation

In order to examine e-Marketplace usage patterns, an investigation into whether or not certain airline groups participate exclusively on certain e-Marketplaces has been carried out (see Figure 37).

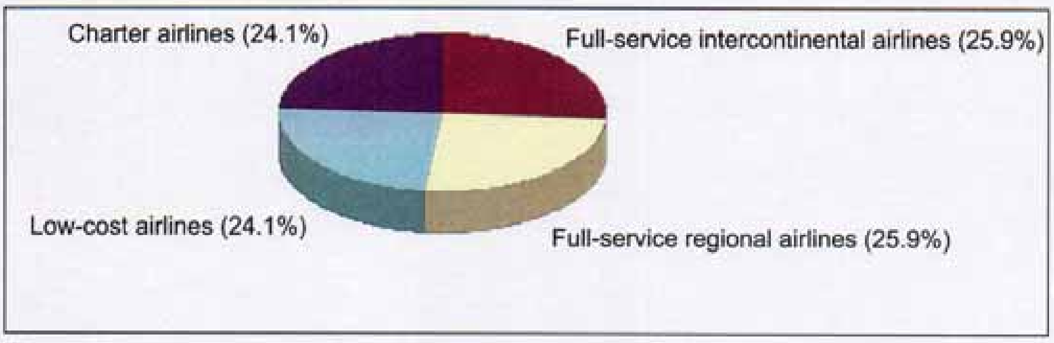


Figure 37: E-Marketplace Use by Airline Type

No difference could be identified in view of whether or not a particular airline group exclusively trades on an e-Marketplace. All e-Marketplaces report that charter airlines, low-cost, regional and international full-service airlines all account for their customers. However, this result only indicates which airline types participate in e-Marketplaces, but not the extent of integration and use. Therefore, it was also required to further break down the extent of e-Marketplace integration by airline type (see Table 7).

	Mean	Std deviation
Full service	4.12	0.33
Regional airlines	3.18	0.81
Low cost airlines	3.35	1.00
Charter Airlines	2.65	0.86
Total	3.32	0.94

on a scale from = not at all to 5 =totally

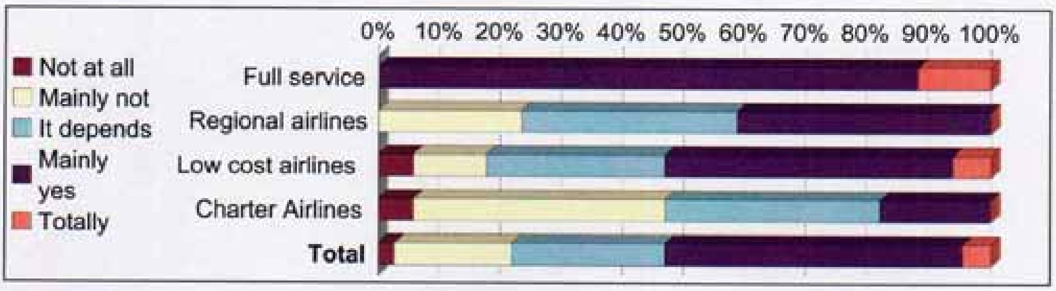


Table 7: Extent of E-Marketplace Integration by Airline Type

Full service airlines (X=4.12) are found to have the most extensive integration of e-Marketplaces, followed by low-cost airlines (X=3.35), regional airlines (X=3.18) and charter airlines (X=2.65).

6.3.2. E-Marketplace Ownership

Besides participating in e-Marketplaces, a certain number of airlines are also active in being financially involved in terms of part ownership or full ownership of an e-Marketplace. Some airlines have taken the initiative in setting up their own e-Marketplaces in industry consortia, often together with other (partner) airlines and/or suppliers.

Yes	4	23.5%
No	13	76.5%
Total	17	100.0%

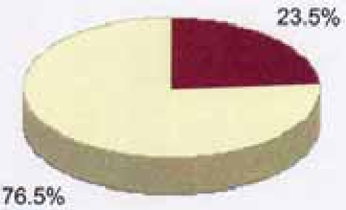


Figure 38: Airline Ownership of E-Marketplaces

24% of surveyed e-Marketplaces cited that they have airlines as part of full stakeholders, while for 76% of all respondents airlines are not stakeholders. In order to determine the distribution of ownership, the survey further sought information on which types of airlines are financially involved (as illustrated in the figure below).

Full service intercontinental airlines	4	66.7%
Regional airlines	1	16.7%
Low cost airlines	1	16.7%
Charter airlines	0	0.0%
Total	6	100.0%

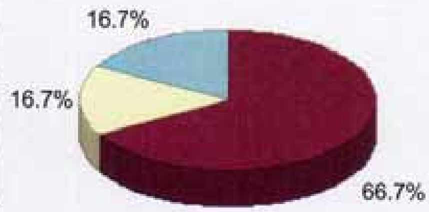


Figure 39: Airline Involvement regards Ownership

Airlines that are financially involved are mainly full service intercontinental airlines (67%), followed by low-cost and regional airlines (17% each), while charter airlines are not financially involved at all. How can that finding be explained? It seems that only airlines that are relatively large in company size and operate a large fleet actively take part in e-Marketplaces in terms of own company stakes. Further, it seems that airlines having stakes in e-Marketplaces are often centred on a common alliance. These airlines use their network relationships to form industry consortia. Furthermore, there are also suppliers that are stakeholders in aviation e-Marketplaces. The survey results reveal that approx. 12% of e-Marketplaces indicate supplier ownership.

6.4. E-Marketplace Strategy

E-Marketplaces were further asked in open-text questions which kind of strategy they employ. Some e-Marketplaces concentrate their strategy on the reduction of processing costs and time savings, such as:

(a) To streamline the communication process and the information flow to change from traditional transfer media (phone, fax) to automated (Internet based) process,

(b) To provide a quality service at minimum cost,

(c) To connect buyers and sellers of aerospace hardware and so are able to provide a time and money saving service.

Another important issue e-Marketplace providers took into account was the improved sourcing capability:

(d) For sourcing, the target is to bundle volumes with other airline/non-airline companies and use e-auctions and e-RFQ (electronic request for quotations) as a professional standard tool within sourcing process,

(e) To assist airlines in sourcing and disposal of surplus inventory and AOG resolvement.

Furthermore, some e-Marketplaces have identified a core business for themselves, e.g. they concentrate all their efforts on providing an exchange and services for a particular product:

(f) To formalise market for ground support equipment (second hand equipment sales),

(g) Industry-wide jet fuel portal for buyers, sellers and other industry participants, which meets all demands for jet-fuel procurement, sales and supply chain management by integrating and digitising the supply chain from refinery to aircraft wing.

(h) Clearing house for buyers and sellers,

(i) To provide the best, most inclusive exchange available, while offering management reports and other needed information.

Also overall value creation is a driver for e-Marketplace strategies:

(j) To create value for founding airlines and develop business from additional carriers,

(k) To work jointly with the industry's twelve leading associations to develop meaningful e-Business standards and marketplace solutions to improve communication and maximise efficiencies between the world's airlines and suppliers.

Overall, e-Marketplaces in the airline industry pursue a variety of business strategies, ranging from process cost and product costs reduction, improvement of sourcing activities, provision of centralised exchanges to other activities such as standardisation initiatives.

Another important strategy issue is the co-operation with other e-Marketplaces. 47% of participants stated that they would consider co-operating with other e-Marketplaces (see Figure 123 in appendix B). This may be a necessity as e-Marketplace consolidation is taking place. Examples of these developments have been b2b-aero and OverhaulSearch that formed the portal OneAero, which further integrated smaller e-Marketplaces in later stages.

6.5. Services Provided by E-Marketplaces and Products Traded

The following figure reveals the services that various e-Marketplaces offer (more details can be found in Table 20 in appendix B).

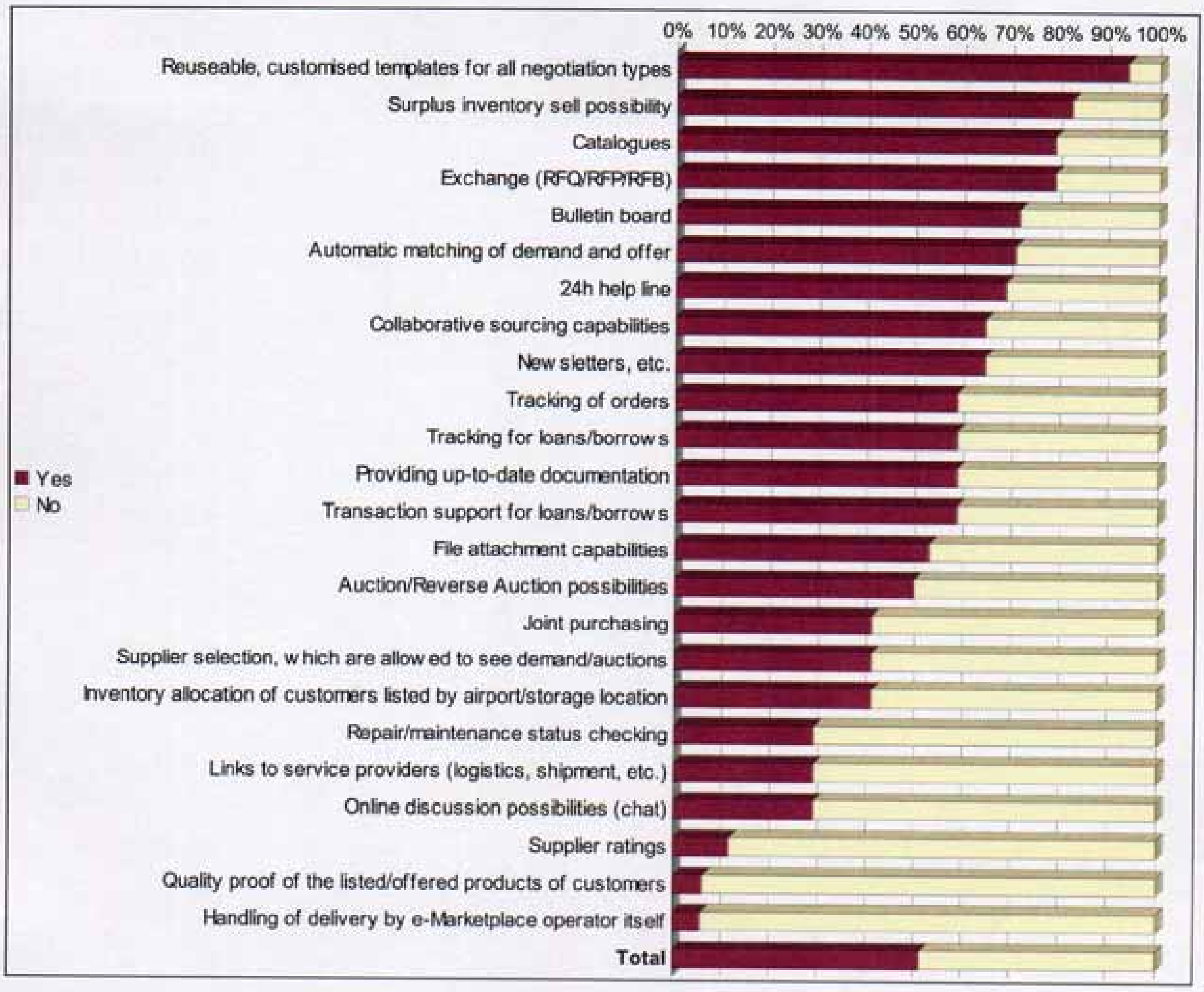


Figure 40: Offered Services

The majority of participants indicated to offer several of the above services. Nearly all respondents (94%) cited that they would offer reusable and already customised templates for the negotiation types offered at their portals, which allows customers to list their offers and demands in a time saving manner. Obviously, this can be considered as a service that can be integrated in a rather quick way, while it is also an important feature for cost and time savings of e-Marketplace customers. Interestingly, 82% of e-Marketplaces offer surplus inventory sell possibilities and 79% integrate product catalogues.

Incidentally, surplus inventory was also identified to be the most traded product on aviation e-Marketplaces. The majority of them trade surplus inventory and spare parts (77%) and airframe products (71%). 59% of respondents indicated trading technical support and maintenance products and services, followed by avionics (41%), ground support equipment (29%) and engines (24%) (see Figure 41).

Surplus, excess and over-run inventory and equipment	13	76.5%	
Spare parts	13	76.5%	
Airframe products	12	70.6%	
Technical support and maintenance	10	58.8%	
Avionics	7	41.2%	
Ground support equipment	5	29.4%	
Engines	4	23.5%	
Catering	3	17.6%	
Aircraft	1	5.9%	
Fuel	1	5.9%	
Total	17		

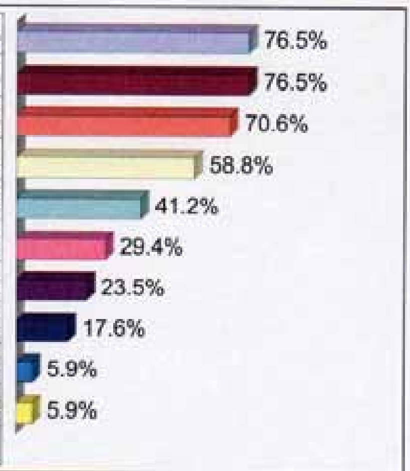
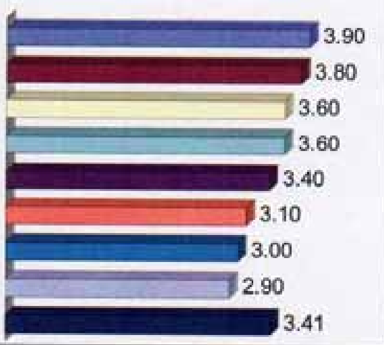


Figure 41: Products Traded on E-Marketplaces

A relatively small number of e-Marketplaces deal with aircraft (6%) and fuel (6%). This finding may be explained in such a way that these product groups tend to be highly specialised and the number of suppliers is relatively small.

Given the rather high level of catalogue offerings, it was also analysed which products groups are considered to work best for fixed price catalogues (on a scale from 1 = completely inappropriate to 5 = very appropriate). Fixed price catalogues are appropriate in the category of general expenses/office supplies (X=3.90), followed by tools/GSE (X=3.80), interiors (X=3.60) and spare parts (X=3.60). Maintenance services (X=3.10) and powerplants (X=3.0) are fairly appropriate, followed by fuel (X=2.90) (see Figure 42).

	Mean	Std deviation
General Expenses	3.90	0.57
Tools / GSE	3.80	0.63
Spare Parts	3.60	0.52
Interiors	3.60	0.52
Catering and Inflight Supplies	3.40	0.70
Maintenance & Repair Services	3.10	0.74
Powerplants	3.00	0.82
Fuel	2.90	0.88
Total	3.41	0.74



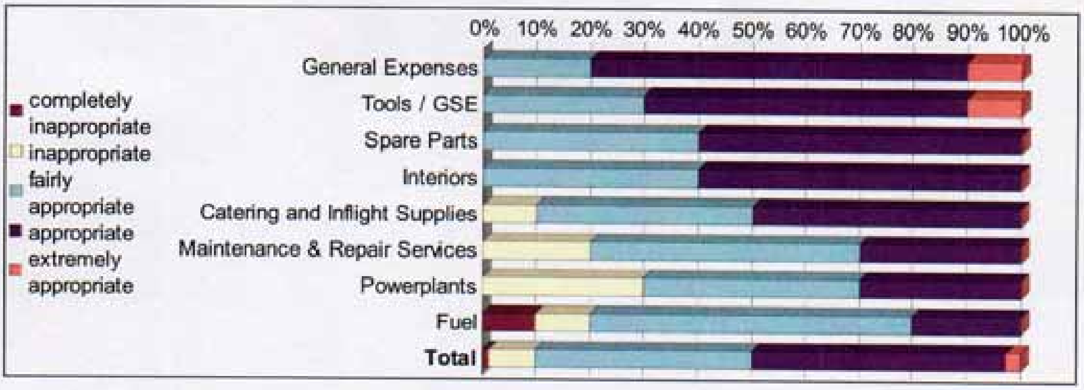


Figure 42: Fixed Price Catalogues by Product Groups

The results of Figure 40 further show that most e-Marketplaces focus their services on transaction support. 71% offer a bulletin board and the automatic matching of demand and supply and 59% tracking of orders, tracking for loans/borrows, and transaction support for loans/borrows. What was not surprising in this respect is that e-Marketplaces act typically just as electronic broker. Only 6% of e-Marketplaces handle deliveries by themselves.

While transaction support services are highly integrated within aviation e-Marketplaces, sourcing capabilities are less offered. Request for quotation services (79%) and collaborative buyer-supplier sourcing (65%) are provided by a relatively high number of e-Marketplaces, but the level of integration drops for auction/reverse auctions to 50% of e-Marketplaces and for demand aggregation / joint purchasing to 41%.

In view of the suitability of competitive tendering for various product groups, participants stated office supplies (X=4.22), spare parts (X=4.20), catering supplies (X= 4.11) and tools / GSE (X=4.10) as appropriate. This is then followed by powerplants (X=4.0), fuel (X=4.0) and interiors (X=3.89).

	Mean	Std deviation
Spare Parts	**4.20**	**0.42**
General Expenses	**4.22**	**0.44**
Catering & Inflight Supplies	**4.11**	**0.33**
Tools /GSE	**4.10**	**0.57**
Powerplants	**4.00**	**0.87**
Fuel	**4.00**	**0.50**
Maintenance & Repair Services	**3.89**	**0.78**
Interiors	**3.89**	**0.60**
Total	**4.05**	**0.57**

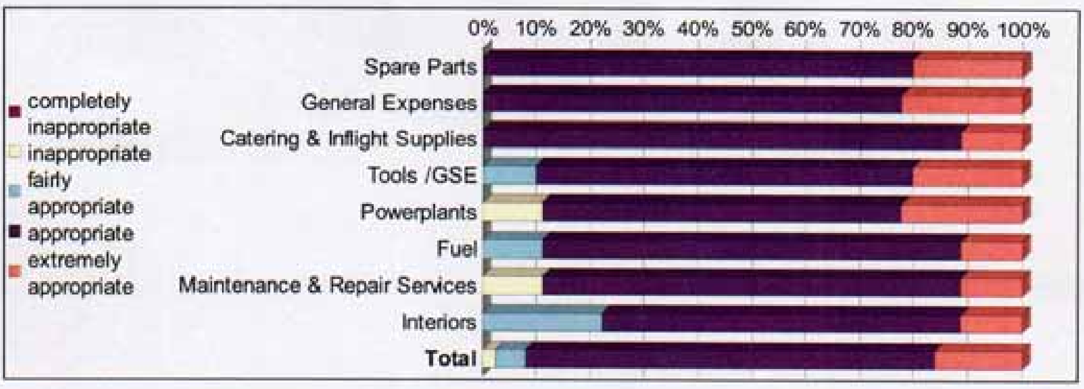
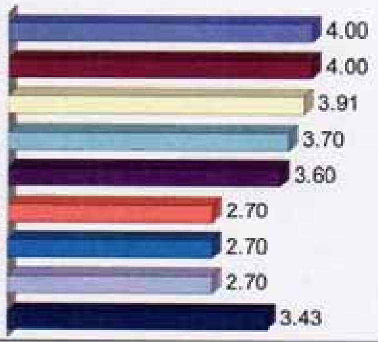


Figure 43: Competitive Tendering by Product Groups

In terms of offering auctions/reverse auctions, most respondents stated this model as to be fairly appropriate to appropriate (X=3.43) When analysing a breakdown by product group, tools / GSE (X=4.0) as well as office supplies (X=4.0) have been rated as appropriate, followed by the spare parts category (X=3.91), fuel (X=3.70) and catering (X=3.60). Powerplants, maintenance and repair services as well as interiors have been cited as inappropriate to fairly appropriate. Maintenance services do not seem to fit this dynamic pricing model mainly due to long-term agreements. Powerplants are highly expensive and complex and often bound to long-term contracts with engine manufacturers or service providers. Also the market for such engines is very oligopolistic. In comparison, office supplies and tools / GSE are products without a great degree of complexity and are usually procured in rather high volumes. These features all contribute for being considered as highly suitable for procuring those goods via auctions / reverse auctions (see Figure 44).

	Mean	Std deviation
General Expenses	4.00	0.63
Tools / GSE	4.00	0.63
Spare Parts	3.91	0.70
Fuel	3.70	0.67
Catering and Inflight Supplies	3.60	0.97
Powerplants	2.70	1.06
Maintenance & Repair Services	2.70	0.82
Interiors	2.70	0.67
Total	3.43	0.94



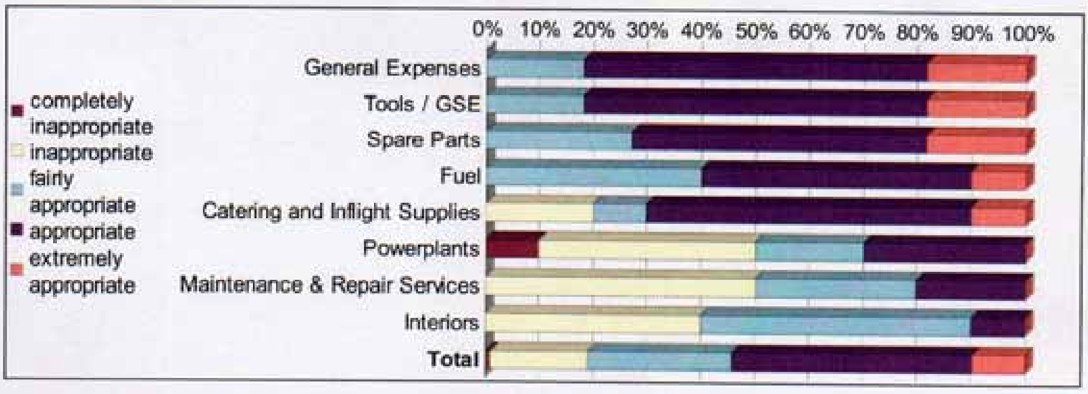


Figure 44: Auctions / Reverse Auctions by Product Groups

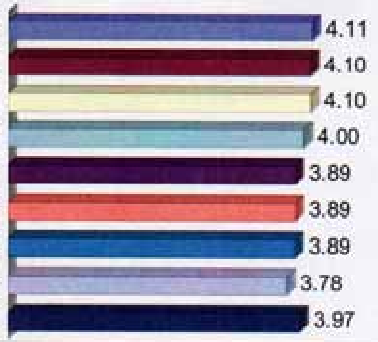
In terms of joint purchasing, e-Marketplaces that are driven in particular by special customer groups, such as buyer-centric, seller-centric or consortia led exchanges have indicated that they all offer joint purchasing, whereas 71% of neutral intermediaries do not (see Figure 45). It may be argued from there that neutral intermediaries apparently focus more on the reduction of processing costs whereas other e-Marketplace types tend to also take the reduction of purchasing prices through higher volumes into account.

	Yes	No	**Total**
Neutral intermediary	**28.6%**	**71.4%**	**100.0%**
Buyer-centric	**100.0%**	**0.0%**	**100.0%**
Seller centric	**100.0%**	**0.0%**	**100.0%**
Industry consortia led exchange	**100.0%**	**0.0%**	**100.0%**
Total	**47.4%**	**52.6%**	**100.0%**

Figure 45: Joint Purchasing by E-Marketplace Type

Joint purchasing was regarded by e-Marketplaces as appropriate to extremely appropriate regarding powerplants (X=4.11). This might be due to the fact that high savings can be achieved when procuring them in higher volumes as this is usually a high cost and low volume product that is very complex and usually bound on certain maintenance contracts. Joint purchasing is also rated as appropriate for the procurement of tools / GSE (X=4.10), office supplies (X=4.10) and spare parts (X=4.0). Maintenance services (X=3.89), catering (X=3.89), interiors (X=3.89) and fuel (X=3.78) are regarded as fairly appropriate to appropriate (see Figure 46).

	Mean	Std deviation
Powerplants	4.11	0.60
Tools / GSE	4.10	0.74
General Expenses	4.10	0.74
Spare Parts	4.00	0.67
Catering and Inflight Supplies	3.89	0.60
Maintenance & Repair Services	3.89	0.60
Interiors	3.89	0.60
Fuel	3.78	0.83
Total	3.97	0.66



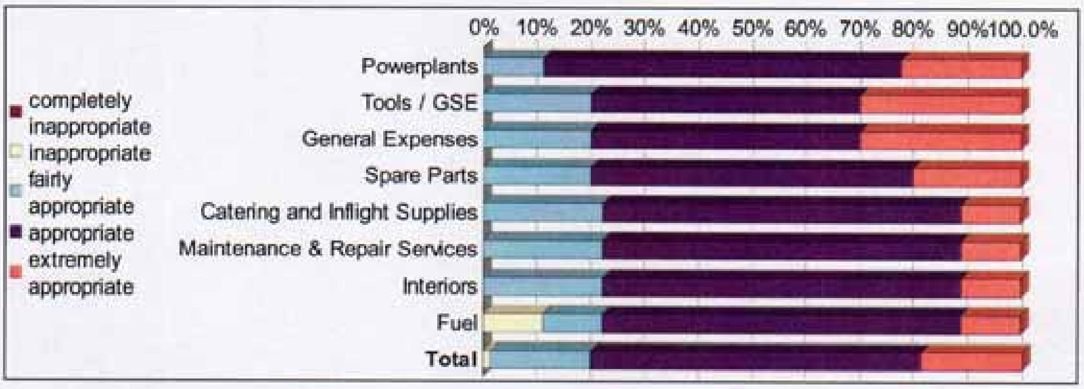


Figure 46: Joint Purchasing by Product Groups

Figure 40 further shows that only 12% of e-Marketplaces offer supplier ratings. Obviously, e-Marketplaces have still significant potential to further develop the integration of advanced sourcing capabilities. This also applies to online discussion possibilities, links to service providers and repair/maintenance status checking (each just offered by 30% of e-Marketplaces). The majority of e-Marketplaces trust on the quality proofs from suppliers, while only 6% would re-examine the quality of listed products.

However, the results also indicate that customer support activities are important to e-Marketplaces with 69% of e-Marketplaces offering a 24 hours help line, 65% providing newsletters and 59% up-to-date information. 49% of portals offer airlines to list their inventories by airport and/or storage locations in order to facilitate parts borrowing or surplus parts selling. 53% offer file attachment capabilities.

Overall, while some services are well integrated within aviation e-Marketplaces, the results demonstrate that there is also still room for improvement. For example, 18% of e-Marketplaces also stated that they have some compatibility difficulties of their e-Marketplace system with ERP and legacy systems of customers (see Figure 124 in appendix B). The next section will cover the impediments to e-Marketplaces in the airline industry in more detail.

6.6. Industry Benefits/Obstacles to E-Marketplace Implementation

4.6.1. Impediments for Suppliers

When asked about potential obstacles for suppliers trying to use or adopt an e-Marketplace, e-Marketplaces indicated the following:

(a) Hesitation to join a neutral platform due to own developments in that field,
(b) Access to reliable delivery service,
(c) Resistance to transparency of information,
(d) Adoption of using the computer and a different system,
(e) Higher transparency leads to a higher degree of exchangeability of the supplier,
(f) The need to keep inventory listings updated and current,
(g) Competition with own websites,
(h) We are an online catalogue without order transaction capability, so suppliers do not use us in the way you questioned,
(i) Lack of knowledge among suppliers,
(j) Too many different standards.

According to these statements, e-Marketplace providers believe that suppliers are partly reluctant to use their services. This is for example due to the fear of losing control over their buyer relationships as e-Marketplaces may offer buyers more favourable and improved supplier sourcing capabilities. Given the supplier assumption that e-Marketplaces host a large number of suppliers, suppliers fear that this could lead to more competition and a higher market transparency. Further obstacles mentioned are associated with the Internet technology itself. E-Marketplaces require the implementation of a new system, where extensive training and education is required for employees.

Also there is a fear of losing track with the continuous need to update product listings, content management and different standards. More that 120 standards that extend XML (Webster, 2000) and more that 200 flavours of XML have been identified. The problem is even worse for dynamic content management (Roberts, 2001). Data to be aggregated (e.g., catalogue data) is typically not in a standard format, either inside a company, or at the suppliers. Hence, aggregation can consume extraordinary amounts of time and resources. Suppliers are often asked to provide data in different formats to distributors and exchanges. The result is considerable frustration and resistance from suppliers. Another mentioned impediment to e-Marketplace implementation from a supplier perspective is the fear of substitution. Suppliers typically have their own online sales websites, which they try to protect from substitution by e-Marketplaces.

6.6.2. Obstacles for Buyers

In turn, when questioning about obstacles for buyers in terms of e-Marketplace implementation, surveyed e-Marketplaces indicated the following:

(a) Hesitation to join a neutral platform/ due to own developments in that field,

(b) Security of delivery,

(c) Change management,

(d) Adoption of using the computer, and a different system, using the computer, and a different system,

(e) Totally different process for the sourcing department, which means the implementation of e-Markets, has to be accompanied by a change management process and a special training in e-Auction design,

(f) Accuracy and currency of information,

(g) Narrow supply and double order entry,

(h) In-house departments/staff think it may eliminate/reduce their job position,

(i) Lack of top management support,

(j) Content management: product integration into electronic catalogue is time-consuming,

(k) Fear of unknown technology,

(l) Lacks of knowledge and training among buyers,

(m) Perception that investments would not warrant savings.

There are clearly a few different patterns that can hinder the use of e-Marketplaces for buyers. There is for example the fear of a lack of security in terms of transactions and accuracy of information. Change management and employee training for new technology is a further obstacle to e-Marketplace implementation. This is accompanied by the fear of employees' job losses. Another issue is whether or not a positive return on investment can be achieved. Some buyers believe that initial and ongoing e-Marketplace costs are too high. In spite of a number of these obstacles, e-Marketplaces also outlined benefits that buyers and supplier can achieve by e-Marketplace adoption.

6.6.3. E-Marketplace Benefits

It was further questioned to which extent airlines can achieve benefits by actively participating in an e-Marketplace (see Figure 47).

	Mean	Std deviation
Reduction of product prices	**4.31**	**0.60**
Time efficiency enhancements	**4.24**	**0.75**
Reduction of search costs	**4.18**	**0.73**
Order processing facilitation	**4.12**	**0.60**
Higher transparency of suppliers	**4.00**	**0.71**
Inventory level reduction	**3.94**	**0.90**
Total	**4.13**	**0.72**

Evaluation of scale modalities: from 1 (Not at all) to 5 (Totally)

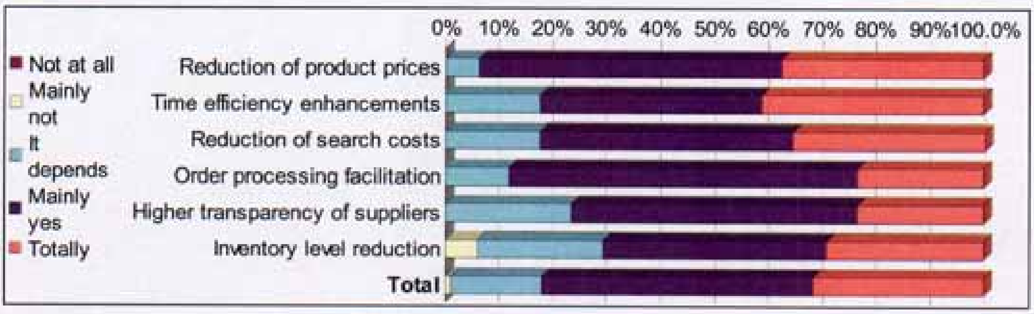


Figure 47: Potential E-Marketplace Benefits for Airlines

The results indicate that more than 80% of e-Marketplaces trust that their airline customers could optimise their order processes (X=4.12) and save time during procurement and sourcing (X=4.24). Over 90% believed that airline customers could achieve reductions in prices (X=4.31). A reduction in search costs (X=4.18) and a higher transparency of suppliers (X=4.0) are frequently cited as further benefits to airlines. Achieving inventory reductions is still perceived to be a benefit from e-Marketplaces use, but has the lowest average among all benefits (X=3.94). Given this background, it was interesting to see which level of cost savings e-Marketplaces would achieve and which kind of fees they would impose.

6.7. Industry Cost Savings Achieved and E-Marketplace Fees

In the survey it was also attempted to explore the gross cost savings that e-Marketplaces would achieve (as a percentage of total procurement costs for airlines). However, these results should also be carefully considered with a certain caution as e-Marketplace providers, due to their very business, may rate their performance indicators in a more positive way.

On average, e-Marketplaces claim that airlines would have achieved gross savings of about 21% of their total procurement costs. Procurement savings can be directly measurable (e.g. price savings and process cost reductions), indirectly measurable (e.g. individual time savings through more efficient processes) and intangibles that are not measurable in financial terms (e.g. cultural change, visibilty of supplier performance, financial approval for spending, etc.) (Eakin, 2003). The high standard deviation (15.98) and Figure 48 reveal that the gross savings achieved are mainly in the region of 10-20%.

less than 10% savings	1	6.3%
from 10% to 20% savings	8	50.0%
from 20% to 30% savings	3	18.8%
from 30% to 40% savings	2	12.5%
40% and more savings	2	12.5%
Total	**16**	**100.0%**

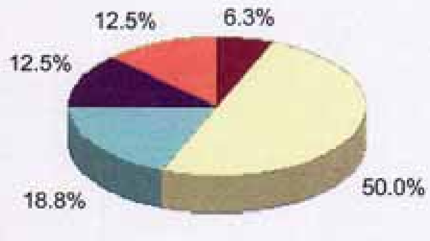


Figure 48: Gross Savings Achieved

E-Marketplaces were also asked if they achieve measurable savings rather in product or processing costs (see following figure).

mainly in product costs	2	12.5%
slightly more in product costs	3	18.8%
about the same	6	37.5%
slightly more in processing costs	2	12.5%
mainly in processing costs	3	18.8%
Total	**16**	**100.0%**

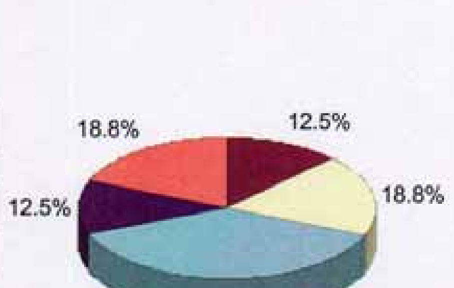


Figure 49: Savings Achieved – Product vs. Processing Costs

The results indicate that the savings are equally achieved in product or processing costs, dependent on the respective e-Marketplace strategy.

When asked about who bears the fees that occur for using the e-Marketplace service, 71% responded that both suppliers and buyers have to share the costs, while 20% charge suppliers only and 13% buyers only.

Supplier	3	20.0%
Buyer	2	13.3%
Both	10	66.7%
Total	**15**	**100.0%**

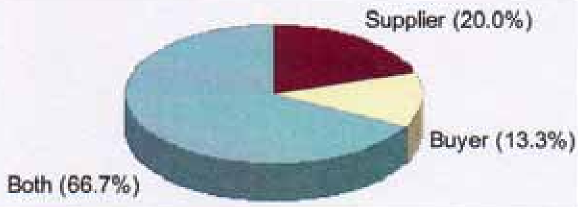


Figure 50: Fee Payment by Party

It has been further asked which types of fees are offered by particular e-Marketplaces, for example a monthly or yearly fee that customers have to pay on a regular subscription basis, a percentage per transaction fee on every transaction made, a uniquely admission fee to use the service, or a listing fee which means that each time a good or service gets listed on the portal, the user has to pay a fee for doing so (see Figure 51).

	Yes	No	Total
Monthly/yearly fee	**80.0%**	**20.0%**	**100.0%**
Percentage per transaction	**40.0%**	**60.0%**	**100.0%**
Uniquely admission fee	**13.3%**	**86.7%**	**100.0%**
Listing fee	**13.3%**	**86.7%**	**100.0%**
Total	**36.7%**	**63.3%**	**100.0%**

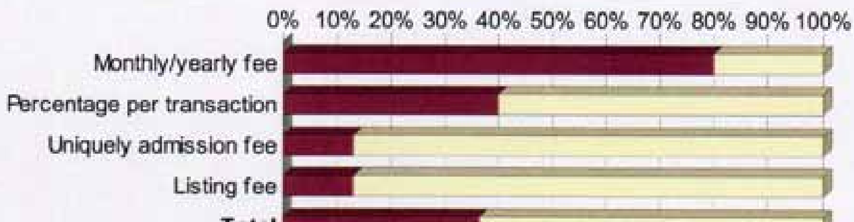


Figure 51: Type of Fees Charged by E-Marketplaces

Many respondents claimed to levy a combination of types of fees. The monthly or yearly fee is the most popular fee and charged by 80% of e-Marketplaces, followed by the percentage per transaction fee (40%). Apparently, transaction fees are less important as they are easily comparable with competitors and other revenue models that are less transparent seem thus more suitable. The monthly or yearly fee model can create incentives to do many transactions as customisation and back-end integration lead to lock-in of participants. However, the up-front fee might be a barrier to entry for participants. Only 13% charge a uniquely admission fee or a listing fee. This finding may be explained in such a way that uniquely admission fees and listing fees can often create problems in terms of exploding costs for goods and services not been sold. That is why more recently, e-Marketplaces have also identified the potential of revenue generation via fees for value-added services and advertising fees (Thong, 2005). Value added service fees may include product forecasting, customer buying patterns, usage profiles, credit and financing activities, insurance, inspections/appraisals/refurbishment, transportation and storage, market information, consulting and other financial services among others.

6.8. Key Findings for the E-Marketplace Survey

The e-Marketplace survey was successful in identifying major drivers and developments in the airline industry. There is a continuous decline and concentration of e-Marketplace providers towards a few operators, which has also been experienced in other industry sectors. A summary table with the characteristics and features of the remaining e-Marketplaces (as by the end of 2005) was therefore developed (see Figure 125 in appendix B).

Current e-Marketplaces show two distinct business models: the concentration towards core competencies on the one hand, as well as the overall approach in trying to address various capabilities on the other. E-Marketplaces that are concentrating on their core competencies are for example offering very specialised transaction services in a particular product field. Such specialised fields may focus on the procurement of ground support equipment, maintenance repair and overhaul, etc. Other types of e-Marketplace portals have evolved aiming to offer rather broad supply chain management services in all product areas. However, the borderline between those two business models becomes increasingly blurred as smaller and specialised exchanges become absorbed into the larger broad portals in forms of alliances or take-overs by the latter. E-Marketplaces can be further categorised as supplier-to-airline or airline-to-airline portals, the latter representing a fairly new concept whereby airlines exchange or trade their excess inventory and/or pool their inventories in order to increase their material demand reaction times in AOG situations.

Overall, the survey evidence demonstrated that all four airline business groupings exhibited take-up of e-Marketplace related procurement activities. However, the difference of these groups becomes apparent when examining the extent of integration of e-Marketplaces. The results show that full-service airlines exhibit the highest level while charter airlines have a rather low usage level. For many decades, charter airlines have sold their tickets exclusively to tour operators. Only recently, they have been adopting new strategic measures such as seat only sales in order to fill their aircraft. Thus, it becomes apparent that their ICT sophistication and readiness might still lack behind traditional airlines that have been employing computer reservation systems long before. Nonetheless, the charter model has for many years constituted as an example of an efficient (non-ICT generated) low-cost operation by maximising load factors with the least amount of costs involved.

It is only in recent years that the competitive environment has changed with the entrance of low-cost airlines that are successfully taking away business from traditional charter airlines on short-haul routes. As a consequence, many traditional charter airlines are now fully integrated tour operator carriers or have focused their strategy towards offering short-haul low-cost services. As integrated tour operator carriers, procurement is often managed by the parent tour company or a third party provider as operators concentrate on their core tourism business.

Given the dependence of the low-cost model on access and use of ICT, it might be expected that this group might exhibit the highest level of integration. In reality, this is not the case. Surprisingly, it is lower than among full-service carriers. The reason might be that low-cost airlines do outsource many non-core activities, such as the maintenance of their aircraft, whereas their full-service counterparts mostly conduct their maintenance works in-house. A similar picture emerges when looking at financial implications regarding e-Marketplace ownership. Large full-service airlines, their alliance partners and their respective key suppliers have been very early active in setting up and being financially involved with e-Marketplaces, while the other airline groupings show a rather moderate to low financial commitment towards e-Marketplaces. Interesting to observe, however, is the fact that even rivalling airlines do co-operate in areas where safety and efficiency is the main concern.

E-Marketplaces offer service variations across the whole spectrum, from generating pure cost reductions through to additional value-added services. Such services can include online negotiation templates, online catalogues and customised dynamic pricing mechanisms. Collaborate sourcing activities can further be undertaken on many of these portals. Tracking of orders, loans/borrows, providing up-to date documentation represent more popular services. Another feature that most e-Marketplaces offer includes bulletin boards where members can post questions and general messages to fellow members. These results coincide with Eng (2004) who researched usage patterns of e-Marketplace customers (see section 9.1.5).

The findings confirm that e-Marketplaces are more popular for transaction-based exchanges than for strategic sourcing type of exchanges (see section 3.5.). When it comes to more sophisticated and distinct services, such as pre-selection of suppliers, inventory allocation by airports and/or storage locations, repair/maintenance status checking, supplier ratings, etc., only a small number of e-Marketplaces currently offer these services. Virtual inventory allocation in particular may prove to be a crucial tool to have as the most traded product groups on e-Marketplaces are surplus, excess and over-run inventory and equipment, whose disposal could be more efficiently handled when the location of the item is posted with the offer in order to save on shipping and handling costs.

By comparing product groups traded on e-Marketplaces, differences exist in view of the pricing mechanisms. While general expenses in terms of office supplies, tools/GSE, spare parts and interiors are handled quite frequently via online catalogues, auctions/reverse auctions and/or RFQs, products such as as powerplants and fuel are less likely to be traded on e-Marketplaces. This is due to the very nature of these products. Powerplants are very often sold under a contract that includes warranties, such as power by the hour. Fuel is usually secured by airlines well in advance by fuel hedging contracts. Nevertheless, e-Marketplace operators see potential for using their portals by combining demands of airlines when powerplants are concerned. In such a case, the portal could act as an initial demand aggregator, whereby individual airlines could post their specifications and demands and then jointly negotiate prices and after-sales / warranty packages. The same may apply to fuel contracts, where different airlines could pool their fuel demands over a certain time period and secure them jointly. Other product groups, such as tools/GSE, general office supplies, spares and repairs have been rated as equally highly suitable for joint procurement. This is due to the fact that savings could be more easily achieved when aggregating demand in these spend categories as these items are quite frequently needed in high volumes.

Joint procurement applications are offered by e-Marketplaces of all types. However, it is not a common tool for neutral e-Marketplaces in comparison to buyer-centric, seller-centric or consortia-led exchanges. This result might be due to the fundamental character of rather detached neutral e-Marketplaces, while consortia-led, seller- and buyer-centric exchanges are built around a certain buyer and/or seller group that focus on specific common goals.

E-Marketplace operators, however, also indicated that the industry is not making full use of their portals as yet. They reported certain obstacles to joining. For instance, suppliers fear to have less control over their long established relationships with buyers due to a higher market transparency. Other obstacles include the fear of losing out on product prices and technological costs involved in implementing an e-Marketplace. The latter is similarly perceived by buyers. Buyers are further reluctant to engage in e-Marketplaces due to perceived obstacles such as accuracy of information and short supply. Both customer groups, buyers and suppliers, fear a lack of security of transactions through online media.

E-Marketplace operators also identified benefits for airlines adopting their services. Reduction of product prices and search costs as well as time efficiency enhancements and order process facilitation were rated on top of the scale. This clearly indicates that e-Marketplace operators are not only focusing on mere product price reductions for their airline customers, but do also perceive process improvement and value-added services that can translate into time and cost savings as highly important. Eng (2004) also notes that the most notable perceived benefit from participating in an e-Marketplace is lower unit cost of procurement. Furthermore, he found that the benefits of strategic supply chain services are centred on communications and efficient exchange processes. Suppliers are given more and more incentives to participate in e-Marketplaces, something reflected in the fee payment schemes of portals. A large number of portals surveyed indicated that fees are levied on both parties, buyers and sellers, by mostly montly/yearly fees or percentages per transactions.

In order to exploit the full potential of e-Marketplaces, barriers remain to be overcome. There is still a wait and see approach among many industry participants. The results of the e-Marketplace survey are considered in depth in conjunction with the airline surveys and the case studies in chapter 9. Hypotheses will be tested and further findings drawn from the airline survey in the following chapter.

VII. RESULTS FROM AIRLINE SURVEY ANALYSIS

7.1. Introduction: Data Collection and Sample Representativeness

The e-Marketplace survey in the previous chapter aimed at seeking broad information on aviation B2B e-Marketplace features and classifications and offering preliminary insights into e-Marketplace adoption drivers from a provider perspective. Due to the low population because of the shakeout and consolidation within the e-Marketplace industry, rigorous hypothesis testing was not the aim for this survey. Therefore, a larger scale survey, aimed at testing postulated hypotheses in chapter 5, has been carried out to seek more explicit information on adoption drivers and performance indicators of B2B e-Marketplaces from an airline (e.g. customer) perspective.

The data collection was carried out in the form of an in-depth questionnaire survey addressing senior procurement and ICT personnel at airlines around the globe. Questions included aspects such as their knowledge and awareness of e-Marketplaces, their attitudes towards those platforms, the determinants for adoption, a number of industry and firm characteristics and performance indicators (see survey instrument in Appendix C). The survey was aimed to carry out extensive hypotheses testing and to build an original contingency framework. The hypothesis were confirmed based on the significance level of $p <= 0.05$.

Survey pre-testing was done by administering the questionnaire to six industry practitioners and academics with experience in this field of research. This provided valuable feedback and qualitative comments on the topic to further refine and improve the survey. The questionnaire was also pilot tested with 20 airlines from the sample of 300 airlines as explained in the following. The feedback from 7 airlines suggested that the questionnaire is sound. Therefore, questionnaires have been sent in successive follow-ups to the remainder of 280 senior purchasing and ICT staff of international passenger airlines of different types and sizes. 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.

After a detailed review process of available airline databases, the author concluded that Flight International (2004) and the Aircraft and Maintenance Engineering Directory

(2004) were the best choice for identifying the world's airline population and respective contact details. Other airline databases such as Jane's World Airlines or OAG Airlines Guide were not employed due to reasons such as high cost and lack of required information.

Flight International (2004) is a single volume reference book consisting of a comprehensive directory of the world's airlines, published annually. It provides a listing of all airlines with passenger aircraft of over 19 seats, plus selected cargo airlines, and further details such as head office addresses, board members, fleet and routes. Contact addresses of the 300 airlines, selected in a stratified random sampling process from Flight International (2004), were further complemented by the Aircraft and Maintenance Engineering Directory (2004), which is also published annually. Contact details that could not be identified via those two databases were sought electronically or by phone by contacting the respecting departments.

The sample of 300 airlines was selected because a larger sample than is needed to achieve the desired results is wasteful of resources and not manageable, whereas very small samples often lead to no practical use in hypotheses testing. A sample frame of 300 airlines was considered as large and robust enough. Furthermore, 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. The subsamples were not proportional to their sizes in the population. This disproportional stratified sampling was carried out to ensure reliable estimates for each stratum and to improve intergroup comparisons. Stratified sampling is a commonly used probability method that is superior to random sampling because it reduces sampling error.

The target frame of 300 airlines was chosen from the database Flight International by using a random number generating software. Each firm in the respective strata was given a number and the software generated 75 random digits between the population size of each stratum. The target sample in each stratum was identified by using the random digits.

88 responses were received representing a response rate of 29.3%. The following distribution occurred in the sample: less than 10 aircraft (18%), from 10 to 20 aircraft (23%), from 21 to 50 aircraft (29%), 51 or more aircraft (30%).

Full service and regional airlines are projected to have a 60% total airline market share in comparison to 15% for charter airlines and 25% for low-cost airlines within the next five years (Schneiderbauer and Fainsilber, 2002). In a similar manner, McKinsey (2002) published a report stating that low-fare airlines have the highest growth rate airline over the coming years. In the sample the following strategy distribution occurred: regional airlines (12%), full service airlines (44%), charter airlines (22%) and low-cost airlines (22%). The sample can, therefore, be considered as broadly representative of the population (see Figure 52).

		Number	Related Percentage
Total Airline Population		1200	
Survey Target Sample		**300**	
Fleet Size of Population	10 aircraft or less		65%
	11-20 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 52: Airline Response Breakdown

An initial very low response rate has been noted after the first mailing and so further mailings had to be conducted subsequently in order to increase the response rate to an adequate level. This was due to several factors: first the questionnaire was very comprehensive and the data sought very detailed so that only very specialised airline employees were able to give full answers to every question. Sheehan (2001) demonstrated in a correlation and regression analysis that the year a survey was undertaken and the number of follow-up contacts had the most influence on response rates among other factors such as the number of questions in the survey, the number of pre-notification contacts and the survey topic salience. Secondly, the nature of the topic suggests that many potential respondents were extremely reluctant to give out information although the cover letter particularly stated strict confidentiality. Nevertheless, giving out information on procurement related enquiries meant outlining sensitive data that not every airline was willing to do due to competitive and benchmarking reasons.

The main mailing of the survey started with sending out a personalised cover letter by e-mail including a link to the survey, which could be filled in online to the respective persons holding senior posts in procurement and logistics. This process was repeated 8 times over a period of 15 months. Sheehan (2001) concluded that e-Mail surveys have demonstrated superiority over postal surveys in terms of response speed and cost efficiency. Furthermore, people also tend to provide longer open-ended responses and an overall better response quality. Simultaneously, the letters including a hard copy of the questionnaire, an envelope including return postage and a link to the online questionnaire were sent out in two postal mailings to the same persons if they had not participated in the survey after 4 months and 10 months respectively. A final further method of encouraging potential respondents was to invite them for conducting survey interviews via phone. About 90% of final responses were received via e-mail / online questionnaire, 5% via postal mail and another 5% via telephone.

Changing modes of data collection may be an effective way for improving response rates (Dillman et al., 2001). Yun and Trumbo (2000) found that using multiple modes for survey delivery generated a high response rate to a randomly selected sample. Also Shettle and Mooney (1999) suggest that changing modes of data collection may be an effective way for improving response rates. Therefore, the Internet, traditional mail and the phone were employed to increase the response rate to a total of 29.3%.

After this long period of gathering data, it was felt that no higher response rate could be achieved as in the later stages of data collection a steady decline in participation was noted. As such, the final response rate of 29.3% can be considered as a good result in comparison to other studies of sensitive nature in the airline industry sector. The response rate is somewhat above the level as of studies related to the adoption of IOS, for example 27.4% (Henriksen, 2003), 25.7% (Chau, 2001), 27% (Masters et al., 1992) or 18.4% (Lai and Guynes, 1997). In a survey aimed on researching the role of e-Marketplaces in supply chain management across various industries, Eng (2004) has achieved a response rate of 21% (sample size: 500 firms). Francis (2005) surveyed airlines in terms of the use of performance measurement techniques by airlines with a response rate of 23% (sample size: 196 airlines). Taking into account the sensitivity of the topic and questions sought via the questionnaire and the response rates of the mentioned studies above, the response rate of 29.3% is considered to be a very good result. With a sample of this size there is a 95% certainty that the results have a statistical precision of plus or minus 10.1% points of what they would be if the entire population had been surveyed with complete accuracy. This sampling error is within expected and reasonable parameters for an exploratory analysis.

The majority of respondents (46%) were purchasing executives, while 6% were general directors and 21% materials and logistics managers (see following figure). 28% have indicated to hold other positions, such as director or manager of purchasing, director of materials, IT manager or head of IT, project manager e-Procurement, supply chain management director or team leader strategic purchasing.

Director General	5	5.7%
Materials & Logistics Manager	18	20.7%
Purchasing Executive	40	46.0%
Others	24	27.6%
Total	**87**	**100.0%**

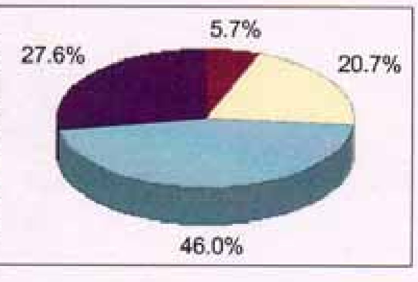


Figure 53: Position of Respondents

A comparison of several variables by return date was also conducted. If early respondents differ in their beliefs from later respondents, and especially if a trend is evident, then the timing of response may signal the presence of a bias between respondents and non-respondents. The early and late respondents have been tested for statistically significant differences and non-response bias with regard to airline size and classification as well as adoption of e-Procurement systems, e-Marketplace portals and Internet services. Results of the t-tests show that there are no significant differences between early and late respondents at the 0.05 level (see Figure 126 in appendix D). Together, these tests suggest that data from the respondents were not significantly different from those of non-respondents.

Table 8 further shows the descriptive statistics of the numeric / scale variables used for hypotheses testing, i.e. the mean, standard deviation, cronbach alpha and results of normality tests (skewness and kurtosis).

	N Stat.	Mean Stat.	Std. Dev.	Cronbach Alpha	Skewness Stat.	Std. Err.	Skewness/Std Err.	Kurtosis Stat.	Std. Err.	Kurtosis/Std Err.	
Pressures Business Context	86	3.32	0.77	0.78	-0.28	0.26	-1.06	-0.81	0.51	-1.57	
Total Number of Employees	85	9134.95	15329.33	Single Variable	2.38	0.26	9.12	6.16	0.52	11.92	High skewness/ kurtosis*
Number of Personnel in Purchasing	81	49.84	62.29	Single Variable	1.62	0.27	6.04	1.61	0.53	3.04	High skewness/ kurtosis*
Total Fleet Size	87	69.56	111.85	Single Variable	4.35	0.26	16.85	25.95	0.51	50.78	High skewness/ kurtosis*
Level of Strategic Partnerships	86	2.90	0.76	Formative	0.20	0.26	0.78	-0.08	0.51	-0.15	
Extent of Resource and Information Sharing	86	2.89	0.89	0.85	-0.28	0.26	-1.08	-0.41	0.51	-0.80	
Joint Procurement Integration	87	2.72	1.04	Formative	-0.17	0.26	-0.65	-1.00	0.51	-1.97	Slight kurtosis*
Extent of Outsourcing	87	2.49	0.86	Formative	-0.13	0.26	-0.50	-0.86	0.51	-1.68	
Procurement Organisation Centralisation	83	3.05	1.51	Formative	-0.19	0.26	-0.73	-1.45	0.52	-2.78	Moderate kurtosis*
Procurement Organisation Decentralisation	80	1.85	1.09	Formative	1.20	0.27	4.47	0.80	0.53	1.50	Moderate skewness*
Decrease in Number of Suppliers	84	3.40	0.88	Formative	-1.01	0.26	-3.84	0.40	0.52	0.78	Moderate skewness*
Level of ICT Sophistication	87	3.14	0.70	0.92	0.17	0.26	0.65	-0.43	0.51	-0.84	
Level of Internet Services Used	88	3.48	0.91	Formative	-0.34	0.26	-1.32	-0.41	0.51	-0.80	
Satisfaction with Procurement Management	88	3.14	0.51	0.87	0.03	0.26	0.14	0.03	0.51	0.06	
Purchase Order Costs	58	68.72	28.37	Single Variable	0.24	0.31	0.76	0.66	0.62	1.06	
E-Marketplace Savings vs. Investment	38	3.71	0.87	Single Variable	-0.17	0.38	-0.45	-0.55	0.75	-0.73	
Overall Airline Performance	85	2.73	1.00	0.87	0.24	0.26	0.93	-1.02	0.52	-1.97	Slight kurtosis*

*** Additional Non-Parametric Hypothesis Test Required**

Table 8: Descriptive Statistics of Numeric / Scale Variables of the Airline Survey Sample Characteristics

As the sample size is rather large (n=88), parametric tests were generally preferably employed due to their statistical power. However, the analysis of the above table reveals that the results of the variables firm size, joint procurement integration, procurement organisation, number of suppliers and overall airline performance do not follow a normal distribution. That is why non-parametric tests were run for these variables in addition to the parametric tests as part of a sensitivity analysis. Non-parametric statistical tests have less restrictive assumptions concerning the distributions of the variables. The following results sections show that both parametric and non-parametric tests correctly and simutaneously show the rejection or non-rejection of the null hypotheses. There are no significant differences in the testing of the hypotheses when both parametric and non-parametric tests were employed. The correlations for each numeric / scale variable are further presented in Table 9.

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1. Pressures Business Context	1																
2. Total Number of Employees	.134	1															
3. Number of Personnel in Purchasing	.064	.788 (**)	1														
4. Total Fleet Size	.067	.728 (**)	.787 (**)	1													
5. Level of Strategic Partnerships	.293 (**)	.101	.266 (*)	.209	1												
6. Extent of Resource and Information Sharing	-.111	-.077	-.006	-.023	.353 (**)	1											
7. Joint Procurement Integration	.093	-.268 (*)	-.254 (*)	-.144	.338 (**)	.437 (**)	1										
8. Extent of Outsourcing	-.186	-.125	-.069	-.013	.110	.103	.022	1									
9. Procurement Organisation Centralisation	.007	-.103	.002	-.107	.052	.395 (**)	.135	.215	1								
10. Procurement Organisation Decentralisation	-.162	.030	.088	.003	.132	-.189	.040	.371 (**)	-.099	1							
11. Decrease in Number of Suppliers	.177	.244 (*)	.214	.221 (*)	.130	-.067	-.073	.139	.071	.005	1						
12. Level of ICT Sophistication	-.120	.129	.219	.229 (*)	.131	.279 (**)	.052	.029	.077	-.148	.087	1					
13. Level of Internet Services Used	-.331 (**)	.059	.055	.103	.150	.274 (*)	.139	.351 (**)	.034	.315 (**)	-.004	.216 (*)	1				
14. Satisfaction with Procurement Management	-.212	.070	.098	.049	-.006	-.055	.093	.026	.001	.142	-.109	.282 (**)	.277 (**)	1			
15. Purchase Order Costs	.185	-.009	-.028	.198	.140	.192	.178	.008	.094	-.376 (**)	.013	.231	-.247	-.173	1		
16. E-Marketplace Savings vs. Investment	.168	.054	.135	.237	.141	.088	.006	.284	-.040	-.006	-.050	.302	.075	.121	.186	1	
17. Overall Airline Performance	-.820 (**)	-.035	.088	.044	-.167	.075	-.199	.053	.120	-.111	-.173	.233 (*)	.168	.186	.091	-.203	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 9: Correlation Matrix of the Airline Survey Sample Characteristics

The results are discussed in the following sections.

7.2. E-Marketplace Adoption and Airline Strategy

Similarly to the e-Marketplace survey, e-Marketplace adoption 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.

Overall, there is a quite high adoption rate of e-Marketplaces among airlines, as 65% report using them for procurement operations. However, the result gives no indication as yet whether or not B2B e-Marketplaces are frequently or rather sporadically used and/or which types of airline make use of them to which extent. This will be elaborated in more detail in the next sections.

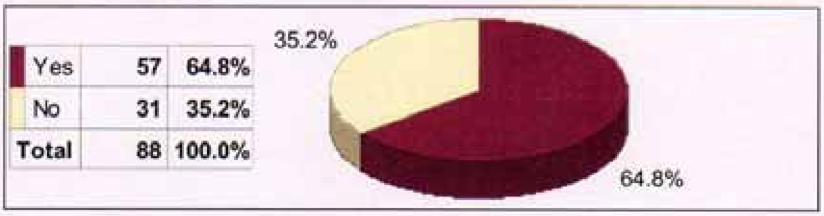


Figure 54: Airline Participation in E-Marketplaces

Out of these 65% of adopters, 40% of airlines use an e-Marketplace and 25% are financially involved.

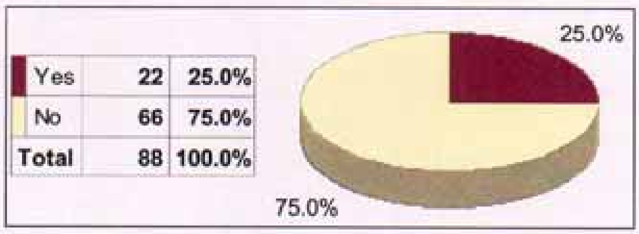


Figure 55: Financial Involvement in E-Marketplaces

Furthermore, airlines that do not participate or are not financially involved in an e-Marketplace have been asked whether or not they have any plans in doing so in the foreseeable future. 64% of non-adopters have indicated that they would consider taking part in such an exchange and only 36% have stated that they would not have any interest in using an e-Marketplace.

Yes	14	63.6%
No	8	36.4%
Total	22	100.0%

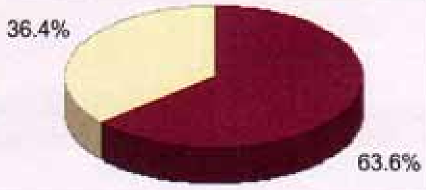


Figure 56: Future Plans of Non-Adopters

The overall importance of e-Marketplaces to an airline's procurement strategy is a further indicator for future take-up. A very significant difference can be observed when comparing the importance of e-Marketplaces among adopters (X= 3.73) and non-adopters (X=2.42) (p=<0.1%; F=46.75). Obviously, airlines that have participated in e-Marketplaces also rate their importance on a higher level (on a scale from 1 = no importance to 5 = very important).

	Importance of e-Marketplaces
Yes	3.73
No	2.42
Total	3.26

p = <0.1% ; F = 46.75 (VS)

Figure 57: Importance of E-Marketplaces among Adopters/Non-Adopters

The majority of airlines have adopted one e-Marketplace (46%) or two e-Marketplaces (47%).

One	25	45.5%
Two	26	47.3%
Three	2	3.6%
More than three	2	3.6%
Total	55	100.0%

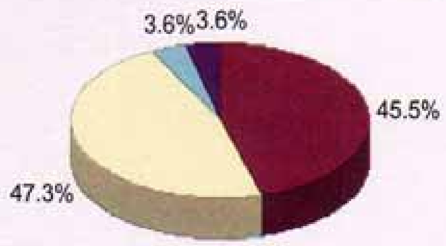


Figure 58: Number of E-Marketplaces Used per Airline

The survey also sought to explore the current implementation rate of e-Procurement applications among airlines.

Yes, currently use e-Procurement system	63	71.6%
Yes, plan to use e-Procurement system	15	17.0%
No, don't use e-Procurement system	10	11.4%
Total	88	100.0%

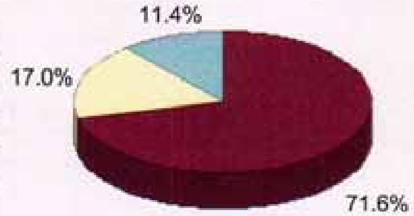


Figure 59: Current Adoption of E-Procurement Systems

The results reveal that 72% of airlines have adopted e-Procurement to date with the majority of these using e-Marketplaces (78%) (see Figure 60). Airlines using an e-Procurement system of any sort are more likely to adopt an e-Marketplace than airlines that do not use any e-Procurement system (p=<0.1%: Chi2= 17.49).

	Yes		No		Total	
	N	%	N	%	N	%
Yes, currently use e-Procurement system	49	77.8%	14	22.2%	63	100.0%
Yes, plan to use e-Procurement system	6	40.0%	9	60.0%	15	100.0%
No, don't use e-Procurement system	2	20.0%	8	80.0%	10	100.0%
Total	57	64.8%	31	35.2%	88	100.0%

p = **<0.1%** ; chi2 = **17.49** ; ddl = **2** (**VS**)

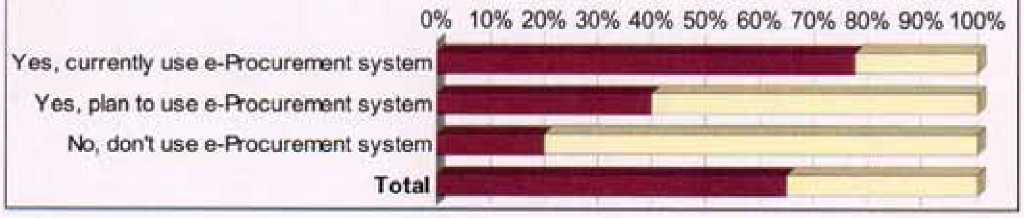


Figure 60: Adoption of E-Procurement System vs. E-Marketplace Use

Airlines are further attributing a high importance to e-Marketplaces (highly significant with p=<0.1%: F=8.09; see Figure 61). This shows the very high relevance of e-Marketplaces for e-Procurement adoption among airlines.

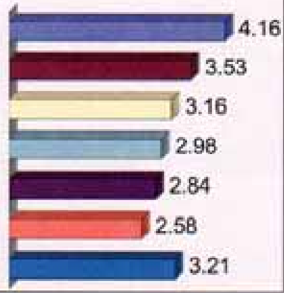
	Importance of e-Marketplaces
Yes, currently use e-Procurement system	3.53
Yes, plan to use e-Procurement system	2.67
No, don't use e-Procurement system	2.50
Total	3.26

p = **<0.1%** ; F = **8.09** (**VS**)

Figure 61: Adoption of E-Procurement System vs. E-Marketplace Importance

Airline and manufacturer driven e-Marketplaces are more important to respondents than parts broker or external player driven e-Marketplaces (see airline preferences in the following figure).

	Mean	Std deviation	Min	Max
Airline driven e-Marketplace	**4.16**	**0.78**	**3.00**	**5.00**
Manufacturer (airframe, spare parts, etc.) driven ...	**3.53**	**1.08**	**1.00**	**5.00**
Neutral e-Marketplace	**3.16**	**1.13**	**1.00**	**5.00**
Consortia driven e-Marketplace	**2.98**	**0.92**	**1.00**	**5.00**
Parts broker driven e-Marketplace	**2.84**	**1.10**	**1.00**	**5.00**
External player driven e-Marketplace	**2.58**	**1.06**	**1.00**	**5.00**
Total	**3.21**	**1.14**	**1.00**	**5.00**



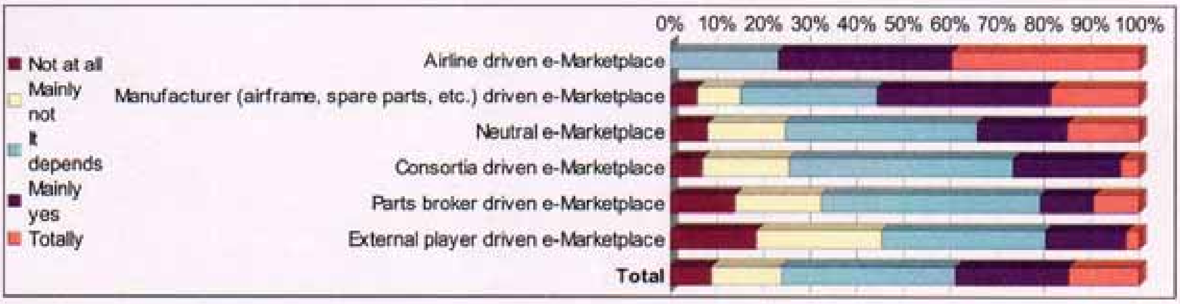
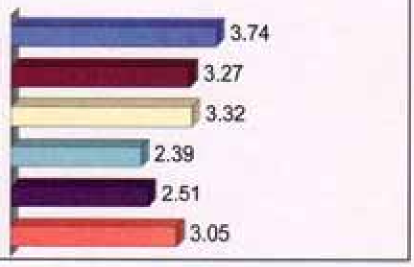


Figure 62: E-Marketplace Preferences

As previously outlined, airlines may be divided into several categories according to their strategic orientation. The following figure illustrates this extent of strategic orientation among airlines (on a scale from 1 = not at all to 5 = totally).

	Mean	Std deviation	Min	Max
Scheduled Regional	**3.74**	**1.66**	**1.00**	**5.00**
Scheduled Intercontinental	**3.27**	**1.80**	**1.00**	**5.00**
Short-haul Charter	**3.32**	**1.45**	**1.00**	**5.00**
Long-Haul Charter	**2.39**	**1.54**	**1.00**	**5.00**
Low-Cost	**2.51**	**1.45**	**1.00**	**5.00**
Total	**3.05**	**1.66**	**1.00**	**5.00**



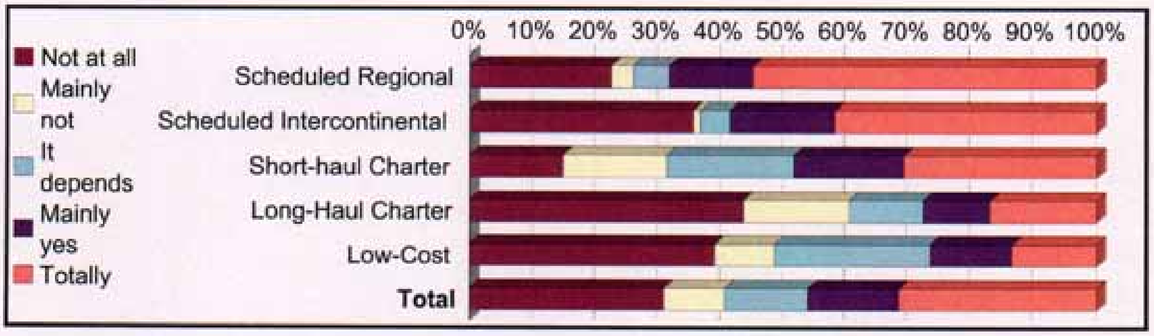


Figure 63: Strategic Airline Focus

Airlines have been further asked to specify in which of the following categories they would classify themselves, i.e. which is their distinctive main strategy. As mentioned before the following distribution occurred: Full service airlines (44.2%), charter airlines (22.1%), low-fare airlines (22.1) and regional airlines (11.6%). Airline strategy is also further used as a control variable for all significant hypotheses to see if differences between airline groupings occur.

These identified airline groups use B2B e-Marketplaces to various extents. 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 26% (highly significant with p=<0.1%; chi2=19.73). H1b - the use of e-Marketplaces is highly dependent on an airline's strategic classification – is confirmed (see Figure 64). A similar finding is also achieved when the airline strategy is cross-tabulated with the current implementation of e-Procurement systems (see Figure 127 in appendix D).

	Yes		No		Total	
	N	%	N	%	N	%
Regional	5	50.0%	5	50.0%	10	100.0%
Full Service	31	81.6%	7	18.4%	38	100.0%
Charter	5	26.3%	14	73.7%	19	100.0%
Low Fares	15	78.9%	4	21.1%	19	100.0%
Total	56	65.1%	30	34.9%	86	100.0%

p = **<0.1%** ; chi2 = **19.73** ; ddl = **3** (**VS**)

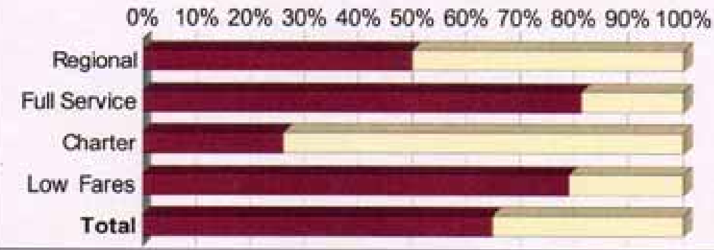


Figure 64: Airline Classification and Use of E-Marketplaces

The analysis by the inclusion of the control variable airline size (in terms of number of employees) confirms that there is a similar pattern in e-Marketplace use for each airline strategy group, independent of size (Figure 128 in appendix D).

While 25% of survey respondents are financially involved in an e-Marketplace, scheduled full service airlines show the highest involvement with 37%, followed by low-cost airlines with 26% and regional airlines with 20% (Figure 65). Low-cost airlines show a lower financial involvement in terms of ownership, but high adoption rates. This might be due to the background that low-cost airlines avoid all unnecessary risks, try to be as flexible as possible and tend to outsource anything but their core business activities. Charter airlines show the least interest in using an e-Marketplace.

	Yes		No		Total	
	N	%	N	%	N	%
Regional	2	20.0%	8	80.0%	10	100.0%
Full Service	14	36.8%	24	63.2%	38	100.0%
Charter	1	5.3%	18	94.7%	19	100.0%
Low Fares	5	26.3%	14	73.7%	19	100.0%
Total	22	25.6%	64	74.4%	86	100.0%

p = **7.8%** ; chi2 = **6.82** ; ddl = **3 (LS)**

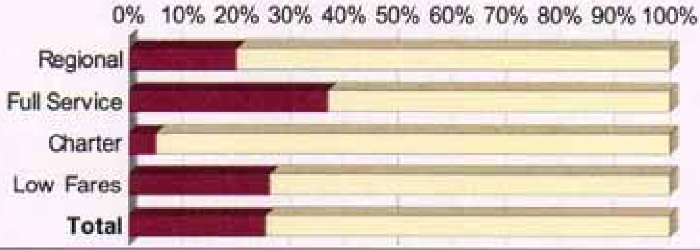
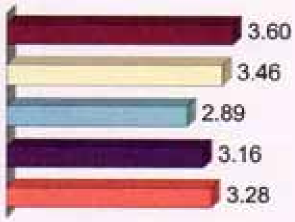


Figure 65: Financial Involvement by Airline Strategy

The overall importance of e-Marketplaces to an airline's procurement strategy is a further indicator for future take-up. As the level of adoption rate of B2B e-Marketplaces gives no indication on the usage rates and patterns of various airlines, the importance of e-Marketplaces in procurement operations may give a better indication which role such means play and how extensive they are used. On a scale from 1 (not at all) to 5 (totally) airlines identified whether or not procurement via e-Marketplaces plays a major role in their day-to-day business operations.

	Importance of e-Marketplaces
Regional	3.60
Full Service	3.46
Charter	2.89
Low Fares	3.16
Total	3.28



p = **19.5%** ; F = **1.60 (NS)**

Figure 66: Importance of E-Marketplaces

E-Marketplaces are more important to regional airlines (X=3.60) and full service airlines (X=3.46) than to low-fare airlines (X=3.16) and charter airlines (X=2.89).

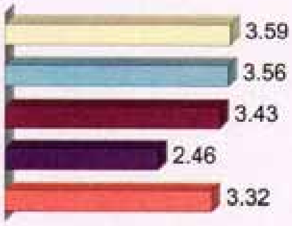
7.3. Competitive Pressures and E-Marketplace Adoption

The survey data also reveals that regional, scheduled and charter airline groups experience strong competitive pressures (see mean values in Figure 67 on a scale from 1 = no pressure at all to 5 = very high competitive pressure).

	Regional	Full Service	Charter	Low Fares	Total
Competitive pressures to reduce costs	4.90	4.82	4.74	4.37	4.71
Decline in passenger numbers	2.70	3.05	3.21	1.63	2.73
Decline in profits	3.40	3.39	3.63	2.00	3.14
Concentration in supplier markets	2.80	3.58	3.00	2.79	3.19
Decline in turnover	3.30	3.47	3.42	1.89	3.09
Decline of passenger load factor	3.50	3.24	3.37	2.05	3.03

Strategy / Competitive pressures to reduce costs p = **0.6%** ; F = **4.41** (**VS**)
Strategy / Decline in passenger numbers p = **<0.1%** ; F = **10.23** (**VS**)
Strategy / Decline in profits p = **<0.1%** ; F = **12.33** (**VS**)
Strategy / Concentration in supplier markets p = **<0.1%** ; F = **7.16** (**VS**)
Strategy / Decline in turnover p = **<0.1%** ; F = **13.03** (**VS**)
Strategy / Decline of passenger load factor p = **<0.1%** ; F = **9.34** (**VS**)

	Pressures from business context
Full Service	3.59
Charter	3.56
Regional	3.43
Low Fares	2.46
Total	3.32



p = **<0.1%** ; F = **15.71** (**VS**)

Figure 67: Pressures from Business Context and Airline Strategy

Interestingly, low-cost airlines tend to report lower overall competitive pressures (X=2.46) from the business context (p=<0.1%, F=15.71). They report significantly lower pressures to reduce costs (X=4.37) than their regional, full service and charter counterparts (p=0.6%, F= 4.41). The same applies with regard to decline in passenger numbers (p=<0.1%, F= 10.23) and overall profits (p=<0.1%, F= 12.33), turnover (p=<0.1%, F= 13.03) as well as load factor (p=<0.1%, F= 9.34) where low cost airlines are differing from the overall mean to a threshold of 95% by exhibiting an overall lower mean value. On the other spectrum, regional airlines differ highly from the overall mean in terms of load factor (X=3.50), full service airlines differ in terms of supplier market concentration (X=3.58) and charter airlines differ with regard to a decline in profits (X=3.63). These results might be attributable to e.g. the continued rise in the number of new-entrant low-cost airlines, the after-effects of overcapacities in the 1990s or additional costs incurred due to increased terrorist threats.

It has further been investigated whether or not increased competitive pressures are related to e-Marketplace adoption (see Figure 68). However, results reveal that there is not a significant relationship (p=85.1%, F=0.02). H1a - e-Marketplace adoption of airlines is highly dependent on external competitive pressures - could not be confirmed.

	Pressures from business context
No	**3.33**
Yes	**3.31**
Total	**3.32**

p = **85.1%** ; F = **0.02 (NS)**

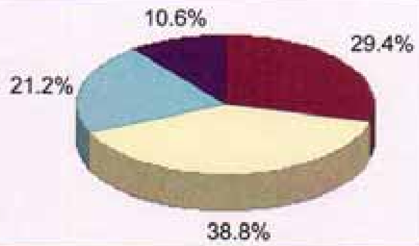
Figure 68: Competitive Pressures vs. E-Marketplace Adoption

This finding is in contrast to Gatignon and Robertson (1989) who report support for their hypothesis that higher levels of competition stimulate innovation adoption. It suggests that the decision to implement an e-Marketplace might not be 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.

7.4. Airline Size and E-Marketplace Adoption

A further distinctive categorisation of airlines can be undertaken by company size measured by the number of employees and fleet size. Of the surveyed airlines, 39% employ 800-5000 employees, followed by 29% employing under 800 employees. 21% of survey participants indicated to have 5,001 to 30,000 employees and 11% more than 30,000 employees.

Less than 800 employees	**25**	**29.4%**
From 800 to 5000 employees	**33**	**38.8%**
From 5001 to 30000 employees	**18**	**21.2%**
More than 30000 employees	**9**	**10.6%**
Total	**85**	**100.0%**



Mean: 9134.95, Std deviation: 15329.33, Median: 2200.00, Min: 60.00 Max: 80000.00

Figure 69: Number of Employees

The number of employees is used as a control variable for firm size (i.e. divided into small airlines (less than 1500 employees) and large airlines (1500 and more employees), as this distribution is close to the median) for the further testing of significant hypotheses.

When split into the identified airline categories, one can identify that regional airlines have a significantly lower employee base (p=0.045; F=2.8) than the other airline groups. Full service airlines employ the highest number of employees with an average of 14,165, followed by low-fare airlines with 7,732 and charter airlines with 5,296.

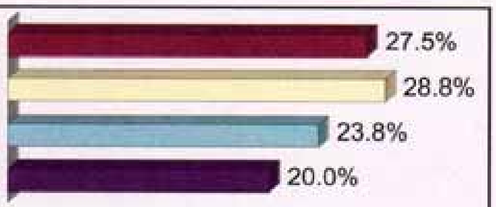
	Total number of employees
Regional	**1 083.90**
Full Service	**14 165.14**
Charter	**5 296.11**
Low Fares	**7 732.89**
Total	**9 270.73**

p = **4.5%** ; F = **2.79 (S)**

Figure 70: Employees by Airline Strategy

Furthermore the total number of employees that are involved in procurement at surveyed airlines has been explored. Typically airlines employ 10 to 30 people in purchasing (29%) or less than 10 employees (28%), followed by the groups from 31 to 100 employees in purchasing (24%) and more than 100 employees (20%).

Less than 10	**22**	**27.5%**
From 10 to 30	**23**	**28.8%**
From 31 to 100	**19**	**23.8%**
More than 100	**16**	**20.0%**
Total	**80**	**100.0%**



Mean: 49.8, Std deviation: 62.3, Median: 21.0, Min: 2.0 Max: 230

Figure 71: Number of Employees Employed in Purchasing

The number of employees in purchasing can be broken down by airline category. A very significant difference in terms of number of employees in purchasing by airline strategy can be identified (p=0.001; F=7.8). Regional and charter airlines have on average 14 employees in procurement which represents a mean that is significantly lower than the theoretical value while full service airlines employ 83 people which represents a mean that is significantly higher than the theoretical value, followed by low-fare airlines with 50 employees on average.

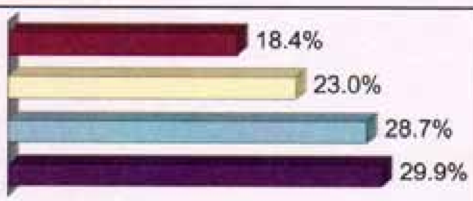
	Employees involved in purchasing
Regional	**14.30**
Full Service	**83.03**
Charter	**14.05**
Low Fares	**49.82**
Total	**50.59**

p = **<0.1%** ; F = **7.78** (**VS**)

Figure 72: Average Number of Employees by Airline Type

Airline size can be further measured by the number of aircraft in fleet. Most of survey participants own or operate 50 and more aircraft in total (30%). This is followed by 20 to 49 aircraft (29%) as well as from 10 to 19 aircraft (23%). 18% of airlines operate less than 10 aircraft.

Less than 10 aircraft	**16**	**18.4%**
From 10 to 19 aircraft	**20**	**23.0%**
From 20 to 49 aircraft	**25**	**28.7%**
50 and more aircraft	**26**	**29.9%**
Total	**87**	**100.0%**



Mean: 69.6, Std deviation: 111.8, Median: 35.0, Min: 3.0 Max: 838.0

Figure 73: Fleet Size of Airlines

Fleet size can be further cross-tabulated with the distinctive airline categories. Regional airlines (30 aircraft on average) and charter airlines (18 aircraft on average) operate a significantly lower number of aircraft (p=0.022; F=3.4) than the mean value (X=70). Full service airlines operate 108 aircraft on average and low-fare airlines 71 aircraft on average.

	Total fleet
Regional	**29.50**
Full Service	**107.51**
Charter	**18.21**
Low Fares	**71.21**
Total	**70.26**

p = **2.2%** ; F = **3.38** (**S**)

Figure 74: Fleet Size by Airline Type

Not only strategic approaches of airlines may impact e-Marketplace adoption, but also the overall size of an airline. As identified above, three attributes have been identified to measure size: number of employees, number of employees involved in procurement and fleet size (all very significantly correlated to each other as not surprisingly identified in Table 9).

	Yes	No	Total
Total number of employees	**12 879.84**	**2 269.33**	**9 134.95**
Employees involved in purchasing	**68.47**	**18.17**	**49.84**
Total fleet	**92.63**	**27.90**	**69.56**

e-Marketplace participation / Total number of employees p = **0.2%** ; F = **10.33 (VS)**
e-Marketplace participation / Employees involved in purchasing p = **<0.1%** ; F = **14.38 (VS)**
e-Marketplace participation / Total fleet p = **0.9%** ; F = **7.16 (VS)**

Figure 75: E-Marketplace Participation by Size of Airline (Parametric Test)

It is statistically highly significant that the use of e-Marketplaces 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). In all three cases (total number of employees, employees in purchasing, total fleet) the mean value of non-adopters is significantly lower than the overall mean value. As the three firm size variables do not follow a normal distribution as identified in Table 8 in section 7.2., a non-parametric Mann-Whitney test was additionally run (see following table).

Ranks

	Do you participate or partly own an e-Marketplace?	N	Mean Rank	Sum of Ranks
How many employees are working in your company world-wide?	Yes	55	49.63	2729.50
	No	30	30.85	925.50
	Total	85		
How many of them are involved in Purchasing?	Yes	51	48.05	2450.50
	No	30	29.02	870.50
	Total	81		
Total fleet	Yes	56	50.39	2822.00
	No	31	32.45	1006.00
	Total	87		

Test Statistics(a)

	How many employees are working in your company world-wide?	How many of them are involved in Purchasing?	Total fleet
Mann-Whitney U	460.500	405.500	510.000
Wilcoxon W	925.500	870.500	1006.000
Z	-3.353	-3.519	-3.174
Asymp. Sig. (2-tailed)	.001	.000	.002

a Grouping Variable: Do you participate or partly own an e-Marketplace?

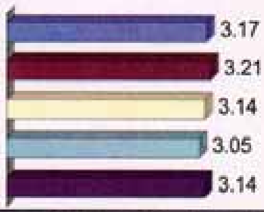
Table 10: E-Marketplace Participation by Size of Airline (Non-Parametric Test)

Again, the non-parametric test confirms the previous findings: It is statistically highly significant that the use of e-Marketplaces increases with the total number of an airline's employees (p=0.1%), the number of employees in purchasing (p=<0.1%) and the fleet size (p=<0.2). H1c - the use of B2B e-Marketplaces is highly dependent on firm and fleet size – is confirmed. The findings support Lehmann (1985) that the size of a firm can influence its level of innovation. Palvia and Chervany (1995) argue that larger firms are more willing and capable of taking the risk of adopting new technologies. Hadaya (2004) also support that a firm's size is positively related to its level of use of B2B e-Marketplaces.

7.5. Technological Context

The level of ICT sophistication of airlines was measured by a four-item construct (on a scale from 1 = not at all to 5 = totally): the level to which a company uses the full potential of ICT, the level to which ICT enables a company to share information with partners and/or suppliers and the level to which a company is has interlinked its supply chain with ICT systems.

	Mean	Std deviation	Min	Max
Use full ICT potential for procurement	3.17	0.81	2.00	5.00
ICT enables partner information sharing	3.21	0.78	2.00	5.00
ICT enables supplier information sharing	3.14	0.72	2.00	5.00
ICT fully interlinked with supply chain	3.05	0.78	2.00	5.00
Total	3.14	0.77	2.00	5.00



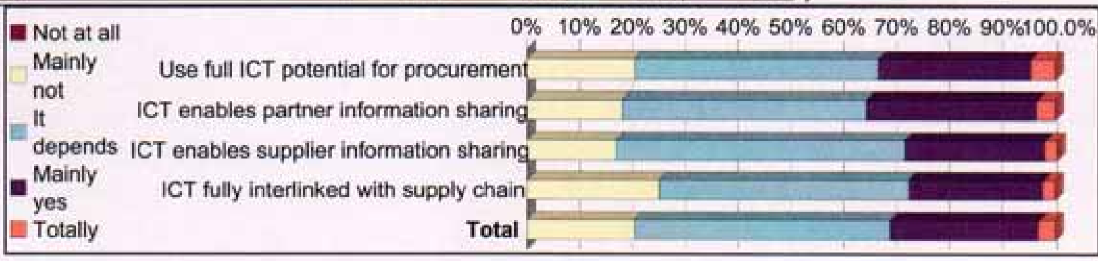


Figure 76: ICT Sophistication of Airlines

Figure 77 reveals a statistically significant relationship between an airline's overall ICT sophistication and e-Marketplace implementation (p=3.5%; F=4.51; further details can be assessed in Table 21 in appendix D). H2a - E-Marketplace implementation is highly dependent on an airline's overall ICT sophistication – is confirmed.

	Level of ICT Sophistication
Yes	3.25
No	2.92
Total	3.14

p = **3.5%** ; F = **4.51** **(S)**

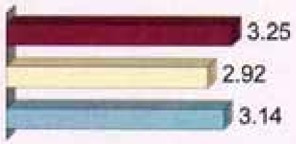


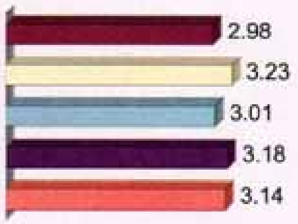
Figure 77: Level of ICT Sophistication vs. E-Marketplace Adoption

A difference between companies employing under and over 1500 employees could be identified. While there was a significant relationship between the implementation of an e-Marketplace and overall ICT sophistication for larger airlines (p=2.8%; F=5.02), this relationship could not be confirmed for small airlines (p=90.1%; F=<0.01; further details can be assessed in Figure 129 in appendix D).

Surprisingly, there was no significant positive correlation between overall airline size and ICT sophistication (p=16.7%, R=0.26, F=0.50), as shown as in Figure 130 in appendix D, with the exception of number of personnel in purchasing. ICT sophistication is however positively related to the overall extent of resource and information sharing, as one would expect (see Table 9).

The results indicate that no airline has rated its ICT sophistication as very poor, while most airlines acknowledge that their ICT sophistication is on a medium level on average. There is no significant difference when comparing the various airline types regards their level of ICT sophistication. Full service airlines have a mean level of X=3.23, followed by low-fare airlines with a mean level of X= 3.18, charter airlines with a mean level of X=3.01 and regional airlines with a mean level of X=2.98.

	Level of ICT Sophistication
Regional	**2.98**
Full Service	**3.23**
Charter	**3.01**
Low Fares	**3.18**
Total	**3.14**



p = **62.8%** ; F = **0.59** **(NS)**

Figure 78: Level of ICT Sophistication vs. Airline Types

In terms of the control variable airline strategy, there are similar patterns for the majority of airlines (with the exception of regional airlines) that there is a positive relationship between e-Marketplace use and level of ICT sophistication (see Figure 131 in appendix D).

The ICT sophistication of an airline can also be determined by the extent of EDI use (on a scale from 1 = never to 5 = very often). A very significant difference could be observed among the four airline groups (p=<0.1%; F=16.77). Full service airlines (X=4.13) have stated to use EDI to a significantly higher extent in procurement in comparison to the overall mean value (X=3.49). Charter (X=2.53) and regional airlines (X=2.20) exhibit a significantly lower use of EDI in procurement in comparion to the overall mean. Low-fare airlines indicated a usage level (X=3.84) closer to the mean. The reason why especially regional airlines show low adoption rates of EDI, but at the same time high adoption rates of e-Marketplaces may be because investment costs for implementing e-Marketplaces are considered to be relatively lower than for EDI.

	Use of EDI
Regional	**2.20**
Full Service	**4.13**
Charter	**2.53**
Low Fares	**3.84**
Total	**3.49**

p = **<0.1%** ; F = **16.77 (VS)**

Figure 79: Use of EDI by Airline Type

Furthermore, there is a highly significant difference between adopters and non-adopters of e-Marketplaces (p=<0.1%; F=27.02). Airlines that have adopted e-Marketplaces have a significantly higher level of EDI use (X=2.91) than non-adopters (X=2.61).

	Use of EDI
Yes	**3.91**
No	**2.61**
Total	**3.45**

p = **<0.1%** ; F = **27.02 (VS)**

Figure 80: E-Marketplace Adoption and EDI Usage

Airlines were also asked how often they take advantage of other Internet services in procurement activities (on a scale from 1 = never to 5 = very often).

	Mean	Std deviation	Min	Max
Search for new suppliers	**3.40**	**0.93**	**1.00**	**5.00**
Get more detailed supplier information	**3.63**	**0.99**	**1.00**	**5.00**
Request for quotations	**3.41**	**1.18**	**1.00**	**5.00**
Total	**3.48**	**1.04**	**1.00**	**5.00**

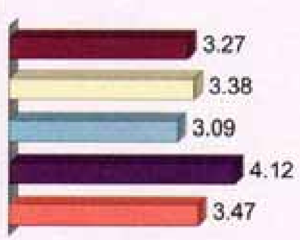
Figure 81: Use of Internet Services in Procurement

Airlines regularly use the Internet on average to search for new suppliers, to get more detailed supplier information and to request quotations. Low-fare airlines in particular take advantage of these services (X=4.12) to a significantly higher extent (p=0.2%, F=5.31) in comparison to their regional, full service and charter counterparts (see Figure 82). Moreover, low fares airlines exhibit overall significantly higher mean values for supplier search (X=3.89), supplier information (X=4.26) and request for quotations (X=4.21), whereas charter airlines show a significantly lower mean value for request for quotations (X=2.84). Not surprisingly, there is a strong significant correlation between the level of Internet services used and the overall ICT sophistication of airlines (p=4.4%, r=+0.22, see details in Figure 132 in appendix D). The more Internet services are used, the higher is also the extent of resource and information sharing, the extent of outsourcing and the decentralisation of the procurement organisation (see significant relationships in correlation matrix in Table 9).

	Search for new suppliers	Get more detailed supplier information	Request for quotations
Regional	**3.40**	**3.30**	**3.10**
Full Service	**3.29**	**3.45**	**3.39**
Charter	**3.05**	**3.37**	**2.84**
Low Fares	**3.89**	**4.26**	**4.21**
Total	**3.38**	**3.59**	**3.42**

Strategy / Search for new suppliers p = **3.4%** ; F = **3.01** (**S**)
Strategy / Get more detailed supplier information p = **0.7%** ; F = **4.38** (**VS**)
Strategy / Request for quotations p = **0.3%** ; F = **5.18** (**VS**)

	Level of Internet services used
Regional	**3.27**
Full Service	**3.38**
Charter	**3.09**
Low Fares	**4.12**
Total	**3.47**



p = **0.2%** ; F = **5.31** (**VS**)

Figure 82: Internet Services Used vs. Airline Type

Figure 83 reveals that there was also a significant dependence between the number of Internet services used and the adoption of e-Marketplaces (p=0.3%; F=9.75). H2b - the adoption of e-Marketplaces among airlines is highly dependent on the overall number of Internet services – is confirmed.

	Yes	No	Total
Search for new suppliers	**3.54**	**3.13**	**3.40**
Get more detailed supplier information	**3.79**	**3.32**	**3.63**
Request for quotations	**3.74**	**2.81**	**3.41**

e-Marketplace participation / Search for new suppliers p = **4.2%** ; F = **4.15** (**S**)
e-Marketplace participation / Get more detailed supplier information p = **3.1%** ; F = **4.69** (**S**)
e-Marketplace participation / Request for quotations p = **<0.1%** ; F = **14.39** (**VS**)

	Level of Internet services used
Yes	**3.69**
No	**3.09**
Total	**3.48**

p = **0.3%** ; F = **9.75** (**VS**)

Figure 83: Internet Services Used and E-Marketplace Adoption

In terms of the control variable airline strategy, there is a significant relationship between the use of e-Marketplaces and the level of Internet services used for all airlines groupings, with the exception of full service carriers which already have a high level of ICT sophististication and therefore use more services (see Figure 133 in appendix D). While for airlines with less than 1500 employees the relationship between e-Marketplace use and level of Internet services used is significant (p=2.8%; F=5.18), airlines with over 1500 employees show a simlar but not yet significant tendency (p=25.2%; F=1.34; see Figure 134 in appendix D).

Overall, the results confirm that ICT technology competence is 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.

Therefore, airlines were also asked which e-Marketplace services they actually use and how important these services are (see Figure 84). Further details are also listed in Table 22 and Table 23 in appendix D.

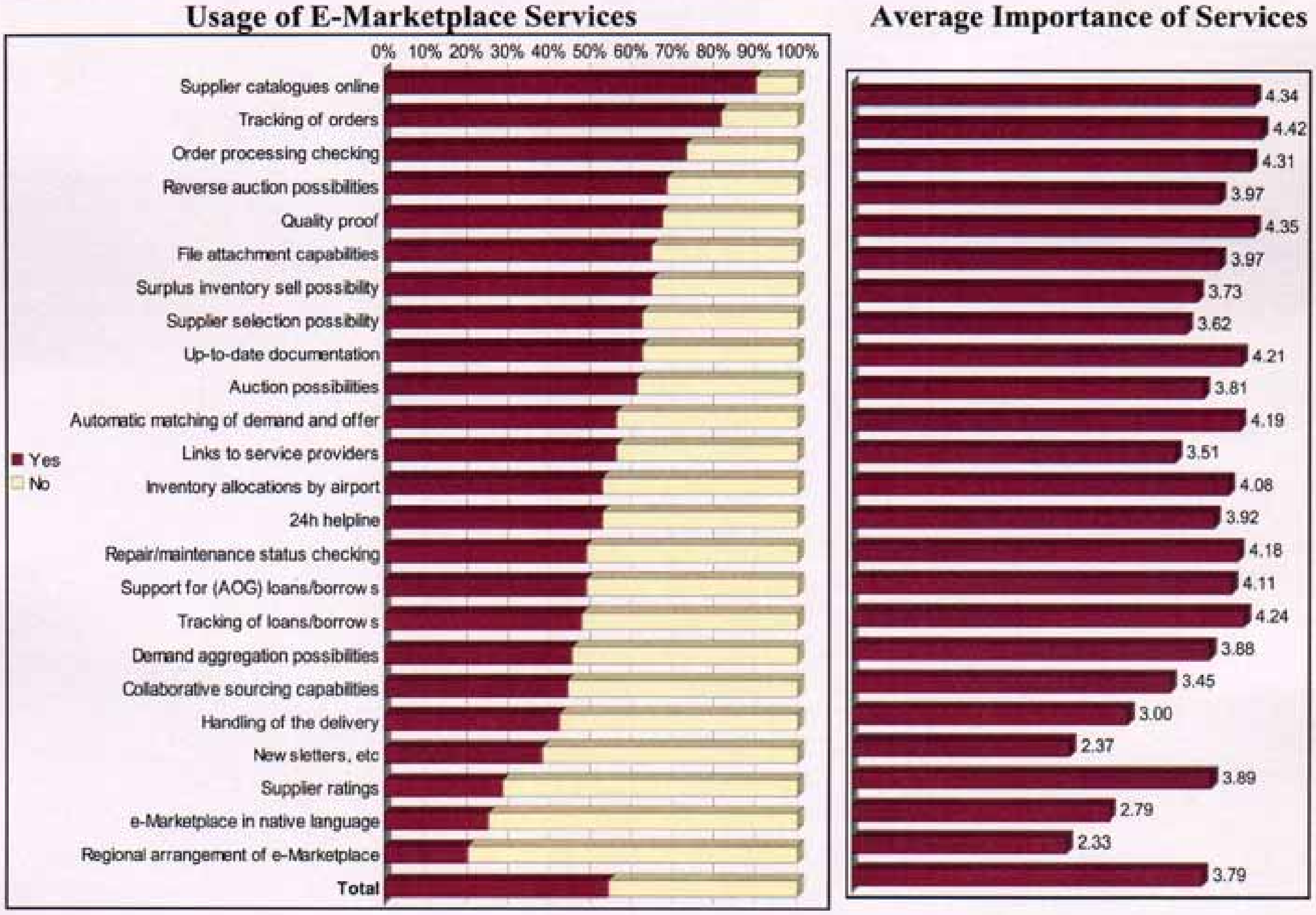
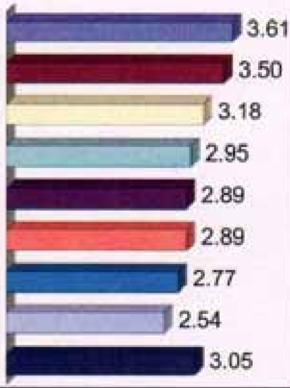


Figure 84: Usage and Importance of E-Marketplace Services

The results confirm the findings from the e-Marketplace survey whereby airlines focus predominantly on transaction support (90% use supplier catalogues online, 82% track orders on e-Marketplaces and 76% take advantage of order process checking). These services were also prioritised in terms of importance to airlines. The results are also very similar to the e-Marketplace survey whereby fixed price catalogues were perceived by airlines as appropriate in the category of general purchases (X=3.61), spares and repairs (X=3.50) and tools / GSE (X=3.18) (see Figure 85).

	Mean	Std deviation	Min	Max
General purchases	3.61	0.76	2.00	5.00
Spares and Repairs	3.50	1.14	1.00	5.00
Tools / GSE	3.18	1.17	1.00	5.00
Interiors	2.95	1.11	1.00	5.00
Pow erplants	2.89	1.28	1.00	5.00
Maintenance	2.89	1.33	1.00	5.00
Catering	2.77	1.31	1.00	5.00
Fuel	2.54	1.38	1.00	5.00
Total	3.05	1.24	1.00	5.00



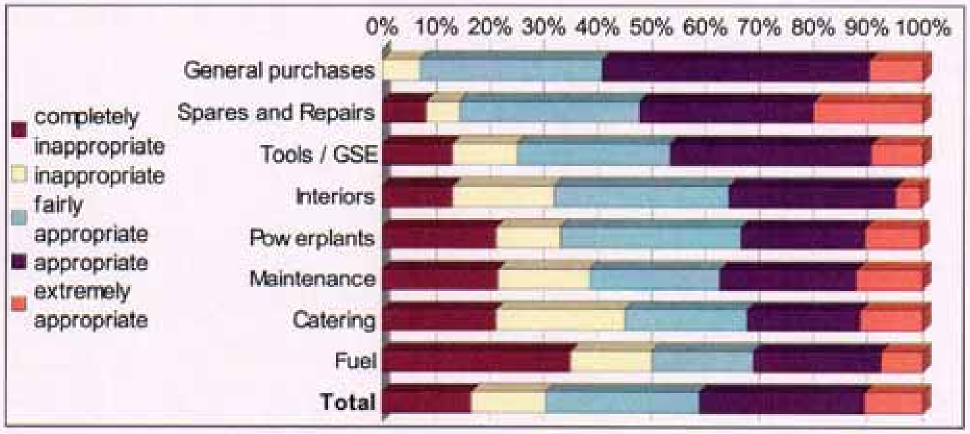
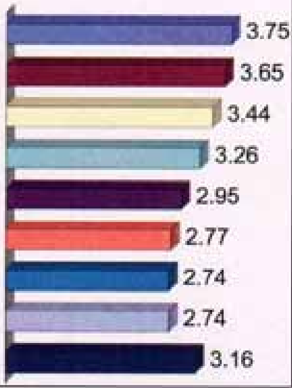


Figure 85: Appropriateness of Fixed Price Catalogue by Product Groups

Sourcing services are less used with 69% of airlines employing reverse auctions and 61% taking advantage of other auctions. They were again mainly perceived as feasible for general purchases (X=3.75), spares and repairs (X=3.65) and tools / GSE (X=3.44).

	Mean	Std deviation	Min	Max
General purchases	3.75	0.78	2.00	5.00
Spares and Repairs	3.65	0.99	2.00	5.00
Tools / GSE	3.44	1.00	1.00	5.00
Catering	3.26	1.16	1.00	5.00
Interiors	2.95	0.86	1.00	4.00
Fuel	2.77	1.21	1.00	5.00
Pow erplants	2.74	0.84	1.00	4.00
Maintenance	2.74	1.19	1.00	5.00
Total	3.16	1.08	1.00	5.00



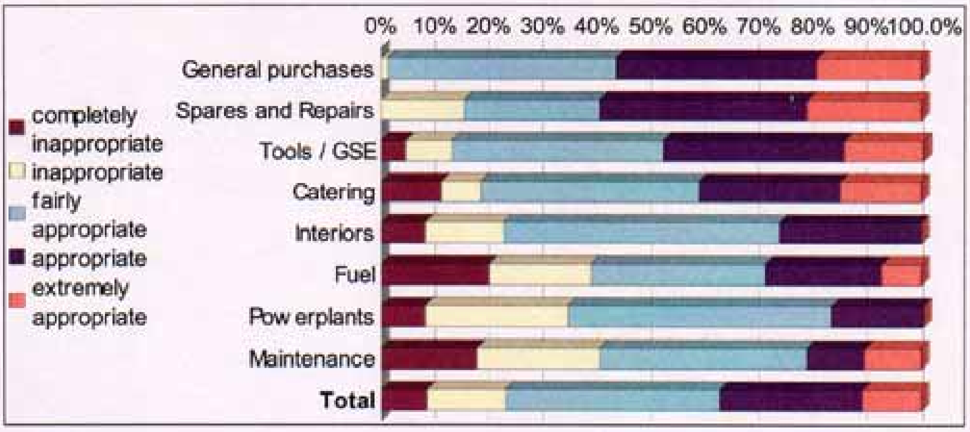


Figure 86: Appropriateness of Auctions/Reverse Auctions by Product Groups

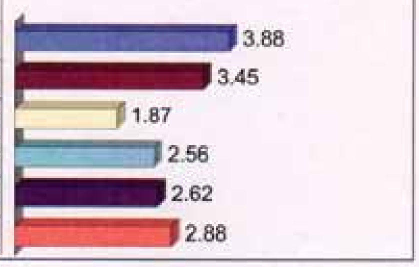
Other strategic procurement services such as demand aggregation possibilities (46%) and collaborative sourcing capabilities (45%) are adopted on a lower level, although their importance is rated quite high. This also applies to supplier ratings (29%). These findings suggest that some e-Marketplaces do not yet provide all services required by airlines. Lenz, Zimmermann and Heitmann (2002) further argue that 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.

7.6. Strategic Partnerships and Joint Procurement

7.6.1. Level of Partnerships and Use of e-Marketplaces

Airlines frequently form partnerships in the form of strategic alliances and/or code-sharing arrangements. Moreover, shares in other airlines and/or airline holdings are more recent forms of co-operation. Therefore, it has been explored if and to what extent airlines are involved in partnerships (on a scale from 1 = not at all to 5 = totally). The most occurring form of co-operation can be found in strategic alliances (X=3.88) and codesharing partnerships (X=3.45). Co-operations in terms of procurement consortia (X=2.62), airline group holdings (X=2.58) and shares in other airlines (X=1.88) are less spread among airlines.

	Mean	Std deviation	Min	Max
Strategic Alliances	3.88	1.52	1.00	5.00
Codesharing Partnerships	3.45	1.38	1.00	5.00
Shares in other Airlines	1.87	0.96	1.00	4.00
Airline Group Holdings	2.56	1.57	1.00	5.00
Procurement Consortia	2.62	0.99	1.00	5.00
Total	2.88	1.49	1.00	5.00



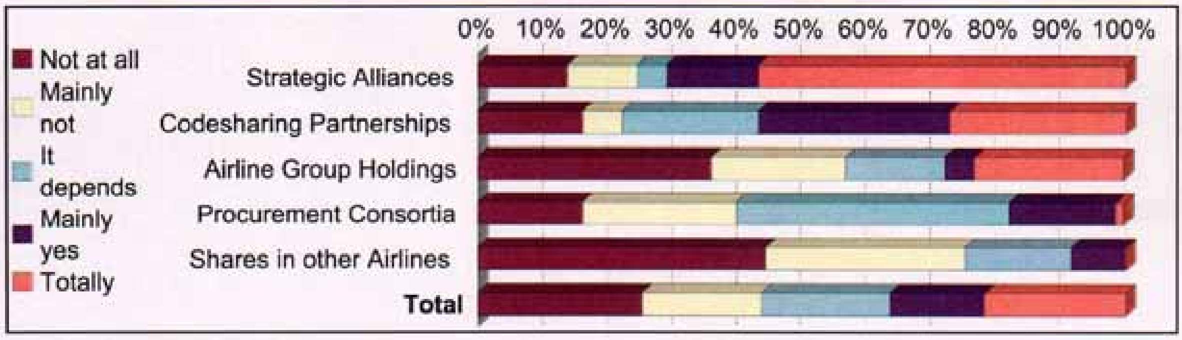


Figure 87: Level of Partnerships among Airlines

Full service airlines (X=3.14) report the highest level of involvement in any partnership. This is gradually followed by regional (X=2.84), low-fares (X=2.68) and charter (2.67) airlines.

	Average level of partnerships
Full Service	**3.14**
Regional	**2.84**
Low Fares	**2.68**
Charter	**2.67**
Total	**2.90**

p = **6.3%** ; F = **2.52** (**LS**)

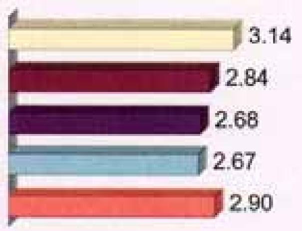


Figure 88: Average Level of Partnerships by Airline Type

The average level of partnerships was then compared to the use of e-Marketplaces in order to determine whether or not e-Marketplace adoption is positively related to the integration of partnerships (see Figure 89). This is the case (p=3.7%; F=4.37). H3a - airlines involved in alliances or partnerships use B2B e-Marketplace more than airlines that are not involved – is confirmed.

	Average level of partnerships
Yes	**3.02**
No	**2.67**
Total	**2.90**

p = **3.7%** ; F = **4.37** (**S**)

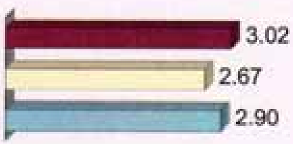


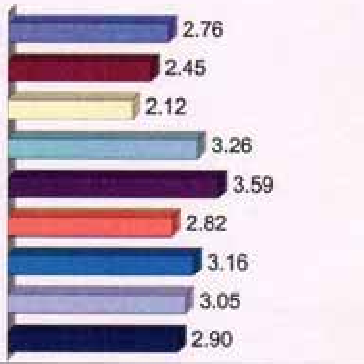
Figure 89: Average Level of Partnerships and E-Marketplace Adoption

Moreover, controlling for airline strategy, there is a similar pattern of the average level of partnerships and e-Marketplace adoption for all airline groupings, with the exception of charter airlines (see Figure 135 in appendix D). In terms of the control variable firm size, there was also a similar tendency for both large and small airlines for the relationship e-Marketplace use and average level of partnerships (see Figure 136 in appendix D).

A multiple regression test identified that airline size is positively related to the level of partnerships (p=4.1%, r=0.33, F=1.82, see Figure 137 in appendix D). Table 9 also reveals that pressures from the business context are very significantly negatively correlated to the level of partnerships.

A further indicator used in the survey to reveal the extent of co-operation among airlines was the extent of resource and information sharing at various organisational levels. Company products, such as lounges, frequent flyer programmes, etc. are a common area where co-operation is in place among airlines (X=3.59). Sharing information regarding suppliers (X=3.26), purchasing tools and techniques (X=3.16) as well as purchasing procedures (X=3.05) are further cited as to a medium extent. Airlines share IT systems (X=2.76) and product prices (X=2.82) to a much less extent.

	Mean	Std deviation	Min	Max
IT Systems	**2.76**	**1.32**	**1.00**	**5.00**
Purchasing Tools	**2.45**	**1.42**	**1.00**	**5.00**
Office Space or Facilities	**2.12**	**1.19**	**1.00**	**5.00**
Suppliers	**3.26**	**1.11**	**1.00**	**5.00**
Company Products	**3.59**	**1.09**	**1.00**	**5.00**
Product Prices	**2.82**	**1.33**	**1.00**	**5.00**
Purchasing Tools and Techniques	**3.16**	**1.02**	**1.00**	**5.00**
Purchasing Procedures	**3.05**	**1.06**	**1.00**	**5.00**
Total	**2.90**	**1.27**	**1.00**	**5.00**



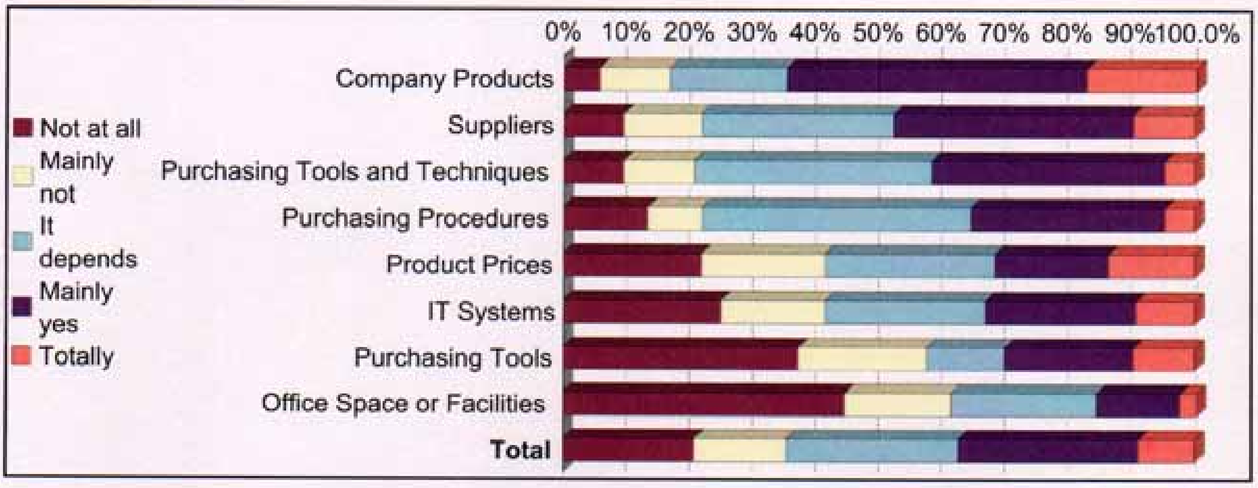
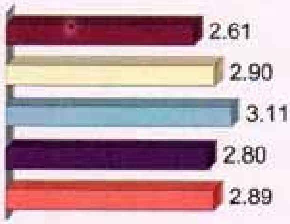


Figure 90: Extent of Resource and Information Sharing with Partners

The average extent of resource and information sharing does not differ to a significant extent among airline groups (p=51.8%; F=0.77). Charter (X=3.11) and full service (X=2.90) airlines have been identified as having the highest level of resource and information sharing, followed by low-fares (X=2.80) and regional (2.61) airlines (see details in Figure 138 in appendix D). A positive significant regression between airline size and the extent of resource and information sharing could also not be identified (p = 84.9%, R = 0.10, F = 0.55, see multiple regression in Figure 139 in appendix D). However, as one would expect, the extent of resource and information sharing is positively correlated to the level of ICT sophistication (p=1%, r=+0.28, see details in Figure 140 in appendix D) and the level of Internet services used (see Table 9).

No significant differences could be found when comparing the level of resource and information sharing among e-Marketplace adopters and non-adopters. Airlines that participate in e-Marketplaces (X=2.91) share information on a similar level as those that have not adopted e-Marketplaces (X=2.86). H3b - e-Marketplace adoption is highly dependent on the extent of resource and information sharing among airlines – is not confirmed (p=80.2%, F=0.05).

	Average extent of resource and information sharing...
Regional	**2.61**
Full Service	**2.90**
Charter	**3.11**
Low Fares	**2.80**
Total	**2.89**



p = **51.8%** ; F = **0.77** **(NS)**

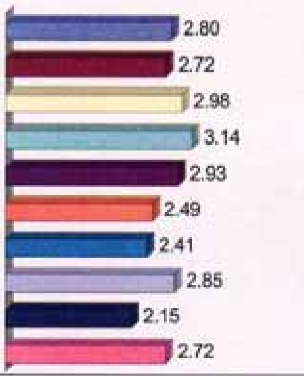
Figure 91: Average Extent of Resource/Information Sharing and E-Marketplace Adoption

This is a very surprising result as the level of strategic alliances and partnerships is positively related to e-Marketplace use and also to the extent of resource and information sharing (p=<0.1%; r=+0.35, see Figure 141 in appendix D). 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). 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. One would also expect that participation in e-Marketplaces would lead to a higher level of resource and information sharing with partners. This is apparently not necessarily the case. The involvement in strategic alliances and e-Marketplaces alone does not necessarily lead to a higher level of resource and information sharing.

7.6.2. Joint Procurement

Joint procurement among airlines was further explored. While an e-Marketplace can be seen as an intermediary for realising those joint-purchasing benefits by enabling aggregate buying (Chritiaanse and Kumar, 2000), the awareness and adoption for electronic joint purchasing is still rather low among airlines and not well integrated. This is demonstrated in the following figure, where airlines were asked to rate the level of integration of joint procurement activities for certain product groups (on a scale from 1 = not at all to 5 = totally).

	Mean	Std deviation	Min	Max
Aircraft	2.80	1.42	1.00	5.00
Pow erplants	2.72	1.40	1.00	5.00
Spares and Repairs	2.98	1.32	1.00	5.00
Maintenance Services	3.14	1.23	1.00	5.00
Fuel	2.93	1.28	1.00	5.00
Tools / GSE	2.49	1.13	1.00	5.00
Interiors	2.41	1.15	1.00	5.00
Catering and Inflight Supplies	2.85	1.42	1.00	5.00
General Expenses (Office Supplies, Computer Hardw a...	2.15	1.32	1.00	5.00
Total	2.72	1.33	1.00	5.00



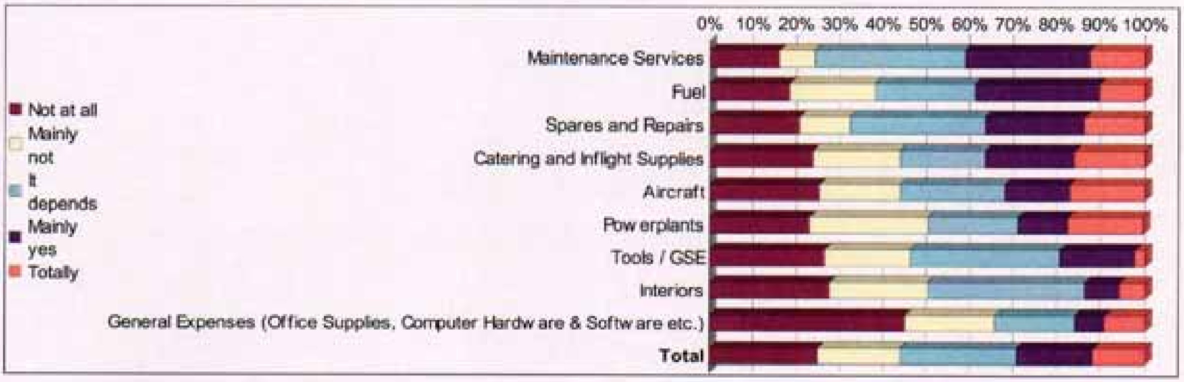
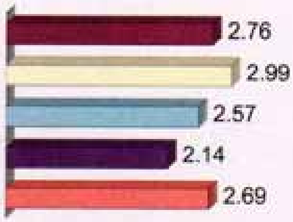


Figure 92: Level of Joint Purchasing by Product Group

Airlines have integrated joint procurement activities in particular for maintenance services, fuel, spares and repairs and catering and in-flight supplies. Low value purchasing such as general expenses are much less jointly purchased. This is confirmed by academic research focusing on economies of scale among airlines. A major conclusion was that above a certain, very low level, economies of scale do not exist to a significant extent (e.g. Caves et al., 1984; Crane, 1944; White, 1979; Xu and Windle, 1994). For low-cost items 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.

Low-fare airlines indicate a significantly lower level of joint purchasing activities (p=3.3%; F=3.04) (see Figure 93 and the full details in Table 24 in appendix D), while airline size is positively correlated to the level of joint purchasing (p=4.1%, R = 0.32, F = 3.16, see details of multiple regression test in Figure 142 in appendix D). This may be explained in such a way that low-fare airlines are less involved in strategic alliances than other airlines and that they operate typically one type of aircraft, where additional economies of scale are already limited. The extent of joint purchasing is positively correlated to the level of partnerships (p=<0.1%; r=+0.34; Figure 143) and the level of resource and information sharing (p=<0.1%, r=+0.44; Figure 144), while it is not to ICT sophistication (p=63.6%, r=+0.05, Figure 145).

	Integration of joint procurement
Regional	**2.76**
Full Service	**2.99**
Charter	**2.57**
Low Fares	**2.14**
Total	**2.69**



p = **3.3%** ; F = **3.04 (S)**

Figure 93: Average Integration of Joint Procurement vs. Airline Type

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).

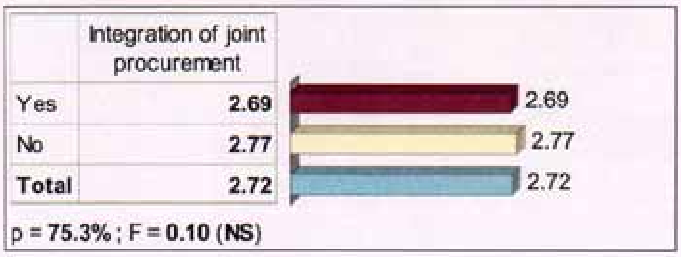


Figure 94: Average Integration of Joint Procurement and E-Marketplace Adoption (Parametric Test)

As the variable joint procurement integration does not follow a normal distribution as identified in Table 8 in section 7.2., a non-parametric Mann-Whitney test was additionally run (see following table).

Ranks

	Do you participate or partly own an e-Marketplace?	N	Mean Rank	Sum of Ranks
Integration of joint procurement	Yes	56	43.27	2423.00
	No	31	45.32	1405.00
	Total	87		

Test Statistics(a)

	Integration of joint procurement
Mann-Whitney U	827.000
Wilcoxon W	2423.000
Z	-.364
Asymp. Sig. (2-tailed)	.716

a Grouping Variable: Do you participate or partly own an e-Marketplace?

Table 11: Average Integration of Joint Procurement and E-Marketplace Adoption (Non-Parametric Test)

The non-parametric Mann-Whitney test also supports that H3c - airlines involved in joint procurement have a higher implementation level of e-Marketplaces than airlines that are not involved - cannot be confirmed (p=71.6%). There are no significant differences among e-Marketplace adopters and non-adopters for joint purchasing broken down by product group (see Table 25 in appendix D).

7.7. Level of Outsourcing

Outsourcing is predominantly employed in maintenance related areas and catering. Especially catering (X=3.26 on a scale from 1 = not at all outsourced to 5 = totally outsourced) shows a high outsourcing potential within all airline groups. General aircraft maintenance services (X=2.59) in conjunction with spares and repairs provisioning (X=2.66) and powerplants servicing (X=2.55) tend to be outsourced to some extent, while interiors and general expenses are rarely outsourced (see the following figure).

	Mean	Std deviation	Min	Max
Catering and Inflight Supplies Outsourci	3.26	1.28	1.00	5.00
Spares and Repairs Outsourcing	2.66	1.27	1.00	5.00
Maintenance Services Outsourcing	2.59	1.28	1.00	5.00
Pow erplants Outsourcing	2.55	1.16	1.00	5.00
Fuel Outsourcing	2.43	1.22	1.00	5.00
Tools / GSE Outsourcing	2.28	1.01	1.00	5.00
Interiors Outsourcing	2.11	0.95	1.00	5.00
General Expenses Outsourcing	2.08	1.07	1.00	5.00
Total	2.49	1.21	1.00	5.00

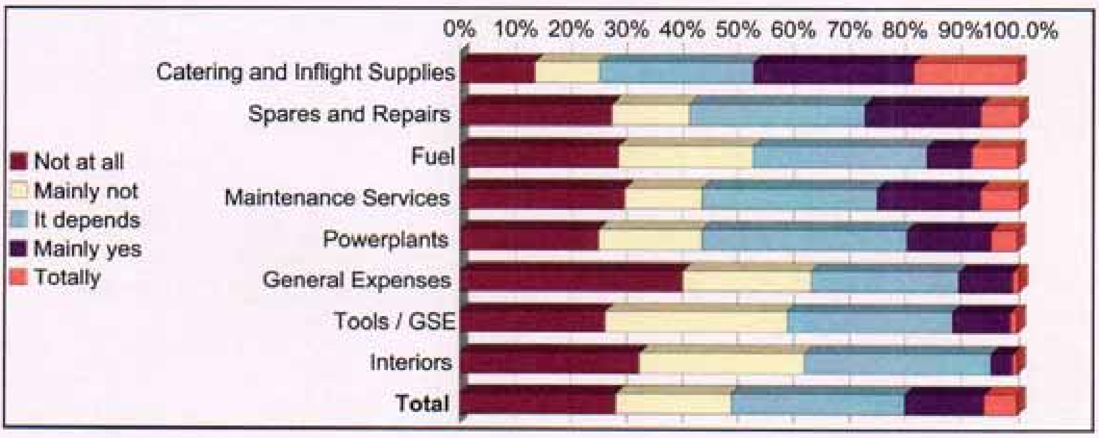
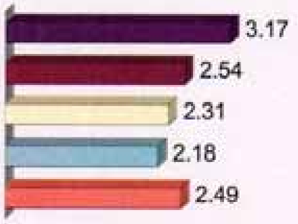


Figure 95: Outsourcing by Airline Spend Areas

Low-cost airlines show a much higher extent of outsourcing (X= 3.17) than their full service (X= 2.31), charter (X= 2.18) and regional airlines (X= 2.54) counterparts. To minimise their own labour costs and focus on the core business, low-cost airlines have typically outsourced the maintenance of their aircraft and with it, the procurement of respective materials. A.T. Kearney (2004) has published a report on current 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.

H4a - the extent of outsourcing is highly dependent on an airline's strategic orientation – is confirmed ($p=<0.1\%$, $F=6.11$). In this context, low fares airlines show a significantly higher mean value ($X=3.17$) than the overall mean ($X=2.49$). The extent of outsourcing is not related to airline size ($p = 46.8\%$, $R = 0.18$, $F = 0.34$, see multiple regression test in Figure 146 in appendix D and control variable test in Figure 147).

	Extent of outsourcing
Low Fares	**3.17**
Regional	**2.54**
Full Service	**2.31**
Charter	**2.18**
Total	**2.49**

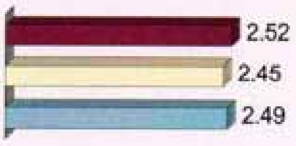


p = **<0.1%** ; F = **6.11** **(VS)**

Figure 96: Outsourcing by Airline Types

The extent of outsourcing is positively correlated to the level of Internet services used (very significant with $p=<0.1\%$; $r=+0.35$; Table 9). Surprisingly, there was no positive significant correlation between the extent of outsourcing and the level of partnerships / alliances ($p=31.6\%$, $r=+0.11$, Figure 148) and the extent of resource and information sharing ($p=34.8\%$, $r=+0.10$, Figure 149). This also applies to the level of joint purchasing ($p=84.3\%$, $r=0.02$; Figure 150). The survey data also suggests no significant dependence between the extent of outsourcing and the adoption of e-Marketplaces ($p=70.7\%$; $F=0.14$).

	Extent of outsourcing
Yes	**2.52**
No	**2.45**
Total	**2.49**



p = **70.7%** ; F = **0.14** **(NS)**

Figure 97: Outsourcing and E-Marketplace Adoption

H4b - e-Marketplace adoption among airlines is highly dependent on the extent of outsourcing – is not confirmed.

7.8. Procurement Organisation and Supplier Strategy

The adoption of e-Marketplaces may enable airlines to organise their procurement organisation into decentralised operating units, which can be centrally co-ordinated to take advantage of the benefits from both approaches. However, it could not be established that e-Marketplace implementation is dependent on an airline's procurement organisation strategy. No significant differences can be found in terms of centralisation ($p= 41.7\%$; $F= 0.68$) or decentralisation ($p=42.3\%$; $F=0.66$). Overall, there is a tendency among airlines to more centralisation ($X=3.05$ on a scale from 1 = not at all to 5 = totally) than to decentralisation ($X=1.85$).

	Centralisation	Decentralisation
Yes	**2.94**	**1.92**
No	**3.23**	**1.71**
Total	**3.05**	**1.85**

e-Marketplace participation / Centralisation p = **41.7%** ; F = **0.68** (**NS**)
e-Marketplace participation / Decentralisation p = **42.3%** ; F = **0.66** (**NS**)

Table 12: Procurement Centralisation vs. Decentralisation (Parametric Test)

As the two variables centralisation and decentralisation do not have a proper bell-shaped distribution as identified in Table 8 in section 7.2., a non-parametric Mann-Whitney test was additionally run (see following table).

Ranks

	Do you participate or partly own an e-Marketplace?	N	Mean Rank	Sum of Ranks
Centralisation	Yes	52	40.14	2087.50
	No	31	45.11	1398.50
	Total	83		
Decentralisation	Yes	52	41.98	2183.00
	No	28	37.75	1057.00
	Total	80		

Test Statistics(a)

	Centralisation	Decentralisation
Mann-Whitney U	709.500	651.000
Wilcoxon W	2087.500	1057.000
Z	-.933	-.848
Asymp. Sig. (2-tailed)	.351	.396

a Grouping Variable: Do you participate or partly own an e-Marketplace?

Table 13: Procurement Centralisation vs. Decentralisation (Non-Parametric Test)

The non-parametric Mann-Whitney test confirms as well that H5a - e-Marketplace implementation is highly dependent on an airline's procurement organisation strategy – cannot be supported (centralisation p=35.1%; decentralisation p=39.6%).

45% of airlines operate a centralised purchasing operation, followed by a decentralised but centrally co-ordinated approach (38%). Only 17% operate in a decentralised purchasing organisation.

centralised	39	44.8%
decentralised, but centrally co-ordinated	33	37.9%
decentralised	15	17.2%
Total	87	100.0%

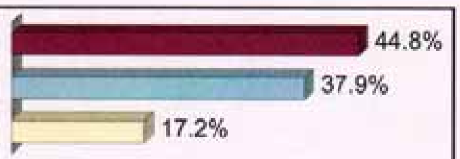


Figure 98: Current Procurement Organisation

Table 14 shows that the adoption of e-Marketplaces is also not related to a decrease in the number of suppliers (p=86.0%; F=0.02) or increase (p=82.1%; F=0.04). H5b - the adoption of e-Marketplaces is positively related to a decrease in the number of suppliers – cannot be confirmed. Overall, however, airlines have more concentrated on decreasing their number of suppliers in the past years (X=3.40 on a scale from 1 = not at all to 5 = totally) instead of increasing (X=1.99), particularly larger airlines (see Table 9).

	Increase in number of suppliers.	Decrease in number of suppliers.
Yes	2.00	3.42
No	1.97	3.39
Total	1.99	3.40

e-Marketplace participation / Increase in number of suppliers. p = **82.1%** ; F = **0.04** (**NS**)
e-Marketplace participation / Decrease in number of suppliers. p = **86.0%** ; F = **0.02** (**NS**)

Table 14: Number of Suppliers and E-Marketplace Adoption (Parametric Test)

Again, a non-parametric test was performed additionally, which confirms that H5b cannot be confirmed (p=92.6%; see following table).

Ranks

	Do you participate or partly own an e-Marketplace?	N	Mean Rank	Sum of Ranks
Your company has decreased or is in the process of decreasing the number of suppliers.	Yes	53	42.67	2261.50
	No	31	42.21	1308.50
	Total	84		

Test Statistics(a)

	Your company has decreased or is in the process of decreasing the number of suppliers.
Mann-Whitney U	812.500
Wilcoxon W	1308.500
Z	-.093
Asymp. Sig. (2-tailed)	.926

a Grouping Variable: Do you participate or partly own an e-Marketplace?

Table 15: Number of Suppliers and E-Marketplace Adoption (Non-Parametric Test)

7.9. Impact on Performance Indicators and Competitive Advantage

7.9.1. Perceived Advantages and Obstacles for E-Marketplace Participation

Perceived advantages in participating in an e-Marketplace have been grouped into four categories as outlined below. These main categories are procurement cost reduction (cited by 37% of respondents), increased procurement efficiency (34%), a higher market transparency (17%) and several service related aspects (12%). Some of the qualitative responses are listed below:

Procurement Cost Reduction:

- Savings through process improvement,
- Cost reduction through seamless integration,
- Cost savings through higher procurement flexibility,
- Product cost savings,
- Savings in terms of reduced man power and administrative costs,
- Cost savings though instant information,

- Reduced costs: material, transactions, operations, distribution,
- Improvement in purchasing processes through better total cost of ownership of purchased products.

Procurement Efficiency:

- Efficiency through better control and better workflow in the company,
- Efficiency through greater visibility,
- Efficiency through less paperwork,
- More efficient process and communication tool,
- Quickly getting information about availability and pricing,
- Reduced purchase order mistakes,
- Reduced time to complete price negotiations (auctions).

Market Transparency:

- Better market transparency,
- Increased sourcing opportunities,
- More competition and access to suppliers,
- Widens existing markets to the global level,
- Easier to contact new vendors,
- New customer acquisition, increased penetration among existing customers,
- Reduced costs of goods through generating increased competition among suppliers,
- Better control over industry supply chains.

Service Aspects:

- Cross-enterprise collaboration,
- Good tool to sell excess inventory, reduced inventory obsolescence,
- Repair tracking,
- Problems associated with time differences with overseas suppliers being reduced,
- Quick and easy to use tool for e-RFQs,
- Improved information flows and decision making.

Office supplies (X=3.92), spares and repairs (X=3.89) and tools/GSE (X=3.70) are perceived to be the areas with the greatest potential for overall cost savings (on a scale from 1 = completely inappropriate to 5 0 extremely appropriate), followed by interiors (X=3.39) and catering (X=3.05; see table below).

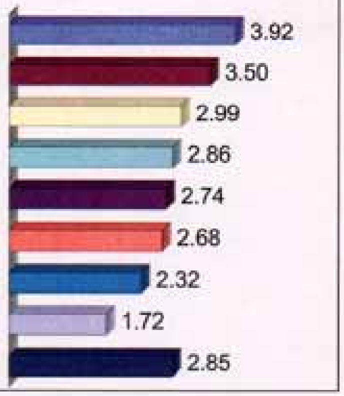
Mean Values / Spend Categories	Reduction of Search Costs	Time Efficiency Enhancement	Order Process Facilitation	Inventory Level Reduction	Supplier Transparency	Reduction of Product Prices	Average Level Overall
Powerplants	3,15	2,92	2,71	2,22	2,63	2,84	2,75
Spares and Repairs	4,11	4,04	3,73	3,74	3,7	3,99	3,89
Maintenance	3,15	2,95	2,88	2,31	2,95	3,08	2,89
Fuel	2,88	2,65	3,02	1,83	2,73	3,14	2,71
Interiors	3,46	3,45	3,52	3,08	3,38	3,46	3,39
Catering	3,16	3,06	3,11	2,54	3,03	3,42	3,05
Tools/GSE	3,92	3,82	3,62	3,42	3,61	3,81	3,70
Office Supplies	3,97	3,94	3,9	3,67	3,83	4,23	3,92
TOTAL	3,48	3,35	3,31	2,86	3,24	3,5	3,29

Table 16: Benefits by Airline Spend Categories

Overall, airlines see the highest potential in the reduction of search costs (X=3.48) and the reduction of product prices (X=4.23). Use of e-Marketplaces to facilitate order processes, overall efficiency enhancement and a greater degree of transparency of suppliers is reported for office supplies, spares and repairs, interiors and tools/GSE. Analysis reveals that survey participants see B2B e-Marketplaces as a tool to reduce their inventories only 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 full details are provided in Figure 151 in appendix D.

These findings are directly reflected in Figure 99 when exploring the most frequently products and services procured via e-Marketplaces. These are spares and repairs, followed by general procurement (e.g. office suppliers), tools/GSE and interiors. Fuel and airport services tend to be purchased to a much lesser extent using such platforms.

	Mean	Std deviation	Min	Max
Spares and repairs	**3.92**	**1.10**	**1.00**	**5.00**
General Procurement	**3.50**	**1.32**	**1.00**	**5.00**
Tools / GSE	**2.99**	**1.20**	**1.00**	**5.00**
Interiors	**2.86**	**1.05**	**1.00**	**5.00**
Catering and Inflight Supplies	**2.74**	**1.12**	**1.00**	**5.00**
Maintenance	**2.68**	**1.18**	**1.00**	**5.00**
Fuel	**2.32**	**0.99**	**1.00**	**5.00**
Airport Services	**1.72**	**0.86**	**1.00**	**4.00**
Total	**2.85**	**1.27**	**1.00**	**5.00**



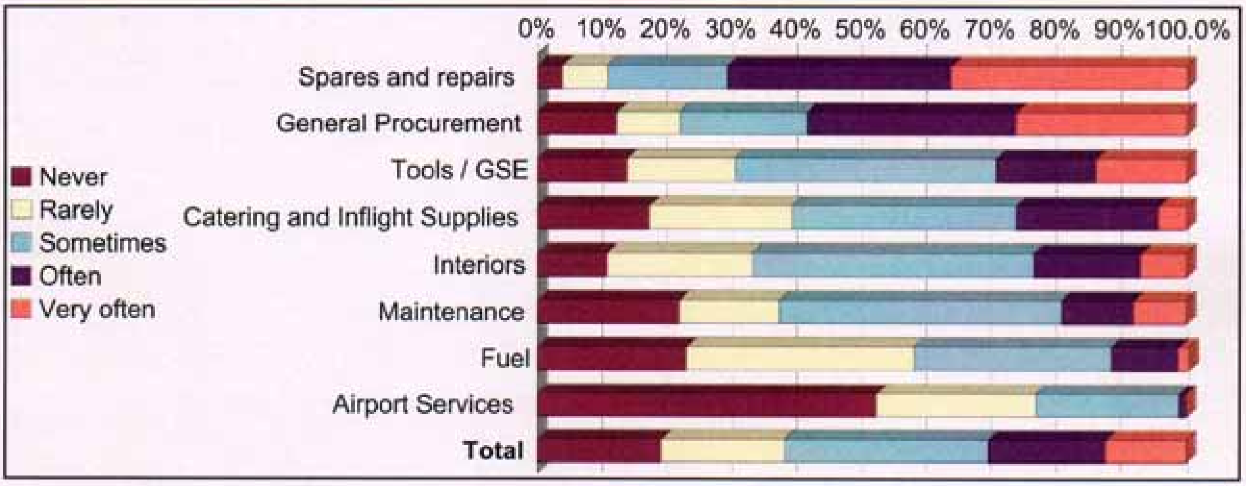


Figure 99: E-Marketplace Spend Categories

To cover these multiple products, airlines were also asked how many different e-Marketplaces would be needed. While 50% of airlines acknowledge that one e-Marketplace is sufficient, at least two are needed for 19% and at least three for 8%. 23% even state that no e-Marketplace could cover all spend categories.

Yes, one	**26**	**50.0%**
Yes, at least two	**10**	**19.2%**
Yes, more than three	**4**	**7.7%**
None	**12**	**23.1%**
Total	**52**	**100.0%**

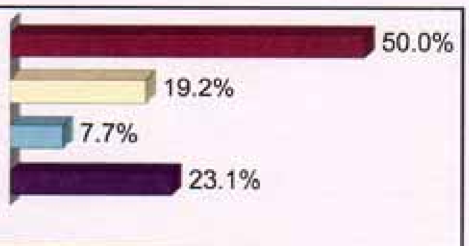


Figure 100: Number of E-Marketplaces Needed to Cover Spend Categories

Not surprisingly, therefore, about 30% of airlines indicated that e-Marketplaces could not cover their procurement needs.

Mean = **2.77**

Not at all	**10**	**17.9%**
Mainly not	**7**	**12.5%**
It depends	**25**	**44.6%**
Mainly yes	**14**	**25.0%**
Totally	**0**	**0.0%**
Total	**56**	**100.0%**

Figure 101: Coverage of Procurement Needs by E-Marketplaces

That is why airline managers have also been asked to identify perceived obstacles and drawbacks of e-Marketplaces. While 14% of respondents could not find any drawbacks from e-Marketplace adoption, the majority identified technological obstacles (24%) and service related aspects (22%), followed by supplier adoption issues (15%), financial risks (14%), security (5%) and other issues (5%). Some of the qualitative responses are listed below:

Technological Obstacles:

- ERP systems compatibility,
- Training and education of staff,
- Interfering with standard e-Procurement tools,
- Out-dated information on e-Marketplaces,
- Difficulty in integrating existing databases and transaction-processing software,
- Fear of employees of being left out by e-Marketplace introduction.

Service Aspects:

- In many cases e-Marketplaces too diverse or too centric in their focus,
- Lack of service options. Not sure which e-Marketplace will survive,
- E-Marketplaces are too focused on parties that run it,
- Unsure about the "real" benefits,
- Function and services are too limited from e-Marketplaces to cover our purchasing needs,
- Extensive staff training required,
- Loss of control through loss of relationships,
- Offers and demands clearly described with pictures.

Supplier Adoption Issues:

- The number of suppliers is limited on e-Marketplaces.
- Our own suppliers are reluctant to participate,
- Does not fit to the intent to reduce number of suppliers,
- High number of market participants is needed.

Financial Risk:

- Often no interface to common ERP systems and therefore implementation costs very high,
- Return on investment uncertain,
- Advantages may be negated by critical mass requirements,
- Change management costs.

Security:

- High danger of receiving bogus parts,
- We do not want to share confidential information on e-Marketplaces,
- Air worthiness.

Overall, a range of benefits and drawbacks from e-Marketplace adoption were identified from the survey analysis. Therefore, the following section examines in more detail the performance indicators from e-Marketplace adoption.

7.9.2. Satisfaction with Procurement Management and Process

A seven-item scale as shown in the following figure was used to assess the overall satisfaction with procurement management and processes among airlines (on a scale from 1 = very dissatisfied to 5 = very satisfied).

	Mean	Std deviation	Min	Max
Satisfaction with procurement processes	**3.31**	**0.84**	**1.00**	**5.00**
Current level of supplier search costs	**3.01**	**0.68**	**1.00**	**5.00**
Time efficiency level	**3.01**	**0.79**	**1.00**	**5.00**
Order process efficiency	**3.14**	**0.72**	**2.00**	**5.00**
Inventory management	**2.90**	**0.70**	**1.00**	**4.00**
Supplier transparency	**3.24**	**0.78**	**2.00**	**5.00**
Product/purchasing prices	**3.23**	**0.66**	**2.00**	**5.00**
Total	**3.12**	**0.75**	**1.00**	**5.00**

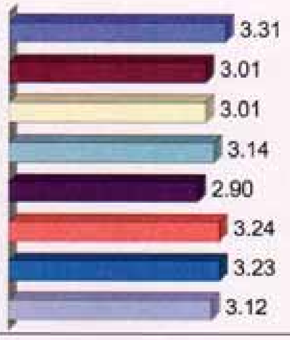
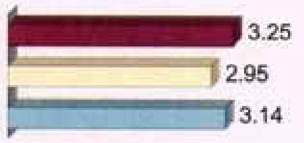


Figure 102: Overall Satisfaction with Procurement Management and Process

The results indicate that the majority of airlines are in general neither satisfied nor dissatisfied with their procurement management. Obviously, there is some improvement potential. Inventory management in particular was perceived to be handled in a less satisfactory way than other procurement activities. No significant differences occurred for the satisfaction with procurement management/processes by airline type (see Figure 152 in appendix D). This satisfaction is also not significantly correlated to a reduction in the number of suppliers (p=32.4%, r=-0.11; Figure 153), to the level of joint purchasing (p=60.4%, r=+0.09; Figure 154) and the extent of outsourcing (p=81.2%, r=+0.03; Figure 155). However, 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). H6a - the overall performance and satisfaction with the procurement practices of an airline is highly dependent on e-Marketplace adoption – is confirmed.

	Satisfaction with procurement management
Yes	**3.25**
No	**2.95**
Total	**3.14**



p = **0.7%** ; F = **7.58** (**VS**)

Figure 103: Overall Satisfaction with Procurement Management / Process and E-Marketplace Adoption

Further details of the significance test are shown in Figure 156 in appendix D. In terms of the control variables number of employees and airline strategy, there is a similar pattern for all groupings that e-Marketplace adoption has a positive effect on the overall satisfaction with procurement management (see Figure 157 and Figure 158 in appendix D).

It is also highly significant that the overall ICT sophistication of an airline and the level of Internet services used are positively correlated to the overall satisfaction with procurement management (see Table 9). This suggests that ICT is crucial for airline procurement processes. Intangible benefits mentioned 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.

7.9.3. Purchase Order Costs

Another performance indicator assessed in more detail was the level of purchase order costs. The average order cost is €68.7 with only 35% of airlines spending less than €60 per purchase order. As expected, there is a negative correlation between the overall satisfaction with procurement management / process and the costs involved per purchase order, while not yet significant (p=19.4%, r=-0.17, see details in Figure 159 in appendix D).

Costs involved per purchase order
Mean =**68.72** Std deviation =**28.37** Median =**70.00** Min =**4.00** Max =**150.00**

Less than 40	9	15.5%
From 40 to 59	11	19.0%
From 60 to 79	22	37.9%
From 80 to 99	7	12.1%
100 and more	9	15.5%
Total	58	100.0%

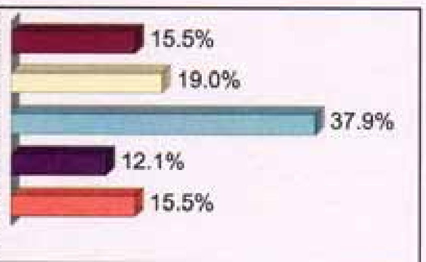
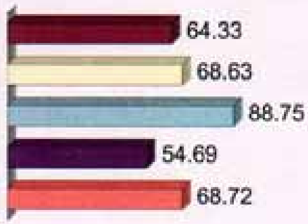


Figure 104: Purchase Order Costs (in €)

Significant differences could be established among the airline groupings (p=1.5%; F=3.81). While low-fare airlines achieve the lowest purchase order costs (X=€55), charter airlines clearly have to improve their competitiveness in this regard (X=€89) and thus illustrate a significantly higher mean value than the overall mean purchase order costs (X=€69) (see also e-Marketplace use and purchase order costs by control variable airline strategy in Figure 161 in appendix D).

	Costs involved per purchase order
Regional	**64.33**
Full Service	**68.63**
Charter	**88.75**
Low Fares	**54.69**
Total	**68.72**



p = **1.5%** ; F = **3.81** **(S)**

Figure 105: Purchase Order Costs by Airline Type

The correlation matrix in Table 9 also shows a very significant negative correlation between the decentralisation of the procurement department and purchase order costs. This finding can be interpreted in such a way that centralisation can lead to more complexity of purchase order processes (e.g. authorisation levels, etc), which can increase the purchase order costs. E-Marketplaces can help reduce these costs and the survey data also confirms that the use of e-Marketplaces has a positive effect on the reduction of purchase order cost (p=4.8%, F= 4.0). H6b - the use of e-Marketplaces has a positive effect on a reduction of purchase order costs of an airline – is confirmed.

	Costs involved per purchase order
Yes	**63.85**
No	**79.56**
Total	**68.72**

p = **4.8%** ; F = **4.00** **(S)**

Figure 106: E-Marketplace Adoption and Purchase Order Costs

There is a similar pattern for both small and large airlines that the use of e-Marketplaces can reduce purchase order costs (see following figure). This is even more so for smaller airlines, as larger airlines have to cope with e.g. more complexity.

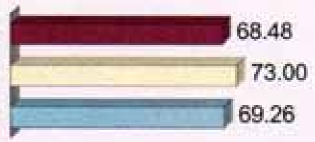
Less than 1500 employees:

	Costs involved per purchase order
Yes	**44.80**
No	**82.83**
Total	**65.55**

p = **0.4%** ; F = **10.88** **(VS)**

1500 and more employees:

	Costs involved per purchase order
Yes	**68.48**
No	**73.00**
Total	**69.26**



p = **69.0%** ; F = **0.16** (**NS**)

Figure 107: E-Marketplace Adoption and Purchase Order Costs by Control Variable Number of Employees

7.9.4. Net Savings Achieved

Most respondents (66%) 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%). H7a - a reduction in purchasing process costs and in procurement product prices can exceed the investment costs for the use of e-Marketplaces – is also supported.

Mean = **3.66** 'Mainly yes'

Not at all	**2**	**5.3%**
Mainly not	**3**	**7.9%**
It depends	**8**	**21.1%**
Mainly yes	**18**	**47.4%**
Totally	**7**	**18.4%**
Total	**38**	**100.0%**

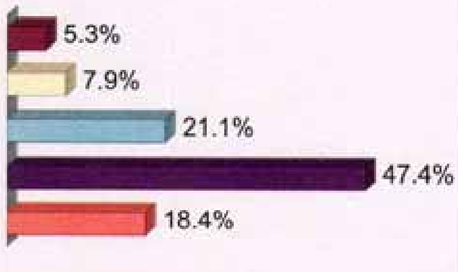


Figure 108: Gross Savings vs. Investment Costs

This is relatively consistent among airline size and strategy (see Figure 163 and Figure 164 in appendix D). There was no significant positive correlation of net savings achieved and the overall satisfaction with procurement management/process (p=47%, r=+0.12; Figure 160) and with purchase order costs (p=33.5%, r=+0.19; Figure 162).

The savings achieved occur slightly more in processing rather than product costs. This result further confirms that e-Marketplaces currently focus more on transaction support services.

Mainly in processing costs	6	15.8%
Slightly more in processing costs	10	26.3%
About the same	15	39.5%
Slightly more in product costs	4	10.5%
Mainly in product costs	3	7.9%
Total	**38**	**100.0%**

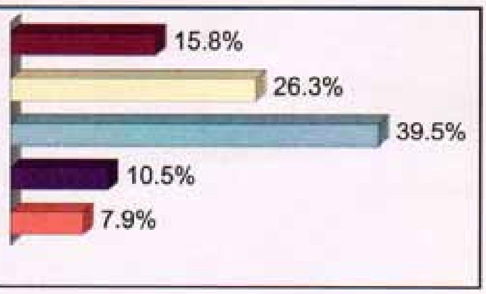


Figure 109: Savings in Processing Costs vs. Product Costs

Airlines were also asked which party should bear the investment costs for e-Marketplaces. E-Marketplace adopters mainly indicated that both buyer and supplier should bear the costs (54%), while non-adopters predominantly reported the supply-side (55%).

	Buyer		Supplier		Both	
	N	%	N	%	N	%
Yes	5	**8.8%**	21	**36.8%**	31	**54.4%**
No	5	**17.2%**	16	**55.2%**	8	**27.6%**

p = **5.7%** ; chi2 = **5.73** ; ddl = **2** (**LS**)

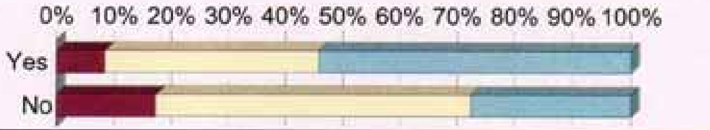


Figure 110: Investment Costs by Party

Airlines predominantly prefer a monthly/yearly fixed fee as investment cost (X=4.04), while other revenue sources for e-Marketplaces are less appreciated (see following figure).

	Mean	Std deviation	Min	Max
Monthly/yearly fee	**4.04**	**1.26**	**1.00**	**5.00**
Percentage per transaction	**2.27**	**1.16**	**1.00**	**5.00**
Uniquely admission fee	**1.81**	**1.01**	**1.00**	**4.00**
Listing fee	**2.03**	**1.08**	**1.00**	**5.00**
Fees paid as a percentage of cost savings	**2.38**	**1.40**	**1.00**	**5.00**
Total	**2.53**	**1.43**	**1.00**	**5.00**

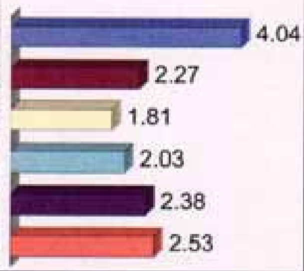


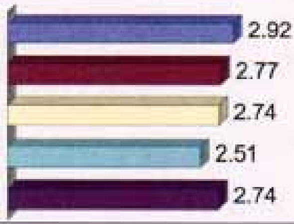
Figure 111: Fee Preferences by Airlines

There were no significant differences for fee preferences among e-Marketplace adopters and non-adopters (details are provided in Table 26 in appendix D).

7.9.5. Overall Airline Performance

A last performance indicator used was the overall airline performance (assessed by a four-item scale from 1 = not at all to 5 = totally).

	Mean	Std deviation	Min	Max
Increase in passenger numbers	2.92	1.19	1.00	5.00
Increase of passenger load factor	2.77	1.08	1.00	5.00
Increase in turnover	2.74	1.11	1.00	5.00
Increase in profits	2.51	1.12	1.00	5.00
Total	2.74	1.13	1.00	5.00



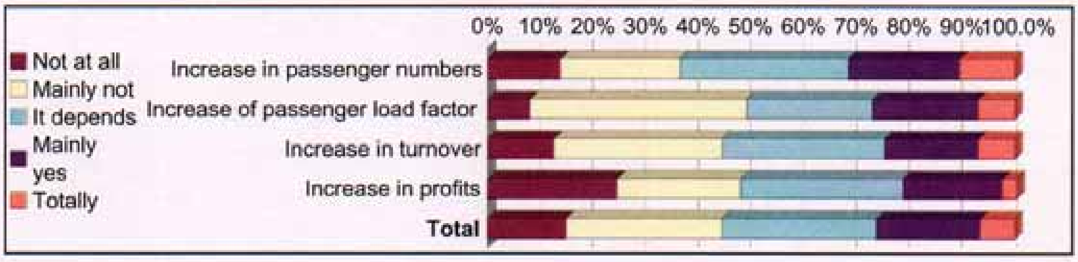


Figure 112: Overall Airline Performance

While 30% of airlines reported an increase in passenger numbers, 50% indicated that they have not achieved a growth in profits. Only low-fare airlines have done particularly better by exhibiting a significantly higher mean value (X=3.65) than regional (X=2.50), full service (2.53) and charter airlines (X=2.39) (highly significant with p=<0.1%, F=8.12). The low fares airline category illustrates moreover significantly higher mean values for passenger number increase (p=1.1%, F=3.99), profit increase (p=0.2%, F=5.38), turnover increase (p=<0.1%, F=7.29) and passenger load factor increase (p=<0.1%, F=8.39).

	Increase in passenger numbers	Increase in profits	Increase in turnover	Increase of passenger load factor
Regional	2.70	2.30	2.50	2.50
Full Service	2.74	2.34	2.50	2.53
Charter	2.68	2.16	2.47	2.47
Low Fares	3.63	3.32	3.63	3.68
Total	2.92	2.51	2.74	2.77

Strategy / Increase in passenger numbers p = **2.9%** ; F = **3.15 (S)**
Strategy / Increase in profits p = **0.4%** ; F = **4.85 (VS)**
Strategy / Increase in turnover p = **<0.1%** ; F = **6.17 (VS)**
Strategy / Increase of passenger load factor p = **<0.1%** ; F = **7.12 (VS)**

	Overall airline performance
Regional	**2.50**
Full Service	**2.53**
Charter	**2.39**
Low Fares	**3.65**
Total	**2.73**

p = **<0.1%** ; F = **8.12** (**VS**)

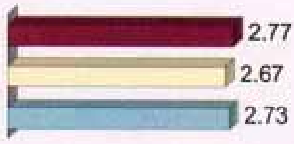
Figure 113: Overall Airline Performance by Airline Type

Figure 114 shows that the use of e-Marketplaces, however, is not positively related to an airline's overall performance (p=66.2%; F=0.20).

	Yes	No	**Total**
Increase in passenger numbers	**3.00**	**2.77**	**2.92**
Increase in profits	**2.49**	**2.53**	**2.51**
Increase in turnover	**2.76**	**2.70**	**2.74**
Increase of passenger load factor	**2.82**	**2.67**	**2.76**

e-Marketplace participation / Increase in passenger numbers p =**39.8%** ; F =**0.73** (**NS**)
e-Marketplace participation / Increase in profits p =**84.5%** ; F =**0.03** (**NS**)
e-Marketplace participation / Increase in turnover p =**79.1%** ; F =**0.06** (**NS**)
e-Marketplace participation / Increase of passenger load factor p =**55.0%** ; F =**0.37** (**NS**)

	Overall airline performance
Yes	**2.77**
No	**2.67**
Total	**2.73**



p = **66.2%** ; F = **0.20** (**NS**)

Figure 114: Overall Airline Performance and E-Marketplace Adoption (Parametric Test)

As the results of the variable overall airline performance do not follow a normal distribution as identified in Table 8 in section 7.2., a non-parametric Mann-Whitney test was additionally run (see following table).

Ranks

	Do you participate or partly own an e-Marketplace?	N	Mean Rank	Sum of Ranks
Overall airline performance	Yes	55	43.53	2394.00
	No	30	42.03	1261.00
	Total	85		

Test Statistics(a)

	Overall airline performance
Mann-Whitney U	796.000
Wilcoxon W	1261.000
Z	-.268
Asymp. Sig. (2-tailed)	.789

a Grouping Variable: Do you participate or partly own an e-Marketplace?

Table 17: Overall Airline Performance and E-Marketplace Adoption (Non-Parametric Test)

H7b - an airline's overall business performance is highly dependent on the use of B2B e-Marketplaces – is also not supported by the non-parametric test. 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. The overall satisfaction with procurement management / processes is not yet positively correlated to the overall airline performance in a significant way (p=8.8%, r=+0.19, see details in Figure 165 appendix D).

The overall airline performance is also not positively related to airline size (p=20.0%, r=0.25, F=0.39; Figure 166), level of partnerships (p=12.7%, r=-0.17; Figure 167), extent of resource and information sharing (p=49.6%, r=+0.07; Figure 168), level of joint purchasing (p=6.8%, r=-0.20; Figure 169) the extent of outsourcing (p=62.8%, r=+0.05; Figure 170), and a reduction of suppliers (p=12.1%, r=-0.17; Figure 171).

A positive relationship could, however, be identified between the ICT sophistication within an airline organisation and the overall airline performance (p=3.3%, r=+0.23; see correlation test in Figure 172). Given the background that airlines have traditionally made large investments in information and communication technology such as CRS, this finding is not very surprising.

7.10. Key Findings for the Airline Survey

Overall, a large proportion of airlines (65%) use e-Marketplaces. Of these, 25% are financially involved by having stakes in the e-Marketplace. 64% of non-adopters are considering to take part in an e-Marketplace. These results show a relatively high awareness of e-Marketplaces. The majority of airlines report using no more than two e-

Marketplaces. Airlines that employ traditional e-Procurement tools tend to attribute a higher importance to e-Marketplaces and have a higher use of e-Marketplaces in comparison to those that do not make use e-Procurement systems at present. Furthermore, a strong preference exists for airline and manufacturer-driven e-Marketplaces. This would suggest that airlines that are ICT experienced are more innovative in adopting newer technologies.

Airlines of the four identified business groupings use e-Marketplaces to varying degrees. The use of e-Marketplaces increases with the total number of airlines' (purchasing) employees and fleet size. Full-service and low-cost airlines show the highest e-Marketplace adoption. Full-service airlines often represent carriers that are long established in the market. Many of these airlines have been pioneers in using early ICT by implementing CRSs and have thus achieved competitive advantage over their competitors. They may see e-Marketplaces as a similar tool to enhance their competitive spectrum. This supports the findings of Joo and Kim (2004) who have identified the propensity and extent of competitive advantage attributable to a new technology as a key adoption driver. Low-cost airlines focus their overall strategy and business model on a sound ICT infrastructure. Organisation size is typically positively correlated with new technology adoption (e.g. Rogers, 1990; Dawe, 1994; Germain, 1993). The results show that full service airlines employ the highest number of employees, followed by low-cost and charter airlines. Regional airlines exhibit a significantly lower employee base (see Figure 70). In terms of employees that are involved in purchasing, charter and regional airlines display the lowest rate (see Figure 72). Moreover, full-service airlines operate the highest average number of aircraft, followed by low-cost airlines. Regional and charter airlines operate a significantly lower number of aircraft. This supports the findings of Grover and Goslar (1993) who argue that larger organisations have the financial and technical resources to invest in new technologies and absorb their risks.

Regional and charter airlines, by contrast, show lower adoption rates. This may be attributed to several factors. First of all, regional airlines are by nature rather small organisations that often operate under the umbrella of a much larger scheduled airline. Like their low-cost counterparts, they often outsource their maintenance and engineering works to third party operators (see also section 7.7).

Charter airlines have undergone some changes in the last few years. Many of them have been vertically integrated into large tourism companies. The other part is facing increasing pressure from low-cost airlines on short-haul routes. As a consequence, many have changed their strategic focus and are now operating and selling their tickets under a low-cost strategy, while simultaneously having contracts with tourism companies. Others have completely changed their strategic direction into operating solely as low-cost airlines.

This trend is also visible when examining competitive pressures in the respective airline fields. Full-service, charter and regional airlines all experience strong pressures from their competitive environment, which is a result of the numerous low-cost airlines that have been founded over the last few years. Moreover, the uncertain global economic environment and inefficiencies add to this effect. On the other hand, low-cost airlines perceive lower competitive pressures and experience a slight increase in passenger numbers and overall profits. Their business is growing at a much higher rate than any other airline groups. One reason for that may be that, besides enticing away business customers from traditional scheduled airlines, many of these low-cost airlines trigger new business from customers that would usually not fly but do so due to the perceived savings. As outlined in section 4.6., lower operating costs strengthen their position. However, the effect of competitive pressures on e-Marketplace adoption could not be confirmed on the basis of statistical analysis. The underlying reason for this might be that managers acknowledge e-Marketplaces as effective procurement tools that will deploy their potential in the long-term rather than in the short term. Furthermore, in many cases, purchasing is not seen as a strategic tool to increase sales and profitability.

A statistically significant relationship was however found between e-Marketplace adoption and airlines's overall ICT sophistication (with the exception of regional airlines), as well as the number of Internet services used. Low-cost airlines in particular show that their level of ICT sophistication has a significant impact on their e-Marketplace use. This suggests that the more experienced and up-to-date an airline is with regard to ICT knowledge, the more likely the airline will adopt the concept of e-Marketplaces. Not surprisingly, low-cost airlines report a significant relationship between ICT sophistication and e-Marketplace adoption as their ICT and Internet capabilities have developed as one of their core business values. Similarly, the use of EDI exhibit significantly different levels among the four airline groupings. Full-service and low-cost airlines report the highest use of EDI, while regional and charter airlines indicated employing EDI to a lesser extent. The underlying reason may be due to the relatively high (switching) costs that are involved in adopting an EDI solution. E-Marketplaces, on the other hand, may be perceived as favourable alternatives. Nevertheless, a highly significant difference could be established between adopters and non-adopters of e-Marketplaces in view of EDI implementation. This also suggests that once an airline has implemented an ICT solution that contributes to adding value, cutting costs and/or improve efficiency, the airline is more inclined to adopting a similar solution that could potentially enhance or complement the existing. Thus, ICT competence can be regarded as an e-Marketplace adoption driver for airlines.

Not surprisingly, full-service airlines report the overall highest level of partnership involvement. This includes not only strategic alliances, but also codesharing partnerships, group holdings, shares in other airlines as well as procurement consortia. The results further reveal that e-Marketplace adoption is positively related to partnership involvement of an airline. However, when employing airline strategy as a control variable, charter airlines do not follow this trend. This might be due to the fact that their partnership involvement might be of a slightly different nature than those of their other airline counterparts. Many charter airlines are vertically integrated into tourism companies and therefore do not actively seek out alliances and/or partnerships with other airlines, except directed by their parent tourism group. Furthermore, analysis has revealed that airline size is positively related to the level of partnerships.

The survey data suggests that resource and information sharing is quite popular with regard to company products, such as lounges and FFPs, while airlines reported the sharing of ICT systems and product prices to a much lesser extent. However, no significant differences could be identified when comparing the level of resource and information sharing among e-Marketplace adopters and non-adopters. Thus, resource and information sharing does not constitute an important factor for e-Marketplace adoption. E-Marketplaces may, however, act as a tool for joint procurement of airlines. Interestingly, airlines that would otherwise compete with each other are quite frequently co-operating when it comes to procurement of in-flight, engineering and security related aspects. As an example, Swissair was one of the first airlines to seek close partnerships with other airlines. Already in 1958, they were co-operating with SAS in purchasing and maintenance related areas. One of the early attempts of consortium purchasing was initiated by Delta Airlines in 1995 called DSS World Sourcing, which was a buying joint-venture formed by Delta Air Lines, Singapore Airlines, and Swissair to leverage better prices for in-flight products, computers, office and equipment, crew uniforms, fuel, etc. In 1999, SAir group later tried to expand their scope by using the Internet to buy various supplies with other companies in order to generate volume-purchasing deals. Today's e-Marketplace capabilities include the aggregation of purchases of different airlines in more areas than just in-flight products and office equipment.

The survey evidence indicates that airlines have integrated joint procurement activities especially for maintenance services, fuel, spares and repairs, catering and inflight-supplies. Low-cost airlines show the lowest level of joint procurement, while full-service carriers exhibit the highest levels. Airline size, however, is positively correlated to the level of joint procurement. Nevertheless, airline involvement in joint procurement is not positively related to e-Marketplace adoption.

It could not be demonstrated that e-Marketplace adoption is dependent on procurement strategy. However, a tendency towards centralisation could be found. Moreover, the use of an e-Marketplace is not related to a decrease or increase in the number of suppliers. Nonetheless, airlines exhibit an inclination towards a decrease of their supplier base. The majority of airlines are, in general, neither satisfied not dissatisfied with their procurement management. Inventory management in particular was not expoliting its full potential, even though holding capital that could be used elsewhere. Nevertheless, e-Marketplace adoption is positively related to the overall satisfaction in procurement management.

Perceived obstacles of e-Marketplaces were mainly of a technological and service related nature, followed by supplier adoption issues, financial risks and security. Similar to the e-Marketplace survey results, airlines indicated distinctive perceived advantages and obstacles by participating in an e-Marketplace. The main advantages are cost reduction, increased efficiency, higher market transparency and various service related aspects. In terms of cost savings, the survey has identified office supplies, spares and repairs and tools/GSE as areas with the highest potential. As in the case of office supplies economies of scale are small, the savings reflect more efficient processing of orders. In terms of spares and repairs, and tools/GSE, economies of scale are more likely. However, in the case of spares, a large percentage of savings may also be attributed to being able to locate parts in the event of an AOG situation more efficiently. This is reflected in the finding that airlines experience the highest potential of e-Marketplaces in the reduction of search costs and product prices.

Purchase order costs are differing between airline groupings. Low-fare airlines exhibit the lowest purchase order cost, while charter airlines have the highest costs. As expected, a negative correlation between overall satisfaction with procurement management and order costs could be identified. Furthermore, a significant negative correlation between procurement decentralisation efforts and order costs is evident. Centralisation appears to create additional costs. The use of e-Marketplaces can help reducing cost levels, which is also confirmed by the analysis. Smaller airlines can benefit from e-Marketplaces as they do not have to cope with complex procedures to the extentfaced by larger airlines.

More than half the respondents indicated that the achieved savings in process and product costs exceed the investment costs into an e-Marketplace. This did not differ between strategic groupings. However, no significant positive correlation of net savings and procurement management satisfaction could be identified. Nonetheless, savings achieved arise slightly more in processing costs.

Overall, the airline survey was successful in identifying e-Marketplace adoption drivers and performance indicators among airlines. Drivers or strategic 'stimuli' for e-Marketplace adoption in the airlines industry include the airline's strategic classification, the airline size, the extent of strategic partnerships, the level of overall ICT sophistication, the level of Internet services used. Converseley, business pressures, the level of strategic partnerships, the level of resource/information sharing, joint procurement integration, the extent of outsourcing and the purchasing organisation were not demonstrated to be significant adoption drivers.

In terms of performance indicators, e-Marketplace adoption has a positive effect on the overall satisfaction with the procurement management/processes and the reduction of purchase order costs. Airlines tend to achieve net savings from e-Marketplaces, although it could not be demonstrated that adopters achieve a better overall business performance than non-adopters.

The major contribution of this survey includes the identification of significant constructs concerning the implementation of e-Marketplaces and the performance outcome. As such, it provides an understanding of the factors that affect e-Marketplace adoption and the role that the factors can play in widening participation. Rogers (1995) acknowledges that "a common problem for many individuals and organisations is how to speed up the rate of diffusion of an innovation".

The survey also fills a void in e-Marketplace research that had been explicitly identified. For example, Kauffman and Walden (2001) recommended that researchers 'cultivate theory for the value and performance of B2B electronic markets'. The survey is more comprehensive than previous empirical research in the area as an attempt is made to compile a comprehensive list of factors. As such, the survey provides a solid foundation for the ongoing study of the rapidly changing arena of B2B e-Marketplaces.

The results of the airline survey in full detail are discueesd in greather depth in conjunction with the findings of the e-Marketplace findings and case study evaluation in chapter 9.

VIII. RESULTS FROM AIRLINE CASE STUDIES

8.1. Introduction

8.1.1. Case Study Selection

In general, case study research can help understand why certain characteristics or effects occur, or do not occur (Meredith, 1998). As such, case study research can provide the means to scientifically answer broader questions that provide for new insight (Christie et al., 2000). According to Perry (1998), case study research efforts also involve the collection of perceptions of external world phenomena such as perceptions that are "unobservable", e.g. non-technological motivations.

The two exploratory case studies described in the following sections represent examples of the airline industry to date, which reflect the challenges of the industry in general and particularly those of implementing an e-Marketplace system in particular in a complex business environment. While the first case illustrates some reasons for non-adopting an e-Marketplace and shows appropriate e-Procurement alternatives, the second case explains the implementation and integration of an e-Marketplace for aviation related goods and services from an adopter perspective. Explanatory case studies were considered to be inappropriate for this particular research, because theory and constructs in the literature to e-Marketplaces are not yet developed sufficiently.

The two case studies cited in the following sections illustrate two individual units of analysis, incorporating two different viewpoints on the adoption of e-Marketplaces and thus represent two unique cases. Yin (1994) argues that single cases may be used to confirm or challenge a theory, or to represent a unique or extreme case.

The basis for selection of the companies developed during the initial stages of the survey data collection when it became apparent that low-cost and traditional scheduled airlines have shown a significantly higher degree of e-Marketplace adoption than charter airlines. To investigate the driving forces of these two individual perspectives of adoption and non-adoption of e-Marketplaces, a charter airline as non-adopter and a traditional scheduled airline as adopter have been chosen in order to represent the two diverging cases adequately and in-depth.

Yin (1994) argues that replication logic and not sampling logic should be used for case studies. The choice of each case should be made that it either: (1) predicts similar results for predictable reasons (literal replication); or (2) produces contrary results for predictable reasons (theoretical replication) (Yin, 1994). The two cases chosen represent the latter, as each case generates a result contrary to the other case (adopter vs. non-adopter). According to Perry (1998), other researchers support this method of case selection and highlight the inappropriateness of random sampling. For example, Eisenhardt (1989) states that the *"random selection of cases is neither necessary, nor even preferable"*.

Patton (1990) lists several strategies of "purposeful sampling"[31] (in contrast to random sampling) which can be used to select cases. Of these, "critical case" sampling has been employed for selecting the companies in the following case studies. Critical cases are those that are, for some reason, particularly important in the scheme of things and have strategic importance in relation to the general problem. The focus of the data gathering in this instance is on understanding what is happening in that critical case. That is particularly important in evaluating the underlying qualitative drivers and decision factors for adoption and non-adoption of e-Marketplaces that cannot be captured with a survey questionnaire.

Although not identical, patterns of similarity can be identified between the lessons learned from each case. While the case studies follow a similar structure (i.e. the strategic company background, the e-Procurement/e-Marketplace adoption drivers, the implementation challenges and the performance indicators), they sometimes intentionally differentiate in context, thereby emphasising and documenting the diversity and complexity in the field.

Looking for critical cases is particularly important where resources may limit the evaluation to the study of only a single site. Under such conditions it makes strategic

[31] Purposeful sampling strategies include: Extreme or deviant case sampling, intensity sampling, maximum variation sampling, homogeneous sampling, typical case sampling, stratified purposeful sampling, critical case sampling, snowball or chain sampling, criterion sampling, theory-based or operational construct sampling, confirming and disconfirming cases, opportunistic sampling, purposeful random sampling, sampling politically important cases, convenience sampling.

sense to pick the site that would yield the most information and have the greatest impact on the development of knowledge (Patton, 1990).

8.1.2. Case Study Data Collection

Case studies typically use multiple methods and tools for data collection from a number of entities by a direct observer(s) in a single, natural setting that considers temporal and contextual aspects of the contemporary phenomenon under study, but without experimental controls or manipulations (Benbasat et al., 1987; Bonoma, 1985; Eisenhardt, 1989; Meredith, 1998; Yin, 1994). The methods and tools employed to collect data include both quantitative and qualitative approaches as well as obtrusive and unobtrusive methods. The goal is to understand as fully as possible the phenomenon being studied through 'perceptual triangulation', the accumulation of multiple entities as supporting sources of evidence to assure that the facts being collected are indeed correct (Meredith, 1998).

The data collection of the two cases was based on documentary analysis, such as various internal (e.g. internal reports, presentation material) and external documents (e.g. annual reports, press releases, company documents), and in-depth interviews. A total of 18 open-ended interviews were held over a 15-month period with employees of different seniority across a range of departments of two airlines.

The researcher integrated and triangulated facts from these data sources in order to achieve a very low level of misinterpretation. A major intend of this thorough data collection was to achieve the best possible insight, both formal aspects (written data) and informal aspects (personal interviews, observations). This was to avoid becoming dependent on a single informant, seek the same data from other sources to verify its authenticity (Tellis, 1997) and increase triangulation (Perry, 1998). Multiple sources of data were therefore used in order to have multiple sources of evidence and better validity (Yin, 1994).

The selection of interviewees was based primarily on the knowledge of key e-Procurement stakeholders and on suggestions from the lead contact person within each airline, which was in both cases the purchasing manager. The data from the airline survey was helpful in this respect to make contact to the two managers and set up a more detailed case study co-operation. The lead contact persons advised on the selection of interviewees who were then contacted personally by the interviewer, and the interview arranged. A few of the interviewees also recommended others within their organisation as appropriate.

The interviewee selection was based on the knowledge obtainable, not the manager's rank. Interviews were done in multiple hierarchical levels inside the case organisations and 15 of the 18 interviews were personal face-to-face interviews. Ten physical site visits have been undertaken in order to discuss the relevant issues with employees who were directly or indirectly affected, in departments such as warranty, technical purchasing, strategic and group purchasing, fuel purchasing, maintenance and information technology.

The author's objective was to interview a broad range of key stakeholder representatives and other individuals having an interest in or knowledge about e-Procurement and e-Marketplaces. The interviewees do not, however, constitute a representative sample of any broader group.

The purpose of these open-ended interviews was not to test the postulated hypotheses but to understand the experiences of the interviewees in relation to the use and perception of e-Marketplaces and the conclusions that they have drawn from them. Having already developed a very structured and in-depth survey instrument with deductive analytics, the author felt that open-interviews are the preferred technique to take advantage of their creative potential. In an open-ended interview, key respondents are asked to comment about certain events. They may propose solutions or provide insight into events. They may also corroborate evidence obtained from other sources.

The author wanted to get as 'clean' responses as possible by not using leading questions. Open-ended interviews are less controlled by the researcher, where the dialogue is started with a topic but the interviewees can then develop and express ideas freely. These open-ended interviews were selected as they allow developing inductive and new research issues that come to light during the interview process. The interview style was designed to elicit detailed, concrete stories about the interviewee's experiences with e-Marketplaces. However, the researcher achieved a degree of standardisation by ensuring that all the main areas had been covered at the end of the meeting (i.e. the strategic company background, the adoptions drivers, the implementation challenges and the performance indicators).

Each interview lasted between one and two hours. No attempt has been made to include every answer by every interviewee. In some cases, the interviewees did not have the answers to the questions posed, while in other cases, answers from more than one interviewee were alike. The effort here has been to provide an overall picture. Tape recordings were not undertaken due to the concern that airline managers may be sensitive to sharing their views.[32] The aim of these interviews was to collect and analyse mainly qualitative data that could underline quantitative results obtained through the survey and express reasons why a certain result may have evolved. Commentary sought included reasons for adopting and non-adopting e-Marketplaces, such as joint procurement activities, ICT sophistication, partner and supplier involvement, satisfaction with current procurement processes and costs, performance under a certain business context among others. The following sections present the case study results, whereby each case study is structured into four sections (i.e. the strategic company background, the adoptions drivers, the implementation challenges and the performance indicators).

8.2. Case Study ONE

8.2.1. Strategic Company Background

Airline group ONE is among the 15 largest airlines worldwide and among the five largest in Europe. It consists of an international holding group made up of six European airlines in six countries and employs 7,500 people in total. The individual airlines still operate as individual firms mainly in the charter sector, albeit under the management of the airline division ONE. The total volume is approx. 20 million passengers per year. ONE owns 88 aircraft with 21,500 seats and possesses a relatively young fleet with an average age of 6.5 years.

It is part of a larger travel company, which has expanded its business through a series of acquisitions and mergers to one of the largest tourism operators in Europe in the late

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[32] Lincoln and Guba (1985) "do not recommend recording except for unusual reasons". Lincoln and Guba base their recommendation on the intrusiveness of recording devices and the possibility of technical failure.

1990s. By acquiring companies in the tourism sector and by gradually de-investing in non-core and non-tourism related sectors, the group has renewed its main focus. Overall, the group employs over 70.000 people world-wide. Its holiday and leisure portfolio is supplemented by a number of different companies in the information technology, logistics and energy sectors. The group covers all major stages of the tourism value chain - travel agencies, tour operators, airlines, hotels and incoming agencies throughout the world. It includes 81 different tour operator brands, more than 3,700 travel agencies, 88 aircraft and approximately 150,000 beds in more than 280 hotels.

According to ONE, the European tourism industry is currently experiencing profound change as tour operators focus on vertical integration and integrated travel groups. Thus, the traditional aspects of a travel package (hotel accommodation, transport, food and point-of-destination tour organisation) are fast being folded into one provider and operated under vertically integrated umbrellas. For example, ONE indicates that almost 60% of holidaymakers in the UK would opt for organised tours. The vertical integration of European tour operators finds reflection in the dominance of tour operator owned charter airlines. According to ONE, approx. 60% of all charter aircraft are currently owned by major tour operators. Scheduled airline groups account for a further 25% of the European charter aircraft fleet, while independent charter airlines own the remaining 15%. A reason why independent airlines have found it difficult to survive in the tourist market lies in their vulnerability to sudden changes in tourist demand, particularly if they are focused on specific tourist routes. During a downturn, vertically integrated rivals focus on their in-house carriers and cancel capacities on flights operated by independent charter airlines.

Consolidation among European tour operators has accelerated in the past years. As a result, a relatively small number of airlines dominate charter operations in certain European countries. For example, five UK charter airlines, all of which are controlled by integrated tour operator groups, account for approximately 90% of the total number of passengers carried on charter operations in Great Britain.

The development of European charter carriers is highly interlinked with the continuous growth of holiday package trip demands from tour operators. Since 1970 the tourism industry has offered an increasing number of travel packages, many of which have been specifically designed for tourist destinations. Charter airlines have emerged, developed, and experienced a similar growth in demand. At this particular time, the core business of charter airlines was to mainly sell aircraft capacity to tour operators. Whereas scheduled airlines have, historically, tended to concentrate on business class (high yield) passengers, they have, of late, become exceedingly active in the tourist segments. Seats are sold to tour operators but, in addition, many scheduled airlines have taken it upon themselves to offer travel packages, particularly on routes to popular tourist destinations. However, ONE has reacted to mounting competition in the tourist market by introducing the so-called "seat only" product. Vertical integration offers the advantages of diversification, i.e. the ability to market spare capacity to other tour operators.

This was also due to the background that, according to the CEO of ONE, charter airlines have to bear comparison with the cost structures of low-cost airlines. Therefore, ONE tried to reorganise processes and cut costs.

8.2.2. Adoption Drivers

Within the airline group, the aspects that can be carried out jointly among the six airlines are handled centrally in order to create synergies and optimise work flows. Previously, each airline had its own spare parts stores, its own flight operations offices and purchased its aircraft independently. In the meantime, the six airlines try to make their purchases together, service their aircraft jointly and help each other in managing capacities. Within this process many business areas (e.g. catering) were outsourced. As one case study interviewee states:

"Outsourcing in our company took place because of cost and service related factors. We wanted a better transparency of prices. However, we will not outsource key strategic areas such as sales and customer support as well as our in-house aircraft maintenance as security is one of our main priorities."

Procurement specialists from each airline had to move to a new central office. ONE tried to carry out this reorganisation systematically in order to avoid any potential jealousies by bringing together a mix of staff from the different airlines in different countries.

"We want to avoid that anyone has the impression being dominated by the other."

ONE had previously eleven different types of aircraft and is striving to minimise the variety of aircraft that make up the fleet. The objective is to only operate with three to four different aircraft modes. Of particular interest is for example the communality of cockpits in different aircraft produced by one manufacturer because this can serve to reduce crew operating costs. It is already possible today to use aircraft in different markets without having to make complex changes. ONE's management believes that these differences could be harmonised in the long term. In addition, the group is also eager to reduce maintenance costs and shows an increasing tendency to favour one manufacturer.

An important part for ONE is the ongoing integration of the group's airlines to gather purchasing power as each airline previously conducted their own purchasing activities and conducted negotiation projects separately. For example, procurement initiatives were undertaken for new tools/GSE contracts within the division, where considerable cost savings could be achieved.

"As an airline group we can achieve additional benefits due to our size and influence in the market. We can thus negotiate better prices by consolidating purchasing and acting as one business rather than several individual companies."

"We must consolidate our buying power. There is quite a price difference between ordering 50 new aircraft and spare parts or just ten."

A standardisation process for products and services is, however, required that can be complex to manage: For example, comparisons between ONE's UK and German charter airlines show a notable difference in the number of seats offered on similar aircraft types. UK-based charter airlines impose a much higher seat density in their aircraft than their German counterparts. UK-based charter airlines' aircraft operate up to a 15% higher seat capacity than German charter airlines in their longhaul fleet and up to 5% in their shorthaul fleet. As an example, the Boeing 767-300ER in the UK operate with an average of 328 seats while their German counterparts operate the same aircraft with an average of 269 seats. Boeing 737-800s in the UK have on average five seats more than in Germany (184 seats). ONE acknowledges that there will still be national differences between the individual airlines in terms of cabin furnishings and in-flight catering. However, it also strived that these differences should be kept at a minimum.

As a backbone for communication and data transmission, the group required modern ICT systems to facilitate the standardisation and alignment of the different airlines. For example, ONE's purchasers typically need information on price, when the part can be delivered, its traceability and its repair status. Previously, each airline of ONE had a variety and myriad of different computer and legacy systems, which meant that the business was more inefficient and difficult to manage. Because the systems were not compatible, each of the six airlines carried an extensive safety level of inventory. Harmonisation of the ICT systems of the individual airlines in order to develop uniform platforms for maintenance operations and business data systems proved to be difficult and is still an ongoing process. For example, as with expendable purchasing, the main problem with managing rotables has been tracking parts and making accurate assessment of inventory requirements.

The fragmented and largely manually driven processes provided limited management information to measure supplier performance and indeed to understand usage and purchasing demand patterns amongst internal users. Initially, through the provision of more automated planning information and the ability to reconcile transactions, Spec 2000 helped to decrease transaction costs, which was used as a standard EDI data transmission code via SITA. Spec 2000 has been used by some of ONE's charter airlines for more than 20 years to make order requests for new parts from OEMs and vendors. However, ONE's smaller airlines did not use Spec 2000 because their volume of transactions could initially not justify the expenditure in EDI. Due to the cost of running Spec 2000, smaller carriers typically have had to use more basic methods of communication. The only alternatives to EDI were enquiries by phone or fax. For example, traditional methods of acquiring rotables required 30-40 pages of paperwork for each component. Airlines using these had to make requests using part numbers from catalogues, and this was subject to errors. While some of the six airlines could initially not justify Spec 2000 and due to its rather limited functionality, the group has begun to use the Internet for their purchasing.

ONE started to look at e-Procurement solutions that would allow enable process standardisation across its European businesses and reduce the time taken in its buying cycle.

"We decided that we needed an elaborated e-Procurement tool to monitor and analyse our purchasing data European wide as our current system cannot handle the amount of new data."

Some of ONE's executives, however, showed a significant scepticism for e-Procurement. According to One, the distinct characteristics of the aviation industry as well as the conservative culture of this particular industry account to a certain extent to this scepticism towards B2B. In most cases, one would experience long product design and lifetime cycles as complicated design and manufacturing processes are involved. As a result, an aircraft can typically be in operation for many years. Moreover, there are extremely strict quality and safety requirements in operation. There was, therefore, limited motivation among the individual charter airlines to change existing procurement processes and business relationships that have proven to work satisfactorily.

This conservative attitude goes even beyond the use of ERP. It took some of the group's individual airlines years to develop interñal legacy systems with their unique requirements, while some of the smaller airlines in the group were less advanced. When an integration process of ERP systems was required, most saw initially little motives and reasons to upgrade their old ERP and legacy systems that may be outdated.

Despite this conservatism, ONE's central top management eventually agreed to further evaluate a variety of e-Procurement and possible e-Marketplace integration solutions. This conservatism was reinforced when a significant number of e-Marketplaces began to consolidate. ONE's executives then decided not to adopt an e-Marketplace for the group's procurement activities. As one case study interviewee stated:

"We have closely investigated several e-Marketplaces but we are not quite sure that our company needs to expand our existing trading relationships. In certain areas, the number of suppliers in our industry is limited and there are not many firms that can manufacture and supply components to our specifications and tolerances."

According to ONE, e-Marketplaces may work for highly standardised products, but are not very useful for its 45% tailor-made products yet.

"Most e-Marketplaces are set-up by entrepreneurs who think all they need to do is matching up buyers and suppliers. However, standard products and services in an e-Marketplace is not what we really need. We want customised and tailor made solutions."

ONE feels that many early e-Marketplaces were quickly built without proper foundations in order to exploit stock market opportunities. Initially, in-depth value creation for participating buyers and suppliers was not one of their priorities. As a result, many e-Marketplaces had to cease operations or consolidate with other e-Marketplaces due to low or declining participation levels before they realised that buyers and suppliers need more functionalities than displaying product availabilities and comparing prices.

"Our B2B transactions are usually of a more complex nature than simple B2C transactions, where consumers choose a product or service, make a few clicks and finally pay for the goods or services via direct debit or credit card. There are currently over ten process steps involved in each of our current transactions. Our analysis suggested that e-Marketplaces do not support all of these steps."

ONE did not adopt an e-Marketplace also due to ERP integration requirements, which were costly, complex and risky in combination with the volatility and consolidation of e-Marketplaces. The group also felt that current e-Marketplaces would not be able to integrate the amount of data and complexity the group needed. Most e-Marketplaces that are left would be rather horizontal, region specific and do not have a critical mass of its own suppliers, which did not support the objectives of ONE.

The group also learnt from its supplier community that the complexity of ERP integration and product catalogue conversion creates major impediments in mass adoption of e-Marketplaces. According to ONE, suppliers who previously had disappointing e-Business experiences with their own websites were, as a result, also fairly doubtful about the benefits and opportunities that they might realise from participating in e-Marketplaces.

The airline group was also not satisfied that a large number of e-Marketplaces charge percentage-based transaction fees. Instead, ONE wanted a system where it just had to pay an initial licence fee or yearly fee. It did also not like the idea of making their price information visible where competitors could potentially compare them. Protecting intellectual property such as CAD drawings or product plans from undesired access is critical for ONE, which also reflects the industry's importance to security.

"Traditionally, we have guarded our data extremely careful. The idea to make our intellectual property available on a third-party platform would be a too revolutionary concept for us."

For example, one of ONE's main suppliers, Airbus, does also not participate in public e-Marketplaces and instead deals with its business partners in its private networks. Therefore, instead of using an e-Marketplace, ONE opted to integrate a central e-Procurement software, which allows users to update and view information across the airlines and to interact with established suppliers. The group's aim is to achieve, while realising the benefits of e-Procurement, a risk minimisation that any proprietary data is given away to its competitors and to avoid having to work with unfamiliar suppliers. ONE's management argues that these benefits include savings made in the administrative cost of buying material and savings made in better purchase pricing from joint group negotiation. However, ONE is also aware that no contractible services such as trust in its existing supplier relationships can be more important than choosing the lowest cost supplier.

That is why it introduced a desktop e-Procurement software to centrally manage the replenishment processes among the airlines and to implement a purchase information backbone. ONE was looking for a solution that would be able to allow further business integration and provide the flexibility to adapt to various scenarios as supplier integration continued to grow, but was also capable to deal with the enormous amount of information that is stored on the current systems. The introduction of the system provided the benefit that integrated suppliers are able to provide real-time data of parts availability, while requisitioners among ONE can complete transactions on-line. For example, one of the most important tasks of this e-Procurement software is joint procurement and supply chain management optimisation of spare parts. Spare parts totalling a significant value are currently steered across the airlines. As one case interviewee remarked: *"This is tied–up capital that could be used more profitably"*.

ONE's top management established the following main objectives for this initiative:

- Implementation of e-Procurement across all relevant business units.
- Automation of the ordering process to drive standards and compliance to contracts.
- Consolidation of expenditure to improve and lower expenditure to third parties.
- Provide management information to allow the business to proactively manage its supplier base and reactively manage non foreseeable market conditions.
- Provide audit controls, tracking and measurement.
- Provide further integration with the supplier base.

8.2.3. Implementation Challenges

The group took several factors into consideration how to select an e-Procurement solution that satisfies the needs of the whole group. The e-Procurement system had to undergo a functional and technical evaluation, while the solutions left were checked for financial stability (see Figure 115).

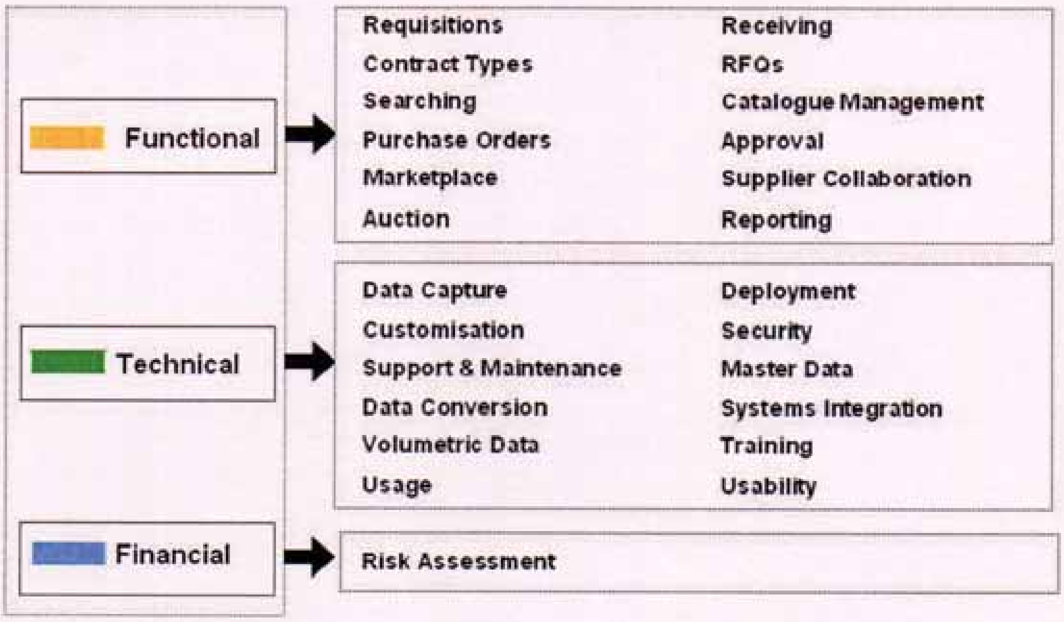

Figure 115: Evaluation of E-Procurement Software

After the evaluation, the group realised that the cost of combining dissimilar systems, such as requisitioning, approval, purchasing, receiving, invoicing and electronic payments from multiple suppliers can by far exceed the initial cost of the software. That is why it opted for one integrated software instead of proprietary systems or e-Marketplaces. This integrated software also suited the group's concentration on the existing supplier base; ONE's main integration effort was not directed towards new suppliers. Only key approved suppliers are listed in the system. Nearly 80% of ONE's spending for new equipment is done with approx. 40 suppliers. The supply of new aviation equipment and the costs thereof, is relatively inelastic.

While joint purchasing activities within the group were gradually employed for all product categories, where standardisation was worthwhile and feasible, the project scope of the e-Procurement system was at the start limited to indirect spend areas such as stationary, uniforms, telecommunications or car rental. Next steps then included the electronic integration of spare parts such as fasteners or bearings, which account for 50% of the group's overall parts but only 5% of its value. The main focus of spare parts integration was to improve the process costs and transparency. Subsequently, the electronic catalogue integration of joint purchasing activities including fuel, standardised training and strategic fleet planning was carried out.

The group's vision was to deliver a solution that provides its employees and suppliers a simple, cost effective and user friendly mechanism for electronic trading. Figure 116 represents the flow of processes in the e-Procurement system incorporated in creating a purchase order (PO) from requisition to invoice. However, to design principles for the usage of such a system in terms of end user requisitioning from local business units as well as the approval of requests, it was essential to gather data from different countries and units to define the end users. It was also required to analyse and allocate the expenditure limits given to different individuals and situations, as well as to define individuals that are allowed to approve invoices, which can be described by the hierarchies of entities and departments.

The e-Procurement software facilitates electronic matching of purchase order to receipt note to invoice (see Figure 117). Instead of having to raise a purchase order for every small-value transaction having to pay each with a separate invoice, the card transactions can be reconciled all at once on a monthly statement. The organisation's ledgers can be set up to receive information about who has made a purchase, when and under which budget heading automatically on a daily basis. The system further provides information on e.g. overstock, rotables performance and float control, repairables and expendables. Substantial investment was required to integrate the system with security concerns and existing legacy systems.

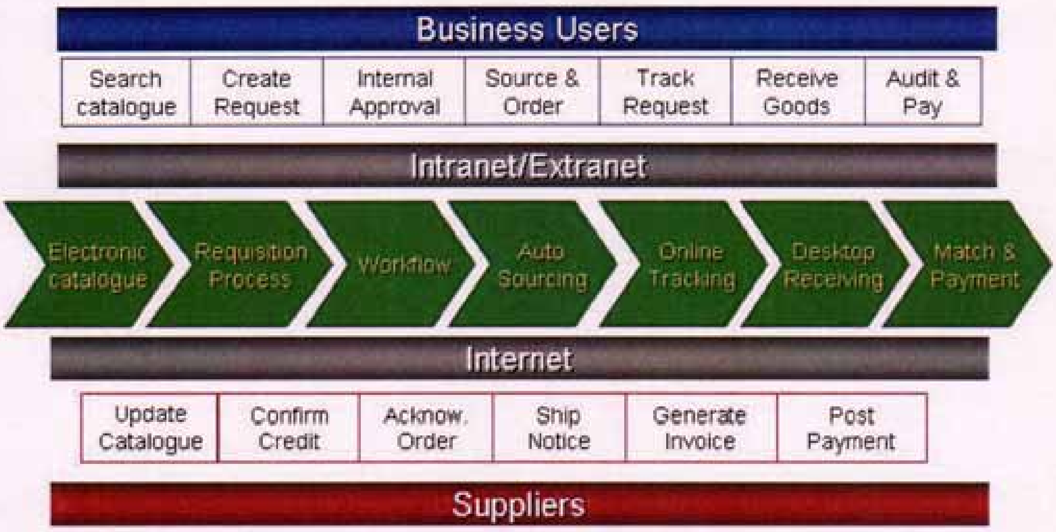

Figure 116: Purchase to Pay Process using Catalogue Transactions

The central e-Procurement system is interlinked with local business units and a group purchasing unit as well as a shared service centre. Local business units represent individual entities that are characterised by local spent activities. The local business unit is for itself responsible of setting up requisitions and their approvals as well as goods receipt and new supplier ads request, which are processed and implemented through the e-Procurement system. It thus automates the individual procurement process to a great extent. It also helps to check order status and see inventory in all stocking locations. Part certification documentation was also integrated into the system. Group purchasing is responsible for negotiating contracts, manual PO creation as well as the maintenance of the online catalogues. The shared service centre is responsible for invoice receipt, invoice entry, invoice matching, invoice queries and resolution, supplier creations and maintenance (see Figure 117).

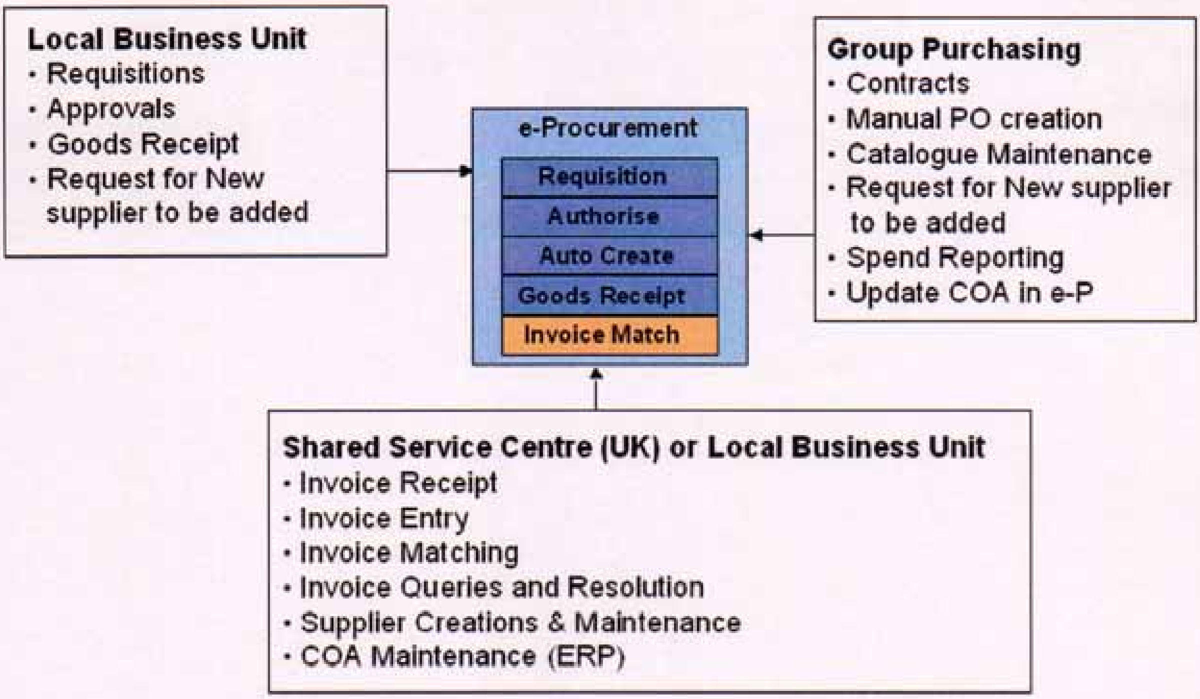

Figure 117: E-Procurement Process Flow

The e-Procurement system has an important part to play for the digitisation of data and ongoing integration of the six airlines within the group. While ONE's central management team is responsible for the quasi back office functions (which was brought together comprising purchasing staff from a number of source markets), the business activities of the airlines in the various markets continue to be local on a case to case basis. Some activities are so diverse that specific skills, technical expertise, and market affinity is needed in the specific location. But, for instance, it does not generally matter for ONE where highly standardisable products and services such as fuel for aircraft are purchased. These products are jointly negotiated and electronically implemented for replenishment processes. The e-Procurement system also contains a joint contract database in key areas such as in-flight service, airports and ground handling and fuel.

As not all suppliers are readily listed in the system so far, there is also the option of non-catalogue requests. All non-catalogue requisitions are routed through central purchasing when an existing purchasing contract is not set-up with the e-Procurement system. If the requisition value is above 7500 euros and the supplier is not in the system, operational purchasing will manually create the purchase order. Through standardising the approach to purchasing and supplier management, the introduction of joint purchasing and electronic replenishment processes made ONE get more control over the significant collective spend of its airlines.

A variety of factors were experienced by ONE to be key elements and lessons learnt:

- Materials standard classification and changing procurement processes can lead to conflicting demands between suppliers and individual airlines within the group, which need to be managed.
- The functionality in the solution and the user interface should be sufficient to cover the required purchase process steps.
- Top management support, a communication plan, end-user support and training should be there to ensure the co-operation and buy in across the group. The scalability and cost of participation needs to be planned. Underestimating the economics of catalogue creation and maintenance will otherwise affect the return on investment.
- The technical complexity needs to be managed. Suppliers that do not have electronic catalogues should also be assisted to cope with technical complexity. Supplier rationalisation process may be necessary to increase electronic integration of suppliers' products.

Supplier adoption and conversion of their products and services to the electronic catalogue format was a significant challenge for ONE. Initially, this process started with suppliers that the group was dealing with in a rather collaborative relational way and was then rolled out to other suppliers. However, only approx. 30% of all suppliers have integrated their products and service into the catalogue system to date. Monopoly suppliers in particular were often not willing to join the system and have their own web-based catalogues online in different formats. SME often do not feel comfortable about the investment costs and the prospect of having their sensitive price information online. The supplier integration is therefore an ongoing challenge.

Another challenge is the electronic integration of the documentation to identify First Article Inspection (FAI) parts and Part Fabrication Order (PFO) parts, which need to be accompanied by a release document from the supplier. This is to avoid unapproved bogus parts. A purchase may only be placed with approved vendors/suppliers who are recorded as approved. Approved in this context means not only that the part or material is airworthy. The part or material must also eligible to be installed in the specific aircraft, engine or component produced under a type certification, or production approval. Parts of material not manufactured under a type certification or production certificate may only be purchased from the supplier if the subcontractor is authorised by the type certificate holder to deliver the part or material direct to the customers. Parts or material purchased from other sources, e.g. brokers, must be accompanied with appropriate documentation which confirms that the part or material has been manufactured by an approved organisation or an authorised subcontractor. Parts purchased in serviceable or overhauled condition must have an approved repair station certificate. In addition suppliers must be able to provide upon request an inspection and findings report and the source of procurement, production or to certificate holder. Therefore, significant integration efforts were needed to electronically provide this kind of certificates, airworthiness directives and documents. This is to avoid the purchase of parts which may have been related to an accident, incident or similar circumstances. As one case study interviewee remarked:

"In this complex industry, you must be able to track and trace everything. To do this efficiently, the data would need to be integrated into a single information technology system, where all relevant data is always at hand."

Any person who makes a fraudulent representation about the quality of an aviation part can be subject to criminal action. It is illegal with severe penalties to falsify or conceal information concerning any aircraft part or use a fraudulent representation, documentation, or record.

Therefore, ONE is required to document the service history of every serialised part and subassembly in every aircraft they fly. There are also the special considerations for regulatory compliance, part life limits, and part compatibility rules, which makes electronic integration more demanding and complex. This information, however, when combined with fleet dynamics data, has also value for ONE for predicting service parts demand and planning maintenance schedules. For example, tracking of the amount of remaining usage on rotable parts determines not only the part's value but also the maintenance activities for which it qualifies, and what parts it should be married to for intelligent scheduling of the next removal. Limited life parts have a planned obsolescence that must be tracked in the planning system to avoid understating future inventory balances. The e-Procurement system therefore has to provide functions for technical records management, configuration management, maintenance planning and scheduling, fault and reliability tracking, life usage tracking, and regulatory compliance assurance.

Other challenges included that, to prevent any misuse, values and processes of approval had to be defined to keep the orders within certain limits. Training and education of staff was very important to make them use the new system. The e-Procurement system was compulsory to use and replaced the traditional ordering procedures, which were not made available any more as alternatives. However, with the existence of different corporate identities, country and work cultures within the individual airlines, users were relatively slow to take advantage of the full scale of functionality the system provided. Extensive training and top management support was needed to improve the usage rate and is still an ongoing process.

Furthermore, ONE's supply chain is complicated as the need for aircraft parts is driven by aircraft utilisation. This, in turn, drives scheduled maintenance, while equipment reliability issues drive unscheduled maintenance. When an aircraft is AOG, awaiting a replacement part, there is an opportunity cost. This leads to a tendency for ONE to have 'bloated inventories' to protect themselves just-in-case. Moreover, many high-value parts can be remanufactured or restored, and returned to service. Aircraft also need to be maintained at various geographic locations, which has to be taken into consideration. The e-Procurement system was helpful in this respect that it could provide management information and data in how to improve these situations.

8.2.4. Performance Indicators

This integration had a positive effect on the reduction of costs, on the control of maverick spending and the delivery of useful management information for decision making. According to ONE, analysing consolidated spend allowed to establish a consistent commodity strategy across the group. Driving more purchases through the approved procurement processes resulted in savings and more accurate spending information with which to negotiate better contracts.

After the e-Procurement software implementation, ONE also gradually employed the use of electronic RFQs and reverse auctions with a technology provider. These tools are used on a case to case basis for highly configurable products and services with large expenditure to take advantage of the group's purchasing power. A sample reverse auction started initially off with the tendering of the in-flight magazine publication and headsets. However, reverse auctions are not appropriate for a wide range of areas of the group's procurement (such as aeroplane maintenance) and only about 4% of expenditure is sourced by means of reverse auctions to date.

"I don't think that we will get to a stage where we would buy everything through electronic reverse auctions. There are certain suppliers that are monopoly suppliers, and some that we have very good relationships with."

Average net savings with reverse auctions were achieved between 2% and 25% on goods and services. However, as material purchasing is just about 15% of the direct operating costs for ONE, process cost optimisation is also highly vital for the group in order to keep up with low-fare airlines.

Process optimisation was achieved through simplified ordering and authorisation procedures, increased automation and standardisation of procurement and payment processes, as well as process quality enhancement, which led to a reduction of process costs and acceleration of processes. It also led to an increased transparency of information about suppliers, sortiments, ordering behaviour and volumes. Cost savings also occurred through an improved ordering discipline via the usage of corporate agreements as well as increased pooling through concentration on catalogue suppliers and sortiments. This all led to an enhancement of negotiation position with a fewer set of suppliers and thus an increased potential for transparency and material price reduction. For example, significant savings were achieved by greater control over third party spend and synergies through collaborative procurement particularly in rotables and consumables.

The group has difficulties, however, to quantify the exact total impact and return of investment achieved. Therefore, ONE will integrate a wider range of accurate key performance measures in e-Procurement in future for more exact validation of the impact (see Figure 118).

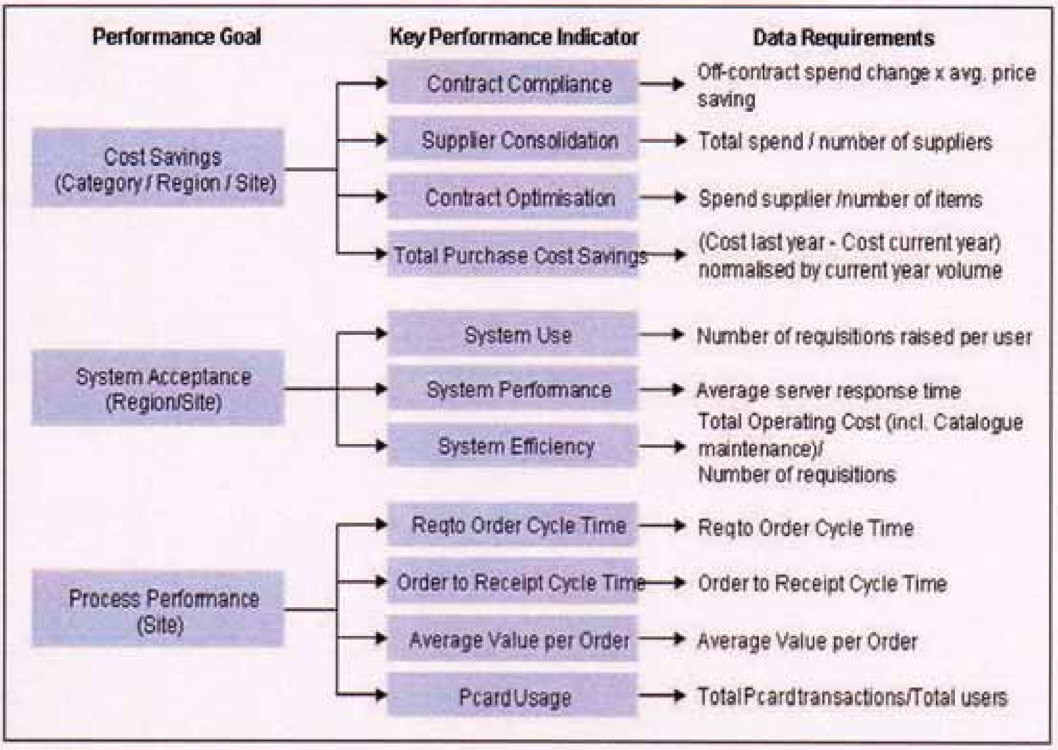

Figure 118: Future Performance Indicators for E-Procurement

Although there are ongoing significant challenges, the airline group is satisfied overall with the progress achieved and the decision made for its e-Procurement software and against the adoption of an e-Marketplace. However, ONE does not rule out that potentially changing procurement needs and conditions may eventually also lead to the participation in an e-Marketplace.

8.3. Case Study TWO

8.3.1. Strategic Company Background

Company TWO is a large scheduled airline, which employs over 60,000 people and operates more than 500,000 flights per year. It was privatised over 15 years ago and experienced that dynamic and liberal markets have led to strong competition among the established carriers and a variety of low-cost newcomers, resulting in tremendous cost pressure for TWO. It was forced to significantly cut costs and reduce inefficiencies such as overstaffing, excessive inventory levels and bureaucratic processes in order to survive as profit-driven private airline.

"Low-cost carriers are clearly staying in the market and we need to find ways how we can compete effectively and how we can co-exist with them."

Examples for cost cutting initiatives include that TWO decreased their staff to about 12,000 people. Rather than paying commissions to travel agencies and other reservation system providers to book passengers on TWO's flights, the company established a new pricing model to encourage customers to book their flights on their website directly. As a result, TWO's web bookings increased from 6% in 2000 to about 40% in 2005. But decreasing the cost level alone was not enough to be sustainable.

"Our company decided to rethink the whole business model in the long term rather than just focusing on cutting our cost base in the short term."

8.3.2. Adoption Drivers

A standardised centralised procurement process was introduced in order to achieve that TWO's procurement personnel to have a more strategic focus in the 6 billion euros sourcing spend. The airline has offices in multiple locations, some of which previously purchased goods and services independently, and TWO found it difficult to control that spending. The airline emphasised the following major objectives in its procurement strategy:

- a reduction of total costs of more than 200 million euros,
- an increase of online procurement to 80% of all materials and services,
- a reduction of order transaction costs to 15 euros per purchase order.
- a reduction of the number of suppliers from approximately 14,000 to 2,000. As a consequence key relationships should be deepened with existing suppliers.

Benchmarking was recognised to play a significant role in dealing with these challenges. TWO used many opportunities to discuss with other carriers and key suppliers about procurement best practices, for example by its participation in a rather large scale airline alliance or by the establishment of a strategic purchasing forum for large multinational companies to share ideas and practices.

"Our team experienced many differences in processes between the different best-practice companies and us, especially when it comes to steady and reoccurring processes."

Therefore, TWO identified five areas to establish and implement best practices: supplier relationships, supplier negotiations, strategy and performance, transactional procurement and supply chain development.

"Previously our team was organised by spend categories. In last few years we have tried to implement a strategic sourcing process. But it has not been as coherent as we have planned at first. One of the key fundamentals of our reorganisation is to give a proper accountability for the implementation and execution of processes to a senior panel."

The reorganisation of the purchasing department at TWO was therefore high on the agenda of the board level. The main aim of the reorganisation was to decrease TWO's total cost base. This included large-scale negotiations on supplier contracts for aircraft and aircraft-related parts and services. Other programs included the increase of the overall process efficiency. This was based on a net present value analysis for each project process and a total cost of ownership approach for all long-term investments such as contracting the parts supply (e.g. engine parts, components, expendables and consumables) and the customer support for new aircraft for more than a decade. According to TWO, this cost-benefit approach broadened the view from simple cost cutting to a more quality-based, longer-term assessment and closer co-operation with key suppliers. While this required a new level of frankness and openness in mind with key suppliers concerning information exchange, it could partly improve the predictability of demand and reduce 'bullwhip effects'.

Making use of online, on-time availability of information to lower stock levels and purchasing tools such as vendor monitoring/ purchasing controlling systems were regarded by TWO as crucial to improve its procurement practices. ICT was an important issue in TWO's benchmarking results to drive the reorganisation of its procurement processes.

This explains the overall background why TWO identified leadership and innovation in ICT and e-Business as vital future strategy requirements. The drivers of increased efficiency and lower costs spurred Internet-based procurement practices, but the airline's motivations began even earlier on in customer service.

"Our customers tell us they want access to us 24/7. They want us to remember what they've already told us. They say they want to be treated as individuals. We soon asked ourselves, how we can expect our employees to provide this level of service to our customers if internally we don't provide that culture and level of service to our staff.'"

Therefore, TWO's senior management was very aware of the emergence of ICT and thus keen to obtain value from it for its business operations. Its strategy was employed on parallel runways. Customer facing activities are aligned under e-Commerce, whereas supply chain activities are encompassed by e-Procurement. The latter ones are explained in more detail in this case study.

Given the importance that TWO assigned to e-Business activities, it set up the objective, as previously outlined, to conduct 80 % of its purchases online by the end of 2009. However, this ambition is a significant challenge, in particular for high value and critical procurement items. As one case study interviewee remarked:

"If we make mistakes or miscalculations in some of these higher value items it will have a huge negative effect. At the same time, the potential benefits are clearly enormous. Nevertheless, profound process changes are to be make, not to mention the implications for back end systems, and this is certainly a process that cannot be done overnight."

While TWO could substantially reduce inefficiencies in its procurement operations from the reorganisation, it saw further benefits to align its strategy with the implementation of an e-Marketplace.

"Of course, one of the major drivers are cost savings and efficiency enhancements. As an example, we can save 70 to 80 % of our process costs using e-Replenishment versus the traditional way with faxes and phone calls for each individual order. This is certainly a tool to reduce manual labour."

TWO's decision to implement an e-Marketplace was based upon the opportunity to improve the transactional procurement side (e.g. information capture), the strategic sourcing side (e.g. to warrant conformity to preferred suppliers) and supply chain management (e.g. reduction of inventory levels because of improved transparency with other trading partners).

TWO did not want the integration of a variety of disparate e-Procurement software systems. The airline therefore regarded the implementation of an e-Marketplace as a more efficient way to organise procurement processes, realise faster reaction times and decrease overall spending.

"E-Procurement allows transparency of our spending: exactly which suppliers we spend our money with and how much we spend on them. The result is increased control over our spendings."

The adoption of an e-Marketplace was also seen as an initiative to rationalise the large and diverse supplier base. The airline therefore decided to participate in a consortia-led e-Marketplace that was initially founded by nine major airlines. Since its launch with the original nine airlines, the e-Marketplace has added a further 24 affiliate airline members. Together, the 33 airlines account for over 40% of the airline industry's total annual procurement spend of around 110 billion euros.

The e-Marketplace was initially set-up to deal with the various processes in the lifecycle of aircraft, e.g. the way they are customised, manufactured, procured, and maintained, the organisation of ground services and equipment or the handling of replacement spares and repairs. It concentrates on enhancing the total cost of ownership by collaborating with suppliers and airlines to increase productivity along the complex aviation supply chain and to facilitate transparency of information.

"We have selected this collaborative e-Marketplace because other partners have already extensive procurement experience with this platform. This knowledge, and close relationship mean that this e-Marketplace should provide us with long term benefits."

Ideally, participants can use the e-Marketplace to create and browse online catalogues, carry out online reverse auctions, formulate RFQs, complete transactions and forecast future requirements. This is done by adjusting manufacturing and inventory management processes to equal demand.

TWO was committed to reducing the inefficiencies in its environment that were created by the different channels of communication to its suppliers, including EDI, OEM web sites, paper, phone, and fax. The e-Marketplace tries to decrease these inefficiencies by consolidating EDI, XML and web-based communications into a single hub, reducing the need for manual communication in the transaction lifecycle.

The e-Marketplace manages centrally hosted catalogues that can be customised to buyer- or supplier-specific views. It offers a configuration management module, which provides TWO with the knowledge of what is on a specific aircraft, when the tail number is entered into the system. This helps TWO's ground staff to explore in a rather quick way what products need replacement on the aircraft. By the use of the e-Marketplace system, it can be discovered where such products are available, in which kind of condition they are in and the time-frame for delivery. This service supports strategic material management by reducing the time required to locate a replacement part in time-critical AOG situations. Financial flows are also handled when a part is ordered, when a consolidated statement is electronically sent to accounts payable comprised of transaction data.

"Each aircraft is different from another, even if they are from the same aircraft families. A lot of parts may be slightly different and especially engines are typically of different vintages. It is important for us to have detailed knowledge what is on an aircraft and what exactly needs replacement, when it lands."

8.3.3. Implementation Challenges

According to TWO, it should be noted that the e-Marketplace does not benefit all AOG eventualities, particularly those involving long-lead parts. Rather, the key to long-lead items lies in effective forecasting and parts standardisation.

"At present, airlines have different standards for their aircraft components."

TWO is reluctant to purchase products and services unless it is known exactly where they have come from due to configuration control issues. TWO has approximately 10,000 rotable parts, and the average component has six modifications. Therefore, TWO shares less than 2% of their collective spare parts inventory and generally only for critical AOG situations, where TWO has created casual sourcing relationships for emergency situations. However, TWO is planning to increase this number as it cannot afford any more to carry all of the computed parts inventories it needs. This initiative would decrease the held inventory and leverage stocks as an alternative to purchasing new stocks. This is especially attractive for its repairables because, unless the broken part is unrecoverable, no replacement is required.

To avoid the duplication of off-wing inventory held by airlines the e-Marketplace was also created to address this situation by using a platform that allowed airlines to pool their assets and trade their surplus parts with each other for multi-airline inventory sharing. TWO believes that pooling could facilitate a 20% reduction in inventory held by airlines, which could translate into significant savings. However, the competitive nature of the industry and the lack of standardisation are impediments to parts pooling.

"The OEMs could make our lives much easier, if only they would change the part number according to different configurations. We could then use the B2B e-Marketplace much more effectively."

Apart from e-Replenishment orders for TWO's end users, the e-Marketplace offers purchasing managers a list of potential suppliers for specific products and services. This is in line with TWO's goal to create an e-Marketplace based process flow where its standardised centralised procurement could be matched with decentralised requisitioning. Requisitioning is performed at the desktop of TWO's end users where they can create and assess individual purchasing transactions with pertinent information throughout the procure-to-pay process (e.g. track and trace).

For centralised sourcing, a RFQ can be requested by clicking on those suppliers that have inventory for a required quantity. Quotes can then be electronically provided from the suppliers. TWO's purchasing managers can obtain reports to analyse e.g. purchase to sales ratios, contract leakage trends, supplier performance, or contract savings summaries. Documents such as supplier specifications or drawings can be electronically attached in the work flow process. According to TWO, this service needs however further progress, as the e-Marketplace does not provide very detailed technical information on products and services. TWO often seeks solutions to customised, aircraft specific applications, so obtaining technical data can be critical.

TWO also discovered that verification and authorisation in the sourcing processes required to be more clearly outlined. To resolve this problem, a sequence of nine stop and go points in the procurement process were created and put into practice by the procurement team. These points allow a structured assessment by senior personnel and process leaders to make sure that all process requirements are being met. As an example, step two in TWO's sourcing and procurement process is research. Within this step, there are five well defined research components that have to be completed before the sourcing process can move to the next step.

Other factors had also implications for the integration of e-Marketplace based procurement activities. Aircraft fleet is one of the most important assets for TWO, and punctuality of flights is of highest importance for its customers. The top priority was to provide both safe and reliable aircraft with short term availability of spare parts. In the past, this has often led at TWO to excessive safety stocks no matter what costs were implied. For example, TWO's main suppliers keep detailed information on nearly 800,000 parts within their enterprise resource planning systems. In addition, for aircraft safety reasons, each of these aircraft-related parts needs to be certified by the aviation authorities and requires full traceability back to the supplier origins. That is why the e-Marketplace has a quite large database of inventory listed by date stamp from its approximately 1,800 supplier members. These high standards for production and approval of parts, as well as other quality regulations for suppliers, in combination with high investment costs, generate an overall highly oligopolistic (for key parts even monopolistic) market structure for the supply of aircraft parts and services. Mergers and acquisitions in the first-tier supplier markets lead to further consolidation, often resulting in fewer alternatives and stronger monopolies.

Therefore, TWO's e-Procurement strategy varies strongly from the volume and the turnover of parts. High-value items such as high-pressure turbine blades have to be treated differently compared with fast-moving low-value items for line maintenance, for example standard hardware like screws, washers, etc. (see the product categorisation in

Figure 119). While maintenance, repair and overhaul are traditionally outsourced by small airlines, TWO has historically maintained in-house MRO capabilities. 90% of total maintenance work is still performed in-house, where the e-Marketplace supports activities such as scheduled checks of the airframe, engines, landing gears, components and cabin interiors, ranging from a brief pre-flight check to a D-check. Another example is fuel, where TWO found that the price is rarely negotiable for this commodity.

Figure 119: Product Categorisation

While the e-Marketplace implementation started with the integration of an e-Replenishment system for rather low value indirect spend in general procurement, the airline also gradually included products in e.g. maintenance and engineering or catering and cabin services. Purchased products and services were also analysed for their suitability for e-RFQs and reverse auctions.

Except of a few products, reverse auctions have primarily focused on areas of indirect spending. These are any items that do not interfere with operating a plane, for example accessories such as paper towels, fire extinguishers, etc. TWO declined to reveal how much of the purchasing spend is being acquired through reverse-auctions or what the total savings achieved has been, but said *"to run an auction it when it economically viable."*

"The most important consideration for running reverse auctions is to choose competitive suppliers. Nevertheless, we have also had suppliers that categorically did not wish to take part in an online auction. However, over a period of time, some of our reluctant suppliers have reconsidered. Some of them told us that they want to participate as market conditions have changed. On the other hand, we have also had participants in reverse auctions that refuse to take part in future."

According to TWO, a reverse auction requires a critical mass of about one million euros in available procurement spend, and products and services should be identified that can sustain those volumes. For example, relevant costs to also take into consideration for each group of parts are capital costs, storage costs, costs with a defined reordering and restocking procedure or demand-driven transportation and other logistics, such as goods receiving and quality checks, plus administrative costs of purchasing and accounting. These costs have also to be judged in relation to the turnover rate of the respective material to decide whether a storage-in-time solution makes more sense with the constraint of highest availability in order to prevent an aircraft on ground caused by a missing part.

Evaluating the intangibles in a reverse auction can be quite difficult, however. For example, one supplier in a reverse auction of TWO was very displeased that it was not presented with the contract despite proposing the lowest bid in the auction. The e-Marketplace gradually employed new tools so that the system automatically classifies all the suppliers based on quality issues and overall performance. This is considered in the final price. The purchasing criteria exceed the traditional best price condition to issues such as quality, supply, reputation and capabilities and each bid is evaluated in the context of the overall proposal. According to TWO, this was important to demonstrate that it does not have predetermined agendas and that it will not buy on price alone.

While the e-Marketplace helps participants plan common purchase requirements, amalgamate them with other airlines to jointly procure greater quantities on the e-Marketplace and run reverse auctions for these requirements, TWO has rarely taken advantage of these opportunities due to reasons such as proprietary data, lack of trust and potential anti-trust issues (as TWO has a rather large firm size). The airline understands that safeguarding the interests of all participants is critical to joint purchasing. TWO outlines that it is difficult for suppliers to know what price to quote because there is no guarantee all purchasers will actually place orders with the winning bidder in the end. If one buyer pulls out, suppliers are supposed to be notified and asked to re-bid.

Therefore, TWO admits that it was approached by the e-Marketplace with a number of further pieces of functionality and services, but TWO did not want to be swayed by these offers. Each extra piece of functionality needs further integration and training of staff and suppliers. Therefore, TWO only focused on the integration of core services and acknowledged the following benefits from the e-Marketplace implementation:

- Single connection to e-Marketplace eliminates the need to connect procurement systems to individual trading partners: Increased market access and connectivity to suppliers and other partners.
- Streamlined processes: Reductions in time and cost as a result of standardisation of systems, requests and responses.
- Avoidance of data re-entering into finance systems / improved accuracy of information / creation of contract and maverick spend visibility.
- Improved asset utilisation and aggregated demand forecasting: Decrease in order and bid cycle times.
- Improved maintenance turnaround time and inventory availability / reporting (e.g. in AOG situations): Decrease in aircraft time spent on the ground for scheduled maintenance through better scheduling, improved capacity matching and more efficient maintenance delivery.

An ongoing significant challenge is, however, the full integration of the e-Marketplace and the airline's ICT and ERP systems to increase overall automation. The e-Marketplace supports ATA/SPEC2000 content standards for aircraft parts, the UNSPSC catalogue standard for all other parts and services categories as well as ANSI X12 and UNEDIFACT for EDI. TWO developed a migration plan to gradually transfer its EDI transactions to XML based on the e-Marketplace standard (to enable for example smaller suppliers to adopt electronic process flows), which will require more additional assets and resources. This also applies to the integration of back-end systems. Although the e-Marketplace offers middleware solutions to decrease transaction delivery integration issues, harmonisation of systems is still work in progress. As TWO operates in a highly regulated industry where product flows are traceable, not just down to part numbers but also lot numbers, integration is a crucial issue. The existence of diverse procurement systems among the airlines participating in the e-Marketplace further complicates the technological challenge posed by creating and managing the 33 airlines' purchases and inventories in electronic form.

TWO also has concerns about security. For instance, members of the e-Marketplace often post their passwords on bulletin boards in their offices. TWO is concerned that if an unscrupulous competitor saw and copied down a password, they could log in to the e-Marketplace system as that buyer and see the catalogue prices and RFP bids.

8.3.4. Performance Indicators

Nonetheless, TWO could achieve part of its outlined procurement goals: So far, approximately 40% of purchase orders are performed online on the e-Marketplace and the supply base has been consolidated from 14,000 to 7,000 suppliers, on its way to the goal of 2,000. However, TWO stated that an accurate ROI from the use of its B2B e-Marketplace cannot yet be estimated. The e-Marketplaces charges (which are based on an annual membership fee, a transmission fee and additional fees for other services offered) are clearly defined and measurable. This also applies to the e-RFQs and reverse auctions. TWO has experienced there immediate net savings of 10% to 15% and a positive ROI on its highly configurable purchases, that have a rather large expenditure.

TWO administers about 80,000 invoices in one month. Many of them are very low value orders. The calculation of average costs for the processing and handling of each single invoice is rather difficult. This is partly because of the ample disparity during the examination and approval of each invoice. As an example, a significant amount of time is usually devoted to the processing of an invoice for expensive components and spare parts that are important to the safety of the airline. In return, orders for simple commodity goods that are usually used in big quantities on every flight, such as plastic and paper bags, small snacks, etc., get approved and processed comparatively quickly.

The implementation of e-Marketplace based procurement has also only a limited effect to counteract adverse factors such as the increase in fuel prices and wages and the decrease in premium business passengers.

"There are certain procurement areas such as jet fuel where we are most probably never going to achieve significant savings. They are not even reaching the five percent mark since it is already a very automated process and procurement of fuel is of a very long-term nature."

As the investment in the e-Marketplace is, however, regarded as a more long-term initiative, a case study interviewee pointed out the importance of having support from all the way up to the top management:

"The support of the top management is absolutely vital - especially at a time where so much is focused on reducing costs."

"You need a lot of patience, ambition and well-trained, open-minded purchasing staff to introduce and build up e-Marketplace supported procurement."

Getting staff to use the new processes was not an easy task at TWO. Many of the purchasing staff were used to long established relationships with suppliers. Also, buyers feared their job loss due to process consolidations. Therefore, courses were organised to get staff trained on how to use the newly established procurement tools and processes. The creation of training programmes was to ensure that staff understands the purpose of the e-Marketplace and how to use it (e.g. for what goods and services, with which suppliers, to what value of purchase).

"We have established clear procurement guidelines and policies. Every buyer knows precisely what he or she is approved to procure, what the individual authorisation level is, and typically which suppliers every buyer is allowed and supposed to use. These conditions are clearly stipulated in each employment contract."

TWO also introduced certain punitive actions in case staff was not following the new processes. First offenders receive an e-mail or letter, copied to their team leaders, aiming to describe the processes in detail and outlining in which respect they are not making use of it. For second offenders, TWO might be considering to withdraw the buyer's power to purchase on behalf of the airline, deny a certain amount of the buyer's bonus, or fine the team's spending budget by 10,000 euros.

While training is one challenge, integration is another. Data is often duplicated, but shared only to some extent. The issues around integration and standardisation are of central importance to TWO.

This also applies to supplier integration. Although the e-Marketplace claims to be neutral to buyers and suppliers, some suppliers are sceptical about this, as the e-Marketplace is owned by a consortium of airlines. Nor is participation in the e-Marketplace cost free for suppliers.

Overall, TWO is satisfied with the progress made, despite these drawbacks, but recognises that more resources and efforts are necessary in future.

"It took us more than four years to subsequently from initial elaboration to finally integrating the e-Marketplace. It got together very slowly and it still takes some time to figure out some particular systems' matters and new developments."

According to TWO, it needs to devote further efforts to integrate the e-Marketplace for more stringent supply chain co-ordination and standardisation, which still remains one of the most urgent challenges and goals for the future of TWO in particular and the aviation industry in general.

8.4. Concluding Remarks for Case Studies

According to Yin (1984), the distinctive need for case studies in research arises out of the desire to understand complex social phenomena and evolutions. Therefore, case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context. A case study approach is also particularly appropriate in new topic areas (Yin, 1994). These conditions applied for the study and therefore explorative case studies were selected. The case studies proved to be a valuable addition to the quantitative analysis. Their validity rests on their providing "flesh" to the statistical picture by illustrating real life experiences. Case studies can provide "thick descriptions" (Stake, 1995) enabling researchers to gather useful insights into the rich social processes that underline technology development and to explain the way in which actors' choice were made and the conditions under which a particular outcome was produced (Russell and Williams, 2002). Before the findings and the interlinkages between case studies and surveys will be discussed in the following chapter, there are some emergent themes worth consideration that evolved from the case studies.

The cases studies revealed that in order to progress with an e-Procurement initiative, top management support or stewardship is required. For example, airline ONE did not implemenet an e-Marketplace partly due to its management's scepticism if e-Marketplaces would be able to deliver the required services and work in a complex environment. There is evidence in the case studies that investments in e-Procurement are tending to automate, rather than re-design existing processes (Barnes et al., 2003). This is partly because existing legacy systems require integration with e-Procurement initiatives, which represents a significant barrier for both airlines ONE and TWO.

A lack of supplier participation is another emergent theme. The case studies reveal that there need to be joint benefits for airlines and suppliers to implement e-Procurement initiatives and which explains why there is increased interest in supplier benefit issues (Karpinski, 2001). A common concern among both airlines is also the cost associated with e-Procurement. A significant amount of investment is needed before an airline can integrate more sophisticated e-Procurement initiatives. It is therefore understandable that there is some management reluctance to invest when there is no guarantee for return of investment.

At the same time, however, the case study results suggest that there is a lack of formal performance measurement in e-Procurement. Relatively little attention is paid to the performance evaluation of e-Procurement investment or operations. Given the cost of some of the investments made, this appears surprising. The case study results suggest that airlines are only in the starting process of implementing formal performance measures and currently use them more on an ad hoc basis. While they broadly agree that e-Procurement is important for the future scope and direction of their operations, there also seems to be little consensus as to which e-Procurement and e-Marketplace performance measures are effective. One of the emergent themes for further research could be to attempt to determine what practices under what circumstances are more likely to lead to competitive advantage in e-Procurement. In particular, it would be of value to study the impact that the adoption of different approaches to quality improvement might have on e-Procurement performance. This would also raise the importance of continuous training of staff that was continually emphasised by both airlines ONE and TWO.

Based on the evidence, Table 18 illustrates a cross-case analysis, by which the case study findings and the interlinkages between case studies and surveys will be discussed in the following chapter.

Case	Motivation	Implementation Challenges	Competitive Advantage
Airline ONE: Non-Adopter of E-Marketplace. **Adopter of E-Procurement Software.**	Centralised procurement among airline group. High level of security and protection of intellectual property. One integrated software instead of single proprietary systems. Avoidance of percentage-based transaction fees. High level of e-Marketplace consolidation.	Classification and standardisation process of products and services. Technical complexity and integration of legacy systems / development of uniform software platforms. Strict quality and safety requirements, e.g. FAI, PFO. Catalogue integration of suppliers. Top management support. End-user support and training.	Lower cost by higher purchase volume. Consolidation of expenditure and increased transparency of supply base. Management information to proactively manage supply base. Lower purchase order and process costs.
Airline TWO: Adopter of E-Marketplace.	Centralised procurement across all business units. Involvement in airline alliance. Internal customer service requirements. Focus on core processes instead of disparate e-Procurement functions.	Multi-airline inventory sharing. Part number standardisation. Technical complexitity and integration of legacy systems. Security concerns. Integration of higher value products. Supplier integration. Top management support. End-user support and training.	Cost reduction by automation of purchase order processes. Improved accuracy of data. Improved transparency and reduction of 'bullwhip effects'. More control over purchasing spend. Supplier rationalisation.

Table 18: Cross-Case Comparison

IX. DISCUSSION OF FINDINGS

9.1. Synthesis between Survey and Case Study Findings

9.1.1. Introduction

The results and the triangulation between the survey and case study findings are discussed in the sections below. The simplified model with a summary of the results of the hypotheses is presented in Figure 120, whereas the detailed contingency model is illustrated in Figure 121.

This section seeks to identify the contribution of the findings to theory by synthesising the literature review and the findings of the surveys and case studies. For consistency reasons, the discussion is similarly structured as the results chapter of the airline survey and as follows: First, the individual adoption drivers are outlined and debated. Next, the performance indicators from e-Marketplace adoption are reviewed and future challenges to e-Marketplace adoption and performance presented. This chapter will also discuss the managerial implications, the original contribution to research, limitations and future research requirements.

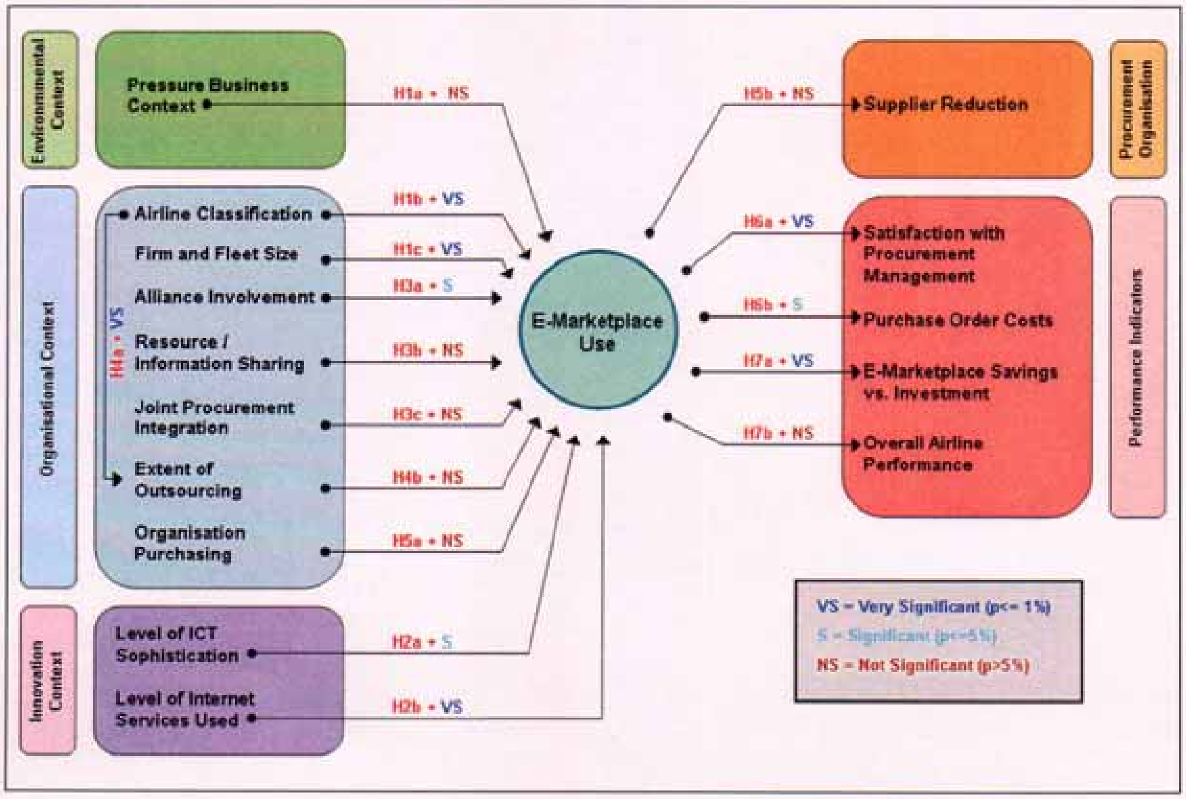

Figure 120: Tested Hypotheses Model

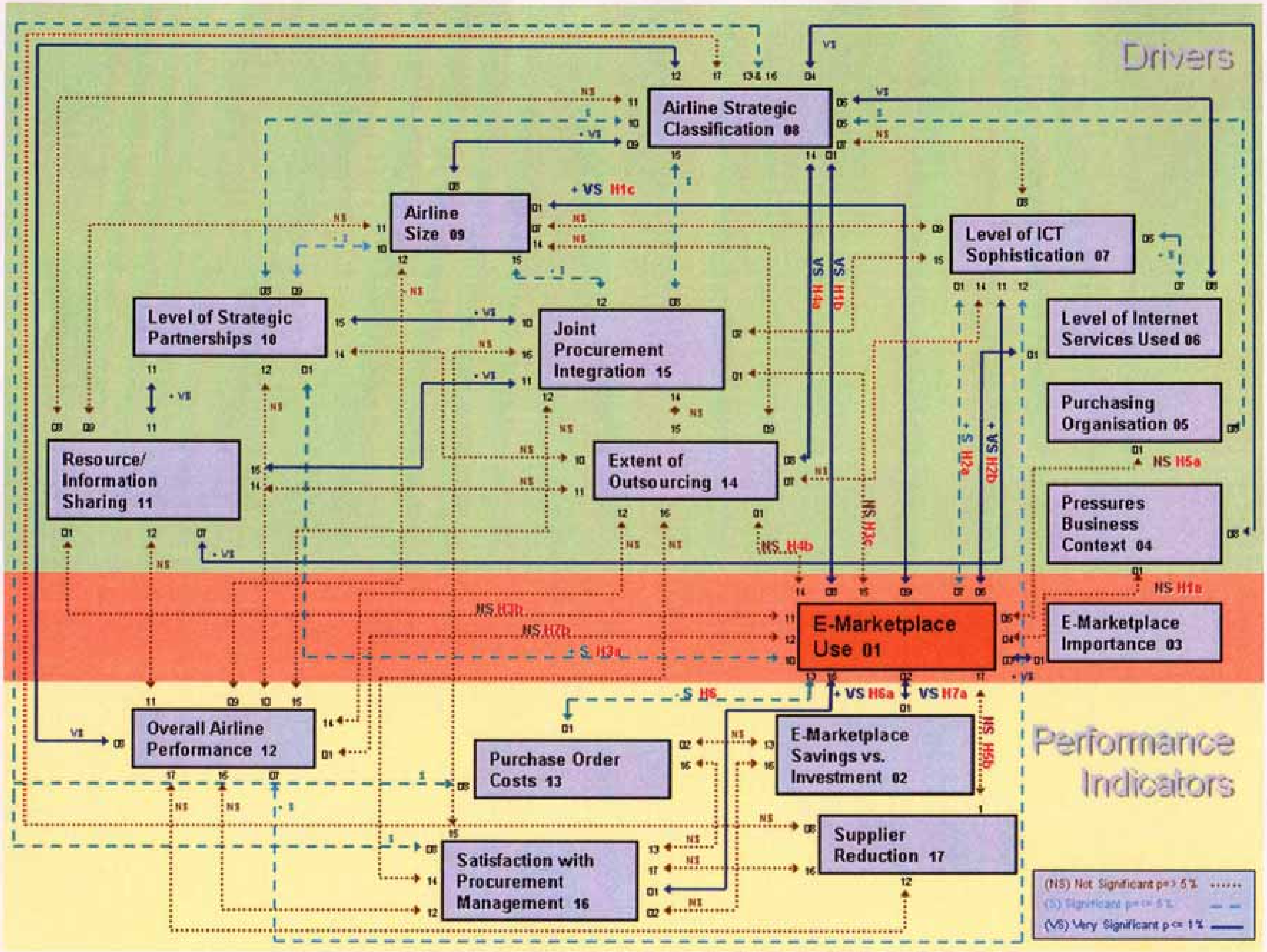

Figure 121: Tested Contingency Model

9.1.2. E-Marketplace Adoption and Airline Strategy

E-Marketplaces have gained momentum in the airline industry, following the typical S-curve pattern of technology adoption. 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. E-Marketplaces have secured a relatively high degree of diffusion and have reached late majority adopters (according to Roger's classification in 1995), with 65% of airlines already having used an e-Marketplace of some sort and 25% being financially involved in terms of ownership. This represents a substantial increase in the adoption of this innovation compared to the survey results of Airline Business in 2000 where 30% of airlines had created B2B e-Commerce applications with suppliers. However, most airlines already indicated in this aforementioned survey in 2000 that they would substantially increase the take-up of e-Business applications.

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% (Hypothesis H1b: highly significant with 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 attributable to the argument that low-cost airlines tend to avoid all unnecessary risks, try to be as flexible as possible and tend to outsource as much as possible except their core business activities. Charter airlines show the least interest in using an e-Marketplace. This may be explained by the fact that many 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. In any case, seats are mostly filled with their own package holiday passengers. Thus, the need to reduce costs and facilitate processes might not be as transparent.

Interestingly, more than 50% of airlines are following a "portfolio" approach, and are active in as many as four or five e-Marketplaces at once. Many airlines (11%) have made a major commitment (sometimes including taking equity) to a single e-Marketplace, and had then combined this with using further other 'neutral' e-Marketplaces that can add specialised services within a more narrow set of spend categories. The majority of e-Marketplaces were found to be neutral in the airline industry.

The e-Marketplace survey revealed that 75% of aviation e-Marketplaces are operating as vertical exchanges. However, a large number of aviation e-Marketplaces specialise in one specific commodity or product group, such as catering, ground support equipment or fuel, to name but a few. The results also show that there are very few aviation e-Marketplaces that have specialised on airline-to-airline transactions only. E-Marketplace members can there take advantage of e.g. inventory pooling, disposal of surplus stock or resolve AOGs through real-time stock visibility. Typically, however, e-Marketplaces offer both airline-to-airline and airline-to-supplier communications.

The results, however, also suggest that while e-Marketplace diffusion is quite high among airlines, many airlines still make only rudimentary use of them. These systems are mainly employed for surplus inventory or for rather low value purchases of spare parts or other MRO goods, while products and services with a very high degree of co-ordination effort with suppliers and a very low order frequency are typically not candidates to start e-Marketplace initiatives among airlines (e.g. aircraft, fuel). The latter product groups tend to be highly specialised and the supplier market is relatively small and oligopolistic.

The findings also suggest, according to Dewan and Kraemer (1998) that together with investment in information and communication technology, there is a need to ensure that organisations have the competence and resources to restructure themselves in order to elevate efficiency and effectiveness. As such, many traditional charter airlines may find it necessary to reassess their current organisational and technological infrastructures.

9.1.3. Competitive Pressures and E-Marketplace Adoption

An industry's competitive dynamics, and how a firm competes within it, has a great influence on the firm's strategic decisions (Porter, 1987). The need to develop and sustain a competitive advantage in the marketplace is what drives successful business strategies (Bradford and Florin, 2003). In recent years since the deregulation airlines are facing competitive pressure and low margins. For example, total airline industry loss in 2001 was almost $12 billion, far surpassing any of the losses during the early 1990s

Gulf War and recession period.[33] Even before the events of September 11, excess capacity on the North Atlantic had contributed to falling traffic and loads.

These conditions may drive airlines to initiate and adopt e-Marketplaces, as these initiatives can be critical for airlines to enhance competitive advantage. For example, e-Business applications can help firms improve market responsiveness and information transparency (Zhu, 2004), increase operational efficiencies (Zhu and Kraemer, 2002) or achieve customer lock-in (Shapiro and Varian, 1999).

The survey data confirms 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 tend 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 and more severe competition, 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 e-Marketplace adoption. According to Patterson et al. (2003), previous research has shown that higher levels of uncertainty relate positively with a greater need for changing technology and faster adoption rates (Ettlie, 1983). Demand uncertainty has also been found to be positively related to technology adoption (Robertson and Gatignon, 1986) as well as EDI adoption (Williams, 1994). Thus, firms facing above average environmental uncertainty are expected to have a greater incentive to adopt supply chain technology to improve information exchange and manage uncertainty between organisations and their task environment. Pressures from the business context can make it "mandatory" for organisations who want to survive to seek out opportunities by using e-Marketplaces.

However, results reveal that there is not a significant relationship between competitive pressures and e-Marketplace adoption (Hypothesis H1a: $p=85.1\%$, $F=0.02$). This finding is contrary to Joo and Kim (2004) who claim that competitive pressure seems to

[33] http://www.boeing.com/commercial/cmo/3_1_airline.html

be the key in determining the overall level of e-Marketplace adoption because firms would be more inclined to maintain their own competitive position, as more and more competitors become e-Marketplace capable. It can be argued that the decision to implement an e-Marketplace might not be 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. For example, the case studies also suggest that ONE and TWO experience strong competitive pressures, but still have different approaches to e-Procurement implementation. While ONE implemented some e-Procurement software and avoided e-Marketplace adoption so far, TWO has participated in a consortia-led e-Marketplace at an early stage.

On the other hand, the findings do also not suggest that competitive pressure detracts airlines from learning how to use e-Marketplaces. Case study TWO in particular showed that new technologies such as e-Marketplaces become effective only through gradual, careful, and sustained assimilation processes that provide organisations with the managerial knowledge and skills necessary to implement the technology efficiently. Adoption needs sufficient time to infuse the innovation into the organisation (see case TWO).

The results demonstrate that competitive pressure has neither a positive nor negative effect on e-Marketplace adoption among airlines. A reason may be that airlines have the choice of a variety of information and communication technologies and e-Procurement alternatives. Case ONE suggests that that it is much more the perceived instability of the electronic environment, i.e. the large scale consolidation of e-Marketplaces and their competitive pressures, that hinders the further progress of e-Marketplace adoption.

9.1.4. Airline Size and E-Marketplace Adoption

According to Carneiro (2006), it is important to understand the organisational context relative to the diffusion of ICT innovations. Fariselli et al. (1999) argue that the literature on e-Marketplaces does not differentiate between size of firm, but rather takes a 'one size fits all' approach. It is evident that the use of e-Marketplaces clearly increases with the total number of an airline's employees (Hypothesis H1c: $p=<0.2\%$; $F=10.3$), the number of employees in purchasing (Hypothesis H1c: $p=<0.1\%$; $F=14.4$) and the fleet size (Hypothesis H1c: $p=<0.9\%$; $F=7.2$). Given that airlines around the globe participated in the survey, this finding does not appear to be localised or country-specific. This result is consistent with prior findings in the literature and confirms Joo and Kim (2004) and Hadaya (2004) that firm size was found to have a significant positive relationship with the adoption level of e-Marketplaces.

Bharati and Chaudhury (2006) explored as well that firm size has a significant impact on what technologies are employed and that large and medium firms are ahead of small and micro firms in terms of supply chain management and e-Procurement employment.

A number of studies acknowledge organisation size to be one of the factors leading to organisational innovativeness (e.g. Lehmann, 1985; Matlay, 2000; Riquelme, 2002; Rogers, 1995; Zhu et al., 2003). Firm size was also found in the airline survey to be a driver for EDI adoption (also confirmed by Chwelos et al., 2001). Larger firms tend to adopt more sophisticated systems and very often are more likely to 'computerise' far more of their business than smaller SMEs (Culkin and Smith, 2000). However, this was not confirmed in this study. Small airlines demonstrated a similar level of ICT competence as larger airlines.

It may be argued, however, that smaller airlines lack adequate capital to undertake technical enhancements (in line with Raymond, 2001) or can suffer from inadequate organisational planning (Tetteh and Burn, 2001). Larger airlines may also tend to adopt e-Marketplaces more easily due to greater economies of scale and scope. For instance, they are better positioned to reap greater procurement cost savings from e-Marketplaces due to their higher procurement volumes. Larger firms are more willing and capable of taking the risk of adopting new technologies (Brigham and Smith, 1967; Palvia and Chervany, 1995; Walker, 1975), while many smaller airlines still adopt a wait-and-see approach to e-Marketplaces to date.

In general, large firms possess more knowledge and slack resources, and thus enjoy advantages in generating innovative ideas and making the investments necessary for innovation adoption (Zhu et al., 2003). Rogers (1995) calls these traits resource advantages, while smaller airlines can suffer from 'resource poverty' (Welsh and White, 1981). As the use of e-Marketplaces requires commitment of financial, technical, and managerial resources, larger airlines are more likely to adopt e-Marketplaces, given their resource advantages.

The European Commission (2004) argues that it is the implementation costs (which were also confirmed that they can be quite substantial particularly for smaller airlines) that are still a barrier for many e-Business initiatives. Although e-Marketplaces are an opportunity to improve business performance, it often involves changes to the work routines that can easily lead to conflicts (see case studies). The implementation of new e-Marketplace technologies and work processes often requires extensive training and motivation measures. This is costly, time-consuming, and often seen as an opportunity cost to doing "productive work" (European Commission, 2004).

On the other hand, large firms may embed structural inertia, a negative factor for innovation routinisation (Nord and Tucker, 1987). In general, as observed in both case studies, large airlines tend to have fragmented legacy information systems, which can increase the complexity and costs of systems adaptation, but can also translate into more intensive and advanced electronic business practices. Moreover, in large airlines, changes in structures and processes can be further complicated by the entrenched organisational structure and hierarchical decision making. These factors would translate into structural inertia that may retard routinisation, but the findings do not suggest that they would have an impact on e-Marketplace adoption.

Overall, there is a significant divide between large and small airlines, the latter often adhering to more traditional forms of purchasing. The dynamic and immature environment of e-Marketplaces is complex and still bewildering for many companies, and the findings show that there is still some reluctance to participate on the part of both smaller airlines. While not specifically covered in this study, the case study findings also suggest that this also applies to smaller suppliers.

Smaller firms therefore still need to understand e-Marketplace opportunities to develop informed strategies and improve operations. For example, the availability and falling costs of personal computers were identified to have had a major effect on the ability of small to medium sized firms to compete in electronic commerce (Stockdale and Standing, 2004).

9.1.5. Technological Context

Firms with a strong overall ICT sophistication are able to (1) integrate the IT and business planning processes more effectively (2) conceive of and develop reliable and cost effective applications that support the business needs of the firm faster than the competition (3) communicate and work with business units more effectively (4) anticipate future business needs of the firm and innovate valuable new product features before competitors (Bharadwaj, 2000).

A significant relationship between an airline's overall ICT sophistication and e-Marketplace implementation was found (Hypothesis H2a: $p=3.5\%$; $F=4.51$). Technology competence appears to facilitate e-Marketplace adoption due to technological complementarities. This finding can be explained in such a way that airlines with high levels of ICT sophistication are less likely to feel intimidated by technology and are more likely to have access to the technological and managerial resources necessary to adopt new technologies.

According to Kallioranta and Vlosky (2004), the resource-based view of the firm suggests that the most important aspect in ICT implementation is the process of organising and managing ICT within the firm. The ICT managerial skills include management's ability to 1) understand and appreciate the business needs and needs of other functional managers, suppliers, and customers, 2) communication and working skills with other functional managers, suppliers, and customers in developing appropriate ICT applications, 3) coordinate ICT activities in ways that support other functions, suppliers, and customers, 4) anticipate the future ICT needs of other functions, suppliers, and customers (Mata et al., 1995).

Other empirical research in IOS confirms that firms with higher levels of technical competence or more recent infrastructure investments are more likely to adopt new ICT (e.g. Armstrong and Sambamurthy, 1999; Byrd, 2001; Forman and Gron, 2005) and that the level of ICT skill within a firm is a strong determinant of the ongoing success with that ICT (Yap et al., 1992; MacGregor et al, 1998). However, Zhu et. al. (2005) have also shown that if such investments are specific to prior generations of ICT, they may in fact slow adoption.

Both case studies demonstrated that there needs to be institutional and legislative support and social acceptance and trust for e-Marketplace adoption. Colombo and Mosconi (1995) refer to this as cumulative learning-by-using effects, which reflect the stock of knowledge, capabilities, technical and managerial skills that a firm has been developing through the use of previous technologies related to the new technology under scrutiny. The existence of such effects apparently has an impact on the e-Marketplace adoption pattern of airlines: As far as complementarities prevail, the marginal benefits from adoption of a technology are greater for airlines which have a high level of ICT sophistication. This seems to result in a more rapid diffusion of e-Marketplaces among airlines that are already experienced users of related ICT.

In other terms, the 'progress' of a firm upon what Koellinger and Schade (2003) call the technological trajectory of e-Marketplaces is likely to retain some cumulative features: the probability of advances is related to the position of an airline vis-à-vis the existing technological frontier. The closer a firm is to the technological frontier, the more likely it will make future advances upon the technological trajectory and adopt e-Marketplaces.

Case TWO also revealed that managerial ICT knowledge and sophistication is an enabler of e-Marketplace adoption. For an airline to implement e-Marketplaces, it is important that the senior leadership and functional management responsible for ICT have a good understanding and the potential strategic impact of e-Marketplaces. This coincides with resource-based view of the firm which suggests that the most important aspect in ICT implementation is the process of organising and managing ICT within the firm (Barney et al., 1995).

Moreover, there was also a very significant positive relationship between the adoption of e-Marketplaces and the number of Internet services used (Hypothesis H2b: p=0.26%; F=9.75). This finding also confirms technology competence as an e-Marketplace adoption driver for airlines. The use of other Internet service technologies implies know-how of managers and employees to implement and use Internet technologies, and a firm strategy that is compatible with e-Procurement innovations. Consequently, airlines that are already advanced users of some Internet services were found to be more likely to adopt.

The range of provided e-Marketplaces services were found to range from very broad to very specialised. The case studies also reveal that that it is specifically these types of services that may influence the final adoption decision according to the requirements of the individual airline. However, many airlines still only apply single e-Marketplace services that mainly focus on transaction support (e.g. 86% of e-Marketplace adopters pursue online tracking and tracing, 76% take advantage order process checking), while strategic sourcing services are less integrated (e.g. only 46% of adopters use demand aggregation on the e-Marketplaces). The proportion of strategic sourcing services conducted on e-Marketplaces is rather small compared to transaction-based supply chain activities. The inclusion of the end-user (requester) in the procurement process via an electronic catalogue is feasible via an e-Marketplace or e-Procurement software. While strategic sourcing services effectively stay within the airline purchasing department, electronic requisitioning affects the whole airline, allowing end-users to purchase their own products and services on a self-service basis. From the case study findings it seems reasonable to argue that airlines would start implementing transaction support services first and then gradually adopt the strategic sourcing capabilities of e-Marketplaces.

These results coincide with Eng (2004) who researched usage patterns of e-Marketplace customers. He stated that the most popular use of e-Marketplaces is in auctions and reverse auctions, followed by processing as regards to online ordering, payment, non-technical negotiations, and customer or supplier information management. Eng (2004) further notes that e-Marketplaces have also been used for listing products or making purchases from catalogues, searching for buyers or sellers, and an improved online communications and exchanges of information. These functions are procurement-related activities such as checking product availability and exchanging information on product specification. However, Eng (2004) notes that technical exchange and development is the least subscribed function of e-Marketplaces. Similarly, interfirm relationship management has a low percentage of usage, which is reflected in this study by the extent to which e-Marketplaces are used for collaborative projects.

Findings from the survey also suggest that e-Marketplaces typically started with basic and relatively simple information and transaction services, and are only now in the process of adding more complex value-added service offerings (also confirmed by Dai and Kauffman, 2001; Hope et al., 2001). Value-added services and a comprehensive service offering were also widely considered by airlines to be critical for the success of e-Marketplaces. Due to this demand, many e-Marketplaces plan to add them to their service offerings in future. 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. Bakos (1991) further confirms that e-Marketplaces have to use value-add facilities to enhance their attractiveness in pursuit of the competitive advantage necessary to survive. With regard to service breadth, Laster and Bodily (2004) also draw upon the IOE argument that sustainable advantage is due, in part, to economies of scope (Ghemawat, 1986; Panzar, 1992).

Overall, the empirical results suggest that the positive externalities of related ICT technologies on one another retain some cumulative features: the probability of adopting e-Marketplaces generally increases with the level of ICT sophistication and the number of Internet services used. Thus, if a company is relatively close to the technological frontier, its probability of adoption increases and vice versa.

9.1.6. Strategic Partnerships and Joint Procurement

Lenz, Zimmermann and Heitmann (2002) argue that soft aspects like partnership come more and more into attention when making the decision to use an e-Marketplace, as the unit of competition has evolved from independent firms to strategic value chains and value networks. The resource-based theory and the positioning stream have not addressed issues where a focal firm has not as such established critical resources and capabilities but in co-operation with other firms. Although the *"ability to integrate efforts of different actors"* (Grant, 1996) and the relevance of *"alliance and acquisition routines that bring new resources into the firm from external sources"* (Eisenhardt and Martin, 2000) have been taken up in the resource-based perspective, complex strategic partnerships remain fairly unarticulated.

This was particularly interesting to research in the airline industry, where formerly rivals in a highly regulated industry have become opportunistic seekers of co-operation (Carswell and Bretherton, 2000). Forms of co-operation include activities such as sub-contracting, code-sharing, franchising or the formation of global marketing networks. The tendency has been to strive for a global presence (Dana and Vignali, 1999), as the majority of airlines are interested in extending their network beyond the markets they currently serve (Iatrou and Alamdari, 2005). Strategic alliance groupings can provide these benefits, but tend to avoid regulatory restrictions on market access, ownership and control. They have therefore become increasingly important elements in an airline's portfolio of strategies and are viewed as a source of competitive advantage in the airline industry (Suen, 2002).

The survey results suggest that airlines involved in strategic alliances or other partnerships tend to exhibit greater levels of use of B2B e-Marketplaces (Hypothesis H3a: $p=3.7\%$; $F=4.37$). E-Marketplaces can play a major role in managing rather complex relationships, in planning joint activities and in enhancing efficiencies in the communication process. The e-Marketplace survey results also suggest that particularly large airlines, which are centred around a common alliance, have invested in e-Marketplaces. Apparently, these airlines use their network relationships and capital to form for example industry consortia e-Marketplaces.

Surprisingly, the extent of resource and information sharing is not related to e-Marketplace adoption (Hypothesis H3b: $p=80.2\%$; $F=0.05$). One would expect that e-Marketplaces can provide access to new resources, channels, and information that would otherwise not be available and thus create opportunities for improved decision-making and for expanded business opportunities. Apparently, the involvement in strategic alliances and e-Marketplaces alone does not necessarily lead to a higher level of resource and information sharing.

E-Marketplaces as new forms of collaborative commerce imply not only more open relationships, but also far richer modes of interaction between company resources and capabilities. However, as observed in both case studies, airlines can be reluctant to share information about their internal operations, especially with competitors. For instance, it takes time to develop trust for sharing strategic information, which is more likely to occur through face-to-face contact. Eng (2004) therefore argues that, since the supply chain is a network of multiple businesses and relationships, the ultimate success of firms will depend on management's ability to integrate the company's intricate network of business relationships. So while airlines may well pursue strategic alliances, the difficulty is still to get a number of companies to really work together and share information.

Moreover, airlines involved in e-Marketplaces do not take advantage of joint procurement tools to a greater extent than non-adopters of e-Marketplaces (Hypothesis H3c: $p=75.3\%$; $F=0.10$). 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 these 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 largely integrated. The case studies again reveal that airlines can be very reluctant to share information for joint purchasing activities due to reasons such as proprietary data (e.g. case ONE), lack of standardisation or potential anti-trust issues (as only a combined market share of below 15% on both the purchasing and the selling market would not breach Article 81 ECT).

The results suggest that the application of joint purchasing on e-Marketplaces is still in the early adoption stage. Some airlines are only beginning to reap the benefits that stem from joint purchasing as well as creating standardisation of product requirements and specifications common to their partners. Low-fare airlines indicate the lowest level of joint purchasing activities, as they are less involved in strategic alliances than other airlines and operate typically one type of aircraft, where additional economies of scale are already limited.

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 and 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, 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. The survey research has also shown that joint purchasing for fuel, which represents a large proportion of an airline's operating costs, is hardly used. Airlines have little influence over the price of fuel, as it is being governed more by the member states of OPEC and the cost of crude oil.

McPherson (1998) confirms that the same situation applies to the joint purchase of aircraft fittings. Substantial savings could be made on the bulk purchase of items such as in-flight entertainment systems and seat fittings. However, such items serve to form brand differentiation in the mind of the passenger. If all the partners in an alliance were to have the same fittings and equipment, then the individuality of each airline would effectively disappear.

Substantial discounts may be, however, 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. For example, for joint purchasing of aircraft there is a high level of commonality exhibited by most modem aircraft, while there are also some differences in specifications and equipments preferred by each carrier. By agreeing to purchase the same type of aircraft, airlines could also benefit from combining their requirement for spare parts. This would result in further savings, not only through being able to purchase fewer items, but also through lower storage and holding costs.

Therefore, McPherson (1998) argues after analysing and assessing the potential purchasing power of airline alliances that significant economies of scale would be available should the policy of joint purchasing of materials be adopted by an airline alliance. The survey results of this study also confirm a good potential for joint purchasing for maintenance services and spares and repairs in particular.

Despite this potential, these economies of scale by joint purchasing on e-Marketplaces are thus currently not largely exploited by airlines. Many airlines still prefer to keep their flexibility and are still reluctant to become involved in joint purchasing on e-Marketplaces that would require co-operation and the relinquishment of control over the selection and purchase of materials.

9.1.7. Level of Outsourcing

Outsourcing is predominantly employed in maintenance related areas in the airline industry. The level of outsourcing is highly dependent on an airline's strategic orientation (Hypothesis H4a: $p=<0.1\%$; $F=6.11$). Low-cost airlines show a much higher extent of outsourcing (X=3.17) than their full service (X=2.31), charter (X=2.18) and regional airlines (X=2.54) counterparts. A reason for this may be that airlines with a high number and diverse kind of fleet may not fully benefit from outsourcing. In quite a few 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 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%.

While companies increasingly outsource activities to suppliers in order to specialise and to focus on their core competences and thereby become more effective and efficient (Gupta and Zhender, 1994), the survey data suggests no significant dependence between the extent of outsourcing and the adoption of e-Marketplaces (Hypothesis H4b: p=70.7%; F=0.14).

It was expected from the literature review that the more airlines outsource, the more they would use e-Marketplaces to explore new sourcing opportunities or find new suppliers. However, outsourcing cannot be regarded as a process driver or as a side-effect of e-Marketplace adoption. An explanation for this finding can be, as observed particularly in case ONE, that airlines can have concerns such as the potential damage to long-term relationships with suppliers or the inherent unsuitability of many airline products for the application of e-Marketplaces due to their complexity.

When large amounts of outsourcing and uncertain environments are involved, strategic sourcing entails more complex tasks, such as detailed analysis and long-term contingency planning. As e-Marketplaces are relatively new and adopted only to a limited extent to date, they are not yet deeply embedded in most airlines' procurement processes. This may help explain why there was no positive relationship between e-Marketplace adoption and the level of outsourcing among airlines. Sambamurthy et al. (2002) confirm that many buyer-supplier transactions, particularly those involving non-contractible factors, may not suit the arms length nature of web-based relationships.

9.1.8. Procurement Organisation and Supplier Strategy

E-Procurement enables companies to decentralise operational procurement processes and centralise strategic procurement processes as a result of the higher supply chain transparency provided by e-Procurement systems (Puschmann and Alt, 2005). The adoption of e-Marketplaces provides airlines with the opportunity to organise their procurement organisation into decentralised operating units, which can be centrally co-ordinated, in order to take advantage of the benefits from both approaches.

Ramanathan (2004) notes that an organisation is able to accumulate its purchase and negotiate volume discounts and economies of scale involving professional expertise when the decision authority is centralised. However, the central authority can take a good decision only when it is well aware of the end user's requirements. Gurbaxani and Whang (1991) term the cost of informing the central authority and the lack of it as decision information costs. Decision information costs tend to be high when the purchasing authority is centralised and low when decentralised. In the latter case end users when given the responsibility can act in a self serving manner instead of serving the organisation, the risk of which is termed as the agency costs. This can result in more scope for employees to take individual responsibility and develop a 'service' mentality.

The use of e-Marketplaces for automating procurement procedures alters the arguments for centralisation and decentralisation. E-Marketplaces can reduce the decision information costs. End users can inform their requirements via a workflow system. The central purchasing authority can then use business intelligence tools for learning about the needs of the organisation and thereby is in a position to negotiate better frame agreements and take into account the detailed requirements of end users. As observed in the case studies, end users can access negotiated frame agreements posted on e-Marketplaces or on other e-Procurement catalogue systems.

Given therefore the variety of e-Procurement systems (case ONE), the hypothesis that e-Marketplace implementation is dependent on an airline's procurement organisation strategy could not be upheld. In general, decentralisation has been a point of contention as researchers have found both positive and negative relationships between decentralisation and technology adoption (Patterson et al., 2003). Germain et al. (1994) found decentralisation of technology decisions does not significantly relate to overall technology adoption but may influence decisions regarding integrative technologies. Williams et al. (1998) indicate that a centralised organisational structure is negatively related, although not significantly, to certain dimensions of EDI participation. Grover and Goslar (1993) found decentralisation of decision-making was significantly related to usage of telecommunications technologies.

However, no significant differences can be found in this e-Marketplace study in terms of centralisation (Hypothesis H5a: $p= 41.7\%$; $F= 0.68$) or decentralisation (Hypothesis H5a: $p=42.3\%$; $F=0.66$). In the sample, 45% operated a centralised purchasing operation, followed by a decentralised but centrally co-ordinated approach (38%). Only 17% operated in a totally decentralised purchasing environment. Any attempt for further centralisation requires technical standardisation and the encouragement of good transparency provisions such as efficient recording and reporting of procurement contracts / transactions and effective management controls (case ONE and TWO).

The line of thought developed from the literature review was also that an increased purchasing power of an airline as a result of a decentralised but centrally co-ordinated approach would allow the supply base to be streamlined. The survey results confirm that airlines tend to reduce their number of suppliers. This may be the consequence of several phenomena: the movement from multiple sourcing to single sourcing over a wide range of systems, and the reduction in the number of suppliers involved in multiple sourcing. Mostly, power systems and avionics are typically single sourced, whereas commodities and standard parts tend to be more multiple sourced in the airline industry.

The adoption of e-Marketplaces is, however, not related to a decrease ($p=86.0\%$; $F=0.02$) or increase (Hypothesis H5b: $p=82.1\%$; $F=0.04$) in the number of suppliers. This may be also explained by the existence of other e-Procurement systems that airlines take advantage of (e.g. case ONE).

Moreover, to ensure the quality necessary and required by many aviation authorities, the aviation and aerospace industry differs from other business sectors, as there are very high barriers to entry due to certification requirements for airlines and suppliers. Products are typically manufactured in low volume with unique design modification and option configurations. High value products are mostly sold under a requirement for full life support with in-service modifications and upgrades and vendors almost invariably supply initial maintenance packages including both spares and support. At the top of the value chain the industry has become highly consolidated with almost no competition (Chan, 2000). Thus, airlines are unlikely to decrease or increase the number of suppliers in any high value product groups. However, while it could be confirmed that airlines have reduced their overall number of suppliers, this is not an explanatory factor for e-Marketplace adoption. E-Marketplaces can help reduce the number of suppliers by generating a higher transparency of purchases, but the findings show at the same time that they can also increase the supplier number due to more transparency and selection opportunities of previously unknown suppliers to airlines.

9.1.9. Impact on Performance Indicators and Competitive Advantage

A firm's competitive advantage as a result of ICT implementation can be reflected in marketplace performance (e.g. market share, sales growth, customer satisfaction and loyalty) and financial performance (e.g. ROI and shareholder wealth) (Varadarajan and Yadav, 2002; Bharadwaj et al., 1993). As Francis (2005) notes, performance indicators have become increasingly important in the airline industry as managers look for ways to cope with the complexities of their environment. While it is widely held as shown in the literature review that e-Business is a source of strategic advantage, it is not clear exactly where that advantage comes from, or how valuable it is. This question of the value of ICT was expressed most strongly in the productivity paradox literature (Brynjolfsson, 1993; Brynjolfsson and Hitt, 1998), which tried to answer the criticism that there were no observable effects of ICT on productivity at the macroeconomic level. One of the outcomes of this stream of literature was that questions of ICT impacts are best addressed at the level of the individual firm (Brynjolfsson and Hitt, 1998). This study has contributed to the literature on performance indicators of e-Marketplaces at the inidividual firm level, since it has generated new insights on how performance can be measured. It followed Ramaswamy recommendation (1992) to use operational indicators since as they are defined at the operational level where competitive advantage is built.

Performance Indicators

Overall, B2B e-Marketplace implementation is positively related to the overall satisfaction and performance of an airline's procurement management and practices

(Hypothesis H6a: $p=0.7\%$; $F=7.58$). According to the European Commission (2004), efficiency of internal processes is one of the main drivers for e-business adoption in all industry sectors. For example, e-Marketplaces can reduce search costs, as the worldwide market for aviation parts and products is highly fragmented and parts are supplied by many types of suppliers, including airlines, OEMs, numerous distributors, fixed base operators, traders and brokers.

Materials, spares and repairs and office supplies 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 also 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.

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. The former includes for example the proactive management of key data, and higher-quality purchasing decisions within airlines, the latter for instance process, products and inventory savings.

Case study TWO reveals that benefits can occur in terms of both efficiency and effectiveness with e-Marketplaces, e.g. shorter order cycle times, higher compliance with organisational contracts, supply base optimisation or purchasing process standardisation. Airlines indicated that main benefits would be procurement cost reduction (cited by 37% of respondents), increased procurement efficiency (34%), a higher market transparency (17%) and several service related aspects (12%).

The survey data confirms that the use of e-Marketplaces has a positive effect on the reduction of purchase order cost (Hypothesis H6b: p=4.8%; F= 4.0). E-Marketplaces claim that airlines would have achieved gross savings of about 21% of their total procurement costs. The high standard deviation (15.98) suggests that the gross savings achieved are mainly in the region of 10-20%.

Introducing new e-Marketplace supported procurement processes can also bear considerable investment risks for airlines. For example, Clegg et al. (1997) found that 80-90 % of ICT investments in general do not meet their performance objectives mostly due to non-technical reasons.

The exact return on e-Marketplace investments can, however, be very difficult to measure for airlines and research participants were found to be reluctant to answer ROI questions in numerical details. A study of the accurate ROI for e-Marketplace implementation is extremely difficult to estimate and a very sensitive issue to industry. The case studies also revealed that airlines may be still in the early stages of their implementations, and therefore exact ROI calculations are hard to obtain.

Most respondents indicated, however, that the reduction achieved in purchasing process costs and product prices exceed the investment costs for the implementation and use of an e-Marketplace (Hypothesis H7a: Chi2=21.21, p=0.03%), and that those savings achieved occur slightly more in processing rather than product costs. Some respondents indicated that a return on investment was achievable in the long-term rather than in the near future.

E-Marketplace revenues represent a significant part of the implementation costs for airlines. It was observed from the surveys that the vast majority of e-Marketplaces rely on multiple sources of revenue. E-Marketplaces seem to have realised that they should take into account different customer types and segments. That is why they seem to have developed alternative billing strategies instead of solely relying on a single fee type.

The most common methods of income generation for e-Marketplaces were, however, found to be the monthly/yearly membership fee, followed by transaction related fees. The advantages of the membership fee are that it can provide a recurring revenue base, and does not vary with changes in economic activity transacted over an e-Marketplace.

The benefit for airlines can be then more accurate forecasting of costs. Transaction related fees have the advantage that they are recurring and are relatively predictable once liquidity is achieved. Reasonable transaction fees were found to be attractive because they do not generate any cost unless and until the customer uses the e-Marketplace. One of the main problems of charging transaction fees is the firm reluctance to be charged every time they decide to transact.

Only a minority of e-Marketplace charge a uniquely admission fee or a listing fee. This finding may be explained in such a way that uniquely admission fees and listing fees can often create problems in terms of exploding costs for goods and services not been sold. Advertising fees in the form of banners, sponsorships, extended listings and hyperlinks to companies' web sites or commercial e-mail to targeted members are less accepted among airlines. E-Marketplaces tend to position advertising fees as a complement to the main business, and not a primary revenue stream. This type of revenue seems to be more appropriate for B2C, where advertising can be directed to a larger community. Professional service fees or value-added services fees such as inspection services, trading partner authentication or credit information services were partly employed as well. Typically, e-Marketplaces form a partnership with other providers of these services and then receive a share of the revenue generated.

When asked about who bears the fees that occur for using the e-Marketplace service, 71% responded that both suppliers and buyers have to share the costs, while 20% charge suppliers only and 13% buyers only. Again, this finding confirms that most e-Marketplaces try to be neutral to both buyers and suppliers in order to achieve a critical mass of participants.

Apart from these e-Marketplace revenue fees, the adoption of e-Marketplaces may also require other costs in areas such as systems integration, project management, staff training, or change management costs. For example, systems integration costs may be required to transfer information from ERP or legacy systems to e-Marketplaces and vice-versa. Training costs may be needed to make sure that the e-Marketplace functionality is actually used by staff and that the benefits and working procedures are understood. Change management costs could include internal and external communication regarding the benefits of the e-Marketplace, analysis, and implementation steps required to transition processes.

As e-Marketplace investments are not necessarily superior to other investments and as smaller airlines have only limited financial resources for investments, airlines have to make a careful strategic decision about how to allocate their scare resources and how to pay for it. Financial resources that are attributed to e-Marketplace investments are not available for alternative investment opportunities.

Moreover, the findings confirm the European Commission (2004) that adoption or investment alone in e-Marketplaces is not enough, as technology by itself does not automatically lead to substantial efficiency gains. For example, it was observed in case study TWO that e-Marketplaces should be accompanied by a high level of managerial understanding and the commitment to re-engineer working and business processes in a changing competitive environment. However, there is no single recipe or panacea for all airlines. For example, the surveys and case studies have also demonstrated that the investment costs involved in integrating an e-Marketplaces with internal ERP-systems may be a large factor hindering the adoption of e-Marketplaces (confirmed by Copeland, 2001; Upton, 2001).

Nonetheless, the findings reveal that B2B e-Marketplace can lead airlines to both tangible and intangible benefits. Tangible benefits include direct measurable cost savings in product and process costs, while intangible benefits include for example improved visibility of price control of procurement, enhanced spending controls and employee compliance, improvement in the quality of information or better relations with suppliers (as mentioned in the surveys and case studies). Many of the experienced benefits are intangible, while most of the costs are tangible, which makes an exact ROI calculation difficult.

Despite the benefits claimed for e-Marketplace adoption, their use, however, is not positively related to an airline's overall performance (Hypothesis 7b: $p=66.2\%$; $F=0.20$). 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. Overall airline performance is dependent on a variety of other combinatorial business and strategy factors (e.g. unexpected environmental factors such as terrorist attacks or health risks such as SARS). Factors such as the airline size, the level of partnerships, the extent of resource and information sharing, the level of joint purchasing, the extent of outsourcing or a reduction of suppliers have also no individual direct impact on overall airline performance.

A positive relationship, however, could be identified between the ICT sophistication within an airline organisation and the overall airline performance. This can be explained by the background that the airline industry is naturally ICT-savvy (with systems such as CRS) and predestined to be open to experiment with new technology-driven management solutions.

For example, the European Commission's survey results in 2004 clearly show that companies with increasing turnover are significantly more innovative than enterprises with stagnating or decreasing turnover. Interestingly, the Commission's findings reveal that Internet related innovations are more strongly correlated with financial success than non-Internet related innovation. Thus they conclude that ICT matters as a strategic device for companies to gain competitive advantage because it offers a variety of firm-specific opportunities to innovate.

Porter (2001), however, also argued that Internet technology should be used as a complement to rather than a cannibal of traditional ways of competing. The companies that will be most successful will be those that use e-Business to make traditional business processes better and those that invent and implement new combinations of virtual and physical activities.

Competitive Advantage

Carr (2003) argues that ICT doesn't matter anymore as a strategic device for companies to gain competitive advantage. As ICT would become ubiquitous, it turns into an infrastructure technology possessed by everyone, instead of a resource that is only available to few. Therefore ICT would lose its potential for creating sustained competitive advantage because it is scarcity, not ubiquity, which would enable a company to gain an edge over rivals. Carr concludes that ICT should be viewed and managed as a commodity and not as a strategic asset. Barney et al. (1995) also argue that ICT systems can be purchased and duplicated fairly easily, and are thus likely not to be considered as competitive advantage.

According to Kallioranta and Vlosky (2004), as more competitors adopt ICT, and while this has become more a necessity to remain competitive, it has also become less effective as a tool for creating competitive advantage (e.g. Anandarajan et al., 1998; Clemmons and Row, 1991). However, Barney (1991) notes that valuable but common resources can help a firm to ensure its survival when they are exploited to create competitive parity, and thus should not be neglected. An information processing system that is deeply embedded in firms' informal and formal processes, structures, management, and decision making systems may hold the potential to being a sustainable competitive advantage (Barney, 1991). Sustainable advantage based on ICT typically requires leveraging unique resources that cannot be easily replicated or leapfrogged by potential competitors (Clemons and Row, 1987).

Given that 65% of airlines have already adopted e-Marketplaces and that there was no significant positive relationship between e-Marketplace adoption and overall business performance, the question is whether e-Marketplaces have already reached this "commodity" status or not. It can be argued that the adoption of e-Marketplaces alone does not necessarily lead to a competitive advantage. However, the adoption of e-Marketplaces can help airlines achieve operational excellence in procurement. E-Marketplace adoption has a significant positive relationship with overall ICT sophistication, the latter of which was empirically found to have a strong positive correlation to overall business performance. This is in line with Sambamurthy (2000): "During the last 15 years strong evidence and managerial belief have accumulated that ICT, when it is effectively deployed, contributes to superior firm performance".

Bakos argued already in 1991 that electronic market systems are likely eventually to become a strategic necessity and part of an industry's infrastructure and that neither size nor being the first mover will guarantee a sustainable advantage. For example, according to Bloch et al. (2001) tradional marketplaces such as Amadeus or Sabre succeeded by providing global information to a global travel community. By matching global demand and supply with service charactersticis they created value for all parties: suppliers (airlines), customers (travellers) and intermediaries (travel agencies).

The European Commission (2004) confirms that ICT are important in improving the efficiency of business processes and promoting innovation in European enterprises. However, the author's own findings from this study also suggest that it is not e-

Marketplaces per se that determine competitive advantage, but rather what airlines decide to do with the new technology. The technology is flexible and the extent to which it is implemented and used to change existing procedures and processes depends on the strategic decision of airlines and their ability to successfully manage and complete change processes. It can be argued that it is the process of technology-enabled change and innovation that makes e-Marketplaces a valuable strategic asset rather than a pure commodity or infrastructure.

The study findings confirm Bakos (1998) that e-Marketplaces can expand a firm's market reach and thus generating lower product prices and facilitate the search process. Thus, e-Marketplaces provide services that can decrease cost in procurement processes in various degrees. Value creation prospects in B2B e-Marketplaces can be the consequence from innovative dynamics of transactions, innovative integration of sources and capabilities, new defined relationships between buyers and suppliers as well as innovative distribution of information. With fast changing market structures and with supply chains competing against each other, virtual co-operation in networks can be another decisive factor for competitive advantage.

Thus, e-Marketplace technologies can have a significant impact on enterprises and their performance. However, many airlines have not yet taken full advantage of all opportunities that e-Marketplace technologies offer to improve their procurement processes. It can be expected based on the research findings that they will continue to gain acceptance in this sector, primarily as a strategic device that helps airlines to make internal processes more efficient and to save costs in purchasing. Jarach (2002) explains that it is a development that is part of the wider scenario within the e-Business framework, where knowledge and information generated by the continuous and complete customer/supplier interface has a fundamental role. It adds to and makes fluid the phases of the value chain, creating new conditions of competitive advantage for firms.

From a resource-based view, the theoretical argument that sustainability is possible can be attributed to certain ICT resources and capabilities that are difficult to imitate. When an ICT-enabled strategy is combined with such resources and capabilities, firms will be able to gain a sustained competitive advantage through barriers to entry, switching costs, and mobility barriers (e.g. Porter, 1980; Barney et al., 1995; Sambamurthy, 2000).

These may include managerial ICT skills, technical ICT skills, and ICT infrastructure (Dehning and Stratopoulos, 2003). E-Marketplaces can be an important part of these resources and capabilities and, as it was shown in the surveys and case studies, can help improve product and process costs, among other intangible benefits. This was found particularly true in the airline industry, which is characterised by global need for parts, demand unpredictability, the need for traceability of parts for safety reasons, and high cost of not having a part (AOG).

The observation that competitive advantages of ICT systems can diminish is, however, food for thought. For example, American Airlines was the first to develop CRS and gained considerable advantages through the use of these systems. As regulations increased and competitors developed similar systems, it had to shift its focus. While 65% of airlines have already implemented e-Marketplaces, most of them are still in the early design stages.

The findings confirm Pires and Aisbett (2003) that adopting technologies associated with major ICT innovation has implications that are multidimensional and, potentially, pervasive to many facets of business activity. Such implications will be uncertain in their reach and scope, and difficult to control.

While e-Marketplaces can improve efficiency and effectiveness, and therefore competitiveness and business opportunities (Bakos and Tracey, 1986), extensive e-Marketplace use is not yet part of everyday practice for some airlines. Therefore, there is still the potential, according to Copeland (1990), that "a successful innovation with ICT often yields new, and often unintended, proprietary information which is the basis for subsequent innovation and exploiting the cumulative nature of this knowledge can make the first mover's advantage long-lasting".

In addition, the increasing use of e-Marketplace technologies by many airlines provides positive network externalities to other potential adopters. When a firm embarks upon an ERP implementation, other industry players feel the pressure to eliminate their competitor's advantage as soon as possible (Poston and Grabski, 2001). Either the incentive of first mover advantage or the urgency to level the playing field will provide the focus and purpose to successfully overcome obstacles and resistance to innovation diffusion within the firm (O'Leary, 2000). Often, firms decide to adopt certain technologies primarily because some of their most important business partners also use them. Kollmann (1998) refers to the 'chicken and egg' problem that buyers are only interested if there are enough sellers and sellers are only interested if there are enough buyers. The "Metcalfe's Law" states that the value of the intercommunication amongst the nodes (or participants) of this network increases proportionally with the square of the number of nodes. E-Marketplace technologies and services have reached critical mass in the airline industry and therefore become attractive for small airlines that had typically chosen a "wait-and-see" approach.

Airlines, however, will have to focus more on cost measurement and reporting and other performance data across functional areas as well as beyond traditional organisational boundaries as more trading activities are conducted on e-Marketplaces. This is one of the future challenges that airlines have to face.

9.1.10. Emergent Challenges for Further E-Marketplace Adoption and Performance Improvement

The findings from the case studies in particular demonstrate that e-Marketplace implementation is complex. The system may not work as proposed, or the training of employees may be insufficient to make it work effectively. The new system may also prove incompatible with existing systems and processes. Supplier integration, e-Marketplace content and integrated supply chain management solutions are also critical for future interoperability.

As noted in the case studies in the previous chapter, airline employees, as with many groups of workers will tend to, can be reluctant to change. This reluctance applies to many instances of e-Marketplace implementation. Airlines can experience major employee resistance with regards to new projects and these employees also tend to be unwilling to learn about e-Marketplaces and their potential benefits. The case studies revealed that in order to overcome pockets of reluctance to change, an important ingredient for e-Marketplace adoption and success is the right top management support and initiatives from employees, together with an atmosphere of open communication, participation, committed cross-functional access to experts, and committed inter-organisational focus. However, as Reunis and Santema (2005) argue, this adoption of the "intended behaviour" is not self-evident. Consequently, addressing the human resource and change management aspects of e-Marketplace implementation is a vital contributory factor to its ultimate success (as observed in the case studies). The case studies also showed that materials standard classification and changing procurement processes can lead to conflicting demands, which need to be managed. The findings also suggest that an inhibitor to e-Marketplace adoption is that many companies are still deeply entrenched in old processes (confirmed by Cloete and Fourie, 2004).

One of the challenges facing the airline industry is also the technological gap between the various procurement systems. As illustrated in the case studies, some of the airlines are using e-Marketplace procurement systems, while others take advantage of software applications in e-Procurement or still rely on paper processes. Proprietary systems such as EDI continue to persist, and have to be included in a company's overall e-Procurement infrastructure. Many smaller airlines are also still slow in procuring online, due to e.g. limitations in incorporating e-Marketplace platforms with their legacy systems and the lack of standardised data. They would have to invest in making custom interfaces, but hardware acquisition and legacy system integration is typically dear and time consuming. Improving the ERP-to-e-Marketplace connectivity is therefore still a major aim in the airline industry.

Many suppliers are also still reluctant to participate in e-Marketplaces in order to maintain close relationships with their customers as they fear that trading via an e-Marketplace could distance them from key contact business connections. The case studies suggest that e-Marketplaces can offer extended informational services to suppliers, but supplier relationships can be rather impersonal and remote due to a loss of direct customer relationship marketing for example in reverse auctions (confirmed by Wigand, Picot and Reichwald, 1997; Turban et al., 2002). That is why suppliers can feel threatened and reluctant to participate, according to Worthington-Smith (2002).

Challenges outside the airline's control also exist. Regulators such as the Federal Trade Commission in the US or the European Union are concerned about joint purchasing or inventory pooling since airline parts would transfer back and forth between airlines, diminishing the airlines control over its maintenance records. Since regulators require that parts be traceable, e-Marketplaces will have to work with the airline regulatory agencies to develop a certification programme that requires stringent tracking of parts used in inventory pools and supports maintenance records for inventory pools.

Although the overall e-Marketplace adoption trends are positive in the airline industry, the study has identified a number of challenges from the surveys and case studies that need to be addressed. These include for example further supplier integration; the training and education of staff; the integration of legacy systems; the lack of industry standards; the importance of board level supervision; or the requirement of further e-Marketplace services, as the technology is often not ready yet to support the range of airline requirements (e.g. additional security issues following the 11 September).

There are also challenges ahead for e-Marketplaces. The surveys and case studies showed that more of them concentrate on the buy-side to support individual activities of the procurement life cycle. Although a variety of individual support services for these phases are offered, e-Marketplaces need to offer strong incentives to both buyers and sellers. For example, sellers are reluctant to participate in e-Marketplaces where the over-riding criterion for comparison with competitors is that of price. Greater focus should be on understanding and communicating with suppliers, providing pro-active and practical support to help them adopt new internet-enabled processes.

Some e-Marketplaces may also focus more on creating distinctive offerings, or map out paths to profitability (also confirmed by Wise and Morrison, 2000). E-Marketplaces have underestimated the investment required to build key functionality and have strongly consolidated due to missing network externalities. For example, e-Marketplaces may focus too much on pricing related features, such as reverse auctions, while this is not the only service that customers consider when joining such a portal. Instead, supplier-buyer relations also need to be taken into account. Factors, such as quality, timing of deliveries and customisation are quite often more important than the price of a product (also outlined by Thong, 2005).

As the majority of aviation e-Marketplaces were established between 1998 and 2001 and are therefore still a rather new phenomenon, it can be expected that functionalities and services will become more tailored to customer needs as the technology and experience in using them increases. Currently, 23% of airlines state that no e-Marketplace could cover all spend categories. 30% even indicate that e-Marketplaces could not cover their procurement needs. Therefore, it is not surprising, that 47% of e-Marketplaces co-operate with other trading platforms to improve services.

Overall, hurdles to realising the full potential of e-Marketplaces remain. These are primarily people, process and technology related. This can generate a high level of scepticism towards e-Marketplaces (case ONE). Both academic research as well as airline and e-Marketplace managers will have to take these critical factors into consideration for successful e-Marketplace implementation.

9.2. Managerial Implications

The study offers several implications for managers. It helps firms to examine and define their strategic procurement needs and to understand the costs and benefits gained from e-Marketplaces. Only after this process, it possible to accurately assess and identify e-Marketplaces that may be suitable. The adoption of e-Marketplace technologies at the airline level is essentially an investment decision which carries uncertainty and risk and is subject to a multitude of relevant conditions. In general, return of investments regarding the adoption of information and communication technologies in general are often unpredictable and thus hard estimate beforehand.

General concerns include the point that prior investments become outdated quickly. As such, the adoption of new ICTs may implicate high switching costs and companies often face initial difficulties in setting them up and make use of them. Srinivasan et al. (2002) confirm that, with new innovative technologies such as those related to e-Business, there is often little guidance available to firms regarding the application, creation and appropriation of value. The study and its empirically tested framework can help with the newness and complexity of e-Marketplace measurement and management. It can motivate and encourage airlines not only to adopt such systems, but integrate and use them to a higher extent. Some airlines also experienced (as reported in the surveys and case studies) some amount of frustration in e-Marketplace adoption that ranged from the decision-making process to implementation difficulties.

In this respect, the study will inform managers how to assess and understand their own adoption drivers and compare their e-Marketplace performance indicators. The contingency model provides a systematic framework that airline managers can use to assess or benchmark their organisation's readiness for adopting e-Marketplaces. An airline could look at how it measures up on the features and then decide whether it was ready or what it needed to do to get ready for adopting e-Marketplaces.

Knowledge of state-of-the-art developments in electronic business should be regarded as a basic and crucial skill for companies that are operating in an international business environment. The thesis provides valuable insights on the conditions that encourage airlines to adopt e-Marketplace initiatives and the performance outcomes. This provides professional managers with valuable suggestions for their own business operations.

The findings from this research also enable e-Marketplace managers and policy-makers understand better the different dynamics and implications of e-Marketplace enabled procurement in the airline industry. The combination of representative surveys and case studies could create a valuable knowledge base. This base contributes to creating a favourable environment that can improve the effectiveness of firms' investments in e-Marketplaces in the airline industry and, consequently, enhance their competitiveness. Managers can then understand the opportunities offered by e-Marketplaces, integrate them into their existing business models and share them with other stakeholders.

For example, some of the lessons drawn from the case studies will be considered of general interest to businesses or other institutions introducing similar initiatives. Issues such as users' acceptance in determining the success of e-Marketplace, the importance of top management support or a commonly shared vision whenever initiatives involve various players, or problems related to the standardisation and the establishment of a common vocabulary for interactions, can be taken as valuable managerial suggestions. This represents a valuable contribution from a practitioner perspective.

The findings also reveal that addressing the human resource and change management aspects of an e-Marketplace implementation is a vital factor contributing to its ultimate success. Managing an inter-organisational system such as an e-Marketplace across multiple businesses and organisational functions is a difficult task, requiring extensive collaboration.

The results also suggest that airlines must pay great attention to their technological capability to adopt e-Marketplaces, and keep in mind that technology competence constitutes both physical infrastructure and intangible knowledge, such as e-Procurement skills. As e-Marketplace technologies diffuse and become more common, technical and managerial knowledge becomes even more significant. This should encourage top managers to foster managerial skills and to develop human resources that possess knowledge of e-business. Moving forward, airlines and e-Marketplaces will need to better address these issues in order to fully reap the benefits of their investments.

The research can also provide policy makers and professional business associations a better understanding how their members perceive information campaigns and pilot-projects, based on the preferences of e-Marketplace adopters, planners, and non-adopters. Results from the study and the comprehensive research framework can therefore help to target future diffusion campaigns in order to reach potential adopters of e-Marketplaces and enable more in-depth integration.

9.3. Original Research Contribution to Theory

This study contributes to theory in the following way. Firstly, this study offers new insight into the e-Marketplace literature and adds to the empirical research on e-Marketplace adoption in organisations by building upon prior work in IOS. The range of applicable theory for e-Marketplaces was identified and a broad-based assessment of different conceptual levels of analysis was conducted, based on the proposed contingency framework. While e-Marketplaces are analysed in more detail from an institutional perspective, studies from a DOI perspective (Rogers, 1995) and IOE viewpoint (Tornatzky and Fleischer, 1990) are rather rare. B2B e-Marketplaces differ from most of the technologies discussed in existing inter-organisational information systems research, as B2B e-Marketplaces require a critical mass of participating organisations rather than a point-to-point connection between two organisations (Koch, 2003).

Zhu et al. (2003) argued that there is a need to improve understanding of the factors that drive organisational adoption of e-Marketplaces. Little information is available on how to successfully integrate e-Business projects with ongoing B2B e-Marketplace systems (Kaplan and Sawhney, 2000; Segev and Gebauer, 2001). The research area of e-Marketplaces does not itself have a unified or definitive and comprehensive theoretical framework upon which facilitators and inhibitors of e-Marketplaces can be evaluated.

This suggested the formation of a new framework, which is anticipated to help researchers identify and understand the motivators leading to adoption of e-Marketplaces. The framework developed in this study introduces additional significant constructs, which are not dealt with by existing theoretical frameworks. Because some researchers argue that a unifying theory might be inappropriate due to fundamental differences between various types of innovations (Downs and Mohr, 1976) the author has developed an original e-Marketplace specific framework. This represents a significant contribution to theory development in this area. The conceptual model was empirically compared to the aviation industry based on a cross-sectional survey of 88 airlines and 17 e-Marketplaces.

The DOI and IOE models for adoption of innovations in organisations were found to be a valuable tool for operationalising factors. This yields improvements and refinements of the presently used adoption theory of e-Marketplaces. Diffusion-of-Innovation theory (Rogers, 1995) posits that the adoption of a technology is based on its characteristics and attributes. However, a criticism of this model is that it neglects the organisational and environmental contexts in which technologies are adopted (Tornatzky and Fleischer, 1990). Mindful of Rogers's warning (Rogers, 1995) not to adopt measures developed for other innovations, the author developed industry-specific constructs based on the DOI and IOE models. Therefore, by viewing e-Marketplaces as a technological innovation (DOI; Rogers, 1995) and examining the contexts in which e-Marketplaces are adopted (IOE; Tornatzky and Fleischer 1990), the author addressed the theoretical gap and extended the existing DOI and IOE frameworks by incorporating influences of contextual airline industry specific and performance related factors.

In summary, this research contributes by developing contingencies within each of the three DOI/IOE contexts (environmental, organisational, technological) and the performance indicators. The contingencies 'pressures from business context (environmental context)', 'firm and fleet size (organisational context)', 'procurement organisation (organisational context)', 'number of suppliers (organisational context)' as well as 'level of ICT sophistication (technological context)' and 'level of Internet services used (technological context)' were based on prior DOI/IOE studies (see table 5 for explicit details). The contingencies 'strategic classification of airlines (organisational context)', 'alliance involvement (organisational context)', extent of resource and information sharing (organisational context)' 'joint-procurement integration' and the 'extent of outsourcing (organisational context)' had to be specifically created to reflect airline specific contexts. The performance indicators were derived from the DOI theory's relative advantage factor together with airline industry specific considerations.

The unique framework developed by this research can help to make the research gap smaller between prior studies in IOS diffusion (based predominantly on EDI) versus e-Marketplace models. To improve understanding the process better by which innovative new technologies may generate competitive advantage or higher productivity, it was essential to explore and understand the process of e-Marketplace adoption.

Adopters of e-Business are frequently believed to gain competitive advantage over their rivals, which in turn can result in changes in market structures and profit levels (OECD, 2000; Brynjolfsson and Hitt, 2003). In addition, there is already evidence that investments into information and communication technologies spur long term growth (Jorgenson, 2001; Nordhaus, 2002). However, the determinants of the adoption process of e-Marketplaces in the airline industry and the outcome of adoption, the performance indicators, were somewhat unclear. The research also provides anchor points and throws light on the performance impacts of e-Marketplace adoption.

The research followed for this thesis took a two-stage triangulated approach: it was comprised of two surveys for e-Marketplaces and airlines (with a focus on the more quantitative end of the spectrum) as well as two case studies (with a focus on the qualitative end). This had the advantage that the study was based on data which was rooted in 'real' business, and not only on ex-ante theoretical considerations (criticised by Ordanini et al., 2004). It also offers the advantage to combine the creative potential of inductive approaches and the analytics of deduction. The data collection for the inductive case studies was performed simultaneously with the data collection for the deductive surveys. The combination of methodological triangulation also meant that both the factor approach (the identification of cross-sectional forces which lead to e-Marketplace adoption) and the process approach (the dynamics of adoption and non-adoption) could be researched.

Due to its explorative nature, the operationalisation of constructs was more based on original theoretical considerations in this study rather than using items from previous research. Developments in the airline industry required the introduction of additional important constructs (like the level of outsourcing; level of joint purchasing), which are not dealt with by existing theoretical frameworks. This represents a significant contribution to theory development.

The need to understand these constructs, however, underpinned the case for valid and reliable measurements. For example, content validity was qualitatively assessed through pre-tests and multiple reviews of the survey instruments. Measurement reliability of the survey instruments' items was also quantitatively validated through assessing Cronbach alphas. All multiple-item scales have acceptable alpha values of at least 0.6., thus ensuring internal consistency. Nunnally (1978) further propounded the minimum factor loadings of 0.30 criteria as a guideline for considering an item to be part of a factor. Based on a varimax rotation, the items loaded highly on the appropriate factors and the results suggest that convergent and discriminant validity are applicable for the latent reflective constructs.

Measures were also taken to improve the external validity of the research. This could be increased through reliance on multiple sources of evidence utilising multiple methods (methodological triangulation) and very satisfactory survey response rates with adequate sampling errors. Stratified random sampling was employed for the airline survey, which is superior to other sampling techniques to reduce sampling errors. In order to avoid non-coverage errors the author tried to obtain and take advantage of up-to-date and accurate framework of populations by using a variety of database listings. Extensive non-response analysis was also conducted.

Parametric tests, treating the scale questions as interval or ratio data, were generally preferably employed. The author followed the conclusions of Dexter and Chestnut (1995) that parametric tests are valid for such data analysis.[34] Non-parametric tests were used for variables with moderate skewness / kurtosis. Munro and Page (1993) agree that there is sufficient evidence to show that use of parametric or non-parametric tests with ordinal data very rarely distorts the results. This was confirmed in the hypotheses testing in this study as both parametric and non-parametric had the same outcomes.

Overall, the study provides an original starting point for further research, as the e-Marketplace literature is primarily composed of research investigating economic aspects (e.g. Malone, Yates and Benjamin, 1987). While anecdotal accounts of e-Business advances are not difficult to find in the popular press, there was a need to bring a more

[34] For example, the Journal of Agricultural Education published 188 research articles in volumes 27 through 32. Responses to individual likert-type items on measurement instruments were analysed in 95, or more than half, of these articles. After reviewing the articles analysing individual likert-type items, 54% reported only descriptive statistics. 13% used non-parametric tests and 34% parametric tests.

structured, theoretical focus to bear towards understanding the adoption process and value creation of B2B e-Marketplaces. The contingency framework can provide a good grounding for future research in this area and provides a sound theoretical platform on which to evaluate e-Marketplace adoption and performance indicators. The following table summarises the outcomes of statistical tests and hypotheses defined for this programme of research.

Hypotheses	
H1a: E-Marketplace adoption of airlines is highly dependent on external competitive pressures.	Not confirmed (p=85.1%, F=0.02)
H1b: The use of e-Marketplaces is highly dependent on an airline's strategic classification.	Confirmed (p=<0.1%; chi2=19.73)
H1c: The use of B2B e-Marketplaces is highly dependent on firm and fleet size.	Parametric Test: Confirmed (Number of an airline's employees p=<0.2%, F=10.3; number of employees in purchasing p=<0.1%, F=14.4; fleet size p=<0.9%, F=7.2) Non-Parametric Test: Confirmed (Number of an airline's employees p=0.1%, Z=-3.35; number of employees in purchasing p=<0.1%, Z=-3.52; fleet size p=<0.2, Z=-3.17)
H2a: E-Marketplace implementation is highly dependent on an airline's overall ICT sophistication.	Confirmed (p=3.5%; F=4.51)
H2b: The adoption of e-Marketplaces among airlines is highly dependent on the overall number of Internet services.	Confirmed (p=0.26%; F=9.75)
H3a: Airlines involved in alliances or partnerships use B2B e-Marketplace more than airlines that are not involved.	Confirmed (p=3.7%; F=4.37)
H3b: E-Marketplace adoption is highly dependent on the extent of resource and information sharing among airlines.	Not confirmed (p=80.2%; F=0.05)
H3c: Airlines involved in joint procurement have a higher implementation level of e-Marketplaces than airlines that are not involved.	Parametric Test: Not confirmed (p=75.3%; F=0.10) Non-Parametric Test: Not confirmed (p=71.6%, Z=-0.37).
H4a: The extent of outsourcing is highly dependent on an airline's strategic orientation.	Confirmed (p=<0.1%; F=6.11)
H4b: E-Marketplace adoption among airlines is highly dependent on the extent of outsourcing.	Not confirmed (p=70.7%; F=0.14)
H5a: E-Marketplace implementation is highly dependent on an airline's procurement organisation strategy.	Parametric Test: Not confirmed (centralisation p= 41.7%, F= 0.68; decentralisation p=42.3%, F=0.66) Non-Parametric Test: Not confirmed (centralisation p=35.1%, Z=-0.93; decentralisation p=39.6%, Z=-0.85).
H5b: The adoption of e-Marketplaces is positively related to a decrease in the number of suppliers.	Parametric Test: Not confirmed (p=82.1%; F=0.04) Non-Parametric Test: Not confirmed (p=92.6%, Z=-0.09)
H6a: The overall performance and satisfaction with the procurement practices of an airline is highly dependent on e-Marketplace adoption.	Confirmed (p=0.7%; F=7.58)
H6b: The use of e-Marketplaces has a positive effect on a reduction of purchase order costs of an airline.	Confirmed (p=4.8%; F= 4.0)
H7a: A reduction in purchasing process costs and in procurement product prices can exceed the investment costs for the use of e-Marketplaces.	Confirmed (p=0.03%; chi2=21.21)
H7b: An airline's overall business performance is highly dependent on the use of B2B e-Marketplaces.	Parametric Test: Not confirmed (p=66.2%; F=0.20) Non-Parametric Test: Not confirmed: (p=78.9%, Z=-0.27)

Table 19: Summary of Tested Research Hypotheses

9.4. Limitations and Recommendations for Further Research

The findings also have theoretical implications to future research. Clearly, the research work that is yet to come will be highly interdisciplinary. Since the development of e-Marketplaces is still in its infancy and changes quickly, there are still many issues that need to be explored and examined. For example, it was observed in the case studies that trust is playing a role in determining e-Marketplace adoption behaviour. This finding suggests that, in addition to the presented factors, social aspects should be further addressed. This is particularly true for e-Marketplaces, which involves more than one party. Neither does this research take cultural differences into account such as trust towards domestic versus foreign suppliers.

An airline with greater power could influence its trading partners to adopt e-Marketplaces, where power is determined by its dependence on the other party. On the other hand, trust encourages a firm to expand the amount of information sharing. The reason trust contributes to this is that it aids in closing deals, building commitment and maintaining satisfaction, all of which leads to continued use of the e-Marketplaces. Other factors might include for example security concerns, as they were found from case study ONE to be a key barrier to e-Marketplace adoption (also confirmed by UNCTAD, 2002).

As reported in case study ONE, airlines can still be reluctant to embrace e-Marketplaces fully. Their reasons for this choice are well warranted, and more often than not reflect a general concern for security, as well as other relevant concerns. Confidentiality is another issue because of the fears of competitors gaining access to highly confidential, business-critical and company-specific information. These issues may be further explored by longitudinal process approaches and socio-technical models such as TAM, TPB, UTAUT or structuration theory, which were not employed in this study.

Therefore the integrated theoretical framework, while representing a synthesis of important constructs, may not encompass all factors that can affect e-Marketplace adoption. For example, e-Marketplaces are currently evolving from simple matching services to offer value-added services that support transactions. A further step in the development will be the integration of knowledge services into transaction exchange, thereby building value trust networks that enhance collaboration within the member communities. Another major area that requires further investigation is the issue of ERP integration with e-Marketplaces. These are issues (besides further process drivers and performance indicators) to be addressed in gaining a fuller understanding of the propensity for adoption of e-Marketplaces in the airline industry and would be worthwhile being included in future research projects.

Another research avenue includes anti-trust limitations for e-Marketplaces. Both the Federal Trade Commission in the USA and the European Union have taken considerable interest in the formation of e-Marketplace (Federal Trade Commission, 2000; European Commission, 2001). Their main concern is that they could allow buyers or sellers to group together in a way that would distort the operation of a competitive market. As a consequence, their main interest has been where e-Marketplaces have been formed in industries that already have a limited number of either buyers or suppliers such as the airline industry, each of whom already have considerable market power.

There is a need for additional measures to be put in place to address potential anti-trust concerns regarding e-Marketplaces involving influential buyers or suppliers. For example, an issue of discrimination could arise if certain market participants were to receive privileged information about transactions in the market. This is particularly important with the development of technologies associated with intelligent agents, which promise new ways to search and participate in e-Marketplaces. Therefore the results also point to the important role for public policy to promote e-Marketplace adoption by providing such protections in legislation, which will increase the willingness to engage in e-Marketplaces.

There are also several other factors such as the supply chain structure, the complexity of procurement processes, standardisation or change management issues, etc. that could also influence e-Marketplace adoption among airlines. As observed in the case studies for example, organisational resistance to new technology implementation may result from employee perceptions that their jobs are in jeopardy. Further research could therefore address more factors which were not covered in this study.

In terms of performance indicators, further research could apply other return on investment models such as a payback method, the accounting rate of return on investment, or a cost benefit analysis. Return on investment is clearly an important concern for airlines. More work, both qualitative and quantitative, is required to further develop and validate this framework. Such validation will therefore need to include also longitudinal studies that can test the framework against future developments. Further research can also include testing the contingency model in other industries.

Although this study has covered an original insight into the broad interdisciplinary research area informing B2B E-marketplaces in procurement, B2B e-Marketplaces are still in their early days. The developed framework and the future e-Marketplace development should offer various cornerstones for further research areas.

X. CONCLUSION

Since the deregulation and the market entry of low-fare airlines, the airline industry has been under high competitive pressures, where continuous change is a part of daily business. For example, low-fares ailines exhibit the highest growth rate and profits (see chapters 4 and 5). As most B2C strategies are typically driven to the limit, competition has now become a distinct feature of supply chains. Accelerating globalisation, perpetuated by the Internet revolution has demanded the attention of the popular press and academia alike (see chapter 1). While e-Commerce has captured significant research attention, most of the relevant research is not industry specific.

This study sought to address the challenges of the airline industry in general and those implementing an e-Marketplace system in particular within a complex business environment. Airlines have been one of the early adapters of ICT, with the introduction of CRS and other early e-Business concepts, and this was also found to be true in this study as 65% of airlines have used at least one e-Marketplace.

The airline survey has tested the hypotheses stated in Table 19 and thus revealed 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. Full service and charter airlines in particular experience increased pressures to reduce their cost base, which might be due to the increasing presence of low-cost airlines in their respective target markets and the unstable economic environment they are operating in at this particular point of time. Full-service and low-cost airlines have taken the lead in using e-Marketplaces. Adoption of e-Marketplaces is also highly dependent on the airline size, which confirms previous research that larger firms are less subject to knowledge and technology barriers. Further, airlines that are involved in strategic partnerships and alliances and that are sophisticated in the use of ICT systems such as the Internet, are more likely to implement e-Marketplaces.

To summarise, drivers or strategic 'stimuli' for e-Marketplace adoption in the airlines industry include the airline's strategic classification, the airline size, the extent of strategic partnerships, the level of overall ICT sophistication, the level of Internet services used, while pressures from the business context, the level of resource/information sharing, joint procurement integration, the extent of outsourcing and the purchasing organisation were not identified as adoption drivers.

The findings further suggest that e-Marketplace use is positively related to the overall satisfaction with and performance of an airline's procurement practices. Results suggest that e-Marketplaces do reduce search cost of airlines, mostly in the area of spares and repairs, tools/GSE and office supplies. Other benefits typically occur in the facilitation of order processes, a higher transparency of suppliers, reduced inventories, product price reductions and a reduction in purchase order costs. Commodities where markets are fragmented to a higher extent, such as spares and repairs, tools/GSE or office supplies, are traded on e-Marketplaces to a higher extent than commodities with a rather concentrated supply base, such as powerplants and accessories, as often the latter items are under full service contracts and complex repair procedures are required. Savings from e-Marketplace adoption, which occur more in process costs rather than product cots, tend to exceed the investment costs. However, e-Marketplace adoption does not have a direct impact on overall airline financial performance, but on operational effectiveness and efficiency.

As an example, demand for unpredictable aircraft maintenance parts is highly sporadic. Thus, airline operators perceive difficulties in parts demand forecasting (see chapter 4 and 5). Airlines often face very high costs in locating spare parts and components, especially for older aircraft types. Airlines can collaborate on e-Marketplaces to liquidate their surplus spare parts or when AOG alert is communicated among airlines, they can support one another by selling or temporarily borrowing critically needed parts and appropriate parts can be located in a very limited timeframe. This can also improve greater transparency, both in parts availability and pricing. However, while advanced airlines enhance their operations by e-Marketplaces, smaller airlines still have to improve e-Marketplace integration.

This challenge is recognised in the industry. 64% of non-adopters (many of them smaller airlines) have indicated that they would consider taking part in e-Marketplaces and only 36% said otherwise. The findings also suggest that the adoption of e-Marketplaces is highly relevant to e-Procurement implementation among airlines.

Overall, industries that are information intense, such as the airline industry, have more advantages from e-Marketplace implementation and are more prone to advance with the technology (as the high level of diffusion of e-Marketplaces has demonstrated). This may have an impact on other industry sectors, since one forth of the world's manufactured exports (by value) reach their markets by air. The airline industry is also the "heart" of travel and tourism, which can be considered as one of the world's largest industries. As such, e-Marketplace adoption can also have widespread implications for other sectors. Only firms able to keep abreast of constant change and rethink the nature of e-Marketplaces from information to execution, can compete and thrive in today's fast-changing economy (Darwinian's imperative of 'adapt or die').

Limited academic research had been undertaken in exploring the adoption drivers and the value creation of B2B e-Marketplaces (in the airline industry). The value and importance of this research are reflected in the opportunities provided for disseminating the results. The research findings have been widely published in various refereed journals (e.g. International Journal of Logistics: Research and Applications, Transportation Research Record) and presented on various conferences (e.g. IPSERA, Logistics Research Network, Transport Research Board, European Transport Conference).[35] Feedback suggests that the findings are of interest and value to both academia and the industry.

[35] See publications in the bibliography section.

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APPENDIX A: E-MARKETPLACE SURVEY INSTRUMENT

nitl

Supply Chain Management Centre of Excellence

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GENERAL INFORMATION

Position of respondent:	
How would you describe your e-marketplace (please tick as appropriate)?	☐ Horizontal e-Marketplace ☐ Vertical e-Marketplace ☐ Vertical and Horizontal e-Marketplace
Is your e-marketplace (please tick as appropriate):	☐ Neutral intermediary ☐ Buyer-centric ☐ Seller centric ☐ Industry consortia led exchange
What is your strategic approach?	☐ General aviation e-Marketplace ☐ Specialised (one product group) aviation e-Marketplace ☐ Airline-to-Airline e-Marketplace ☐ Supplier-to-Airline e-Marketplace
Which type of airlines operate on your e-Marketplace?	☐ Full-service intercontinental airlines ☐ Full-service regional airlines ☐ Low-cost airlines ☐ Charter airlines
What is the overall strategy of your e-Marketplace? How do your participants benefit?	

Of the following airlines, which groups show the highest integration of your e-Marketplace on a scale from 1-5 (1: not at all - 5: totally) ?

	1	2	3	4	5
Full service intercontinental airlines	☐	☐	☐	☐	☐
Regional airlines	☐	☐	☐	☐	☐
Low cost airlines	☐	☐	☐	☐	☐
Charter airlines	☐	☐	☐	☐	☐

Not at all (1), Mainly not (2), It depends (3), Mainly yes (4), Totally (5).

AIRLINE PURCHASING INFORMATION

What gross savings (as a percentage of total procurement costs) have your airline customers achieved through using your e-Marketplace?	
Where do you think airlines achieve most gross savings by the use of your e-Marketplace? By reduction of processing costs or product costs?	☐ mainly in product costs ☐ slightly more in product costs ☐ about the same ☐ slightly more in processing costs ☐ mainly in processing costs

E-MARKETPLACE INFORMATION

Is there any airline involvement regarding ownership of your electronic marketplace?	☐ Yes ☐ No
If yes, which types of airlines?	☐ Full service intercontinental airlines ☐ Regional airlines ☐ Low cost airlines ☐ Charter airlines
Is there any supplier involvement regarding ownership of your electronic marketplace?	☐ Yes ☐ No
What obstacles or disadvantages, if any, do suppliers see in participating in your electronic marketplace?	
What obstacles or disadvantages, if any, do buyers see in participating in your electronic marketplace?	

Which products and services are traded on your e-Marketplace?

☐ Spare parts ☐ Technical support and maintenance ☐ Avionics
☐ Engines ☐ Airframe products ☐ Aircraft
☐ Surplus, excess and over-run inventory and equipment ☐ Catering ☐ Ground support equipment
☐ Fuel

If others, please specify:

Which of the following trading functions do you offer ?	Yes	No
Joint purchasing	☐	☐
Auction/Reverse Auction possibilities	☐	☐
Catalogues	☐	☐
Exchange (RFQ/RFP/RFB)	☐	☐
Bulletin board	☐	☐
Automatic matching of demand and offer	☐	☐
Collaborative sourcing capabilities	☐	☐
Reuseable, customised templates for all negotiation types	☐	☐
Supplier selection, which are allowed to see demand/auctions	☐	☐
File attachment capabilities	☐	☐
Quality proof of the listed/offered products of customers	☐	☐
Supplier ratings	☐	☐
Tracking of orders	☐	☐
Tracking for loans/borrows	☐	☐
Repair/maintenance status checking	☐	☐
Handling of delivery by e-Marketplace operator itself	☐	☐
Providing up-to-date documentation	☐	☐
Inventory allocation of customers listed by airport/storage location	☐	☐
Transaction support for loans/borrows	☐	☐
Surplus inventory sell possibility	☐	☐
24h help line	☐	☐
Newsletters, etc.	☐	☐
Links to service providers (logistics, shipment, etc.)	☐	☐
Online discussion possibilities (chat)	☐	☐
Do you offer any other services that are not listed here?		

Please indicate which of the following modes of fee payment you offer.	Yes	No	
Monthly/yearly fee	☐	☐	
Percentage per transaction	☐	☐	
Uniquely admission fee	☐	☐	
Listing fee	☐	☐	
Other:	☐	☐	
If other, please specify:			
Who pays the fees?	☐ Supplier	☐ Buyer	☐ Both
Comments:			

Which of the following pricing models do you think are appropriate for buying and selling each kind of the following products and services (see explanation below)?

1: completely inappropriate; 2: Inappropriate; 3: Fairly appropriate; 4: Appropriate; 5: Extremely Appropriate

	Auction/ Reverse Auction *(1)					Fixed Price Catalogue *(2)					Competitive Tendering *(3)					Power Buying *(4)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Powerplants	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Spare Parts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Maintenance & Repair Services	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Catering and Inflight Supplies	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
General Expenses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

*(1) "Auction Marketplace": A method for selling an asset to the highest bidder. It brings dynamic pricing to the selling process. Sellers take lead in auctions, putting products up for sale and letting potential buyers increase the bid price.

"Reverse Auction Marketplace": An auction where buyers post a listing for an item or service. The buyer may specify a particular purchase and allow suppliers to bid on it. Typically, the lowest bid wins a reverse auction according to the requirements set by the buyer.

*(2) "Fixed Price Catalogue Marketplace": A marketplace where offers of many suppliers can be called and prices be compared. Finally, the suppliers of choice can be contacted.

*(3) "Competitive Tendering Marketplace": Here only one part (either buyer or seller) put their offers/demands on the marketplace. The other part can then put their offers / demands accordingly and contact the other party.

*(4) "Power Buying Marketplace": Here buyers that require the same products come together to reduce the price of a product.

To which extent can airlines achieve the following by participating in your e-Marketplace?	1	2	3	4	5
Reduction of search costs	☐	☐	☐	☐	☐
Time efficiency enhancements	☐	☐	☐	☐	☐
Order processing facilitation	☐	☐	☐	☐	☐
Inventory level reduction	☐	☐	☐	☐	☐
Higher transparency of suppliers	☐	☐	☐	☐	☐
Reduction of product prices	☐	☐	☐	☐	☐

Not at all (1), Mainly not (2), It depends (3), Mainly yes (4), Totally (5).

Do you collaborate with other e-Marketplaces?	☐ Yes	☐ No	
Do you ever experience compatibility/integration problems with companies' ERP/legacy systems and to which extent?	☐ Never ☐ Often	☐ Rarely ☐ Very often	☐ Sometimes

COMPANY INFORMATION

How many employees are working in your company world-wide?	
How long did it take you to become operational as an e-Marketplace (in years and/or months)?	
When was your company founded?	

If you fill in your contact details, a summary of the research findings will be mailed to you. Your contact details will be recorded seperately from the questionnaire and all information provided will be held in the strictest confidence.

Your contact details (optional)	
Name:	
Company address:	
Country:	
e-mail:	
Web Site:	

Comments / Recommendations:

Please press "SAVE" on the top of this page in order to submit the questionnaire.

You will then automatically be linked to the NITL Web Site.

THANK YOU VERY MUCH FOR YOUR PARTICIPATION !

APPENDIX B: E-MARKETPLACE SURVEY RESULTS

Figure 122: Sample Representativeness - Comparison of Early to Late Respondents

Strategic Approach of Aviation E-Marketplaces:

	Early respon dents	Late respon dents	**Total**
General aviation e-Marketplace	**29.4%**	**33.3%**	**31.3%**
Specialised (one product group) aviation e-Marketplace	**5.9%**	**13.3%**	**9.4%**
Airline-to-Airline e-Marketplace	**35.3%**	**26.7%**	**31.3%**
Supplier-to-Airline e-Marketplace	**29.4%**	**26.7%**	**28.1%**
Total	**100.0%**	**100.0%**	**100.0%**

p = **86.8%** ; chi2 = **0.72** ; ddl = **3** (**NS**)

Type of Airlines Operating on E-Marketplaces:

	Early respondents	Late respondents	**Total**
Full-service intercontinental airlines	**25.0%**	**26.9%**	**25.9%**
Full-service regional airlines	**25.0%**	**26.9%**	**25.9%**
Low-cost airlines	**25.0%**	**23.1%**	**24.1%**
Charter airlines	**25.0%**	**23.1%**	**24.1%**
Total	**100.0%**	**100.0%**	**100.0%**

p = **99.4%** ; chi2 = **0.08** ; ddl = **3** (**NS**)

Airline Involvement regards E-Marketplace Ownership:

	Early respondents	Late respondents	**Total**
Yes	**25.0%**	**22.2%**	**23.5%**
No	**75.0%**	**77.8%**	**76.5%**
Total	**100.0%**	**100.0%**	**100.0%**

p = **89.3%** ; chi2 = **0.02** ; ddl = **1** (**NS**)

Joint Purchasing Conducted by E-Marketplace:

	Early respondents	Late respondents	**Total**
Yes	**50.0%**	**33.3%**	**41.2%**
No	**50.0%**	**66.7%**	**58.8%**
Total	**100.0%**	**100.0%**	**100.0%**

p = **48.6%** ; chi2 = **0.49** ; ddl = **1** **(NS)**

Figure 123: Collaboration with other E-Marketplaces

Yes	**8**	**47.1%**
No	**9**	**52.9%**
Total	**17**	**100.0%**

Table 20: Services Offered by E-Marketplaces

	Yes	No	**Total**
Reuseable, customised templates for all negotiation types	**93.8%**	**6.3%**	**100.0%**
Surplus inventory sell possibility	**82.4%**	**17.6%**	**100.0%**
Catalogues	**78.6%**	**21.4%**	**100.0%**
Exchange (RFQ/RFP/RFB)	**78.6%**	**21.4%**	**100.0%**
Bulletin board	**71.4%**	**28.6%**	**100.0%**
Automatic matching of demand and offer	**70.6%**	**29.4%**	**100.0%**
24h help line	**68.8%**	**31.3%**	**100.0%**
Collaborative sourcing capabilities	**64.7%**	**35.3%**	**100.0%**
New sletters, etc.	**64.7%**	**35.3%**	**100.0%**
Tracking of orders	**58.8%**	**41.2%**	**100.0%**
Tracking for loans/borrow s	**58.8%**	**41.2%**	**100.0%**
Providing up-to-date documentation	**58.8%**	**41.2%**	**100.0%**
Transaction support for loans/borrow s	**58.8%**	**41.2%**	**100.0%**
File attachment capabilities	**52.9%**	**47.1%**	**100.0%**
Auction/Reverse Auction possibilities	**50.0%**	**50.0%**	**100.0%**
Joint purchasing	**41.2%**	**58.8%**	**100.0%**
Supplier selection, w hich are allow ed to see demand/auctions	**41.2%**	**58.8%**	**100.0%**
Inventory allocation of customers listed by airport/storage location	**41.2%**	**58.8%**	**100.0%**
Repair/maintenance status checking	**29.4%**	**70.6%**	**100.0%**
Links to service providers (logistics, shipment, etc.)	**29.4%**	**70.6%**	**100.0%**
Online discussion possibilities (chat)	**29.4%**	**70.6%**	**100.0%**
Supplier ratings	**11.8%**	**88.2%**	**100.0%**
Quality proof of the listed/offered products of customers	**6.3%**	**93.8%**	**100.0%**
Handling of delivery by e-Marketplace operator itself	**5.9%**	**94.1%**	**100.0%**
Total	**51.4%**	**48.6%**	**100.0%**

Figure 124: Compatibility / Integration Problems between E-Marketplaces and ERP Systems

Never	14	82.4%	
Rarely	1	5.9%	
Sometimes	2	11.8%	
Often	0	0.0%	
Very often	0	0.0%	
Total	**17**	**100.0%**	

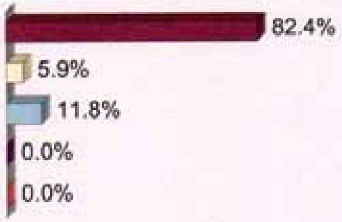


Figure 125: Summary of Characteristics and Features of E-Marketplaces (as of End 2005)

E-Marketplace	Aerochain	AerospaceOnline	Aeroxchange	Aircraft Market Place	AirParts.com	AirportHub	APLS	AVSupportOnline	Cargo Portal Services
Products and Services Traded		New and used equipment within the areas of avionics systems integration, air traffic control, MRO and engines	Maintenance and airline services and products for trading partners in the aviation supply-chain such as airframe, avionics and engine components	Aircraft, aircraft equipment and parts in the commercial aviation industry	Aircraft, aircraft parts, avionics, equipment and clothes, watches, books, videos related to aviation	Airport accessities, products and services including those pertaining to safety & security, environment, IT, finance & administration.	Goods and services in the defence industry such as aerospace and defence parts, spares and components, electronics, hardware, overhaul and repair.	Aircraft parts, aircraft for sale, aviation pma's (Parts Manufacturer Approval) and overhaul capabilities for commerical as well as general aviation	Air cargo industry, Transportation services
Buyers and Sellers	Airlines, suppliers, manufacturers and OEM's of the mentioned industries	Buyers and sellers in the aviation industry	Airlines, distributors, manufacturers, PMAs, service providers, suppliers, and surplus vendors	Airlines, manufacturers, suppliers and others in the aviation industry	Private and commercial companies in the aviation industry	Airport operators and their suppliers	Buyers are the military, the defence and aviation companies. Sellers are suppliers or manufacturers of defence equipment, electronics, hardware etc.	Buyers, wholesalers, distributors, and manufacturers of aircraft parts, products and services	Companies in the air cargo industry. Sellers are the carriers and buyers are the forwarders
Geographic Focus	Global	Global with focus on North America	Global	Global with focus on North America	Global with a focus on USA	North America	USA	North America	Global, CPS (Cargo Portal Services) carriers serve 430 cities in 117 countries
Trading Functions	Auction, Catalogues, Catalogues with online-order, Request for Quotation/Proposals/Bid, Reverse auction	Catalogues with online-order, Request for Quotation/Proposals/Bid	Auction, Catalogues with online-order, Classified ads, Request for Quotation/Proposals/Bid, Reverse auction	Auction, Catalogues with online-order, Request for Quotation/Proposals/Bid	Catalogues with online-order, Classified ads, Request for Quotation/Proposals/Bid	Auction, Classified ads, Request for Quotation/Proposals/Bid	Catalogues, Request for Quotation/Proposals/Bid	Auction, Catalogues, Request for Quotation/Proposals/Bid	Catalogues with online-order
Criteria for Membership	Registration required	Registration with say VertMarket required	Registration is required	Registration required	Registration required	Registration required	To utilize APLS a user is required to have a part number, national stock number (NSN), national item identification number (NIIN) or military specification (mil-spec) on the products traded.	Registration required	It is open to all carriers and forwarders on a neutral basis. Forwarders also need an account with one of the participating carriers.
Fees	Not disclosed	Suppliers pays the fee. Different fees for different services	Subscription fees vary by product and are based on usage/size profiles	Different fees for different services	Free 30 Day RFQ Signup. At the end of 30 days, there is an annual subscription fee	Not disclosed	Different forms of subscriptions available. Trial/short term subscriptions (3 or 7 day option) and Professional subscription options (Monthly, Quarterly or Annual options).	Buyer can locate parts or send RFQ for free. Sellers' first inventory upload is free, then they pay update plan of it. Other Features against fee	Services are free for forwarders
Transaction and membership statistics	Over 650 aircrafts sold since the starting of the operations. In Europe, currently 47 operators are using the platform	3510 suppliers listed on site	12 million parts are listed	Not disclosed	International buyers submit over 4,000 RFQs per year	Not disclosed	APLS draws from multiple data sources which aggregated contain a total of over 120 million records of component part information	2,300+ active inventory suppliers; information for 1,250,000+ sellers; 200,000+ monthly hits by active members; 1,200+ buyers and sellers added each month	3,780 branch offices of 1,902 forwarder companies in 74 countries are on-line with CPS. CPS carriers serve 430 cities in 117 countries
Owners	France's ATR and Brazil's Embraer	VertMarkets, a wholly owned subsidiary of Corry Publishing, is the former VerticalNet SMB group. Verticalnet sold this division to Corry Publishing in June 2002	13 Founding airlines include: Air Canada, Air New Zealand, ANA, America West Airlines, Austrian Airlines, Cathay Pacific, FedEx, JAL, KLM, Lufthansa, Northwest, SAS, Singapore Airlines	Privately held	Turbine World International, Inc	aeroVISTAS.net, Airports Council International- North America	Defence Solutions Group, Inc. (DSGI)	AvSupport Inc	Cargo Portal Services is a neutral brand. Unisys runs the service
Date established	2002	1999	2000	2000	1995	Not disclosed	1995	1994	2003
Headquarters	Sao Paulo, Brazil	Horsham, PA, USA	Dallas, Texas, USA	Houston, Texas, USA	Englewood, Colorado, USA	Vancouver, BC, Canada	Arlington, TX, USA	Fargo, ND, USA	Blue Bell, PA, USA

E-Marketplace	Exostar	GSEMarket.com	ILSmart.com	Industrial SupportOnline	OneAero	onePO	PartsBase	Resale.de
Products and Services Traded	Integrated supply-chain solutions, products and services to the aerospace and defence (A&D) industry	Used ground support equipment for the aviation industry	Aviation and maritime parts, equipment and services, including surplus, excess and over-run inventory and equipment	Aviation related industrial parts, products and services	Aviation inventory, overhaul/repair and maintenance services	Surplus aircraft parts and related maintenance services	Parts, overhauls and services within the aviation, aerospace and defence industries, e.g. engines, tools, electronic components, training services and coatings	All kinds of used machinery, including commercial vehicles, tools and engines, machinery for wood working, metal working, plastic and rubber processing, packaging, agriculture, printing, food processing etc.
Buyers and Sellers	Companies, assembly and component manufacturers, service suppliers and government agencies that buy/sell direct or indirect products and/or services in the commercial, military and government sectors.	Airlines, other industry related companies and their suppliers of products & services to the aviation industry	Governmental defence institutes and manufacturers, distributors, traders, providers of repair services, and aircraft operators within the aviation or maritime industry	Industrial parts buyers and sellers; wholesalers, distributors and manufacturers	Airlines, OEM's, third party repair facilities, leasing companies, government agencies, military, etc.	Members of the airline industry and the air transport industry's end users	Airlines, OEMs, independent distributors, on-site airport maintenance providers, Federal Aviation Administration certified repair and overhaul facilities, traders and brokers	Aircraft owners and companies that want to buy aircrafts
Geographic Focus	Global	Global, USA prevalence	Global with focus on USA	USA and Canada	Global	Global	Global with focus on the USA	Global with focus on Europe
Trading Functions	Auction, Catalogues with online-order, Request for Quotation/Proposals/Bid, Reverse auction	Auction	Auction, Catalogues, Request for Quotation/Proposals/Bid	Auction, Catalogues, Request for Quotation/Proposals/Bid	Classified ads, Request for Quotation/Proposals/Bid	Catalogues, Request for Quotation/Proposals/Bid	Request for Quotation/Proposals/Bid	Catalogues, Classified ads, Request for Quotation/Proposals/Bid
Criteria for Membership	Registration required	Registration is required	Registration required	No requirements except their terms of use, Registration required	Registration is required	Registration is required, companies need to meet certain requirements to join the trading hub.	Registration required except for using the industry directory	Registration required, application form is available online
Fees	Four different types of memberships available; Bronze, Silver, Gold and Platinum. Different fees for different services	Sellers are charged a listing fee and an awarded bid fee. Buyers do not pay any fee. But if a bid is accepted, the buyer is legally obligated to complete the transaction	ILS is a subscription database and fees depend on one's usage of the site	Membership fees for premium membership. Usage of basic services is free. Updating of inventory information is done against a fee. Sellers: fees for various membership plans.	A monthly membership fee is taken. Pricing is based on the business's size and the services used	A transaction percentage fee is paid by both the buyer and seller	Not disclosed	Services for buyers are free of charge. Sellers can place up to 3 ads for free, to place more they have to pay a membership fee.
Transaction and membership statistics	Exostar has connected over 300 procurement systems in 20 different countries, and has registered more than 16,000 trading partners worldwide	Not disclosed	The site has approximately 5 billion parts listed and 16,000 subscribers	over 2,200 active suppliers; information for over 1,250,000 sellers and over 200,000 monthly hits by active members.	Approximately 1,500 companies are registered	Not disclosed	more than 3,500 registered companies	Over 12,000 items online and more than 12,000 companies from 116 countries are registered
Owners	BAE SYSTEMS, Boeing, Lockheed Martin, Raytheon, Rolls-Royce	GSEmarket.com is privately held and operated by GSE Market LP, a Georgia limited partnership. GSE Market LP is owned by its general partner, GSE Management, LLC and limited partners.	Avnet Inc (NYSE: AVL)	AvSupport Inc.	Overhaul Search, b2b-wire, cPark Labs	Privately held	PartsBase, Inc.	RESALE.DE, powered by Gris Internet Marketing
Date established	2000	2000	1993	1998	2004	2000	1996	1996
Headquarters	Herndon, VA, USA	Palm City, Florida, USA	Memphis, TN, USA	Fargo, North Dakota (ND), USA	Hamburg, Germany	Luton, UK	Boca Raton, FL, USA	Braunschweig, Germany

APPENDIX C: AIRLINE SURVEY INSTRUMENT

nitl

Supply Chain Management
Centre of Excellence

National Institute for Transport and Logistics, Dublin, Ireland

This questionnaire was developed covering the scope of a doctoral dissertation in order to facilitate a study on the overall reception of B2B digital marketplaces in the Aviation Industry. All responses will be treated confidentially. Thank you very much for your time and participation.

GENERAL INFORMATION AND CORPORATE STRATEGY

Position of respondent:	☐ Director General ☐ Materials & Logistics Manager ☐ Purchasing Executive ☐ Others
If others, please specify:	
How many employees are working in your company world-wide?	
How many of them are involved in Purchasing?	
What is the total number of aircaft in your fleet?	

Your company's strategy focuses on the following business models

	1	2	3	4	5
Scheduled Regional	☐	☐	☐	☐	☐
Scheduled Intercontinental	☐	☐	☐	☐	☐
Short-haul Charter	☐	☐	☐	☐	☐
Long-Haul Charter	☐	☐	☐	☐	☐
Low-Cost	☐	☐	☐	☐	☐

Your company's strategy is to be involved in the following partnerships:

	1	2	3	4	5
Strategic Alliances	☐	☐	☐	☐	☐
Codesharing Partnerships	☐	☐	☐	☐	☐
Shares in other Airlines	☐	☐	☐	☐	☐
Airline Group Holdings	☐	☐	☐	☐	☐
Procurement Consortia	☐	☐	☐	☐	☐

In your company you jointly share the following resources and information with your partners:

	1	2	3	4	5
IT Systems	☐	☐	☐	☐	☐
Purchasing Tools	☐	☐	☐	☐	☐
Office Space or Facilities	☐	☐	☐	☐	☐
Suppliers	☐	☐	☐	☐	☐
Company Products	☐	☐	☐	☐	☐
Product Prices	☐	☐	☐	☐	☐
Purchasing Tools	☐	☐	☐	☐	☐
Purchasing Procedures	☐	☐	☐	☐	☐

BUSINESS CONTEXT

Over the last three years your company experienced strongly competitive pressures to reduce costs.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years your company experienced a strong decline in passenger numbers.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years your company experienced a strong decline in overall profits.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years your company experienced a strongly increased concentration in the supplier markets.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years, your turnover has declined.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years, your passenger load factor per aircraft has decreased.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years your company experienced a strong increase in passenger numbers.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years your company experienced a strong increase in overall profits.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years, your turnover has increased.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Over the last three years, your passenger load factor per aircraft has increased	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally

PURCHASING STRATEGY

Is your corporate purchasing operation ... ☐ centralised ☐ decentralised ☐ decentralised, but centrally co-ordinated

Your company experiences a change in your procurement operation towards...

	1	2	3	4	5
Centralisation	☐	☐	☐	☐	☐
Decentralisation	☐	☐	☐	☐	☐

Not at all (1), Mainly not (2), It depends (3), Mainly yes (4), Totally (5).

Your company has plans to increase the number of suppliers.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Your company has has plans to decrease the number of suppliers.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
What are your average costs involved per P.O. (Purchase Order) in Euros ?	☐				

In your company you jointly procure with partners in the following spend categories:

	1	2	3	4	5
Aircraft	☐	☐	☐	☐	☐
Powerplants	☐	☐	☐	☐	☐
Spares and Repairs	☐	☐	☐	☐	☐
Maintenance Services	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering and Inflight Supplies	☐	☐	☐	☐	☐
General Expenses (Office Supplies, Computer Hardware & Software etc.)	☐	☐	☐	☐	☐

Your company's strategy is to outsource any of the following

	1	2	3	4	5
Powerplants	☐	☐	☐	☐	☐
Spares and Repairs	☐	☐	☐	☐	☐
Maintenance Services	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering and Inflight Supplies	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
General Expenses	☐	☐	☐	☐	☐

Not at all (1), Mainly not (2), It depends (3), Mainly yes (4), Totally (5).

INFORMATION TECHNOLOGY

Please indicate the purpose for which you use the Internet in procurement.

	1	2	3	4	5
Search for new suppliers	☐	☐	☐	☐	☐
To get more detailed or complete information about suppliers	☐	☐	☐	☐	☐
Request for quotation	☐	☐	☐	☐	☐

Never (1), Rarely (2), Sometimes (3), Often (4), Very often (5).

To which extent do you/did you use EDI (Electronic Data Interchange)? ☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Very often

	Not at all	Mainly not	It depends	Mainly yes	Totally
Your company uses the full potential of information and communication technology to facilitate procurement	☐	☐	☐	☐	☐
Your ICT infrastructure enables you to share viable information with partners.	☐	☐	☐	☐	☐
Your ICT infrastructure enables you to share viable information with suppliers.	☐	☐	☐	☐	☐
Your company has interlinked the full supply chain with its ICT system(s).	☐	☐	☐	☐	☐

E-PROCUREMENT STRATEGY

Are you using or planning to use any e-Procurement systems?	☐ Yes, currently use e-Procurement system	☐ Yes, plan to use e-Procurement system	☐ No, don't use e-Procurement system

Your company currently uses e-Marketplace applications in the following spend areas:

	1	2	3	4	5
Spares and repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering and Inflight Supplies	☐	☐	☐	☐	☐
Airport Services	☐	☐	☐	☐	☐
General Procurement	☐	☐	☐	☐	☐

Never (1), Rarely (2), Sometimes (3), Often (4), Very often (5).

B2B E-MARKETPLACE STRATEGY

Are you a part owner of an electronic marketplace?	☐ Yes	☐ No			
If no, do you participate in an electronic marketplace?	☐ Yes	☐ No			
If no, do you intend to participate in the future?	☐ Yes	☐ No			
How important are e-Marketplaces to your procurement strategy?	☐ No importance	☐ Little importance	☐ Average Importance	☐ Quite important	☐ Very important
What obstacles or disadvantages, if any, do you see in participating in an e-Marketplace?					
What advantages do you expect in participating in an e-Marketplace?					
If you use e-Marketplace(s), do you tend to procure from a single one or do you use more than one?	☐ One	☐ Two	☐ Three	☐ More than three	
The e-Marketplace(s) you are using cover all your procurement needs.	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
How many of the e-Marketplaces you are using cover multiple product markets?	☐ Yes, one	☐ Yes, at least two	☐ Yes, more than three	☐ None	
Do you think that the savings achieved in processing and product costs exceeded the investment costs?	☐ Not at all	☐ Mainly not	☐ It depends	☐ Mainly yes	☐ Totally
Where do you think you achieve gross savings by the use of e-Marketplaces? More in the reduction of product costs or of processing costs?	☐ Mainly in processing costs	☐ Slightly more in processing costs	☐ About the same	☐ Slightly more in product costs	☐ Mainly in product costs

Please indicate to which extent you use e-Marketplaces in the following:	1	2	3	4	5
Catering and Inflight Supplies3					
Materials, Spares and Repairs					
Fuel					
Maintenance Services					
Tools / GSE					
Interiors					
General Procurement					
Airframe Manufacturers					
Spare Parts Dealers					
Other Manufacturers					

Never (1), Rarely (2), Sometimes (3), Often (4), Very often (5).

Please score which e-Marketplace you prefer or would consider participating in.	1	2	3	4	5
Airline driven e-Marketplace					
Manufacturer (airframe, spare parts, etc.) driven e-Marketplace					
Parts broker driven e-Marketplace					
External player driven e-Marketplace					
Neutral e-Marketplace					
Consortia driven e-Marketplace					

Not at all (1), Mainly not (2), It depends (3), Mainly yes (4), Totally (5).

Do you use the following value added e-Marketplace services?			Please score their importance.				
	Yes	No	1	2	3	4	5
Regional arrangement of the e-Marketplace							
e-Marketplace website in your native language							
Auction possibilities							
Reverse auction possibilities							
Supplier catalogues online							
Demand aggregation possibilities							
Automatic matching of demand and offer							
Collaborative sourcing capabilities							
Reuseable, customised templates for all negotiation types							
Supplier selection which are allowed to see demands/auctions?							
File attachment capabilities							
Quality proof (certification, etc.) of the offered products							
Supplier ratings							
Tracking of orders							
Handling of the delivery via the e-Marketplace operator							
Order processing checking							
Repair/maintenance status checking							
Up-to-date documentation							
Inventory allocations listed by airport							
Transaction support for (AOG) loans/borrows							
Tracking of loans/borrows							
Surplus inventory sell possibility							
24h helpline							
Newsletters, etc.							
Links to service providers (Logistics, Shipment, etc.)							
Online discussion possibilities (chat)							

To which extent the pricing model "Auction / Reverse Auction" is appropirate for buying and selling the following products and services?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares and Repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
General purchases	☐	☐	☐	☐	☐

completely inappropriate (1), inappropriate (2), fairly appropriate (3), appropriate (4), extremely appropriate (5).

To which extent the pricing model "Fixed Price Catalogue" is appropirate for buying and selling the following products and services?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares and Repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
General purchases	☐	☐	☐	☐	☐

completely inappropriate (1), inappropriate (2), fairly appropriate (3), appropriate (4), extremely appropriate (5).

To which extent the price model "Power Buying" is appropriate for buying and selling the following products and services?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares and Repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
General purchases	☐	☐	☐	☐	☐

completely inappropriate (1), inappropriate (2), fairly appropriate (3), appropriate (4), extremely appropriate (5).

To which extent a reduction of search costs can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

To which extent time efficiency enhancements can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

To which extent order processing facilitation can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

To which extent inventory level reduction can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

To which extent a higher transparency of suppliers can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

To which extent a reduction of product prices can be achieved by using e-Marketplaces?

	1	2	3	4	5
Pow erplants	☐	☐	☐	☐	☐
Spares & repairs	☐	☐	☐	☐	☐
Maintenance	☐	☐	☐	☐	☐
Fuel	☐	☐	☐	☐	☐
Interiors	☐	☐	☐	☐	☐
Catering	☐	☐	☐	☐	☐
Tools / GSE	☐	☐	☐	☐	☐
Office supplies	☐	☐	☐	☐	☐

completely inappropriate (1), inappropriate (2), fairly appropriate (3), appropriate (4), extremely appropriate (5).

Please score which of the following modes of fee payment you would prefer.

	1	2	3	4	5
Monthly/yearly fee	☐	☐	☐	☐	☐
Percentage per transaction	☐	☐	☐	☐	☐
Uniquely admission fee	☐	☐	☐	☐	☐
Listing fee	☐	☐	☐	☐	☐
Fees paid as a percentage of cost savings	☐	☐	☐	☐	☐
Other:	☐	☐	☐	☐	☐

Who should pay the fees? ☐ Buyer ☐ Supplier ☐ Both

COMMENTS AND ADDRESS (OPTIONAL)

Comments / Recommendations:

If you fill in your contact details, a summary of the research findings will be mailed to you. Your contact details will be recorded separately from the questionnaire and all information provided will be held in the strictest confidence.

Please press SAVE when completed in order to submit the questionnaire.

You will then automatically be linked to the NITL website.

Name:	
Address:	
e-mail:	
Country:	
Web Site:	

Thank you very much for your participation !

Contact Details:
Claudia-Maria Wagner
National Institute for Transport and Logistics
17 Herbert Street
Dublin 2
Ph: +353 1 661 1943
e-mail: claudia.wagner@dit.ie

APPENDIX D: AIRLINE SURVEY RESULTS

Figure 126: Sample Representativeness - Comparison of Early to Late Respondents

Airline Size

	Early respondents	Late respondents	Total
Total number of employees	8 986.0	9 287.4	9 135.0
Employees involved in purchasing	56.0	44.1	49.8
Total fleet	83.8	55.0	69.6

Early vs. late respondents / Total number of employees p =89.0% ; F = <0.1 (NS)
Early vs. late respondents / Employees involved in purchasing p =39.7% ; F = 0.7 (NS)
Early vs. late respondents / Total fleet p =22.8% ; F = 1.5 (NS)

Airline Classification

	Regional		Full Service		Charter		Low Fares		Total	
	N	%	N	%	N	%	N	%	N	%
Early respondents	6	14.0%	20	46.5%	8	18.6%	9	20.9%	43	100.0%
Late respondents	4	9.3%	18	41.9%	11	25.6%	10	23.3%	43	100.0%
Total	10	11.6%	38	44.2%	19	22.1%	19	22.1%	86	100.0%

p = 79.4% ; chi2 = 1.03 ; ddl = 3 (NS)

Use of E-Procurement System

	Yes, currently use e-Procurement system		No, don't use e-Procurement system		Total	
	N	%	N	%	N	%
Early respondents	34	77.3%	10	22.7%	44	100.0%
Late respondents	29	65.9%	15	34.1%	44	100.0%
Total	63	71.6%	25	28.4%	88	100.0%

p = 23.7% ; chi2 = 1.40 ; ddl = 1 (NS)

Use of e-Marketplaces

	Yes		No		Total	
	N	%	N	%	N	%
Early respondents	32	72.7%	12	27.3%	44	100.0%
Late respondents	25	56.8%	19	43.2%	44	100.0%
Total	57	64.8%	31	35.2%	88	100.0%

p = 11.8% ; chi2 = 2.44 ; ddl = 1 (LS)

Importance of e-Marketplaces

	Importance of e-Marketplaces
Early respondents	**3.44**
Late respondents	**3.09**
Total	**3.26**

p = **12.0%** ; F = **2.42** (**LS**)

Use of Internet Services

	Early respondents	Late respondents	**Total**
Search for new suppliers	**3.50**	**3.30**	**3.40**
Get more detailed supplier information	**3.70**	**3.55**	**3.63**
Request for quotations	**3.57**	**3.25**	**3.41**

Early vs. late respondents / Search for new suppliers p = **30.5%** ; F = **1.07** (**NS**)
Early vs. late respondents / Get more detailed supplier information p = **45.9%** ; F = **0.57** (**NS**)
Early vs. late respondents / Request for quotations p = **20.5%** ; F = **1.61** (**NS**)

Figure 127: E-Procurement Implementation vs. Airline Type

	Yes, currently use		Yes, plan to use		No		Total	
	N	%	N	%	N	%	N	%
Full Service	**35**	**94.6%**	2	5.4%	0	0.0%	**37**	**100.0%**
Charter	**11**	**55.0%**	**4**	**20.0%**	5	25.0%	**20**	**100.0%**
Low Fares	**12**	**63.2%**	**5**	**26.3%**	**2**	**10.5%**	**19**	**100.0%**
Regional	**5**	**50.0%**	**2**	**20.0%**	3	30.0%	**10**	**100.0%**
Total	**63**	**73.3%**	**13**	**15.1%**	**10**	**11.6%**	**86**	**100.0%**

p = **0.4%** ; chi2 = **18.87** ; ddl = **6** (**VS**)

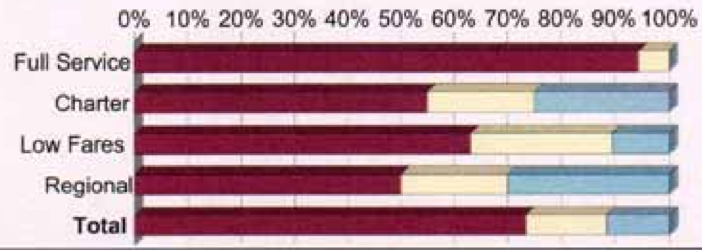
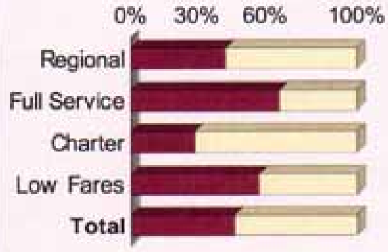


Figure 128: E-Marketplace Use by Airline Strategy Group and Control Variable Airline Size

Less than 1500 employees:

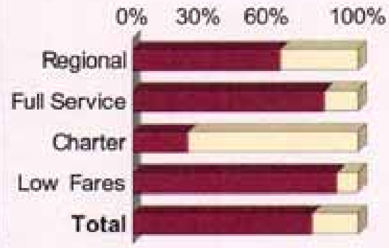
	Yes		No		Total	
	N	%	N	%	N	%
Regional	3	42.9%	4	57.1%	7	100.0%
Full Service	6	66.7%	3	33.3%	9	100.0%
Charter	4	28.6%	10	71.4%	14	100.0%
Low Fares	4	57.1%	3	42.9%	7	100.0%
Total	17	45.9%	20	54.1%	37	100.0%



p = 30.3% ; chi2 = 3.64 ; ddl = 3 (NS)

1500 and more employees:

	Yes		No		Total	
	N	%	N	%	N	%
Regional	2	66.7%	1	33.3%	3	100.0%
Full Service	24	85.7%	4	14.3%	28	100.0%
Charter	1	25.0%	3	75.0%	4	100.0%
Low Fares	10	90.9%	1	9.1%	11	100.0%
Total	37	80.4%	9	19.6%	46	100.0%



p = 2.4% ; chi2 = 9.43 ; ddl = 3 (S)

Table 21: E-Marketplace Adoption vs. ICT Sophistication

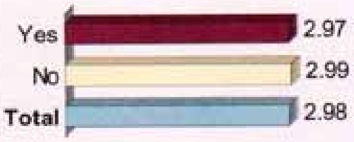
	Yes	No	Total
Use full ICT potential for procurement	3.33	2.87	3.17
ICT enables partner information sharing	3.30	3.03	3.21
ICT enables supplier information sharing	3.19	3.03	3.14
ICT fully interlinked with supply chain	3.19	2.77	3.05

e-Marketplace participation / Use full ICT potential for procurement p = 1.0% ; F = 6.98 (VS)
e-Marketplace participation / ICT enables partner information sharing p = 12.9% ; F = 2.30 (LS)
e-Marketplace participation / ICT enables supplier information sharing p = 32.9% ; F = 0.97 (NS)
e-Marketplace participation / ICT fully interlinked with supply chain p = 1.3% ; F = 6.29 (S)

Figure 129: E-Marketplace Adoption vs. ICT Sophistication by Control Variable Firm Size

Less than 1500 employees

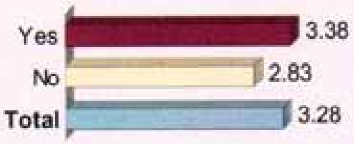
	Level of ICT Sophistication
Yes	**2.97**
No	**2.99**
Total	**2.98**



p = **90.1%** ; F = **<0.01** (**NS**)

1500 and more employees:

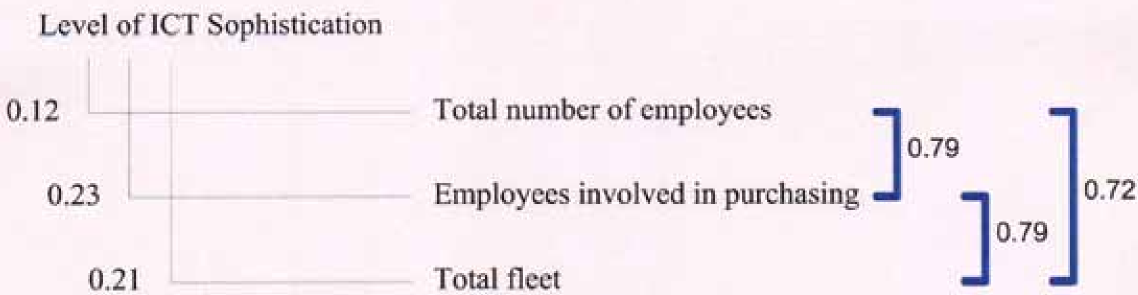
	Level of ICT Sophistication
Yes	**3.38**
No	**2.83**
Total	**3.28**



p = **2.8%** ; F = **5.02** (**S**)

Figure 130: Multiple Regression of Airline Size and Level of ICT Sophistication

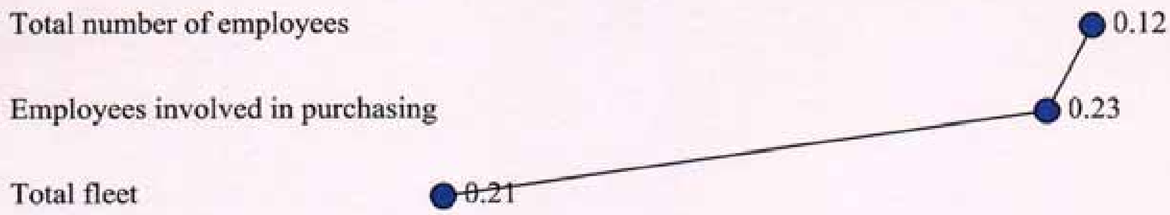
For the variables Total number of employees, Employees involved in purchasing, Total fleet.



- : coef.>0.85
- : 0.85>coef.>0.70
- : 0.70>coef.>0.50

10 observations are not taken into account (non-response for at least one criteria).

Correlations with 'Level of ICT Sophistication'



'Level of ICT Sophistication' : mean = 3.12, st.dev. = 0.69
'Total number of employees' : mean = 9034.24, st.dev. = 15604.54
'Employees involved in purchasing' : mean = 50.91, st.dev. = 62.83
'Total fleet' : mean = 69.37, st.dev. = 110.96
10 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Level of ICT Sophistication = -0.000 * Total number of employees +0.003 * Employees involved in purchasing +0.001 * Total fleet +2.982

These 3 variables explain 6.6% of the variance of Level of ICT Sophistication
Multiple correlation coefficient: R = 0.26, Fisher coefficient: F = 0.50

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.465	3	.822	1.738	.167
	Residual	34.996	74	.473		
	Total	37.462	77			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Level of ICT Sophistication

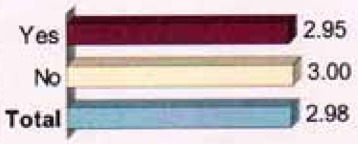
Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = 0.00, standard-deviation = 0.00 (low influence)
'Total fleet' : coefficient = 0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
10 observations are not taken into account (non-response for at least one criteria).

Figure 131: E-Marketplace Adoption vs. ICT Sophistication by Control Variable Airline Strategy

Regional airlines:

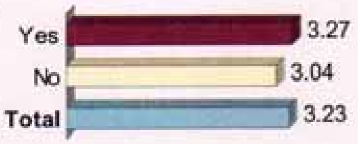
	Level of ICT Sophistication
Yes	**2.95**
No	**3.00**
Total	**2.98**



p = **88.8%** ; F = **<0.01** (**NS**)

Full service airlines:

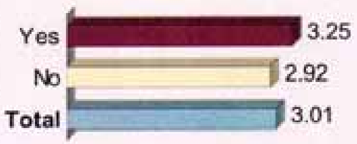
	Level of ICT Sophistication
Yes	**3.27**
No	**3.04**
Total	**3.23**



p = **47.0%** ; F = **0.55** (**NS**)

Charter airlines:

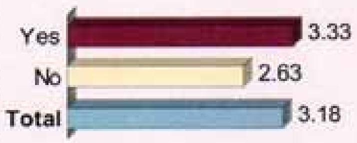
	Level of ICT Sophistication
Yes	**3.25**
No	**2.92**
Total	**3.01**



p = **21.1%** ; F = **1.68** (**NS**)

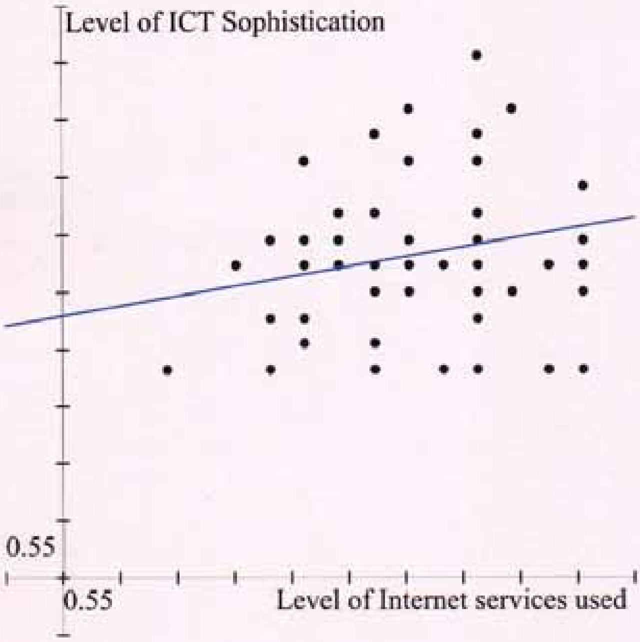
Low-cost airlines:

	Level of ICT Sophistication
Yes	**3.33**
No	**2.63**
Total	**3.18**



p = **9.2%** ; F = **3.12** (**LS**)

Figure 132: Correlation between Level of ICT Sophistication and Extent of Internet Services Used



The graph shows 87 points of coordinates Level of Internet services used; Level of ICT sophistication.

Regression line equation: Level of ICT Sophistication = 0.17 * Level of Internet services used + 2.55
Correlation coefficient: +0.22 (Level of Internet services used explains 4% of the variance of Level of ICT sophistication)
Standard deviation of regression coefficient: 0.083

1 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

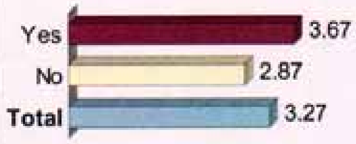
		Level of Internet services used	Level of ICT Sophistication
Level of Internet services used	Pearson Correlation	1	.216
	Sig. (2-tailed)	.	.044
	N	88	87
Level of ICT Sophistication	Pearson Correlation	.216	1
	Sig. (2-tailed)	.044	.
	N	87	87

* Correlation is significant at the 0.05 level (2-tailed).

Figure 133: E-Marketplace Use and Level of Internet Services Used by Control Variable Airline Strategy

Regional airlines:

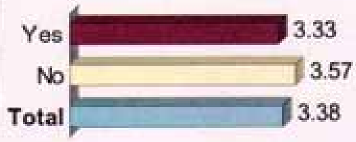
	Level of Internet services used
Yes	**3.67**
No	**2.87**
Total	**3.27**



p = **40.9%** ; F = **0.77** **(NS)**

Full service airlines:

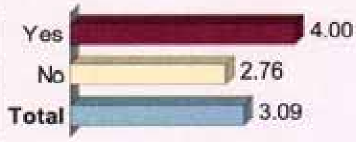
	Level of Internet services used
Yes	**3.33**
No	**3.57**
Total	**3.38**



p = **41.2%** ; F = **0.70** **(NS)**

Charter airlines:

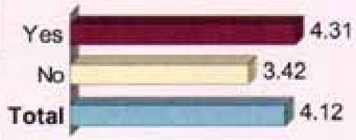
	Level of Internet services used
Yes	**4.00**
No	**2.76**
Total	**3.09**



p = **0.3%** ; F = **11.54** **(VS)**

Low-cost airlines:

	Level of Internet services used
Yes	**4.31**
No	**3.42**
Total	**4.12**

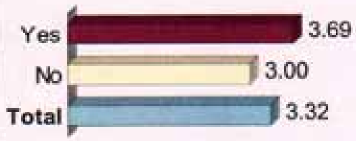


p = **3.3%** ; F = **5.25** **(S)**

Figure 134: E-Marketplace Use and Level of Internet Services Used by Control Variable Firm Size

Less than 1500 employees:

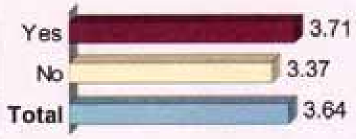
	Level of Internet services used
Yes	**3.69**
No	**3.00**
Total	3.32



p = **2.8%** ; F = **5.18** (**S**)

1500 and more employees:

	Level of Internet services used
Yes	**3.71**
No	**3.37**
Total	3.64



p = **25.2%** ; F = **1.34** (**NS**)

Table 22: E-Marketplace Services Used by Airlines

	Yes		No		Total	
	N	%	N	%	N	%
Supplier catalogues online	75	90.4%	8	9.6%	83	100.0%
Tracking of orders	68	81.9%	15	18.1%	83	100.0%
Order processing checking	61	73.5%	22	26.5%	83	100.0%
Reverse auction possibilities	57	68.7%	26	31.3%	83	100.0%
Quality proof (certification, etc.) of the offered products	56	67.5%	27	32.5%	83	100.0%
File attachment capabilities	54	65.1%	29	34.9%	83	100.0%
Surplus inventory sell possibility	54	65.1%	29	34.9%	83	100.0%
Supplier selection w hich are allow ed to see demands/auctions?	52	62.7%	31	37.3%	83	100.0%
Up-to-date documentation	52	62.7%	31	37.3%	83	100.0%
Auction possibilities	51	61.4%	32	38.6%	83	100.0%
Automatic matching of demand and offer	47	56.6%	36	43.4%	83	100.0%
Links to service providers (Logistics, Shipment, etc.)	47	56.6%	36	43.4%	83	100.0%
Inventory allocations listed by airport	44	53.0%	39	47.0%	83	100.0%
24h helpline	44	53.0%	39	47.0%	83	100.0%
Repair/maintenance status checking	41	49.4%	42	50.6%	83	100.0%
Transaction support for (AOG) loans/borrow s	41	49.4%	42	50.6%	83	100.0%
Tracking of loans/borrow s	38	48.1%	41	51.9%	79	100.0%
Demand aggregation possibilities	38	45.8%	45	54.2%	83	100.0%
Collaborative sourcing capabilities	37	44.6%	46	55.4%	83	100.0%
Handling of the delivery via the e-Marketplace operator	35	42.7%	47	57.3%	82	100.0%
New sletters, etc.	32	38.6%	51	61.4%	83	100.0%
Supplier ratings	24	28.9%	59	71.1%	83	100.0%
e-Marketplace w ebsite in your native language	21	25.3%	62	74.7%	83	100.0%
Regional arrangement of the e-Marketplace	17	20.5%	66	79.5%	83	100.0%
Total	1086	54.7%	901	45.3%	1987	100.0%

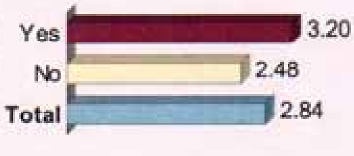
Table 23: Importance of E-Marketplace Services

	Mean	Std deviation	Min	Max
Supplier catalogues online	**4.34**	**0.76**	**3.00**	**5.00**
Tracking of orders	**4.42**	**0.79**	**2.00**	**5.00**
Order processing checking	**4.31**	**0.77**	**3.00**	**5.00**
Reverse auction possibilities	**3.97**	**0.87**	**2.00**	**5.00**
Quality proof	**4.35**	**0.81**	**2.00**	**5.00**
File attachment capabilities	**3.97**	**0.91**	**2.00**	**5.00**
Surplus inventory sell possibility	**3.73**	**0.81**	**2.00**	**5.00**
Supplier selection possibility	**3.62**	**0.67**	**2.00**	**5.00**
Up-to-date documentation	**4.21**	**0.79**	**3.00**	**5.00**
Auction possibilities	**3.81**	**0.90**	**2.00**	**5.00**
Automatic matching of demand and offer	**4.19**	**0.72**	**2.00**	**5.00**
Links to service providers	**3.51**	**1.20**	**1.00**	**5.00**
Inventory allocations listed by airport	**4.08**	**0.71**	**3.00**	**5.00**
24h helpline	**3.92**	**0.84**	**2.00**	**5.00**
Repair/maintenance status checking	**4.18**	**0.81**	**3.00**	**5.00**
Transaction support for (AOG) loans/borrow s	**4.11**	**0.81**	**3.00**	**5.00**
Tracking of loans/borrow s	**4.24**	**0.82**	**3.00**	**5.00**
Demand aggregation possibilities	**3.88**	**0.85**	**2.00**	**5.00**
Collaborative sourcing dapabilities	**3.45**	**0.80**	**2.00**	**5.00**
Handling of the delivery	**3.00**	**1.39**	**1.00**	**5.00**
New sletters, etc.	**2.37**	**0.89**	**1.00**	**5.00**
Supplier ratings	**3.89**	**0.88**	**2.00**	**5.00**
e-Marketplace w ebsite in your native language	**2.79**	**1.42**	**1.00**	**5.00**
Regional arrangement of the e-Marketplace	**2.33**	**0.93**	**1.00**	**4.00**
Total	3.79	1.06	1.00	5.00

Figure 135: E-Marketplace Use and Level of Partnerships by Control Variable Airline Strategy

Regional airlines:

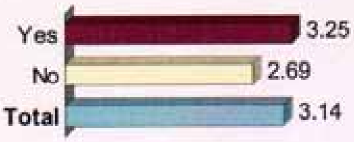
	Average level of partnerships
Yes	**3.20**
No	**2.48**
Total	**2.84**



p = **28.3%** ; F = **1.33** **(NS)**

Full service airlines:

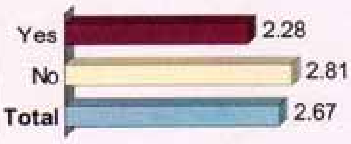
	Average level of partnerships
Yes	**3.25**
No	2.69
Total	**3.14**



p = **2.8%** ; F = **5.14** (**S**)

Charter airlines:

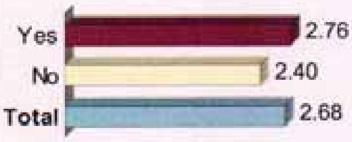
	Average level of partnerships
Yes	**2.28**
No	**2.81**
Total	**2.67**



p = **19.3%** ; F = **1.82** (**NS**)

Low-cost airlines:

	Average level of partnerships
Yes	**2.76**
No	**2.40**
Total	**2.68**

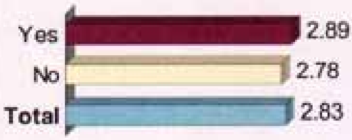


p = **42.1%** ; F = **0.69** (**NS**)

Figure 136: E-Marketplace Use and Level of Partnerships by Control Variable Number of Employees

Less than 1500 employees:

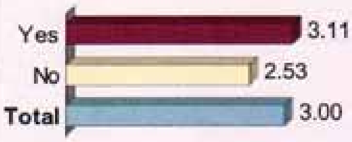
	Average level of partnerships
Yes	**2.89**
No	**2.78**
Total	**2.83**



p = **67.1%** ; F = **0.19** (**NS**)

1500 and more employees:

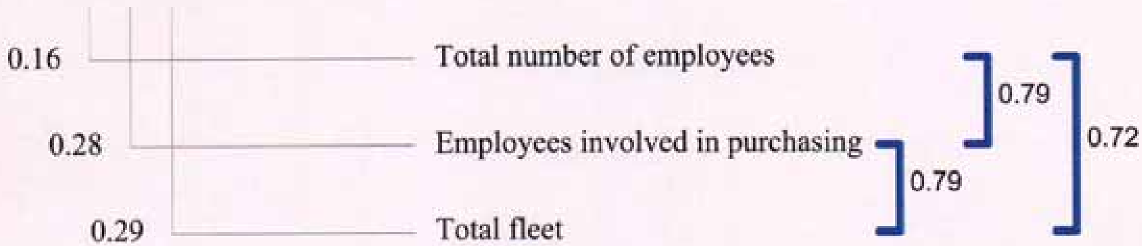
	Average level of partnerships
Yes	**3.11**
No	**2.53**
Total	**3.00**



p = **3.2%** ; F = **4.81** (**S**)

Figure 137: Multiple Regression of Airline Size and Level of Partnerships

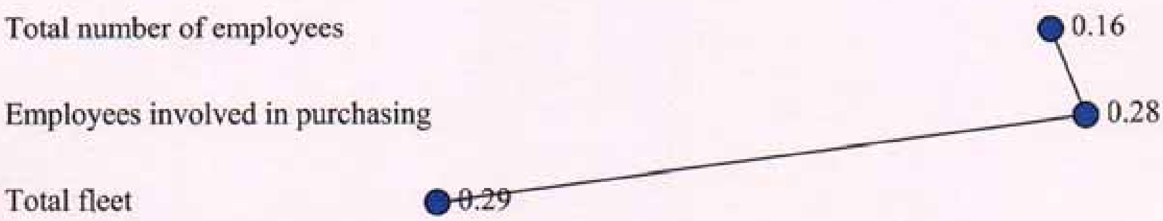
For the variables Total number of employees, Employees involved in purchasing, Total fleet.



: coef.>0.85
: 0.85>coef.>0.70
: 0.70>coef.>0.50

11 observations are not taken into account (non-response for at least one criteria).

Correlations with 'Average level of partnerships'



'Average level of partnerships' : mean = 2.95, st.dev. = 0.74
'Total number of employees' : mean = 9093.13, st.dev. = 15697.76
'Employees involved in purchasing' : mean = 51.38, st.dev. = 63.11
'Total fleet' : mean = 69.56, st.dev. = 111.69
11 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Average level of partnerships = -0.000 * Total number of employees +0.003 * Employees involved in purchasing +0.002 * Total fleet +2.775

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.484	3	1.495	2.888	.041
	Residual	37.788	73	.518		
	Total	42.272	76			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Average level of partnerships

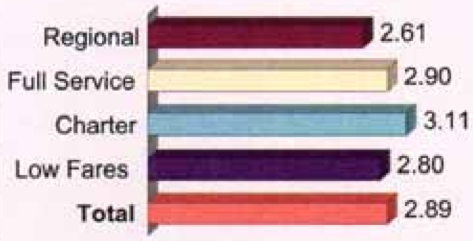
These 3 variables explain 10.6% of the variance of Average level of partnerships
Multiple correlation coefficient: R = 0.33, Fisher coefficient: F = 1.82

Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = 0.00, standard-deviation = 0.00 (low influence)
'Total fleet' : coefficient = 0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
11 observations are not taken into account (non-response for at least one criteria).

Figure 138: Average Extent of Resource and Information Sharing vs. Airline Type

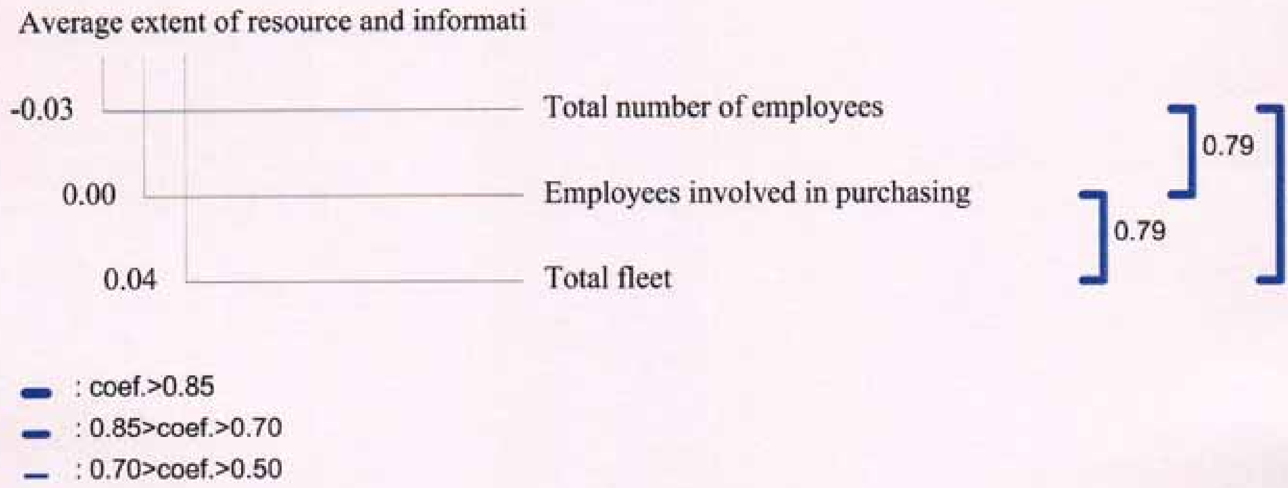
	Average extent of resource and information sharing...
Regional	**2.61**
Full Service	**2.90**
Charter	**3.11**
Low Fares	**2.80**
Total	**2.89**



p = **51.8%** ; F = **0.77** (**NS**)

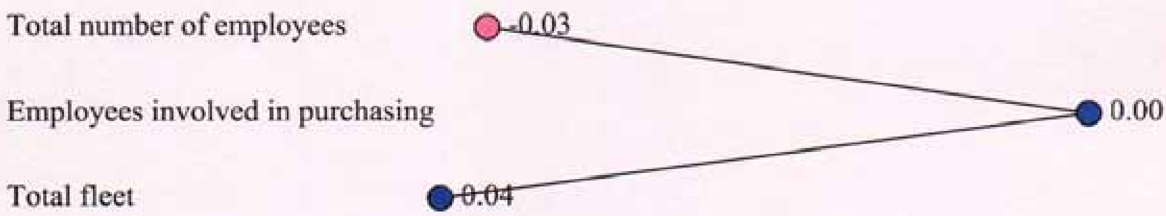
Figure 139: Multiple Regression of Airline Size and Level of Resource/Information Sharing

For the variables Total number of employees, Employees involved in purchasing, Total fleet.



11 observations are not taken into account (non-response for at least one criteria).

Correlations with 'Average extent of resource and informati'



'Average extent of resource and information': mean = 2.94, st.dev. = 0.88
'Total number of employees' : mean = 9093.13, st.dev. = 15697.76
'Employees involved in purchasing' : mean = 51.38, st.dev. = 63.11
'Total fleet' : mean = 69.56, st.dev. = 111.69
11 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Average extent of resource and information = -0.000 * Total number of employees - 0.000 * Employees involved in purchasing +0.001 * Total fleet +2.932

These 3 variables explain 1.1% of the variance of Average extent of resource and information sharing
Multiple correlation coefficient: R = 0.10, Fisher coefficient: F = 0.55

ANOVA

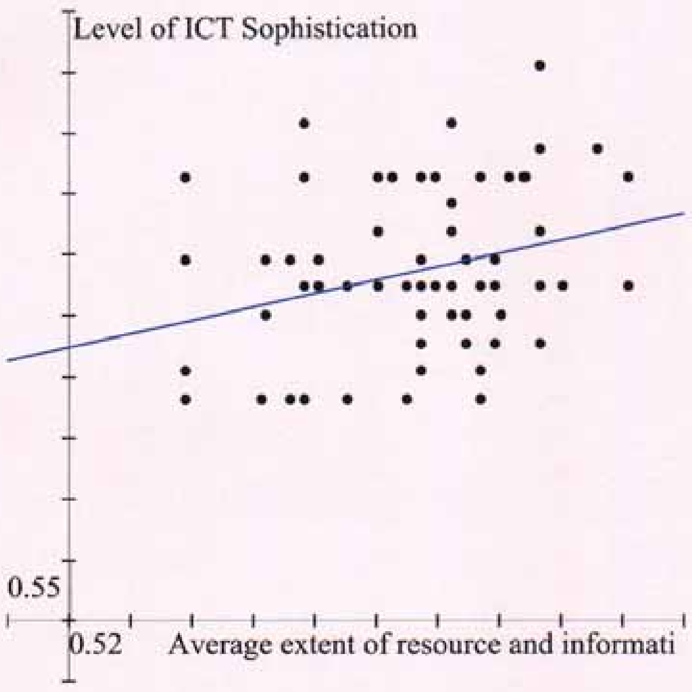
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.643	3	.214	.267	.849
	Residual	58.586	73	.803		
	Total	59.229	76			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Average extent of resource and information sharing with partners

Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Total fleet' : coefficient = 0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
11 observations are not taken into account (non-response for at least one criteria).

Figure 140: Correlation between Extent of Information/Resource Sharing and ICT Sophistication



The graph shows 85 points of coordinates Average extent of resource and information sharing; Level of ICT Sophistication.

Regression line equation: Level of ICT Sophistication = 0.23 * Average extent of resource and information sharing + 2.48
Correlation coefficient: +0.28 (Average extent of resource and information sharing explains 7% of the variance of Level of ICT Sophistication)
Standard deviation of regression coefficient: 0.086

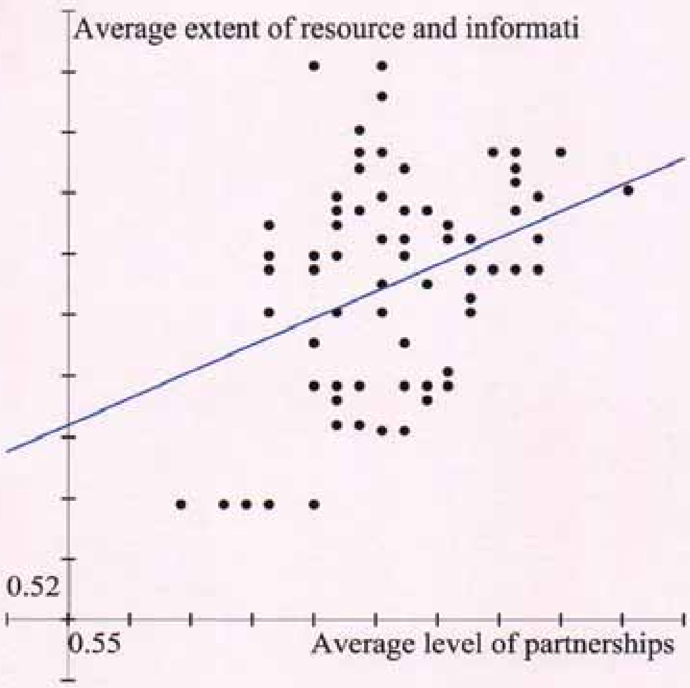
3 observations are not taken into account (non-response for at least one criteria). Each observation is represented by a dot.

Correlations

		Average extent of resource and information sharing with partners	Level of ICT Sophistication
Average extent of resource and information sharing with partners	Pearson Correlation	1	.279
	Sig. (2-tailed)	.	.010
	N	86	85
Level of ICT Sophistication	Pearson Correlation	.279	1
	Sig. (2-tailed)	.010	.
	N	85	87

** Correlation is significant at the 0.01 level (2-tailed).

Figure 141: Correlation between Level of Strategic Partnerships and Resource/Information Sharing



The graph shows 86 points of coordinates. Average level of partnerships; Average extent of resource and information sharing.

Regression line equation: Average extent of resource and information sharing = 0.41 * Average level of partnerships + 1.69
Correlation coefficient: +0.35 (Average level of partnerships explains 12% of the variance of Average extent of resource and information sharing)
Standard deviation of regression coefficient: 0.120

2 observations are not taken into account (non-response for at least one criteria). Each observation is represented by a dot.

Correlations

		Average level of partnerships	Average extent of resource and information sharing with partners
Average level of partnerships	Pearson Correlation	1	.353
	Sig. (2-tailed)	.	.001
	N	86	86
Average extent of resource and information sharing with partners	Pearson Correlation	.353	1
	Sig. (2-tailed)	.001	.
	N	86	88

** Correlation is significant at the 0.01 level (2-tailed).

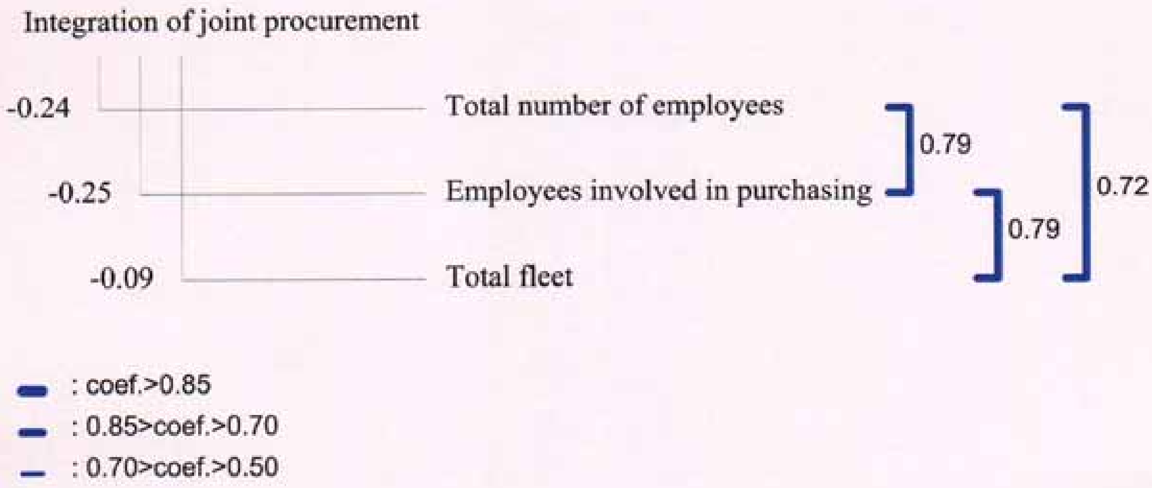
Table 24: Average Level of Joint Purchasing vs. Airline Type

	Regional	Full Service	Charter	Low Fares	Total
Aircraft	3.10	2.92	2.79	2.17	2.75
Powerplants	2.70	3.00	2.53	2.11	2.67
Spares and Repairs	3.10	3.24	3.00	2.22	2.95
Maintenance Services	3.10	3.29	3.16	2.72	3.12
Fuel	2.30	3.37	2.89	2.28	2.91
Tools / GSE	2.80	2.79	2.16	2.00	2.48
Interiors	2.80	2.50	2.16	2.22	2.40
Catering and Inflight Supplies	2.70	3.18	2.47	2.39	2.80
General Expenses (Office Supplies, Computer Hardwa...	2.20	2.63	2.00	1.17	2.13

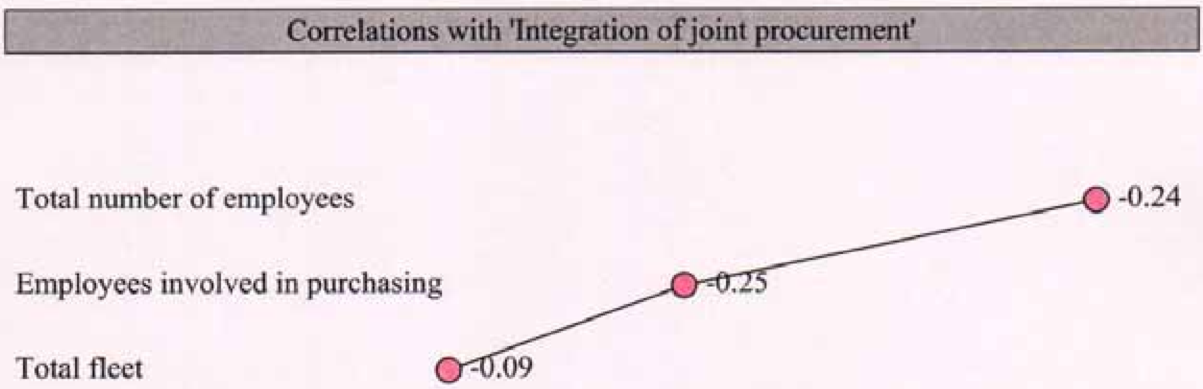
Strategy / Aircraft p = **22.6%** ; F = **1.48** (**NS**)
Strategy / Powerplants p = **13.9%** ; F = **1.87** (**LS**)
Strategy / Spares and Repairs p = **5.8%** ; F = **2.59** (**LS**)
Strategy / Maintenance Services p = **46.8%** ; F = **0.86** (**NS**)
Strategy / Fuel p = **0.8%** ; F = **4.24** (**VS**)
Strategy / Tools / GSE p = **3.7%** ; F = **2.96** (**S**)
Strategy / Interiors p = **44.2%** ; F = **0.91** (**NS**)
Strategy / Catering and Inflight Supplies p = **13.4%** ; F = **1.90** (**LS**)
Strategy / General Expenses (Office Supplies, Computer Hardwa... p = **0.1%** ; F = **5.95** (**VS**)

Figure 142: Multiple Regression of Airline Size and Level of Joint Procurement

For the variables Total number of employees, Employees involved in purchasing, Total fleet.



10 observations are not taken into account (non-response for at least one criteria).



'Integration of joint procurement' : mean = 2.69, st.dev. = 1.05
'Total number of employees' : mean = 9058.60, st.dev. = 15592.84
'Employees involved in purchasing' : mean = 51.18, st.dev. = 62.68
'Total fleet' : mean = 69.59, st.dev. = 110.86
10 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Integration of joint procurement = -0.000 * Total number of employees -0.006 * Employees involved in purchasing +0.003 * Total fleet +2.897

These 3 variables explain 10.5% of the variance of Integration of joint procurement
Multiple correlation coefficient: R = 0.32, Fisher coefficient: F = 3.16

ANOVA

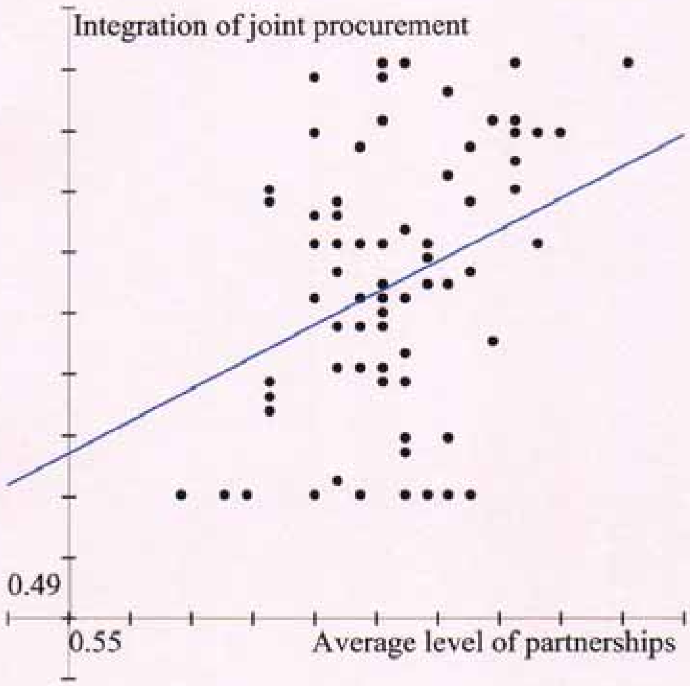
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.044	3	3.015	2.894	.041
	Residual	77.084	74	1.042		
	Total	86.128	77			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Integration of joint procurement

Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = -0.01, standard-deviation = 0.00 (low influence)
'Total fleet' : coefficient = 0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
10 observations are not taken into account (non-response for at least one criteria).

Figure 143: Correlation between Level of Strategic Partnerships and Joint Procurement



The graph shows 85 points of coordinates Average level of partnerships; Integration of joint procurement.

Regression line equation: Integration of joint procurement = 0.47 * Average level of partnerships + 1.33
Correlation coefficient: +0.34 (Average level of partnerships explains 11% of the variance of Integration of joint procurement)
Standard deviation of regression coefficient: 0.142

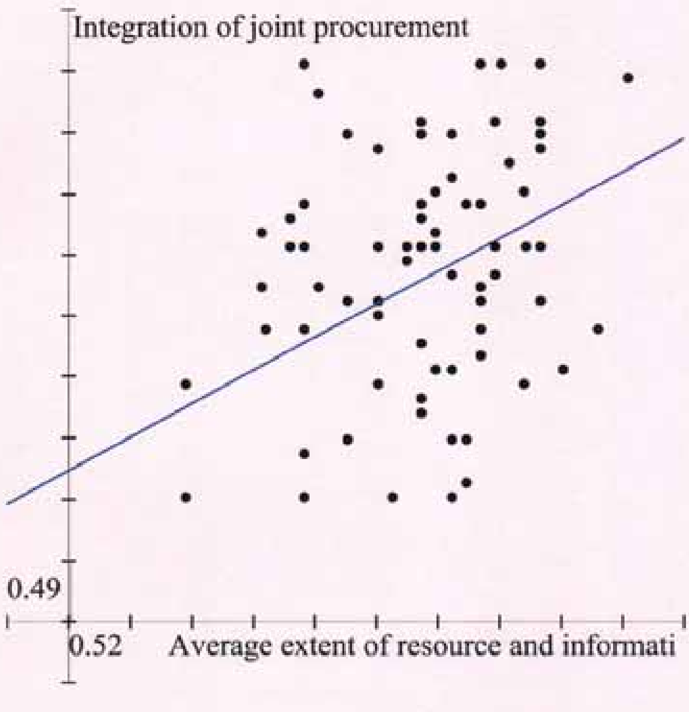
3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Average level of partnerships	Integration of joint procurement
Average level of partnerships	Pearson Correlation	1	.338
	Sig. (2-tailed)	.	.002
	N	86	85
Integration of joint procurement	Pearson Correlation	.338	1
	Sig. (2-tailed)	.002	.
	N	85	87

** Correlation is significant at the 0.01 level (2-tailed).

Figure 144: Correlation between Extent of Resource/Information Sharing and Level of Joint Purchasing



The graph shows 85 points of coordinates Average extent of resource and information sharing; Integration of joint procurement.

Regression line equation: Integration of joint procurement = 0.51 * Average extent of resource and information sharing + 1.22

Correlation coefficient: +0.44 (Average extent of resource and information sharing explains 19% of the variance of Integration of joint procurement)
Standard deviation of regression coefficient: 0.115

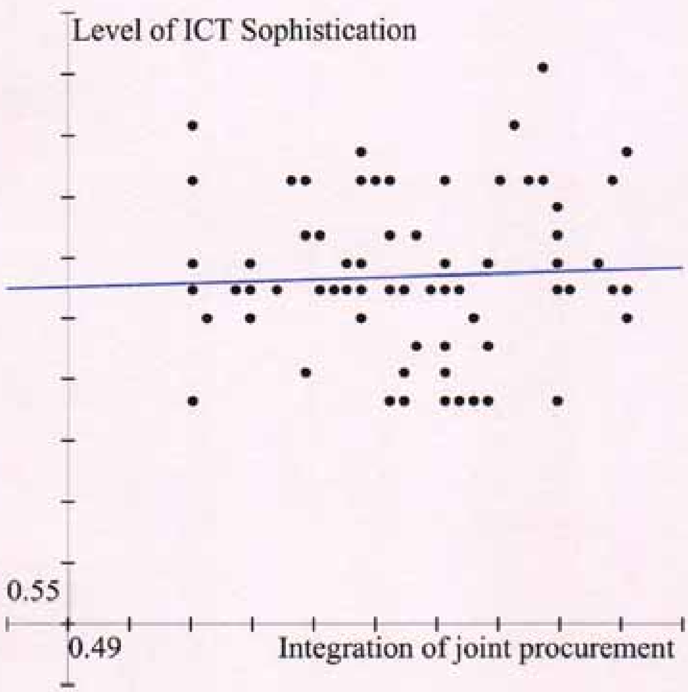
3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Average extent of resource and information sharing with partners	Integration of joint procurement
Average extent of resource and information sharing with partners	Pearson Correlation	1	.437
	Sig. (2-tailed)	.	.000
	N	86	85
Integration of joint procurement	Pearson Correlation	.437	1
	Sig. (2-tailed)	.000	.
	N	85	87

** Correlation is significant at the 0.01 level (2-tailed).

Figure 145: Correlation between Joint Procurement and ICT Sophistication



The graph shows 86 points of coordinates Integration of joint procurement; Level of ICT Sophistication.

Dependence is not significant.

Regression line equation: Level of ICT Sophistication = 0.04 * Integration of joint procurement + 3.05
Correlation coefficient: +0.05 (Integration of joint procurement explains 0% of the variance of Level of ICT Sophistication)
Standard deviation of regression coefficient: 0.074 (low influence)

2 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Integration of joint procurement	Level of ICT Sophistication
Integration of joint procurement	Pearson Correlation	1	.052
	Sig. (2-tailed)	.	.636
	N	87	86
Level of ICT Sophistication	Pearson Correlation	.052	1
	Sig. (2-tailed)	.636	.
	N	86	87

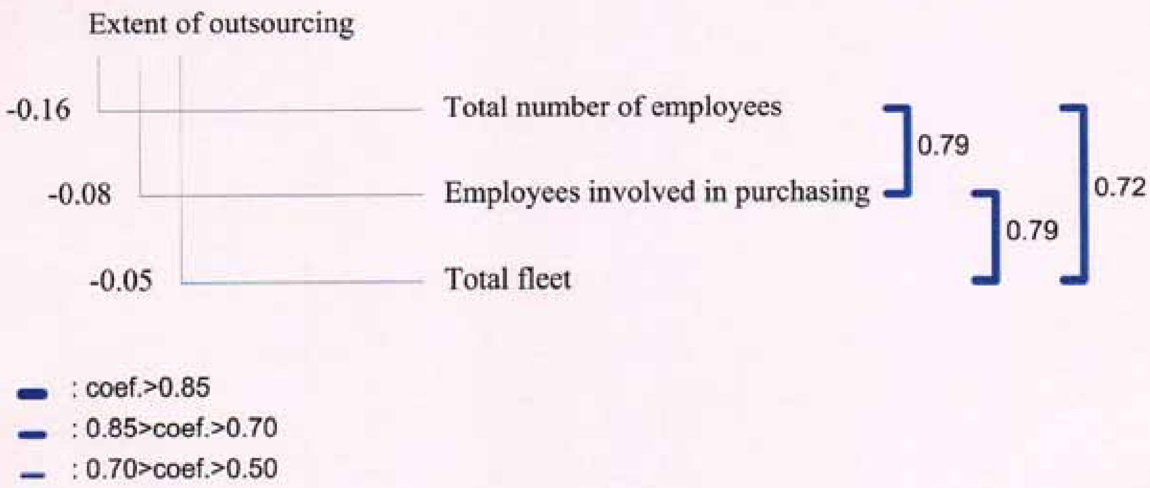
Table 25: Average Joint Purchasing by Product Group vs. E-Marketplace Adoption

	Yes	No	Total
Aircraft	**2.68**	**3.03**	**2.80**
Pow erplants	**2.64**	**2.87**	**2.72**
Spares and Repairs	**2.91**	**3.10**	**2.98**
Maintenance Services	**3.16**	**3.10**	**3.14**
Fuel	**2.95**	**2.90**	**2.93**
Tools / GSE	**2.48**	**2.52**	**2.49**
Interiors	**2.32**	**2.58**	**2.41**
Catering and Inflight Supplies	**2.88**	**2.81**	**2.85**
General Expenses (Office Supplies, Computer Hardw a...	**2.23**	**2.00**	**2.15**

Do you participate or partly ow n an e-Marketplace? / Aircraft p = **26.8%** ; F = **1.24** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Pow erplants p = **47.5%** ; F = **0.53** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Spares and Repairs p = **54.0%** ; F = **0.39** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Maintenance Services p = **80.3%** ; F = **0.05** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Fuel p = **85.4%** ; F = **0.02** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Tools / GSE p = **86.4%** ; F = **0.02** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Interiors p = **31.7%** ; F = **1.02** (**NS**)
Do you participate or partly ow n an e-Marketplace? / Catering and Inflight Supplies p = **81.3%** ; F = **0.05** (**NS**)
Do you participate or partly ow n an e-Marketplace? / General Expenses (Office Supplies, Computer Hardw a... p = **44.0%** ; F = **0.62** (**NS**)

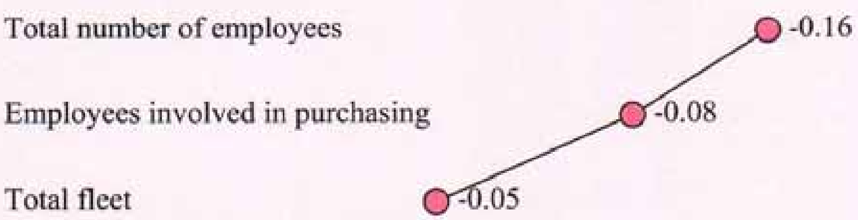
Figure 146: Multiple Regression of Airline Size and Level of Outsourcing

For the variables Total number of employees, Employees involved in purchasing, Total fleet.



10 observations are not taken into account (non-response for at least one criteria).

Correlations with 'Extent of outsourcing'



'Extent of outsourcing' : mean = 2.47, st.dev. = 0.87
'Total number of employees' : mean = 9058.60, st.dev. = 15592.84
'Employees involved in purchasing' : mean = 51.18, st.dev. = 62.68
'Total fleet' : mean = 69.59, st.dev. = 110.86
10 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Extent of outsourcing = -0.000 * Total number of employees +0.001 * Employees involved in purchasing +0.001 * Total fleet +2.515

These 3 variables explain 3.3% of the variance of Extent of outsourcing
Multiple correlation coefficient: R = 0.18, Fisher coefficient: F = 0.34

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.977	3	.659	.855	.468
	Residual	57.052	74	.771		
	Total	59.029	77			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Extent of outsourcing

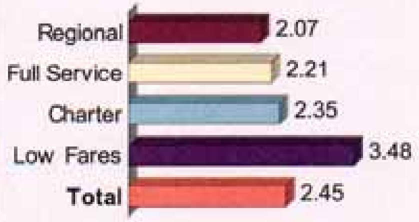
Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = 0.00, standard-deviation = 0.00 (low influence)
'Total fleet' : coefficient = 0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
10 observations are not taken into account (non-response for at least one criteria).

Figure 147: Airline Strategy and Extent of Outsourcing by Control Variable Number of Employees

Less than 1500 employees:

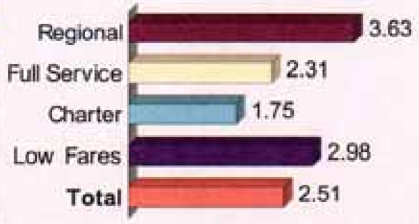
	Extent of outsourcing
Regional	**2.07**
Full Service	**2.21**
Charter	**2.35**
Low Fares	3.48
Total	**2.45**



p = **0.8%** ; F = **4.63** **(VS)**

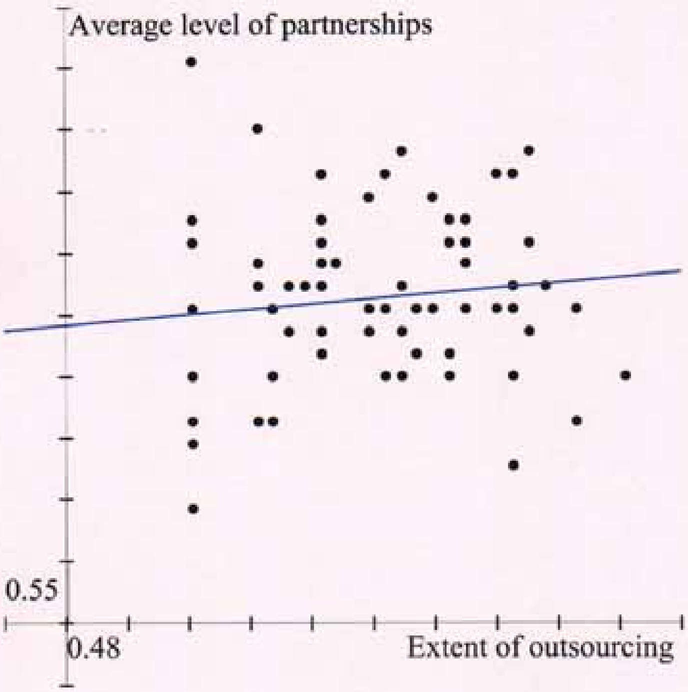
1500 and more employees:

	Extent of outsourcing
Regional	3.63
Full Service	**2.31**
Charter	**1.75**
Low Fares	**2.98**
Total	**2.51**



p = **0.3%** ; F = **5.47** **(VS)**

Figure 148: Correlation between Extent of Outsourcing and Level of Strategic Alliances



The graph shows 85 points of coordinates Extent of outsourcing; Average level of partnerships.
Dependence is not significant.

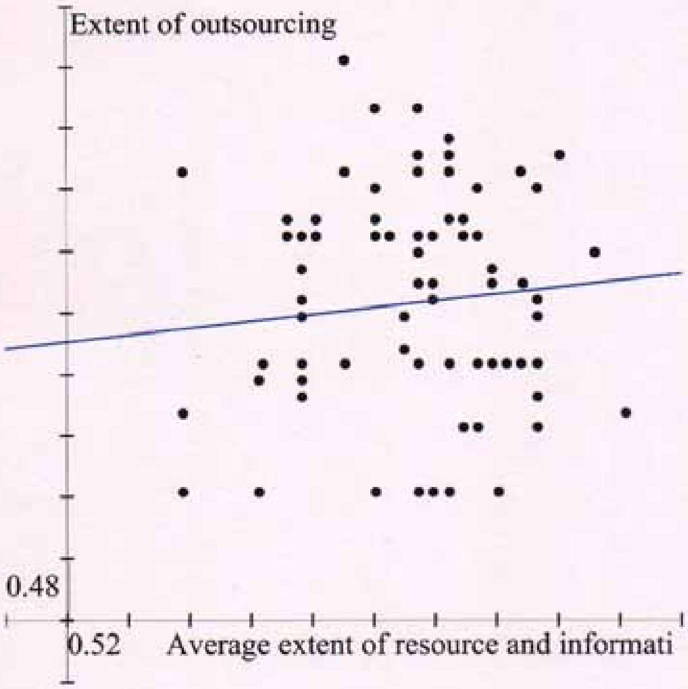
Regression line equation: Average level of partnerships = 0.10 * Extent of outsourcing + 2.68
Correlation coefficient: +0.11 (Extent of outsourcing explains 1% of the variance of Average level of partnerships)
Standard deviation of regression coefficient: 0.095 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Average level of partnerships	Extent of outsourcing
Average level of partnerships	Pearson Correlation	1	.110
	Sig. (2-tailed)	.	.316
	N	86	85
Extent of outsourcing	Pearson Correlation	.110	1
	Sig. (2-tailed)	.316	.
	N	85	87

Figure 149: Correlation between Extent of Outsourcing and Level of Information / Resource Sharing



The graph shows 85 points of coordinates Average extent of resource and information sharing; Extent of outsourcing.
Dependence is not significant.

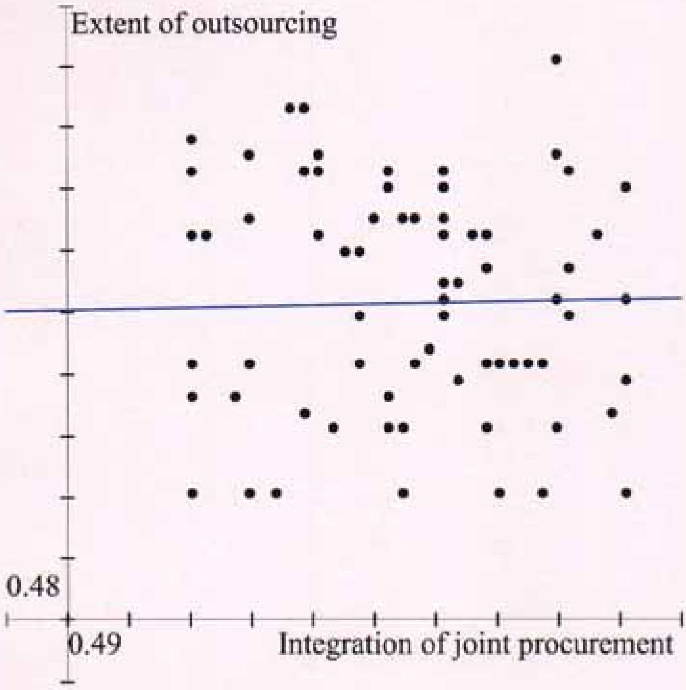
Regression line equation: Extent of outsourcing = 0.10 * Average extent of resource and information sharing + 2.20
Correlation coefficient: +0.10 (Average extent of resource and information sharing explains 1% of the variance of Extent of outsourcing)
Standard deviation of regression coefficient: 0.106 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Average extent of resource and information sharing with partners	Extent of outsourcing
Average extent of resource and information sharing with partners	Pearson Correlation	1	.103
	Sig. (2-tailed)	.	.348
	N	86	85
Extent of outsourcing	Pearson Correlation	.103	1
	Sig. (2-tailed)	.348	.
	N	85	87

Figure 150: Correlation between Level of Outsourcing and Extent of Joint Procurement



The graph shows 87 points of coordinates Integration of joint procurement; Extent of outsourcing.
Dependence is not significant.

Regression line equation: Extent of outsourcing = 0.02 * Integration of joint procurement + 2.45
Correlation coefficient: +0.02 (Integration of joint procurement explains 0% of the variance of Extent of outsourcing)
Standard deviation of regression coefficient: 0.089 (low influence)

1 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

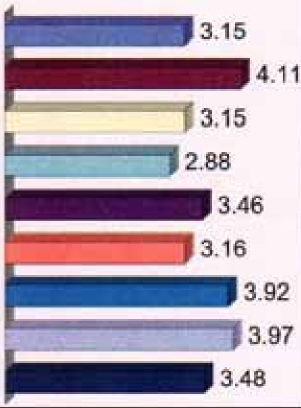
		Integration of joint procurement	Extent of outsourcing
Integration of joint procurement	Pearson Correlation	1	.022
	Sig. (2-tailed)	.	.843
	N	87	87
Extent of outsourcing	Pearson Correlation	.022	1
	Sig. (2-tailed)	.843	.
	N	87	87

__Figure 151: Benefits by Airline Spend Categories__

On a scale from 1 = completely inappropriate to 5 = very appropriate.

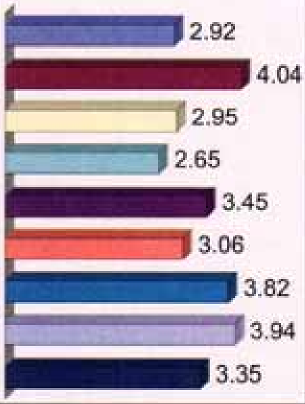
Reduction of search costs by using e-Marketplaces

	Mean	Std deviation	Min	Max
Powerplants	**3.15**	**1.09**	**1.00**	**5.00**
Spares & repairs	**4.11**	**0.80**	**2.00**	**5.00**
Maintenance	**3.15**	**1.28**	**1.00**	**5.00**
Fuel	**2.88**	**1.25**	**1.00**	**5.00**
Interiors	**3.46**	**1.14**	**1.00**	**5.00**
Catering	**3.16**	**1.05**	**1.00**	**5.00**
Tools / GSE	**3.92**	**0.80**	**3.00**	**5.00**
Office supplies	**3.97**	**0.86**	**2.00**	**5.00**
Total	**3.48**	**1.13**	**1.00**	**5.00**



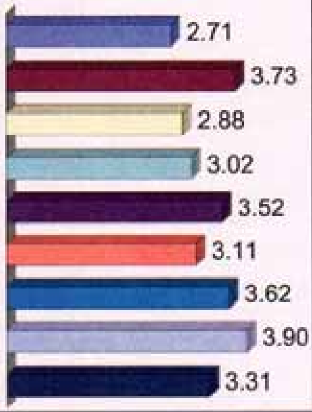
Time efficiency enhancement

	Mean	Std deviation	Min	Max
Powerplants	**2.92**	**1.11**	**1.00**	**5.00**
Spares & repairs	**4.04**	**0.77**	**2.00**	**5.00**
Maintenance	**2.95**	**1.30**	**1.00**	**5.00**
Fuel	**2.65**	**1.30**	**1.00**	**5.00**
Interiors	**3.45**	**0.93**	**1.00**	**5.00**
Catering	**3.06**	**1.10**	**1.00**	**5.00**
Tools / GSE	**3.82**	**0.87**	**2.00**	**5.00**
Office supplies	**3.94**	**0.77**	**2.00**	**5.00**
Total	**3.35**	**1.14**	**1.00**	**5.00**



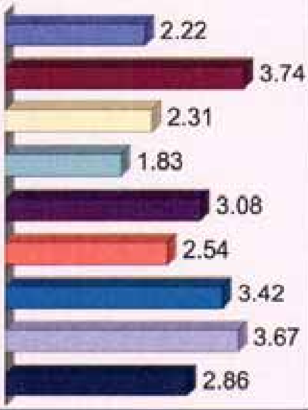
Order processing facilitation

	Mean	Std deviation	Min	Max
Powerplants	**2.71**	**1.20**	**1.00**	**5.00**
Spares & repairs	**3.73**	**0.99**	**2.00**	**5.00**
Maintenance	**2.88**	**1.29**	**1.00**	**5.00**
Fuel	**3.02**	**1.22**	**1.00**	**5.00**
Interiors	**3.52**	**0.98**	**2.00**	**5.00**
Catering	**3.11**	**1.23**	**1.00**	**5.00**
Tools / GSE	**3.62**	**0.96**	**2.00**	**5.00**
Office supplies	**3.90**	**0.87**	**2.00**	**5.00**
Total	**3.31**	**1.17**	**1.00**	**5.00**



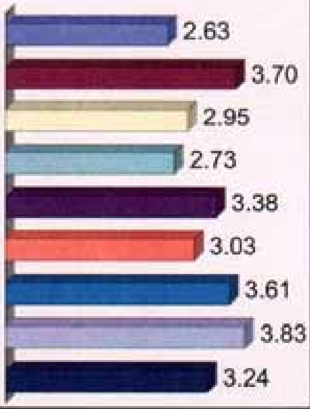
Inventory level reduction

	Mean	Std deviation	Min	Max
Powerplants	**2.22**	**0.85**	**1.00**	**4.00**
Spares & repairs	**3.74**	**0.93**	**2.00**	**5.00**
Maintenance	**2.31**	**1.20**	**1.00**	**5.00**
Fuel	**1.83**	**1.05**	**1.00**	**4.00**
Interiors	**3.08**	**1.06**	**1.00**	**5.00**
Catering	**2.54**	**1.26**	**1.00**	**5.00**
Tools / GSE	**3.42**	**0.80**	**1.00**	**5.00**
Office supplies	**3.67**	**0.88**	**2.00**	**5.00**
Total	**2.86**	**1.21**	**1.00**	**5.00**



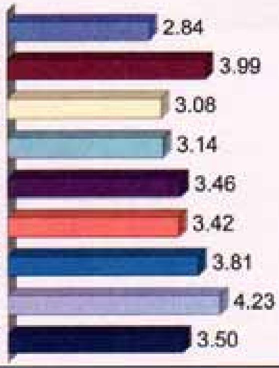
Higher supplier transparency

	Mean	Std deviation	Min	Max
Powerplants	**2.63**	**1.08**	**1.00**	**5.00**
Spares & repairs	**3.70**	**0.67**	**2.00**	**5.00**
Maintenance	**2.95**	**0.85**	**1.00**	**5.00**
Fuel	**2.73**	**1.06**	**1.00**	**5.00**
Interiors	**3.38**	**0.76**	**1.00**	**5.00**
Catering	**3.03**	**1.01**	**1.00**	**5.00**
Tools / GSE	**3.61**	**0.69**	**2.00**	**5.00**
Office supplies	**3.83**	**0.78**	**2.00**	**5.00**
Total	**3.24**	**0.97**	**1.00**	**5.00**



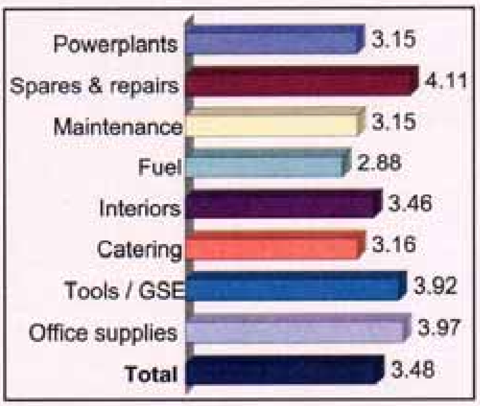
Reduction of product prices

	Mean	Std deviation	Min	Max
Powerplants	**2.84**	**1.15**	**1.00**	**5.00**
Spares & repairs	**3.99**	**0.81**	**2.00**	**5.00**
Maintenance	**3.08**	**1.23**	**1.00**	**5.00**
Fuel	**3.14**	**1.21**	**1.00**	**5.00**
Interiors	**3.46**	**0.95**	**2.00**	**5.00**
Catering	**3.42**	**1.23**	**1.00**	**5.00**
Tools / GSE	**3.81**	**0.87**	**2.00**	**5.00**
Office supplies	**4.23**	**0.73**	**2.00**	**5.00**
Total	**3.50**	**1.13**	**1.00**	**5.00**

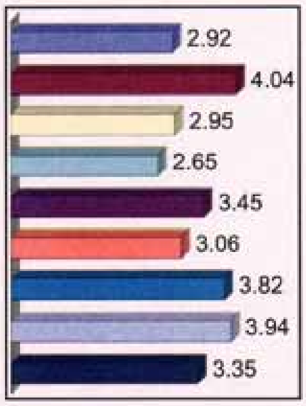


Summary

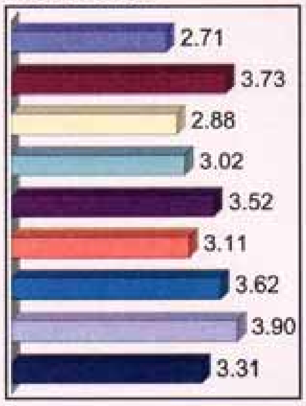
Reduction of search costs



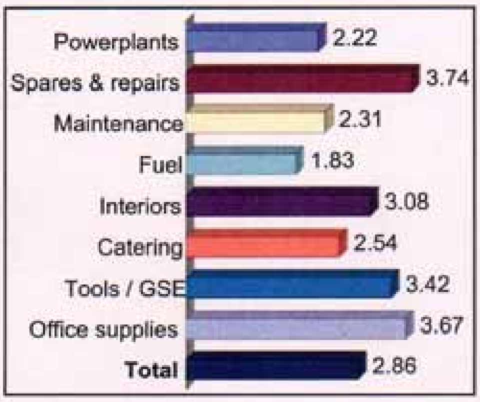
Better time efficiency



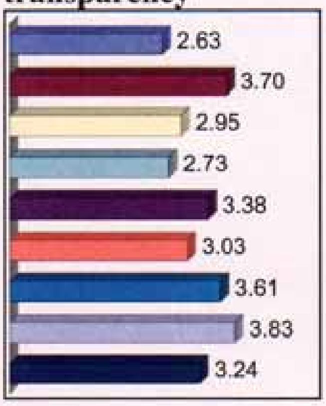
Order process facilitation



Inventory level reduction



Higher supplier transparency



Reduction of product prices

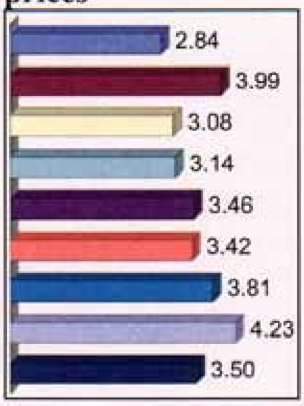
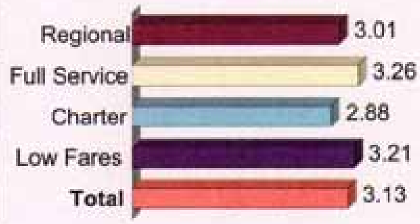


Figure 152: Satisfaction with Procurement Management / Process by Airline Type

	Regional	Full Service	Charter	Low Fares	Total
Satisfaction with procurement processes	**3.20**	**3.34**	**3.26**	**3.32**	**3.30**
Current level of supplier search costs	**2.78**	**3.16**	**2.72**	**3.12**	**3.01**
Time efficiency level	**2.67**	**3.21**	**2.65**	**3.11**	**3.01**
Order process efficiency	**3.11**	**3.29**	**2.82**	**3.16**	**3.14**
Inventory management	**2.67**	**3.11**	2.47	**3.00**	**2.90**
Supplier transparency	**2.89**	**3.34**	**3.06**	**3.39**	**3.24**
Product/purchasing prices	**3.11**	**3.32**	**2.94**	**3.39**	**3.23**

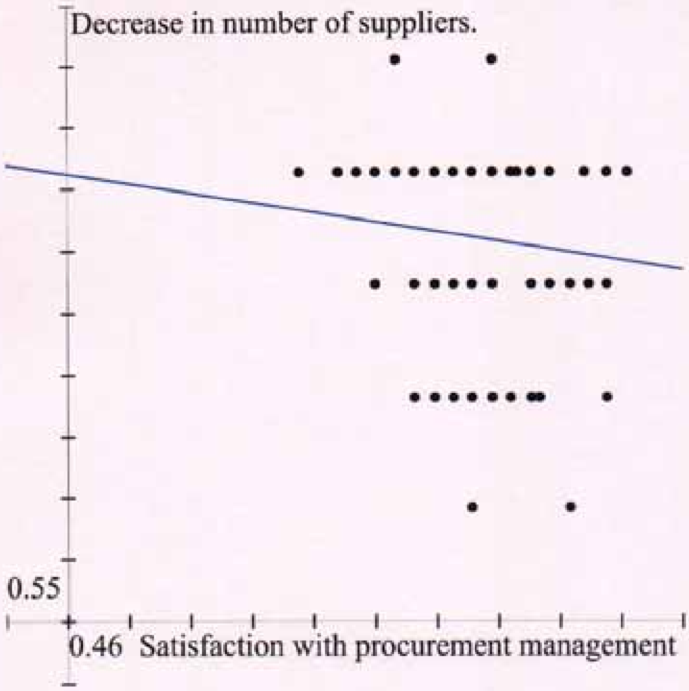
Strategy / Satisfaction with procurement processes p = **96.0%** ; F = **0.09** (**NS**)
Strategy / Current level of supplier search costs p = **8.3%** ; F = **2.30** (**LS**)
Strategy / Time efficiency level p = **4.1%** ; F = **2.86** (**S**)
Strategy / Order process efficiency p = **17.2%** ; F = **1.70** (**NS**)
Strategy / Inventory management p = **0.9%** ; F = **4.16** (**VS**)
Strategy / Supplier transparency p = **25.7%** ; F = **1.37** (**NS**)
Strategy / Product/purchasing prices p = **14.3%** ; F = **1.85** (**LS**)

	Satisfaction with procurement management
Regional	**3.01**
Full Service	**3.26**
Charter	**2.88**
Low Fares	**3.21**
Total	**3.13**



p = **4.7%** ; F = **2.75** (**S**)

Figure 153: Satisfaction with Procurement Management/Process and Supplier Reduction



The graph shows 84 points of coordinates Satisfaction with procurement management; Decrease in number of suppliers.
Dependence is not significant.

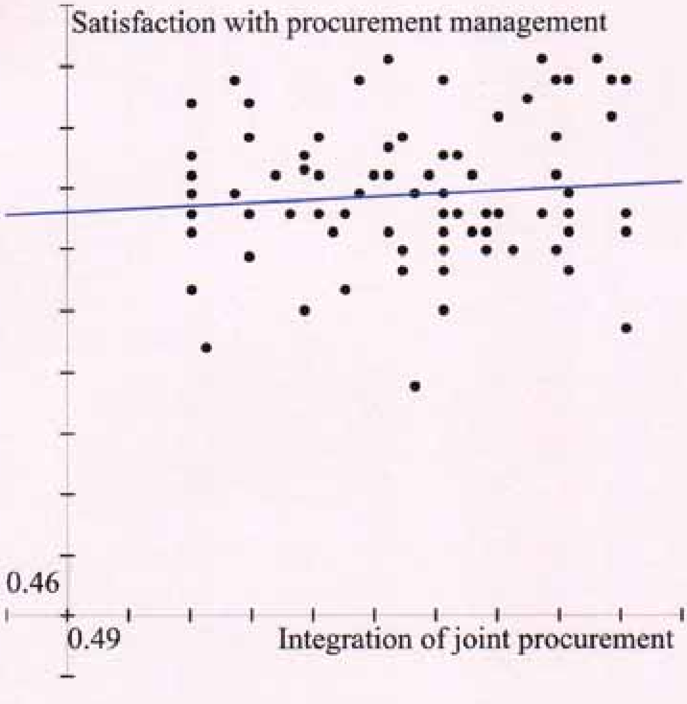
Regression line equation: Decrease in number of suppliers. = -0.19 * Satisfaction with procurement management + 4.00
Correlation coefficient: -0.11 (Satisfaction with procurement management explains 1% of the variance of Decrease in number of suppliers.)
Standard deviation of regression coefficient: 0.189 (low influence)

4 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Satisfaction with procurement management	Your company has decreased or is in the process of decreasing the number of suppliers.
Satisfaction with procurement management	Pearson Correlation	1	-.109
	Sig. (2-tailed)	.	.324
	N	88	84
Your company has decreased or is in the process of decreasing the number of suppliers.	Pearson Correlation	-.109	1
	Sig. (2-tailed)	.324	.
	N	84	84

Figure 154: Correlation between Satisfaction with Procurement Management/Process and Joint Purchasing



The graph shows 87 points of coordinates Integration of joint procurement; Satisfaction with procurement management
Dependence is not significant.

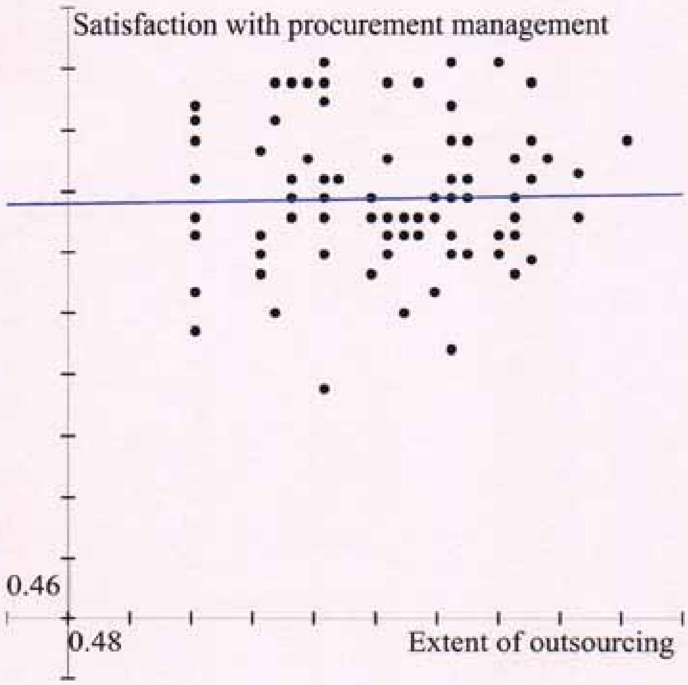
Regression line equation: Satisfaction with procurement management = 0.05 * Integration of joint procurement + 3.02
Correlation coefficient: +0.09 (Integration of joint procurement explains 0% of the variance of Satisfaction with procurement management)
Standard deviation of regression coefficient: 0.053 (low influence)

1 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Integration of joint procurement	Satisfaction with procurement management
Integration of joint procurement	Pearson Correlation	1	.086
	Sig. (2-tailed)	.	.604
	N	87	87
Satisfaction with procurement management	Pearson Correlation	.086	1
	Sig. (2-tailed)	.604	.
	N	87	88

Figure 155: Correlation between Overall Satisfaction with Procurement Management/Process and Level of Outsourcing



The graph shows 87 points of coordinates Extent of outsourcing; Satisfaction with procurement management
Dependence is not significant.

Regression line equation: Satisfaction with procurement management = 0.02 * Extent of outsourcing + 3.11
Correlation coefficient: +0.03 (Extent of outsourcing explains 0% of the variance of Satisfaction with procurement management)

Standard deviation of regression coefficient: 0.065 (low influence)

1 observations are not taken into account (non-response for at least one criteria). Each observation is represented by a dot.

Correlations

		Satisfaction with procurement management	Extent of outsourcing
Satisfaction with procurement management	Pearson Correlation	1	.026
	Sig. (2-tailed)	.	.812
	N	88	87
Extent of outsourcing	Pearson Correlation	.026	1
	Sig. (2-tailed)	.812	.
	N	87	87

Figure 156: Satisfaction with Procurement Management / Process and E-Marketplace Adoption

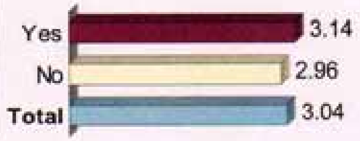
	Yes	No	Total
Satisfaction with procurement processes	**3.39**	**3.16**	**3.31**
Current level of supplier search costs	**3.13**	**2.79**	**3.01**
Time efficiency level	**3.20**	2.63	**3.01**
Order process efficiency	**3.32**	2.78	**3.14**
Inventory management	**3.05**	2.59	**2.90**
Supplier transparency	**3.35**	**3.04**	**3.24**
Product/purchasing prices	**3.33**	**3.04**	**3.23**

e-Marketplace participation / Satisfaction with procurement processes p = **22.8%** ; F = **1.46** (**NS**)
e-Marketplace participation / Current level of supplier search costs p =**2.6%** ; F = **5.01** (**S**)
e-Marketplace participation / Time efficiency level p =**0.2%** ; F = **10.50** (**VS**)
e-Marketplace participation / Order process efficiency p = **0.1%** ; F = **11.82** (**VS**)
e-Marketplace participation / Inventory management p =**0.4%** ; F = **8.74** (**VS**)
e-Marketplace participation / Supplier transparency p =**8.8%** ; F = **2.91** (**LS**)
e-Marketplace participation / Product/purchasing prices p =**5.2%** ; F = **3.79** (**LS**)

Figure 157: Satisfaction with Procurement Management / Process and E-Marketplace Adoption by Control Variable Number of Employees

Less than 1500 employees:

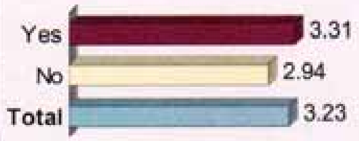
	Satisfaction with procurement management
Yes	**3.14**
No	**2.96**
Total	**3.04**



p = **25.1%** ; F = **1.36** (**NS**)

1500 and more employees:

	Satisfaction with procurement management
Yes	**3.31**
No	**2.94**
Total	**3.23**

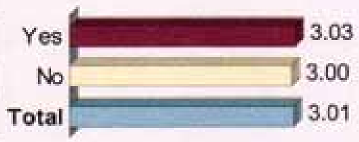


p = **5.4%** ; F = **3.81** (**LS**)

Figure 158: Satisfaction with Procurement Management / Process and E-Marketplace Adoption by Control Variable Airline Strategy

Regional airlines:

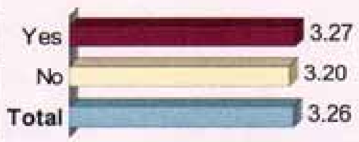
	Satisfaction with procurement management
Yes	**3.03**
No	**3.00**
Total	**3.01**



p = **89.6%** ; F = **<0.01** (**NS**)

Full service airlines:

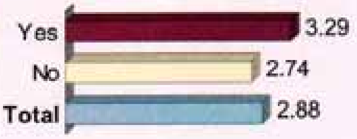
	Satisfaction with procurement management
Yes	**3.27**
No	**3.20**
Total	**3.26**



p = **76.1%** ; F = **0.09** (**NS**)

Charter airlines:

	Satisfaction with procurement management
Yes	3.29
No	2.74
Total	**2.88**



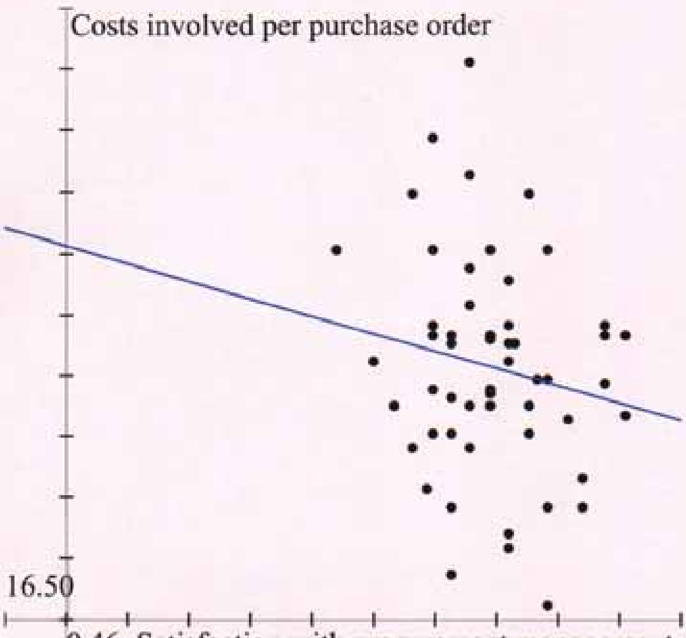
p = **4.8%** ; F = **4.47** (**S**)

Low-cost airlines:

	Satisfaction with procurement management
Yes	3.29
No	2.89
Total	**3.21**

p = **7.7%** ; F = **3.46** (**LS**)

Figure 159: Correlation between Satisfaction with Procurement Management / Process and Purchase Order Costs



The graph shows 58 points of coordinates Satisfaction with procurement management; Costs involved per purchase order.
Dependence is not significant.

Regression line equation: Costs involved per purchase order = -10.37 * Satisfaction with procurement management + 101.54

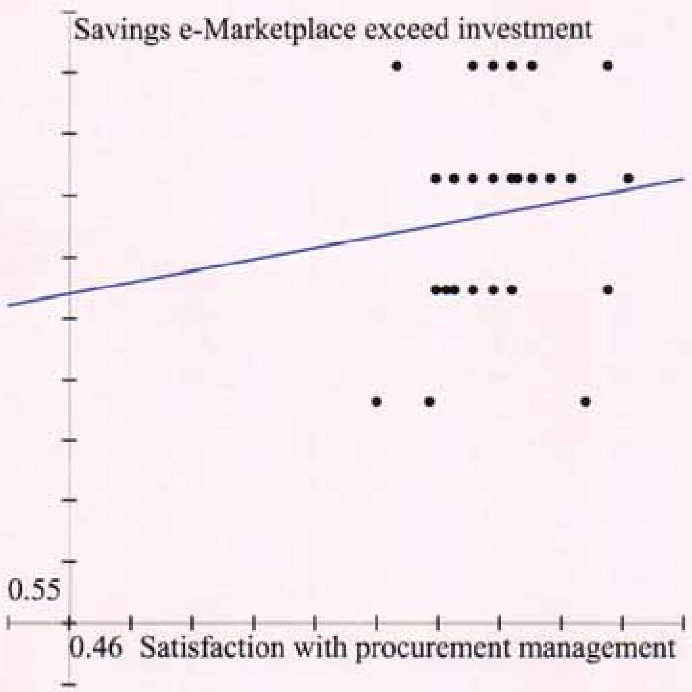
Correlation coefficient: -0.17 (Satisfaction with procurement management explains 2% of the variance of Costs involved per purchase order)
Standard deviation of regression coefficient: 7.883 (low influence)

30 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Satisfaction with procurement management	What are your average costs involved per P.O. (Purchase Order)?
Satisfaction with procurement management	Pearson Correlation	1	-.173
	Sig. (2-tailed)	.	.194
	N	88	58
What are your average costs involved per P.O. (Purchase Order)?	Pearson Correlation	-.173	1
	Sig. (2-tailed)	.194	.
	N	58	58

Figure 160: Correlation between Satisfaction with Procurement Management/Process and Savings / Investment Costs for E-Marketplace



The graph shows 38 points of coordinates Satisfaction with procurement management; Savings e-Marketplace exceed investment
Dependence is not significant.

Regression line equation: Savings e-Marketplace exceed investment = 0.23 * Satisfaction with procurement management + 2.98

Correlation coefficient: +0.12 (Satisfaction with procurement management explains 1% of the variance of Savings e-Marketplace exceed investment)
Standard deviation of regression coefficient: 0.309 (low influence)

50 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Satisfaction with procurement management	Do you think that the savings achieved in processing and product costs exceeded the investment costs?
Satisfaction with procurement management	Pearson Correlation	1	.121
	Sig. (2-tailed)	.	.470
	N	88	38
Do you think that the savings achieved in processing and product costs exceeded the investment costs?	Pearson Correlation	.121	1
	Sig. (2-tailed)	.470	.
	N	38	38

Figure 161: E-Marketplace Use and Purchase Order Costs by Control Variable Airline Strategy

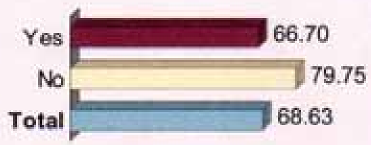
Regional airlines:

	Costs involved per purchase order
Yes	46.00
No	73.50
Total	64.33

p = **14.5%** ; F = **20.58** (**LS**)

Full service airlines:

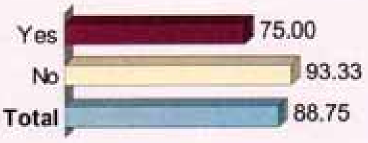
	Costs involved per purchase order
Yes	66.70
No	79.75
Total	68.63



p = **31.1%** ; F = **1.08** (**NS**)

Charter airlines:

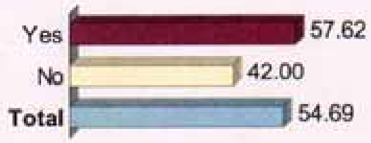
	Costs involved per purchase order
Yes	**75.00**
No	**93.33**
Total	**88.75**



p = **21.3%** ; F = **1.75** (**NS**)

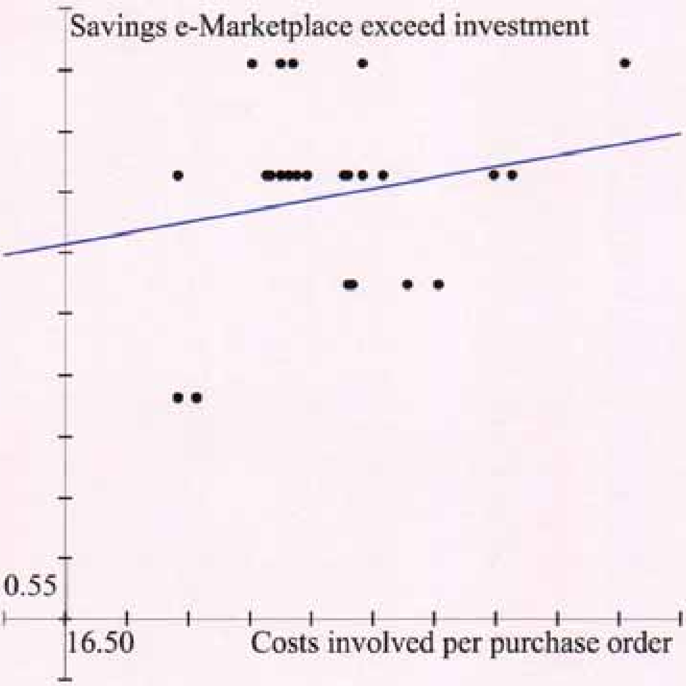
Low-cost airlines:

	Costs involved per purchase order
Yes	**57.62**
No	**42.00**
Total	**54.69**



p = **50.9%** ; F = **0.47** (**NS**)

<u>Figure 162: Correlation between Purchase Order Costs and Savings / Investment Costs for E-Marketplace</u>



The graph shows 29 points of coordinates Costs involved per purchase order; Savings e-Marketplace exceed investment
Dependence is not significant.

Regression line equation: Savings e-Marketplace exceed investment = 0.01 * Costs involved per purchase order + 3.39

Correlation coefficient: +0.19 (Costs involved per purchase order explains 3% of the variance of Savings e-Marketplace exceed investment)
Standard deviation of regression coefficient: 0.006 (low influence)

59 observations are not taken into account (non-response for at least one criteria). Each observation is represented by a dot.

Correlations

		What are your average costs involved per P.O. (Purchase Order)?	Do you think that the savings achieved in processing and product costs exceeded the investment costs?
What are your average costs involved per P.O. (Purchase Order)?	Pearson Correlation	1	.186
	Sig. (2-tailed)	.	.335
	N	58	29
Do you think that the savings achieved in processing and product costs exceeded the investment costs?	Pearson Correlation	.186	1
	Sig. (2-tailed)	.335	.
	N	29	38

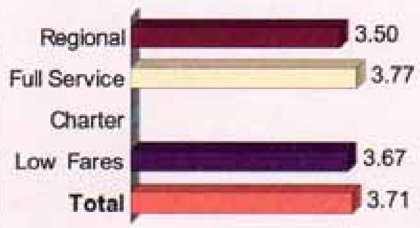
Figure 163: Savings / Investment Costs for E-Marketplace by Control Variable Firm Size

	Savings e-Marketplace exceed investment
Less than 1500 employees	3.17
1500 and more employees	3.81
Total	3.70

p = **9.9%** ; F = **2.81** **(LS)**

Figure 164: Savings / Investment Costs for E-Marketplace by Control Variable Airline Strategy

	Savings e-Marketplace exceed investment
Regional	3.50
Full Service	3.77
Charter	
Low Fares	3.67
Total	3.71



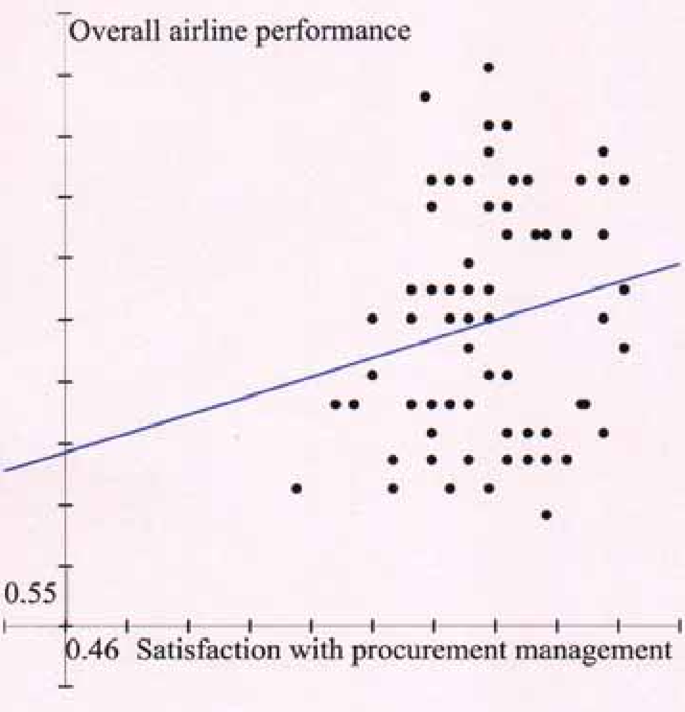
p = **83.4%** ; F = **0.18** **(NS)**

Table 26: Fee Preferences vs. E-Marketplace Adoption

	Yes	No	Total
Monthly/yearly fee	**4.21**	**3.69**	**4.04**
Percentage per transaction	**2.04**	**2.69**	**2.27**
Uniquely admission fee	**1.78**	**1.86**	**1.81**
Listing fee	**1.86**	**2.31**	**2.03**
Fees paid as a percentage of cost savings	**2.27**	**2.57**	**2.38**

Do you participate or partly own an e-Marketplace? / Monthly/yearly fee p =**6.5%** ; F = **3.42** (**LS**)
Do you participate or partly own an e-Marketplace? / Percentage per transaction p =**1.4%** ; F =**6.23** (**S**)
Do you participate or partly own an e-Marketplace? / Uniquely admission fee p =**74.3%** ; F = **0.10** (**NS**)
Do you participate or partly own an e-Marketplace? / Listing fee p =**7.0%** ; F = **3.30** (**LS**)
Do you participate or partly own an e-Marketplace? / Fees paid as a percentage of cost savings p = **36.1%** ; F = **0.85** (**NS**)

Figure 165: Correlation between Satisfaction with Procurement Management / Process and Overall Airline Performance



The graph shows 85 points of coordinates Satisfaction with procurement management; Overall airline performance.
Dependence is not significant.

Regression line equation: Overall airline performance = 0.37 * Satisfaction with procurement management + 1.58
Correlation coefficient: +0.19 (Satisfaction with procurement management explains 3% of the variance of Overall airline performance)
Standard deviation of regression coefficient: 0.213 (low influence)

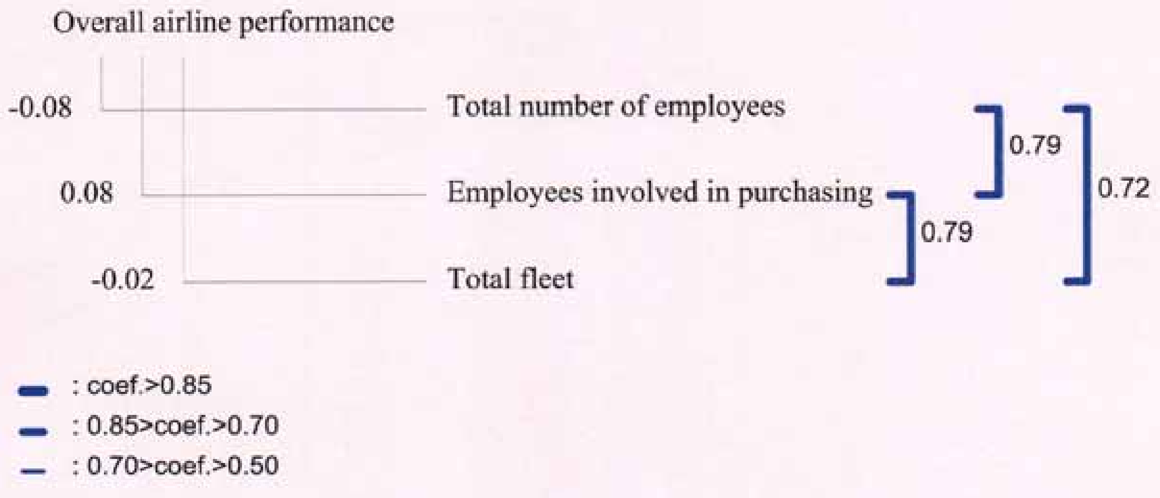
3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Overall airline performance	Satisfaction with procurement management
Overall airline performance	Pearson Correlation	1	.186
	Sig. (2-tailed)	.	.088
	N	85	85
Satisfaction with procurement management	Pearson Correlation	.186	1
	Sig. (2-tailed)	.088	.
	N	85	88

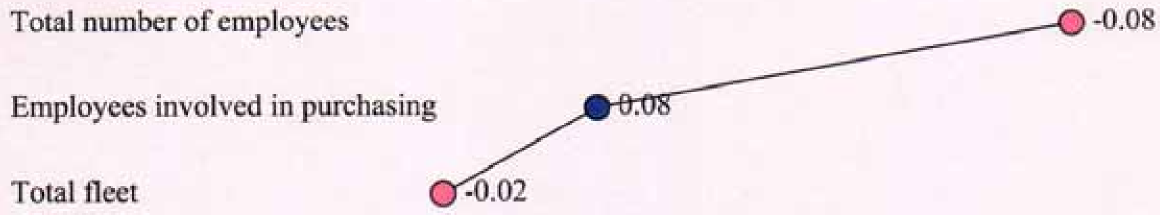
Figure 166: Multiple Regression of Airline Size and Level of Overall Business Performance

For the variables Total number of employees, Employees involved in purchasing, Total fleet.



12 observations are not taken into account (non-response for at least one criteria).

Correlations with 'Overall airline performance'



'Overall airline performance' : mean = 2.74, st.dev. = 1.00
'Total number of employees' : mean = 9204.88, st.dev. = 15770.24
'Employees involved in purchasing' : mean = 52.00, st.dev. = 63.29
'Total fleet' : mean = 70.37, st.dev. = 112.20
12 observations are not taken into account (non-response for at least one criteria).

Regression equation:
Overall airline performance = -0.000 * Total number of employees +0.007 * Employees involved in purchasing -0.001 * Total fleet +2.654

These 3 variables explain 6.2% of the variance of Overall airline performance
Multiple correlation coefficient: R = 0.25, Fisher coefficient: F = 0.39

ANOVA

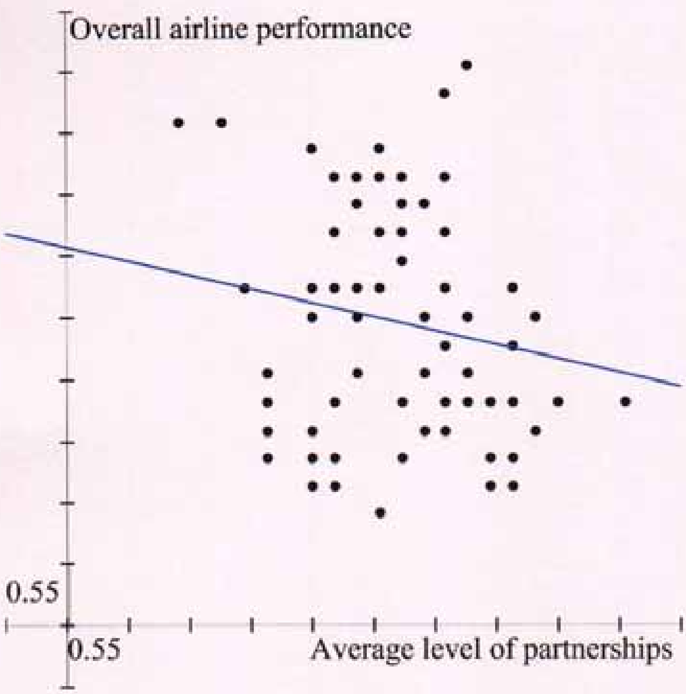
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.725	3	1.575	1.587	.200
	Residual	71.455	72	.992		
	Total	76.180	75			

a Predictors: (Constant), Total fleet, How many employees are working in your company world-wide?, How many of them are involved in Purchasing?
b Dependent Variable: Overall airline performance

Significance of each parameter:
'Total number of employees' : coefficient = -0.00, standard-deviation = 0.00 (low influence)
'Employees involved in purchasing' : coefficient = 0.01, standard-deviation = 0.00
'Total fleet' : coefficient = -0.00, standard-deviation = 0.00 (low influence)

Some terms in the equation are not very influential; the coefficient/standard-deviation ratio is less than 1.96
12 observations are not taken into account (non-response for at least one criteria).

Figure 167: Correlation between Level of Strategic Partnerships vs. Overall Business Performance



The graph shows 85 points of coordinates Average level of partnerships; Overall airline performance.
Dependence is not significant.

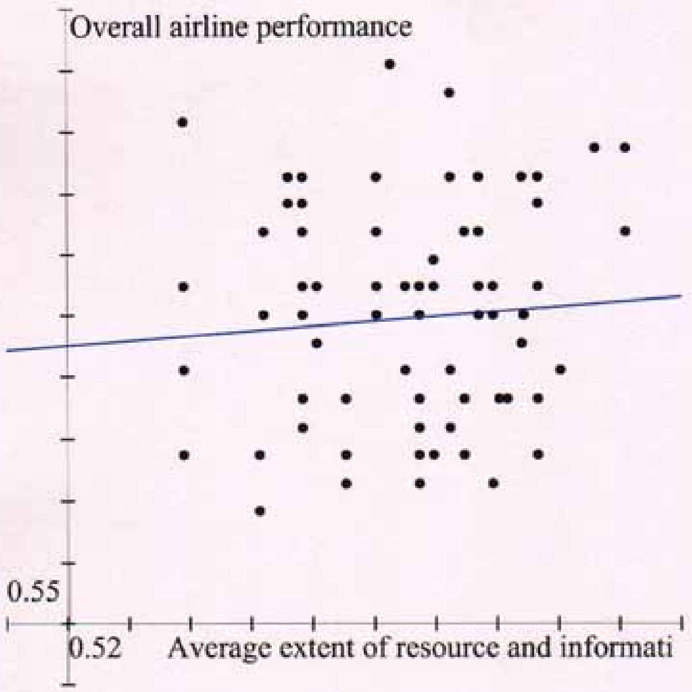
Regression line equation: Overall airline performance = -0.22 * Average level of partnerships + 3.38
Correlation coefficient: -0.17 (Average level of partnerships explains 2% of the variance of Overall airline performance)
Standard deviation of regression coefficient: 0.144 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Average level of partnerships	Overall airline performance
Average level of partnerships	Pearson Correlation	1	-.167
	Sig. (2-tailed)	.	.127
	N	86	85
Overall airline performance	Pearson Correlation	-.167	1
	Sig. (2-tailed)	.127	.
	N	85	85

Figure 168: Correlation between Extent of Resource / Information Sharing and Overall Airline Performance



The graph shows 85 points of coordinates Average extent of resource and information sharing; Overall airline performance.
Dependence is not significant.

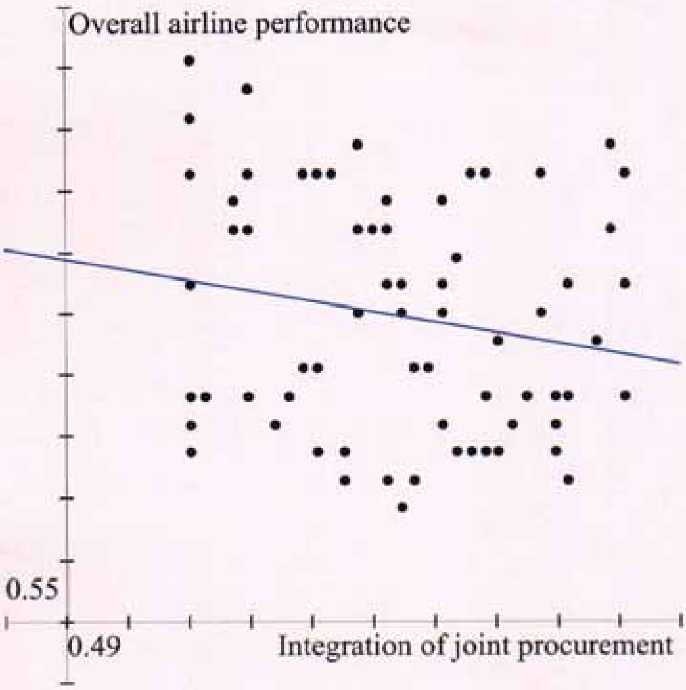
Regression line equation: Overall airline performance = 0.08 * Average extent of resource and information sharing + 2.49
Correlation coefficient: +0.07 (Average extent of resource and information sharing explains 0% of the variance of Overall airline performance)
Standard deviation of regression coefficient: 0.123 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Overall airline performance	Average extent of resource and information sharing with partners
Overall airline performance	Pearson Correlation	1	.075
	Sig. (2-tailed)	.	.496
	N	85	85
Average extent of resource and information sharing with partners	Pearson Correlation	.075	1
	Sig. (2-tailed)	.496	.
	N	85	86

Figure 169: Correlation between Joint Procurement and Overall Airline Performance



The graph shows 85 points of coordinates Integration of joint procurement; Overall airline performance

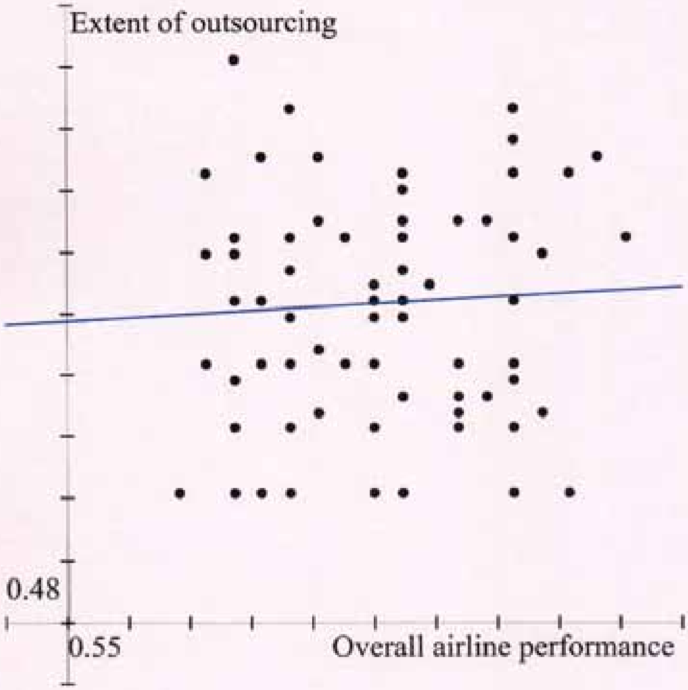
Regression line equation: Overall airline performance = -0.19 * Integration of joint procurement + 3.25
Correlation coefficient: -0.20 (Integration of joint procurement explains 3% of the variance of Overall airline performance)
Standard deviation of regression coefficient: 0.104 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Integration of joint procurement	Overall airline performance
Integration of joint procurement	Pearson Correlation	1	-.199
	Sig. (2-tailed)	.	.068
	N	87	85
Overall airline performance	Pearson Correlation	-.199	1
	Sig. (2-tailed)	.068	.
	N	85	85

Figure 170: Correlation between Extent of Outsourcing and Overall Airline Performance



The graph shows 85 points of coordinates Overall airline performance; Extent of outsourcing.
Dependence is not significant.

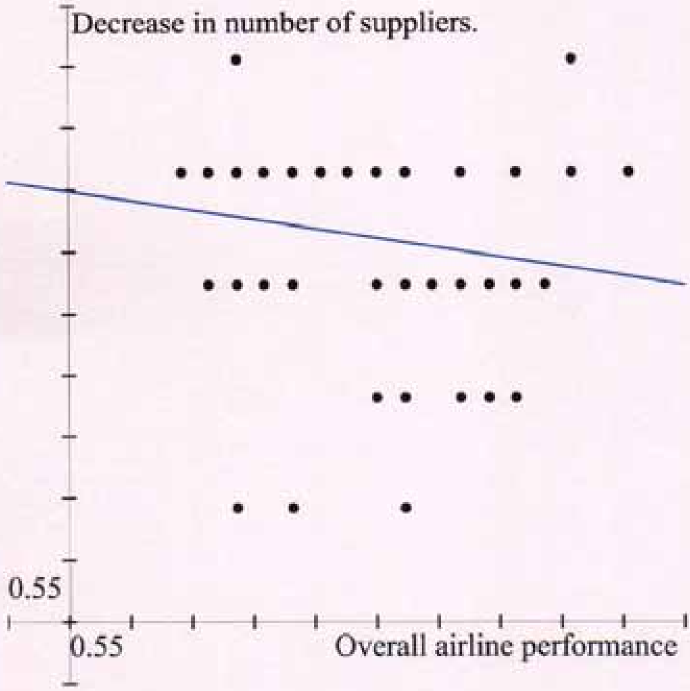
Regression line equation: Extent of outsourcing = 0.05 * Overall airline performance + 2.36
Correlation coefficient: +0.05 (Overall airline performance explains 0% of the variance of Extent of outsourcing)
Standard deviation of regression coefficient: 0.094 (low influence)

3 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Extent of outsourcing	Overall airline performance
Extent of outsourcing	Pearson Correlation	1	.053
	Sig. (2-tailed)	.	.628
	N	87	85
Overall airline performance	Pearson Correlation	.053	1
	Sig. (2-tailed)	.628	.
	N	85	85

Figure 171: Correlation between Overall Airline Performance and Supplier Reduction



The graph shows 82 points of coordinates Overall airline performance; Decrease in number of suppliers.
Dependence is not significant.

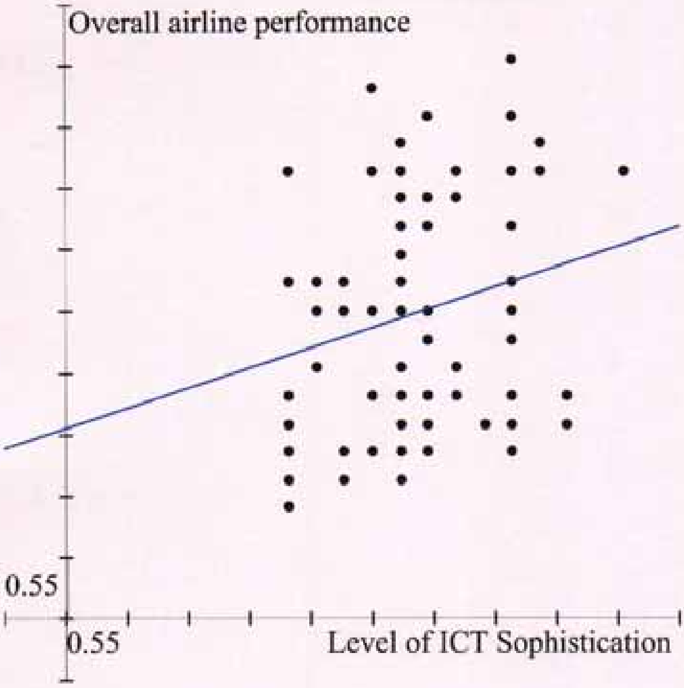
Regression line equation: Decrease in number of suppliers. = -0.15 * Overall airline performance + 3.85
Correlation coefficient: -0.17 (Overall airline performance explains 2% of the variance of Decrease in number of suppliers.)
Standard deviation of regression coefficient: 0.097 (low influence)

6 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Your company has decreased or is in the process of decreasing the number of suppliers.	Overall airline performance
Your company has decreased or is in the process of decreasing the number of suppliers.	Pearson Correlation	1	-.173
	Sig. (2-tailed)	.	.121
	N	84	82
Overall airline performance	Pearson Correlation	-.173	1
	Sig. (2-tailed)	.121	.
	N	82	85

Figure 172: Correlation between Overall Airline Performance and ICT Sophistication



The graph shows 84 points of coordinates Level of ICT Sophistication; Overall airline performance.

Regression line equation: Overall airline performance = 0.33 * Level of ICT Sophistication + 1.72
Correlation coefficient: +0.23 (Level of ICT Sophistication explains 5% of the variance of Overall airline performance)
Standard deviation of regression coefficient: 0.151

4 observations are not taken into account (non-response for at least one criteria).
Each observation is represented by a dot.

Correlations

		Level of ICT Sophistication	Overall airline performance
Level of ICT Sophistication	Pearson Correlation	1	.233
	Sig. (2-tailed)	.	.033
	N	87	84
Overall airline performance	Pearson Correlation	.233	1
	Sig. (2-tailed)	.033	.
	N	84	85

* Correlation is significant at the 0.05 level (2-tailed).

Figure 173: Convergent and Discriminant Validity

In addition to the assessment of Cronbach's alphas for the research reliability, construct and discriminant validity was also assessed for the reflective constructs 'pressures from business context', 'overall business performance', 'overall satisfaction with procurement practices', 'extent of resource and information sharing', and 'overall ICT sophistication'. Unidimensionality was required for these reflective constructs. An exploratory factor analysis on the basis of a principal component analysis was employed to find out whether or not the designed measures loaded as predicted on the expected number of factors. The orthogonal varimax rotation was chosen over non-orthogonal rotation methods.

Descriptive Statistics

	Mean	Std. Deviation	Analysis N	Missing N
Over the last three years your company experienced strongly competitive pressures to reduce costs.	4.71	.506	86	2
Over the last three years your company experienced a strong decline in passenger numbers.	2.73	1.162	86	2
Over the last three years your company experienced a strong decline in overall profits.	3.14	1.108	86	2
Over the last three years your company experienced a strongly increased concentration in the supplier markets.	3.19	.790	86	2
Over the last three years, your turnover has declined.	3.09	1.134	86	2
Over the last three years, your passenger load factor per aircraft has decreased.	3.03	1.057	86	2
Over the last three years your company experienced a strong increase in passenger numbers.	2.92	1.190	86	2
Over the last three years your company experienced a strong increase in overall profits.	2.51	1.125	86	2
Over the last three years, your turnover has increased.	2.74	1.108	86	2
Over the last three years, your passenger load factor per aircraft has increased	2.77	1.081	86	2
How satisfied are you with your procurement processes?	3.31	.835	88	0
How satisfied are you with the current level of your search costs?	3.01	.676	82	6
How satisfied are you with your current time efficiency level?	3.01	.789	83	5
How satisfied are you with the current level of your order process efficiency?	3.14	.718	83	5
How satisfied are you with the current level of your inventory management?	2.90	.696	82	6
How satisfied are you with the current level of your supplier transparency?	3.24	.779	82	6
How satisfied are you with the current level of your product/purchasing prices?	3.23	.657	81	7
IT Systems	2.76	1.323	84	4
Purchasing Tools	2.45	1.416	83	5

Office Space or Facilities	2.12	1.193	83	5
Suppliers	3.26	1.109	82	6
Company Products	3.59	1.088	82	6
Product Prices	2.82	1.335	82	6
Purchasing Tools	3.16	1.024	82	6
Purchasing Procedures	3.05	1.065	82	6
Your company uses the full potential of information and communication technology to facilitate procurement	3.17	.810	87	1
Your ICT infrastructure enables you to share viable information with partners.	3.21	.780	87	1
Your ICT infrastructure enables you to share viable information with suppliers.	3.14	.718	87	1
Your company has interlinked the full supply chain with its ICT system(s).	3.05	.776	87	1

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.709
Bartlett's Test of Sphericity	Approx. Chi-Square	1856.577
	df	406
	Sig.	.000

Bartlett's test of sphericity (p=0.000) indicates the statistical probability that the correlation matrix has significant correlations among at least some of the variables, and the Kaiser–Meyer–Olkin measure (0.709) shows acceptable sampling adequacy.

Communalities

	Initial	Extraction
Over the last three years your company experienced strongly competitive pressures to reduce costs.	1.000	.232
Over the last three years your company experienced a strong decline in passenger numbers.	1.000	.741
Over the last three years your company experienced a strong decline in overall profits.	1.000	.785
Over the last three years your company experienced a strongly increased concentration in the supplier markets.	1.000	.292
Over the last three years, your turnover has declined.	1.000	.833
Over the last three years, your passenger load factor per aircraft has decreased.	1.000	.838
Over the last three years your company experienced a strong increase in passenger numbers.	1.000	.599
Over the last three years your company experienced a strong increase in overall profits.	1.000	.767
Over the last three years, your turnover has increased.	1.000	.789
Over the last three years, your passenger load factor per aircraft has increased	1.000	.754
How satisfied are you with your procurement processes?	1.000	.194
How satisfied are you with the current level of your search costs?	1.000	.363
How satisfied are you with your current time efficiency level?	1.000	.631
How satisfied are you with the current level of your order process efficiency?	1.000	.684
How satisfied are you with the current level of your inventory management?	1.000	.768
How satisfied are you with the current level of your supplier transparency?	1.000	.574
How satisfied are you with the current level of your product/purchasing prices?	1.000	.467
IT Systems	1.000	.507
Purchasing Tools	1.000	.422
Office Space or Facilities	1.000	.318
Suppliers	1.000	.644
Company Products	1.000	.808
Product Prices	1.000	.753
Purchasing Tools	1.000	.594
Purchasing Procedures	1.000	.693
Your company uses the full potential of information and communication technology to facilitate procurement	1.000	.833
Your ICT infrastructure enables you to share viable information with partners.	1.000	.795
Your ICT infrastructure enables you to share viable information with suppliers.	1.000	.769
Your company has interlinked the full supply chain with its ICT system(s).	1.000	.768

Extraction Method: Principal Component Analysis.

The result of the factor analysis supports a unidimension assumption for each construct. The factor analysis resulted in four constructs explaining 63% of the overall variance.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.256	25.020	25.020	7.256	25.020	25.020	6.315	21.775	21.775
2	4.713	16.250	41.270	4.713	16.250	41.270	4.583	15.803	37.578
3	3.861	13.314	54.584	3.861	13.314	54.584	3.712	12.800	50.378
4	2.386	8.229	62.812	2.386	8.229	62.812	3.606	12.434	62.812
5	1.854	6.393	69.206						
6	1.284	4.427	73.633						
7	1.076	3.709	77.341						
8	.901	3.107	80.448						
9	.827	2.850	83.299						
10	.680	2.346	85.644						
11	.585	2.016	87.660						
12	.504	1.737	89.397						
13	.428	1.475	90.872						
14	.384	1.323	92.195						
15	.319	1.100	93.295						
16	.260	.895	94.191						
17	.244	.842	95.032						
18	.236	.813	95.846						
19	.220	.758	96.604						
20	.179	.618	97.222						
21	.174	.600	97.822						
22	.128	.440	98.261						
23	.121	.416	98.677						
24	.090	.311	98.988						
25	.084	.289	99.276						
26	.071	.245	99.522						
27	.057	.198	99.720						
28	.048	.164	99.884						
29	.034	.116	100.000						

Extraction Method: Principal Component Analysis.

In social sciences, a combination of factors that accounts for 40% of the total variance is deemed satisfactory.

The following varimax rotation has then the effect of optimising the factor structure, with loading smaller than 0.3 omitted for ease of interpretation.

Rotated Component Matrix(a)

	Component			
	1	2	3	4
Over the last three years your company experienced strongly competitive pressures to reduce costs.	-.309		-.327	
Over the last three years your company experienced a strong decline in passenger numbers.	-.827			
Over the last three years your company experienced a strong decline in overall profits.	-.863			
Over the last three years your company experienced a strongly increased concentration in the supplier markets.	-.417		.318	
Over the last three years, your turnover has declined.	-.898			
Over the last three years, your passenger load factor per aircraft has decreased.	-.893			
Over the last three years your company experienced a strong increase in passenger numbers.	.759			
Over the last three years your company experienced a strong increase in overall profits.	.866			
Over the last three years, your turnover has increased.	.859			
Over the last three years, your passenger load factor per aircraft has increased	.851			
How satisfied are you with your procurement processes?			.369	.335
How satisfied are you with the current level of your search costs?				.545
How satisfied are you with your current time efficiency level?				.774
How satisfied are you with the current level of your order process efficiency?				.817
How satisfied are you with the current level of your inventory management?				.839
How satisfied are you with the current level of your supplier transparency?				.751
How satisfied are you with the current level of your product/purchasing prices?				.627
IT Systems		.706		
Purchasing Tools		.601		
Office Space or Facilities		.527		
Suppliers		.781		
Company Products		.867		
Product Prices		.816		
Purchasing Tools		.732		
Purchasing Procedures		.804		
Your company uses the full potential of information and communication technology to facilitate procurement			.871	
Your ICT infrastructure enables you to share viable information with partners.			.861	
Your ICT infrastructure enables you to share viable information with suppliers.			.832	
Your company has interlinked the full supply chain with its ICT system(s).			.825	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 6 iterations.

All designated latent constructs showed a high level of factors loadings and yielded strong convergent validity. None of the items had to be dropped.

- The latent constructs 'Pressures from Business Context' and 'Overall Business Performance' were analysed as one latent construct due to their similarities.
  'Pressures from Business Context': The 6 designed items loaded from -0.309 to -0.898.
  'Overall Business Performance': The 4 designed items loaded from 0.759 to 0.851.

- Latent construct 'Satisfaction with Procurement Practices': The 7 designed items loaded from 0.335 to 0.839.

- Latent construct 'Extent of Resource and Information Sharing': The 8 designed items loaded from 0.527 to 0.867.

- Latent construct 'Overall ICT Sophistication': The 4 designed items loaded from 0.825 to 0.871.

In this varimax rotation, all of the items loaded predictably on the designed latent variables. Rather strong discriminant validity was also demonstrated as only three items cross-loaded on a minor scale on other latent variables. Therefore, the assessment of convergent and discriminant validity confirms that the data can be interpreted in the light of the theory that motivated the research in the first place.

APPENDIX E: DEREGULATION OF AIR TRANSPORT

One of the most significant trends that had a strong impact on the airline industry's environment has been the gradual liberalisation of international air transport. This has had a profound effect both on market structure and on operating patterns (Doganis, 2001). Until thirty years ago air transport was one of the largely regulated sectors in any economy. Fares and frequency of service were strictly regulated and airlines were often state owned. That situation has changed dramatically in several countries where air transportation has been liberalised from regulatory restrictions. Experience has revealed the clear and distinct advantages of freeing the air transport market from economic regulation (Button, 1998). In 1978, airline deregulation was first introduced in the United States. In later years, the airline deregulation experience has been imitated around the world, not only within the airline industry itself but also in other sectors (Chan, 1998). This process was supposed to cut travel costs and enhance productivity.

In its early years, the U.S. airline industry was affected by the Great Depression in the USA. Thus, as part of a general approach to limit competition and protect firms from failing, commercial aviation was organised essentially as a government supervised cartel. From 1938 to 1978, the Civil Aeronautics Board (CAB), which was created to assist maintaining stability in the rapidly growing field of commercial aviation, and to avoid destructive competition (Robson, 1998), basically decided which carrier could fly to which cities. The CAB also set one single price which airlines could charge for each specific route (Poole and Butler, 1998). In most cases only one or two airlines were approved to fly a specific route. The paperwork permitting an airline to serve particular routes was an expensive and time-consuming process. That bureaucratic, long-winded process was far away from the real dynamics of the marketplace and hence even more subject to internal regulatory politics than to market forces. To illustrate, while an airline's cost for shorthaul flights is much higher than for longhaul flights, the CAB typically set shorthaul ticket fares artificially low so that per mile fares were competitive with other transportation modes such as trains and cars, and essentially uniform across the system. The cost of that subsidy was passed along to long distance travellers who paid fares that were pegged artificially high. As such, there was no real price competition under regulation (Robson, 1998). Prices were high, and increasing since the CAB allowed increased costs to be passed onto passengers as higher fares.

This did not provide strong incentives for airlines to seek out new ways to reduce their cost base (Poole and Butler, 1998).

Taking this stringent regulation into account, the CAB also made every effort that existing airlines would not get out of business. Thus, the ability to pass on costs to passengers via predetermined fares allowed very inefficient processes and expensive management practices. However, during the 1960s and early 1970s, economists had observed that in those few markets that were not regulated by the CAB – especially within California – dynamic competition among carriers led to air fares that were significantly lower than on other routes elsewhere that had comparable distance and traffic levels. This new found evidence forced pressures onto the CAB to liberalise its regulations during the 1970s (Poole and Butler, 1998). Legislators came to the conclusion that airlines could serve passengers better if the regulatory structures were dismantled, thereby permitting market forces to be the arbiter of fares and service (Robson, 1998). Initially, after the U.S. government deregulated the industry in 1978, new entrants entered the market and challenged the established airlines. Many new airlines entered especially high volume point-to-point markets with costs that were approximately 30-40% lower than the established carriers. They could offer lower fares through low cost non-union labour and inexpensive second-hand aircraft. The established major airlines responded with a full range of innovative strategies, capitalising on their enormous size to the fullest advantage possible. Within the first 10 years of deregulation, the major scheduled airlines changed their route systems dramatically from point-to-point to hub-and-spoke. In a hub and spoke system, flights are concentrated to, and from, a limited number of airports that are used as collection and distribution centres for passengers. Hub-and-spoke systems allow higher traffic densities than would not be possible in a system of direct flights. This is because channelling passengers through a hub airport concentrates passengers onto a limited number of routes, and hence generates higher densities – the alternative would be to spread passengers over the larger number of aircraft that may be required in a system of direct flights (Renard, 2004).

In addition to the transformation of their network, airlines also changed their fleets to serve hub-and-spoke services, shifting to smaller aircraft in order to provide more frequent services and as such feeding their hubs from a rising number of spokes. This implied an overall cut back on long-haul aircraft and a simultaneous increase on short-haul aircraft in order to be able to increase flights on many spoke routes from one or two per day on smaller jets to a considerably larger number per day on much-smaller turboprops. The latter were often flown by commuter airlines operating under codeshare agreements with their major airline partner (Poole and Butler, 1998). Traditional scheduled airlines also set up frequent flyer programmes or exploited computer reservation systems.

In the post-deregulation environment, the most important of scheduled airlines' strategic developments was the hub-and-spoke network, which facilitated the reduction of the number of flights required to provide a full coverage of their network. In turn, this reduced their operating costs, which could be passed to the consumers in lower fares. As a result, the immense strategic response of the big carriers destroyed many of the new entrants. By 1986, most carriers of the post-deregulation era had disappeared and the industry stabilised. However, this was not the end of competition. The major hub-and-spoke carriers now competed against each other in trying to compete with their hub-and spoke networks buying large number of new aircraft to support their expansion. As a direct result, between 1988 and 1992, the U.S. jet fleet increased by up to 60 % at most airlines. This and strong price competition forced many airlines into bankruptcy and liquidation, which were only prevented by governmental aid. The turning point came when attention was channelled to the lucrative and growing international markets and U.S. airlines soon could establish themselves there as major players (Chan, 1998).

The ever increasing level of congestion at major hub airports during the 1980s, however, created opportunities for alternative strategies. One such strategy was low-fare, no frills, point-to-point services. Due to the liberalisation of air traffic, Southwest Airlines, whose origins pre-date deregulation, could offer its at then unique shorthaul, no-frills and low-priced service on a more frequent and U.S. wide basis. Avoiding congested airports and hubs and so direct competition with the major airlines, it discovered a booming market niche during the 1980s by stimulating low-cost point-to-point services. The obvious success of this strategy led to many startup airlines attempting to replicate this model. However, many startup airlines did not survive the first few years or pursued other niche market strategies. But most recently, several of the major airlines (including Continental, Delta, United, and US Airways in the USA) have created subsidiaries in order to compete with the successful low-fares carriers by also offering low-fare, low-frills point-to-point service, using a single type of aircraft and lower-paid crews (Poole and Butler, 1998).

The U.S. air transportation market is however still not fully open to competition (Button, 1998). In 1979 the United States initiated its so-called Open Skies policy by passing the International Air Transport Competition Act, which mandates that the U.S. Department of Transportation promotes competition in international markets. The Open Skies policy enables countries to negotiate bilateral agreements that essentially deregulate international travel between the United States and the other country. The typical agreement allows U.S. carriers to fly from the United States to any point in the other country, with beyond rights and no restrictions on fares or frequency of service, while granting reciprocal rights to the other country's carriers (Button, 1998). However, institutional constraints still exist and need to be lifted before the market can be considered fully competitive. In particular, the U.S. market remains closed to competition from foreign carriers, which are denied cabotage, that is, the right to compete on routes between points within the United States. In addition, the United States enforces cabotage restrictions by limiting foreign investment in airlines that operate domestic routes. Foreign shareholders cannot own more than 25 % of the voting stock of a domestic airline, or more than 49 % of equity under certain circumstances (Button, 1998).

The other important continent that has experienced liberalisation is the European Union. European airlines have had the benefit of studying the strategies of the U.S. airlines. Furthermore, the hub-and-spoke system was already implemented as an important feature of the European air transport scene as each European flag carrier had its network centred on one particular hub in their home country. In contrary to the USA, the position of dominance at each hub was defended through market entry barriers imposed by the relevant regulatory authorities. When those barriers were removed by the actual liberalisation process, which took place in several steps, European airlines could react with formulating new and softer defensive strategies (Chan, 1998). In Europe, the deregulation process has also implied that government control of the airlines has diminished and more and more airlines have been privatised.

Prior to deregulation, EU airlines faced a highly regulated domestic industry with significant barriers of entry. For example, fares were fixed, capacity was predetermined, and revenues were pooled. Preference was inevitably given to state-owned carriers, many of them heavily subsidised (Button, 1998). Due to regulatory restrictions on route expansion and gate access, growth in turnover and profits was largely based on capturing competitors' customers through departure frequency and time, and brand differentiation. The EU's direct involvement in developing a common aviation policy emerged in the late 1980s. Progress, though, was slow and uneven. The first important measures came in 1988, when limited pricing freedom was permitted and a phased relaxation of the normal 50–50 division of traffic on international EU routes was introduced.

A second package of reforms initiated in 1989 essentially removed government-to-government capacity-sharing arrangements. The reforms also phased in the double disapproval of fares (meaning that the governments of both countries involved in a route had to object in order to overrule fares set by operators) and prevented governments from discriminating against airlines, provided that technical and safety standards were met. Ownership regulations were reformed, which made foreign participation easier. The granting of "beyond rights" (the right to fly from a point outside of the airline's home country to a point in a third country) became virtually automatic. The latest round of deregulation began in 1993, resulting in a regulatory framework similar to that prevailing in the U.S. aviation market. Cabotage was phased in, with "consecutive cabotage" introduced initially to enable an EU-based carrier to fly to a second destination within another EU country as long as the number of passengers on the second leg did not exceed 50 % of the total on the international flight. With the phase complete, any EU airline can now fly between member states and between cities within member states without restriction. Foreign ownership of EU carriers is permitted, and carriers have, for EU internal purposes, become European airlines. One result of those changes has been a considerable increase in cross-shareholding and the rapidly expanding number of code-sharing and similar alliances among airlines within the EU (Button, 1998).

To summarise, due to the severe price competition, many airlines, especially in the U.S., did not survive, or were forced into mergers, consolidations or leveraged buy-outs (e.g. Glisson et al., 1996). As Europe has learned lessons from the U.S. example, it liberalised the aviation market gradually. Therefore the impacts were not as severe as in the U.S.A. However, in both cases, equity distributions are still highly regulated, and still, in many cases, the home government is often the majority shareholder. While airlines in Europe and North America now largely operate in highly competitive markets, the majority of the world's air routes are still very strongly regulated (e.g. Button, 1996; Nijkamp and Pels, 2002). Furthermore, international routes are governed by a series of bilateral agreements between nations. Due to the restrictive nature of international competition in the industry, domestic airlines have only a limited means of competing globally.

A very distinct feature of the airline industry is therefore the historical and political legacies that basically have hindered it from developing fully like other industries. Another feature is that, up to this date, the industry is largely based on a national model. In the past the concept of 'national' airlines has played an important strategic role in state affairs, led to tight governmental control, which meant that inter-organisational co-operative work between airlines and even particular suppliers was very restrictive. Many airlines remain full or at least partially government-owned (e.g. Chan, 2000). National preferences still represent an important factor in the way an airline operates. Unlike other industries, which have often developed into internationally organised organisations and enterprises incorporating international mergers and acquisitions, the aviation industry has a certain conservative national character inhibiting its full growth potential internationally. This is to be expected, as aviation has played an important strategic role in the affairs of states such as a role to represent their nations abroad. Many airlines of the world are still state-owned companies and/or get subventions in order to remain in business. Trade in aviation goods and services is frequently controlled by governments. This also explains why bilateral air agreements and services between nations have been extremely difficult so far (Chan, 1998). All these national factors can explain why the industry hasn't developed in a comparable manner and at a similar pace to many other industries.

APPENDIX F: AIRLINE COSTS AND ECONOMICS

Aircraft size can have a profound effect on an airline's unit costs. In most cases, the larger the aircraft, the lower will be its direct operating costs per passenger kilometre. The flying costs per block hour of a large aircraft are, of course, greater than those of a small aeroplane, but when this cost is divided by the corresponding total output of each aircraft a lower unit cost is produced. This situation occurs because the hourly productivity of a larger aircraft increases more rapidly with size than does its hourly operating cost. Other characteristics of an aircraft affecting operating costs include range, fuel consumption, capital charges and maintenance requirements. Figure 174 summarises sources of cost advantages.

The aircraft most commonly in use with low-cost operators are the Boeing 737 classic (150 seats) and new generation (180 seats) series. In contrast, for short and medium haul charter operations the Airbus 321 (220 seats) and Boeing 757 (230 seats) are typical, whilst for long haul flights the Boeing 767-300 (320 seats) and Airbus 330-200 (360 seats) predominate (Williams, 2001).

Characteristics	Low-Cost Airline	Scheduled Airline	Integrated Charter	Independent Charter
Larger Aircraft		X	X	(X)
Longer Sectors		X	X	(X)
Higher Load Factor			X	(X)
Higher Labour Productivity			X	(X)
Lower Distribution Costs	(X)		X	(X)
Lower Passenger Service Costs	X			
Lower Landing Fees	(X)		X	(X)
Lower Insurance Premiums		(X)	X	(X)
Lower Aircraft Leasing Costs			X	(X)
Lower Admin. & Finance Costs			X	(X)
Higher Aircraft Utilisation	(X)		X	X

Figure 174: Sources of Cost Advantage

Source: Derived from Williams, 2001, Will Europe's Charter Carriers be replaces by no-frills scheduled airlines?, Journal of Air Transport Management, 7.

In addition to aircraft size, aircraft utilisation plays a major role in achieving cost advantages. Aircraft utilisation for short to medium haul scheduled airlines is with few exceptions lower than that achieved by charter airlines. While scheduled airlines and low-fare airlines are usually more or less constrained to specific operating hours, charter airlines are not so limited in this respect. However, more recently, low-fare airlines are following the example of charter airlines. The seasonal nature of a charter operation is apparent, with aircraft operating often twice as many flying hours during the summer period compared to the winter months. However, the shorter turnaround times of low-fare airlines brought the utilisation close to that of charter airlines. The average sector distance affects the utilisation of aircraft and crew, the amount of fuel used per block hour, the relative size of station costs and part of an airline's maintenance expenses. Charter airlines typically fly sectors over 2000 km by contrast to 1000 km flown by low-cost companies.

Aircraft load factors further determine the cost advantage of an airline. Typically high load factors can be associated with charter airlines since their planes usually get filled by the tourism companies, while load factors of low-cost and scheduled airlines are significantly lower.[36] Labour productivity is considerably influenced by the extent to which a carrier outsources its activities and by the nature of the product it offers to its customers. The low-fare, scheduled and charter airlines have much in common in terms of the products they supply, but wide differences are apparent with respect to the degree of outsourcing that occurs. The long established charter operators and scheduled airlines often undertake their maintenance in-house, whereas the low-fare companies have mainly outsourced this activity. Therefore, the labour forces of the integrated charter airlines are producing around three times the level of output of a low-fare airline. Distribution costs are virtually non-existent for the vertically integrated charter airline, as sales and promotion activities are undertaken by the tour operator parent company. By contrast, the low-fare and scheduled airlines need to expend a sizeable proportion of their resources to notify the public of their services. The lower distribution costs associated with Internet selling has proved an attractive option for the low-fare scheduled airlines – the majority of bookings are typically made over the Internet.

Passenger service costs cover primarily in-flight catering and entertainment expenditure. The low-fares airlines spend very little in this regard and therefore have the advantage over their charter and scheduled counterparts. In certain instances, the quality of in-flight catering provided by charter airlines is substantially better than that supplied by the large network scheduled companies to their economy class passengers. By providing in-flight refreshments that needs to be purchased, low-fare airlines reduce the amount of turnaround time, as considerably less time is spent cleaning and restocking aircraft. Landing fees are lower on average for charter and low-fare airlines due to their greater use of secondary airports and avoidance of peak time operations at primary airports. Insurance costs are lower the longer an airline is in operation. Therefore, for new established low-fares airlines, the insurance policies are slightly higher. Once established, however, it is likely that the differential will reduce over time. The higher aircraft utilisation rates that are achieved, the lower the insurance expenses are when averaged out on a per flight basis. This also applies to aircraft leasing costs.

Administration and finance expenses will be lowest for the integrated charter airlines, as many of the tasks usually included under this category are undertaken by the tour operator parent company. Similar sized low-cost airlines and independent charter

[36] According to a report of the Civil Aviation Authorities in 1999, charter airlines achieved an average load factor of 90%, low-fares airlines 75%, and scheduled airlines 70% (Williams, 2001).

airlines face much of the same levels of expenditure on general administration and finance, while scheduled airlines generally have a higher cost base (Williams, 2001).

Cost and cost drivers may vary between airlines and may be something special and individual to each of them. However, similarities exist and it is important to know in this context to what extent these airlines' costs can be controlled by purchasing activities. Mostly traditional airline have to cope with low-cost carriers that focus more on cost management rather than cost cutting. In traditional material divisions, airlines are often defending their current cost levels and as they are busy doing that, they lose sight of the more strategic approach towards cost (Boll, 2001).

There are several ways to classify costs in the airline industry. How an airline's costs are broken down and categorised depends mainly on the purpose for which they are being used. No single cost categorisation is capable of simultaneously satisfying all management or policy analysis requirements (Tae Houm, 1998). As there have been distortions on how costs are calculated because of the fact that many airlines have developed special methods for calculating their costs, the ICAO (International Civil Aviation Organisation) produced a standard format for the reporting of costs and expenditure (Form EF-1). The majority of airlines are using this method of reporting, which basically divides airline costs into two particular categories: operating costs and non-operating costs, which combined form the total costs of an airline. Non-operating costs can be described as those arising concomitantly with the normal activities of an airline (McPherson, 1998). Operating costs constitute the largest part of expenditure by an airline. To enable a clearer identification of those costs (see Figure 9), they can be divided into Direct Operating Costs (DOC), which are summative as a direct cause of a flight, and Indirect Operating Costs (IOC), which are amassed in support of that flight. According to Doganis (1991), direct costs account for approximately half of total operating costs. This also highlights the importance of indirect costs, which may not be assignable to specific traffic. Total costs of an airline are illustrated in the following table (according to the ICAO).

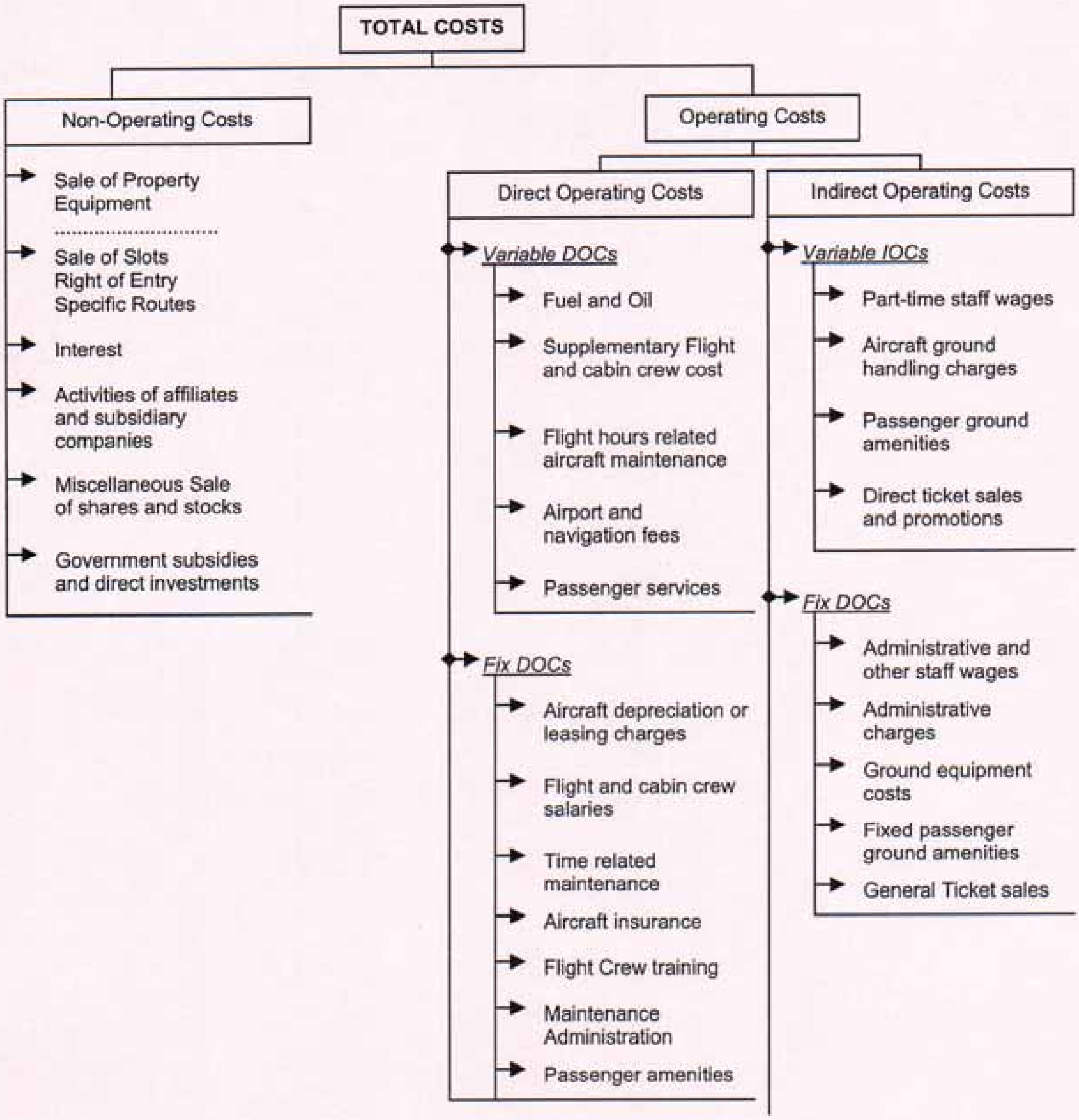


Figure 175: Costs involved in the Aviation Operation

Airlines typically also classify costs by factors of production. There are five categories of airline costs, which are: labour; fuel; materials; flight equipment; and, ground property and equipment. Figure 176 presents a listing of these cost elements as a percentage of total airline costs to illustrate the breakdown. The cost of material input accounts for about 35% up to 57% of total cost, thus being the most important component. Labour costs represent between 11% to 42% of total costs. These high variations are due to differences in prevailing wage levels and labour market conditions of different countries. Fuel costs account for about 6-15% (Tae Houm, 1998).

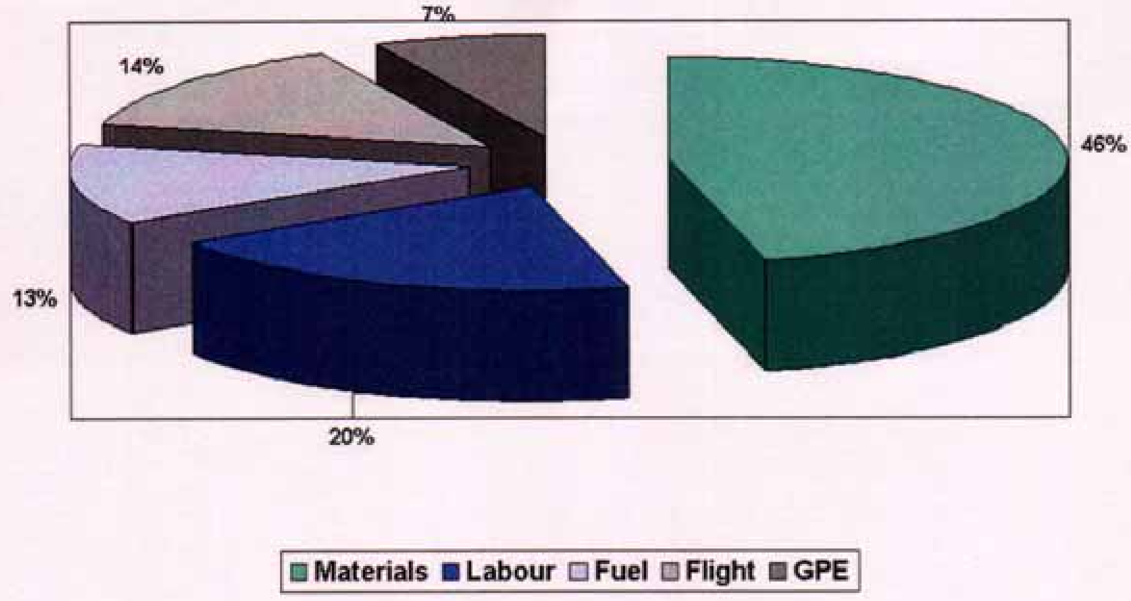


Figure 176: Airline Costs by Categories
Source: Oum,T.H., 1998, Winning Airlines: Productivity and cost competitiveness of the world's major airlines, Kluwer Academic Publisher.

Commonality over some aircraft types can reduce the spare parts overhead, effectively merging small fleets to a single big one. In order to achieve market economies of scale, spare parts commonality has become a major marketing tool of airframe and engine manufacturers. Commonality has even spread onto tooling for maintenance and training requirements. According to several authors (e.g. Antoniou, 1991; Oum and Zhana, 1997; Xu and Windle, 1994) the larger the fleet, the less that has to be invested per aircraft in spares. However, the rule used in the industry is that as the fleet size increases from one aircraft to five, the number of parts and investment per aircraft reduces rapidly. This rate of reduction slows as the fleet gets even larger, until there is only little or no reduction. Important to note is however that there is no fixed fleet size at which point the spares investment per aircraft becomes uniform because different types of aircraft have a different number of parts, different failure rates, etc. A general rule is that once a fleet of aircraft is larger than 50, the investment in spare parts per aircraft will be similar for each one added to the fleet (Aircraft Economics No. 32, July/August 1997). As an example, Hollaway calculated that the cost of spare parts, when being measured as a percentage of the cost of the fleet, would be 30% for one aircraft, then it sharply decreases to 12% for five aircraft before gradually declining to 7.5% for twenty (Hollaway, 1996).

Quite similar in terms of decrease of percentage, British Airways reported in 1997 that the spares requirement for Boeing 757 aircraft would be 6% of total fleet cost for five aircraft, 4.2% for ten and 3.9% for fifteen. For this reason, the benefits of commonality only apply to airlines with two fleets of different types, at least one of which is small. For example if a fleet of 40 Airbus A320s is operated alongside a fleet of 5 Airbus A319s, the airline will have to invest the minimum amount of parts it has to buy for the Airbus A319 which are common to those of the Airbus A320. However, when operating two large fleets such as 150 McDonnell Douglas MD-80s and 80 Boeing B757s, spare parts commonality will not apply and so it will not matter which aircraft types to use and if there is any commonality as the fleets have their own economies of scale. This is one reason why airlines may decide to operate fleets of different aircraft types even tough they are designed to fulfil the same role. If the aircraft being purchased were short to medium haul types, such as an Airbus A320 or Boeing B737, then the scale economies would be available to many individual airlines themselves excluding the involvement of other carriers. On the other hand, few airlines have large fleets of long haul aircraft like a Boeing B747 and B777 or Airbus A330 and A340. In this case, joint purchasing could generate benefits from economies of scale (Aircraft Economics, 1997).

Significant economies are available by increasing the size of a production unit. If an airline replaces a 757 with a 747, unit costs, the costs per seat over a given sector distance, will fall. If the airline can maintain a seat factor close to that achieved on the smaller aircraft, costs per passenger will also decline (Humphreys, 1998). Economies of scale, on the other hand, are achieved at the next level of production at the firm level, and involve a reduction in the overall unit costs of the firm. In any industry the question of whether significant economies of scale are possible has important implications for competition and the regulatory environment, and aviation is certainly no exception. Significant economies of scale are probably the most persuasive argument in favour of a single monopoly producer in a market, since the larger the firm, the lower its unit costs.

This is why a debate on the regulation of an industry should start with a consideration of whether the industry is capable of significant scale economies. Most industries are not, which is why they are characterised by a number of competing firms of different sizes. There are several areas where an airline's cost can be reduced simply because of its size. For example, a large airline will probably be able to negotiate lower unit prices for equipment and fuel than its smaller competitors. However, there is a significant part of companies that tend to become flabby as they grow (i.e. X-inefficiency). There have been a number of studies of economies of scale among airlines and all have concluded that above a certain, very low level, they do not exist to a significant extent (see e.g. Caves, Christensen and Tretheway, 1984; Crane, 1944; Doganis, 1991; Holloway, 1997; White, 1979; Xu and Windle, 1994). It has been argued that economies of scope are the key to understanding the tendency towards concentration in the airline industry (Humphreys, 1998).

Like scale economies, economies of scope appear at the company level. They are found where a single firm is able to produce particular levels of output of two or more goods of service at a total lower cost than they could be produced separately by different firms. For example, repair and maintenance services account for approximately ten percent of an airline's operating costs. It is estimated that maintenance costs over 15 years represent approximately two thirds of the sale price of the aircraft. Maintenance is traditionally undertaken by companies for their own account, often without the creation of subsidiaries and internal billing. With recent trends towards deregulation, such activities are increasingly being undertaken externally (Findlay and Nikomborirak, 1999). In reality, there is considerable overlap of economies of density, scale and scope (Humphreys, 1998). According to Holloway (1997), the supply of output is one of the first elements in the operating performance model as follows:

Output x Unit Cost > < Traffic x Yield = Operating Performance (i.e. loss or profit).

In any company where ownership and management are separated, managers are in a powerful position to pursue their own objectives and in the airline industry governments have also been highly influential by imposing their own political and social agendas. However, among all subjects, the importance of airline profitability has become much more pronounced in recent years, but profit maximisation is never realistically going to be a sole objective. The traditional theory of the firm nonetheless remains an important toll of economic analysis simply because it is felt by many economists to yield powerful insights into what actually happens in the marketplace (Holloway, 1997). Supply is the quantity of a good or service that producers are willing and able to sell during a defined period of time and subject to a particular set of conditions. Price is clearly one important condition, as is the price of any competing good or service. Other conditions include the level of input costs, the current state of technology, and the presence of route licensing or similar restraints on free market entry. According to the theory of the firm, supply will rise as long as the marginal benefit to the producer – measured in terms of the marginal revenue earned by producing one additional unit – exceeds the marginal cost of production (Holloway, 1997).

Airline output can be measured with two variables. First in available seat-miles (ASMs) or available seat kilometres (ASKs), each of which represents one seat carried one mile or kilometre respectively, and secondly in available ton-miles (ATMs) or available tonne-kilometres (ATKs), which represent one ton of payload capacity carried one mile or kilometre (Holloway, 1997). As airline markets are progressively liberalised, intensifying competition and greater commercial freedom often lead to increases in output. Airlines then tend to face downward pressure on the prices their output can earn. This has made it essential for them to act decisively on non-price variables in the supply function (Holloway, 1997).

There are three particular facets of supply in the airline industry. First of all, airline seats are perishable. Because carriage by air is a service that is produced and consumed at the same time, airline seats and cargo space cannot be produced and then placed inventory for later sale. This puts considerable pressure on carriers to lower their prices in order to sell scheduled output remaining unsold as a departure date approaches. Secondly, empty airline seats are not necessarily just a manifestation of oversupply – they are also part of a product. Certain types of passengers tend to book quite close to departure and also to change their travel plans after booking or once the journey has begun. Such passengers usually pay the highest fares chargeable in the chosen class of travel in order to obtain this flexibility, and the revenue their custom generates is therefore particularly important for many scheduled airlines. Fully-booked airplanes inhibit such flexibility and, whilst being beneficial to airline revenues in the short term, might have negative long-term repercussions if the brand loyalty of these customers is eroded by frequent inability to make or change bookings at short notice. To ensure this does not happen to an unacceptable extent, airlines try to build seat accessibility into their full-fare products.

This means that, particularly in first and business class, although an airplane might depart with some empty seats there is not necessarily an oversupply problem. More generally, however, the fact that air transport is one of the few industries in which a growth in the level of output also increases the quality of the product in the perception of consumers inevitably tends to create pressure towards oversupply. Third, airlines face a daily, weekly or seasonal demand peaking problem. Inevitably what tends to happen is that during peak periods there is an undersupply of capacity leading to spillage of demand, whilst during off-peak periods there is an oversupply. In principle, the price mechanism should work to dampen these extremes (Holloway, 1997). Airline costs and economics play therefore an important part for effective and efficient supply chain and procurement operations.

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