Effects of Service Quality, Innovation and Corporate Image on Customer's Satisfaction and Loyalty of Air Cargo Terminal

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Abstract—The air cargo terminals (ACTs) recently focus on developing relationship with customers to meet their requirements and enhance loyalty in the competitive environments in Taiwan. The purpose of this study is to explore the effects of service quality, innovation capability and corporate image on customer's satisfaction and loyalty of ACTs. After reviewing the literatures, the structural equation modeling (SEM) was conducted to test the research model. The data was collected from ACTs' customers by the questionnaire at Taoyuan International Airport in Taiwan. The results show that customer satisfaction has a statistical on loyalty, and service quality, innovation capability and corporate image have a positive effect on customer satisfaction respectively. Finally, this study discussed the managerial implications and offered suggestions for the future researches.

Keywords—Air cargo terminal, service quality, innovation capability, corporate image, satisfaction, loyalty

1. INTRODUCTION

In the aviation industry, air cargo terminal (ACT) function as relay stations in between land-to-air transportation. Due to the lagging development and growth of domestic cargo volume in recent years, ACT operators have resorted to price warfare in order to maintain stable growth in business. The battle of market dominance with such vicious competition and price cutting strategies could only result in reduced profit for all contenders. In addition, one of the key causes of intense market competition is the lack of distinctive differentiation amongst services provided by various ACT operators. The absence of clear differentiation between the services available has allowed price to become the primary factor to consider in the existing market. With numerous operators presently engaging in intense competition at the ACTs of Taoyuan International Airport, a variety of diverse services are made available to the customers (Wang, 2007). And, as customers' needs for ACT services become more and more sophisticated by the day, strengthening customer loyalty by satisfying their needs through unique services has become a pressing challenge that ACTs have to overcome immediately.

Some scholars believe that customer loyalty is derived from customer satisfaction and have concluded that the two are highly correlated (Reichheld and Sasser, 1990; Anderson and Sullivan, 1993; Oliver, 1999; Davis and Mentzer, 2006) while others have suggested that different factors of influence exist with regards to customer satisfaction due to differences in sector characteristics. First, when customers experience positive emotions with service quality, corporations would be able to elevate customer satisfaction (Davis and Mentzer, 2006). With that said, most scholars maintained that service quality is still the primary factor that determines customer satisfaction (Zeithaml and Bitner, 1996; de Ruyter *et al.*, 1997; Blackmon and Chase, 2004; Lin *et al.*, 2005; Davis and Mentzer, 2006) and the improvement in customer satisfaction is directly proportional to the enhancement of a company's services (Cronin and Taylor, 1992; Innis and La Londe, 1994; Rust *et al.*, 1995; Zeithaml *et al.*, 1996). Second, results from relevant researches indicate that innovation has also been recognized as a critical factor that corporations rely on to maintain competitive advantages (Tang., 1999; Zahra and George, 2002). Innovation is not only able to improve customer satisfaction (Athanassopoulos *et al.*, 2001) for corporations but also allow them to secure strategic positions externally and strengthen internal abilities through product or technological innovation (Geroski, 1994; Zahra and George, 2002). Finally, some researchers point out that consumers' awareness of companies corporate images would not only minimize the factor of uncertainty in their purchase decisions, but corporate images would ultimately affect customer satisfaction from accumulated purchase experiences (Bolton and Drew, 1991).

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The purpose of this study is to create a relationship model between ACT service quality, innovation, corporate image, customer satisfaction and customer loyalty. Presently, there are currently six operators in Taiwan. Among them, four operators are local: Everterminal Co., Ltd., Taiwan Air Cargo Terminal, Evergreen Air Cargo Services Corporation and Farglory Free Trade Zone (listed in the ranking of the dates of their official establishment). The two remaining foreign operators are United Parcel Service of America, Inc. and Federal Express Corporation and they both offer international integrated express air cargo delivery services. And as such, their scope of operation differs from the domestic operators. For the sake of differentiating the scope of operation and functionality between domestic and international ACT operators, this study will only involve the four local operators. In addition, ACT operations focus primarily on cargo handling services and the main clientele may be divided into three categories: air carriers, customs brokers, and air forwarders and consigners/consignees. As such, corporate customers that fall under these three categories have been selected as the primary subjects for this study. Besides, the structural equation modeling (SEM) was chosen as the means of fit verification for the models. We have chosen the two-phase step proposed by Anderson and Gerbing (1988) to first examine data fitness for the measurement model through confirmatory factor analysis (CFA) followed by performing path analysis and fit verification for the theoretical model.

2. LITERATURE REVIEWS

2.1 Air cargo terminal in Taiwan

According to Article 2, Section 16 of the Civil Aviation Law of The Republic of China, the operation of air cargo terminal is defined as "business pertaining to making a profit by providing equipment and services related to custom clearance and cargo storage required at import/export/transit/transshipment cargo freight stations or for leaving/entering restricted zones at the airport". Because of the nature of such operations, ACTs not only function as hubs for air cargo import/export in the entire air cargo shipping supply chain, but also feature characteristics of relay stations for land-to-air transport. This is why typical ACTs must feature four major functions of transit, sorting, storage and cargo information processing.

In addition, ACT's main line of business involves the provision of cargo handling services, and these service products can be further divided into the following according to their characteristics: Import General Cargo, Export General Cargo, Transit Cargo, Import Perishable Cargo, Export Perishable Cargo, Import Express Handle Unit (Import EHU) and Export EHU. Cargo types and formats differ under these categories; for instance, while Import General Cargo primarily consists of electronics and electrical products, it also includes relevant raw materials such as textiles. Livestock and fresh vegetables/fruits fall under Import/Export Perishable Cargo, and EHU cargo mainly consist of documents, luxury goods and parcels. Transit cargo may include products under all other categories.

Presently, ACTs belong to one of the six licensed industries governed by the Civil Aviation Law of The Republic of China and there are currently six operators in Taiwan. Among them, four operators are local: Everterminal Co., Ltd., Taiwan Air Cargo Terminal, Evergreen Air Cargo Services Corporation and Farglory Free Trade Zone (listed in the ranking of the dates of their official establishment). The two remaining foreign operators are United Parcel Service of America, Inc. and Federal Express Corporation and they both offer international integrated express air cargo delivery services. And as such, their scope of operation differs from the domestic operators. For the sake of differentiating the scope of operation and functionality between domestic and international ACT operators, this study will only involve the four local operators.

2.2 Service Quality

Amongst numerous interpretations, "meeting or surpassing customer expectations" has been accepted as the most common definition for service quality (Reeves and Bednar, 1994). Parasuraman *et al.* (1988) have developed the famous scale of service quality – SERVQUAL – to quantitatively measure service quality. However, according to the findings of Cronin and Taylor (1992), Triplet *et al.* (1994) in their application of the SERVQUAL model, the SERVQUAL model would not necessarily yield consistent results on service quality. This has led to the proposal of SERVPERF scale developed by Cronin and Taylor (1992), which emphasized a simplified assessment of customer motivation and actual behavior purely from performance alone.

Furthermore, one should also be able to identify a measurement dimension for service quality after studying the relevant literature on ACTs. Chang (2007) has also designated five dimensions of "Tangibles", "Reliability", Responsiveness", "Assurance" and "Empathy" based on the characteristics of ACT service for ACT service quality in Taiwan. Wang (2007) used quality function deployment to explore the service quality of air cargo terminal. Their study suggested that the factors in greatest need of improvement with regard to quality technology are customer service, cargo loading/unloading management, IT development, training, and customer service hotline operations. On the other hand, some scholars support the notion that a positive correlation exists between service quality and customer satisfaction and identified service quality as the primary factor that affects customer satisfaction (Zeithaml and Bitner, 1996; de Ruyter *et al.*, 1997; Lin *et al.*, 2005; Davis

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and Mentzer, 2006). Therefore, when a company is capable of offering better services, there would be significant improvement in customer satisfaction (Innis and La Londe, 1994).

2.2 Innovation

For an organization, "innovation" is not only limited to innovation of technology or product, as it also involved process, strategy, organization architecture and so forth. Drucker (1974) suggested that "innovation is not an exclusive terminology for technology and it should also be a vocabulary for economics and society" and its scope includes changes in management knowledge or economic systems.

The objective of corporate innovation is to strengthen corporations' external competitiveness and enhance internal capabilities through product or process innovation (Geroski, 1994). Froehle *et al.* (2000) believed that innovation is comprised of technology, organization and regularized developmental steps. Chapman *et al.* (2003) proposed that innovation is the product of technology, knowledge and relationship network. Guan *et al.* (2006) suggested that technological innovation is the combination of knowledge and technologies from different fields of specialization for the sake of product innovation and that the improvement in technological innovation capabilities would strengthen an organization's competitiveness. Athanassopoulos *et al.* (2001) also have identified innovation as an aspect for the assessment of customer satisfaction.

2.3 Corporate Image

The concept of the corporate image came to existence during 1950s and 1960s, but scholars have focused the center of their research on corporate brands in recent years (Balmer and Greyser, 2006). Walters (1978) suggested that while corporate image covers a substantial amount of factors, as far as consumers are concerned, the most essential aspects may be summarized into organizational image, functional image and merchandize image. Nguyen and LeBlanc (2001) believe that factors that constitute corporate image might have originated from customers' awareness of corporations as physical entities and their behaviors, including corporation name, tradition, management philosophy, diversification of products and so forth. Hatch *et al.* (2003) stated in their research that corporate image encompasses the feelings of company employees and the perspectives of customers, shareholders, the media, the general public and external interested parties on the corporation. Pina *et al.* (2006) summarized the theories proposed by the aforementioned scholars and pointed out that the task of objective assessment of corporate image could be fairly difficult because corporate image is an intuitive, subjective concept.

According to Keller (1998), corporate image can be evaluated in terms of product attribute/benefit/attitude association, corporate credibility, employee and customer relationship and corporate culture. Based on the results of Keller's (2000) reorganization, key associations most likely to be triggered by the consumer demographic for corporations cover four major aspects: merchandize image, customer-orientated image, corporate citizen image and corporate reputation. Some scholars have also discovered that corporate image would have impact on customer satisfaction due to accumulated purchase experiences during the observation of how customer satisfaction is formed (Bolton and Drew, 1991).

2.4 Customer Satisfaction and Customer Loyalty

The majority of scholars still uphold "customers' expectation on products and the extent of fulfillment for such expectations after use" and "the extent of like or dislike after consumption" as the central concepts on determining customer satisfaction (Fomell, 1992). Loverlock (1996) identified customer satisfaction as an important driving force for customer loyalty and demonstrated a marked positive correlation between the two. Moreover, numerous studies conducted by several scholars have came to the same conclusion that customer satisfaction has direct influence over customer loyalty and it is one of the key variables that determines customer loyalty (Anderson and Sullivan, 1993; Oliver, 1999; Reynolds and Arnold, 2000; Zins, 2001; Stank *et al.*, 2003; Vickery *et al.*, 2004; Panayides and So, 2005; Davis and Mentzer, 2006).

On the other hand, as far as corporations are concerned, customer loyalty remains as one of the most important factors in determining market competitiveness (Davis and Mentzer, 2006). Reichheld and Sasser (1990) believe that customer loyalty is heavily influenced by customers' satisfaction of services and pointed out that customer satisfaction is a crucial factor that would elevate customer loyalty. Based on Gronholdt *et al.* (2000)'s comments, customer loyalty can be analyzed with four indices: customers' inclination to make repeated purchases, inclination to recommend the company/brand to others, price tolerance and inclination to make cross purchases. Lam *et al.* (2004) separated customer loyalty into the inclination to recommend the company to others and the inclination to make repeated purchases. Fullerton (2005) has chosen to measure consumers' service brand loyalty with willingness to make repeated purchases and willingness to show support.

3. RESEARCH METHODS

3.1 Research Model and Hypothesis

This research will focus primarily on the investigation of customer satisfaction and loyalty at ACTs and we will examine the effects of factors such as service quality, innovation and the concept of corporate image on customer satisfaction and loyalty. In addition, we have also presented a conceptual model (as shown in Fig. 1) for the sake of this study. There are four hypotheses in this research model.
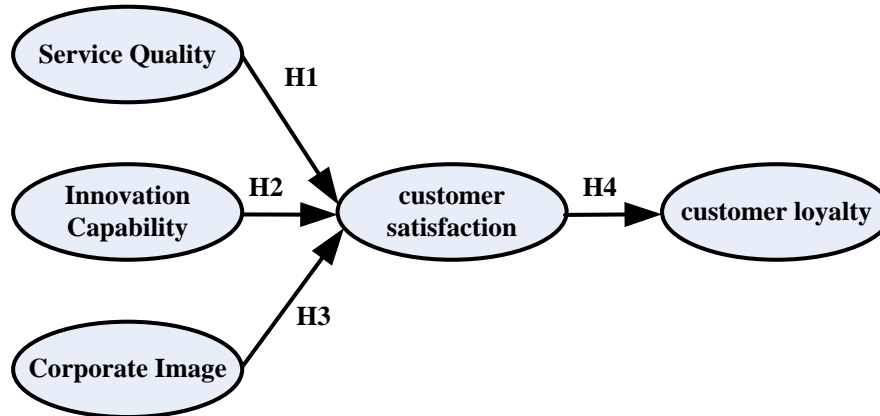

Figure 1. Research model

Based on the purpose and research model adopted for this study, we have made four hypotheses in this research. From the relevant literature on service quality, we discovered that many scholars agree on the notion that a positive correlation exists between service quality and customer satisfaction and identified service quality to be the primary factor that affects customer satisfaction (Zeithaml and Bitner, 1996; de Ruyter *et al.*, 1997; Hurley and Estelami, 1998; Lin *et al.*, 2005; Davis and Mentzer, 2006). Hence we propose the first hypothesis H1 of this research:

H1: Service quality has a positive influence on customer satisfaction.

In order for corporations to sustain operations and maintain their competitive advantages, "innovation" has become one of the crucial capabilities that corporations pursue aggressively (Zahra and George, 2002). In this research, we will examine the effects of innovation on customer satisfaction from the perspective of organization behavior. According to the theory that product innovation is a dimension in the assessment of customer satisfaction proposed by Athanassopoulos *et al.* (2001), we propose the second hypothesis H2 of this research:

H2: Innovation capability has a positive influence on customer satisfaction.

In essence, corporate image is the general public's overall impression and opinion of a corporation's activities and performance (Worcester, 1972; Walters, 1974; 1978). During the observation of how customer satisfaction is formed, some scholars have discovered that corporate image would have impact on customer satisfaction due to accumulated purchase experiences (Oliver, 1981; Bolton and Drew, 1991; Fornell, 1992). From this, we propose the third hypothesis H3 of this research:

H3: Corporate image has a positive influence on customer satisfaction.

Finally, from the discussions on the relationship between customer satisfaction and customer loyalty, many scholars propose that the experience of satisfaction for customers has a positive influence on customer loyalty. In other words, higher customer satisfaction would naturally lead to higher customer loyalty (Fornell, 1992; Anderson and Sullivan, 1993; Gronholdt *et al.*, 2000; Vickery *et al.*, 2004; Panayides and So, 2005; Davis and Mentzer, 2006). Based on this notion, we propose the fourth hypothesis H4 of this research:

H4: Customer satisfaction has a positive influence over customer loyalty.

3.2 Measurement Variables

This section will describe how aspects of service quality, innovation, corporate image, customer satisfaction and customer loyalty would be adopted as variables of measurement.

In the field of service quality research and study, no other scholar is more representative of the domain or has more profound influence over the domain than Parasuraman *et al.* Therefore, we have referred to the content of Parasuraman *et al.* (1988), the essence of Cronin and Taylor (1992) while relating to Chang (2007)'s relevant studies on ACT service quality to adopt "Tangibles", "Reliability", "Responsiveness", "Assurance" and "Empathy" as dimensions of measurement for ACT service quality. "Tangibles" refers to physical hardware that ACT may have to offer such as comprehensive, modern

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warehousing facilities or ideal location that would allow convenient custom clearance for cargoes; "Reliability" refers to service personnel faithfully carrying out guarantees made to customers or sincerely resolving customers' troubles; "Responsiveness" involves ACT staffs rapidly and willingly solving problems for customers; "Assurance" involves service personnel successfully creating a sense of trust in customers by demonstrating competence with professional knowledge and capacity to resolve problems so that the ACT would seem trustworthy in the eyes of customers; "Empathy" involves ACTs offering convenient operations or demonstrating concern to safeguard customers' rights.

Furthermore, we have referred to theories proposed by Froehle *et al.* (2000), Chapman *et al.* (2002) and Guan *et al.* (2006) and devised four reference points to analyze ACTs' capacity for innovation, namely: "technical innovation refers to the assistance that customers receive from advance technology or information system that ACTs provide", "system innovation refers to the capacity for ACTs to launch innovative customized service systems and items to satisfy the needs of external users or the market", "knowledge innovation refers to innovative knowledge and abilities that ACTs possess to improve operational efficiency" and "organization innovation refers to innovative organizational structures (such as IT CARE group, Shipper Load group, Monitoring Center, Joint-Management Center, Customer Service Center and so forth) that ACTs adopt to better satisfy customers' demands.

Based on the arguments of Walters (1978), Keller (2000) and Nguyen and LeBlanc (2001), we have adopted the view that the factors that constitute ACT image originate from customers' perception of ACTs as physical entities and their behaviors, including company name, management philosophies, company reputation/credibility, service image/attitude demonstrated by the company and so forth. In addition, we have excluded merchandize image and corporate citizen image proposed by the aforementioned scholars according to the characteristics of services offered at ACTs. In other words, this research has taken the viewpoints of the aforementioned scholars and described corporate image of ACTs as the combination of company image, service image and corporate credibility. The questions for corporate image include: "company image refers to the traits that would present a specific ACT as a better company when compared with other competitors in the industry", "service image refers to the intensity of customers' impression on specific services provided by ACTs" and "corporate credibility refers to an ACT's credibility and reputation in the eyes of customers".

In light of the characteristics of ACT operation, which do not involve physical products or stores to display merchandizes, we have therefore excluded factors such as customers' perception and feelings on products and stores and referred only to the design of questions featured in the studies conducted by Homburg *et al.* (2002), Stank *et al.* (2003) and Vickery *et al.* (2004) for the design of the questionnaire used in this study. In addition, based on the theories proposed by the aforementioned scholars and in consideration of the characteristics of ACT services, we have defined customer satisfaction as "customers' experience with overall services or collaboration with ACTs" and "the gap between customers' anticipation prior to utilizing ACT services and impressions after actually experiencing ACT services".

In their research, Jones and Sasser (1995) proposed that customer loyalty may be divided into long-term loyalty and short-term loyalty; the former is considered as true customer loyalty while customers with short term loyalty would opt for other choices when better choices become available. They have also indicated that the assessment of customer loyalty can be determined by examining customers' inclination to make repeated purchases and their willingness to introduce or openly recommend the operator to others. Gronholdt *et al.* (2000) also brought up similar theories that customer loyalty is represented by customers' inclination to make repeated purchases, inclination to recommend the company/brand to others, price tolerance and inclination to make cross purchases. Based on the theories proposed by the aforementioned scholars and in consideration of the characteristics of ACT services, we have defined customer loyalty as "inclination for customers to show support for ACTs" and it covers "inclination for customers to prefer a specific ACT over other candidates", "maintenance of long term collaboration relationship" and "inclination to recommend an ACT to others".

3.3 Data Collection

A survey of the corporate customers of Taiwan's domestic ACT operators has been conducted with a questionnaire in this research and a Likert five-level scale is applied to all questions to allow subjects to rate each construct variable (1 stands for "strongly disagree" and 5 for "strongly agree"). ACT corporate customers cover air carriers, customer broker and air forwarders, and import/export consigner/consignee. First, in order for the samples to justly represent their groups, the study has taken the statistical data (compiled in December 2007) provided by Taoyuan International Airport into consideration. For the air carrier group, the data showed 33 air carriers currently collaborating with domestic ACTs. As for custom broker and air forwarder group, we have referred to the membership lists of two custom broker and air forwarder associations in Taipei City to determine the number of active operators in 2008 to be 1,083. With regards to import/export consigner/consignee, since numerous parent companies exist and the quantifying process was deemed not feasible, we have taken the liberty to refer to various ACTs to estimate the number of major importer/exporter to be 30. These operators across the three groups have been selected as subjects of the research.

Second, for the purpose of this research, we have set the estimated number of samples at 400 in order for meet the basic requirements for the structural equation model (SEM) to be valid. In order to effectively obtain the number of samples

required and due to various constraints such as time and budget available, the quota sampling method (Shi-mo Lin, Yuan-chin Chen, 2003) was applied according to the industrial weighting for the aforementioned corporate customers for the investigation. Refer to Table 1 for the industrial weighting of corporate customers in the actual sampling. Sample allocation for the other four ACT operators has been determined according to their current market share as shown in Table 2.

Table 1. Industrial distribution for the sample planning

Industries	Num. of Firms	Market Share	Sample size planning
Air Carrier	33	2.9%	12
Customs Broker and Air Forwarder	1,083	94.5%	377
Consigner/Consignee	30	2.6%	11
Total	1,146	100%	400

Table 2. Sample planning across ACT and industries

ACT \ Industries	Market Share	Air Carrier	Customs Broker and Air Forwarder	Consigner/ Consignee	Sample size planning
TACT	41%	5	155	5	165
EGAC	28%	3	105	3	111
Everter.	13%	2	49	1	52
FFTZ	18%	2	68	2	72
Total	100%	12	377	11	400

3.4 Analysis

The paths in the research model (Fig. 1) were analyzed using structural equation modeling (SEM). Analysis followed a two-step procedure based partly on the approach recommended by Anderson and Gerbing (1988). The first step applied confirmatory factor analysis to develop a measurement model that has an acceptable fit to data. The second step then tests the theoretical model (or structural model) via path analysis to ensure that the structural model is meaningful and statistically acceptable.

Technically, when the appropriate assumptions hold, the chi-square test may be statistically insignificant. However, in practice, the chi-square test is extremely sensitive to sample size and departures from multivariate normality, frequently resulting in rejection of a well-fit model (Hoyle, 1995). Therefore, chi-square/degree-of-freedom (df) ratio can be used as an index of goodness-of-fit (James *et al.*, 1982; Joreskog and Sorbom, 1989). The acceptable chi-square/df ratio is <5 (<3 is better) (Joreskog and Sorbom, 1993; Hatcher, 1998). Many fitness indices exist, such as Bentler's comparative fit index (CFI), goodness of fit index (GFI), GFI adjusted for degrees of freedom (AGFI), normed-fit index (NFI), non-normed-fit index (NNFI); all of which should exceed or be close to 0.9. Notably, root mean square residual (RMR) should be <0.05, and root mean square error of approximation (RMSEA) should be <0.08 (<0.05 is better) (Hatcher, 1998).

4. RESULTS

4.1 Sample Structure

A total of 400 questionnaires were distributed for the research and 330 copies were recovered. Out of the collected questionnaires, 325 copies were valid. The valid sample rate was 81.3%. 140 copies were returned for Taiwan Air Cargo Terminal (TACT), 97 copies for Evergreen Air Cargo Services Corporation (EGAC), 34 copies for Everterminal Co., Ltd. (Everter) and 54 copies for Farglory Free Trade Zone (FFTZ). In terms of industrial distribution, custom brokers and air forwarders came on top with 303 operators to constitute 93% of the overall weighting with a valid sample return rate of 80.4%. Table 3 shows the details on the valid return sample destruction.

Table 3. Cargo type distribution obtained from valid samples

| | Customs Broker and Air Forwarder | | | | | | Air Carrier | | Consigner/Consignee | |
| | General Cargo | | Perishable Cargo | | Express Handle Unit | | General Cargo | | | |
	N.	%	N.	%	N.	%	N.	%	N.	%
TACT	114	54.8	6	11.8	10	22.7	5	45.5	5	45.5
EGAC	84	40.4	3	5.9	5	11.4	2	18.2	3	27.3
Everter.	28	13.5	0	0.0	3	6.8	2	18.2	1	9.1
FFTZ	33	15.9	5	9.8	12	27.3	2	18.2	2	18.2
Total	259	100	14	100	30	100	11	100	11	100

4.2 Reliability and Validity Analysis

With regards to the test of reliability, we have chosen Cronbach's α reliability coefficient for the analysis in this study. The reliability coefficients for the construct variables presented in the questionnaire are shown in Table 4. From the table, the α value for each dimension is greater than 0.8, and this means all dimensions adopted in this research are highly reliable.

Table 4. Reliability analysis

	SQ	IN	CI	SAT	LOY
Cronbach's α	0.841	0.836	0.807	0.874	0.919

In addition, while consistency is a required condition for a valid measurement scale, it is not a sufficient condition and must be supplemented with validity analysis in order to determine if a given instrument of measurement is capable of adequately and effectively testing the hypotheses presented in this study to accomplish the objectives. With regards to content validity, since a significant portion of questionnaire design was based on theoretical bases and evidence proposed by various scholars, one should be able to expect reasonable content validity from the research. Furthermore, care has been taken to refer back to the valid literature before the central theoretical framework/hypotheses were established or presented in this study to ensure construct validity for correlations between the relevant variables. As for the test of validity, most researchers have resorted to factor analysis to support their construct validity. Factor analysis is a technique that involves cross analysis of factors and depending on the desired purpose, factor analysis is often divided into exploratory factor analysis (EFA) and confirmatory factor analysis (CFA): the former is used to identify common attributes amongst a group of chaotic and unsorted variables in order to establish new hypotheses or develop new theoretical framework while the latter is used to validate existing theoretical framework proposed by researchers. For the purpose of this research, we have chosen confirmatory factor analysis from SEM to analyze the model fitness of measurement models constructed in this research to ensure the validity of each question in the questionnaire.

4.3 Measurement Model: Confirmatory Factor Analysis

Confirmatory factor analysis is primarily used to validate or confirm the attribute of parameters in the factor analysis or the number of factors involved. There are five latent variables present in the model presented in this research: Service quality (V1~V5), Innovation (V6~V9), Corporate image (V10~V12), Customer satisfaction (V13~V15) and Customer loyalty (V16~V18).

Results of measurement model fitness indices prior to adjustment are shown in Table 5. With removed three complex variables, the value of Chi-square for the measurement model dropped to 332.159 with $p < 0.001$. The ratio of Chi-square/df was smaller than 5 (332.159 /80 = 4.152) after the adjustment. In addition, we could also see from the table above that the value of GFI and AGFI were approaching 0.9 while other indices such as CFI, NFI and NNFI have exceeded 0.9. Not only that, RMR has fallen below 0.05 with RMSEA dropping below 0.10. Overall speaking, the indices show the acceptable fitness of measurement model.

Table 5. Result of measurement model fitness indices prior to adjustment

	Chi-square	df	GFI	AGFI	CFI	NFI	NNFI	RMR	RMSEA
M_0	614.810	125	0.810	0.741	0.896	0.873	0.872	0.057	0.110
M_1 (V11 deleted)	489.064	109	0.838	0.773	0.915	0.893	0.893	0.053	0.104
M_2 (V5 deleted)	401.763	94	0.854	0.789	0.926	0.906	0.905	0.051	0.101
M_3 (V1 deleted)	332.159	80	0.872	0.807	0.938	0.921	0.919	0.038	0.099

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The result of measurement model characteristic analysis is shown in Table 6. From the t-value in the table, it is evident that the standardized factor loadings for all indices have reached the significance level. In addition, the standardized factor loadings for all indices have exceeded 0.5. This showed that all indices have sufficient convergent validity (Anderson and Gerbing, 1988). Furthermore, All constructs have shown excellent composite reliability (>0.7) (Fornell and Larker, 1981). The variance extracted estimate for each construct variable is greater than 0.5. Thus, the measurement model has the both reliability and validity.

Table 6. Analysis of measurement model characteristics

	Standardize. Factor loading	t-value	Composite reliability	Variance extracted estimates
SQ			0.903	0.755
V2	0.863	18.981*		
V3	0.869	19.188*		
V4	0.875	19.398*		
IN			0.847	0.584
V6	0.683	13.344*		
V7	0.844	17.980*		
V8	0.836	17.736*		
V9	0.677	13.199*		
CI			0.877	0.781
V10	0.907	19.868*		
V12	0.861	18.431*		
SAT			0.875	0.701
V13	0.864	19.225*		
V14	0.843	18.522*		
V15	0.804	17.231*		
LOY			0.920	0.793
V16	0.888	20.246*		
V17	0.901	20.754*		
V18	0.883	20.050*		

Note: * indicates t-test has reached the significance level of p<0.001.

4.4 Theoretical Model: Path Analysis

The paths of causal relationship for each item presented in this research have been established based on various theories proposed by other scholars. In order to ensure that the parameters for model estimation are reasonable, we need to verify if the model has been over-identified (Hair *et al.* 2005). In the model presented in this research, there were 15 observable variables, hence the type of data points would be $t = 15(15+1)/2 = 120$. Parameters that have yet to be estimated come in three categories: (a) path coefficient: the number of correlation among latent variables + latent variables against observable variables (excluding those that have been set to 1). There were 14 path coefficients in this path model. (b) variance: observable variables + latent internal variables + all external variables; there were 20 variances in this path model. (c) covariance: the number of covariant relationship amongst external variables. There are three external variables in this research model, and this works out to three covariance parameters in the path model. The total number of parameters to be estimated in this model comes to $14+20+3 = 37$. The number is much smaller than the data point (120) and this meant that the path model has been over identified. In other words, this model offers multiple solutions and can be used to conduct fitness tests.

The next portion involved path analysis, and the value of Chi-square for the model came to 355.189 as shown in the result. The ratio of Chi-square/df was smaller than 5 (355.189/83=4.279). The result of other indices is showed in Table 7: the values of CFI, NFI and NNFI have all exceeded 0.9 and both GFI and AGFI were greater than 0.8. Results for RMR and RMSEA have also turned out to be within the accepted range. This proves that the results of fitness obtained from this structural model turned were ideal and met the required standards.

Table 7. Result of theoretical model fitness indices

Chi-square	*df*	GFI	AGFI	CFI	NFI	NNFI	RMR	RMSEA
335.189	83	0.869	0.811	0.938	0.920	0.922	0.038	0.097

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The number of path coefficients amongst the latent variables is shown in Table 8. The value of R^2 for each equation has been fairly high and this proves the explanation capacity of the paths to be relatively adequate. Overall speaking, the positive and negative signs for all path coefficients have been consistent with the hypotheses we have presented in this study. The ACTs' service quality, innovation and corporate image have all showed significant positive influence on customer satisfaction. Out of these dimensions, service quality has exhibited the most significant influence (0.442), followed by corporate image (0.403) while innovation turned out to be fairly low (0.219). These results have validated hypotheses H1, H2 and H3 presented in this study. In addition, significant positive influence of customer satisfaction over customer loyalty (0.974) has also been proven in this research, thus validating H4.

Table 8. Result of structural model path analysis

	Standardized parameter estimate	*t*-value	R^2
SAT			0.839
SQ	0.442	9.456*	
IN	0.219	3.857*	
CI	0.403	7.445*	
LOY			0.949
SAT	0.974	21.161*	

Note: * indicates t-test has reach significance level p<0.001.

5. CONCLUSION AND DISCUSSION

5.1 Conclusion

In summary, the model structure presented in this research has been faithfully validated. We have managed to confirm the relationships among the five variables through the causal paths of four hypotheses. The results show that the ACTs' service quality has significant positive influence on customer satisfaction and its influence is greater than innovation and corporate image. The ACTs' customer loyalty is also under positive influence of customer satisfaction. Besides, we set out to investigate the level of satisfaction and loyalty for customer brokers/air forwarders, air carriers and importer/exporter at Taoyuan International Airport on the four domestic ACT operators. We have learned from the findings that even in a B2B circumstance, customer loyalty remains heavy influenced by customer satisfaction. This meant that when the level of customer satisfaction is high for corporate customers, they would be more inclined to maintain the existing collaboration and show higher level of loyalty.

5.2 Managerial Implications

We have come up with the following suggestions on management for ACT operators. First, the research has proven service quality to be a primary factor that influences customer satisfaction. This can be explained by the fact that air cargoes are mostly comprised of high tech and high value items, and customers of ACTs place a great deal of emphasis on the efficiency of ACTs' operation quality, such as "would the cargo be delivered safely to the air carriers and the recipients in a timely manner?", "would the goods be exposed to threats of damage or theft?", "are the service personnel equipped with adequate professional knowledge to resolve issues and assure customers" and so forth. If an ACT's service quality has proven outstanding, it would be able to better satisfy customer needs and this explains why service quality has the greatest influence on customer satisfaction. This should therefore remind ACT operators that while customers can be persuaded by the existing low-price marketing strategies, they remain very fastidious about service quality. In other words, decent service quality is one of the most important factors that would elevate customer satisfaction. On the other hand, this research has also discovered a particular phenomenon that makes the ACT industry different from other service industries. Namely, corporate customers of the ACT industry did not show significant demands for tangible service and empathy compared to the other industries. Subjects of the research have indicated that valuable service mostly involves reliability, responsiveness and assurance. Therefore, ACTs should place more emphasis on the importance of service quality. Apart from adopting strategies that would ensure stable quality for cargo handling services, lower the frequency of anomaly, improve punctuality and accuracy of invoices and relevant information and offering more convenient and rapid operation processes, ACTs also need to improve service personnel's professional knowledge and service attitude in order to better cater to customer needs.

Second, out of the three antecedents, corporate image has shown significant positive influence (following service quality) on customer satisfaction. Generally speaking, established international corporate customers operating large scaled businesses would care more about the image, credibility and reputation of ACTs. For instance, foreign importer/exporter and air carriers would often require that ACTs be certified to international level professional licenses such as IOSA (IATA Operational Safety Audit), TAPA (Technology Asset Protection Association) and similar international safety certifications. In this research, we have found that corporate customers are most concerned with ACTs' company image, followed by

corporate credibility, and this shows customers do care about ACTs' display of professional image, their corporate reliability and extent of preference. In addition, out of the notion that "corporate image itself stands for the guarantees that a company has to offer", as long as the customers are convinced that an ACT is well reputed with a decent image, they would be more inclined to seek for long term collaboration. In other words, a decent corporate image can help companies improve name recognition, satisfy customer needs and lower risks of consumption to improve business. Therefore, it would be feasible for ACT operators to reinforce customer confidence through continued promotion of corporate image and strengthening of corporate reputation.

Finally, this research has also proven that a significant positive correlation exists between innovation and customer satisfaction. However, its influence is at levels comparable to service quality or corporate image. This may be due to the fact that the majority of customers of the industry are custom brokers and air forwarders whose overall level of E-operation is lower compared to air carriers and high tech importer/exporter, which explains why innovation fail to achieve significant influence in this investigation. According to the findings of this research, out of the four measurement variables under innovation, the order from the most explanative to the least explanative is system innovation, knowledge innovation, technical innovation and organization innovation. This shows that corporate customers are fairly concerned about ACTs establishing systems and items of customized service. Therefore, in the present market where supply has exceeded demands and amidst the intensely competitive environment, the four domestic ACT operators should continue to launch customized services and establish relevant service systems to satisfy customer needs. In addition, well-planned systems and regulations would not only facilitate services but also lower operational costs for corporations and prevent opportunities of resource waste in the process of launching new services. With regards to knowledge innovation, ACT personnel can be trained to offer innovative services through participation in internal training, brainstorming and QCCs to achieve effective transformation of knowledge so as to create more added value for the company. In light of the characteristics of handling and storage for air cargoes, technical capabilities should be centered on the construction of hardware storage facilities and information system. By insisting in the innovation of technical capability and improvement, ACTs would be able to rapidly respond to changes in the external environment and to improve their competitiveness. Lastly, organization innovation involves new ways of personnel deployment and new construction of organization structures; if ACT operators were able to establish relevant organization structure in time as requested by customers, they would be able to contribute to the improvement of customer satisfaction.

5.3 Limitations and Future Research

With regards to suggestions for follow-up research, due to the constraints of research budgets and time limitations, we were unable to exercise greater control over subjects and samples collected. Although our research has gone to great lengths to make market differentiation for corporate customers according to their industrial weighting and market share, we were unable to perform group discussion and comparative analysis for corporate customers of each ACT operator due to the grossly under-represented number of air carrier and importer/exporter subjects. Furthermore, for the custom broker/air forwarder subjects, questionnaires were mostly collected from operators involved with import/export general cargoes and subjects related to perishables and EHU were significantly lower. Therefore, it is suggested that follow-up researches expand the selection of samples for different customer groups to obtain the opinions of different industry customers or custom broker/air forwarder dealing with different cargo types.

In addition, this research only included domestic ACTs in Taiwan within the scope of investigation and researchers interested in conducting follow-up studies may consider expanding the scope of research to include all ACTs in the neighboring areas of Asia-Pacific region in their studies to see if the theoretical model and correlations amongst variables validated in this research still stand. They may also compare to see if there were significant differences between the effects of factors that influence customer satisfaction and loyalty for different types of ACTs.

It is also worth noting that whilst the questions in the questionnaire were designed for construct variables that were derived from the results of past literatures according to the characteristics of the industry, there may still be other important variables that might affect customer satisfaction or customer loyalty that have not been discussed in this research such as promises, trust, perception control and so forth. Follow-up researches may choose to include different variables so that the findings in this area of research would be more expansive and comprehensive.

Finally, we have proven in this research that ACT service quality, corporate image and innovation have direct and significant positive influence on customer satisfaction, which indirectly affects customer loyalty. However, whether the conclusions of this research are applicable for other industries (such as container terminal for sea freight) for the investigation of effects of different industries/cargo volume/cargo value on the correlations amongst variables presented in the model is a question that has yet to be discussed. One may also choose to investigate if ocean freight/air freight industries would come to different conclusions due to different customer groups. And thus, follow-up researches may also perform comparative analysis using the competitive model presented in this study for other industries.

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