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How Ready Air Freight Forwarders Are to Introduce a Cloud Information System

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Abstract: This study examined critical factors affecting air freight forwarders' decision to adopt the cloud information system using a technology-organization-environment model with air freight forwarders in Taiwan as the base. This study mainly investigated the relationships between the technological (complexity, security concern, adoption cost), organizational (top management support, IT competence) and environmental (trading partner pressure, government policy, competitive pressure) contexts and adoption of cloud information system by the air freight forwarding industry. The findings show that 'government policy' and 'trading partner pressure' have significant positive effects and the 'adoption cost' has a negative effect on air freight forwarders' decision to adopt the cloud information system. Finally, the findings of this study can provide suggestions on management for businesses and government support agencies.

Keywords: Air Freight Forwarder; Technological-Organization-Environmental; Cloud Information System; Adoption

1. INTRODUCTION

With global trade development moving towards maturity, booming online shopping and e-commerce are also driving the continuing growth of global air cargo (Airbus, 2014; Boeing, 2014). According to the forecast by Boeing in 2014, global revenue tonne-kilometers (RTK) will grow 4.0-5.5% per year in the next 20 years (Boeing, 2014). International air cargo is an operation-intensive industry involving many participants and different specific operations. The participants include shippers, air freight forwarders, customs brokers, cargo terminal operators, ground handling operators, and airlines. Air freight forwarders play an important role in air cargo transport activities, and are extremely important to most airlines. Many airlines even market their air freight services only through air freight forwarders, viewing them as their major customers and the main source of freight demand. Hence, the operations of air freight forwarders have a significant effect on the entire air cargo market.

Air freight forwarding encompasses various services for transport, transit, warehousing, distribution and insurance of goods consigned by cargo owners or shippers and protects shipper interests on behalf of shippers while coordinating with airlines to deliver consigned goods to their final destinations. The scope of the air freight forwarding business mainly includes export/import/transit freight transport and currently also extends to customs brokerage and inland transport. Whether cargo information can be transferred effectively is often a key determinant of smooth cargo movement. Efficiency and accuracy of cross-organizational information transfer are relative vital for transaction processes in airliners and related industries. Against the backdrop of the trend of high level global competition and IT challenges, lowering costs of paperwork by reducing mutual transaction procedures and processes can create more business opportunities. Today's cloud-based air cargo information system provides various services, such as Consignment Order and Booking Management for freight forwarders; and Air Export Bill of Lading and Billing Management as an optional function for the forwarder's internal staff to control incoming and outgoing operating capital as well as achieve rapid information exchange and transfer. Therefore, the purpose of this study was to investigate factors affecting the intention to introduce the cloud-based air cargo information system among air freight forwarders.

The technology-organization-environment (TOE) framework introduced by Tornatzky and Fleischer (1990) can affect a company's willingness to introduce new technology initiatives and use new technologies internally. The technological context refers to a company's existing IT competence and use of newly introduced technologies. The organizational context refers to its characteristics as a company, such as attributes like corporate information technology and expertise as well as globalization and top management structure. The environmental context refers to the business environment it faces, including the industries it addresses, competitors and government policies. Orlikowski (2000) suggested that the purpose of an IT system is to improve an organization's performance in internal operations and external competitiveness while the corporate culture and strategies in the organization's structure can both affect the adoption, introduction and integration of the IT system itself. Many studies have used the TOE framework to examine how corporate organizations introduced cross-organizational projects (Zhu et al., 2006; Li et al., 2010; Wang et al., 2010; Chong and Chan, 2012; Lian et al., 2013; Lin, 2013). This study uses Taiwan's air freight forwarders as the base and cites the TOE model to investigate from the their perspective what critical factors affect their participation in the cloud information system program and introduction of cloud-based air cargo information systems and provide suggestions on management for businesses and government support agencies.

2. CLOUD-BASED AIR CARGO INFORMATION SYSTEM

2.1 Concept of Cloud Computing

The rapid development of information technology has driven the trend of globalization of services, which include not only business to business (B2B), but also business-to-individual (B2C) services. Cloud computing is an internet-based computing service that provides internet access for individual and business users. There are now three types of cloud computing services, which are described in the following three-tier architecture diagram, i.e. infrastructure as a service (IaaS) in the first tier, platform as a service (PaaS) in the second tier, and software as a service (SaaS). IaaS is to provide hardware resources for customers, including computing, storage and networking etc. PaaS is a mid-tier service of cloud computing that provides an operating system for users so that application developers can write programs and deliver services to external users directly in the system. SaaS is to provide applications already developed in the cloud and allows users to select applications according to their needs. Most cloud information systems in the air freight forwarding industry are SaaS. The next section will look into how the cloud-based air cargo system is applied in practical scenarios.

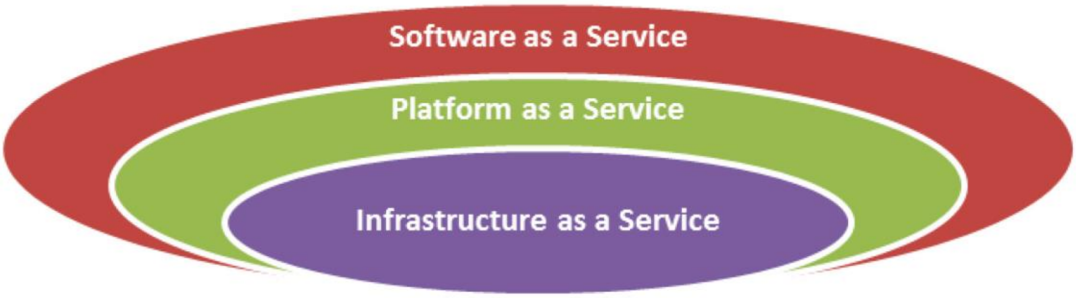
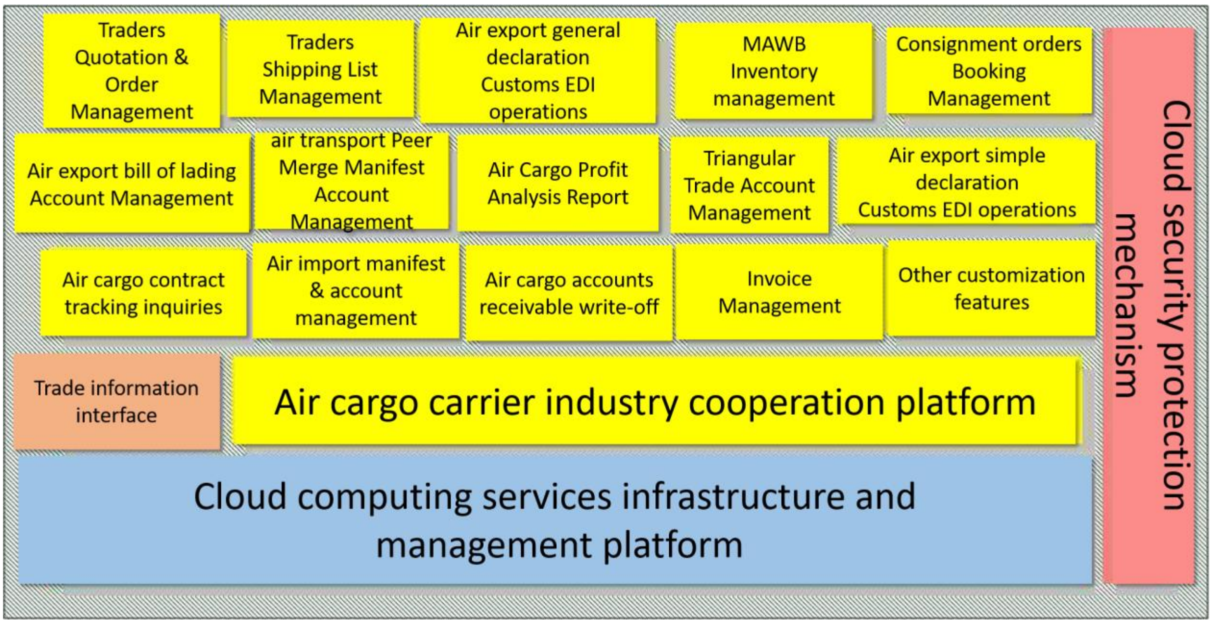


Figure 1. Cloud computing three levels of simple diagram Simple three-tier diagram of cloud computing

2.2 Application of Cloud-Based Cargo Information System

The following provides an overview of various cloud systems for air cargo business, including those for air cargo contract coordination, air cargo information (with many functions), air transport services and others (such as CML, 2013; Goodservice Information Corp, 2013; Bolin Information Technology, 2014).

The cloud-based cargo information system provides 16 main functions, which form a module that is a loosely coupled mechanism for the delivery of on-demand software services (i.e. software-as-a-service or SaaS) to all users, as shown in Figure 2:

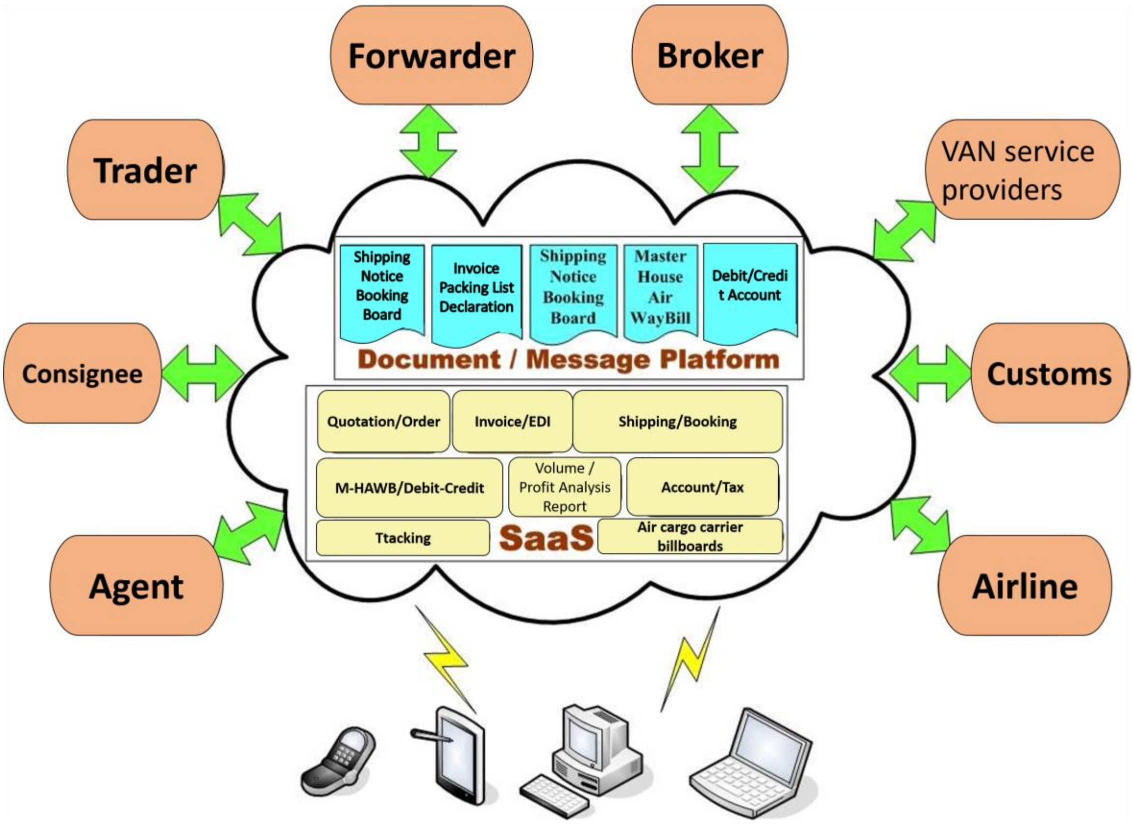


Source: CML (2013)

Figure 2. Cloud freight information system functions in the cloud-based cargo information system

As shown in Figure 3, Quotation and Order Management for Trader and Shipper Management for Merchant allow traders to document operating data of their company and store these documents into the service system database while the Message Interface enables direct information transfer to the contractor or customs broker for customs clearance and air transport operations. With Consignment Order and Booking Management, the contractor's internal staff can log on to the system directly from their laptops or smartphones and by selecting the optional Air Export Bill of Lading and Billing Management, they can take over the subsequent production of relevant transport documents and other operational processes. With Airfreight Receivable and Write-Off Management, the accounting department can control the company's incoming and outgoing capital. With Air Cargo Profit and Analysis Report, business executives can steer and adjust their operating direction effectively anytime by determining customer transactions in the near future based on the analysis. The customs broker can receive shipping information from the trading partner through Trade Message Interchange and select General Declaration and Customs EDI for Air Export for subsequent production of relevant customs documents, customs EDI and declaration. The infrastructure and management mechanism in the bottom tier of the cloud computing system is a cloud computing data center built by a system vendor. The data center mainly provides hardware resources such as server host, storage device and network equipment powered by virtual computing technology and together forming a virtual supercomputer that enables dynamic and high utilization of computing resources for users. Some system vendors also provide firewalling, anti-virus and anti-terrorism protection in a comprehensive information security package.

Figure 3 further reveals that the cloud-based air cargo information system plays various operational roles, such as application server host, message storage data center and message exchange interface system.



Source: CML (2013)

Figure 3. Air freight cloud information operation structure of cloud-based air cargo information operations

2.3 Summary

Cloud computing is an internet-based service that provides access for individual and business users. Development and competition in the cloud computing industry have brought great changes. Most of current cloud-based air cargo information systems are powerful, providing not only operations services for the cloud information system, but also build customization for each enterprise. With Consignment Order and Booking Management for communication with external customers, the contractor's internal staff can log on to the shipping information system directly from their laptops or smartphones and by selecting the optional Air Export Bill of Lading and Billing Management, they can take over the subsequent production of relevant transport documents and other operational processes. With Airfreight Receivable and Write-Off Management, the accounting department can control the company's incoming and outgoing capital.

3. METHODOLOGY

3.1 Hypotheses Development

This study cites the TOE framework to examine how the TOE factors affect the the cloud information system adoption by air freight forwarders in the technological, organizational and environmental contexts.

3.1.1 Technological context

(1) Complexity

In the diffusion of innovation, a theory published by Roger (2003), complexity is defined as the degree to which the innovation is perceived as difficult to understand and use and having a negative effect upon its adoption, whereas Lian et al. (2013) suggested that human interfaces help the adoption of new technologies. The possibility that complex products may slow down or cut short adoption indicates that the ease of learning and use of new technologies has a great impact on adoption. Employees of air freight forwarders have to deal with considerably complex daily activities and have to perform services online, such as standard conversion of house manifests and waybills and trade documents, exchange of data in electronic documents, and cargo status inquiries. For those who have adopted the cloud information system and introduced cloud-based air cargo information systems, the time and effort required for educating and learning the cloud information system and associated systems or technologies will be the key considerations for the adoption of the cloud information system. As mentioned, this study proposes that greater complexity in the adoption of the cloud information system by air freight forwards will reduce the likelihood of such adoption. Therefore, this study assumes that complexity has a negative effect on the adoption of the cloud information system and proposes the first hypothesis as follows:

H1: Complexity has a negative effect on the adoption of the cloud information system.

(2) Security concern

Cheng et al. (2006) suggested that users become less inclined to make transactions and payments online when they perceive greater risk, indicating the importance of perceived risk to consumers. Lu et al., (2007), while exploring shipper intention toward the use of internet services provided by shipping companies, discover that security has a significant positive effect on behavioral intention. Yang and Lu (2012) suggested that security is one of the key factors that affect the use of e-commerce and internet services. Therefore, corporate perception of internet information security is undoubtedly an essential factor for corporate adoption of IT systems. To sum up the above mentioned arguments, this study finds that information security will be a key factor for users to decide whether to adopt the cloud information system or not. Based on the above analysis, this study suggests that security concern has a negative effect on adoption of the cloud information system and proposes the second hypothesis as follows:

H2: Security concern has a negative effect on the adoption of the cloud information system.

(3) Adoption cost

Zhu et al. (2006) reported that the technology cost required for European companies to adopt e-commerce, including those for software and hardware installation and employee education and training, can actually pose obstacles to e-commerce adoption by corporate organizations. Therefore, adoption cost is one of the key factors that affect adoption of new information technologies. Wei et al. (2009) argued that adoption cost is one of the key factors that affect the development of e-commerce. Lin (2013) examined how excessive adoption cost affects the adoption of electronic supply chain management systems by Taiwanese companies. To sum up the above mentioned arguments, this study finds that adoption cost will be a key factor for air freight forwarders to decide whether to adopt the cloud information system. This study hence suggests that adoption cost has a negative effect on the adoption of the cloud information system by air freight forwarders and proposes the third hypothesis as follows:

H3: Adoption cost has a negative effect on the adoption of the cloud information system.

3.1.2 Organizational context

(1) Top management support

Past studies showed that top management support has become one of the keys to project success. Caldeira and Ward (2002) suggested that the attitudes and views top management maintain regarding information technology are crucial and can contribute significantly to the development of internal IT competence (financial and human resources and user attitude) and external IT content (vendor support, product quality, service), enabling companies to achieve greater success with their IT adoption. Lian et al. (2013) found in their investigation of factors that affect the adoption and application of cloud technologies by Taiwanese hospitals that top management support has a positive effect on employee intention to use such technologies. To sum up the above mentioned arguments, this study infers that top management support has a positive effect on adoption of the cloud information system and proposes the fourth hypothesis as follows:

H4: Top management support has a positive effect on the adoption of the cloud information system.

(2) IT competence

Tippins and Sohi (2003) pointed out that information technology competence includes three co-specialized resources: IT objects, IT knowledge and IT operations. Wang et al. (2010) claimed that implementation of RFID applications requires introduction of new IT competences and mutual adaptation between newly introduced and existing IT systems; therefore, companies have to have more IT competences to be able to adopt new technology systems. Chong and Chan (2012) pointed out that specialized IT means possessing the knowledge and skills required for building IT applications of new technologies. This study infers that IT competence has a positive effect on adoption of the cloud information system and proposes the fifth hypothesis as follows:

H5: IT competence has a positive effect on the adoption of the cloud information system.

3.1.3 Environmental context

(1) Trading partner pressure

Hsu et al. (2006) suggested that external pressure faced by corporate operations mainly come from up- and downstream trading partners in supply chains and trading partner pressure is usually one of the key factors that drive companies to adopt new information technologies. Wang et al. (2010) argued that trading partner pressure has a positive effect on the intention to adopt REID across the supply chain in the case of the manufacturing industry. Lin (2013) claimed that trading partner pressure is one key factor for successful implementation of electronic supply chain management systems. Based on the findings of the aforementioned empirical studies, this study proposes the sixth hypothesis regarding adoption of the cloud information system as follows:

H6: Trading partner pressure has a positive effect on the adoption of the cloud information system.

(2) Government policy

King et al. (1994) claimed that governments play a key role in IT adoption by companies and can provide funds or incentive programs that prompt companies to accelerate their new IT adoption and thereby improve their operations. Lian et al. (2013) pointed out that Taiwan government's healthcare policies mainly aim to prevent waste of medical resources and the government's enforcement of the policy of electronic medical records exchange across hospitals serves as an example showing that promotion policies from governments have a positive effect on new IT adoption by companies. This study considers government policy to have a positive effect on adoption of the cloud information system and proposes the seventh hypothesis as follows:

H7: Government policy has a positive effect on the adoption of the cloud information system.

(3) Competitive pressure

Zhu et al. (2003) suggested that industry-wide competitive pressure has become one of the key factors that affect IT adoption. Lin (2013) claimed that highly competitive and increasingly unstable business environments prompt individuals or organizations to adopt innovative technologies. As market competition intensifies, companies are seeking to gain competitive advantages through innovative technologies and adopting better information technologies can greatly benefit companies (Chao et al., 2011). Companies believe that it is necessary to achieve competitive advantages through innovation and greater competitive pressure can instead motivate them to maintain their competitive advantages by adopting innovative technologies. Based on the findings of the aforementioned empirical studies, this study proposes the eighth hypothesis regarding adoption of the cloud information system as follows:

H8: Competitive pressure has a positive effect on the adoption of the cloud information system.

3.2 Research Framework and Variables

This study mainly investigated the relationships between the technological (complexity, security concern, adoption cost), organizational (top management support, IT competence) and environmental (trading partner pressure, government policy, competitive pressure) contexts and adoption of cloud information system by the air freight forwarding industry. The research framework is shown in Fig. 4.

This study adopted the viewpoint on complexity set forth by Wang et al. (2010) and compiled four question items. Regarding security concern, the viewpoint set forth by Yang and Lu (2012) was referred to, resulting to the compilation of three question items. Regarding adoption cost, reference was made to the viewpoint set forth by Zhu et al. (2006) resulting to the compilation of four question items. Regarding top management support, this study followed the viewpoint set forth by Ifinedo (2008) and compiled four question items. The viewpoint on IT competence set forth by Wang et al. (2010) was also employed, resulting in the compilation of three question items. The viewpoint set forth by Hsu et al. (2006) was also followed, resulting in the compilation of three question items. Regarding competitive pressure, Chao et al. (2011) pointed out, ‘As market competition intensifies, companies are seeking to gain competitive advantages through innovative technologies and adopting better information technologies can greatly benefit companies’, which gave rise to the compilation of two question items. Regarding adoption, Fishbein and Ajzen (1975) claimed, ‘Behavioral intention means the degree of willingness that a person shows to engage in a given behavior. To observe a person’s positive feeling and attitude toward a given behavior, it is necessary to understand the person’s intention toward that behavior.’ This study converted this viewpoint to the corporate perspective for the measurement of adoption and compiled three question items. All the question items in our survey were measured using a 7 point Likert scale. These and their references are outlined in Table 1.

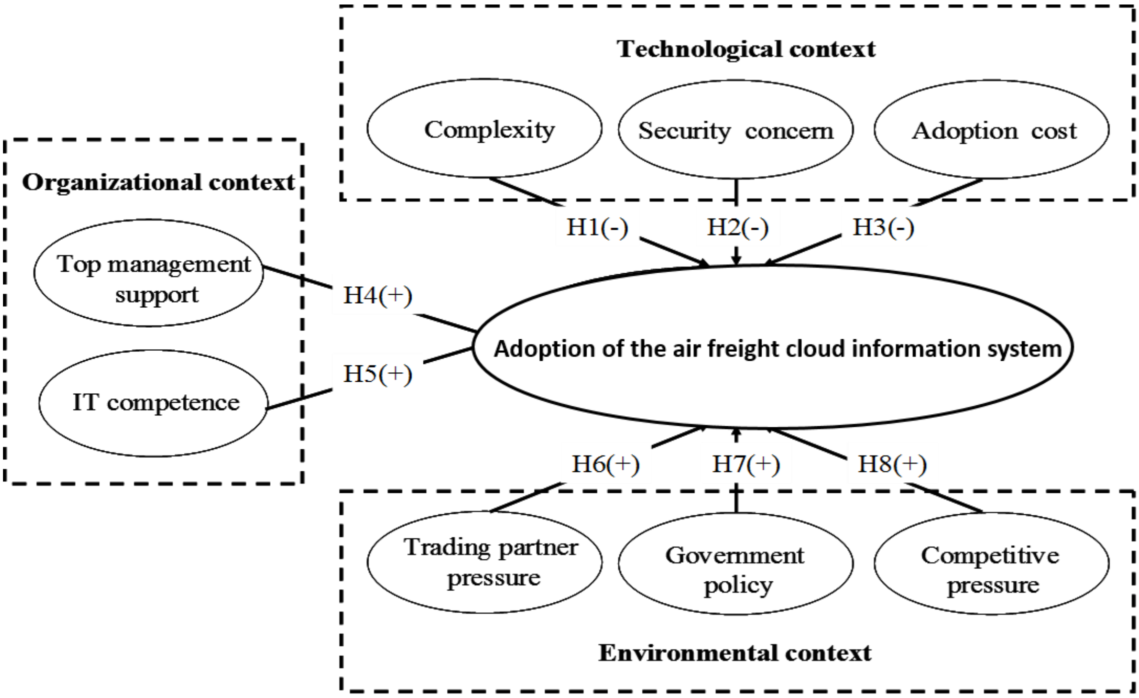


Figure 4. Research framework

Table 1. Measurement of research variables and references

Variable/Item	Reference
Complexity (CM)	
CM1. Adopting the cloud information system is a complex process. CM2. Our company's computer system is not exactly compatible with the cloud information system. CM3. Adopting the cloud information system is not consistent with our company's values and beliefs. CM4. It is difficult to incorporate the cloud information system into our company's current operational practices.	Wang et al. (2010); Chong and Chan(2012)
Security concern (SC)	
SC1. Adopting the cloud information system is not safe for our operating environment. SC2. The operating model of the cloud information system is not protected by law. SC3. The security measures in the cloud information system are not perfected.	Lu et al. (2007); Yang and Lu, (2012)
Adoption cost (AC)	
AC1. Adopting the cloud information system has a build cost greater than its benefit. AC2. Adopting the cloud information system has an operating cost greater than its benefit. AC3. Our company thinks that adopting the cloud information system requires a fairly high cost for employee training. A4C. Adopting the cloud information system yields an overall benefit less than its cost.	Zhu et al. (2006); Chong and Chan(2012)

Top management support (TM)	
TM1. Our company's top management is highly interested in adopting the cloud information system. TM2. Our company's top management will actually participate in the adoption of the cloud information system. TM3. Our company's top management recognizes that adopting the cloud information system can improve business performance. TM4. Our company's top management will consider the adoption of the cloud information system as our company's key development strategy.	Lee and Kim (2008); Ifinedo (2008); Yang and Lu (2012)
IT competence (TC)	
TC1. Our company's information infrastructure can be used in support of the adoption of the cloud information system. TC2. Our company will be committed to training our employees on knowledge required for the adoption of the cloud information system. TC3. Our employees already have the skills required for the adoption of the cloud information system.	Jain et al. (2009); Wang et al.(2010)
Trading partner pressure (TP)	
TP1. Airlines strongly recommend us to adopt the cloud information system. TP2. Shippers strongly recommend us to adopt the cloud information system. TP3. Customs brokers or depot operators strongly recommend us to adopt the cloud information system.	Hsu et al. (2006); Lin(2013)
Government policy (GP)	
GP1. We will adopt the cloud information system if our government requires e-AWB. GP2. We will adopt the cloud information system if our government actively promotes it. GP3. We will adopt the cloud information system if our government funds it.	Lian et al. (2013)
Competitive pressure (CP)	
CP1. Adopting the cloud information system is a necessity in our company's business strategy. CP2. Adopting the cloud information system can increase our company's competitiveness. CP3. Not adopting the cloud information system may lead to customer loss.	Chao et al. (2011); Zhu et al. (2006)
Adoption (AD)	
AD1.Our company's procedures require the adoption of the cloud information system. AD2. Our company is willing to adopt the cloud information system. AD3. We will recommend our trading partners (e.g. airlines, customs brokers or terminal operators) to adopt as well.	Fishbein and Ajzen (1975); Ajzen and Fishbein (1980)

3.3 Research Design

The survey base was air freight forwarders in Taiwan and the population came from the member directories of Taipei Airfreight Forwarders & Logistics Association of Taiwan (TAFLA) and Kaohsiung Airfreight Forwarder's Association (KAFA). The main source of the questionnaire content was our literature review, which determined dimensions and questions. Any inappropriate parts were then modified based on the results of expert interviews to finalize the first draft. The questionnaire content included two parts. Part 1 was for the respondents to provide their profile information and a summary on their adoption of the cloud information system; and Part 2 was for surveying factors that affect their adoption of the cloud information system. To avoid semantic ambiguities that mislead the respondents to provide wrong answers, the first draft underwent a pretest and subsequent modifications by experts on air cargo transportation from the industry, government and academia for increased reliability and validity of the questionnaire. Sample data were collected via a survey, for which the questionnaires were mailed to the respondents. The collected data were analyzed using SPSS and the methods involved included descriptive statistics, reliability and validity analysis, Pearson correlation analysis, and multiple regression analysis.

4. RESULTS

4.1 Samples

For this study, a general survey was conducted on the managers from 1088 air freight forwarders who were members listed in the directories of TAFLA and KAFA between April and June, 2014. After eliminating 17 questionnaires that were found to be incomplete from the in total 166 collected, 149 were valid, accounting for the recovery rate of 13.7%. According to the statistical analysis in Table 2, respondents who were completely unfamiliar and not so familiar with the cloud-based air cargo information system constituted 30.2% of the total samples and those who were moderately familiar, quite familiar and very familiar accounted for 69.8%.

4.2 Analysis of Respondent Perception in Terms of TOE and Adoption

First, statistical analysis was performed on respondent perception in the questions of all the dimensions. Responses to these questions were measured using a 7-point Likert scale. A higher average score in all the questions means the respondent is more agreeable to the dimensions including complexity, security concern, adoption cost, top management support, IT competence, trading partner pressure, government policy, competitive pressure and adoption. In contrast, a lower average score denotes lower respondent agreeableness.

Table 2. Respondent profiling

Profile attribute	No. of respondents	Ratio (%)	Profile attribute	No. of respondents	Ratio (%)
Title			**Number of employees**		

Deputy Manager	41	27.5	10 or less	30	20.1
Assistant Manager	8	5.4	11-30	27	18.1
Deputy Manager	72	48.3	31-50	26	17.4
Section Chief	3	2.0	51-100	22	14.8
Director	5	3.4	101-400	20	13.4
Sales	7	4.7	401-700	9	6.0
Site Operator	2	1.3	701 or more	10	10.1
Others	11	7.4	**Turnover (NT$ million)**		
Years of establishment			<5	8	5.4
2 years or less	2	1.3	5-9	12	8.1
3-5 years	12	8.1	10-29	12	8.1
6-10 years	8	5.4	30-49	27	18.1
11-15 years	18	12.1	50-99	21	14.1
16-20 years	24	16.1	100-499	29	26.2
21-30 years	43	28.9	>500	30	20.1
31 years or more	42	28.2	**Number of subsidiaries**		
Years of service in air freight			2 or less	37	24.8
5 years or less	8	5.4	3-5	26	17.4
6-10 years	25	16.8	13.4	20	13.4
11-15 years	19	12.8	11-15	11	7.4
16-20 years	24	16.1	16-20	11	7.4
21 years or more	73	49.0	21-25	8	5.4
			26 or more	36	24.2
Understand the air freight could information system					
Strongly not understand				3	2.0
Not understand				43	28.2
Probably understand				30	10.1
Understand				39	26.2
Strongly understand				35	23.5

As shown in Table 3, the respondents' current agreeableness to the cloud information system scored on average between 5.638 and 3.852. The top five items with highest agreeableness are: 'we will adopt the cloud information system if our government funds it'; 'we will adopt the cloud information system if our government actively promotes it'; 'we will adopt the cloud information system if our government requires e-AWB'; 'we will recommend our trading partners to adopt as well'; and 'our company is willing to adopt the cloud information system' (each with an average score higher than 5.36). This also shows that the air freight forwarders now urgently need government support and promotion to adopt the cloud information system.

Table 3. Descriptive statistics results

Item	Mean	S.D.	Rank	Item	Mean	S.D.	Rank
GP3	5.638	1.264	1	TP3	4.785	1.553	16
GP2	5.503	1.094	2	AC2	4.752	1.502	17
GP1	5.423	1.128	3	SC3	4.718	1.598	18
AD3	5.416	1.300	4	TP2	4.711	1.476	19
AD2	5.369	1.265	5	CP3	4.705	1.482	20
TC1	5.295	1.402	6	AC1	4.604	1.537	21
TC2	5.161	1.371	7	TM1	4.584	1.110	22
TM4	5.148	1.397	8	AC3	4.550	1.513	23
CP2	5.134	1.364	9	CM4	4.450	1.574	24
CP1	5.101	1.298	10	CM1	4.342	1.618	25
TP1	5.087	1.515	11	CM2	4.336	1.691	26
TM2	5.007	1.402	12	SC2	4.336	1.518	27
AD1	4.926	1.395	13	SC1	4.336	1.549	28
TM3	4.879	1.419	14	AC4	4.174	1.719	29
TC3	4.859	1.598	15	CM3	3.852	1.553	30

The bottom five items with lower average scores are: ‘adopting the cloud information system is not safe for our operating environment’; ‘our company’s computer system is not exactly compatible with the cloud information system ’; ‘adopting the cloud information system is a complex process’; ‘adopting the cloud information system yields an overall benefit less than its cost.’; and ‘adopting the cloud information system is not consistent with our company’s values and beliefs’. This result shows that the negative items have relatively lower scores, indicating that the air freight forwarders perceive it safe to adopt the cloud information system. A possible explanation is that no complexity involved in the adoption process causes the air freight forwarders to perceive no risk and cost issues.

Reliability analysis was further performed to measure internal consistency and credibility of each dimension. Cronbach’s α and overall corrected item-total correlation coefficient values served as the basis to eliminate items without internal consistency. A higher Cronbach’s α value indicates higher reliability. It is generally required that a reliability value must be greater than 0.7 and overall corrected item-total correlation coefficient value must be greater than 0.4 (Hair et al., 2009). Table 4 shows that each dimension regarding the cloud information system has an alpha value greater than 0.8 and the overall corrected item-total correlation coefficient is greater 0.6, indicating excellent reliability.

Table 4. Reliability analysis of all the dimensions regarding the cloud information system

Variable	Mean	S.D.	Cronbach's α	Corrected item-total correlation
CM	4.201	1.412	0.903	0.862-0.885
SC	4.423	1.409	0.913	0.848-0.925
AC	4.470	1.330	0.863	0.770-0919
TM	4.868	1.171	0.888	0.819-0.906
TC	5.070	1.367	0.916	0.849-0.926
TP	4.803	1.374	0.887	0.802-0.872
GP	5.488	1.070	0.898	0.819-0.918
CP	4.930	1.203	0.840	0.674-0.917
AD	5.195	1.192	0.879	0.771-0.870

4.3 Effects of TOE Factors Concerning Air Freight Forwarders on Adoption

4.3.1 Correlation analysis

To have an initial understanding of whether correlations exist between factor dimensions, the mean value in each dimension was used for Pearson Product-moment correlation analysis. The results show that each factor dimension achieved significant highly positive correlations both when the significance level was 0.05 and 0.01, as shown in Table 5. In this correlation matrix concerning the cloud information system, it is mainly notable that the independent variables 'complexity', 'security concern' and 'adoption cost' have no correlations with the dependent variable 'adoption'.

4.3.2 Multiple regression analysis

Multiple regression analysis was also used. Prior to this, each factor was first subjected to a variance inflation factor (VIF) test. A VIF value greater than 10 indicates possible collinearity between the independent variables. For the multiple regression analysis regarding the cloud information system , the VIF values of all the factor dimensions were between 1.885~4.887, i.e. less than 10, indicating no collinearity between the independent variables. Therefore, the data was suitable for multiple regression analysis.

Table 5. Pearson correlation matrix

	AD	CM	SC	AC	TM	TC	TP	GP	CP
AD	1.000								
CM	-0.009	1.000							
SC	-0.045	0.824**	1.000						
AC	-0.255*	0.764**	0.818**	1.000					
TM	0.561**	-0.313**	-0.351**	-0.237**	1.000				
TC	0.599**	-0.234**	-0.256**	-0.191**	0.543**	1.000			
TP	0.567**	-0.121*	-0.197**	-0.047	0.463**	0.610**	1.000		

GP	0.652**	-0.158*	-0.165*	-0.142*	0.481**	0.498**	0.504**	1.000	
CP	0.534**	-0.198**	-0.140*	-0.118	0.444**	0.570**	0.471**	0.641**	1.000

Note: * means when the significance level is 0.05; and ** means when the significance level is 0.01.

Following the regression analysis, as can be seen in Table 6, all the DW (Durbin Watson) statistics are between 1.5~2.5, indicating no residual autocorrelation and the significant effect of the model in which the air freight forwarders adopt the cloud information system with an overall explanatory power up to 58.5% pertaining to adoption. Among the variables, adoption cost had a significant negative effect while trading partner pressure and government policy both had significant positive effects.

Table 6. Analysis of the effect of each factor on the adoption of the cloud information system

Independent variable	Adoption (Standardized coefficient)
Complexity	0.173
Security concern	0.191
Adoption cost	-0.203*
Top management support	0.163
IT competence	0.184
Trading partner pressure	0.216**
Government policy	0.390**
Competitive pressure	0.11
R^2	0.585
Adjusted R^2	0.562
F value	24.715
p-value	0.000
Durbin Waston statistic	1.782

Note:* means when the significance level is 0.05; and ** means when the significance level is 0.01.

When the costs for building the system and training employees were greater, the air freight forwarders were less willing to introduce the cloud-based air cargo information system. They also need to pay attention to their interactions with their trading partners as the system has enormous functionality and involves shippers, airliners, customs brokers and others. When their partners introduced the system, they were more willing to follow the suit. Finally, government policy in favor of such system introduction also had a positive effect on their intention to do so. When the government provides funding or promote the benefits of introducing the system, this will greatly encourage air freight forwarders to do so.

5. CONCLUSION AND SUGGESTIONS

5.1 Conclusion

The purpose of this study is to investigate how the technology, organization and environment aspects of the cloud information system affect adoption. The empirical results show that government policy and competitive pressure that concern air freight forwarders all have significant positive effects and the adoption cost has a significant negative effect on their adoption while complexity, security concern, top management support, IT competence and trading partner pressure do not have any significant effect.

The surveyed air freight forwarders were less in agreement over complexity, safety concern and adoption cost associated with the cloud-based air cargo information system. They considered the system to be relatively reliable. Although they did not perceive the system to be too complex, many researchers consider safety to be one of the key influence factors for new technology introduction (Lu et al., 2007; Yang and Lu · 2012) while the industry agreed in their perceptions that the system was safe. The possible reason might be that these air freight forwarders encountered no complexities during their participation and hence perceived no risk and cost issues. The system performed better in government policy and adoption intention, indicating that the air freight forwarding industry urgently needs government assistance and promotion for the introduction of the cloud-based air cargo information system.

5.2 Suggested Practices

1. The government authorities should build an integrated service platform.

The findings of this study show that government policy plays a key role in the intention to introduce the cloud-based air cargo information system among air freight forwarders. The current logistics information service platform built by Taiwan’s government mainly focuses on business transaction needs between shippers and logistics providers. However, with the international logistics operations model becoming increasingly complex, more diverse logistics information services are required. Cloud-based logistics information integration and services can help improve logistics efficiency and international competitiveness.

2. Vendors of the cloud-based cargo information system should develop marketing strategies.

The findings of this study show that adoption cost has a significant effect on whether enterprises are willing to introduce the cloud-based air cargo information systems. Therefore, vendors of the system should focus on explaining adoption cost and highlighting the benefits that the system can bring in their marketing to prevent misunderstanding of or rejection to the system in the air freight forwarding industry. They can also cite specific customer success stories, such as the difference before and after system introduction by their air freight forwarder clients, to increase the introduction intention in the industry. System vendors can also find potential adopters in the 'organizational size' samples of this study and develop specific marketing strategies accordingly.

5.3 Suggestions for Further Research

This study only analyzed 149 valid samples. It is therefore suggested that further researchers may increase sample size to make their research results more representative. Moreover, the base of this study only included the air freight forwarding industry. Therefore, further researchers may expand the base to include consigners and airliners so as to understand how different industries perform with the introduction of the cloud-based air cargo information system.

Multiple regression analysis was used for analysis in this study. If higher valid survey response rates can be achieved, further researchers may use the structural equation model for more in-depth empirical analysis with interest reduction. Therefore, it is suggested that further researchers may further leverage the structural equation model for creating a research verification model in which they can understand and verify the correlations that exist between individual influence factors for better research results. Further research can also further dive into whether inhibitory effects exist between factors.

The selection of research variables in this study was mainly referred to currently available literature. Appropriate variables were selected using the Technological-Organization-Environmental framework for hypothesis verification. Nevertheless, the inability to enumerate all the variables affecting adoption intention may affect the comprehensiveness of this study. It is therefore suggested that further research may explore more variables that can affect the introduction of the cloud-based air cargo information system, such as organizational size, knowledge management capability and perceived industry pressure.

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