The Effects of Knowledge Management on Organizational Performance of Taiwan Listed Communication Network Companies: Using Cloud Technology Investment as the Moderator

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ABSTRACT

In recent years, there has been a rapid growth in the amount of dollars invested in R&D in the communications network industry in Taiwan, particularly the increase of investment in cloud technology that has enabled the communications network industry to create a brilliant performance that is magnificent to behold. The primary objective of this study is to verify the effects of having good knowledge management on organizational performance of Taiwan-listed communications network companies; while using cloud technology investment as the extraneous variable, using managers of section supervisor level and above of these communications network companies as research subjects, and mining ROE data from the database of the Taiwan Economic Journal for the research data. The simple Random Sampling method is used to sample the population, while Structural Equation Modeling (SEM) is used to verify the overall research model and the fitting effect of its Structural Model and Measurement Model. The research results show: that good knowledge management and the cloud technology investment of Taiwan-listed communications network companies have a significant positive interaction effect on organizational performance, which also implies that an increase in cloud technology investment plays a role in the positive enforcement of improving organizational performance.
Keywords: *Knowledge Management, Cloud Technology Investment, Organizational Performance*

INTRODUCTION

Since the year 2000, the communications network industry in Taiwan has been growing, and while the speed of growth is increasing and market capitalization is growing, the industry's investment in the dollar amount for R&D, R&D intensity and employee productivity is also growing (Chen, 2008). In other words, there has been a rapid growth in the amount of dollars invested in the R&D of the communications network industry in Taiwan in recent years, particularly the increase of investment in cloud technology that has enabled the communications network industry to create a brilliant performance that is magnificent to behold.

According to the Gartner Group, cloud computing is ranked as the first of the top-ten future trends of IT industry. During times of recession, the use of cloud computing can directly help companies reduce costs and improve efficiency. Cloud technology changes personal lives, but its impact is more significant on enterprises. An image that specifically represents the cloud is a vast expansive engineering room filled with countless servers, which require good monitoring and control systems. Vendors with related technologies can also benefit from the boom of cloud technology (Lin, 2009). Furthermore, cloud computing, is the critical revolutionary technology that drastically changes the entire ecology of the IT industry, or even the ideals of business operations. In this age of competition with its rapid changes, many corporations are actively investing in cloud technology, hoping to be the first to reduce operational costs, improve efficiency, or even create new operational models and value (Lin, 2010).

While we are at the juncture of the age of a new economy, knowing how to effectively apply new technologies, in addition to having, distributing, producing, and using the available knowledge, will be the important drive required to smoothly launch and sustain the entire knowledge-based economy. However, the complex and diversified nature of the knowledge itself, and its characteristic of having specific significance often cause issues of great difficulty in the management of such knowledge. Particularly, with the development of internet network-related technologies and applications, the emergence of large volumes of information is making it more difficult to effectively read, extract and apply such knowledge (Lin, 2007). Cloud computing has completely overturned our modality of internet operation. It is an extension of a concept, not a complex nor a massive science, and as such, the concept is then extended into other technologies. With the integration of the computer and internet, the services they provide are reaching farther and wider. In the future, general tasks will be accomplished simply with a computer and the internet.

Therefore, Cloud Computing is not an entirely new technology, but it has reshaped the appearance of the IT industry's value chain, and started a competitive age that focuses on software and services. The development trends and transformation of cloud computing in recent years have generated such a significant impact on industries and the nation that IT software and hardware industries must be upgraded to focus on higher value-added software and a transformation in services. Even the current service industry and traditional industry of Taiwan must adopt the applications of cloud computing to improve operation efficiency. Since cloud computing is the new mainstream of IT applications for the next decade, and every national government is scrambling to formulate regulations on cloud computing, Taiwan must take part in this industry while it is still in the early development phase (MOEA, ROC).

To grab the advantage in a rapidly changing environment, an enterprise must implement good knowledge management, and improve its organizational performance by increasing cloud technology investment in order to ensure its sustainable operation and development. However, to know if good knowledge management and the increase on cloud technology investment can generate interactive synergy on the organizational performance of an enterprise is the motivation leading to the study of this research. Therefore, this study took Taiwan-listed communications network companies as the research subjects, constructed the research model and performed research verification based on existing literature reviews so as to understand the goodness-of-fit of the model's fitting effect. In other words, the specific purposes of this study are listed as follows:

(1) To verify and understand whether good knowledge management has a significant positive effect on the organizational performance of Taiwan-listed communications network companies.

(2) To verify and understand whether cloud technology investment has a significant positive effect on the organizational performance of Taiwan-listed communications network companies.

(3) To verify and understand whether good knowledge management and the increase on cloud technology investment have a significant positive interactive effect on the organizational performance of Taiwan-listed communications network companies.

LITERATURE REVIEW

This section is written for the understanding of research results of past scholars, and its relevance to this research topic. Research hypotheses were derived from and research framework was constructed based on the literature review. The theory and relevant research are described as follows:

Knowledge Management

Nonaka & Takeuchi (1995) proposed the concept of Tacit Knowledge and Explicit Knowledge, and the theory of Spiral of Knowledge that opened the research field of knowledge management.

The Definition of Knowledge Management

O'Dell & Grayson (1998) pointed out that knowledge management is "the process of accurately transferring knowledge to the company staff in a timely manner to assist the staff in taking proper action to improve the continuity of organizational performance"; while such a process includes steps, such as knowledge creation, verification, collection, classification and storage, sharing and access, use, improvement and elimination.

Yang (2001) pointed out that knowledge, from the perspective of knowledge management, can be defined as follows: Knowledge is a fluid mix that includes framed experience, values, contextualized information, and organized and analyzed information that can be understood and can be applied to solve problems and make decisions.

Lee et al (2010) pointed out that knowledge management refers to the organizational and technological infrastructure of an enterprise.

Summarizing the above, this study adopts the definition of O'Dell & Grayson (1998) concerning knowledge management, i.e. the process of accurately transferring knowledge to the company staff in a timely manner to assist the staff in taking proper action to improve the continuity of organizational performance.

The Measurement Dimensions of Knowledge Management

Arthur Andersen and APQC (1996) proposed a knowledge model construction that includes seven processes: Create, Identify, Collect, Adept, Organize, Apply, and Share.

Davenport (1997) classified knowledge into two categories based on its accessibility: (1) Tacit Knowledge; and (2) Explicit Knowledge.

Nonaka (1998) utilized the characteristics of tacit and explicit knowledge, and interactively paired four types of corporate knowledge creation models that go from tacit knowledge to tacit knowledge, tacit knowledge to explicit knowledge, explicit knowledge to explicit knowledge, and explicit knowledge to tacit knowledge. These models were respectively defined as: Socialization, Externalization, Combination, and Internalization. The previously mentioned four models form an endless loop that is known as "knowledge spiral". Its main purpose is to illustrate that when more members of corporate organizations participate in the interaction of tacit knowledge and explicit knowledge, the conversion of knowledge speeds up and the scale becomes larger, and that individual knowledge is subsequently converted into corporate organization knowledge or even into the level of cross-organizational knowledge.

Summarizing the above, this study refers to, and makes modification to the taxonomy of Arthur et al. (1996) concerning knowledge management. Therefore, the primary discussion on knowledge management of this study involves three aspects: (1) knowledge absorption; (2) knowledge sharing; and (3) knowledge storage.

CLOUD COMPUTING-CLOUD TECHNOLOGY INVESTMENT

The Definition of Cloud Computing

Li (2009) suggested that the so-called "Cloud" is nothing more than the action of sending data to a distance server. While this server has a very large capacity, I can store as much data as I want. In addition, every night, this system will automatically make a backup copy, and store all data on a hard disc.

The term "cloud" first appeared in the 1990's. It was commonly denoted with the image of "cloud", which is still in use today, to represent the entire internet. The web-based services of Amazon started at around the year 2000, providing services to readers, while Yahoo and Google started offering cloud computing around 2006 to a few well-known colleges for use in the development of new internet services (Chang, Tuan, Chen, Chen, and Huang, 2010). While "cloud computing" may have been merely a concept, the great enhancements of bandwidth speed of the internet network enables the operation of such an idea. In other words, "cloud computing" is a mode of information flow that provides the freedom of access and storage, just like water or electricity. Users can obtain water and electricity from the supplies of water and power plants simply by turning on the faucet or plugging into a socket at home without the need of building their own water tower or a generator. Thus, Cloud Computing, by nature, is a new application of Distributed Computing. Its fundamental concept is to take a huge computation program (Process) via internet network, auto-split it into numerous smaller sub-routines (Sub Process), then move it to a system that is composed of multiple servers (Multi-Server), and after the analysis of search and calculation, the result is then sent back to the user. Through this technology, a Service Provider can process millions or even billions of bits of information in a few seconds, and achieve an internet service effectiveness that equals the power that a supercomputer can provide (Huang, 2009).

Simply put, it is to allow multiple computers on the internet to do one job for you, which significantly enhances the process speed. Some people suggest that Cloud Computing should be translated as "Cloud Calculation", while others interpret it as "Yun Duan Computing". "Yun" (Cloud) is the internet that we use all the time; while "Duan" refers to the end user (Client) or generally refers to how users complete a task using internet service. The ultimate goal is to do-away-with software installations. All the resources come from the cloud, where the end users only need a device and a simple interface (such as an explorer browser) to connect to the cloud.

Summarizing the above, this study defines cloud computing as "referring to how users complete a task using internet service. The ultimate goal is to do-away-with software installations. All the resources come from the cloud, where the end users only need a device and a simple interface (such as an explorer browser) to connect to the cloud."

Cloud Technology Investment

Furthermore, Yong Ben (2011) suggested that the so-called "cloud technology" refers to activities enabled through the use of the internet network that range from email, file transfer, remote registration communication, remote dialog, or taking online courses, information researching, video viewing, merchandize marketing, personal blogs, and others. Zhang (2011) believed that the concept of "cloud technology" is turning large amounts of data into information through calculation, then turning information into knowledge through "learning by doing", subsequently turning knowledge into wisdom by applying methodologies. Chen (2011) pointed out that "cloud technology" is an intelligent management method that enhances performance. While stimulating employees' potential, management must reduce the factors of interference with the employees, so that they may continuously innovate, learn how to integrate through failure, and detach from the methods to which they were previously so attached (Merit Times, 2011).

Summarizing the above, this study adopts the definition of Zhnag (2011) concerning "Cloud Technology", where it refers to turning large amounts of data into information through calculation, then turning information into knowledge through "learning by doing", subsequently turning knowledge into wisdom by applying methodologies.

The Dimensions of Cloud Technology Investment

As gathered from the above-mentioned definitions concerning Cloud Computing, it is obvious that while "cloud computing" may be merely a concept, it is the great enhancements of bandwidth and speed of internet network that enable the operation of such an idea. Additionally, the formation of "cloud computing" is a new creation of, and an ecological change of the ICT industry, enabled by the substantial improvement in the delivery of information flow of the internet network. The reason it is called "cloud computing" is that in a computer flow chart, the internet network is usually represented by a cloud shape image. Thus the computation delivered to remote large-scale virtual host computers through internet networks is called "cloud computing". Additionally, the service models derived from cloud computing are: (1) Infrastructure as a Service, IaaS; (2) Platform as a Service (Paas); and (3) Software as a Service (SaaS). Therefore, services offered by "cloud computing", whether they are providing infrastructure or software, may render lower investments in fixed assets, less software-hardware, and reduce personnel and operating costs for small to medium sized enterprises (SME) that lack inherent resources, thereby promoting better efficiency for the SMEs (Cai, 2010).

The study of Lee (2012) suggested that the conceptual definition of cloud technology investment is "Using the Internet to configure a Cloud Computing environment as a virtual environment, which for example has proven to provide good access to Telecare platforms, is an effective and flexible network architecture. That is the investment for Cloud Computing Technologies." In this study, the dimension of cloud technology investment is divided into three aspects: (1) Online learning; (2) Network database; and (3) Network software and hardware equipment.

Summarizing the above, this study adopted the dimensions proposed by Lee (2012) concerning cloud technology investment.

Organizational Performance

Initially referring to how much the results of an endeavor are shown, performance is a concept significant in the two different layers of *efficiency* and *effectiveness*. While efficiency is the output-to-input ratio, effectiveness is the degree of goal achievement for an organization. Organizational operations are pursuits of results that are both efficient and effective. According to the motivation theory of management sciences, performance is interpreted as "a piece of work completed by an employee" (Wang, 1997). The science of organizational behavior, nevertheless, refers to performance as "an integrated success consisting of efficiency, effectiveness and efficacy" (Hsieh, 2006).

There is a massive amount of previous studies addressing the measurement dimensions of organizational performance. Since the benefits of organizational performance will eventually be fed back to the financial dimension, most scholars adopt financial performance as one of the measurement indicators. In an environment characterized by conveniently transmitted information and fast-changing markets, nevertheless, a company nowadays shall never solely rely on financial performance for survival and competitiveness. That is to say, it is impossible to fully gauge the organizational performance using financial performance as the sole indicator (Ling and Hung, 2010).

Moreover, Ling et al (2010) argued that organizational performance is the sum of accomplishments attained by all businesses/departments involved in an organizational goal during a determined period of time, with the goal either meant for a specific stage or on the overall extent.

Based on research results proposed by Daft (2006), Delaney & Huselid (1996), Jones & Johnes (1993), Wu (1998) and Ling et al (2010), This study decided to measure both the financial and non-financial aspects of organizational performance, while correctly gauging how knowledge management and/or cloud technology investment affect the organizational performance. In this study, therefore, the financial performance indicator is defined as output in the financial accounting sense, measured by indices concerning corporate growth and profitability. For example, a company's Earning per Share (EPS) is above the average of other businesses in the same sector, or is used along with Return on Equity (ROE) or Return on Assets (ROA) as measurement indices for financial performance (Huang, 2008). The non-financial performance, on the other hand, is measured by means of *innovation performance*, which in turn is gauged from multiple perspectives of organizational innovation (e.g., technological and managerial innovations). While technological innovations refer to technologies required by an organization for manufacturing products or providing services, a managerial innovation occurs within the organization's social system and is related to the hiring/management processes and organizational structure (Damanpour & Evan, 1984; Kimberly & Evanisko, 1981; Johns, 1993; Ling et al, 2010).

The "effects of knowledge management on organizational performance" that this study explores is primarily focused on the "innovation performance" and "ROE" of organizational performance.

The Effects of Knowledge Management on Organizational Performance

Wu (2009) suggested that the mechanism of knowledge management has obvious impacts on organizational performance, and that an enterprise's organizational performance will be enhanced once the mechanism of knowledge management is implemented.

Kun Meng, Xion and Wang (2009) all believed that there is a positive correlation between knowledge management and organizational performance of networked culture and communal culture.

Lin (2011) believed that output control has a positive moderating effect on the relationship between the share strategy of knowledge transfer and organizational performance.

Although the research subjects of these articles do not belong to the field of communications-network technology industry, this study derives the above analysis to obtain the following hypotheses:

Hypothesis 1: *(H1) Knowledge management has a significant positive effect on organizational performance.*

The Effects of Cloud Technology Investment on Organizational Performance

Research articles directly related to cloud computing and organizational performance are still lacking so far. But within the research articles of Lin (2009) and Huang (2009) , this study found that there is some relevance between the concept of cloud technology investment and organizational performance. Thus, this study hypothesizes:

Hypothesis 2: *(H2) Cloud technology investment has a significant positive effect on organizational performance.*

However, the question of whether knowledge management and the increase on cloud technology investment can simultaneously affect organizational performance with a multiplying effect or synergy is a very important topic worthy of discussion. Therefore, this study deduces the third hypothesis:

Hypothesis 3: *(H3) Good knowledge management and cloud technology investment have a significant positive interactive effect on the organizational performance of Taiwan-listed communications network companies.*

RESEARCH METHOD

Figure 1 illustrates how motivations, research objectives and literature review cited in the previous passages led to this study's hypotheses and conceptual research framework:

Research Framework

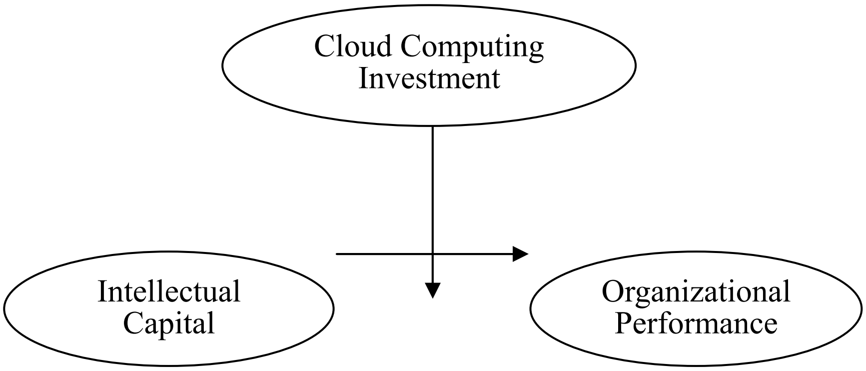

Figure 1: Research Framework

Designing the Questionnaire

The questionnaire in this study was compiled based on Itemization Survey method and the afore-mentioned observable dimensions. On a 7-point Likert Scale, the answers were measured with 7 denoting Strongly Agree and 1 denoting Strongly Disagree. A higher score represents a greater level of agreement, and vice versa. The sample data collected was then "centralized" so the sum of scores given to all questionnaire items is zero after deducting the average. Centralization erases multicollinearity between the independent and extraneous variables, in order that their interactions are tested more accurately, as shown in the mathematical equation below:

$$\Sigma(X_i - \bar{x}) = \Sigma Y_i = 0$$

This study referenced and modified the classification of Arthur et al. (1996) concerning the questionnaire design of "knowledge management", which includes three sub-dimensions: (1) knowledge absorption; (2) knowledge sharing; and (3) knowledge storage; with a total of nine questions.

This research referenced the dimension classification proposed by Lee (2012) concerning "Cloud Computing" questionnaire design, which contains three sub-dimensions: (1) Network learning; and (2) Network database; and (3) Network software and hardware equipment, with a total of nine questions.

Concerning the measurement indicators of "organizational performance" that include innovation performance and ROE, this study referenced Ling et al (2010) for the former, and referenced the database of the Taiwan Economic Journal for the latter, to formulate a total of six questions.

Sampling Method

The respondents of questionnaire survey (i.e., section chief level and above of the finance and marketing departments of Taiwan-listed network communication companies) were selected by using the Simple Random Sampling method, 20 copies of questionnaire were given out to experts in a pilot-test. After revising or removing unsuitable items as per the experts' advice, the study's author sent out 500 copies of questionnaire in an official post-test and received 202 validly completed copies for a 40.4% response rate.

The Data Obtained from Questionnaire and Measurement Model

This study adopted SEM in a Confirmatory Factor Analysis (CFA) of the research framework, and based the questionnaire design on three latent variables (i.e., knowledge management, cloud technology investment and organizational performance), each of which was divided into observable/explicit sub-variables containing several questions, as shown in the table below. After processing the collected data, the author created a primary file that preceded the design of the questionnaire, using Itemization Survey method for the construction of this study's measurement system. Although Itemization Survey method is applied to the design of the questionnaire, Dual Measurement was adopted to ensure the computer software efficiently handled and/or measured all data (Chen, 2010). Table 1 shows the number of questions under each implicit or explicit variable, as well as the referential sources.

Table 1: Number of Questionnaire Items under each 'Implicit Variable' and 'Observable Variable'

Implicit Variables	Explicit Variables	Total Number of Questionnaire Items	Referential Sources
Knowledge management (X)	Knowledge Absorption (X_1)	3	Arthur et al. (1996)
	Knowledge Sharing (X_2)	3	
	Knowledge Storage (X_3)	3	
Cloud Computing (Mo)	Online Learning Dimension (Mo_1)	3	Lee (2012)
	Network database (Mo_2)	3	
	Network software and hardware equipment (Mo_3)	3	
Organizational performance (Y)	Innovation performance (Y_1)	3	Taiwan Economic Journal database; Ling et al (2010)
	ROE(Y_2)	3	

RESULTS AND ANALYSIS

Linear Structure Model Analysis

This study includes a CFA, an analytical method contrary to the Exploratory Factor Analysis (EFA), on the three unobservable/latent variables of knowledge management, cloud technology investment and organizational performance. SEM is made up of structural and measurement models to efficiently tackle the cause-effect relations among implicit/latent variables. The three parts of model-testing in this study are: (1) goodness-of-fit of the measurement model; (2) goodness-of-fit of the structural model; (3) the overall model's conformity with goodness-of-fit indicators. In other words, goodness-of-fit indictors were applied to a test of the overall goodness-of-fit effect of SEM (Diamantopoulos & Siguaw, 2000, 2012).

Analyzing Fit of the Measurement Model

Largely, factor loading is intended to measure the intensity of linear correlation between each latent/implicit variable and a manifest/explicit one. The closer the factor loading is to 1, the better an observable variable is in measuring latent variables. Since this study's reliability is supported by the fact that factor loadings for all observable variables range between 0.8 and 0.9, all observable/explicit variables in the measurement model appropriately gauged the latent/implicit ones. The Average Variance Extracted (AVE), on the other hand, gauges an unobservable/implicit variable's explanatory power of variance with regard to an observable one, with the VE value growing in proportion to the reliability and convergent validity of that particular implicit/latent variable. As a rule, VE must be larger than 0.5 for an observable variable's explainable variance to exceed the measurement error (Fornell and Larcker, 1981). As Table 2 and Figure 2 show that all AVEs in this study exceed 0.5, the explicit variables have excellent reliability and convergent validity.

Table 2: Judgment Indicators for the Measurement Model

Unobservable variables (Implicit Variables)	Observable Variables (Explicit Variables): Centralized Dual Measurement	Factor loading	Average Variance Extracted, AVE
Knowledge Management (X)	X1C	0.86	0.67
	X2C	0.84	0.65
Cloud Technology Investment (Mo)	M1C	0.84	0.65
	M2C	0.83	0.63
X*Mo	X1M1C	0.85	0.66
	X2M2C	0.85	0.66
Organizational Performance (Y)	Z1C	0.86	0.67
	Z2C	0.85	0.66

ANALYZING FIT OF STRUCTURE MODEL

Path Analysis Results of Structure Model

This study made sure that the overall model passed the goodness-of-fit test before calculating the parameter estimates, Standard Errors (S.E.) and Critical Ratio (C.R.) among latent variables (see Table 3).

Table 3 Path Analysis Results of the Structural Model (Un-standardized)

Path Coefficients between Implicit Variables			Estimate	S.E.	C.R.	P	Label
Knowledge management (X)	→	Organizational performance (Y)	1.081	. 42	2.574	***	a
Cloud technology investment (Mo)	→	Organizational performance (Y)	.931	. 13	7.162	***	b
X*Mo	→	Organizational performance (Y)	.924	.31	2.981	***	c

*Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001*

Additionally, Table 4 indicates: knowledge management and cloud technology investment (X*Mo) have a significant interactive effect (c=0.682) on organizational effectiveness (Y), which means that when a company increases cloud technology investment while implementing a good knowledge management scheme that affects organizational performance, it will also promote organizational performance to achieve multiplied synergy.

Table 4: Path Analysis Results of the Structural Model (Standardized)

Path Coefficients between Implicit Variables			Estimate
Knowledge Management(X)	→	Organizational performance (Y)	.431
Cloud Technology Investment (Mo)	→	Organizational performance (Y)	.323
X*Mo	→	Organizational performance (Y)	.682

*Note: * indicates P<0.05; ** indicates P<0.01; *** indicates P<0.001*

Coefficient of Determination

The so-called coefficient of determination is also known as Squared Multiple Correlation (SMC), which is the explanatory level of the implicit independent variable on the implicit dependent variable. In other words, the R^2 value shown in Table 5 indicates that the implicit independent variable has adequate explanatory ability on the implicit dependent variable respectively.

Table 5 Path Coefficient of Determination

Table 5: Coefficients[a]【Hierarchical Regression)】

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.874[a]	.764	.753	.316	.011	179.218	2	97	0.000
2	.883[b]	.780	.776	.413	.004	7.024	1	96	0.000

a. Predictors: (Constant), Mo and X
*b. Predictors: (Constant), Mo, X and Mo*X*

Table 6 was derived from Table 5:

Table 6: Coefficients[a]

Coefficients of Determination	R^2
Knowledge management (X), and cloud technology investment (Mo) on organizational performance (Y)	0.764
Knowledge management (X), cloud technology investment (Mo), and X*Mo upon organizational performance (Y)	0.780

Indices of Fit of the Overall Model

The purpose of adopting SEM in the modeling phase of this study is to explore how unobservable variables are interconnected within the structural model, to determine if the measurement model has measurement reliability, and also to measure this study's overall goodness-of-fit effect using such indices as χ^2, d.f., GFI, AGFI, NFI, CFI, RMR and RMSEA. In most cases, it is required that χ^2/d.f. <5, 1>GFI>0.9, 1>NFI>0.9, 1>CFI>0.9, RMR<0.05 and RMSEA<0.05 (Bagozzi & Yi, 1988). The goodness-of-fit of the overall model proved satisfactory because χ^2/d.f. <5 and GFI, AGFI and NFI all exceed 0.90, with the RMR smaller than 0.05 (see Table7).

Table 7: The Fitting Evaluation Table of the Overall Model

Determination index	χ^2	DF	GFI	AGFI	NFI	CFI	RMR	RMSEA
Fit value	12.705	14	0.915	0.903	0.904	0.905	0.023	0.022

Standardized Results of SEM Analysis

The model's overall framework resulted from computer-aided standardization, as shown in Fig.2

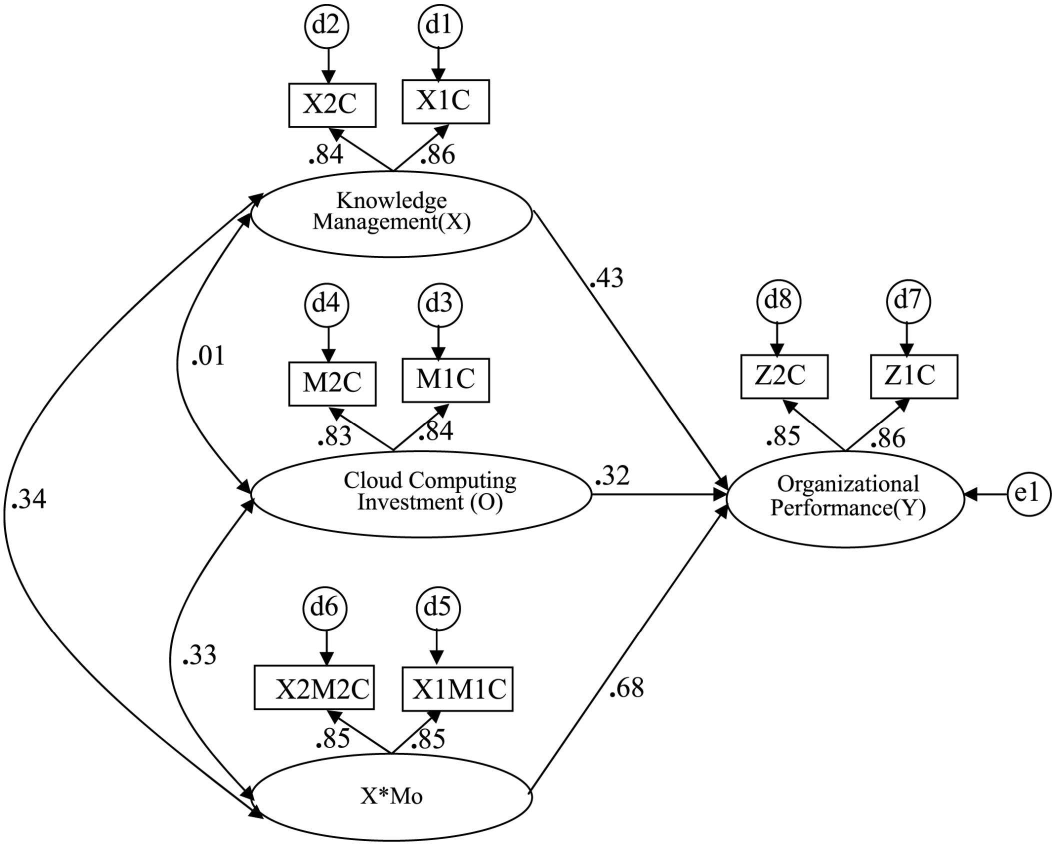

Figure 2: Standardized results of SEM analysis

Analytical Testing of Path Effects for the Structural Model

To test the extraneous variable, This study performed a hierarchical regression analysis (see Table5), followed by centralized regression analyses and t-tests of Y versus X, Mo and X*Mo in order to examine whether the hypothesis about a significant regression coefficient was substantiated (i.e. whether was zero or not). The test results are shown in Table 8.

Table 8: Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.817	.881	.453	4.333	.000
	X	1.754	.502	.481	3.494	.000
	Mo	1.885	.321	.296	5.872	.000
2	(Constant)	2.036	.561	.451	3.629	.000
	X	1.197	.125	.431	9.576	.000
	Mo	1.373	.136	.323	10.096	.000
	X*Mo	3.407	.531	.682	6.416	.000

a. Dependent Variable: Organizational Effectiveness(Y)

As shown in Table 8, the Path Coefficient of Mo*X versus Y is c = 0.682, which is not equal to zero, thus it suggests a moderating effect of Mo*X on Y.

The following results were derived from analyses mentioned above:

(1) Good knowledge management affects organizational performance in a significant positive manner, with a 0.43 standardized path coefficient that supports H1 (Hypothesis substantiated).

(2) The increase on cloud technology investment affects organizational performance in a significant positive manner, with a 0.32 standardized path coefficient that supports H2 (Hypothesis substantiated).

(3) Good knowledge management and the increase on cloud technology investment affect organizational performance in a significant positive interactive manner, with a 0.68 standardized path coefficient that supports H3 (Hypothesis substantiated).

CONCLUSION AND SUGGESTIONS

Conclusions

This study conclusions are derived from the afore-mentioned data analyses and results, as detailed in the following passages:

Regarding the verification of SEM, this study has a good model fit as its author constructed a SEM with satisfactory goodness-of-fit in the measurement, structural and the overall models.

Conclusions regarding the verification of business practices at Taiwan-listed communication network companies:

Good knowledge management and cloud technology investment by Taiwan-listed communications network companies provides organizational performance with a significant positive interaction effect. In other words, the "cloud technology investment" variable of this study has a positive moderating effect. The research of Chen (2010) pointed out that, when both the Extraneous Variable and the independent variable have significant interactive effects on the dependent variable, then the effect of the independent variable on the dependent variable, or the effect of the extraneous variable on the dependent variable, have very little significance.

Contributions of the Present Study

(1) From the Perspective of Practice:

Unlike previous studies, largely based on EFA, This study performed modeling in accordance with the summarized literature review and then verified the model for goodness-of-fit effects. Consequently, the present study is a CFA-based one addressing topics that are both important and innovative in terms of business practices, with the research results not only serving as a reference for further studies in relevant fields, but for decision-makers at Taiwan-listed communication network companies seeking management insights as well.

(2) Innovative Applications of Research Method

When reviewing the relevant existing literature, this research found that a majority of the papers applied regression analysis for exploratory research, and rarely considered using the research framework of CFA that applies the extraneous effect of the implicit variable. Since the primary aspect of this study's topic is the implicit variables, CFA and Structure Equation Modeling (SEM) are more suitable for use as the measurement tools and model structures for this study. Therefore, the research method of this study is more innovative.

LIMITATIONS AND SUGGESTIONS

(1) This study adopts the Simple Random Sampling method to sample the population, and utilizes posting for questionnaire mailing, which might have contributed to a low valid-sample return rate. The result may be insufficient to represent the population.
(2) The model of this study falls on "one cause, one factor, and one moderator", and the CFA is limited to Taiwan-listed communication network companies. Subsequent researchers may consider exploring different industries to compare the differences of goodness-of-fit of the same model, or different models, of various industries.
(3) Regarding modeling for a CFA-based study like the present one, it is advisable that a simple verification model be built to avoid excessive complexity, and the subsequently poor goodness-of-fit (Chen, 2010). This study, therefore, decided to focus solely on how knowledge management affects organizational performance, with cloud technology investment being the extraneous variable.

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