The SWOT-AHP Framework for the Enterprise Cloud Computing Strategy

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Ⅰ. Introduction

Information technology (IT) has become an integral part in human's daily activities. It has been adopted in most areas and sectors quickly, especially in business environment where the new IT innovations and trends are often welcome and accepted, due to its virtue the highly competitive pressure and the dynamic environment. These days, e-business (electronic-business) is emerging that forces the enterprise to catch up with the trend and keep up the high-paced development. Hence, the new innovations or solutions in IT have become a powerful tool for the enterprise to renew and improve itself to survive and win in that severe business environment. Cloud computing is now growing and gaining attention from the users and huge IT companies. It promises a bright new computing era with lot of advantages. Most of big IT companies or IT solution providers in the world have started cloud computing initiatives and have gotten certain results. Many cloud

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computing-based applications are also introduced to individual user, like GoogleDocs, Dropbox, etc. Within the near future, cloud computing will surely be a dominating trend in IT and the company must face the problem of transferring the IT software or information systems to IT cloud-based services and systems at that time. Moving to the cloud requires the enterprise a rational and strategic schedule to be successful, which means enjoying the advantages of the cloud as the early-movers also avoiding the losses in business as with the laggards.. Actually it is not easy for the enterprise to build a strategic plan for cloud computing adoption at this time, while there is still much information about the cloud and they are not totally unified. The most important is that cloud computing is also in its developing stage. Therefore, a need to have a systematic framework to support the enterprise in planning the cloud strategy is necessary. This paper presents an efficient framework, also a logical method to assist the enterprise in that issue through evaluating the critical factors in cloud computing adoption and utilizing them in developing the cloud strategic plans. The framework is built using two popular and effective techniques, namely, SWOT and AHP. By leveraging these familiar techniques in a systematic way, the enterprise can easily apply the introduced framework to solve the problem of building the strategic plan for cloud computing adoption. The framework will help the enterprise effectively cover the strengths, weaknesses,

opportunities and threats of cloud computing, and simultaneously construct and pick up the best strategic plan for itself. The results of this study hope to address the current needs of the enterprise for cloud computing. In addition, it could be a useful guideline for practitioners such as the CIO (Chief Information Officer) or a reference for further research in cloud computing.

The remainder of this paper is organized as follows. Section 2 is the review of prior work related to the topic. In section 3, the proposed framework is discussed, and in section 4 a case is introduced for illustration purpose. Finally, in section 5, a summary of main issues in the paper and conclusion are provided.

Ⅱ. Literature Review

2.1 SWOT

SWOT is the acronym for strength, weakness, opportunity and threat. It is quite popular and a basic technique in business; leaders of an enterprise must know and apply it in handling many business decisions in their company. In essence, SWOT analyses the internal factors and external factors to provide a comprehensive view of the company situation with respect to a certain problem or objective, including strengths, weaknesses, opportunities and threats. Accoring do Wickramasinghe and Takano (2009), "SWOT is a convenient and promising way of conducting

a situational assessment." Based on the results of SWOT, the enterprise knows what advantages it is possessing (strengths), what benefits it can gain (opportunities), what issues it has to improve (weaknesses) and what potential risks it has to face (threats). Then it is able to develop better and more efficient strategies to solve the problem or achieve the goal. Application of SWOT spreads over a wide spectrum of areas (Wickramasinghe and Takano, 2009).

According to Osuna and Aranda (2007), the strategic planning process contains two stages. "For a complete strategic planning process, it should be complemented with the analysis of the proposed strategies and the selection of the one considered as the most convenient to the organization" (Osuna and Aranda, 2007). We usually rely on the SWOT technique to finish the first step (called design of strategies). For the second stage, we conduct the analysis of alternatives and selection of the most convenient one.

In reality, there are several shortcomings in the effort of performing the strategic planning process. Most of the organizations use SWOT only to obtain a description of their actual situation and the organization's environment (Aranda, 2004). "Furthermore, when they use it for strategies design they do not follow with an appropriate analysis of the alternatives" (Osuna and Aranda, 2007). Because of the technical limitations of the SWOT analysis (Kurttila et al. 2000) such as the impreciseness and lack of a

quantitative examination, "utilization of SWOT alone in decision making process is insufficient" (Wickramasinghe and Takano, 2009). The use of SWOT analysis couldn't determine the importance of each factor in SWOT (Shinno et al. 2006), then leading to the difficulty in assessing the most influencing factor for the relevant problem in the strategic decision (Pesonen et al. 2000).

Thus, to fix these issues in the real planning process, many researchers employed SWOT-AHP as a hybrid method to improve its usability (Jeon and Kim, 2011) by leveraging the advantages and eliminating the weak points of each technique. "To fix the gaps in the process, we should use a formal analysis and selection of the proposed alternatives by means of AHP techniques." (Osuna and Aranda, 2007)

2.2 AHP

The Analytic Hierarchy Process (AHP), which is developed by Saaty (1980), is a decision making process based on multi-criteria evaluation. It provides the decision-maker a systematic and useful technique to support them in the process of making decision which isn't totally easy in the complex context like nowadays. "The basic formula of AHP is paired comparisons among each criterion, and the results of paired comparisons demonstrate the overall ranking in the decision task" (Jeon and Kim, 2011). The measurement instrument for

the pairwise comparison is a ratio scale, namely nine-point scale developed by Saaty (2001). Besides, the AHP steps are not too complicated to perform and a software can be used to execute the calculations in the AHP process to save time and effort instead of doing the lengthy calculations manually. Due to its obvious strong points such as an intuitive approach and ease of use, it has been widely applied and has become a commonly used multi-criteria decision making method (MCDM) among the researchers and experts (Jeon and Kim, 2011; Wickramasinghe and Takano, 2009). An overview work of Sipahi and Timor (2010) shows that there were a total of 232 application articles of the group AHP and analytic network process (ANP) decision making methodologies published in highly reputed international academic journals during the years 2005-2009, while the use of AHP was dominant in 169 articles and the rest belonged to the others, e.g. Fuzzy AHP, ANP, Fuzzy ANP, etc. AHP is used flexibly by both individuals and groups to deal with not only personal issues but also general problems. AHP adoption has appeared in corporate planning, portfolio selection, benefit/cost analysis, resource allocation, conflict resolution, estimation and prediction, etc. (Saaty, 2001). Besides its main functions, "AHP also enables people to test the sensitivity of the solution, or outcome, to changes in information" (Satty, 2001). Moreover, the decision makers can revise the AHP model by expanding the elements of a designed hierarchy and modifying their judgments to keep solving the up-to-date problems and developing the sound solutions over time. AHP is not a static framework, but dynamic in its features and functions.

AHP has been applied in a wide range of area, from natural sciences to social sciences because of its strong points like scientific and systematic approach to the problems, quantitative evaluation, intuitive and ease of use method, etc. Some fields can be named, for instance manufacturing industry, education, logistics, e-business, IT, R&D, telecommunication industry, finance and banking, defense industry and military, government, tourism and leisure, archaeology, auditing, mining industry, sport, and politics (Sipahi& Timor, 2010).

However, every method has its limitations, and AHP is not an exception. The weak point of AHP is in finding out the factors and constituting the hierarchy. It could be considered the most difficult step in the AHP process. In this step, we have to determine the factors which are essential and significant to the issue, then organize these factors into the appropriate levels to make a complete hierarchy. The quality of the hierarchy will affect the final result (the selection of the strategies/plans/solutions). In case of the government project and public sector works, this step is almost done by the corporation of the experts who are specialized in a certain area. They are invited to consult and give their opinions for

the issue. By discussing and working together, finally they will propose a best hierarchy. But it is not much easy in case of the company, especially small and medium-sized enterprise (SME). The users usually tend to identify the factors using a process that is arbitrary and subjective. Therefore we need a more systematic and efficient approach to assist the accomplishment of this step. Hence, using SWOT method is a suitable choice. Combining SWOT together with AHP would utilize the strong points and moderate the weak points of each method, and leverage them in the most effective way.

2.3 SWOT-AHP Methodology

Basically, the steps of SWOT-AHP are "(1) SWOT analysis, (2) paired comparisons between SWOT factors within each SWOT group, (3) paired comparisons between the four SWOT groups, and (4) a strategy formulation from the results." (Jeon and Kim, 2011)

According to Jeon and Kim (2011), we could use the result of factor evaluation to design the strategic plan. It means that we use the factors which have received the highest priorities to make a specific plan which its detail points will solve or give an appropriate action to the corresponding factors. In case we already have designed several specific plans or strategies, by combining AHP and SWOT framework, we can perform pair-wise comparisons between SWOT factors and get a quantitative measure of the importance of them, then further conducting pair-wise comparisons between the strategic plans (or called the alternatives). The final value of the strategic plans is constituted by the extent to which it contributes to the SWOT factors and the degree of importance

<Table 1> Three groups of combining and using ways of SWOT-AHP

Flexible changes	Details	Papers
In combining the steps of SWOT-AHP	Define the SWOT factors and use the AHP process to evaluate them	Jeon and Kim, 2011
	Insert one criteria level (strategic objectives) between AHP-SWOT	Osuna and Aranda, 2007; Wickramasinghe and Takano, 2009
In developing strategy	Based on SWOT	Osuna and Aranda, 2007; Jeon and Kim, 2011
	Based on TOWS matrix	Wickramasinghe and Takano, 2009
In evaluating SWOT factors and strategies	Pair-wise comparison.	Jeon and Kim, 2011
	Rating by using control criteria.	Wickramasinghe and Takano, 2009
	Direct evaluations of the degrees of efficiency of the strategies to fulfill the requirements of the factors.	Osuna and Aranda, 2007

of SWOT factors with respect to the organization's goals.

This offers a good basis for examining the present or anticipated situation, or new strategy alternative more comprehensively (Kurttila et al., 2000).

So we can see that depending on the research issues and the researcher, SWOT-AHP has various versions. These different and abundant versions could be generalized to 3 groups. The first one is the way how SWOT and AHP are combined. The second one is based on how the method is used to develop the strategy, and the last group is distinguished by the measurement instrument used to evaluate the factors of the alternative strategies. Table 1 clarifies and lists the three groups of utilizing SWOT and AHP along with example papers.

A detailed explanation of the steps involved in conventional SWOT-AHP technique is found in (Pesonen et al. 2000), (Shrestha et al., 2004), (Kurttila et al., 2000), (Masozera et al., 2006), (Osuna and Aranda, 2007), and (Wickramasinghe and Takano, 2009).

There are also many papers employing SWOT-AHP as a hybrid research method in various areas (Kahraman, Demirel, and Demirel, 2007). Table 2 summarizes some of the areas and the papers that have applied the analysis based on SWOT-AHP method.

As shown in Table 2, most of the papers are in the social science fields such as tourism, healthcare, environment. Because SWOT-AHP is a very practical method, it has been utilized to the realistic and social issues in such areas in Table 2.So applying SWOT-AHP to technology areas, business and enterprise issues could generate more new and interesting results. It is

<Table 2> Literature review of areas having the appearance of SWOT-AHP method

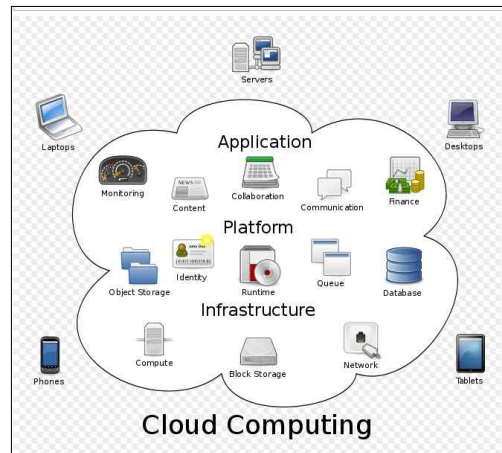| Area	Authors
Environment	Kurttile et al., 2000; Pesonen et al., 2000; Masozera et al., 2006
e-government	Kahraman et al., 2007, 2008 (Turkey case) Shareef, Jahankhani and Pimenidis, 2011 (e-government stage model evaluation)
GIS implementation	Taleai, Mansourian and Sharifi, 2009
Tourism industry	Kajanus et al., 2004; Jeon and Kim, 2011; Wickramasinghe and Takano, 2009
Health care	Dey and Hariharan, 2008
Project management	Stewart et al., 2002
Manufacturing	Shinno et al., 2006 Li et al., 2010 (green manufacturing selection)
Agriculture	Shrestha et al., 2004 Wang et al., 2010 (agricultural mechanization development)
Forestry	Kurttila et al., 2000a (forest planning) Kurttila et al., 2000b (certificate for timber production) Leskinen et al., 2006 (tool for strategy process)

quite promising for the researchers and, and especially for the practitioners to achieve better applications in the future.

2.4 Cloud Computing

Cloud computing isn't a new technology in IT. Instead, it is a model for providing IT services to meet certain requirements. It is a new way to organize and operate the resource in the Internet environment through the widespread adoption of several existing technologies (Weiss, 2007) such as virtualization, service-oriented architecture (SOA) (Yeo et al., 2010), autonomic computing (Sterritt 2005) and gird computing (Baker et al., 2002). The unique contribution of cloud computing that differentiates it from the other innovations in IT is helping to deliver IT applications and services to the user anytime, anywhere, any computer (Figure 1). That is the reason why some scholars refer to it as a public utility like water or electrical power (Yeo et al., 2010).

"After the dot-com bubble, Amazon played a key role in the development of cloud computing by modernizing their data centers" (Wikipedia). To date, cloud computing is still an evolving paradigm with the participation of many giants in IT such as Google, Microsoft, IBM, Yahoo, Zoho, and Salesforce. There is no common definition for cloud computing concept in the scientific literature (Weinhardt et al., 2009; Petkovic, 2010). Here is one definition from (Erdogmus, 2009) which is descriptive and easy to understand: "… cloud computing is an emerging computational model in which applications, data, and IT resources are provided as services over the Web (so called 'cloud')".
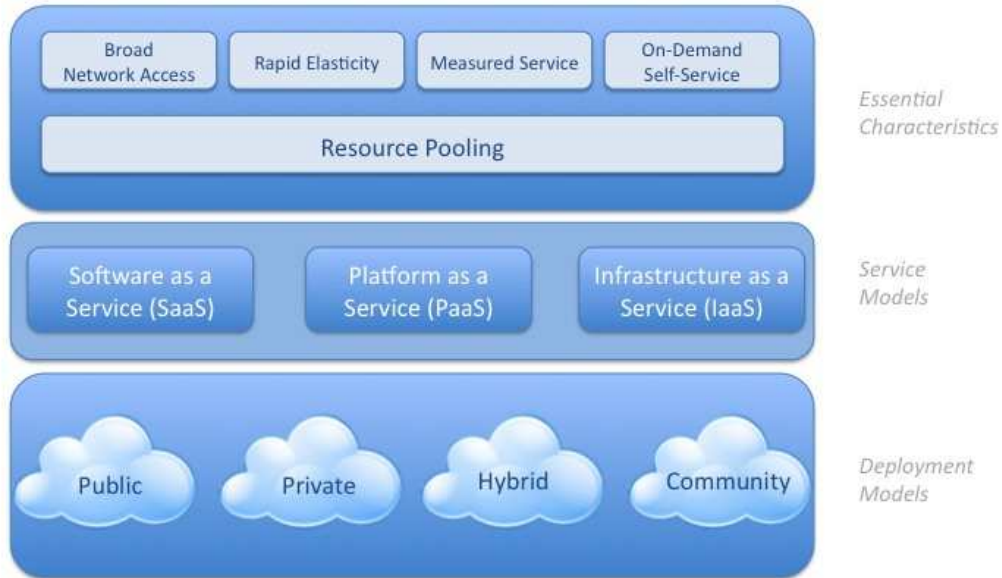

<Figure 1> Overview of Cloud Computing

According to NIST (Mell and Grance, 2009), cloud computing contains five essential characteristics, three service models and four deployment models (see Figure 2). "This definition seems to have captured the commonly agreed aspects of cloud computing" (Khajeh-Hosseini et al., 2010).

Currently, the issues related to cloud computing such as definition, features, underlying technologies, benefits, risks, challenges and chances are continuously explored and refined to give a comprehensive and unified picture for cloud computing in the future.

Even though there are many research areas which have applied SWOT-AHP, cloud computing is still pretty new to this approach. It is not easy to find prior work related to this study

<Figure 2> Visual model of NIST Working Definition of Cloud Computing

directly. Hence the literature review has been carried out relying on the boundary and the main idea of this research. It focuses on the SWOT analysis of cloud computing, and the AHP technique.

Ⅲ. Research Model

3.1 Model Building Process

The whole process requires the responsibility of the most important people in the company like the CEO, CIO, etc. The decision makers who play an important role in making the strategic plan should cooperate and work together. This group working style ensures the reliability of the method and the validity of the results. It is well-suited and a popular way of working for the decision making process for large enterprise/organization.

The basic steps of the constructing process for the enterprise's cloud computing strategy are shown in Figure 3 and briefly described below.

① *Conduct SWOT analysis of cloud computing.* The result of this step is a list of SWOT of cloud computing which can reflect the understanding about cloud computing and the vision of how they look at the cloud in the future. The decision making team may ask for support from cloud experts for more precise and helpful factors in SWOT list.

② *Constructing the strategic plan for cloud computing.* After getting the SWOT overview list for cloud computing, the decision makers start to develop their
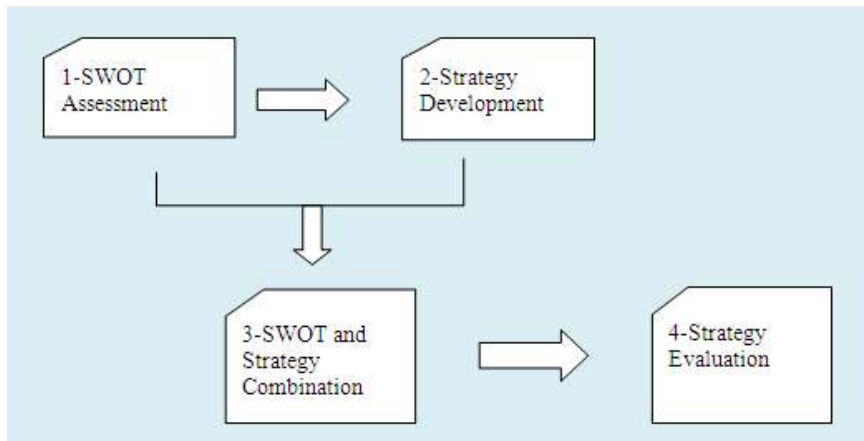
Figure 3. Visual summary for the framework building process

strategy gradually. They should define which the optimal goal of the plan is, and what objectives the strategic plan has to achieve for the cloud implementation process in the enterprise. The more detailed the goals are, the better it is. It will make the proposed plan more clear and specific. Hence, it is easy to execute the plan.

③ *Combining the SWOT list and the pre-defined goals to build the complete AHP model.* At this time, each side in SWOT becomes the criteria to assess the strategic plan, while the particular factors under the side (strength, weakness, opportunity, threat) now are the sub-criteria. The goals and objectives in step 2 become the criteria to evaluate the importance level (or the contribution level) of each side of SWOT for the whole plan. The combined model will become a hierarchical AHP model from these independent parts. The decision makers just develop or update the potential strategic plans to be more perfect and complete. These strategies will be the alternatives (or the candidates) for the last choice in the decision making process.

④ *Evaluating the alternatives-strategies.* When the AHP hierarchy has been finished, the decision making team will assess the importance and the contribution of each of the strategies to select the best strategic plan for the enterprise. And this is the final result. The evaluation process follows the usual AHP judgment process. The decision makers can employ the basic technique like pair-wise comparison using 9-point scale, or leverage the other assessing techniques which are represented in the literature review.

3.2 SWOT Assessment

Table 3 shows the SWOT factors of cloud computing for an organization. We have synthesized and developed these SWOT factors based on the various characteristics and features of cloud computing for a general enterprise.
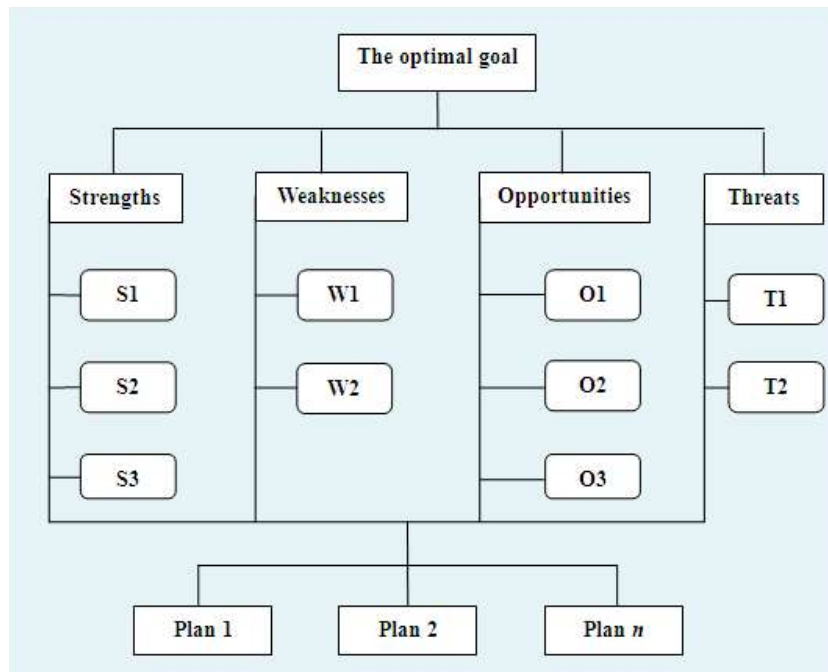
<Table 3> SWOT analysis for cloud computing and factor descriptions

	Aspect	Factor	Operational definition
Internal environment	**Strengths**	**Accessibility (S1)**	One of cloud characteristics is unlimited accessibility. User can connect to the cloud service anywhere, anytime, any computer, any network, and easily.
		Low investment (S2) (Hamilton, 2009; Armbrust et al., 2010; Weinhardt et al., 2009; Martens and Teuteberg, 2011; Zhang et al., 2010)	Comparing to a traditional information system, cloud computing is more convenient adoption in general for these aspects Infrastructure and facility Human resource (IT staff) Time and effort
		Service diversification (S3)	An abundant kind/type of cloud services and application, e.g. SAAS, IAAS, PAAS, office, storage, CRM application, etc. They are available and the various others are in development stage for the enterprise to choose.
	Weaknesses	**Insufficient awareness (W1)**	Probably not wholly understanding and aware of cloud computing, also its services, and related issues due to the objective factors, maturation of cloud, and the saturation of cloud market.
		Safety and security (W2) (Guo et al., 2010; Petkovic, 2010; Gupta et al., 2008; Weinhardt et al., 2009)	It is always the top and crucial consideration of the cloud adopter and provider (John, 2010; Jun and Sha-sha, 2011; Xiao and Cheng, 2010). Because "the application will be exposed to the Internet, so the security threats will be far higher than the traditional model" (Xiao and Cheng, 2010). "For cloud computing to spread, users must have a high level of trust in the methods by which service providers protect their data" (Hwang et al. 2011). And "make sure a cloud service includes data encryption, effective data anonymization, and mobile location privacy." (Guo et al., 2010)
External environment	**Opportunities**	**Integration (O1)**	Because everything is in the cloud, it opens the possibility that all IT system and services in the organization could be integrated and connected into one unified system. It seems easier than doing the same thing for the bulky traditional IT systems. It can improve the performance of IT systems and business processes between departments, thus enhancing the overall productivity of the enterprise.

		Expansion (O2) (Petkovic, 2010; Armbrust et al., 2010; Talukder et al., 2010)	The ability to link to new cloud applications, or extend using new service trends in IT is pretty open in the cloud. One advantage of cloud computing is that it is able to scale without depending on geographical locations and hardware performance "in order to handle rapid increase in service demands (e.g. flash-crowd effect) (Zhang et al., 2010).
		1st mover advantage (O3)	The chance to obtain the benefits of early adopter in cloud computing area, for example leap-frogging the new IT achievements, innovating the business processes, etc.
	Threats	Underdeveloped regulation (T1)	Lack of complete regulation/policy/ rule from authority agency/government or specialized organization which is responsible for IT sector.
		Non-unified standard (T2)	The immature agreement for cloud when the enterprise signs the contract, for example Service Level Agreements (SLA). Lack of unified standard for building and developing cloud computing (structure, model, etc.) between the huge IT companies due to poor coordination.

3.3 Strategy Building

The biggest goal for the strategic cloud plan is

<Figure 4> The basic AHP hierarchy for the strategic plan for the cloud computing adoption

to maximize the cloud computing benefits and minimize the negative and at the same time build the best and most suitable plan for the enterprise's condition in the cloud adoption road map.

3.4 AHP Hierarchy Structure

After having the necessary elements for the AHP hierarchy, we just arrange these components to the right position in the AHP hierarchy.

Figure 4 shows the way how to combine the defined goal and SWOT factors into the hierarchy.

Each decision team will develop different strategies for their company. It is represented here by Plan 1, Plan 2, and Plan *n*. Between the optimal goal and the SWOT, the decision makers can insert more specific goals or objectives to consider SWOT factors with respect to the strategic plans to make it more holistic and complete.

In general, they could construct and enhance the AHP hierarchy based on their own AHP knowledge and practices.

3.5 Factors and Strategies Evaluation

When the AHP hierarchy is complete, the model evaluation starts. There are several ways to assess, but the most fundamental and common way is the pair-wise comparison between the elements in the hierarchy. Then the calculation step is executed to gain the priority/relative

weight of each plan. Based on that result, the team can make the final decision. This stage totally depends on the AHP practices. Moreover, the AHP software (Expert Choice 2000, Super Decision) can support the lengthy calculation and give the final weights quickly and accurately. So the practitioner doesn't have to spend much time and effort for this stage.

IV. Numerical Example

To demonstrate our approach and make it more intuitive and understandable, we introduce an illustration example below.

Let us assume that XYZ is a big stock company. It is working in the stocks and securities area for a long time. Because of the particular features of the sector, IT and its applications are quiet important for the company. It invests much money for the information system to keep up with the high speed change and the strict competition in business. Due to the emerging of cloud computing, XYZ enterprise notices it and proposes a serious consideration for its adoption. They employ the SWOT-AHP method to solve this issue.

They also establish a team consisting of important and related people to respond to the cloud strategy planning. The team has seven people including the CEO, CIO and five heads of department in the company. The specific process of utilizing SWOT-AHP performed by the

company's decision making team is described as below. The decision team follows the SWOT-AHP framework introduced in Figure 3.

① The team conducts SWOT analysis and generates the SWOT factor table similar to the one shown in Table 3.

② The team defines the must-gain goal which is likely the mentioned goal in the second step above. It is to maximize the cloud computing benefits and minimize the negative and at the same time build the best and most suitable plan for the company's condition in the cloud adoption roadmap.

③ Then the decision team compromises to the 3 strategic plans shown below:

ⅰ) Plan A - Neutral. The company does nothing, just wait for the big picture of cloud and its impact on their field to become clearer and brighter and then act.

ⅱ) Plan B – Apropos. The company starts to search for the provider of cloud services/applications in the market to apply cloud services for small applications/systems within 2 years, then gradually implement the cloud computing solution for the rest of the systems in the next years until all information systems are moved to the cloud.

ⅲ) Plan C – Proactive. The company cooperates with a 3rd party IT provider to help them move their existing IT system and related IT applications to the cloud. This 3rd party IT provider will work together with the company to propose a cloud implementation plan with the detailed steps and time schedule. They will work out a complete cloud IT system for the company. It is proposed to take 2 years.

After that, they construct the AHP hierarchy by combining the SWOT factors, the optimal goal and the three

<Table 4> The relative weights of SWOT factors and three strategic plans

SWOT	Factors	Alternatives		
		Plan A	Plan B	Plan C
Strengths 0.153	Accessibility (S1) – 0.444	0.075	0.333	0.592
	Low Investment (S2) – 0.111	0.131	0.793	0.076
	Service Diversification (S3) – 0.444	0.075	0.333	0.592
Weaknesses 0.114	Insufficient Awareness (W1) – 0.200	0.558	0.122	0.320
	Safety and Security (W2) – 0.800	0.558	0.122	0.320
Opportunities 0.495	Integration (O1) – 0.167	0.097	0.570	0.333
	Expansion (O2) – 0.167	0.075	0.333	0.592
	1st Mover Advantage(O3) – 0.667	0.067	0.272	0.661
Threats 0.238	Underdeveloped Regulation (T1) – 0.800	0.558	0.122	0.320
	Non-unified Standard (T2) – 0.200	0.540	0.163	0.297

proposed strategic plans. They develop the AHP framework similar to the one shown in Figure 4.

④ The decision makers ~~can~~ use the software Expert Choice 2000 for the evaluation and synthesizing the relative weights of the three plans. They apply the pair-wise comparison with 9-point scale to judge the criteria, factors and the strategic plans. The relative weights of SWOT factors and the three strategic plans toward SWOT factors are shown in Table 4 and Table 5.

Then, the final priority of each plan is synthesized by the software Expert Choice 2000.The final weights are shown in Figure 5.

Based on the results shown in Table 4, the team may select plan C to execute because it receives the highest relative weight from the decision makers. The final priorities also mean that plan C is able to fit with SWOT factors in the hierarchy the most. It could be seen in Table 4 that plan C is more dominant than plan B and plan C in Strengths factors, and especially Opportunities factors. It makes the final priority of plan C fairly

higher than the priorities of the two remaining plans.

Ⅴ. Discussion and Conclusion

This paper has presented an approach that supports practitioners to deal with the cloud computing adoption issue. It contributes to both theory and practice as discussed below.

First, it applies a hybrid technique SWOT-AHP to a new and important topic – cloud computing. This technique may be fairly common in other research areas, but it is not familiar to researchers in cloud computing. By taking the first steps in applying SWOT-AHP for cloud computing, it is hopeful that it will become a useful and easy research methodology to employ for cloud researchers in particular, and for other technical research areas in general.

Second, it provides a framework and guideline for enterprises to make strategic plans for the cloud computing adoption process based on leveraging SWOT, AHP technique. There are various ways to combine and use the SWOT-AHP
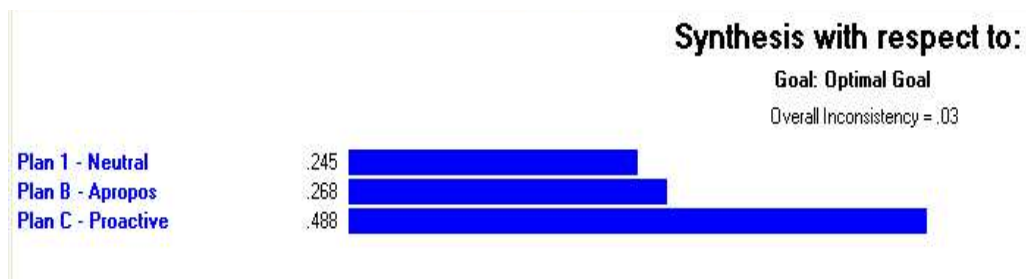

Figure 5. The final priorities of the three alternatives

technique as mentioned above in the literature review, but we have proposed a new and different design of this hybrid technique for cloud computing strategy making issues. The steps in the framework are carefully introduced and explained in detail along with a sample case. The reader could easily understand and put it into practice intuitively as described through the tables and figures.

Third, through the SWOT-AHP framework developed in this paper, a SWOT analysis for cloud computing and its results are introduced. The factors in SWOT analysis can be a helpful recommendation for an enterprise when performing the same analysis. They could think about these suggestions, then adjust or update it depending on their own assessment and situation. The SWOT factors in this paper help the practitioners save time and effort.

However, the study has some shortcomings which need to be improved. The first is the lack of giving a specific cloud computing plan for an enterprise. The reason is that each enterprise has its own story, situation and condition. Generally, strategic plans are designed just to fit a specific enterprise. We can't simply suggest several strategic plans that will satisfy all companies. That's why we haven't specified particular plans instead of naming plan A, plan B, plan n. But we have specified high level cloud plans for the XYZ company in the illustration case, thus it isn't difficult for practitioners to perform this step. Moreover, the same issue applies to the optimal

goal of the enterprise's cloud strategies. Thus, the overall goal and objective suggested in this paper are just for reference purposes, and a specific company is not required to follow the exact same goal and strategy.

The second is the lack of a real world case. To get the real experience in conducting the case study and the practical feedback for the SWOT-AHP approach, we should find a suitable enterprise and perform the research for that enterprise. It will help us gain more valuable lessons and improve the SWOT-AHP framework.

The SWOT-AHP framework proves to be powerful and efficient tool in identifying, exploring and dealing with the emerging and complex issues like cloud computing. It is a logical, practical and appropriate approach for the decision maker through combining a qualitative method and a quantitative technique together. Cloud computing is gradually becoming more sophisticated and dominant. The approach discussed this paper helps an enterprise become familiar with cloud computing and be able to handle the cloud-related issues effectively. It provides the directions for further research. Thus, it not only contributes to the research in cloud computing area and makes it become more comprehensive, but also help to consolidate and widen the findings in this research area.

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당응웬하인(Tang, Nguyen Hanh)

동국대학교 일반대학원 경영학 석사학위를 취득하고 현재 동 대학원 테크노경영협동과정 박사과정에 재학 중이다. Information Systems Management, 한국IT서비스학회지, 지식경영연구 등 국내외 학술지 및 학회에 논문을 발표하였다. 주요 연구 관심분야는 고객관계관리, 클라우드 컴퓨팅, 공개기반 소프트웨어 등이다.

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동국대학교 일반대학원 경영학 석사학위를 취득하고 현재 동 대학원 국제비즈니스협동과정 박사과정에 재학 중이다. 주요 관심분야는 국제투자전략, 다국적 기업관리, 기업의 사회적 책임 등이다.

이영찬(Lee, Young-Chan)

서강대학교 경영학사, 동 대학원에서 경영학 석사 및 박사학위를 취득하였다. 현재 동국대학교 경주캠퍼스 경상학부 교수로 재직하고 있으며, Annals of Management Science, The Open Operational Research Journal의 Editorial Board, 한국정보시스템학회 편집위원장으로 활동 중이다. Expert Systems with Applications, Knowledge-Based Systems, Human Factors and Ergonomics in Manufacturing, Technological and Economic Development of Economy, Information Systems Management 등에 논문을 게재하였으며, 주요 관심 분야는 지식경영, 기업성과측정, 데이터마이닝, 복잡계 이론, 다기준의사결정 등이다.

<Abstract>

기업의 클라우드 컴퓨팅 전략수립을 위한 SWOT-AHP 프레임워크 개발

당응웬하인 · 소정 · 이영찬

　최근 클라우드 컴퓨팅이 학계나 실무계에서 많은 주목을 받고 있으며, 공공기관에서도 클라우드 컴퓨팅을 도입하고 있는 추세에 있다. 클라우드 컴퓨팅은 장·단점을 모두 가지고 있지만 지속적으로 발전하고 있으며, 기업들은 클라우드 기반의 정보시스템을 도입하기 위한 다양한 솔루션들을 활용하고 있다. 따라서 기업에서 클라우드 컴퓨팅 도입을 위해 고려해야 할 요소들은 무엇이며, 어떻게 계획을 수립할 것인지는 시급한 과제라고 할 수 있다. 본 논문의 목적은 기업이 클라우드 컴퓨팅 채택 전략을 수립하기 위한 프레임 워크를 제시하는 것이다. 구체적으로, SWOT-AHP는 클라우드 컴퓨팅을 실행하는 과정에서 강점-약점-기회-위협 요인을 파악하고, 전략 계획을 보다 효율적으로 수립 하는데 사용된다. 경영전략 이론에서 널리 알려져 있는 SWOT과 다기준의사결정기법 중 실무에서 가장 활발하게 사용되고 있는 AHP는 복잡하지 않고 적용이 쉽기 때문에 본 연구에서 제안하는 방법을 이용한다면 실무에서도 큰 어려움 없이 SWOT-AHP 프레임워크를 클라우드 컴퓨팅 전략 수립에 적용할 수 있을 것으로 기대한다.

Keywords : 클라우드 컴퓨팅(Cloud Computing), 계층분석과정(Analytic Hierarchy Process; AHP), 강점-약점-기회-위협(Strength-Weakness-Opportunity-Threat; SWOT), 전략(Strategy)