

# A Decision Framework for Cloud Service Selection for SMEs: AHP Analysis

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## Abstract:

The purpose of this paper is to study how advances in cloud computing impact the processes of creating and running businesses over the tourism sector for small and medium-sized enterprises in Taiwan, and to identify the main factors that relate to the adoption of CRM cloud systems by SMEs. This study adopts two steps to build the structure of decision model with the analytic hierarchy process method. The findings confirm that factors affecting the adoption of Cloud CRM service in SMEs are grouped into four categories, which is financial benefits, marketing benefits, management factors, and environment factors. This study hopes to enhance the quality of the evaluation process, and help support SME decision makers in exploring their opportunities surrounding Cloud services adoption.

## Keywords:

Analytic Hierarchy Process; Cloud Service; Customer Relationship Management

## 1. INTRODUCTION

This research tries to learn more about how cloud computing affect the processes of creating and running businesses over the Internet and use of cloud technology within Small and Medium-sized Enterprises (SMEs) in the tourism industry. The ubiquitous nature of this technology would allow SMEs to adopt e-business applications to support all aspects of their operations just like large organizations, not restricted by their limited resources, and enabling them to more effectively compete with large rivals. Therefore, many SMEs have the chance to implemented Customer Relationship Management (CRM), so that they can compete effectively in today's highly changeable economic and market climate.

Leimeister, Riedl, Bhm, & Kremer [1] indicated that cloud computing is an IT deployment model, based on virtualization, in terms of infrastructure, applications and data are deployed via the internet as a distributed service by one or several service providers. These kinds of services are scalable on demand and can be priced on a pay-per-use basis. Keramati, Mehrabi, and Mojir [2] found that firms with improved CRM process capabilities enjoy better organizational performance. In the contemporary business environment, customers are considered to be the central element of all marketing actions, and CRM has become a priority for companies [3]. For local small or medium-sized companies, a CRM operation fully depend on their sales force and back-office resources is normally beyond their capacity. The emerging of cloud technology really offers unprecedented opportunities for SMEs running CRM to horizon their business scope. Especially, it is important to Taiwans SME sector because the number of

SME has 97% of Taiwan enterprise number [4].

There is a large of number of services are available in nowadays technical environment, most of which are target SMEs. The technology allows SMEs avoiding huge initial investments in hardware resources and software and reducing ongoing operational, upgrade and maintenance costs. The wide range and low cost of cloud services provides SMEs an unprecedented opportunity and financial motivation for moving their IT infrastructure to services in the cloud. With mobile and ubiquitous computing systems, SMEs are allowed to create and run a virtual business using cloud services in competitive environment.

In this regard, cloud computing has the potential to rebuild the mode of computing resource and application deployment, providing SMEs new chance to break up traditional value chains and expand new business models. Many providers like Amazon, Google, Microsoft, Chunghwa Telecom positioned themselves as platform and infrastructure providers in the cloud computing market. To survive in the global markets, many SMEs have pressing need to implement CRM, so that they can compete effectively over their counterparts [5]. With increasingly competitive markets worldwide, the need for small businesses to adopt e-business simply to survive is becoming more critical [6]. There is extensive research on SME adoption of electronic business, but fewer study on how CRM in Cloud provides SMEs with opportunities is remain unexploited.

Previous studies have only examined the current state of the technology and issues related to cloud services [7–9], there have been few researches that identify the important factors influencing the decision to adopt CRM Cloud service in SME sector, and how SME can take advantage of a new resource called cloud computing. Garg, Versteeg, & Buyya [10] provide a framework to to evaluate Cloud offerings and rank them based on their ability to meet the users requirements, which selecting a Cloud service provider based on: Accountability, Agility, Assurance of Service, Cost, Performance, Security and Privacy, and Usability. Considering the business potential of the new technology of cloud computing for SMEs, the business concept remains somewhat unclear and vague to many. There is limited research conducted in this area, and in seeking to address this issue in the context of Taiwan economy; especially, the invaluable contribution of SMEs to the Taiwan economy (SME is account for 97% of Taiwan enterprise number). This research uses expert interview and survey study aimed at identifying the related factors influencing CRM cloud service adoption by SMEs. Understanding this relationship is essential in guiding entrepreneurial behavior to improve SMEs performance.

The purpose of this paper is to study how a SME can expand its business with the CRM Cloud service model and to identify the main factors that relate to the adoption of CRM cloud systems by SMEs. To this end, this study hopes to enhance the quality of the evaluation process, and help support SME decision makers in exploring their opportunities surrounding Cloud services adoption.

To develop a decision model for Cloud service adoption, this study adopt two steps to build the structure of decision model with the analytic hierarchy process (AHP) method. We first found the potential determinants from the literature review. The first step is for verifying the reasonableness of the chosen determinants. In this section, expert interviews were conducted with someone familiar with the travel CRM process, factors affecting the decision were identified, and structure of decision model was build. The second step is for computing the weight of determined factors through the first step, and data were collected from 10 SMEs located throughout the Taiwan. These two steps accomplish the development of a decision model that influence CRM adoption in the SME sector.

## 2. LITERATURE REVIEW

## 2.1 CRM and SME

The fundamental concept of CRM is a customer centric approach to identify quality customers, understand their needs and align organizations capabilities to meet those needs. The long-term relationship with premium customers is the key to having a successful business. Previous studies have revealed that there are three aspects of CRM: 1) used in the external operation with customers and facilitate a two way communication between a firm and its customers; 2) used in the internal operations to recommend activities for marketing, sales, and customer service; 3) enable a firm to analyze data and disseminate the resulting knowledge throughout the organization [11, 12].

In the contemporary business environment, customers are considered to be the central element of all marketing actions, and CRM can create mutually beneficial relationships between the firm and its customers [12, 13]. In this regards, CRM has become a priority for companies [3], viewing it as a strategy is now evident in the literature. Hashim [14] point out the firms using Information Communication Technology (ICT) can redefine the notion of customer relationship and get some benefits, including outlining an information strategy by understanding their customers, expanding business by covering new and multiple channels, and increasing profit by enhancing customers trust and loyalty.

Actually, CRM is deeply rooted and intertwined with the core IT capability of a firm. Payne and Frow [9] confirm this by suggesting that CRM is more commonly used in the context of technology solutions and has been described as information-enabled relationship marketing. Moreover, the findings indicate that firms with advanced CRM process capabilities enjoy better organizational performance [2]. Therefore, it CRM can expect to increase sales and increase customer loyalty.

CRM adoption among SMEs has been limited because of resource constraints and not familiar with the strategic value of CRM. To facilitate decision making concerning CRM applications and their implementation, simple, low cost tools are needed to assist in analyzing and developing effective CRM strategies. It can give the SMEs ability to identify, understand and cater to the needs of their premium customers.

However, CRM is now widely recognized as having the potential to improve the profit of business, but it seems that most firms do not fully understand the business potential of CRM. They just focus on technical implementation issues instead of the broader business service view [15], and Keramati, et al. [2] also found that CRM processes are more affected by infrastructural CRM resources rather than technological CRM resources. From a pragmatic perspective, there is widespread recognition of the fact that various SMEs issues need to be addressed for the successful implementation of any information technology [16].

## 2.2 Cloud service economy

Cloud computing is an advancement of computing history that evolved from large tabulating machines and mainframe architectures that centrally offered calculating resources via distributed and decentralized client-server architectures to personal computers, and eventually to ubiquitous, small personal (handheld) devices [17]. Motahari-Nezhad, et al. [8] summarizes the cloud customers in the following types: IT administrators, software developers, managers and business owners, and finally individual users.

Motahari-Nezhad, et al. [8] classify cloud services into the four types: 1) Infrastructure as a service (IaaS): Hardware resources and computing power are offered as services to customers; 2) Database as a service (DaaS): A more specialized type of storage is offering database capability as a service; 3) Software as a service (SaaS): software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers; 4) Platform as a service (PaaS): This refers to providing facilities to support the entire application development lifecycle including design,

implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet. A CRM built using clouds can reduce the burden on development cost, share data and tools, manage less, be useful for archiving and remote data backup, but the security is one of the major concerns when laboratories consider moving sensitive information to machines they do not own [18]. Wherever a laboratory stores its data, internally or externally, outside hackers pose a threat.

Amit and Zotts [19] and Motahari-Nezhad, et al. [8] analyzed the factors that aid or impede cloud service adoptions. The aids includes: 1) avoiding huge initial investments in hardware and software; 2) reducing ongoing operational and maintenance costs; 3) scaling up and down the network capacity based on demand; 4) accessing to a variety of software applications and features offered by vendors. In contrast, the impedes includes: 1) losing direct control of resources and software; 2) increasing liability risk caused by security breaches and data leaks; 3) decreasing reliability due to the service providers go out of business, causing business continuity and data recovery issues; 4) solutions are mainly built as one-size-fits-all customers, and hard to customize solutions based on its needs.

In view of the economy of Cloud service, there are three related economic theories to explain why firms should adopt Cloud services in shaping their business value creation. 1) From the Property Rights Theory, cloud service providers can relieve them from the costs of asset ownership, and use external service providers rather than its own assets and people [20]. This economic efficiency can expand the boundaries of the firm. 2) The Resource-Based View highlights the value of adopting cloud service, which empower the management of their own company to focus on their most promising activities by relieving them from non-core responsibilities and focusing on the role of specialization of management [21]. 3) The Entrepreneurial Theory of the Firm can extend their business boundaries towards new entrepreneurial opportunities being constrained by its managerial capacity [22].

Kim and Mahoney [20] indicated that it is possible to see how property rights theory is well suited to explain business situations where inefficient economic outcomes persist. Additionally, property rights theory forges new theoretical connections with other branches of organizational economics, in particular, resource-based theory.

### 2.3 Factors affecting SMEs adopting technology

Several authors have identified cost as a main factor for the adoption of technology, while others focus on the nature of the Cloud technology provided, and some study emphasize what the Cloud provides to its customers. Yang et al. [23] indicated that expectation, risk, and environment perspectives are major factors which influence the adoption of business process outsourcing in SMEs. Mehrrens et al. [24] found that perceived benefits, organizational readiness, and external pressure are major factors which influence the internet adoption. Levy, Powell, and Yetton [25] found that size is not a determinant of information technology adoption, but the owners' knowledge of technology and attitude to growth dominate. However, Lin (2006) indicated that the size of organization, among other factors, has a strong influence on how these factors affect the adoption process. King and Burgess [26] and Greenberg [27] indicated that organizational context and top management support play a role in their study of critical success factors for CRM adoption. Hashim [14] classified the factors influencers in SMEs ICT adoption innovations into three main factor groups, which are organizational, technical and data quality. Organization factors include firm size, vendor after sale support, and Software selection criteria, and strategic intent. Factors that relate to the technical which include: ICT infrastructure; Purchase, implementation and integration cost; System evaluation and selection criteria; Data quality factors refer to the factors that relate directly to the concept of data quality and how it is being conducted in the context of CRM adoption, and which include: Evaluation of the quality of customer data; Customer data infrastructure; Customer data types

classification; and Customer data sources classification.

Brown and Kaewkitipong [28] found that environmental factors, technological factors and organizational factors are the main three factors which influencing the e-business adoption in SME tourism enterprises. The most important factor is environmental according their study. For the travel agencies, the e-business adoption was forced predominantly by the industry-wide supplier systems and reinforced by customers need for intensive and timely information. These unequivocal observations that for SMEs in the travel service sector industry-specific factors are the major influence on e-business adoptions. In Technological category, perception of benefits of using technology were the main concern to adopt e-business, which include matching their business goals, accessible of application services, vendors support on a rental or commission model for the advanced applications, and the levels of customization and additional functionality. Finally, in relation to organizational factors the SMEs did not consider their size an absolute barrier or facilitator of their adoption decision. The SMEs owner or managers specifically identified the need to strengthen their online position as the rationale for their interest in adopting more complex e-business technologies as well as in using them more efficiently.

Alshawi, Missi, and Irani [29] identified the evaluation and selection criteria dimension for software or systems, which include purchase cost dimension, complexity dimension, vendor support dimension, idle capacity, and system administration. As discussed in above, the reasons for a firm adopting advanced technology usually include cost savings, a focus on core competency, and flexibility in management. In addition to the expected benefits, SME owner and manager need to carefully consider the related shortcomings alongside the Cloud CRM. The generally recognized disadvantages include information security and loss of management control.

By reviewing prior studies for the determinants of Cloud CRM service, this study identify the main factors which influence the SMEs adoption include expectation benefit and risk, environmental factors, technological factors and organizational factors, organizational readiness, external pressure, vendors quality, and owners' knowledge of technology etc.

### 3. METHODOLOGY

From the previous literature, we identify the potential determinants affecting the CRM cloud service, and structure a decision model using analytic hierarchy process (AHP) method. In this research, two expert surveys were conducted. The first survey, using personal interview, is for finding the important factors in Taiwan which should be considered in the decision of cloud technology adoption; while the second survey, using the AHP method, is for computing the weight of determined factors in the first survey. These two processes construct a decision model of cloud technology adoption.

AHP is a multi-objective decision making tool which was introduced and developed by Saaty [30]. The AHP has found widespread application in decision making problems, involving multiple criteria in systems of many levels. In general, the process follows five steps [31]: (1) Defining criteria and sub criteria for supplier selection; (2) comparing pair-wise for all criteria and sub criteria; (3) checking the consistency of the input data through the maximum eigenvalue method; (4) computing the relative weights of the decision criteria and sub criteria; and (5) Prioritizing the order of criteria or sub criteria and Structuring the hierarchical model.

In the first survey, five tourist agencies and two hotels were selected based on their willingness to commit considerable time to on-site discussions, and their size (SME). The interviews were designed to be conducted with someone familiar with the organizations CRM initiatives, preferably at managerial/decision making level. In the second survey, e-mail was used as a way to contact the tourist agencies that is interested in this topic and willing to do the survey. Ten out of Thirty-two contacted agencies are

willing to do the survey. The respondents are from IT managers, CRM managers, marketing managers and managing directors.

## 4. ANALYSIS AND RESULTS

### 4.1 The results of first expert survey

The main goal of the first survey is to identify the determinants that will be the factors involved in cloud service for SME among potential factors acquired from prior research. All interviewees agreed that selection of the Cloud CRM presented some problems associated with large number of products available on the market. This problem is aggravated by the lack of clear and agreed selection criteria, as indicated by 7 enterprises. In the interviews, for 20 potential determinants, respondents were asked how important each factor was on a 5-point scale ranging from very unimportant to very important. A total of 12 survey samples were acquired. Most of the respondents have job experience of more than six years in tourist industry. Respondents interviewed consist of CEOs and leaders who have responsible positions in organizations that are considering technology service adoption. Table I summarizes the survey results.

The respondents were requested to include any additional criteria that seemed important, and rate the level of importance of those potential factors. The rate is seven-point scale, 1 is the least important and 7 is very important. The effective extremely important criteria such as acquisition cost, ongoing and maintenance cost, CRM service application, information security and privacy, and timely information. The average importance of acquisition cost is 6.83, and the standard deviation is 0.389. From the top five factors, it shows our respondents are extremely concerned on cost saving when consider using CRM Cloud service, followed by the matter of information.

One remarkable feature is that environment-related factors, such as Industry-wide content supplier systems, Cloud technology reliability, are also concerned by SMEs. We reduce the number of factors by eliminating some potential factors that below average rates of 4. Following this rule, 14 factors were remained as the factors of affecting CRM Cloud adoption.

### 4.2 Decision factors involved in cloud service for SME

This study based on the major factors identified by Mehrtens et al. [24] and Yang et al. [23] that influence SMEs internet and BPO adoption, and the results of our first expert interviewee; we divided SMEs Cloud CRM adoption factors into four categories: Financial benefits, Marketing benefits, management factors, and environment factors.

Financial benefits is related to cost saving. Cost savings are still a very important consideration among interviewees, and the most frequently mentioned of cost consideration on could CRM adoption are payment based on demand, acquisition cost, and ongoing and maintenance cost. Marketing benefits is refer to how well suppliers application will perform on the different Clouds and whether these devices can expand SMEs business and provide better services to their customers. The considering marketing benefits on using Cloud CRM include intensive and timely information, the performance of CRM application services, green marketing appealing, and updated technological image.

Management risk is concern about an undesirable or uncontrollable outcome on adoption Cloud CRM. The most mentioned risks are Information security and privacy, management control, and agility & adaptability. Especially, most Cloud CRM solutions in Taiwan market are mainly built as one-size-fits-all clients although there are sometimes add-ons to complement the functionality. Interviewees

**Table 1. The Importance of Affecting Factors**

| Factors affecting CRM Cloud adoption   | Average /deviation |
|--|--------------------|
| Acquisition cost                       | 6.83/.389          |
| Ongoing and maintenance cost           | 6.67/.492          |
| The performance of CRM application     | 6.67/.500          |
| Information security and privacy       | 6.50/.522          |
| Intensive and timely information       | 6.33/.492          |
| payment based on demand                | 6.25/.754          |
| Industry-wide content supplier systems | 5.58/.515          |
| Management control                     | 5.50/.522          |
| Cloud technology reliability           | 5.25/.622          |
| Technological image                    | 5.08/.669          |
| Agility & adaptability                 | 4.92/.515          |
| Green marketing                        | 4.83/.577          |
| Vendors accountability                 | 4.83/.389          |
| Organizational readiness               | 4.42/.793          |
| System administration                  | 3.92/.900          |
| Technical problem solving              | 3.83/.577          |
| Focus on core competence               | 3.42/.669          |
| Other firms interest                   | 3.25/.866          |
| Service (Product) variety              | 3.17/.835          |
| Trust between key men                  | 2.75/.866          |

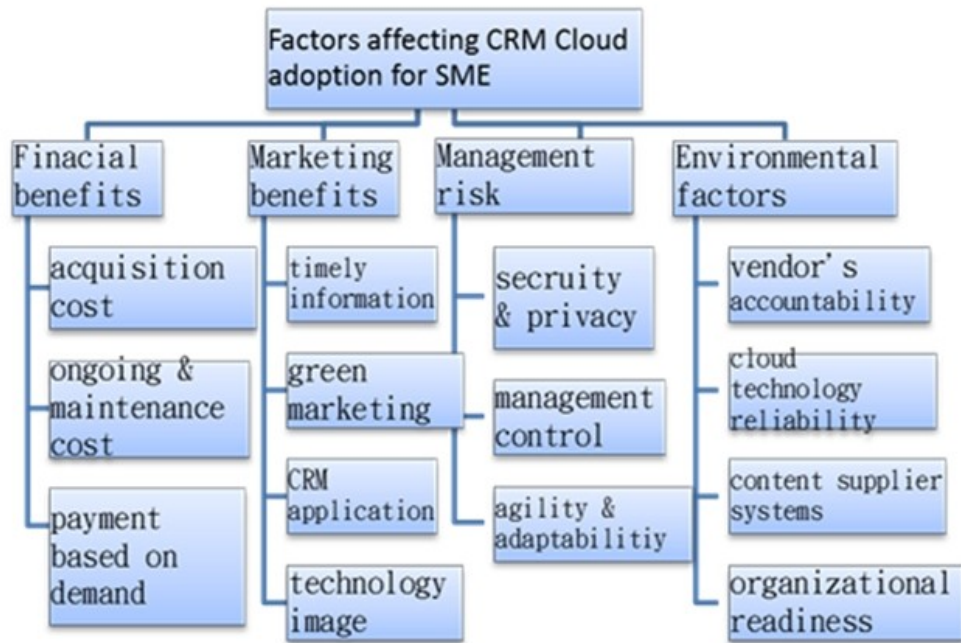
want to understand whether the Cloud service is elastic, portable, adaptable and flexible. The primary of environmental factors in their decision to adopt Cloud is reflecting the trend for mobile commerce technology and travel service sector industry-specific factors, which includes vendors accountability, Cloud technology reliability, industry-wide content supplier systems, and SMEs organizational readiness. Fig. 1 shows AHP structure in this decision model.

### 4.3 The results of second expert survey for AHP

The main goal of the second survey is to evaluate the weight of each factor using AHP methodology. The elements in each level of the hierarchy are compared based on their importance in a given criterion, that is, the level just above the elements being compared. We divide the decision problem of cloud adoption into four criteria: financial benefits, marketing benefits, management factors, and environment factors. Each criterion includes its related sub-factors and a pairwise comparison is performed. The function of the pairwise comparisons is by finding the relative importance of the criteria and sub criteria which is rated by the nine-point scale proposed by Saaty [30], which indicates the level of relative importance from equal, moderate, strong, very strong, to extreme level by 1, 3, 5, 7, and 9, respectively.

The local and global weights of each factor were obtained by synthesizing the 10 respondents opinions. Table II shows the structure of AHP hierarchy including the weight of each factor. The results show that in the financial benefits (0.545), acquisition cost and ongoing & maintenance cost have the most influence on CRM Cloud adoption; while the marketing benefits (0.241) were second in importance to financial benefits, the performance of CRM service application has the most influence in this category, followed by intensive and timely information.

The importance of management factors is 0.139, in which Information security and privacy is most concerned, followed by the management control. On the other hand, the importance of environmental



**Figure 1.** Factors affecting CRM Cloud adoption for SME

factors (0.076) rates low among four criteria. It can be seen that respondents have a favorable attitude toward Cloud service. However, reviewing the weight of each factor in the environment factors, industry-wide content supplier is the most important determinant, followed by vendors accountability. From the global weights in Table II, it implies that prospective decision makers of Cloud service consider the acquisition cost as the highest determinant, followed by the maintenance cost, and the performance of CRM application.

There exists a slight difference of ranks between the first survey results and the second survey results. The top five ranking is the same between the two surveys, and differences of ranks within the criteria are quite small. In other words, both experts and decision makers have almost identical priority ranks in the tourism industry for SMEs.

## 5. CONCLUSION

This paper focusing on investigating more about the adoption and use of cloud technology within SMEs in Taiwan small or medium-sized tourism enterprises and how and why this differs from its use in large-sized enterprises in the same industry. This study reviews the current state of the Cloud technology, discusses the new business model it associated as an enterprise strategy for SMEs, and suggests a conceptual framework for travel agencies to use the Cloud CRM service in practice.

In addition to identify the factors influencing the decision to adopt it Cloud technology, this paper shifts the focus from an exclusive technological perspective to a broader understanding of business opportunities and business value. The findings of this study confirm that factors affecting the adoption of Cloud CRM service in SMEs are grouped into four categories, which is financial benefits, marketing benefits, management factors, and environment factors. The results is different from Garg, Versteeg, and Buyyas [10] framework which evaluate Cloud offerings and rank them based on Accountability, Agility,



**Table 2. Composite priority Weights for Criteria**

| Criteria            | Local Weight | Sub Criteria                           | Local Weight | Global Weights | Rank |
|---------------------|--------------|--|--------------|----------------|------|
| Financial benefits  | 0.545        | acquisition cost                       | 0.521        | 0.284          | 1    |
|                     |              | ongoing and maintenance cost           | 0.348        | 0.189          | 2    |
|                     |              | payment based on demand                | 0.131        | 0.071          | 5    |
| Marketing benefits  | 0.241        | intensive & timely information         | 0.181        | 0.044          | 6    |
|                     |              | green marketing                        | 0.091        | 0.022          | 10   |
|                     |              | the performance of CRM application     | 0.554        | 0.133          | 3    |
|                     |              | technological image                    | 0.173        | 0.042          | 8    |
| Management factors  | 0.139        | Information security and privacy       | 0.543        | 0.075          | 4    |
|                     |              | management control                     | 0.313        | 0.043          | 7    |
|                     |              | agility & adaptability                 | 0.145        | 0.020          | 11   |
| Environment factors | 0.076        | vendors accountability                 | 0.225        | 0.017          | 12   |
|                     |              | Cloud technology reliability           | 0.224        | 0.017          | 13   |
|                     |              | industry-wide content supplier systems | 0.422        | 0.032          | 9    |
|                     |              | organizational readiness               | 0.129        | 0.010          | 14   |

Assurance of Service, Cost, Performance, Security and Privacy, and Usability.

Cloud is emerging as a flexible and powerful management approach chosen by managers to expand a wide range of possible business opportunities. This study suggests a decision model for Cloud CRM adoption for SMEs, and a total of 14 factors in four criteria were chosen, and the model was developed by AHP method. The framework of decision determinants can facilitate SMEs to overcome the confusion regarding the selection of Cloud technologies and packages. The AHP framework can also provide other researchers and practitioners as a frame of reference associated with CRM adoption in SMEs.

The impact of organizational structure, culture and other organizational factors, such as possibly size and industry sector, on the decision to adopt Cloud also provides significant opportunities for research. In addition, studying the impact of environmental factors such as standards, availability and maturity of tools, and successful case studies that may affect the decision to adopt, could provide interesting insights into the adoption of Cloud CRM.

By proposing a quantitative decision model, this study will not only assist owners and managers in SME making better decisions to choose quality Cloud CRM provider to obtain the most benefits from it, but also help them to take advantage of a new resource called Cloud computing on their business processes. Our results have several implications for Cloud CRM practitioners. First, managers considering Cloud CRM should identify its pros and cons and weigh the decision to vendors very carefully. They should also use their own quantitative decision model in order to make better decisions related to Cloud CRM adoption. In addition, since it is up to managers to assess the determinants affecting Cloud CRM adoption, they need to have a clear picture as to the nature of Cloud CRM relation to its business model.

As well, managers of Cloud CRM vendors should understand what factors affect Cloud CRM adoption. For example, they need to make special efforts to enhance their service quality because a vendor's service quality plays a significant role in the decision model for Cloud CRM, such as the performance of CRM application, vendor's accountability, and service agility & adaptability. Understanding the target customers of cloud services and their requirements allows determining what type of services can be used by which customers.

This study is not without limitations. First, the sample size is small because most of the owners and managers in SMEs not willingness to commit considerable time to do the discussions. Second, most of the interviewees thought the Cloud CRM is still in the early stages and the concept is quite vague in Taiwan small or medium-sized tourism enterprises. Third, the AHP method also has its own limitations;

the use of a more advanced form of AHP method would be desirable. The last, the determinants in the decision model are not complete. Further studies need to include additional possible factors through a more extensive literature review. A useful area of future research would be to empirically investigate the real factors influencing Cloud CRM adoption in the long term.

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