Constructing a Test Method to Evaluate Collaborative Cloud Finance Information System

Chiu-Chin Chen and An-Pin Chen

***Abstract*—Cloud computing technology can effectively save business costs and facilitate public use without having to buy expensive computer equipment. Cloud computing allows immediate access to critical decision-making information. This paper establishes a test method for solving finance information system (FIS) development problems combining cloud computing technology and the grey situation decision-making (GSDM) model. This method facilitates collaborative FIS systems design performance evaluation and demonstrates the proposed GSDM method effectiveness.**

***Index Terms*—Collaborative technology, collaborative cloud system, finance information system, grey situation decision-making.**

I. Introduction

The stock market has exhibited volatility in recent years. Retail investors can only follow venture capitalists, foreign institutional investors and stock market in stock trading, or watch the company's financial report to make investment decisions [1].

Many expect news coverage to be positive and small investors to mimic the trade [2]. Financial investors are usually structurally inferior to financial services and products providers due to lack of professional knowledge, information or experience.

In an unfavorable market, retail investors usually suffer losses [3]. This research uses the grey situation decision-making (GSDM) method to evaluate the Taiwan financial information system (FIS) to reduce the perceived risk and expected gap between the products offered by a software development firm and end users' requirements [4].

Cloud computing is outsourced IT capacity and applications as-needed from a utility collaborative service provider [5]. This work researched a test method based on collaborative cloud system performance for FIS. This paper focuses on selecting the most appropriate approach [6] for a given application.

Accordingly, GSDM procedures are applied to help decision makers optimize a multi-criteria selection process for a collaborative cloud FIS system. The main feature of the "GSDM method" is that it can be applied with limited information to support an objective decision based on different criteria information. Practical studies are used in this work to demonstrate the current finance system environment, the future co-operation environment to provide enterprise finance system vendors a reference.

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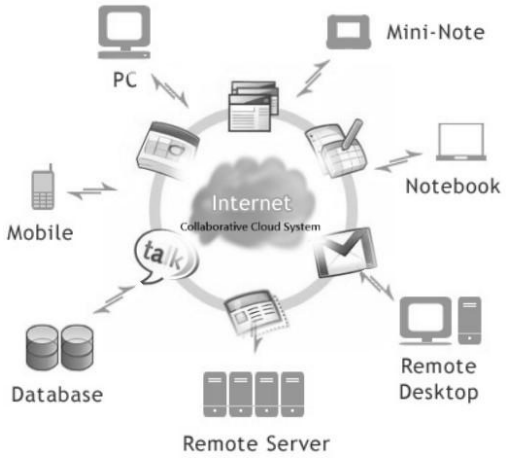

Fig. 1. Collaborative cloud system

II. Evaluation Model

The collaborative cloud system is a new emerging way of sharing and co-authoring computer files using cloud computing. Documents are uploaded to a central "cloud" for storage [7] where they can then be accessed by others from numerous locations.

A. Grey Situation Decision-making Algorithm

GSDM algorithm provides a method to deal with one event that has multiple decisions in the same event and choose the best situation in "real time". The definition and algorithm for this method are as follows [8, 9, 10]:

Definition 1: Let a_i, i=1, 2, …, n, be the measurable criteria and b_j, j=1, 2, …, m, be the digital video recorder and the firm safety protection system. Then, a_i and b_j are referred to as combined events, and S_{ij} refers to a decisive situation and is given by,

$$S_{ij} = \left(a_i,\ b_j\right) \tag{1}$$

Definition 2: The effectiveness evaluation of a measurable criterion is the target. Each criterion has only one target.

Definition 3: If S_{ij}= (a_i, b_j) is a situation, then the effectiveness of a_i and b_j can be written as E_{ij}. Let M be a mapping, $M(E_{ij})=R_{ij}$, where R_{ij} is the value of the mapping. If M satisfies $M(E_{ij})=R_{ij} \in R$, $R_{ij} \in [0, 1]$, then M can be referred to as the mapping effectiveness measurement. The properties of M are as follows:

1) The upper-bound effectiveness measuring target of M is "larger-the-better."

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$$R_{ij} = \frac{E_{ij}}{\max_i E_{ij}}. \quad (2)$$

2) The lower-bound effectiveness measuring target of *M* is "smaller-the-better."

$$R_{ij} = \frac{\min_i E_{ij}}{E_{ij}}. \quad (3)$$

3) The moderate effectiveness measuring target of *M* is "normal-the-better."

$$R_{ij} = \frac{\min_i \{E_{ij},\ E_0\}}{\max_i \{E_{ij},\ E_0\}}, \quad (4)$$

where $E_0 = \frac{1}{n}\sum_{i=1}^{n} E_{ij}$; *i* is the index of measurable criteria, and j is the index of the digital video recorder and the safety protection system.

Definition 4: Let the situation S_{ij}, have *i* measuring targets. If the mapping of E_{ij} is $M(E_{ij})=R_{ij}$, then the synthetic measured effectiveness value R_{ij}, for one of the event is,

$$R_i^{\Sigma} = \frac{1}{n}\sum_{j=1}^{n} R_{ij}\ . \quad (5)$$

The associated mapping synthetic effectiveness measuring vectors, R_i^{Σ}, exists and can be expressed as,

$$R_i^{\Sigma} = \{R_{i1}^{\Sigma},\ R_{i2}^{\Sigma},\ ...,\ R_{il}^{\Sigma}\}. \quad (6)$$

Definition 5: If $R_{ij}^{\Sigma^*}$ satisfies the following condition,

$$R_i^{\Sigma^*} = \max_i \{R_{ij}^{\Sigma}\}, \quad i \in I = \{1,\ 2,\ ...,\ m\}, \quad (7)$$

then $S_{ij}^* = (a_i,\ b_j^*)$ are "satisfied situations"; b_j^* is the satisfied digital video recorder and safety protection system for multi-criteria screened event, ai and $R_i^{\Sigma^*}$ is the best situation of the satisfactory situation.

III. Applying GDSM to Evaluating the FIS Base on the Collaborative Cloud System

The GSDM method provides an effective means of dealing with one event that involves multiple decisions and a choice between situations [11], [12]. This method can be used to select a suitable collaborative FIS cloud system performance.

There are four steps in GSDM. Step 1 is preparation, in which experts make assessments, collaborative cloud system information and rational and measurable criteria are selected. Step 2 is assessment, during which situations are determined, targets are confirmed and the collaborative cloud system is measured against multi-criteria. Step 3 is decision-making, in which the effectiveness is measured against the best finance information system. Step 4 is testing, in which the selected collaborative cloud system is tested.

Step 1: Preparation

Twelve experts in company co-design were selected from industry, government and academia, based on the following conditions: (a) the company experts must hold a managerial position in either a company; (b) the government expert must have responsibilities related to the IT sector, and (c) the academic expert must have experience analyzing research topics related to co-design.

Experts selected in this study included six managers, four governmental officials and two academics. They were selected to assess the FIS collaborative cloud system performance. The firms provided the modules, information and performance. Based on the above information, the experts referenced the BOCR criteria for assessing the FIS collaborative cloud system performance. They then averaged the measured criteria for the collaborative cloud system.

Step 2: Assessment

Decide upon the situations, confirm the targets and events.

1) Event: decide the criteria, and define as a_1.

2) Countermeasure: Firm 1 collaborative cloud finance information system 1 (defined as b_1); Firm 2 collaborative cloud finance information system 2 (defined as b_2); Firm 3 collaborative cloud finance information system 3 (defined as b_3); Firm 4 collaborative cloud finance information system 4 (defined as b_4).

3) Situation:

$S_{11} = (a_1, b_1)$ = (screening the criterion; countermeasure for collaborative cloud finance information system Firm 1). In S_{ij}, *i* is the index of the criterion; *j* is the firm's index of the digital video recorder and safety protection system.

$S_{12} = (a_1, b_2)$ = (screening the criterion; countermeasure for collaborative cloud finance information system Firm 2);

$S_{13} = (a_1, b_3)$ = (screening the criterion; countermeasure for collaborative cloud finance information system Firm 3);

$S_{14} = (a_1, b_4)$ = (screening the criterion; countermeasure for collaborative cloud finance information system Firm 4);

4) Target:

According to definition 2, the Benefits, Opportunities and Risks targets are the target-is-the-best effective measured value, only the Costs is the lower-the-better effective measured value.

Step 3: Deciding

According to (4) in phase 2, the target criteria for the dimensionless linear normalization are simplified as,

Target 1: Use Eq. (2) to compute the effective measured value of benefits,

$R_{11}=1$, $R_{21}=0.53$, $R_{31}=0.55$ and $R_{41}=0.56$.

Target 2: Use Eq. (2) to compute the effective measured value of opportunities,

R_{12} =0.69, R_{22} =0.86, R_{32} =1 and R_{42} =0.72.

Target 3: Use Eq. (3) to compute the effective measured value of costs,

R_{13} =0.74, R_{23} =0.93, R_{33} =1 and R_{43} =0.97.

Target 4: Use Eq. (2) to compute the effective measured value of risks,

R_{14} =1, R_{24} =0.63, R_{34} =0.73 and R_{44} =0.66.

Table I illustrates the measured results, and Eq. (5) yields the synthetic effective measured value as: $R_{11}^{\Sigma} = 0.86$ Similarly, $R_{12}^{\Sigma} = 0.74$, $R_{13}^{\Sigma} = 0.82$ and $R_{14}^{\Sigma} = 0.73$. Thus, the best collaborative cloud finance information system is Firm 1.

TABLE I: MEASURED MULTI-CRITERIA OF COLLABORATIVE CLOUD SYSTEM OF FIS

System	Criteria				
	Benefits	Opportunities	Costs	Risks	Synthetic
Firm 1	1.00	0.69	0.74	1.00	**0.86**
Firm 2	0.53	0.86	0.93	0.63	0.74
Firm 3	0.55	1.00	1.00	0.73	0.82
Firm 4	0.56	0.72	0.97	0.66	0.73

Step 4: Testing

To confirm that the Firm 1 collaborative cloud system is stable, the end-users tested the system for one week. The decision makers used the same conditions to test the four Firms' FIS collaborative cloud system performance. During the test time decision makers applied monitoring software to measure CPU efficiency and MEM loading. During the test week the system never crashed. The system did need to be automatically shut-down and restarted. Clearly, the collaborative cloud system from Firm 1 is very stable and meets the end users' requirements.

IV. CONCLUSIONS

We suggest that customized collaborative cloud finance information system development be further divided into several cycles. Each cycle can be evaluated to control collaborative cloud finance information system quality. The grey decision making method can use fewer evaluators to measure gaps in quality as perceived by the groups. Gaps measure the difference between user perceptions and expectations and the software firm about collaborative cloud finance information system quality.

The system provider can obtain the end-users' expectations more precisely to evaluate modules and functions. According to the end-users' expectation gaps, the system supplier can access specific system requirements and opinions to modify the next collaborative cloud finance information system version.

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