KMITL Sci. J. Vol. 5 No. 1 Feb. 2005

THE ICTs EVALUATION SYSTEM FOR END USER'S PERSPECTIVE GROUP DECISION

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ABSTRACT

The objective of this research is to present an ICTs evaluation system in a way to assist a single or a group of decision makers, who are the end users or customers in Business-to-Customer (B2C), on the evaluation of the investment in an ICTs project. In this research, principally there are two main models, the Delphi Analysis and the Analytic Network Process (ANP) analysis. The result from the research provides benefits to the industry on the evaluation of ICTs, particularly at the assessment of the Enterprise Resource Planning (ERP) project. The contribution of this research lies in the methodology for integrating quantitative and qualitative analysis which can be implemented in a real industry.

KEYWORDS: Information Communication Technologies (ICTs), Delphi, Analytic Network Process (ANP)

1. INTRODUCTION

At the end user's viewpoint, the decision on the investment on ICTs hardware, software or both is particularly crucial for a long-running business. There are a number of papers, for example, [1], [2] which have attempted to design a model to evaluate IT projects. However, none of them proposed an approach that considers the evaluation system of ICTs from the end user's perspective. As a result, this research aims to assess and design an evaluation system in a holistic way to assist a single or a group of decision makers, as the end user, in the selection of the investment in the ICTs project.

2. THE BACKGROUND OF THE ICTs EVALUATION SYSTEM

In terms of the background of the evaluation system, there are a number of applications, for example, [3] applies a multi criteria decision method for selecting the best possible automated inspection device used in flexible manufacturing systems. They face the difficulty of

justifying the value of this advanced technology, particularly in financial terms. The papers [4], [5] develop a decision support tool for the selection of advanced technology by using Analytic Hierarchy Process (AHP), Costs and Benefits and Statistical Analyses to assess the value of investment. However, there is a need to achieve an evaluation system which is able to assess holistically the ICTs project selection from amongst Decision Makers (DMs).

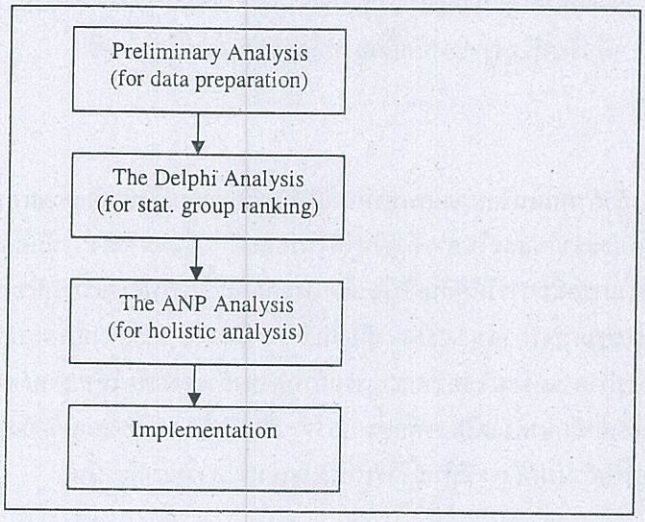

Figure 1: The ICT Evaluation System

As illustrated in Figure 1, the purpose of the evaluation system in this research is to assist a single or group of Decision Makers (DMs) in the selection of the ICTs project in which it can be either software or hardware or both. In achieving the purpose, principally it consists of two main models. Firstly, the Delphi Analysis, a well-known method in Group Decision Support System (GDSS), is applied to gather the average ranking data from amongst DMs. Secondly, the Analytic Network Process (ANP) analysis is brought in to analyse holistically which is able to perform quantitative and qualitative analysis. The literature below is relevant to the model above.

2.1 The Delphi Analysis

The paper [6] suggests that groups are at an advantage in integrating talents and providing innovative solutions to possibly unfamiliar problems; the fact that a group possesses a range of skills and knowledge above that of an individual is a distinct point in favour of the group. The goal of GDSS is support in the interface from amongst users in order to improve productivity of decision making meetings either by speeding up the decision making process or by improving the quality of the decision results.

Whilst there are a number of GDSS techniques in practice, the Delphi method developed by the Rand Corporation, is amongst the most practical, see [7]. Its objective is to obtain the most reliable consensus of opinion of a group of experts without direct confrontation. The Delphi method is composed of three essential processes. Firstly, to achieve judgements from individual DMs. Secondly, to collate and statistically summarise the individual judgements. Finally, to feed the collated information back to individual DMs without revealing their identity and seek for a revision in their judgements, if any. Theoretically, the sequence of collating, feedback and revision is repeated over several rounds until no further change is achieved.

2.2 The Analytic Network Process (ANP) Analysis

There are a number of researches using the Analytic Hierarchy Process (AHP) in the decision making analysis, however, the AHP assumes the system elements are uncorrelated between different main attributes and are unidirectional influenced with a hierarchical relationship. The ANP concepts known as "System with Feedback" approach has a capability to allow interdependencies amongst and between levels of attributes. ANP does involve the hierarchy relationship but does not require a strict hierarchical structure as in AHP.

Based upon evidence in [8], the original concept of ANP was first developed in 1975 but not formally published until 1980 in an AHP book, see [9]. In those days, the

concentrations were on non-linear network, dependencies and finding the solution of supermatrix.

According to the above research, the advantages of ANP are highlighted as follows:

- Allow feedback to be included in the decision model.
- Decision Maker does not need to decompose the relationships in a hierarchical form because vertical and lateral relationships are available.
- More complicated relationships can be analysed in a network system e.g. inner relationship or self-influenced relationship by itself etc.

3. AN ILLUSTRATION APPLICATION OF THE ICTs EVALUATION SYSTEM

In order to illustrate the use of the evaluation system of ICTs projects, in-depth, the assessment is conducted by using the Super Decisions software to perform the ANP Analysis in Thailand. In this application, it is necessary to add the alternatives cluster within each element relationship in which it should be able to compare with doing nothing. This is the Status Quo, as the objective is to achieve the value of investment in ICTs. The paper [2] states that the Enterprise Resource Planning (ERP), which is a well-known ICT investment, concerns particularly one of the most expensive software implementation projects in any size of company and is said to be the single business investment most likely to go wrong. We, therefore, choose ERP as an illustrative alternative in comparison with the Status Quo. For this exercise, the name of the ERP vendor shall not be revealed but it is replaced by the country where it originated. There are 4 ERP alternatives namely: USA 1, USA 2, EU and the last alternative is Status Quo which is also illustrated in Figure 4: All the decision makers (DMs) are well experienced in Information Technology (IT) field and informed of the real name of the ERP vendor in order to understand the information of each ERP software feature. The information has been distributed to the DMs equally and each priority impacted on ANP

calculation is calculated by using the Delphi method 1-9 point scale which is similar to the 1-9 point scale of the AHP.

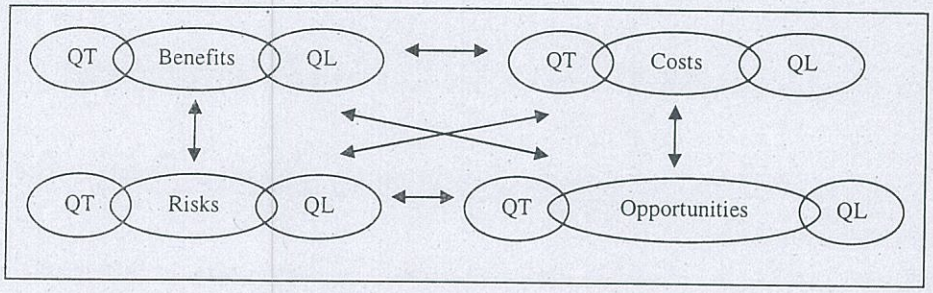

Figure 2: Relationships of Control Criteria
Remark: QT = Quantitative, QL = Qualitative

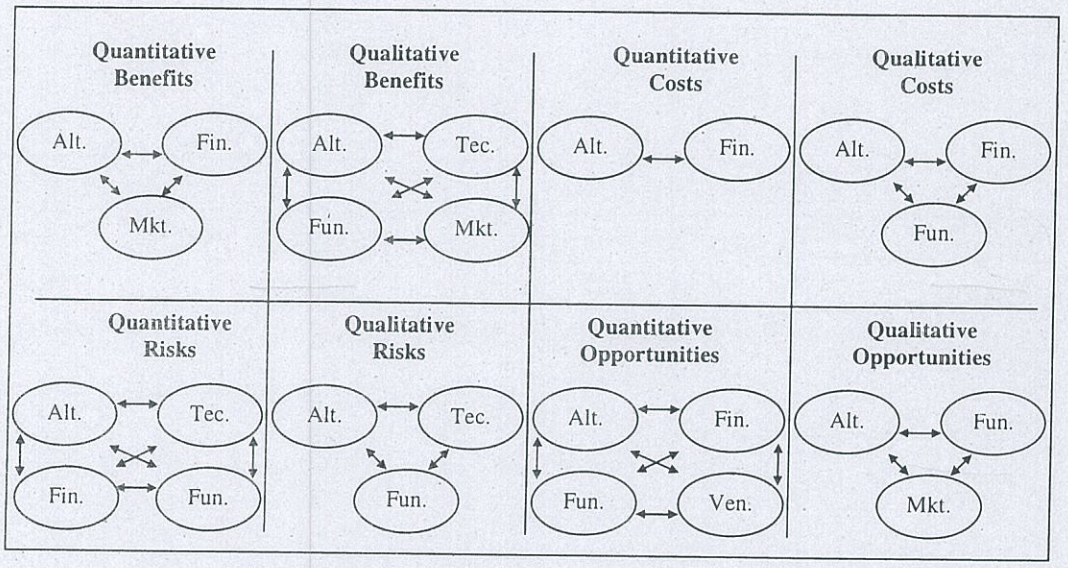

Figure 3: The Relationship of Control Sub-Criteria
Remark: Alt. = Alternatives, Fin. = Financial, Mkt. = Marketing, Tec. = Technical, Fun. = Functionality, Ven. = Vendor

After developing the Control Hierarchy, Clusters, Elements and the relationships *between Control Criteria and Control Sub-Criteria (Quantitative and Qualitative Benefits, Costs, Risks, Opportunities) as illustrated in Figure 2 and 3*, a set of pairwise comparison matrices is constructed in response to the questions formulated, to elicit the judgements from

those relationships in the Control Hierarchy. At this point, the Delphi Analysis is used to statistically calculate the pairwise comparison amongst DMs before the result is input to the ANP Analysis. There are 5 experienced DMs participated by using Super Decision Software, during which DMs spent approximately 2 hours to answer the comparison questions. The example of the question at section Quantitative Benefits Relationships between Alternatives and Financial is, for example, "with respect to Quantitative Benefits, which of a pair of ERP will yield greater expected income, and how much more (on a scale of 1-9)"? Each element of the cluster in each Control Criterion and Sub-Criterion will be subjected to a pairwise comparison as above.

Table 1: Priorities and Synthesised Results

	Benefits (0.28)		**Costs (0.27)**		**Risks (0.24)**		**Opportunities (0.21)**	
	Quanti.	**Quali.**	**Quanti.**	**Quali.**	**Quanti.**	**Quali.**	**Quanti.**	**Quali.**
Prior.	**(0.17)**	**(0.16)**	**(0.14)**	**(0.12)**	**(0.11)**	**(0.10)**	**(0.10)**	**(0.10)**
USA 1	0.2525	0.3120	0.2968	0.3250	**0.2175**	**0.2156**	0.2205	**0.2969**
USA 2	0.2002	0.2402	**0.1881**	0.2435	0.2399	0.2300	**0.3005**	0.2495
EU	**0.3827**	**0.3409**	0.2005	0.2209	0.2876	0.2969	0.2351	0.2446
Sta. Quo	0.1646	0.1069	0.3146	**0.2106**	0.2550	0.2575	0.2439	0.2090

Then, the explanation of ANP concept, Control Criteria (Figure 2) and the Relationship of Control Sub-Criteria (Figure 3), are given to the DMs and formulated to elicit the judgements. All the pairwise comparison results from the Delphi Analysis of the Control Criteria and Sub-Criteria (or called the Converged Supermatrices and the *normalised* results) are presented in Table 1. At Control Criteria, the rating indicates that Benefits is the most important (0.28) then Costs (0.27), Risks (0.24), and Opportunities (0.21) respectively. At Control Sub-Criteria, in terms of Benefits, Quantitative (0.17) and Qualitative (0.16) are amongst the most important because the ERP user needs a software that can generate benefits as well as being user friendly to its staff, to adapt with a flexibility feature to harmonise with

the previous system. That is the reason for leading the majority to select the EU ERP. The next most important priorities are Quantitative and Qualitative Costs (0.14, 0.12) because comparing between budget spent and incomes generated from ERP (in the form of time savings) are the main objectives of business which would lead to select USA 2 and Status Quo. The reason that Status Quo obtains high priority is because there is a concern that previous job efficiency may decrease due to the need to practise the new ERP system. (Remark: for Costs and Risks priority the lower the better.) In terms of Risks, Quantitative (0.11) is of greatest concern because a high investment in ERP needs to have a good return on investment which would lead the majority to select USA 1 due to the fact that the popularity of US made ERP is higher than EU made, therefore, the medium budget and long term reputation of the vendor can justify the ROI and can keep highly skilled staff in enjoyable work with the new ERP system. The Opportunities, Quantitative and Qualitative receive equal priority (0.10), the USA 2 and 1 are selected because the economies of scale of USA made can generate more opportunities for new service and market than the others. Based upon, Quantitaive and Qualitative Risks and Qualitative Opportunuties from Table 1, we can conclude that the DMs should invest in the ERP from USA1.

4. CONCLUSIONS AND RECOMMENDATIONS

The objective of this paper is to present an evaluation system to assist the end user, as a group or a single DM, on the evaluation of the investment in ICTs project. The value of this research lies in the methodology for integrating quantitative and qualitative analysis which can be implemented in a real industry. The evaluation system (as illustrated in Figure 1) is the combination of a number of models beginning from the Delphi to provide the result and feedback about inconsistencies amongst DMs, then ANP recognises the preference given to elements by individuals, therefore, integration of Delphi - ANP can increase in-depth analysis and contribute to providing a higher quality decision.

The contribution of this research is in developing a new approach to the B2C users who are planning to find the most appropriate investment for their ERP systems. The advantage of this research is that the model can include the qualitative data as well as the quantitative data because using quantitative data alone can mislead and be inadequate (see [5]). There is therefore a need to utilize quantitative and qualitative analysis together, as this case provides evidence.

Another advantage of Delphi - ANP is that in a group setting, status differences can reduce the willingness of group members to participate, and it is possible a few individuals can dominate the decision process. In Delphi - ANP, DMs are questioned systematically and feedback is provided anonymously. The logical structure of the approach and the impersonal feedback of Delphi reduce the inhibitory effects of status differences and the potential domination of the group by a few individuals.

In terms of limitations, by experience of the authors, this research is most appropriate if there are no more than 10 DMs because of the time consumed in processing the research. If there were more than 10 DMs, the model should be analyzed separately and then compared to achieve a single result. There is also a need to have a person who has a good understanding about the model concept to eliminate the bias and error. It is possible that a very new manufacturer who is totally inexperienced with any ERP system may have difficulty in using the model.

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