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THE ICTs EVALUATION SYSTEM FOR DISTRIBUTOR'S PERSPECTIVE GROUP DECISION

Athakorn Kengpol

Department of Industrial Engineering, Faculty of Engineering
King Mongkut's Institute of Technology North Bangkok,
1518 Piboolsongkram Rd., Bangkok 10800, Thailand
Tel./Fax. + 662-5874842. Email: athakorn@kmitnb.ac.th

ABSTRACT

The aim of this research is to provide an ICTs evaluation system in a way to assist the Small and Medium Enterprises (SMEs) who have a single or a group of decision makers, on the evaluation to become the ICT's distributor. The ICTs evaluation system is assessed by using Delphi and Analytic Network Process (ANP) model with an illustrative data based upon industrial entrepreneurs in Thailand. The advantage of this research is that the model can include the qualitative data as well as the quantitative data. The results of the research provide benefits to the industry, particularly at the assessment of the Enterprise Resource Planning (ERP) project.

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

1. INTRODUCTION

Several recent publications, for example, [1] states that in 1999, Business-to-Business (B2B) e-commerce in the USA predicted that in the year 2003, the USA B2B e-commerce should reach $1.3 trillion but in reality it turns out to be $2.4 trillion. They also mention that Europe B2B purchased goods and services worth more than $200 billion in the year 2002 which is a fourfold increase from the year 2000. Currently, several of the ICTs manufacturers who design a global product are seeking to have a local firm act as its sales and services representative (called a distributor) to the end user. This applies particularly to the SMEs manufacturers of the ICTs who have a limited budget to markets the product on an international level.

The example of this case is that there are a number of SMEs game software manufacturers from developed countries who want to establish their local distributor in developing country regions. From the company's viewpoint in a developing country, there is a

need to have an evaluation system in guiding the company for assessing a particular game software manufacturer to become its distributor. Based upon the literature, there are a number of papers, for example, [2] which has attempted to design a model to evaluate IT projects. However, none of them proposed an approach that considers the evaluation of ICTs from the distributor's perspective. As a result, this research aims to evaluate the ICT to assist a single or a group of decision makers, as is the distributor, in the selection of the investment in becoming a distributor.

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 paper [4] and [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 obtain an evaluation system which is able to assess holistically the ICTs manufacturer's selection from amongst the Decision Makers (DMs).

As illustrated in Figure 1, the purpose of the evaluation system model in this research is to assist a single or group of Decision Makers (DMs) in the selection to become the ICTs distributor in which the product can be either software or hardware or both. In achieving the purpose, principally the evaluation system 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.

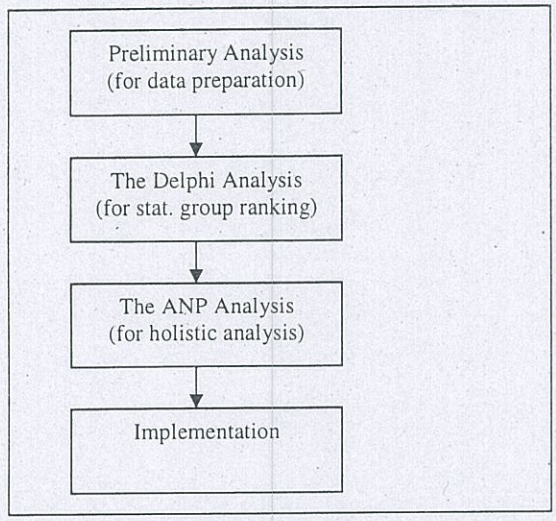

Figure 1: The ICT Evaluation System

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 over and above these of an individual is a strong point in favour of the group. The goal of GDSS is to support the interface from amongst users in order to improve productivity of the 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.

The strength of ANP e.g. systems with feedback or non-linear relationship assists them to generate more in-depth analysis than an approach such as AHP.

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 to become an ICTs distributor, in-depth, the assessment is conducted by using the Super Decisions software to perform ANP Analysis.

In this application, there is a need to add the alternatives cluster within each element relationship in which it should be able to compare with doing nothing, or called Status Quo. The paper [2] states that Enterprise Resource Planning (ERP), which is a well-known ICT investment, particularly concerns 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 the ERP as an illustrative alternative to become its distributor from amongst ERP manufacturers (vendor) in comparison with the Status Quo. For this application, the name of the ERP vendor shall not be revealed but is replaced by its country of origin. There are 4 alternatives, namely: USA 1, USA 2, EU and the last alternative is Status Quo. 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 background of each ERP vendor. 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 the same as the 1-9 point scale of the AHP.

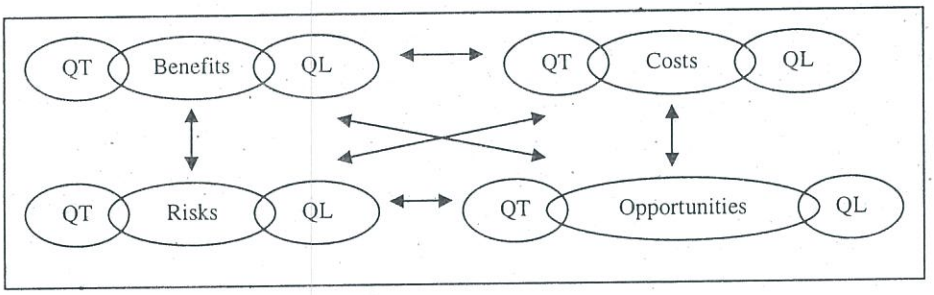

Figure 2: Relationships of Control Criteria
Remark: QT = Quantitative, QL = Qualitative

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. Five entrepreneurs (as DMs) participated by using Super Decision Software at which DMs spent approximately 1.5 hours answering the comparison questions. In terms of ANP software, the example of the question at the section Quantitative Benefits Relationships between Alternatives and Financial is, for example, "with respect to Quantitative Benefits, which of a pair of vendors 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.

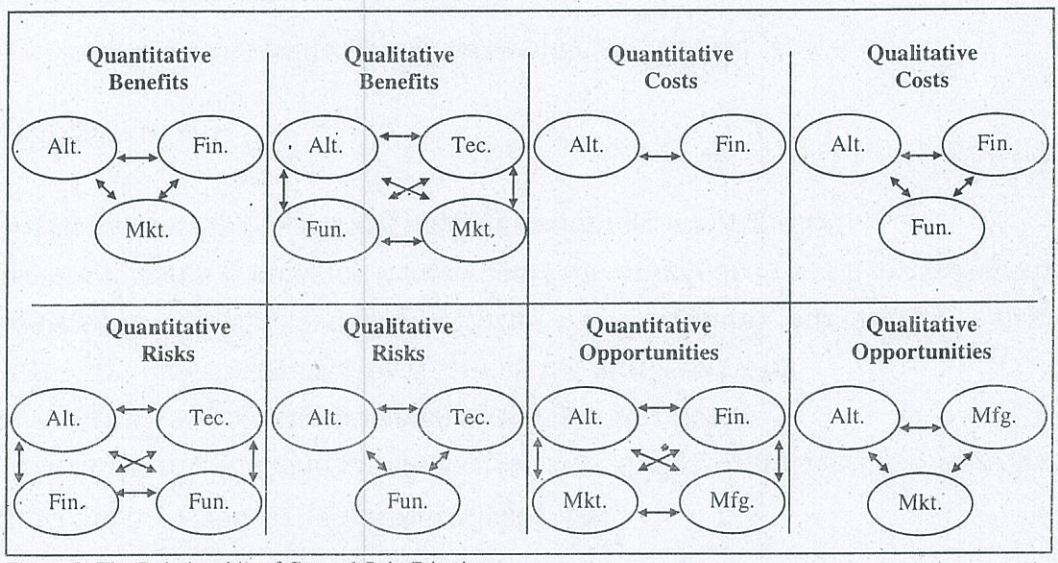

Figure 3: The Relationship of Control Sub-Criteria
Remark: Alt. = Alternatives, Fin. = Financial, Mkt. = Marketing, Tec. = Technical, Fun. = Functionality, Mfg. = Manufacturer

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 (0.26) then Risks (0.25), Opportunities (0.25), and Costs (0.24), respectively. At

Control Sub-Criteria, in terms of Quantitative Benefits, Risks, and Opportunities (all 0.15) are amongst the most important because from the view point of an entrepreneur the quantitative benefits, risks, and opportunities are critical for the survival and continuing growth of the firm. In case the firm needs to borrow money from the bank, the predicted income in its balance sheet needs to be approved by the banker in which the positive quantitative data become a must. That is why quantitative benefits, risks, and opportunities obtain the highest priority, despite the fact that Costs is also important, though having less effect on the profit than Benefits, see [5]. Qualitative Risks (0.12) receives a high priority (0.12) because losing of becoming a distributor from a large ERP vendor can decrease reputation of the firm.

Table 1: Priorities and Synthesised Results

	Benefits (0.26)		**Costs (0.24)**		**Risks (0.25)**		**Opportunities (0.25)**	
	Quanti.	**Quali.**	**Quanti.**	**Quali.**	**Quanti.**	**Quali.**	**Quanti.**	**Quali.**
Prior.	**(0.15)**	**(0.10)**	**(0.12)**	**(0.11)**	**(0.15)**	**(0.12)**	**(0.15)**	**(0.10)**
USA 1	0.2525	0.2561	0.1996	0.3390	**0.2106**	**0.2095**	0.2666	0.2465
USA 2	0.2425	0.2455	**0.1801**	0.2401	0.2305	0.2366	0.2765	0.2255
EU	**0.2936**	**0.3001**	0.2895	0.2304	0.2799	0.2877	**0.2966**	**0.2866**
Sta Quo	0.2114	0.1983	0.3308	**0.1905**	0.2790	0.2662	0.1603	0.2414

In terms of alternatives for choosing the distributor, both EU and USA made have different strengths and weakness, for example, USA has its strength in costs and risks from the economies of scale, and the long term reputation of the vendor can justify the Return on Investment (ROI) and can keep highly skilled staff in enjoyable work under the new system. On the other hand, the EU has its strength in benefits and opportunities (incomes) as the EU product distributor tends to market well in EU countries because of the tax incentive. Based upon, Quantitaive and Qualitative Benefits and Opportunuties from Table 1, we can conclude that the ERP from EU receive the highest priority from the DMs.

4. CONCLUSIONS AND RECOMMENDATIONS

The objective of this research is to present an evaluation system to assist the SMEs, as a group or a single DM, on the assessment of becoming the ICTs distributor. 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 model (as illustrated in Figure 1) is the combination of a number of models beginning with the Delphi to provide the result and feedback about inconsistency decisions amongst DMs, then ANP recognises the preference given to elements by individuals, therefore, the 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 entrepreneurs who are planning to find the most appropriate investment to becoming an ERP distributor. 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 can be seen from the case.

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 time consumed in processing the research. If there were more than 10 DMs, the model should be analysed 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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