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Identification and Ranking the Effective Factors on CRM Performance by Using of BSC and Fuzzy AHP

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ABSTRACT

Recently, several leading companies have taken advantage of the power of CRM to expand their markets sharply. These companies established CRM systems to maintain and further create loyal customers. The purpose of this paper is applying a new method to ranking the effective factors on CRM performance. Proposed approach is based on Fuzzy AHP and BSC methods. Balanced Scored Card is used to identify effective factors on CRM performance after that Fuzzy AHP method is used to determining the weights of the criteria by decision makers According to result, problems management (C9) is selected as the most important factor that effect on CRM performance.

Introduction

As the business world has shifted from product focus to customer focus, managers have found that the enhancement of existing customer relations brings the benefit of profitable and sustainable revenue growth. Customer relationship management (CRM) enables a business to understand better the stated, and especially the implied, requirements of its customers. Alajoutsija¨rvi, Klint, and Tikkaner (2001) have argued that through maintaining a consistent and permanently cooperative relationship with profitable customers, a business can considerably reduce the fluctuations of price and demand in its business cycles and stabilize its environment in the long run. Recently, several leading companies have taken advantage of the power of CRM to expand their markets sharply. These companies established CRM systems to maintain and further create loyal customers. Formulating CRM strategies can also create valuable marketing opportunities, increase customer value and enhance customer satisfaction in the pursuit of business excellence (Lin & Su, 2003). Customer relationship management (CRM) systems are a group of information systems that enable organizations to contact customers and collect, store and analyze customer data to provide a comprehensive view of their customers. CRM systems mainly fall into three categories: operational systems (used for automation and increased efficiency of CRM processes), analytical systems (used for the analysis of customer data and knowledge), and collaborative systems (used to manage and integrate communication channels and customer interaction touch points) (Iriana & Buttle, 2007). CRM is the overall process of building and maintaining profitable customer relationships by delivering superior customer value and satisfaction (Kotler & Armstrong, 2006).

Customer Relationship Management (CRM)

CRM is a complex term that involves several aspects within the organization and it cannot be reduced to only one of these aspects. Systemic approaches to CRM help organizations coordinate and effectively maintain the growth of different customer contact points or communication channels. The systemic approach places CRM at the core of the organization, with customer-orientated business processes and the integration of CRM systems (Bull, 2003). Customer Relationship Management is a concept that is based on the philosophy of using a combination of customers and marketing for relationship building (Kotler, 2003). Different approaches are carried out to define CRM ranging from narrow definitions (technical) to broad definitions (strategic) (Payne and Frow, 2006). From a technical point of view CRM, Chen and Chin (2004) defined as CRM as a methodology that heavily employs certain information technology such as database and internet to leverage the effectiveness of relationship marketing process. On the other hand, the wider definition of CRM concentrates on strategic orientation of CRM. For instance, Gray and Byun (2001) have defined CRM as a primarily strategic business process issue rather than technology which consists of the following components: Customer, Relationship, and Management. Gronroos

(2000) defined CRM in service marketing as a communicating process between customers and an organization's service in order to attract and maintain those customers who will be the organization's true customers who are using the organization's services. These customers also have a tendency to pay willingly for the organization's services at a higher price. Although researchers have developed different detentions for CRM, these definitions are closely related. There is a general acceptance among researchers of the categorization of CRM components. CRM consists of three major components: Technology, people, business culture and relationship, and Process (Ali and Alshawi, 2003). Handen (2000) considered that five dimensions (strategy, organization, technology, segmentation and process) are necessary to implement a CRM project effectively. To achieve the CRM objective, there is a series of aspects (Chen & Popovich, 2003):

The Processes through which the customer relates with the organization, according to Thompson, are: marketing, sales, and service. In addition to these processes, and depending on the area of business, there are other processes which are directly affected and that must also be considered.

• The Human factor (people) with a key role within the CRM strategy, both on behalf of employees within the organization (who must be immersed in a cultural change) as of the customers.

• The Technology is what facilitates implementing the CRM strategy; thus, it is necessary to know which of these technologies are and how they favor the CRM strategy.

Performance measurement can be defined as a part of a management process that is realized periodically in order to determine the success or quality of a particular process or activity (Oztaysi, 2009). Performance measurement is process of choosing different attributes (and indicators about them) and generating a combined evaluation based on these attributes. While numerous studies relating to CRM frameworks, IT, implementation strategies, and cases have been conducted, there has been a definite lack of academic effort addressing the issue of CRM performance measurement. We could find only a few papers in the literature dealing with CRM performance measurement or related issues (Lindgreen et al., 2006). The purpose of this paper is identification and prioritization of affective factors on CRM performance.

Balanced Scored Card (BSC)

Focusing exclusively on traditional financial accounting measures, such as return on investment and payback period, has implications, and has been criticized as the root cause for many problems in industries (Hafeez, Zhang, & Malak, 2002). As managers stress on short-term financial performance metrics, they have a tendency to trade off actions, such as new product development, process improvements, human resource development, information technology and customer and market development that can bring in long-term benefits, for current profitability, and this limits the investments with future growth opportunities (Banker, Chang, Janakiraman, & Konstans, 2004). Such actions of managers are a consequence of poorly designed performance measurement systems that only focus on short-term financial performance. In the attempt to solve the problem by supplementing financial measures with additional measures that can help evaluate the long-term performance of a firm, Kaplan and Norton introduced the BSC, a performance measurement framework that provides an integrated look at the business performance of a company by a set of measures, which includes both financial and non-financial metrics ([Kaplan and Norton, 1992], [Kaplan and Norton, 1993] and [Kaplan and Norton, 1996a]). The name of BSC is with the intent to keep score of a set of measures that maintain a balance "between short- and long-term objectives, between financial and non-financial measures, between lagging and leading indicators, and between internal and external performance perspectives" (Kaplan & Norton, 1996b). Of the BSC's four performance perspectives, one is a traditional financial performance group of items, and the other three involve non-financial performance measurement indexes: customer, internal business process, and learning and growth. The four perspectives are explained briefly as follows (Kaplan & Norton, 1996b):

• Financial: This perspective typically contains the traditional financial performance measures, which are usually related to profitability. The measurement criteria are usually profit, cash flow, ROI, return on invested capital (ROIC), and economic value added (EVA).

• Customer: Customers are the source of business profits; hence, satisfying customer needs is the objective pursued by companies. In this perspective, management determines the expected target customers and market segments for operational units and monitors the performance of operational units in these target segments. Some examples of the core or genetic measures are customer satisfaction, customer retention, new customer acquisition, market position and market share in targeted segments.

• Internal business process: The objective of this perspective is to satisfy shareholders and customers by excelling at some business processes that have the greatest impact. In determining the objectives and measures, the first step should be corporate value-chain analysis. An old operating process should be adjusted to realize the financial and customer dimension objectives. A complete internal business-process value chain that can meet current and future needs should then be constructed. A common enterprise internal value chain consists of three main business processes: innovation, operation and after-sale services.

• Learning and growth: The primary objective of this perspective is to provide the infrastructure for achieving the objectives of the other three perspectives and for creating long-term growth and improvement through people, systems and organizational procedures. This perspective stresses employee performance measurement, such as employee satisfaction, continuity, training and skills, since employee growth is an intangible asset to enterprises that will contribute to business growth. In the other three dimensions, there is often a gap between the actual and target human, system and procedure capabilities. Through learning and growth, enterprises can decrease this gap. The criteria include turnover rate of workers, expenditures on new technologies, expenses on training, and lead time for introducing innovation to a market.

Evaluation Methods

In this section, some essentials of the fuzzy set and Fuzzy AHP are briefly described as follows.

Fuzzy Sets and Fuzzy Numbers

Fuzzy set theory, which was introduced by Zadeh (1965) to deal with problems in which a source of vagueness is involved, has been utilized for incorporating imprecise data into the decision framework. A fuzzy set $\tilde{A}$ can be defined mathematically by a membership function$\mu_{\tilde{A}}(X)$, which assigns each element *x* in the universe of discourse *X* a real number in the interval [0,1]. A triangular fuzzy number $\tilde{A}$can be defined by a triplet (*a*, *b*, *c*) as illustrated in Figure 1.

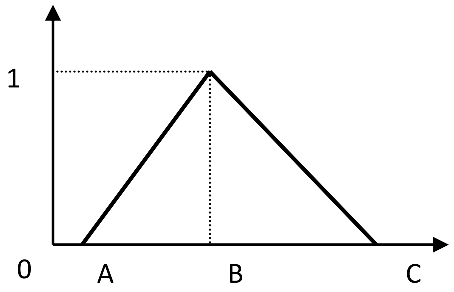

Figure 1. A triangular fuzzy number $\tilde{A}$

The membership function $\mu_{\tilde{A}}(X)$ is defined as

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-a}{b-a} & a \le x \le b \\ \frac{x-c}{b-c} & b \le x \le c \\ 0 & oterwise \end{cases} \tag{1}$$

Basic arithmetic operations on triangular fuzzy numbers $A_1 = (a_1,b_1,c_1)$, where $a_1 \le b_1 \le c_1$, and $A_2 = (a_2,b_2,c_2)$, where $a_2 \le b_2 \le c_2$,can be shown as follows:

Addition: $A_1 \oplus A_2 = (a_1 + a_2, b_1 + b_2, c_1 + c_2)$ (2)

Subtraction: $A_1 \ominus A_2 = (a_1 - c_2, b_1 - b_2, c_1 - a_2)$ (3)

Multiplication: if k is a scalar

$$K \otimes A_1 = \begin{cases} (ka_1, kb_1, kc_1), & k > 0 \\ (kc_1, kb_1, ka_1), & k < 0 \end{cases}$$

$A_1 \otimes A_2 \approx (a_1a_2, b_1b_2, c_1c_2)$, if $a_1 \ge 0$, $a_2 \ge 0$ (4)

Division: $A_1 \oslash A_2 \approx (\frac{a_1}{c_2}, \frac{b_1}{b_2}, \frac{c_1}{a_2})$,
if $a_1 \ge 0$, $a_2 \ge 0$ (5)

Although multiplication and division operations on triangular fuzzy numbers do not necessarily yield a triangular fuzzy number, triangular fuzzy number approximations can be used for many practical applications (Kaufmann et al. 1988). Triangular fuzzy numbers are appropriate for quantifying the vague information about most decision problems including personnel selection (e.g. rating for creativity, personality, leadership). The primary reason for using triangular fuzzy numbers can be stated as their intuitive and computational-efficient representation (Karsak, 2002). A linguistic variable is defined as a variable whose values are not numbers, but words or sentences in natural or artificial language. The concept of a linguistic variable appears as a useful means for providing approximate characterization of phenomena that are too complex or ill-defined to be described in conventional quantitative terms (Zadeh, 1975).

Fuzzy Analytic Hierarchy Process

First proposed by Thomas L. Saaty (1980), the analytic hierarchy process (AHP) is a widely used multiple criteria decision-making tool. The analytic hierarchy process, since its invention, has been a tool at the hands of decision makers and researchers, becoming one of the most widely used multiple criteria decision-making tools (Vaidya et al. 2006). Although the purpose of AHP is to capture the expert's knowledge, the traditional AHP still cannot really reflect the human thinking style (Kahraman et al. 2003). The traditional AHP method is problematic in that it uses an exact value to express the decision maker's opinion in a comparison of alternatives (Wang et al. 2007). And AHP method is often criticized, due to its use of unbalanced scale of judgments and its inability to adequately handle the inherent uncertainty and imprecision in the pairwise comparison process (Deng, 1999). To overcome all these shortcomings, fuzzy analytical hierarchy process was developed for solving the hierarchical problems. Decision-makers usually find that it is more accurate to give interval judgments than fixed value judgments. This is because usually he/she is unable to make his/her preference explicitly about the fuzzy nature of the comparison process (Kahraman et al. 2003). The first study of fuzzy AHP is proposed by Van Laarhoven and Pedrycz (1983), which compared fuzzy ratios described by triangular fuzzy numbers. Buckley (1985) initiated trapezoidal fuzzy numbers to express the decision maker's evaluation on alternatives with respect to each criterion Chang (1996) introduced a new approach for handling fuzzy AHP, with the use of triangular fuzzy numbers for pair-wise comparison scale of fuzzy AHP, and the use of the extent analysis method for the synthetic extent values of the pair-wise comparisons. Fuzzy AHP method is a popular approach for multiple criteria decision-making. In this study the extent fuzzy AHP is utilized, which was originally introduced by Chang (1996). Let X = $\{x_1, x_2, x_3,\ldots, x_n\}$ an object set, and G = $\{g_1, g_2, g_3,\ldots, g_n\}$ be a goal set. Then, each object is taken and extent analysis for each goal is performed, respectively. Therefore, m extent analysis values for each object can be obtained, with the following signs:

$$\tilde{M}^1_{g_i}, \tilde{M}^2_{g_i}, \ldots, \tilde{M}^m_{g_i}, \qquad i = 1, 2, \ldots, n$$

Where $\tilde{M}^j_{g_i}$ (j=1, 2, 3,…, m) are all triangular fuzzy numbers. The steps of the Chang's (1996) extent analysis can be summarized as follows:

Step 1: The value of fuzzy synthetic extent with respect to the ith object is defined as:

$$Si = \sum_{j=1}^{m} \tilde{M}^j_{g_i} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m} \tilde{M}^j_{g_i}\right]^{-1} \tag{6}$$

Where $\otimes$ denotes the extended multiplication of two fuzzy numbers. In order to obtain $\sum_{j=1}^{m} \tilde{M}^j_{g_i}$,we perform the addition of m extent analysis values for a particular matrix such that,

$$\sum_{j=1}^{m} \tilde{M}^j_{g_i} = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j\right) \tag{7}$$

And to obtain $[\sum_{i=1}^{n}\sum_{j=1}^{m} \tilde{M}^j_{g_i}]^{-1}$, we perform the fuzzy addition operation of $\tilde{M}^j_{g_i}$ (j =1,2,…,m) values such that,

$$\sum_{i=1}^{n}\sum_{j=1}^{m} \tilde{M}^j_{g_i} = \left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i\right) \tag{8}$$

Then, the inverse of the vector is computed as,

$$\left[\sum_{i=1}^{n}\sum_{j=1}^{m} \tilde{M}^j_{g_i}\right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i}\right) \tag{9}$$

Where u_i , m_i , $l_i > 0$

Finally, to obtain the S_j, we perform the following multiplication:

$$S_i = \sum_{j=1}^{m} \tilde{M}^j_{g_i} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m} \tilde{M}^j_{g_i}\right]^{-1}$$
$$= \left(\sum_{j=1}^{m} l_j \otimes \sum_{i=1}^{n} l_i, \sum_{j=1}^{m} m_j \otimes \sum_{i=1}^{n} m_i, \sum_{j=1}^{m} u_j \otimes \sum_{i=1}^{n} u_i\right) \tag{10}$$

Step 2: The degree of possibility of $\tilde{M}_2 = (l_2, m_2, u_2) \geq \tilde{M}_1 = (l_1, m_1, u_1)$ is defined as

$$V(\tilde{M}_2 \geq \tilde{M}_1) = sup[\min(\tilde{M}_1(x), \tilde{M}_2(y))] \tag{11}$$

This can be equivalently expressed as,

$$V(\tilde{M}_2 \geq \tilde{M}_1) = hgt(\tilde{M}_1 \cap \tilde{M}_2) = \tilde{M}_2(d) = \begin{cases} 1 & if\ m_2 \geq m_1 \\ 0 & if\ l_1 \geq u_2 \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & otherwise \end{cases} \tag{12}$$

Figure 2 illustrates $V(\tilde{M}_2 \geq \tilde{M}_1)$ for the case d for the case $m_1 < l_1 < u_2 < m_1$, where d is the abscissa value corresponding to the highest crossover point D between $\tilde{M}_1$ and $\tilde{M}_2$,To compare $\tilde{M}_1$ and $\tilde{M}_2$, we need both of the values $V(\tilde{M}_1 \geq \tilde{M}_2)$ and $V(\tilde{M}_2 \geq \tilde{M}_1)$.

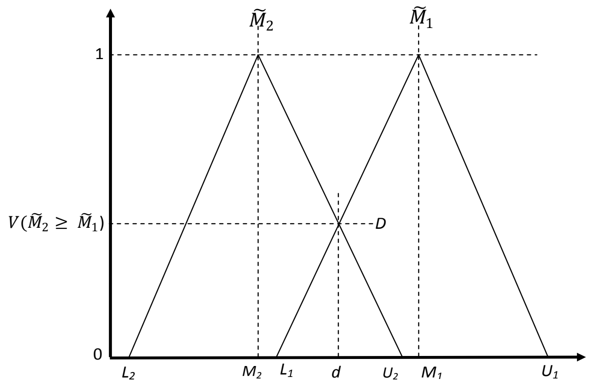

Figure 2. The intersection between M_1 and M_2 (Chang 1996)

Step 3: The degree of possibility for a convex fuzzy number to be greater than k convex fuzzy numbers M_i (i=1, 2… k) is defined as

$V(\widetilde{M} \geq \widetilde{M}_1, \widetilde{M}_2, \ldots, \widetilde{M}_k) = \min V(\widetilde{M} \geq \widetilde{M}_i)$, $i = 1,2,\ldots,k$

Step 4: Finally, $W = (\min V(s_1 \geq s_k), \min V(s_2 \geq s_k), \ldots, \min V(s_n \geq s_k))^T$, is the weight vector for $k = 1,\ldots,n$.

The Application of Proposed Approach

This research has been conducted in organization which presenting tourism services. The problem is prioritization of effective factors on CRM performance. For this reason, first of all, four type criteria based on Balanced Scored Card (BSC) perspectives are determined. Secondly, Fuzzy AHP method is proposed to realize the evaluation. Evaluation criteria for CRM performance are increasing profitability, efficiency improvement and cost management (Financial), customer service, customer satisfaction and customer acquisition (Customer), responsibility improvement, contacts improvement and problems management (Internal business process) and change management, personnel empowerment and knowledge generation (Learning and growth). The schematic structure established is shown in Fig 3.

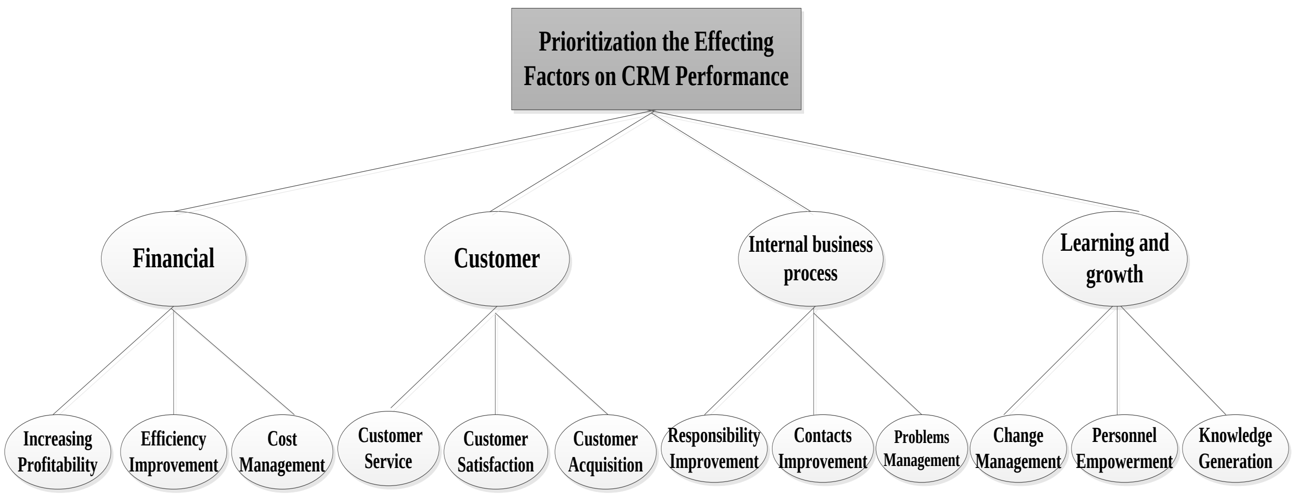

Figure 3. The conceptual framework: goal, criteria and sub criteria

After forming the decision hierarchy for ranking factors, the criteria to be used in evaluation process are assigned weights by using fuzzy AHP method. Geometric means of these values are found to obtain the pairwise compassion matrix on which there is a consensus (Table 1).

Table 1. Fuzzy pair-wise comparison matrix between sub criteria

	C_1	C_2	..	C_{11}	C_{12}
C_1	(1.00,1.00,1.00)	(1.50,2.10,2.70)	…	(2.00,2.40,3.10)	(2.50,2.90,3.70)
C_2	(0.44,0.55,0.80)	(1.00,1.00,1.00)	…	(1.60,2.40,3.90)	(0.20,2.73,5.00)
…	…	…	…	…	…
C_{11}	(0.36,0.51,0.65)	(0.44,0.56,0.78)	…	(1.00,1.00,1.00)	(2.20,2.80,3.40)
C_{12}	(0.29,0.37,0.42)	(0.20,1.84,5.00)	…	(0.30,0.38,0.57)	(1.00,1.00,1.00)

Thus, the weight vector from Table 1 is calculated and normalized as

W^t = (0.122, 0.089, 0.052, 0.101, 0.051, 0.091, 0.066, 0.072, 0.159, 0.08, 0.079, 0.09)

According to result, effective factors on CRM performance are ranked as follow:

C9 > C1 > C4 > C6 > C12 > C2 > C10 > C11 > C8 > C7 > C3> C5

Conclusions

As the business world has shifted from product focus to customer focus, managers have found that the enhancement of existing customer relations brings the benefit of profitable and sustainable revenue growth. Customer relationship management (CRM) enables a business to understand better the stated and especially the implied, requirements of its customers. The purpose of this paper is applying a new method to ranking the effective factors on CRM performance. Proposed approach is based on Fuzzy AHP and BSC methods. Balanced Scored Card is used to identify effective factors on CRM performance after that Fuzzy AHP method is used to determining the weights of the criteria by decision makers According to result, problems management (C9) is selected as the most important factor that effect on CRM performance.

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