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Evaluation and management of new service concepts: An ANP-based portfolio approach

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ABSTRACT

One of the most crucial decisions in service development is concept selection. Nevertheless, little attention has been paid to evaluation of new service concepts (NSCs). This study proposes an analytic network process (ANP) approach to evaluation of NSCs. ANP is a multiple criteria decision making (MCDM) method that can accommodate interdependency among decision attributes. The proposed approach measures feasibility of NSCs in terms of strategy, technology, market, implementation, and operation. The derived feasibility values of NSC alternatives are then employed to construct the NSC portfolio matrix, together with customers' preference. The NSC portfolio matrix is expected to aid decision making on concept selection and provide managerial implications for service development. A case of the mobile information and entertainment service is presented to illustrate the proposed approach.

1. Introduction

The importance of the service sector is ever-increasing, so is the intensity of competition (Metters & Marucheck, 2007). Service firms are forced to continuously innovate for survival in the increasingly dynamic competitive environments by introducing new services. New service development (NSD) has become an important competitive concern for many service firms; consequently, there is a growing body of knowledge on NSD (Johne & Storey, 1998). Recently, parallel to the concept of NSD which is strictly market-oriented, service engineering has emerged as an engineering-centric discipline for service development and been paid increasing attention from academia and practice. Service engineering is concerned with the systematic development and design of new services using suitable models, methods, and tools (Bullinger, Fähnrich, & Meiren, 2003). Although it is still in its infancy, the methods and tools for service engineering are not brand-new but existing ones in the more established fields of industrial engineering, operational research, and computer science (IBM Research, 2004). The existing engineering methodologies for traditional product development can be utilized along the whole service development process.

Concept evaluation and selection is one of such areas. As is in the case of new product development (NPD), the service development process is comprised of a series of decision making (Krishnan & Ulrich, 2001). One of the most crucial decisions in service development is to determine what services to develop, namely, concept selection, since it influences the direction of the remaining activities. Contrary to the extensive body of literature on concept evaluation and selection in NPD, however, relatively little attention has been paid to evaluation of new service concept (NSCs). It has been found that there is a general lack of research between idea generation and launch (Davison, Watkins, & Wright, 1989). In practice, most service firms have been observed to use informal procedures and qualitative methods (Easingwood, 1986; Edgett, 1993). The primary purpose of this study is to propose a systematic approach to evaluation of NSCs.

The concept evaluation problem needs to address the following two basic questions. The first question is what criteria to employ. Most of the previous attempts in NSD were centered on measuring customer preference, to put it differently, attractiveness from customers' view points. However, the bias to customers in concept selection has the following problems. Firstly, customers may not know what it is. Since it is hard to describe the exact concept and benefits of new services to customers (Edvardsson, Haglund, & Mattsson, 1995; Mohammed-Salleh & Easingwood, 1993), customers' judgment is not always reliable. Secondly, customers

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may not know what they want (Riquelme, 2001). They are often incapable of recognizing the utility of a new service until it is delivered. This feature is even more prominent in the technology-based services that have technology-driven characteristics. Thus, a wider range of issues that cannot be obtained from customers needs to be taken into account (Johne & Storey, 1998). The proposed approach measures "feasibility" of NSC alternatives. The feasibility is an umbrella concept concerned about whether it is reasonable to develop the NSC when considering internal capability and external environments.

The second question that needs to be answered is what method to use. A number of methods have been introduced and employed for concept selection (Yan, Chen, & Shieh, 2006). King and Sivaloganathan (1999) defined five types of concept selection methods: utility theory, analytic hierarchy process (AHP), graphical tools such as matrices, quality function deployment (QFD), and fuzzy logic. As one of the aforementioned methods, the AHP has been widely used for concept selection in NPD due its advantage that it can handle qualitative criteria (Marsh, Slocum, & Otto, 1993). However, the AHP cannot be applied to problems in which there exists interdependency among decision attributes. To address this limitation, this study employs the analytic network process (ANP) which allows for more complex interrelationships among decision elements (Saaty, 1996). The usefulness of ANP for concept selection in NPD was demonstrated by Ayağ and Özdemïr (2007).

In sum, this paper firstly develops an ANP approach to evaluation of feasibility of NSCs. We also propose the NSC portfolio matrix for final selection and continuous management of NSCs. The portfolio management for new products has been proved to be useful for evaluating concept alternatives and allocating scarce resources (Cooper, Edgett, & Kleinschmidt, 1999, 2001; McNally, Calantone, Durmusoglu, & Harmancioglu, 2007; Zapata, Varma, & Reklaitis, 2008). New services are the ones that need to be managed as a portfolio more than new products. Even if a NSC is evaluated to be unlikely to achieve success, it should never be discarded. Changes in the specification of NSCs are relatively more flexible and easier than new product concepts. Some adjustments to the existing concepts can easily generate new service ideas. Consequently, it is insisted that managing NSCs as a portfolio is imperative for successful NSD. The NSC portfolio matrix proposed as a tool for portfolio management of NSCs is constructed based on the results of the ANP-based evaluation, together with customers' preference. Since the ANP procedure only evaluates NSCs from the perspective of feasibility based on expert judgment, it neglects customers' preference to NSCs on which previous approaches have mainly focused. For a balanced view between feasibility and attractiveness to be reflected in final selection, the NSC portfolio matrix incorporates both dimensions.

The remainder of this paper is organized as follows. Section 2 reviews the underlying methodology of the proposed approach, the ANP. The proposed approach is explained in Section 3 and illustrated with a case study in Section 4. The paper ends with conclusions in Section 5.

2. ANP

The ANP is a generalization of the AHP (Saaty, 1996). The AHP, also developed by Saaty (1980), is one of the most widely used MCDM methods. The AHP decomposes a problem into several levels making up a hierarchy in which each decision element is considered to be independent. The ANP extends the AHP to problems with dependence and feedback. The ANP allows for more complex interrelationships among decision elements by replacing the hierarchy in the AHP with a network (Meade & Sarkis, 1999). Recent years, therefore, have seen a huge increase in the use of the ANP. In NPD, the ANP has been employed for various problems: determining the importance of product technical requirements to be incorporated into a zero-one goal programming (Karsak, Sozer, & Alptekin, 2003); determining the importance of factors in product design using QFD (Raharjo, Brombacher, & Xie, 2008); prioritizing the alternative connection types in design for disassembly (Güngör, 2006); selecting the best concept for new product development (Ayağ & Özdemïr, 2007).

The process of the ANP is comprised of the following four major steps (Lee, Kim, Cho, & Park, 2009; Meade & Sarkis, 1999; Saaty, 1996):

(i) *Step 1 (model construction)*: The problem is decomposed into a network in which nodes correspond to clusters. The elements in a cluster can influence some or all of the elements of any other cluster. These relationships are represented by arcs with directions. Also, relationships among elements in the same cluster can exist, and are represented by a looped arc.

(ii) *Step 2 (pairwise comparisons and local priority vectors)*: The elements of each cluster are compared pairwisely with respect to their impacts on other elements in the cluster. In addition, pairwise comparisons are made for interdependency. When cluster weights are required to weight the supermatrix at the next stage, clusters are also compared pairwisely with respect to their impacts on other clusters. The way of conducting pairwise comparisons and obtaining priority vectors is the same as in the AHP. The relative importance values are determined on a scale of 1–9, where a score of 1 indicates equal importance between the two elements and 9 represents the extreme importance of one element compared with the other one. A reciprocal value is assigned to the inverse comparison; that is, $a_{ji} = 1/a_{ij}$ where a_{ij} denotes the importance of the ith element compared with the jth element. Also, $a_{ii} = 1$ is preserved in the pairwise comparison matrix. Then, the eigenvector method is employed to obtain the local priority vectors for each pairwise comparison matrix.

(iii) *Step 3 (supermatrix formation and transformation)*: The local priority vectors are entered into the appropriate columns of a supermatrix, which is a partitioned matrix where each segment represents a relationship between two clusters. The supermatrix of a system of N clusters is denoted as the following:

$$
W = \begin{array}{c c} & \begin{array}{c c c c c} C_1 & \cdots & C_k & \cdots & C_N \\ e_{11}\cdots e_{1n_1} & \cdots & e_{k1}\cdots e_{kn_k} & \cdots & e_{N1}\cdots e_{Nn_N} \end{array} \\ \begin{array}{c c} & e_{11} \\ C_1 & \vdots \\ & e_{1n_1} \\ \vdots & \vdots \\ & e_{k1} \\ C_k & \vdots \\ & e_{kn_k} \\ \vdots & \vdots \\ & e_{N1} \\ C_N & \vdots \\ & e_{Nn_N} \end{array} & \begin{pmatrix} W_{11} & \cdots & W_{1k} & \cdots & W_{1N} \\ \vdots & & \vdots & \ddots & \vdots \\ W_{k1} & \cdots & W_{kk} & \cdots & W_{kN} \\ \vdots & & \vdots & \ddots & \vdots \\ W_{N1} & \cdots & W_{Nk} & \cdots & W_{NN} \end{pmatrix} \end{array} \quad (1)
$$

C_k is the kth cluster ($k = 1, 2, \ldots, N$), which has n_k elements denoted as $e_{k1}, e_{k2}, \ldots, e_{knk}$. A matrix segment, $\boldsymbol{W}_{ij}$, represents a relationship between the ith cluster and the jth cluster.