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Exploring smart phone improvements based on a hybrid MCDM model

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ABSTRACT

In recent years, the smart phone equipped with advanced mobile applications such as convenient and easy access to the Internet has become an essential tool for the multitasking era, recently termed the M-era. How we can understand customers' needs and gaps and subsequently satisfy these needs and lessen these gaps by creating a high value-added product to enhance customer satisfaction and increase the benefits to, and the competitive advantage of, enterprises? This study proposes a smart phone improvement for promoting the product value to satisfy the customers' needs with a hybrid MCDM model, which combines the DANP (DEMATEL-based ANP) and VIKOR. The DANP can establish an influential network relation map (INRM) to analyze interrelationship among dimensions/criteria by using the DEMATEL technique and then can measure the influential weights by combining the basic concept of the ANP. Furthermore, the VIKOR combining the influential weights in each criterion can integrate into each dimensional and overall evaluation based on the INRM to improve the gaps for achieving aspiration level and can enhance their competitive advantage in the smart phone market by lessening the gaps related to mobile convenience, thus creating a high value-added mobile phone product.

1. Introduction

Smart phones are electronic devices that combine the universal mobile phone and the personal computer. They integrate useful functionalities such as e-mail, web browsing, audiovisual amusement, word processing, mobile video, and a Global Positioning System (GPS). With the technological advancements of semiconductors, wireless communication, multiprocessors, real-time operating systems and high performance memory capacity, the performance and the size of smart phones have continually improved. Moreover, smart phones enable mobile conveniences, such as electronic payments, broadband internet access, high computing and communication performance, and multimedia platforms. According to investigation of the Gartner Group (Gartner), smart phones were considered the most desired consumption device by American consumers in 2011, thus surpassing mobile phones, e-book readers, media tablets and gaming machines. Gartner also predicts that the smart phone market will continue to expand and rapidly create significant business opportunities. Smart phones exemplify the multitasking era, or the M-era, by possessing the multiple features previously mentioned. Smart phone usage has continued to grow via the advancement in mobile marketing (Watson, McCarthy, & Rowley, 2013). Academic research involving smart phones, however, is scarce. Hence, the issue of smart phone has become more significant.

The study uses a hybrid MCDM (Multiple Criteria Decision Making) model combining the DANP (DEMATEL-based ANP) with VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje) to reduce the gaps corresponding to each dimension/criterion. This improvement model can provide useful information to enterprises regarding how to optimally satisfy customer needs. By adopting the realized improvement scheme, enterprises consequently attain a high enterprise competitive advantage. In this study, challenges to the interrelationship and influential weights among the dimensions/criteria of smart phones are resolved by MCDM, which Kleijnen (2005) explained as a method that can consider the methodology of multiple decision-attributes simultaneously with priority ranking and evaluation according to the feature/attribute of each alternative, thus helping decision-makers when faced with limited feasible alternatives. This study also uses DEMATEL (Decision Making Trial and Evaluation Laboratory), a technique developed by the Geneva Battelle Research Center in 1972 that is effective for understanding the causality structure by observing the degree of factor interactions (Tzeng, Cheng, & Huang, 2007; Tzeng, Chiang, & Li, 2007). Moreover, this study adopts the ANP (Analytic Network Process), which Saaty (1996) noted can address problems of interdependence and feedback among criteria. Hence, we use the inter-relational influence matrix of the DEMATEL technique with the basic concepts of the ANP to determine the

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influential weights of dimensions/criteria (called DANP). By using the DANP, individual weights and rankings can be used to determine the key factors for decision-making. Finally, the optimal decision-making alternative can be obtained with VIKOR, which probes enterprises' problems to suggest how to lessen the gaps in dimensions/criteria for achieving a specific aspiration level.

The traditional model (Büyüközkan, 2009; Büyüközkan, Feyzioğlu, & Nebol, 2008; Işıklar & Büyüközkan, 2007; Chen, Hu, Kuo, & Liang, 2010; Zavadskas & Turskis, 2011) assumes that the criteria are structured independently and hierarchically; however, in real world problems, the relationships between the criteria or dimensions are often interdependent and sometimes provide feedback-like effects. Büyüközkan et al. (2008) and Büyüközkan (2009) listed many MCDM methods, but assumed independent criteria in a hierarchical structure (such as additive model and weighting by AHP). In addition, the traditional model can only conduct the selection/ranking (achieving the relatively optimal result) without improvement for achieving the aspiration level. So this study attempts to achieve the aspiration level using an empirical case of an improvement plan for the smart phone and seeks to contribute to grasp the improvement strategies for promoting competitiveness of smart phones with a hybrid MCDM model based on an influential network relation map (INRM) and the degree of influence derived from the DEMATEL technique and the gaps derived from VIKOR method. Fig. 1 illustrates the basic concepts of problem-solving (Liou & Tzeng, 2012; Tzeng & Huang, 2011). Responses and social and personal attributes of the objectives may be represented as a data set (e.g., crisp, fuzzy set, and rough set) via investigation of the objectives. The data could be analyzed by using MCDM. MCDM could help decision-makers when faced with multiple-objective or multiple-attribute problems (Tzeng, Cheng, et al., 2007; Tzeng, Chiang, et al., 2007; Chiu, Tzeng, & Li, 2013; Lee, Tzeng, Yeih, Wang, & Yang, 2013; Liou, 2013; Liou & Tzeng, 2012).

The paper is organized in the following order: Section 2 describes the evaluation attributes of the smart phone; Section 3 illustrates the research methods; Section 4 provides an empirical case analysis for smart phones; and Section 5 presents the conclusion.

2. Evaluation attributions of the smart phone

Smart phones have become a system intimately associated with areas such as personal needs, commercial applications, and Internet access. Young people play games, listen to music, and watch YouTube videos with smart phones to stay abreast of the latest trends. Previously, a computer would have been required to perform these actions (Pooters, 2010). A smart phone combines a general mobile phone with a personal digital assistant (PDA), which includes more convenient and mobile commercial services such as electronic wallets and electronic payments, broadband Internet access and multimedia (Chang, Chen, & Zhou, 2009). In the current communication market, Internet access via mobile phones is becoming increasingly popular with the constant development of Internet networks and information science. Moreover, mobile communication is being popularized, thus gradually increasing consumers' desire to use smart phones (Watson et al., 2013). As smart phones become powerful mobile tools for wireless internet access by combining the advantages of mobile phones and Internet networks, an effective evaluation method of their services is important. In this regard, this paper explores the evaluation attributes with the existing literature and questionnaire responses and suggests that the three dimensions of customer equity, product function and mobile convenience can influence consumer willingness to purchase a smart phone.

Customer equity, as advanced by Rust, Zeithaml, and Lemon (2000), comprises value equity, brand equity and retention equity,

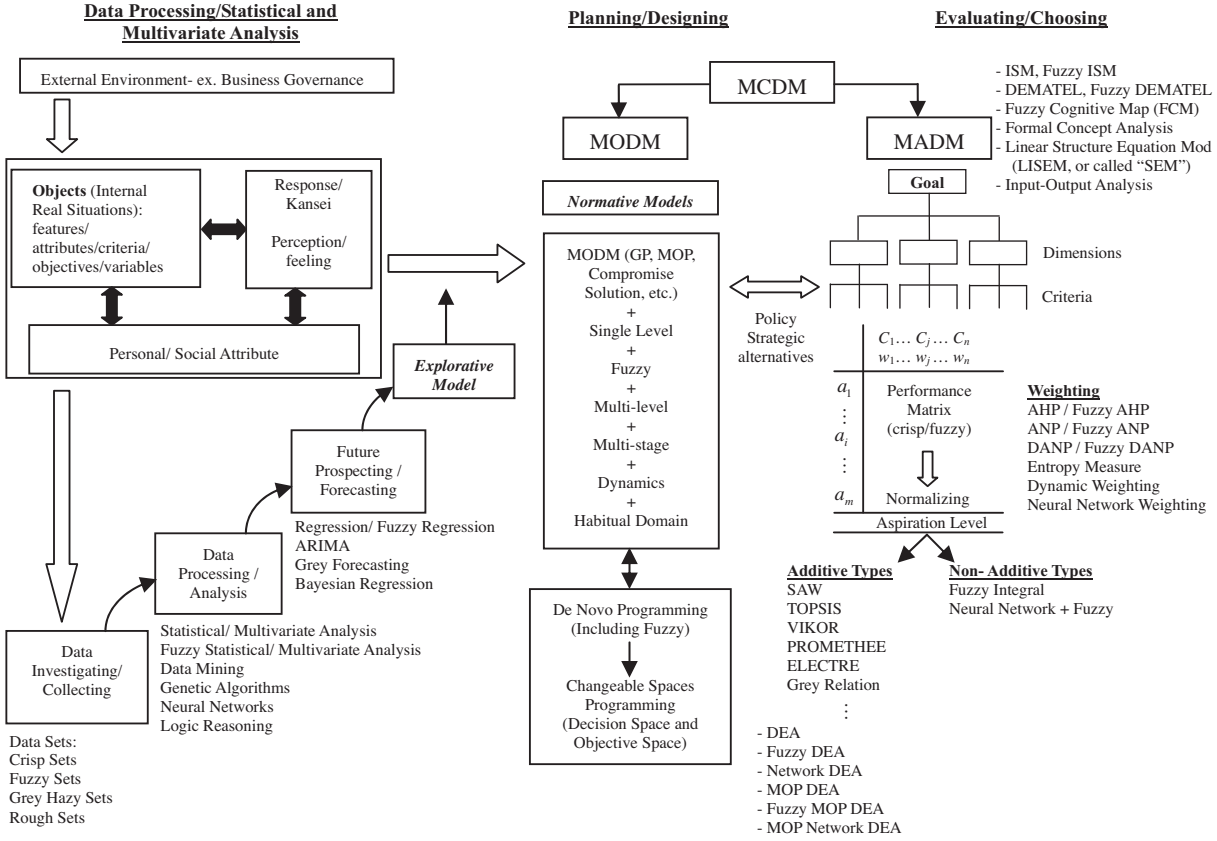

Fig. 1. The basic concepts and framework in research methods for problem-solving (Liou & Tzeng, 2012; Tzeng & Huang, 2011).