New financial service development for banks in Taiwan based on customer needs and expectations

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The purpose of this study aims to employ an analytic approach to analyze efficient managerial strategies for advancing new service development (NSD) by involving viewpoints of customer needs and expectations within a financial service context. This paper uses a sample of potential banks' credit card applications, customers' preferences and satisfaction ratings, and new credit card service data with the applications of both analytic hierarchy process and VlseKriterijumska Optimizacija I Kompromisno Resenje to analyze customer satisfactions and preferences simultaneously. Then, it applies the importance–performance analysis technique to diagnose managerial strategies for reducing the customer gaps between customer perceptions and expectations. The study emphasizes the importance of analyzing customer preferences and reducing gaps between customer satisfactions of perceptions and expectations to ensure NSD success.

Keywords: new service development; financial services; customer needs; customer expectations; gap reduction strategies

Introduction

Involving customers in the new service development (NSD) is an increasingly critical issue. Customers possess considerable latent power, as they can choose to use or not use the services, thus having a direct impact on the success of NSD (Smith & Fischbacher, 2005). A service development strategy that does not consider potential customer patterns, needs, or backgrounds is outdated and bound to be ineffective as it fails to include critical factors that influence service success (Kumar & Kumar, 2004). The goal of service development is to attract, satisfy, and fulfill customer needs and expectations; the process of receiving customer input is very important in developing new services (Gustafsson, Ekdahl, & Edvardsson, 1999).

Financial services often involve direct interactions between customers and providers, and customers play a more active role in the financial service development process (Olsen & Sallis, 2006). Financial service sectors should emphasize more the fulfillment of customer needs and expectations when they continuously improve existing services or develop new ones for sustainable survival and continued growth in the industry. Customer expectations are primarily based on customer needs. They are also influenced by the company's reputation and the customer's previous experience with the services or

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the company's marketing efforts (Edvardsson, 1997). Every financial service firm must take a systematic approach to analyzing customer expectations and needs to improve an existing financial service or to develop a new service (Gustafsson et al., 1999). Zeithaml and Bitner (2003) developed the service gap model with the focus on the customer gap, which is the difference between customer expectations and perceptions. Service providers need to design appropriate strategies to reduce the gap. We selected the credit card service as an example of financial services to provide an analytic approach and to quantitatively calculate the customer gap based on the sample customer needs and also to find out efficient strategies of reducing the gap.

In this study, we investigated both customer preferences and customer satisfactions, which were assessed in terms of customer perceptions and expectations of the financial service. We employed an integrated approach to combine the AHP (analytic hierarchy process) method with the VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje in Serbian, means Multicriteria Optimization and Compromise Solution) method to consider customer preferences and customer satisfactions simultaneously. We also addressed managerial strategies to improve the new financial service development by reducing the gaps between customer satisfactions of perceptions and expectations through the importance–performance analysis (IPA) technique.

The remainder of this paper is organized as follows. The second section reviews the relevant literature on the service concept model and the service gap model as the conceptual background of our analytic approach. The third section presents the research method to describe AHP, VIKOR, and IPA methods as well as sample and data collection. The fourth section presents results and analyses. The fifth section discusses results and implications. The final section presents conclusions, limitations, and recommendations.

Literature review

Service concept model

The goal of NSDs is to attract and keep target customers who are satisfied, and therefore, it is appropriate and often necessary to involve them in the process of NSDs (Gustafsson et al., 1999). In order to involve customers in NSDs, Edvardsson (1997) proposed the service concept model with the focus on customer needs and how these needs will be met in the form of service content or design of the service package. In other words, the matching of customer needs and service offer is the key to having a successful service business. The service concept model, illustrated in Figure 1, is a detailed description of customer needs
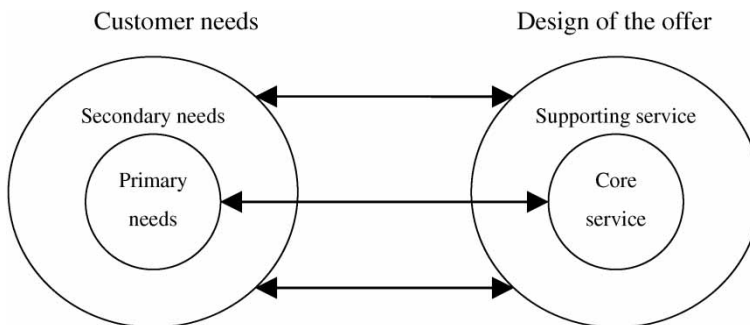

Figure 1. Model of the service concept.
Source: Edvardsson, Gustafsson, Johnson, and Sanden (2000, p. 47).

and how they should be satisfied as well as how they are to be achieved. It includes both the domain of needs with respect to primary and secondary customer needs and design to provide core and supporting services to meet these needs. To match customer needs and service is crucial. The service concept model defines the demand for the attributes or features that must be present for a service with the right quality to be realized. When designing a service concept, attention should be given to the fact that an individual service is only part of the system that includes other existing or new services. To achieve the right quality and high productivity in the NSD, these aspects should also be taken into account.

Although both academia and practitioners are interested in NSDs, there is a dearth of research on how customers' viewpoints are involved in NSDs (Alam, 2002). Previous marketing research on involving customer needs in NSDs is also limited (Matthing, Sanden, & Edvardsson, 2004). In terms of the new financial service development, Alam (2002) had studied customer involvement by case research of investment and insurance services firms operating in Australia, but this study focused only on describing actual activities performed by both customers and service providers of NSD process through the exploratory interviews. There is still a paucity of literature on empirically tracking customers' true needs and expectations and involving the customers' viewpoints in new financial service developments.

Customer needs and preferences

According to the service concept model, a successful financial service development should focus on customers' primary needs in designing the core service (Edvardsson, 1997). Hence, one crucial aspect of investigating customer needs is to recognize the target customers' preferences. In order to understand customer preferences, the service firm should consider relative benefits that customers can obtain from various features of the service. When faced with a choice task, customers prefer to use features that they are already familiar with or new features that are understandable (Lynch, Marmorstein, & Weigold, 1988). The propensity to use either one or both sets of features is a function of the users' search costs and benefits associated with processing the information associated with the features (Verma, Iqbal, & Plaschka, 2004). Therefore, to understand customer choice drivers for financial services, we need to assess how customers make trade-offs among features of financial services, and this can be formulated as a multiple-criteria decision making (MCDM) problem.

A lot of research has investigated MCDM problems in analyzing decision makers' preferences (Lam & Chin, 2005; Lin & Hsu, 2003; Lin & Wu, 2008; Tsai & Chou, 2009; Tsai, Chou, & Hsu, 2009; Tsai & Hsu, 2008; Tsai, Lo, & Chou, 2009). MCDM analysis had also been successfully employed in analyzing customers' preferences (Soota, Singh, & Mishra, 2008; Yoo & Choi, 2006). Some other previous studies of customer preferences in financial services chose to use conjoint analysis, ANOVA method, or both (Karjaluoto, 2002; Pass, 2005; Vyas, 2005); others used the multinomial logit model (Ding, Verma, & Iqbal, 2007; Verma et al., 2004). But these methods only showed the relationship between customer preferences and customer choices individually and could not consider customer preferences and customer satisfactions simultaneously to help improve new financial service developments directly.

An IPA technique (Martilla & James, 1977) is useful to diagnose the managerial strategies by analyzing customer preferences (importance) and customer satisfaction (performance) simultaneously within an MCDM problem. For measuring importance, it uses stated or statistically inferred methods to determine customer importance ratings

for attributes (Garver, 2003; Hansen & Bush, 1999; Lambert & Sharma, 1990; Matzler, Bailom, Hinterhuber, Renzl, & Pichler, 2004). Stated importance ratings often display a lack of discriminating power between customer preferences of attributes (Myers, 2001). Customers often think everything is 'very important' and the previous analysis reveals that 78% of customer service attributes is 'very important' with little variance in importance between these attributes (Garver, 2003). Although statistically inferred methods can overcome the shortcomings of stated importance ratings, they have assumptions of a relatively normal distributed data, linear relationships between independent and dependent variables, and relatively low multicollinearity between independent variables; in customer satisfaction research, these assumptions are almost always violated (Garver, 2003).

The AHP method is an MCDM tool that uses the pair-wise comparisons to determine the relative rankings or preferences of decision alternatives. Prior studies used the AHP method to deal with customer preferences in manufacturing and chemical industries (Helm, Scholl, Manthey, & Steiner, 2004; Partovi, 2007; Soota et al., 2008). Helm et al. (2004) compared the conjoint analysis and the AHP method and found that the AHP method performed slightly better. The AHP method also has an advantage in obtaining a set of weights from measuring relative importance of service attributes and this set of weights representing customer preferences can be subsequently used to evaluate customer satisfactions by considering both customer needs and expectations simultaneously. In this paper, we employed the AHP method to assess customer preferences and needs in terms of improving the financial service development.

Service gap model

Zeithaml and Bitner (2003) developed the service gap model as shown in Figure 2. The service gap model positions the key concepts, strategies, and decisions in services marketing in a manner that begins with the customer and builds the organization's tasks around what is needed to close the gap between customer expectations and perceptions (Zeithaml & Bitner, 2003). The central focus of the service gap model is the customer gap, which is the difference between customer's expectation and perception. The service gap model conceptualizes perceived service quality as the 'service quality gap', which is the difference between the expectation of service quality from an ideal excellent service provider and the perception of service quality from the current service provider (Mukherjee & Nath, 2005). Firms need to close the customer gap in order to satisfy customers and build long-term
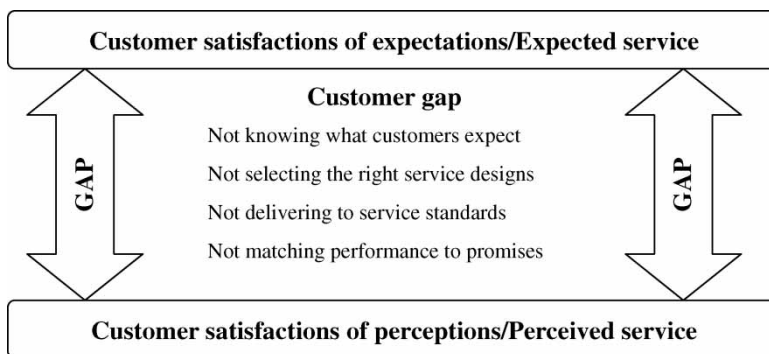

Figure 2. Service gap model.
Source: Zeithaml and Bitner (2003, p. 533).

relationship with them. Accordingly, customer perceptions are subjective assessments of actual service experiences; customer expectations are the ideal or reference point for performance against which service experiences are compared. The sources of customer expectations consist of marketer-controlled factors, such as advertising, as well as factors that the marketer has limited ability to affect, such as innate personal needs (Zeithaml & Bitner, 2003).

The service gap model based on customers' viewpoints had been applied widely in assessing the quality of various services, such as airline services (Frost & Kumar, 2001), room services (Luk & Layton, 2002), ERP services (Yeh, Yang, & Lin, 2007), retail services (Lee-Ross, 2008), healthcare services (Wicks & Chin, 2008), and shipping services (Chen, Chang, & Lai, 2009). In terms of financial services, the service gap model had also been employed to analyze customer perceptions of current/deposit account service quality in UK retail banking (Blanchard & Galloway, 1994). Mukherjee and Nath (2005) individually assessed the service gap model and an MCDM approach, the Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS), to investigate the service quality for leading Indian commercial banks. They found that the rankings obtained from the two approaches can provide equally good measurement of service quality, but the two approaches should not be used in an interchangeable manner (Mukherjee & Nath, 2005). However, seldom published research papers had integrated the concept of the service gap model into an MCDM approach to eliminate or reduce the customer gap.

Customer expectations and satisfactions

Customer perceptions and expectations of a service are focused evaluations of customer satisfactions that reflect the customers' perceptions of the attributes or features of the service (Zeithaml & Bitner, 2003). Prior studies showed that greater customer satisfactions improve performances of financial services, including both sales volume (Megicks, Mishra, & Lean, 2005) and relationship quality through customer trust, commitment, and loyalty (Liang & Wang, 2004; Ndubisi, 2006). Typically, customer satisfaction surveys requested participants to rate the performance. Researchers have traditionally measured either actual or relative performance for input IPA (Garver, 2003). Actual performance scores are not compared with the competition or an ideal performance and have a problem in deciding the split point to discriminate high performance and low performance (Matzler et al., 2004). By examining relative performance, researchers can easily use the midpoint of the performance axis as the split point to discriminate high performance and low performance, and calculate performance scores by comparing a firm's performance to that of the best competitor (Garver, 2003). The problem arises if the competitors all have equivalent or even worse performances; these competitors are not appropriate reference points. VIKOR method can be used to avoid such problems; it is an MCDM method to build a ranking index based on the particular measure of 'closeness' to the 'ideal' solution. Another MCDM method, TOPSIS, is also able to measure the distance to the 'ideal' solution, but it suffers from theoretical shortcomings of rankings (Opricovic & Tzeng, 2004). In this paper, we integrated the concept of the service gap model into the VIKOR method to evaluate the relative distances between the perceptive performances and the ideal performances of the new financial services to illustrate the customer gap.

In summary, financial service providers need to match customers' primary and secondary needs at the NSD process based on the service concept model; according to the service gap model, successful service providers are those who are able to zero the gaps between

customer perceptions and expectations. To be successful, service providers need to understand customer needs and expectations in order to adopt good service strategies (Kumar & Kumar, 2004). In this paper, we employ an integrated MCDM approach, which is able to analyze customer needs and expectations simultaneously, to devise managerial strategies of efficiently reducing the customer gaps in the new financial service development.

Research method

Based on the service concept model and service gap model, this study designed an integrated approach to evaluate the customer gaps between customer expectations and perceptions and analyze managerial strategies for reducing the gaps within the credit card service context. The credit card service is a high manpower and computer-intense product. In the past, financial attributes such as interest rates, speed, simplicity and ease of issuing credit cards, the content of bill statements, and other value-added attributes such as insurance and bonuses were crucial factors influencing customers to apply for the credit cards. With the advent of an era of many people with several credit cards and low interest rates, customers begin to put more emphasis on other attributes such as the quality of customer service, image of bank, and other value-added activities.

In this study, we selected three banks in Taiwan – Taishin Bank, Taipei Fubon Bank, and Citibank Taiwan Ltd. – as the research objectives and used each one of their new ordinary credit cards as our evaluated alternatives. These three ordinary credit cards were initially launched by each bank during November 2007 to January 2008. These three banks were targeting relatively low-income customers with minimum application requirements, 20 years old with an annual income of NT$220,000 (about US$7000).

The analytic approach

Our analytic approach consists of two phases, a gap illustration phase and a strategy analysis phase. In the gap illustration phase, we combined the AHP and the VIKOR method. The AHP method was used to evaluate customer preferences; the VIKOR method was applied to integrate the customer preferences and customer satisfactions to illustrate the customer gaps. In the strategy analysis phase, we used the IPA technique to analyze the managerial strategies for reducing the customer gaps.

The AHP method has been successfully used to detect decision makers' preferences in a variety of fields such as hospitality management (Tzeng, Teng, Chen, & Opricovic, 2002), conflict management (Lam & Chin, 2005), public transportation (Tzeng, Lin, & Opricovic, 2005), market strategies of private hotels (Lin & Wu, 2008), and manufacturing product development (Soota et al., 2008). Davies (2001) showed that AHP has also been applied to consumer selection decisions. Saaty (1980) first introduced the AHP method for decision structuring and decision analysis. The AHP method is also a measurement theory that prioritizes the hierarchy and consistency of judgmental data provided by a group of decision makers. Seol and Sarkis (2005) compared AHP with other approaches and found that AHP had the advantage of allowing users to break down and categorize factors that can be ranked within groups and among factors of all groups.

AHP incorporates the evaluations of all decision makers into a final decision by pairwise comparisons of attributes or criteria. This method is designed to incorporate tangible as well as non-tangible factors, especially where the subjective judgments of different individuals constitute an important part of the decision process. The process of the AHP method requires the decision makers to develop a hierarchical structure for the factors

or criteria that are explicit in the given problem and to provide preference judgments about the relative importance of each of these factors or criteria. The AHP method is able to provide a prioritized ranking order indicating the overall preference by the obtained weights for each of the criteria. The weights assessment procedure of the AHP method is presented in Appendix 1.

After each alternative is evaluated according to each criterion function by each target customer, the VIKOR method can be applied to calculate the relative distance between a compromise solution and the ideal point, helping the decision makers to reach the final decision. The VIKOR method has been introduced as one applicable technique to deal with MCDM tasks by developing a ranking index based on the particular measure of 'closeness' to the 'ideal' solution. The main features of this method are presented in Appendix 2. Opricovic and Tzeng (2004) provided and compared two MCDM methods, VIKOR and TOPSIS, which are based on an aggregate function representing 'closeness to the ideal point'. Their results showed that the VIKOR method was slightly better than the TOPSIS method. The VIKOR method has been applied to several different fields such as hospitality management (Tzeng et al., 2002), public transportation (Tzeng et al., 2005), policy-making (Yang & Wang, 2006), and university development (Chen & Chen, 2008).

The VIKOR method is based on an aggregate function (G_j) which represents the aggregate distance relative to the ideal point and the negative point; it is calculated by the equation (A3) in Appendix 2, as a function of measure C and measure D. The measure C, representing 'concordance' and calculated by the equation (A1), provides a maximum 'group utility' of the 'majority', while the measure D, representing 'discordance' and calculated by the equation (A2), refers to a minimum of individual regret for the 'opponent'. Hence, the VIKOR method provides measurements of determining the aggregate relative distance between a perceived alternative and the ideal point and is appropriate and useful for this study.

In order to involve customer preferences in computing the relative distance between a compromise solution and the ideal point, we applied the weights of criteria obtained from the AHP method as input into the VIKOR method as w_i, $i = 1, 2, \ldots, n$; n is the number of criteria. For simultaneously considering both customer preferences and satisfactions to determine the relative distance between the perceived alternative (customer satisfactions of perceptions) and the ideal point (customer satisfactions of expectations), we used the VIKOR method to integrate the weights of customer preferences and customer satisfactions of each alternative (credit card service) and to illustrate the aggregate customer gaps of each credit card issuing bank.

In the strategy analysis phase, we employed the IPA method to diagnose the managerial strategies for reducing customer gaps. The traditional IPA method was introduced by Martilla and James (1977). In the traditional IPA method, attributes or criteria pertaining to a particular service are evaluated on the basis of how important each is to the customer, and how the service is perceived to be performing to each attribute (Sampson & Showalter, 1999). In this study, we first applied the AHP weight of each criterion as the relative importance value of each criterion, and then we used the unweighted relative distance to replace the performance and to represent as the relative unimproved distance. The unweighted relative distance ($(f_i^* - f_{ij})/(f_i^* - f_i^-)$) indicates the relative unimproved distance of the ith criterion (c_i) of the jth credit card (OC_j) (i.e. f_i^* is the evaluated value of the ith criterion (c_i) of the ideal point; f_i^- is the evaluated value of the ith criterion (c_i) of the negative point; f_{ij} is the evaluated value of the ith criterion (c_i) of the jth ordinary card (OC_j)). Therefore, we can map the unimproved distance (x-axis) and the importance value (y-axis) of each alternative ordinary credit card on a two-axis map.

Development of the multiple-criteria evaluation framework

Before data collection, it is necessary to develop a hierarchy evaluation framework. In order to empirically establish the multiple-criteria evaluation framework of credit card services, we collected in-depth qualitative data from high-level executives in financial service industry and customers with several year experiences in holding credit cards. Then, we requested them to suggest credit card service attributes and criteria that reflected our conceptual variables. Based on the executive and customer responses, a review of existing credit card service offerings, an assessment of possible new features, and a review of academic and practitioner literature, we selected market drivers and their extensions and also designed a framework that covered all the core market driver issues. This framework was then presented to the initial five executives in the financial services industry, all of whom refined the original list of attributes and criteria. Finally, we showed the resultant list of attributes to two business school professors to verify our classification. Table 1 lists the final set of attributes and their classification mapped onto various conceptual variables of interest.

Sample and data collection

Since we need to obtain data regarding satisfactions and preferences of target customers with respect to three credit cards, we categorized the characteristics of the target customers by interviewing five high-level executives in the financial services industry. We, along with these five executives, collectively determined to focus on the target customers of 25–35 years old and NT\$22,000 to NT\$1 million annual earnings according to the employment rate and basic annual earnings of Taiwan people. We formed a consumer panel of 100 target customers (50% male and 50% female) from general manufacturing, business service industries, hi-tech industries, healthcare industries, and government and educational institutions. Customer panels are an appropriate sampling frame and have been used in various business applications (Iqbal, Verma, & Baran, 2003; Lohse, Bellman, & Johnson, 2000). These 100 volunteers were all qualified in application

Table 1. List of categories, attributes, and criteria of credit cards.

Construct	Attribute	Criterion/feature	Explanation
Price	Service price	Annual fee (c_1)	Basic annual fee
		Penalty charge (c_2)	Revolving interest rate; late payment charge
		Other charge (c_3)	Replacement card fee; foreign currency transaction fee; statement copy retrieval fee; sales flip retrieval fee
Value	Basic service	Service quality (c_4)	Information disclosure of website; speed and simplicity of issuing; customer consultation quality
		Risk assurance (c_5)	Bank reliability; guarantee of consumption and card missing
		Convenience (c_6)	Convenience of consumption; convenience of payment
		Card design (c_7)	Artistry and freshness of card
	Added service	Cash bonus (c_8)	Cash back; consumption discount in allied stores
		Non-cash bonus (c_9)	Points reward; free gifts; free travel insurance; free road assistance; free airport pick-up; free parking hours; frequent flight mileage

requirements of the three selected ordinary credit cards and all had more than 3-year experiences of holding credit cards.

During the data collection phase of customer preferences, we focused on measuring the relative importance of the nine criteria by the AHP questionnaire. Therefore, our AHP questionnaire did not include the pair-wise comparison questions of comparing the three alternative credit card services. Each respondent was requested to respond to 12 pair-wise comparison questions of the AHP questionnaire by using a 9-point scale of 1 to 9 representing 'equal importance' to 'extreme importance'. At the data collection phase of customer satisfactions, the respondents received the relevant information of the three selected ordinary credit cards. This information is summarized in Tables 2–4. After reading the relevant information, the respondents evaluated the three ordinary credit cards on each criterion by using a 5-point scale of 1 to 5 representing 'very dissatisfactory' to 'very satisfactory'. We applied the consistency test to evaluate those who gathered AHP data and eliminated the data according to the consistency ratio (threshold value $CR \leq 0.1$). After screening for consistency, our total valid sample size was 74, which consisted of 34 males and 40 females.

Results and analysis

Assessment of customer preferences

In assessment of customer preferences, we obtained the weights of attributes and criteria through the AHP method, as shown in Table 5. We grouped respondents into four types: male, female, price lover (individuals who responded that price is more important than value), and value lover (individuals who responded that value is more important than price). From Table 5, male customers consider value (51.02%) slightly more important than price (48.98%); on the contrary, females consider price (52.16%) slightly more important than value (47.84%). Overall, the weights of price and value were approximately 50% and 50% for male and female, respectively. In reviewing male preferences, annual fee (18.98%) and other charge (17.21%) are the two most important selection criteria, while card design (3.79%) is the least important criterion. In reviewing female preferences, annual fee (18.55%) and penalty charge (18.47%) are emphasized mostly

Table 2. Comparison of the service prices of alternatives.

Item	Ordinary card 1	Ordinary card 2	Ordinary card 3
Basic annual fee	NT$300	NT$800	NT$1200
Revolving interest rate (%)	Maximum 20	7.98–20	12.99–20
Late payment charge	3% of amount of late payment	As amount of late payment exceeds NT$1001, charge NT$300–4000	As amount of late payment exceeds NT$1000, charge NT$150–2000
Replacement card fee	NT$1000	NT$1000	NT$1000
Foreign currency transaction fee	1.55% of amount of transaction	1.55% of amount of transaction	2.2% of amount of transaction
Statement copy retrieval fee	NT$100	NT$100	Domestic: NT$50; abroad: NT$100
Sales flip retrieval fee	NT$30	Original bank: NT$100; other banks: NT$130	NT$30

Source: The websites of Taishin Bank, Taipei Fubon Bank, and Citibank.

Table 3. Comparison of the basic services of alternatives.

Item	Ordinary card 1	Ordinary card 2	Ordinary card 3
Online application	×	×	×
Online check	×	×	✓
Card-losing assurance	Issuing bank affords the losing in 24 h before losing requisition (maximum amount of card-holder responsibility is NT$3000)	Issuing bank affords the losing in 24 h before losing requisition (maximum amount of card-holder responsibility is NT$3000)	Issuing bank affords all losing amount
Consumption assurance	Maximum amount of card-holder responsibility is 10% of losing amount (at least NT$500)	×	×
Online payment	✓	✓	✓
Other payment function	Visa Paywave function, prepaid function	Prepaid function	×

Source: The websites of Taishin Bank, Taipei Fubon Bank, and Citibank.

Table 4. Comparison of the added services of alternatives.

Item	Ordinary card 1	Ordinary card 2	Ordinary card 3
Cash back	0.5–1.5%	×	×
Consumption discount in allied stores	✓	✓	✓
Frequent bonus point	NT$20 of consumption, obtain one point	NT$20 of consumption, obtain one point	NT$30 of consumption, obtain one point
Frequent flight mileage	×	×	×
Road assistance	×	✓	✓
Travel insurance	NT$8 million	NT$5 million	NT$20 million
Free parking	✓	✓	×
Free airport pick-up	×	×	✓

Source: The websites of Taishin Bank, Taipei Fubon Bank, and Citibank.

and card design (2.19%) is the lowest weight. Regarding price lovers' preferences, annual fee (26.18%) and other charge (25.22%) are the two criteria with highest weights, and card design (1.6%) is the lowest weighted criterion. Regarding value lovers' preferences, cash bonus (23.69%) and non-cash bonus (16%) are considered with highest importance and card design (3.81%) with lowest importance. For the total sample, annual fee (18.86%) and cash bonus (16.70%) are criteria with highest importance, while card design (2.83%) is the lowest importance.

Evaluation of customer satisfactions

The Likert's 5-point scale, of 1 to 5 representing 'very dissatisfactory' to 'very satisfactory', was used to evaluate customer satisfactions of each criterion for each alternative ordinary credit card and the evaluating results are presented in Table 6. For male target

Table 5. Weights of customer preferences (%).

	Male (n = 34)	Female (n = 40)	Price lover (n = 32)	Value lover (n = 38)	Total (n = 74)
Price	**48.98**	**52.16**	**74.35**	**30.11**	**50.70**
Service price	**48.98**	**52.16**	**74.35**	**30.11**	**50.70**
Annual fee	18.98	18.55	26.18	11.78	18.86
Penalty charge	12.78	18.47	22.95	09.36	15.69
Other charge	17.21	15.14	25.22	08.97	16.15
Value	**51.02**	**47.84**	**25.65**	**69.89**	**49.30**
Basic service	**26.98**	**21.37**	**13.61**	**30.20**	**23.88**
Service quality	06.50	05.26	03.33	07.23	05.83
Risk assurance	09.53	07.63	05.20	09.93	08.50
Convenience	07.17	06.29	03.48	09.23	06.72
Card design	03.79	02.19	01.60	03.81	02.83
Added service	**24.04**	**26.47**	**12.04**	**39.69**	**25.42**
Cash bonus	16.26	16.94	08.54	23.69	16.70
Non-cash bonus	07.78	09.53	03.50	16.00	08.72

Note: The bold values represent the sum of non-bold values.

Table 6. Average and weighted customer satisfactions of the alternatives.

	Average				Weighted			
	PS	VS	TS	Rank	PS	VS	TS	Rank
Male (n = 34)								
OC_1	3.2353	3.1275	3.1814	1	1.6109	1.6312	3.2421	1
OC_2	2.8627	3.1471	3.0049	3	1.4118	1.5907	3.0025	3
OC_3	2.8824	3.3725	3.1275	2	1.3974	1.7075	3.1049	2
Female (n = 40)								
OC_1	3.0167	3.0917	3.0542	1	2.0733	1.1472	3.2205	1
OC_2	2.7167	3.0167	2.8667	3	1.8713	0.9772	2.8485	2
OC_3	2.6000	3.4000	3.0000	2	1.6890	1.0603	2.7493	3
Price lover (n = 32)								
OC_1	3.1250	3.0313	3.0782	1	2.3376	0.8122	3.1498	1
OC_2	2.8958	2.9479	2.9219	3	2.1515	0.7504	2.9019	2
OC_3	2.7083	3.3229	3.0156	2	2.0044	0.8339	2.8384	3
Value lover (n = 38)								
OC_1	3.0877	3.1667	3.1272	1	0.9443	2.3230	3.2672	1
OC_2	2.7368	3.1842	2.9605	3	0.8329	2.1732	3.0061	3
OC_3	2.7719	3.4649	3.1184	2	0.8252	2.3693	3.1946	2
Total (n = 74)								
OC_1	3.1171	3.1081	3.1126	1	1.5963	1.6018	3.1981	1
OC_2	2.7838	3.0766	2.9302	3	1.4185	1.4910	2.9094	3
OC_3	2.7297	3.3874	3.0586	2	1.3743	1.6354	3.0097	2

Notes: OC_j, the *j*th ordinary card, $j = 1, 2, 3$; PS, customer satisfaction of price; VS, customer satisfaction of value; and TS, total customer satisfaction.

customers, all three ordinary credit cards are considered to be 'satisfactory' (a value more than three); the rankings of these three ordinary credit cards are the same either in average or weighted total satisfaction scores ($OC_1 \succ OC_3 \succ OC_2$). For female respondents, only ordinary card 1 (OC_1) is considered to be 'satisfactory' and the other two alternatives (OC_2 and OC_3) are inclined to be 'dissatisfactory' (a value less than three); the rankings

of the three ordinary credit cards are different between using the average total satisfaction scores ($OC_1 \succ OC_3 \succ OC_2$) and weighted total satisfaction scores ($OC_1 \succ OC_2 \succ OC_3$).

For price lovers, ordinary card 1 (OC_1) is considered to be 'satisfactory', and ordinary card 2 (OC_2) is considered to be 'dissatisfactory'; ordinary card 3 (OC_3) is considered to be 'satisfactory' by using average satisfaction scores but 'dissatisfactory' by using weighted total satisfaction scores. The rankings have difference in average total satisfaction scores ($OC_1 \succ OC_3 \succ OC_2$) from weighted total satisfaction scores ($OC_1 \succ OC_2 \succ OC_3$).

For value lovers, almost all evaluations of the three alternatives are sided with 'satisfaction', except ordinary card 2 (OC_2), which is considered to be 'dissatisfactory' in average total satisfaction. The rankings of the three ordinary credit cards are the same both in average and weighted total satisfaction scores ($OC_1 \succ OC_3 \succ OC_2$).

For the total sample, ordinary card 1 (OC_1) is considered to be 'satisfactory', ordinary card 2 (OC_2) is considered to be 'dissatisfactory', and ordinary card 3 (OC_3) is considered to be 'satisfactory' by using average total satisfaction scores but 'dissatisfactory' by using weighted total satisfaction scores; the rankings of the three ordinary credit cards are the same either in average or weighted total satisfaction scores ($OC_1 \succ OC_3 \succ OC_2$).

Illustration of the aggregate customer gaps

By using the VIKOR method, we are able to calculate the relative distance between the perceived alternative and the ideal point. Following Figure A1 as a model, we first display the two-construct (value and price) results. Thus, we calculated the average customer satisfaction scores of three value criteria ($c_1–c_3$) and the average satisfaction scores of six price criteria ($c_4–c_9$). Then, we mapped the average satisfaction scores of the three alternative ordinary credit cards on a two-construct (value and price) sketch map, which is shown in Figure 3. The three dotted lines in Figure 3 represent the customer
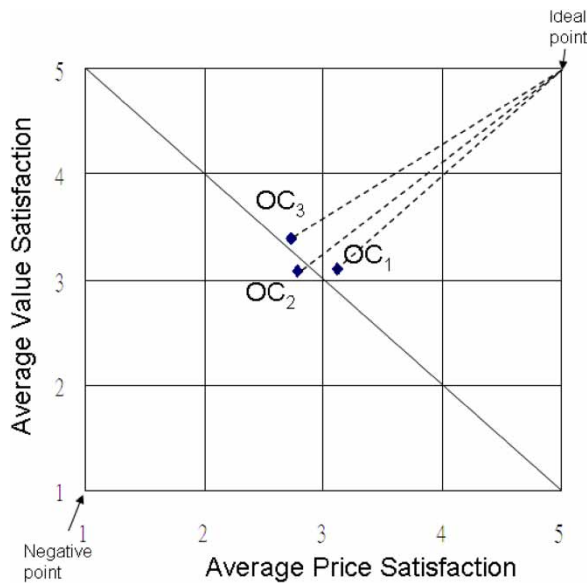

Figure 3. Illustration of the customer gap of the alternatives.
Notes: OC_j, the *j*th ordinary card, $j = 1, 2, 3$; the three dotted lines represent the gaps of the three ordinary cards to the ideal point.

gaps of three ordinary credit cards to the ideal point. The two-construct aggregate results were computed by the VIKOR method. The measure C, representing 'concordance' scores of three alternative ordinary cards, is $(OC_1, OC_2, OC_3) = (0.4718, 0.5180, 0.4865)$, with the ranking order of $OC_1 \succ OC_3 \succ OC_2$; the measure D, representing 'disconcordance' scores of three ordinary cards, is $(OC_1, OC_2, OC_3) = (0.4730, 0.5541, 0.5676)$, with the ranking order of $OC_1 \succ OC_2 \succ OC_3$; and the measure G, representing aggregate distance scores of three ordinary cards, is $(OC_1, OC_2, OC_3) = (0.4724, 0.5360, 0.5270)$, with the ranking of $OC_1 \succ OC_3 \succ OC_2$.

Similarly, the VIKOR method can help us to compute the relative distance between the perceived alternative and the ideal point in our nine-criterion problem. Table 1 shows the nine criteria of evaluating credit card services in our study. More accurate than the two-construct results, the nine-criterion results from the VIKOR method are shown in Table 7. Again, we categorized the respondents into four groups: male, female, price lover, and value lover. For the male group, the ranking order of measure C is $OC_1 \succ OC_3 \succ OC_2$; the ranking of measure D is $OC_1 \succ OC_2 \succ OC_3$; and the ranking of measure G is $OC_1 \succ OC_2 \succ OC_3$. For the female group, the ranking of measure C is $OC_1 \succ OC_2 \succ OC_3$; the ranking of measure D is $OC_1 \succ OC_2 \approx OC_3$; and the ranking of measure G is $OC_1 \succ OC_2 \succ OC_3$. For the price lover group, the ranking of measure C is $OC_1 \succ OC_2 \succ OC_3$; the ranking of measure D is $OC_1 \succ OC_2 \approx OC_3$; and the ranking of measure G is $OC_1 \succ OC_2 \succ OC_3$. For the value lover group, the ranking of measure C is $OC_1 \succ OC_3 \succ OC_2$; the ranking of measure D is $OC_1 \succ OC_2 \approx OC_3$; and the ranking of measure G is $OC_1 \succ OC_3 \succ OC_2$. For the total sample, the ranking of measure C is $OC_1 \succ OC_3 \succ OC_2$; the ranking of measure D is $OC_1 \succ OC_2 \succ OC_3$; and the ranking of measure G is $OC_1 \succ OC_3 \succ OC_2$.

Table 7. VIKOR measures of the alternatives.

	C	Rank	D	Rank	G	Rank
Male ($n = 34$)						
OC_1	0.4395	1	0.5735 (c_4)	1	0.5065	1
OC_2	0.4994	3	0.5882 (c_3)	2	0.5438	2
OC_3	0.4738	2	0.6176 (c_1)	3	0.5457	3
Female ($n = 40$)						
OC_1	0.4449	1	0.6375 (c_2)	1	0.5412	1
OC_2	0.5379	2	0.6750 (c_3)	2	0.6064	2
OC_3	0.5627	3	0.6750 (c_1)	2	0.6188	3
Price lover ($n = 32$)						
OC_1	0.4626	1	0.6094 (c_4)	1	0.5360	1
OC_2	0.5245	2	0.6406 (c_4)	2	0.5826	2
OC_3	0.5404	3	0.6406 (c_1)	2	0.5905	3
Value lover ($n = 38$)						
OC_1	0.4332	1	0.6184 (c_2)	1	0.5258	1
OC_2	0.4985	3	0.6447 (c_3)	2	0.5716	3
OC_3	0.4514	2	0.6447 (c_1)	2	0.5480	2
Total ($n = 74$)						
OC_1	0.4505	1	0.5946 (c_2)	1	0.5225	1
OC_2	0.5226	3	0.6351 (c_3)	2	0.5789	3
OC_3	0.4976	2	0.6486 (c_1)	3	0.5731	2

Notes: OC_j, the jth ordinary card, $j = 1, 2, 3$; C (the measure C), a maximum 'group utility' of the 'majority'; D (the measure D), a minimum of individual regret for the 'opponent'; and G (the measure G), the aggregate distance relative to the ideal point and the negative point.

Gap reduction analysis

Based on the concept of IPA, we mapped the unimproved distance (x-axis) and the impor-
tance value (y-axis) of each alternative ordinary credit card on a two-axis map, shown in
Figures 4–6. The mean (0.11) of the important values of the nine criteria was used to split
high importance from low importance. The values of the unweighted relative distance
were all between 0 and 1. We set the midpoint of 0.5 to discriminate large unimproved
distance and small unimproved distance. Improving a criterion/feature with higher
importance and large unimproved distance should have more opportunities to lead the
perceptive alternative closer to the ideal point (the expected service). Criteria mapped
closer to the top-right point had priorities of improvement. Criteria/features in the gray
areas of Figures 4–6 are identified as 'opportunities' and criteria/features in the white
areas are 'satiated needs'.

Figure 4. The importance–unimproved distance map of ordinary card 1 (OC$_1$).
Notes: c_1, annual fee; c_2, penalty charge; c_3, other charge; c_4, service quality; c_5, risk assurance; c_6,
convenience; c_7, card design; c_8, cash bonus; and c_9, non-cash bonus.

Figure 5. The importance–unimproved distance map of ordinary card 2 (OC$_2$).
Notes: c_1, annual fee; c_2, penalty charge; c_3, other charge; c_4, service quality; c_5, risk assurance; c_6,
convenience; c_7, card design; c_8, cash bonus; and c_9, non-cash bonus.
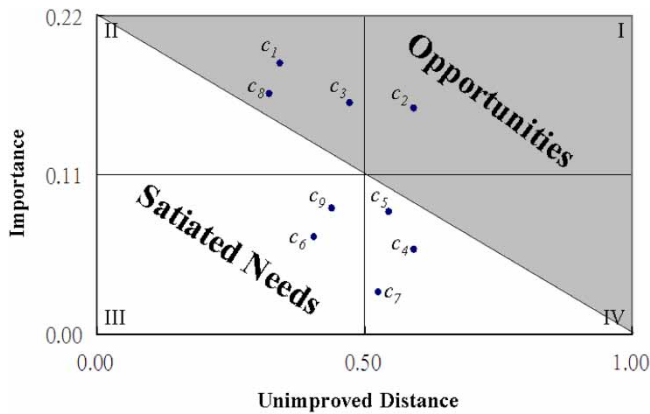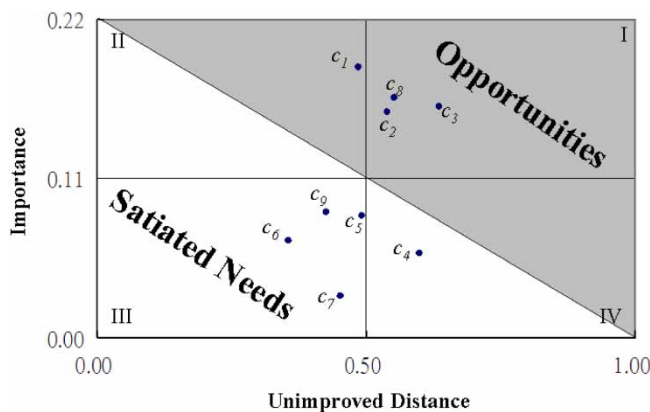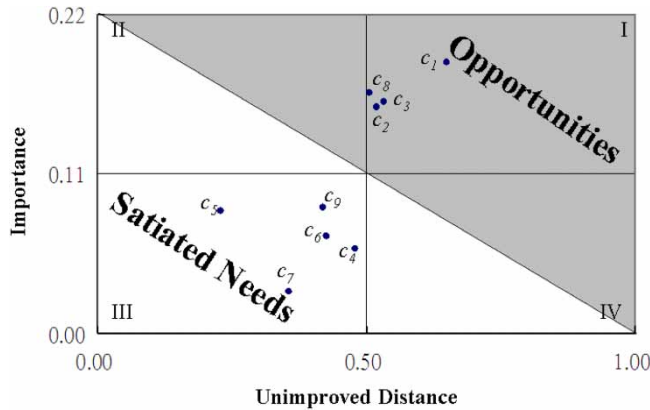
Figure 6. The importance–unimproved distance map of ordinary card 3 (OC_3).
Notes: c_1, annual fee; c_2, penalty charge; c_3, other charge; c_4, service quality; c_5, risk assurance; c_6, convenience; c_7, card design; c_8, cash bonus; and c_9, non-cash bonus.

Discussions and implications

This study empirically explored the target customers' preferences and satisfactions of three ordinary credit card services in the different views of various customer groups. Generally speaking, price and value are almost equally important in credit card services for their target customers, but males give a slightly higher weight on value construct and females give a slightly higher weight on price construct. In the comparison of the three attributes (service price, basic service, and added service), most males and females just emphasize service price. One possible reason is that our target customers applying for ordinary credit cards are those who have lower annual earnings in Taiwan, and thus they pursue the new credit card service with the lower price. Comparing the nine criteria, we found that card design (c_7) is evaluated as the lowest importance by each group; annual fee (c_1) and cash bonuses (c_8) are almost included in the top three important criteria list of each group. We also noticed that the sum of the weights of the top three important criteria/features of each group is greater than 50% of all nine criteria. That is, the top three features hold more than 50% of importance and the remaining six features only hold less than 50% of importance. According to the service concept model (Edvardsson, 1997), service providers should design the core service and supporting service of credit card services with respect to customers' primary and secondary needs to achieve a successful service business. Thus, when designing a new ordinary credit card service, service development managers can devise the features which are target customers' primary needs as the core service of the NSD so designers can grasp the top three important features, which hold more than 50% of customer importance, of ordinary credit card services. The remaining six features, which are regarded as secondary customer needs and hold less than 50% of importance, could be devised as the supporting service.

Table 6 shows different ranking orders between average customer satisfactions and weighted customer satisfactions for various groups. For the ranking of three ordinary credit cards, ordinary card 1 (OC_1) is the best choice and closest to the expected service for each group. One possible reason is that ordinary card 1 (OC_1) offers the lowest annual fee (NT\$300) and it is the only card giving the cash back bonus (Tables 2–4). These two features (c_1 and c_8) are listed in the top three important criteria for males, females, value lovers, and total samples. However, ordinary card 1 (OC_1) still may not

fully satisfy target customers and still have unimproved gaps to target customers' ideal ordinary credit card. It implies that our proposed approach is capable of analyzing improvement gaps even for the best existing NSD and assisting service development managers to design superior NSDs in the future. In other words, our analytic approach successfully solved the problem which would arise when the competitors having equivalent or worse performances become inappropriate reference points.

In order to improve NSDs time after time, service providers not only have to design their NSDs with respect to target customers' primary and secondary needs according to the service concept model (Edvardsson, 1997) but also need to find out the customer gap of the existing services and close it to satisfy their target customers' expectations based on the service gap model (Zeithaml & Bitner, 2003). Therefore, service development managers should focus on the features with high importance and long unimproved distance as priority of improvement when they design or renovate their NSDs. Our proposed MCDM approach modified the traditional IPA method and is able to analyze the relative importance and performance simultaneously to diagnose managerial strategies by using the importance–unimproved distance map.

Figure 4 shows that the criterion penalty charge (c_2) of ordinary card 1 (OC_1) is rated by customers as high in importance and a large unimproved distance. One possible reason is that this card's late payment charge is set at 3% of the amount of the late payment, which is not similar to others (Table 2). Customers disliked this setting; so the penalty charge of ordinary card 1 (OC_1) is evaluated with a lower customer satisfaction and had large unimproved distance. Figure 4 also shows that OC_1 has lower importance but large unimproved distance for three criteria of service quality (c_4), risk assurance (c_5), and card design (c_7). Although these three criteria are not regarded by target customers as being highly important, they still have a lot of space to be improved. Other three criteria, namely annual fee (c_1), other charge (c_3), and cash bonus (c_8), are rated as highly important but small unimproved distance. They should still be focused on since target customers regarded them as essential factors.

The ranking results of ordinary card 2 (OC_2) and ordinary card 3 (OC_3) are almost regarded as equal by customers, either in terms of the weighted satisfactions in Table 6 or the VIKOR measures in Table 7. However, only the two evaluated values of customer satisfactions (annual fee (c_1) and convenience (c_6)) of ordinary card 2 are higher than ordinary card 3; the remaining seven criteria of ordinary card 3 are all evaluated higher than ordinary card 2. It is evidenced again that annual fee is the crucial criterion or feature considered by target customers in their choices of ordinary credit card services. Comparing Figure 5 with Figure 6, penalty charges (c_2), other charges (c_3), and cash bonuses (c_8) are the three significant criteria/features with high importance and large unimproved distance; only ordinary card 2 had smaller unimproved distance in annual fee (c_1) and larger unimproved distance in service quality (c_4). The target customers' needs and expectations are herein revealed through our analytic process. Overall, the target customers of ordinary credit card services in Taiwan had an opinion that annual fee (c_1) and cash bonus (c_8) are the two most significant criteria/features of the existing ordinary credit card services.

Grounded on the concepts of the service concept model and service gap model, our proposed approach employs the importance–unimproved distance map to diagnose different managerial strategies for different criteria/features of an NSD. In summary, we proposed the improvement strategies map of gap reduction as shown in Figure 7. The *x*-axis represents the relative unimproved distance and *y*-axis is the degree of relative importance for each criterion or feature. This two-axis map put each criterion/feature into one of four types.

	Quadrant II	Quadrant I
High	**Quadrant II** Find Possibility of Improvement *High Importance* *Small Unimproved Distance*	**Quadrant I** Higher Priority of Improvement *High Importance* *Large Unimproved Distance*
Low	**Quadrant III** Keep the Good Attributes *Low Importance* *Small Unimproved Distance*	**Quadrant IV** Lower Priority of Improvement *Low Importance* *Large Unimproved Distance*

Figure 7. Improvement strategy map of gap reduction.

Criteria or features in Quadrant I are of relatively high importance and of a large unimproved distance; that is, the same improvement of these criteria/features led to greater gap reductions and the large unimproved distance meant more opportunities of gap reductions. So managers should treat these criteria/features as higher priority of improvement. Criteria or features in Quadrant II are of relative high importance and small unimproved distance; that is, the same improvement led to greater gap reductions but the small unimproved distance meant fewer opportunities of reductions, and thus managers should try to find the possibility of improvement. Criteria or features in Quadrant III are of relative lower importance and small unimproved distance; that is, the same improvement led to smaller gap reductions and the small unimproved distance meant fewer opportunities of reductions, and thus the best strategy for managers was to keep the good performance. Criteria or features in Quadrant IV are of relatively lower importance but with a large unimproved distance. The same improvement led to smaller gap reductions but the large unimproved distance meant greater opportunities of reductions; thus managers should put these criteria or features into the improvement list with lower priority.

This improvement strategies map of gap reduction not only provides a clear classifying approach for categorizing various criteria or features but also assists NSD managers to adopt the right strategy to the right criterion or feature when they design or renew their NSDs.

Conclusions, limitations and recommendations

Financial service providers need to develop new services to fulfill their customers' needs and expectations, and thus, involvement of customers' viewpoints in NSDs is often necessary. After reviewing the literature and NSD theories, this paper used a sample of potential bank credit card application, customers' preferences, and satisfaction ratings of three banks in Taiwan. New credit card service data with the applications of both the AHP method and VIKOR method were employed as an integrated MCDM approach to analyze customer satisfactions (customer perceptions and expectation) and preferences (customer needs) simultaneously. It then applied the IPA technique to analyze managerial strategies for reducing the customer gaps between customer perceptions and expectations. The findings of this study provide insights into involving customers' viewpoints in the

improvement of new credit card service developments. For ordinary credit card services of banks in Taiwan, customers emphasize annual fee and cash bonus when they choose to use the service. Thus, business practitioners of ordinary credit card services should try to focus on these two features at the process of NSDs. The importance–unimproved distance map, based on the foundation of the service concept model and the service gap model, provides managerial strategies to improve NSDs efficiently, and practitioners are offered a valid analytic approach to assist them to identify their target customers' needs and expectations of new services. Finally, practitioners can diagnose the best managerial strategies to set up an effective NSD process and launch successful new services.

Our study contributes to the financial service development literature in two aspects. First, this paper is the first empirical study that incorporates the customer gaps of financial services involving customer needs and expectations based on conceptual theories of the service concept model, customer needs and preferences, the service gap model, as well as customer expectations and satisfactions by integrating AHP, VIKOR, and IPA methods. Second, we mapped out managerial strategies in terms of improving financial service developments, assisting development managers in designing customized service offerings efficiently and effectively.

Although our study contributes to the financial service developments, it still has limitations. Since we only studied the ordinary credit card service and gathered the target sample size in Taiwan, culture is a significant influence in marketing management and hence our results would not be generalized widely. Moreover, although the criteria/ features of ordinary credit card services were edited according to suggestions from other academic researchers and high-level executives of financial service industry in Taiwan, we may overlook other important criteria/features. For practitioners of credit card service development, one could conduct our analytic approach to improve new credit card services. For future researchers, other kinds of new financial services or NSDs in other different service industries could be chosen for further investigations. In this study, the AHP method assumes independence among the criteria. Additionally, customer satisfactions were measured by Likert's 5-point scale, and the deviations of each point were assumed to be equal. These might not be true in the real world. One avenue for extending this study is to select different importance criteria and further consider the dependence among them when the analytic process is adapted to other different local circumstances; another approach is to incorporate the fuzzy theory in measurements to overcome the limitation of assuming that the deviations among the measurement point to be equal.

Acknowledgements

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Appendix 1. The AHP method

The AHP is a systematic procedure with the main procedures summarized as follows:

(1) *Structuring the hierarchy for evaluation*.
(2) *Constructing the pair-wise comparison matrix*. After structuring a hierarchy, we asked the customers to input their judgments on relative importance of different criteria (attributes) with respect to the attributes (constructs) by a pair-wise comparison procedure. All related values can be determined by using a scale of 1 to 9 to represent 'equal importance' to 'extreme importance' (Saaty, 1980).
(3) *Calculating the weights and testing the consistency*. For each pair-wise comparison matrix (A), the theory of eigenvector, i.e. $(A - \lambda_{max}I)w = 0$, was used to calculate the eigenvalue (λ_{max}) and the eigenvector ($w = (w_1, w_2, \ldots, w_n)$), and to estimate weights. Super Decisions 1.6.0 software was employed in this study to aid all calculations of AHP. Finally, the consistency of the comparison matrix was tested and the opinions of the regional decision maker group were integrated to obtain the final results. In the consistency test (Saaty, 1990), consistency index (CI = $(\lambda_{max} - n)/(n - 1)$) is used to verify the consistency of the comparison matrix, RI represents the average consistency index over numerous random entries of same order reciprocal matrices, and consistency ratio (CR = CI/RI) is utilized to determine the degree of consistency. When CR $\leq$ 0.1, it is considered to be acceptable.

Appendix 2. The VIKOR method

The VIKOR method is introduced as one applicable technique to implement within the MCDM. Assuming that each alternative is evaluated according to each criterion function, the VIKOR method is performed by comparing the measure of closeness with the ideal alternative (Opricovic, 1998; Opricovic & Tzeng, 2002, 2003, 2004; Tzeng et al., 2002). The multiple-criteria merit for compromise ranking is developed from the d_p-*metric* used in the compromise programming method (Zeleny, 1982). The various alternatives will be denoted as $a_1, a_2, \ldots, a_m$ and the criteria will be denoted as $c_1, c_2, \ldots, c_n$. For an alternative a_j, the merit of the ith aspect is denoted by f_{ij}, i.e. f_{ij} is the value of ith criterion (c_i) function for the jth alternative (a_j). Given a two-criterion problem (i.e. $c_i = c_1, c_2$), Figure A1 illustrates the ideal point $F^* = (f_1^*, f_2^*)$, the negative point $F^- = (f_1^-, f_2^-)$, and a perceived alternative $F^p = (f_1^p, f_2^p)$. The gap between the perceived alternative (F^p) and the ideal point (F^*) can also be illustrated in Figure A1.
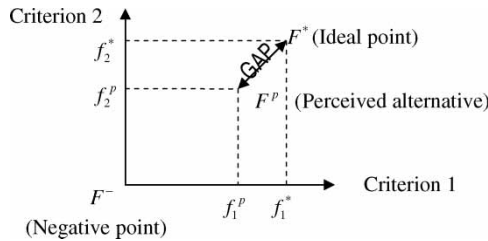

Figure A1. Illustration of VIKOR.
Source: Tzeng et al. (2002).

Compromise programming method introduced the d_p-*metric* as an aggregate function. The development of the VIKOR method started with the following form of the d_p-*metric*:

$$d_j^p = \left\{ \sum_{i=1}^{n} \left[\frac{w_i (f_i^* - f_{ij})}{(f_i^* - f_i^-)} \right]^p \right\}^{1/p}, \quad 1 \le p \le \infty; j = 1, 2, \ldots, m.$$

The compromiseranking algorithm VIKOR that we used in this paper has the following steps:

(1) *Determining the values of the ideal point and negative point.* This study set the value of the ideal point f_i^* as the scale of 'very satisfactory' of each criterion; the value of the negative point f_i^- as the scale of 'very dissatisfactory' of each criterion of the *i*th criterion. Hence, $f_i^* = 5$ and $f_i^- = 1$.

(2) *Computing the 'concordance' and 'discordance' value.* By the compromise ranking method, the compromise solution is determined, which could be accepted by the decision makers because it provides a maximum 'group utility' of the 'majority' (with measure C, representing 'concordance'), and a minimum of the individual regret of the 'opponent' (with measure D, representing 'discordance'). Thus, we computed the values C_j and D_j, $j = 1, 2, 3$, the measure C of the ideal point (C^*) and the measure C of the negative point (C^-), and the measure D of the ideal point (D^*) and the measure D of the negative point (D^-) by the relations:

$$C_j = d_j^1 = \sum_{i=1}^{9} w_i \frac{(f_i^* - f_{ij})}{(f_i^* - f_i^-)}, \tag{A1}$$

$$D_j = d_j^\infty = \max_i \left[\frac{(f_i^* - f_{ij})}{(f_i^* - f_i^-)} | i = 1, 2, \ldots, 9 \right], \tag{A2}$$

where the weights of the criteria (w_i) are introduced to express the relative importance of the criteria calculated by the AHP method. The smaller value of measure C indicates the larger 'group utility' of the 'majority'; the smaller value of measure D indicates the smaller 'individual regret' of the 'opponent'.

(3) *Calculating the aggregate distance from the ideal point.* We computed the values G_j, $j = 1, 2, 3$, as the aggregate distance from the ideal point by the relation

$$G_j = v \frac{(C_j - C^*)}{(C^- - C^*)} + (1 - v) \frac{(D_j - D^*)}{(D^- - D^*)}, \tag{A3}$$

where C^* = the measure C of the ideal point, C^- = the measure C of the negative point, D^* = the measure D of the ideal point, D^- = the measure D of the negative point, and v is introduced as the weight of the strategy of 'the majority of criteria' (or 'the maximum group utility'), usually $v = 0.5$. The smaller value of measure G represents the smaller customer gap.