



RANKING THE SKILL PRIORITIES OF BANKING MANAGERS FOR SERVICE DEVELOPMENT WITH FUZZY QUALIFLEX

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Abstract: This study aims to evaluate the skills required by bank managers to be successful in developing new products and services. In this process, 3 different types of skills were identified: technical, conceptual and human skills. Fuzzy QUALIFLEX method is considered to rank these different skills. The findings state that conceptual skills are the most significant for the bank managers in order for the success of new service development process. Thus, it is recommended that banks should employ managers to the new product and service development department who have more effective conceptual skills. Because the managers, who have conceptual thinking skills, question why an event is necessary. Therefore, they can solve their complexity more successfully. Since this situation is crucial for new service development process, banks should firstly make a survey analysis with the candidates to understand their skills more effectively and give priorities for the people who have conceptual skills.

Keywords: Skill Priorities, Banking Industry, New Service Development, Fuzzy QUALIFLEX.

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BANKA YÖNETİCİLERİNİN HİZMET GELİŞTİRME ÖNCELİKLERİNİN BULANIK QUALIFLEX İLE ANALİZ EDİLMESİ

Öz: Bu çalışma, banka yöneticilerinin yeni ürün ve hizmetler geliştirmede başarılı olabilmeleri için ihtiyaç duydukları becerileri değerlendirmeyi amaçlamaktadır. Bu süreçte, teknik, kavramsal ve insan becerileri olmak üzere 3 farklı beceri türü belirlenmiştir. Bulanık QUALIFLEX yöntemi bu farklı becerileri sıralayabilmek için dikkate alınmıştır. Bulgular, yeni hizmet geliştirme sürecinin başarısına yönelik olarak, banka yöneticileri için kavramsal becerilerin en önemli faktör olduğunu ortaya koymaktadır. Bu nedenle, bankaların yeni ürün ve hizmet geliştirme departmanına daha etkin kavramsal becerilere sahip yöneticiler istihdam etmesi önerilmektedir. Çünkü kavramsal düşünme becerisine sahip yöneticiler, bir olayın neden gerekli olduğunu sorgulamaktadır. Bu nedenle, bahsi geçen yöneticiler meydana gelen karmaşıklıkları daha başarılı bir şekilde çözebilmektedirler. Bu durum yeni hizmet geliştirme süreci için hayati önem taşıdığından, bankaların öncelikle becerilerini daha etkili anlayabilmeleri ve kavramsal becerilere sahip kişilere öncelik verebilmeleri için adaylarla anket analizi yapmaları yerinde olacaktır.

Anahtar Kelimeler: Beceri Öncelikleri, Bankacılık Sektörü, Yeni Hizmet Geliştirme, Bulanık QUALIFLEX.

INTRODUCTION

Intercompany competition is highly preferred for customers. When companies compete with each other, they take a number of actions to prevent others and win customers. The main action taken is to lower the prices of the products. Therefore, customers are very pleased with the fact that they pay less for the products. However, firms are not very satisfied with this situation. Because they lower their prices in order to compete, sales volumes will decrease. This situation will negatively affect the profitability of the related companies. As can be seen here, companies cannot continuously lower their prices. Since this will cause firms to have negative profit margins after a certain point, they have to consider other possibilities in terms of price reduction in order to gain competitive advantage.

Unlike price reduction, another preferred way for companies to increase their competitive advantage is to develop new products and services. Companies develop products and services on the ground, giving customers the opportunity to have products



that they have not experienced before. This is likely to attract customers, because customers think that their benefits will increase when they use a new product or service. As can be seen, new product and service development is an important strategy that companies can implement to differentiate from their competitors. In this way, these companies will not have to decrease their price and reduce their profitability.

One of the sectors where new product and service development is very important is banking. Particularly with the effect of globalization, the banking sector is experiencing significant competition all over the world.¹ Therefore, banks pursue effective strategies to differentiate themselves from their competitors. As mentioned before, price reduction is an application that both reduces the profitability of banks and also discontinues it. Therefore, banks, as an effective strategy, prefer to develop new products and services. Banks have many different fields of activity such as lending, opening a deposit account, selling credit cards and making money transfers. As a result, it is clear that developing new products and services is a very suitable strategy for banks (Eti et al., 2020).

It is possible to mention a number of factors that affect the performance of banks in developing new products and services. As an example, it is thought that technological development in banks has an effect on performance in this regard. Banks that are more technologically advanced can develop new products and services that are more preferable. On the other hand, it is important to analyze customer expectations correctly.² Banks can understand what their customers want and can develop new products more successfully. In addition, banks that are better able to manage their financial position are considered to be more successful in this process. In other words, banks that do not have liquidity problems and have reasonable indebtedness are likely to develop more successful new products.

In addition, the competence of bank managers is crucial for a bank to be successful in the development of new products and services. In order for banks to be successful in this process, first of all, bank managers need to have good communication with staff. Bank managers who have more effective communication will be able to understand the expectations of the staff more accurately. Moreover, it is very important that bank managers have good training. More educated and following the current issues in the market, bank managers are likely to develop new products more successfully. In summary, in order for a bank to be successful in developing new products, bank

¹ Serkan Eti vd. "G20 Ülkelerinde Bankacılık Sektörünün 5 Yıllık Geleceğinin Arıma Yöntemi ile Tahmin Edilmesi" *Uluslararası Hukuk ve Sosyal Bilim Arařtırmaları Dergisi* 1/1 (2019), 26-38.

² İrfan Ersin - Serkan Eti. "Measuring the Waste-Conscious and Saving Habits of the Youth in Turkey: The Sample of Istanbul Medipol University." *International Journal of Islamic Economics and Finance Studies* 30/5618 (2017), 1-9.

managers must have a high level of technical equipment and a good level of communication.

In this study, the skills required by bank managers to be successful in developing new products and services are analyzed. In this context, firstly, the literature has been searched extensively and 6 different criteria have been selected which can affect the performance of new product and service development. These criteria were weighted using fuzzy DEMATEL method. In the final stage of the analysis process, the skills required by bank managers are listed according to their materiality. Within this framework, 3 different types of skills were identified: technical, conceptual and human skills. The fuzzy QUALIFLEX approach was also taken into account in ordering these skills.

This study is thought to bring innovation to the literature in many respects. First of all, in this study, the factors that affect the performance of the managers are listed in order for the banks to be successful in the new product and service development process. On the other hand, these issues are weighted for banks. Therefore, these weighted criteria are considered to play a significant role in the selection of managers of banks. In addition, the fuzzy QUALIFLEX method was considered for the first time in a study in this field. This situation is thought to increase the originality of the study.

1. LITERATURE REVIEW FOR NEW PRODUCT OR SERVICE DEVELOPMENT

Developing new products and services is an important issue for the continuity of companies. Therefore, in the literature, many researchers have focused on this issue. In general, the studies focused on the issues to be taken into consideration during the development of new products and services. In this context, one of the most prominent issues is customer satisfaction. According to the authors, when developing a new product or service, it is necessary to first understand what customers expect.³ However, it is also stated that as there are different customer profiles in some sectors, it is difficult to determine these expectations clearly.⁴ In this context, a very detailed analysis by companies is important.

The bank's technological development has been recognized as the most important indicator of new product and service development performance in many

³ Hasan Dinçer - Serhat Yüksel. "Comparative Evaluation of BSC-based New Service Development Competencies in Turkish Banking Sector with the Integrated Fuzzy Hybrid MCDM Using Content Analysis." *International Journal of Fuzzy Systems* 20/8 (2018), 2497-2516.

⁴ Kong YuSheng - Masud Ibrahim. "Service Innovation, Service Delivery and Customer Satisfaction and Loyalty in the Banking Sector of Ghana." *International Journal of Bank Marketing* 37/5, (2019).



studies. Banks have many different fields of activity such as lending, deposit collection, credit card usage and money transfer. In order to develop new products and services in these processes, they need to be technologically advanced.⁵ In other words, it is easier for technologically advanced banks to succeed in this process than others. Additionally, it is also underlined that thanks to the technological strength of banks, it is possible to provide more efficient service to customers on the internet. This will help to reduce the concentration on the bank branches.⁶ As a result, banks' costs will decrease, and profit margins will increase. Moreover, it is also indicated that without technological development, it becomes very difficult for the banks to be successful in new product and service development process.⁷ On the other hand, a significant portion of the studies emphasized that banks' financial position should be suitable for new product and service development performance. The process of developing new products and services creates significant costs for the. In order to develop a new product, extensive preparation is required.⁸ In addition, it is also defined that it is necessary to make significant expenditure on the IT software of the new product developed. Similarly, the accuracy of this software needs to be tested before the product is released.⁹

As can be seen from these issues, in order to develop new products and services, the financial position of banks must be in line with this. Within this framework, the most important issue is the capital adequacy of the bank.¹⁰ It is not appropriate for the bank, which has liquidity problems, to develop new products and services. Moreover, it is also identified that the indebtedness level of banks is another important issue in this context.¹¹ In other words, it would be more appropriate for the bank with a very high debt to improve its indebtedness situation before developing new products and services. Finally, in some studies, it is also concluded that the foreign exchange position of banks is another issue that needs to be controlled in this process. A bank with a foreign

⁵ Andrey Martovoy - Anne-Laure Mention. "Patterns of New Service Development Processes in Banking." *International Journal of Bank Marketing* 34/1 (2016), 62-77.

⁶ Glauco HS Mendes et al. "Uncovering the Structures and Maturity of the New Service Development Research Field through a Bibliometric Study (1984-2014)." *Journal of Service Management* 28/1 (2017).

⁷ Jack Crumbly and Lemuria Carter. "Social Media and Humanitarian Logistics: The Impact of Task-Technology Fit on New Service Development." *Procedia Engineering* 107 (2015): 412-416.

⁸ Hasan Dinçer vd. "Determining Influencing Factors of Currency Exchange Rate for Decision Making in Global Economy Using MARS Method." *Geopolitics and Strategic Management in the Global Economy*. IGI Global, (2018), 261-273.

⁹ Wim Biemans and Abbie Griffin. "Innovation Practices of B2B Manufacturers and Service Providers: Are They Really Different?." *Industrial Marketing Management* 75 (2018), 112-124.

¹⁰ Md Asadul Islam et al. "Determinants of Profitability of Commercial Banks in Bangladesh." *International Journal of Banking and Financial Law* 1/1 (2017), 1-11.

¹¹ Uyen Le Van Dinh and Phuong Le. "Measuring the Impacts of Internet Banking to Bank Performance-Evidence from Vietnam." (2015).

exchange position deficit has a significant risk. Therefore, it is important to take measures to manage these risks before developing a new product.¹²

Since new product and service development is very important for banks, it has attracted the attention of many authors in the literature. In the studies, the process of developing new products and services has been addressed for many different purposes. According to a significant number of authors, customer satisfaction has come to the forefront in this process, while other authors have mentioned the importance of technological development. In addition, many studies emphasized that the financial position of banks will determine the success of this process. The effectiveness of internal communication is another highlighted in this process. As can be understood from the studies examined, the method to be applied must be different in order for a new study to be different from the previous ones.

2. METHODOLOGY

In this study, a hybrid method is used for ranking the alternatives. For this purpose, first the DEMATEL method is used for weighting the criteria of service development, and then the QUALIFLEX method is applied for ranking the alternatives entitled skills of managers for banking industry. In previous chapters, the DEMATEL method is explained in detail. In this study, the methodology of QUALIFLEX and its computation procedure are defined as follows

The QUALIFLEX method is introduced by Paelinck to generalize the Jacquet-Lagrange's permutation.¹³ This method provide a novel way in the flexible multicriteria decision making tools with the correct treatment of cardinal and ordinal information and the preferences with the concordance results.¹⁴ The QUALIFLEX method is widely used for the complex decision making problems with the several extensions and interval type 2 fuzzy sets are one of the extensions for the QUALIFLEX under the fuzzy environment. The computation details of interval type 2 fuzzy QUALIFLEX are illustrated as below.¹⁵

¹² Dan Luo et al. "The Impact of Foreign Bank Penetration on the Domestic Banking Sector: New Evidence from China." *The European Journal of Finance* 23/7-9 (2017), 752-780.

¹³ Jean Paelinck "Qualitative Multiple Criteria Analysis, Environmental Protection and Multiregional Development." *Papers of the Regional Science Association* 36/1, Springer-Verlag, 1976.

¹⁴ Abdelwaheb Rebai vd. "A Multi-Attribute Method for Choosing among Potential Alternatives with Ordinal Evaluation." *European Journal of Operational Research* 174/1 (2006), 360-373.

¹⁵ Ting-Yu Chen vd. "The Extended QUALIFLEX Method for Multiple Criteria Decision Analysis Based on Interval Type-2 Fuzzy Sets and Applications to Medical Decision Making." *European Journal of Operational Research* 226.3 (2013), 615-625.



Initially, decision matrix is constructed. In this study, interval type 2 fuzzy sets are used for appointing the fuzzy scales for linguistic evaluations. The matrix is illustrated in the following equation

$$\begin{matrix}
 & X1 & X2 & X3 & \dots & Xn \\
 A_1 & A_{11} & A_{12} & A_{13} & \dots & A_{1n} \\
 A_2 & A_{21} & A_{22} & A_{23} & \dots & A_{2n} \\
 A_3 & A_{31} & A_{32} & A_{33} & \dots & A_{3n} \\
 \vdots & \vdots & \vdots & \vdots & \ddots & \vdots \\
 A_m & A_{m1} & A_{m2} & A_{m3} & \dots & A_{mn}
 \end{matrix}
 \quad D = \tag{1}$$

$$A_{ij} = \frac{1}{k} \left[\sum_{e=1}^k A_{ij}^e \right] \tag{2}$$

The averaged values of k decision makers' criteria evaluations are considered for each alternative. In the second step, signed distance is calculated. Signed distance $d(A_{ij}, \tilde{0})$ is calculated for each A_{ij} in the decision matrix with the equation.

$$d(A_{ij}, \tilde{0}) = \frac{1}{8} \left(a_{1ij}^L + a_{2ij}^L + a_{3ij}^L + a_{4ij}^L + 4a_{1ij}^U + 2a_{2ij}^U + 2a_{3ij}^U + 4a_{4ij}^U + 3(a_{2ij}^U + a_{3ij}^U - a_{1ij}^U - a_{4ij}^U) \frac{h_{ij}^L}{h_{ij}^U} \right) \tag{3}$$

$$A_{ij} = [A_{ij}^L, A_{ij}^U] = \left[\left(a_{1ij}^L, a_{2ij}^L, a_{3ij}^L, a_{4ij}^L; h_{ij}^L \right), \left(a_{1ij}^U, a_{2ij}^U, a_{3ij}^U, a_{4ij}^U; h_{ij}^U \right) \right] \tag{4}$$

Third step is to compute the concordance/discordance index. The index I_j^l is employed for each pair of alternatives (A_ρ, A_β) with m alternatives, m! permutations of the ranking of the alternatives exist:

$$I_j^l = \sum_{A_\rho, A_\beta \in A} I_j^l(A_\rho, A_\beta) = \sum_{A_\rho, A_\beta \in A} \left(d(A_{\rho j}, \tilde{0}_1) - d(A_{\beta j}, \tilde{0}_1) \right) \tag{5}$$

$$A_{\rho j} = [A_{\rho j}^L, A_{\rho j}^U] = \left[\left(a_{1\rho j}^L, a_{2\rho j}^L, a_{3\rho j}^L, a_{4\rho j}^L; h_{\rho j}^L \right), \left(a_{1\rho j}^U, a_{2\rho j}^U, a_{3\rho j}^U, a_{4\rho j}^U; h_{\rho j}^U \right) \right] \tag{6}$$

$$A_{\beta j} = [A_{\beta j}^L, A_{\beta j}^U] = \left[\left(a_{1\beta j}^L, a_{2\beta j}^L, a_{3\beta j}^L, a_{4\beta j}^L; h_{\beta j}^L \right), \left(a_{1\beta j}^U, a_{2\beta j}^U, a_{3\beta j}^U, a_{4\beta j}^U; h_{\beta j}^U \right) \right] \tag{7}$$

Fourth step of the interval type 2 fuzzy sets-based QUALIFLEX is to employ the comprehensive concordance/discordance index. In this step, criterion weights are also applied in the concordance/discordance index by the formula

$$I^l = \sum_{A_\rho, A_\beta \in A} \sum_{j=1}^n I_j^l(A_\rho, A_\beta) \cdot W_j = \sum_{A_\rho, A_\beta \in A} \sum_{j=1}^n \left(d(A_{\rho j}, \tilde{0}_1) - d(A_{\beta j}, \tilde{0}_1) \right) \cdot W_j \quad (8)$$

Finally, the values of comprehensive index are calculated for all permutations and the maximum value is the optimal ranking order of the alternatives. Fuzzy QUALIFLEX becomes very popular in the literature especially in the last years.^{16,17,18}

2. APPLICATION ON THE BANKING INDUSTRY

In this study, it is aimed to measure the priorities of managerial skills entitled technical skills (alternative 1), conceptual skills (alternative 2), human or interpersonal skills (alternative 3) with the criteria set of service development in banking industry. For this purpose, the DEMATEL method is used for measuring the weights of each criterion and then, the QUALIFLEX method is applied for ranking the priorities of 3 managerial skills as alternatives. First of all, the factors of new service development are defined based on the supported literature. The selected criteria are seen in Table 1.

Table 1: Proposed criteria for Service Development

Criteria	Definition
Communication (Criterion 1)	Learning the capacities of organization and interacting with the efficient network
Customer (Criterion 2)	Understanding the customer needs for using the feedback
Performance (Criterion 3)	Steady measurement of innovative competencies
Designing (Criterion 4)	Managing the process of innovation multidimensionally
Competition (Criterion 5)	Benchmarking and screening the best efforts for the market conditions
Cooperation (Criterion 6)	Finding the alternative sources for the incremental and radical innovations

¹⁶ Hasan Dincer - Serhat Yüksel. "IT2-Based Fuzzy Hybrid Decision Making Approach to Soft Computing." *IEEE Access* 7 (2019), 15932-15944.

¹⁷ Xiaolu Zhang - Zeshui Xu. "Hesitant Fuzzy QUALIFLEX Approach with a Signed Distance-Based Comparison Method for Multiple Criteria Decision Analysis." *Expert systems with applications* 42/2 (2015), 873-884.

¹⁸ Jian Li - Jian-qiang Wang. "An Extended QUALIFLEX Method under Probability Hesitant Fuzzy Environment for Selecting Green Suppliers." *International Journal of Fuzzy Systems* 19/6 (2017), 1866-1879.



In Table 1, there are six criteria for the determinants of service development with the literature review. First criterion is communication that highlights learning and interactions with the efficient network and organization. Second criterion defines the customer expectations could be obtained by the feedbacks. Third criterion is the measurement of innovative competencies for the effective performance management. Fourth criterion is to design the process by managing the innovation studies. Fifth criterion examines the best practices of rivals that should be screened for selecting the policies of benchmarking. Final criterion is to cooperate with the alternative sources for the innovative solutions.

Secondly, the weights of criteria are computed with interval type 2 fuzzy DEMATEL method. For that, linguistic evaluations from 3 decision makers, that have expertise in the field of banking management and innovation, are obtained for evaluating each criterion. Linguistic scales and their trapezoidal fuzzy numbers for criteria and alternatives are provided in Table 2.¹⁹

Table 2: Linguistic scales and interval type-2 trapezoidal fuzzy numbers for the criteria and alternatives

Criteria	Alternatives	IT2TrFNs
Absolutely Low (AL)	Absolutely Poor (AP)	((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))
Very Low (VL)	Very Poor (VP)	((0.0075, 0.0075, 0.015, 0.0525;0.8), (0.0,0.0,0.02,0.07;1.0))
Low (L)	Poor (P)	((0.0875, 0.12, 0.16, 0.1825;0.8), (0.04,0.10,0.18,0.23;1.0))
Medium Low (ML)	Medium Poor (MP)	((0.2325, 0.255, 0.325, 0.3575;0.8), (0.17,0.22,0.36,0.42;1.0))
Medium (M)	Fair (F)	((0.4025, 0.4525, 0.5375, 0.5675;0.8), (0.32,0.41,0.58,0.65;1.0))
Medium High (MH)	Medium Good (MG)	((0.65, 0.6725, 0.7575, 0.79;0.8), (0.58,0.63,0.80,0.86;1.0))
High (H)	Good (G)	((0.7825, 0.815, 0.885, 0.9075;0.8), (0.72,0.78,0.92,0.97;1.0))
Very High (VH)	Very Good (VG)	((0.9475, 0.985, 0.9925, 0.9925;0.8), (0.93,0.98,1.0,1.0;1.0))
Absolutely High (AH)	Absolutely Good (AG)	((1.0, 1.0, 1.0, 1.0; 1.0), (1.0, 1.0, 1.0, 1.0; 1.0))

¹⁹ Kaui-Hwang Chen et al. "Service Innovation and New Product Performance: The Influence of Market-Linking Capabilities and Market Turbulence." *International Journal of Production Economics* 172 (2016), 54-64.

Direct-relation matrix with the linguistic evaluations of each decision maker for the criteria are given in Table 3.

Table 3: Linguistic direct-relation matrix

	C1			C2			C3			C4			C5			C6		
	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3
C1	-	-	-	M	M	MH	M	M	ML	M	M	M	M	M	M	MH	H	MH
C2	MH	H	VH	-	-	-	MH	MH	MH	VH	H	H	MH	M	MH	H	MH	M
C3	M	MH	M	MH	MH	M	-	-	-	VH	H	H	MH	M	M	MH	MH	MH
C4	M	M	MH	M	MH	M	M	H	MH	-	-	-	ML	MH	M	ML	M	M
C5	ML	ML	M	M	MH	M	VH	MH	M	ML	M	M	-	-	-	M	MH	M
C6	M	ML	M	M	ML	M	MH	M	MH	VH	H	H	M	M	MH	-	-	-

Initial direct-relation matrix with the trapezoidal fuzzy numbers is represented and the averaged values of fuzzy numbers are considered for the relation matrix. And then, normalization procedure is applied, and the results are given in Table 4.

Table 4: Normalized initial direct fuzzy relation matrix

	C1	C2	C3
C1	$((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))$	$((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))$	$((0.08,0.09,0.11,0.12;0.80), (0.07,0.08,0.12,0.14;1.00))$
C2	$((0.19,0.20,0.21,0.22;0.80), (0.18,0.19,0.22,0.23;1.00))$	$((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))$	$((0.16,0.16,0.19,0.19;0.80), (0.14,0.15,0.20,0.21;1.00))$
C3	$((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))$	$((0.10,0.11,0.13,0.14;0.80), (0.09,0.10,0.14,0.16;1.00))$	$((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))$
C4	$((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))$	$((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))$	$((0.15,0.16,0.18,0.18;0.80), (0.13,0.15,0.19,0.20;1.00))$
C5	$((0.07,0.08,0.10,0.10;0.80), (0.05,0.07,0.11,0.12;1.00))$	$((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))$	$((0.16,0.17,0.19,0.19;0.80), (0.15,0.16,0.19,0.20;1.00))$



C6	((0.08,0.09,0.11,0.12;0.80), (0.07,0.08,0.12,0.14;1.00))	((0.08,0.09,0.11,0.12;0.80), (0.07,0.08,0.12,0.14;1.00))	((0.14,0.15,0.17,0.17;0.80), (0.12,0.14,0.18,0.19;1.00))
	C4	C5	C6
C1	((0.10,0.11,0.13,0.14;0.80), (0.08,0.10,0.14,0.16;1.00))	((0.10,0.11,0.13,0.14;0.80), (0.08,0.10,0.14,0.16;1.00))	((0.17,0.18,0.20,0.20;0.80), (0.15,0.17,0.21,0.22;1.00))
C2	((0.20,0.21,0.22,0.23;0.80), (0.19,0.21,0.23,0.24;1.00))	((0.14,0.15,0.17,0.17;0.80), (0.12,0.14,0.18,0.19;1.00))	((0.15,0.16,0.18,0.18;0.80), (0.13,0.15,0.19,0.20;1.00))
C3	((0.20,0.21,0.22,0.23;0.80), (0.19,0.21,0.23,0.24;1.00))	((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))	((0.16,0.16,0.19,0.19;0.80), (0.14,0.15,0.20,0.21;1.00))
C4	((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))	((0.10,0.12,0.14,0.15;0.80), (0.08,0.11,0.15,0.17;1.00))	((0.08,0.09,0.11,0.12;0.80), (0.07,0.08,0.12,0.14;1.00))
C5	((0.08,0.09,0.11,0.12;0.80), (0.07,0.08,0.12,0.14;1.00))	((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))	((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))
C6	((0.20,0.21,0.22,0.23;0.80), (0.19,0.21,0.23,0.24;1.00))	((0.12,0.13,0.15,0.16;0.80), (0.10,0.12,0.16,0.18;1.00))	((0.0,0.0,0.0,0.0;1.0), (0.0,0.0,0.0,0.0;1.0))

Total relation fuzzy matrix is constructed before the defuzzification process. The matrix is presented in Table 5.

Table 5: Total relation fuzzy matrix

	C1	C2	C3
C1	((0.17,0.23,0.44,0.58;0.80), (0.10,0.17,0.65,1.42;1.00))	((0.28,0.34,0.57,0.72;0.80), (0.19,0.27,0.79,1.59;1.00))	((0.28,0.35,0.60,0.76;0.80), (0.18,0.28,0.84,1.70;1.00))

C2	((0.41,0.48,0.75,0.92;0.80), (0.31,0.41,1.00,1.92;1.00))	((0.24,0.31,0.57,0.74;0.80), (0.15,0.24,0.82,1.76;1.00))	((0.42,0.50,0.80,0.99;0.80), (0.31,0.41,1.08,2.09;1.00))
C3	((0.32,0.40,0.65,0.81;0.80), (0.22,0.32,0.89,1.77;1.00))	((0.34,0.41,0.67,0.83;0.80), (0.24,0.33,0.91,1.81;1.00))	((0.26,0.33,0.59,0.76;0.80), (0.16,0.25,0.85,1.80;1.00))
C4	((0.28,0.35,0.58,0.72;0.80), (0.19,0.28,0.79,1.58;1.00))	((0.28,0.35,0.58,0.73;0.80), (0.19,0.28,0.80,1.60;1.00))	((0.34,0.40,0.65,0.81;0.80), (0.24,0.33,0.89,1.75;1.00))
C5	((0.24,0.30,0.52,0.66;0.80), (0.15,0.24,0.73,1.49;1.00))	((0.28,0.34,0.57,0.71;0.80), (0.19,0.27,0.78,1.56;1.00))	((0.34,0.41,0.65,0.81;0.80), (0.24,0.34,0.87,1.71;1.00))
C6	((0.26,0.33,0.57,0.71;0.80), (0.17,0.26,0.78,1.59;1.00))	((0.27,0.33,0.57,0.72;0.80), (0.17,0.26,0.79,1.62;1.00))	((0.34,0.41,0.67,0.83;0.80), (0.24,0.34,0.91,1.79;1.00))
	C4	C5	C6
C1	((0.32,0.40,0.66,0.83;0.80), (0.22,0.32,0.91,1.81;1.00))	((0.26,0.33,0.56,0.71;0.80), (0.17,0.26,0.78,1.58;1.00))	((0.34,0.41,0.65,0.81;0.80), (0.25,0.34,0.89,1.74;1.00))
C2	((0.49,0.58,0.89,1.08;0.80), (0.38,0.49,1.18,2.23;1.00))	((0.36,0.44,0.71,0.89;0.80), (0.26,0.36,0.97,1.92;1.00))	((0.41,0.49,0.78,0.97;0.80), (0.29,0.40,1.06,2.07;1.00))
C3	((0.46,0.55,0.83,1.01;0.80), (0.36,0.46,1.11,2.10;1.00))	((0.32,0.39,0.65,0.82;0.80), (0.22,0.32,0.90,1.80;1.00))	((0.38,0.45,0.73,0.91;0.80), (0.28,0.37,1.00,1.95;1.00))
C4	((0.23,0.30,0.55,0.71;0.80), (0.15,0.23,0.79,1.68;1.00))	((0.27,0.33,0.56,0.71;0.80), (0.18,0.26,0.78,1.59;1.00))	((0.28,0.35,0.60,0.76;0.80), (0.18,0.27,0.83,1.69;1.00))



C5	$((0.31, 0.39, 0.64, 0.80; 0.80), (0.21, 0.31, 0.88, 1.76; 1.00))$	$((0.17, 0.23, 0.44, 0.57; 0.80), (0.10, 0.17, 0.64, 1.41; 1.00))$	$((0.30, 0.37, 0.61, 0.76; 0.80), (0.21, 0.30, 0.84, 1.67; 1.00))$
C6	$((0.42, 0.50, 0.76, 0.93; 0.80), (0.32, 0.42, 1.01, 1.92; 1.00))$	$((0.29, 0.36, 0.60, 0.75; 0.80), (0.20, 0.29, 0.82, 1.64; 1.00))$	$((0.21, 0.27, 0.51, 0.67; 0.80), (0.12, 0.20, 0.74, 1.61; 1.00))$

At final step of interval type 2 fuzzy DEMATEL, impact degrees of factors are computed, and the interval type 2 fuzzy numbers of each criterion are presented in Table 6.

Table 6: Impact degrees of criteria

Criteria	$(\tilde{D}_i + \tilde{R}_i)$
Communication (Criterion 1)	$((3.35, 4.16, 7.00, 8.82; 0.80), (2.26, 3.31, 9.69, 19.62; 1.00))$
Customer (Criterion 2)	$((4.02, 4.89, 8.03, 10.04; 0.80), (2.82, 3.96, 11.01, 21.92; 1.00))$
Performance (Criterion 3)	$((4.06, 4.93, 8.09, 10.11; 0.80), (2.86, 3.99, 11.09, 22.06; 1.00))$
Designing (Criterion 4)	$((3.93, 4.81, 7.86, 9.81; 0.80), (2.76, 3.90, 10.76, 21.39; 1.00))$
Competition (Criterion 5)	$((3.32, 4.12, 6.95, 8.76; 0.80), (2.24, 3.28, 9.63, 19.52; 1.00))$
Cooperation (Criterion 6)	$((3.72, 4.55, 7.56, 9.49; 0.80), (2.57, 3.66, 10.41, 20.89; 1.00))$

Thirdly, the ranking of managerial skills in banking industry is applied with interval type 2 fuzzy QUALIFLEX. For that, linguistic choices for each type of managerial skills are listed in Table 7.

Table 7: Linguistic decision matrix

	Alternative 1 (Technical Skills)			Alternative 2 (Conceptual Skills)			Alternative 3 Human or Interpersonal Skills)		
	DM 1	DM 2	DM 3	DM 1	DM 2	DM 3	DM1	DM2	DM3

Communication (Criterion 1)	F	MG	MG	MG	G	VG	VG	G	AG
Customer (Criterion 2)	G	MG	MG	G	MG	G	AG	G	VG
Performance (Criterion 3)	VG	VG	G	VG	VG	G	G	G	VG
Designing (Criterion 4)	VG	AG	VG	VG	G	G	G	G	MG
Competition (Criterion 5)	G	VG	G	VG	AG	VG	G	G	G
Cooperation (Criterion 6)	VG	AG	G	VG	G	VG	VG	G	VG

Expert evaluations with the trapezoidal fuzzy numbers are presented in Table 8. Averaged values of the decision makers are used for the fuzzy decision matrix.

Table 8: Fuzzy decision matrix

	Alternative 1	Alternative 2	Alternative 3
Criterion 1	((0.57,0.60,0.68,0.72;0.80), (0.49,0.56,0.73,0.79;1.00))	((0.79,0.82,0.88,0.90;0.80), (0.74,0.80,0.91,0.94;1.00))	((0.91,0.93,0.96,0.97;0.80), (0.88,0.92,0.97,0.99;1.00))
Criterion 2	((0.69,0.72,0.80,0.83;0.80), (0.63,0.68,0.84,0.90;1.00))	((0.74,0.77,0.84,0.87;0.80), (0.67,0.73,0.88,0.93;1.00))	((0.91,0.93,0.96,0.97;0.80), (0.88,0.92,0.97,0.99;1.00))
Criterion 3	((0.89,0.93,0.96,0.96;0.80), (0.86,0.91,0.97,0.99;1.00))	((0.89,0.93,0.96,0.96;0.80), (0.86,0.91,0.97,0.99;1.00))	((0.84,0.87,0.92,0.94;0.80), (0.79,0.85,0.95,0.98;1.00))
Criterion 4	((0.97,0.99,1.00,1.00;0.80), (0.95,0.99,1.00,1.00;1.00))	((0.84,0.87,0.92,0.94;0.80), (0.79,0.85,0.95,0.98;1.00))	((0.74,0.77,0.84,0.87;0.80), (0.67,0.73,0.88,0.93;1.00))
Criterion 5	((0.84,0.87,0.92,0.94;0.80), (0.79,0.85,0.95,0.98;1.00))	((0.97,0.99,1.00,1.00;0.80), (0.95,0.99,1.00,1.00;1.00))	((0.78,0.82,0.89,0.91;0.80), (0.72,0.78,0.92,0.97;1.00))



Criterion 6	((0.91,0.93,0.96,0.97; 0.80), (0.88,0.92,0.97,0.99;1.00))	((0.89,0.93,0.96,0.96;0.80), (0.86,0.91,0.97,0.99;1.00))	((0.89,0.93,0.96,0.96;0.80), (0.86,0.91,0.97,0.99;1.00))
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The signed distance $d(A_{ij}, \tilde{\theta}_1)$ for each A_{ij} in the decision matrix are assigned to compute the concordance/discordance index and the signed distance results are provided in Table 9.

Table 9: Signed distance $d(A_{ij}, \tilde{\theta}_1)$

	Alternative 1 (Technical Skills)	Alternative 2 (Conceptual Skills)	Alternative 3 (Human or Interpersonal Skills)
Communication (Criterion 1)	1.283	1.698	1.887
Customer (Criterion 2)	1.521	1.609	1.887
Performance (Criterion 3)	1.875	1.875	1.786
Designing (Criterion 4)	1.976	1.786	1.609
Competition (Criterion 5)	1.786	1.976	1.697
Cooperation (Criterion 6)	1.887	1.875	1.875

6 permutations of the ranking for the alternatives have been provided as $P_1 = (A_1, A_2, A_3)$, $P_2 = (A_1, A_3, A_2)$, $P_3 = (A_2, A_1, A_3)$, $P_4 = (A_2, A_3, A_1)$, $P_5 = (A_3, A_1, A_2)$, $P_6 = (A_3, A_2, A_1)$. And, the comprehensive index results for each pair of alternatives in the permutation are given in Table 10 and 11.

Table 10: The results of concordance/discordance index

	P1 (A1, A2, A3)			P2 (A1, A3, A2)			P3 (A2, A1, A3)		
	A1, A2	A1, A3	A2, A3	A1, A3	A1, A2	A3, A2	A2, A1	A2, A3	A1, A3
Communication (Criterion 1)	-0.415	-0.604	-0.189	-0.604	-0.415	0.189	0.415	-0.189	-0.604
Customer (Criterion 2)	-0.088	-0.366	-0.278	-0.366	-0.088	0.278	0.088	-0.278	-0.366

Performance (Criterion 3)	0.00 0	0.08 9	0.08 9	0.08 9	0.00 0	-0.089	0.00 0	0.08 9	0.08 9
Designing (Criterion 4)	0.19 0	0.36 8	0.17 7	0.36 8	0.19 0	-0.177	-0.19 0	0.17 7	0.36 8
Competition (Criterion 5)	-0.1 90	0.08 9	0.28 0	0.08 9	-0.1 90	-0.280	0.19 0	0.28 0	0.08 9
Cooperation (Criterion 6)	0.01 2	0.01 2	0.00 0	0.01 2	0.01 2	0.000	-0.01 2	0.00 0	0.01 2
	P4 (A2, A3, A1)			P5 (A3, A1, A2)			P6 (A3, A2, A1)		
	A2, A3	A2, A1	A3, A1	A3, A1	A3, A2	A1, A2	A3, A2	A3, A1	A2, A1
Communication (Criterion 1)	-0.1 89	0.41 5	0.60 4	0.60 4	0.18 9	-0.415	0.18 9	0.60 4	0.41 5
Customer (Criterion 2)	-0.2 78	0.08 8	0.36 6	0.36 6	0.27 8	-0.088	0.27 8	0.36 6	0.08 8
Performance (Criterion 3)	0.08 9	0.00 0	-0.0 89	-0.0 89	-0.0 89	0.000	-0.08 9	-0.0 89	0.00 0
Designing (Criterion 4)	0.17 7	-0.1 90	-0.3 68	-0.3 68	-0.1 77	0.190	-0.17 7	-0.3 68	-0.1 90
Competition (Criterion 5)	0.28 0	0.19 0	-0.0 89	-0.0 89	-0.2 80	-0.190	-0.28 0	-0.0 89	0.19 0
Cooperation (Criterion 6)	0.00 0	-0.0 12	-0.0 12	-0.0 12	0.00 0	0.012	0.00 0	-0.0 12	-0.0 12

Table 11: Comprehensive concordance / discordance index

	$I_j^1(A_1, A_2)$	$I_j^1(A_1, A_3)$	$I_j^1(A_2, A_3)$	I^1	$d(r^1, \tilde{\theta}_1)$
P_1	$((-5.42, -3.96, -1.35, -0.39; 0.80), (-13.23, -6.03, -0.18, 2.71; 1.00))$	$((-6.85, -4.53, 0.02, 1.91; 0.80), (-18.37, -7.75, 2.48, 9.42; 1.00))$	$((-2.47, -1.11, 1.91, 3.34; 0.80), (-8.43, -2.93, 3.86, 10.01; 1.00))$	$((-14.74, -9.61, 0.58, 4.86; 0.80), (-40.03, -16.71, 6.16; 22.14; 1.00))$	-11.75
P_2	$I_j^2(A_1, A_3)$	$I_j^2(A_1, A_2)$	$I_j^2(A_3, A_2)$	I^2	$d(r^2, \tilde{\theta}_1)$



P_2	((-6.85,-4.53,0.02,1.91;0.80), (-18.37,-7.75,2.48,9.42;1.00))	((-5.42,-3.96,-1.35,-0.39;0.80), (-13.23,-6.03,-0.18,2.71;1.00))	((-3.34,-1.91,1.11,2.47;0.80), (-10.01,-3.86,2.93,8.43;1.00))	((-15.61,-10.40,-0.22,3.99;0.80), (-41.60,-17.65,5.23,20.57;1.00))	-13.82
P_3	$I_j^3(A_2, A_1)$	$I_j^3(A_2, A_3)$	$I_j^3(A_1, A_3)$	I^3	$d(I^3, \tilde{\theta}_1)$
	((0.39,1.35,3.96,5.42;0.80), (-2.71,0.18,6.03,13.23;1.00))	((-2.47,-1.11,1.91,3.34;0.80), (-8.43,-2.93,3.86,10.01;1.00))	((-6.85,-4.53,0.02,1.91;0.80), (-18.37,-7.75,2.48,9.42;1.00))	((-8.93,-4.29,5.89,10.67;0.80), (-29.51,-10.50,12.37,32.66;1.00))	2.07
P_4	$I_j^4(A_2, A_3)$	$I_j^4(A_2, A_1)$	$I_j^4(A_3, A_1)$	I^4	$d(I^4, \tilde{\theta}_1)$
	((-2.47,-1.11,1.91,3.34;0.80), (-8.43,-2.93,3.86,10.01;1.00))	((0.39,1.35,3.96,5.42;0.80), (-2.71,0.18,6.03,13.23;1.00))	((-1.91,-0.02,4.53,6.85;0.80), (-9.42,-2.48,7.75,18.37;1.00))	((-3.99,0.22,10.40,15.61;0.80), (-20.57,-5.23,17.65,41.60;1.00))	13.82
P_5	$I_j^5(A_3, A_1)$	$I_j^5(A_3, A_2)$	$I_j^5(A_1, A_2)$	I^5	$d(I^5, \tilde{\theta}_1)$
	((-1.91,-0.02,4.53,6.85;0.80), (-9.42,-2.48,7.75,18.37;1.00))	((-3.34,-1.91,1.11,2.47;0.80), (-10.01,-3.86,2.93,8.43;1.00))	((-5.42,-3.96,-1.35,-0.39;0.80), (-13.23,-6.03,-0.18,2.71;1.00))	((-10.67,-5.89,4.29,8.93;0.80), (-32.66,-12.37,10.50,29.51;1.00))	-2.07
P_6	$I_j^6(A_3, A_2)$	$I_j^6(A_3, A_1)$	$I_j^6(A_2, A_1)$	I^6	$d(I^6, \tilde{\theta}_1)$
	((-3.34,-1.91,1.11,2.47;0.80), (-10.01,-3.86,2.93,8.43;1.00))	((-1.91,-0.02,4.53,6.85;0.80), (-9.42,-2.48,7.75,18.37;1.00))	((0.39,1.35,3.96,5.42;0.80), (-2.71,0.18,6.03,13.23;1.00))	((-4.86,-0.58,9.61,14.74;0.80), (-22.14,-6.16,16.71,40.03;1.00))	11.75

The comprehensive concordance/discordance index illustrates the permutation performances of each alternative. According to the results, permutation that has the maximum value of $d(I^6, \tilde{\theta}_1)$ is selected as best alternative for ranking the permutation. Accordingly, alternative with the maximum value is the optimal ranking order in a set of permutation for the alternatives. P4 is the best choice among the alternative set. It means that optimal ranking order is alternative 2 (Conceptual Skills), alternative 1 (Technical Skills), alternative 3 (Human or Interpersonal Skills) by the ranking degrees between them. However, permutation 2 is ranked as the worst value in the index results. The order of alternative 1 (Technical Skills), alternative 3 (Human or Interpersonal

Skills), alternative 2 (Conceptual Skills) could give the worst performance of service development for the managerial skills in the banking industry.

CONCLUSION

In this study, the skills of bank managers in the process of developing new products and services were analyzed. In this context, the current studies in the literature have been examined primarily. As a result of this evaluation, 6 different criteria have been determined which may affect the performance of bank managers in this process. On the other side, the fuzzy DEMATEL approach was taken into consideration during the determination of the importance weights of these criteria.

In the second stage of the analysis process, the skills of bank managers in the new service development process are listed. In this context, these skills are first divided into 3 different groups. In this scope, 3 different types of skills were identified: technical, conceptual and human skills. In the process of weighting these skills, fuzzy QUALIFLEX method is used. The results show that P4 is the best choice among the alternative set. It means that optimal ranking order is alternative 2 (Conceptual Skills), alternative 1 (Technical Skills), alternative 3 (Human or Interpersonal Skills) by the ranking degrees between them.

Analysis results of this study indicated that conceptual skills are the most significant for the bank managers in order for the success of new service development process. On the other side, technical skills have the second important skills in this framework. Moreover, human or interpersonal skills take place on the last rank. To the extent that people think conceptually, they can solve their complexity more successfully. Conceptual thinking affects the way people view things. Managers, who have conceptual thinking skills, question why an event is necessary. In other words, they ask why and how for the situations they encounter. The actions they will take will also be aimed at satisfying these questions. According to the findings of this study, it is recommended that banks should employ managers who have effective conceptual skills. For this purpose, banks should firstly make a survey analysis with the candidates to understand their skills more effectively. In this framework, they should give priorities for the people who have conceptual skills.

This study used fuzzy DEMATEL and fuzzy QUALIFLEX methods in order to analyze the skills of bank managers who work in new product and service development process. These approaches are firstly considered for this purpose which has an increasing effect on the originality of the study. In the future studies, this subject can be evaluated with different approaches. For example, fuzzy AHP and fuzzy ANP can be



used to weight the criteria. On the other side, fuzzy TOPSIS, fuzzy VIKOR and fuzzy MOORA can be taken into consideration to rank the alternatives.

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