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Research Article

Quantitative Analysis in Prioritizing Critical Success Factors for E-finance: A Case Study in Eskişehir

E-finansta Kritik Başarı Faktörlerinin Ağırlıklandırılmasına İlişkin Niceliksel Bir Analiz: Eskişehir'de Bir Örnek Olay Çalışması

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Öz

Özellikle 1980'li yılların sonlarıyla birlikte bilgi ve iletişim teknolojilerindeki olağanüstü gelişmeler birçok alanda olduğu gibi finansal piyasalarda da yeni ürün ve hizmetlerin doğmasına neden olmuştur. 1990'lı yılların ortalarından itibaren internetin hızla yaygınlaşması sayesinde elektronik finans (e-finans) finansal piyasalardaki yeni uygulama ve hizmetlerden biri olarak ön plana çıkmaya başlamıştır. Bankacılık sektörünün öncülük ettiği şirketler e-finans alanında yatırımlar yapmakta ve potansiyel müşteri bulma ve mevcut müşteriyi elde tutmada elektronik dağıtım kanallarını faal bir biçimde kullanmaktadır. Başta ticari bankacılık ve bağlı hizmetler, aracılık, fon yönetimi, mortgage ve sigortacılık gibi segmentlerde e-finans önemli bir ilerleme kaydetmiştir. Bu çalışmanın amacı belirsizlik ortamında e-finans için kritik başarı faktörlerinin Eskişehir'de oturan ve 100.000 $ üzerinde portföy büyüklüğüne sahip bireyler için ağırlıklandırılmasıdır. Bu amaçla e-finans alanında 43 karar vericinin görüşleri dikkate alınmış ve sezgisel bulanık küme tabanlı DEMATEL yönteminden yararlanılmıştır. Sonuçta e-finans için hız en çok etkileyen, güvenilirlik ise en çok etkilenen kritik başarı faktörü olarak elde edilmiştir.

Anahtar Kelimeler: *Finansal uygulamalar ve hizmetler, e-finans, internet bankacılığı, sezgisel bulanık kümeler, DEMATEL*

JEL Kodları: *C44, D14, G32*

Abstract

Extraordinary developments in information and communication technologies especially in the late 1980s gave rise to the emergence of new products and services also in financial markets as they did in several other areas. Along with the proliferation of internet as of the mid-1990s, electronic finance (e-finance) began to come to the forefront as one of the new practices and services in financial markets. Corporations under the leadership of banking sector make investments in the field of e-finance and use electronic distribution channels extensively for finding potential customers and keeping existing customers. E-finance had important progress in certain segments of finance such as commercial banking and related services, brokerage, fund management, mortgage and insurance. The aim of this study is to prioritize the e-finance related critical success factors for individuals accommodating in Eskişehir and having the portfolio size of more than 100.000 $ under uncertain environment. For this purpose the views of 43 decision makers in

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the field of e-finance are taken into the consideration. Intuitionistic fuzzy DEMATEL method has been used for this study. As a result while speed was found as the most essential cause criteria by having greater level of impact on the whole system, reliability was obtained as the most considerable effect criteria by easily affected by other criteria in terms of e-finance.

Keywords: *Financial practices and services, e-finance, internet banking, Intuitionistic fuzzy sets, DEMATEL*

JEL Codes*: C44, D14, G32*

1.Introduction

Any transaction which involves a financial institution and is performed through internet is deemed as e-finance. In this respect, financial transactions conducted by persons or non-finance institutions through internet are described as e-finance transaction (Erdoğdu, 2002, p.82).

E-finance is defined as electronic activities and transactions performed in combination with financial services. Electronic activities are carried out through internet and dial-up, e-banking, ATMs and telephone banking. Among e-finance activities, there exist themes such as cash management, payments, foreign exchange transactions, financing, e-brokerage, investments and data transfer (Ban et al., 2003, p.205).

Processing, transfer and storage of quantitative data and eventually, their use for or in a commercial activity by persons or institutions in intranet environment which can be accessed by a restricted number of users or internet environment are defined as electronic commerce (e-commerce). The part of e-commerce related to financial instruments and practices is covered by e-finance (Açıkgöz, 2006, p.48). Providing financial services by means of electronic and quantitative communication, in other words, the e-finance covers the use of internet and other communication tools in monetary, banking, payment systems, capital and insurance industries (Allen et al., 2001, p.1).

Through e-finance practices, receiving accurate and quick information especially in banking and finance issues is facilitated. The risk of error likely to be made through conventional financial methods is reduced through e-finance. Moreover, it is possible to reduce the workload on agencies. Furthermore, as well as low costs, accessibility at any time and place, confidentiality and trust felt by the customer, e-finance presents several alternatives to customers. Besides, by extending the opportunity to have easy access to information, e-finance contributes to the solution of asymmetric information problem by reducing transaction costs. While reducing risks, new financial products in e-finance market have also the positive effect that enables the transfer of risk. The fact that e-finance adds a new dimension to markets in terms of satisfying their liquidity needs is one of its striking features (Kınık, 2002, p.1).

Even though internet use in financial sector has a relatively short history, online channels were acknowledged to act as a crucial distribution channel in a short span of time. Starting to use computer networks frequently and establishing e-finance applications easily and at low costs on this architecture which formed the mainframe of e-finance infrastructure paved the way also for small companies to enter into the B2B (Business-to-Business) market.

Together with e-finance applications, businesses began benefiting from internet-based systems convenient for all their financial needs in diverse and broad range of areas such as management of bank accounts, payment of bills, management of funds (actives) and insurance products.

Analyses on developed OECD economies where internet is utilized at advanced levels demonstrate that almost half of small and medium-size companies receive online financial services. Institutions involved in the field of finance particularly the banks make important investments in e-finance and use distribution channels effectively to obtain new customers and keep existing ones. E-finance achieves significant progress especially in areas of commercial banking and related services (checking accounts, debit and credit card, payment services), brokerage and related services of security, management of funds (actives), mortgage finance and insurance (Erdoğdu, 2002, pp.82-83).

Putting e-finance applications into practice is firstly dependent on infrastructure investments, and then on several other investments such as security and software. Eventually, online banking, new payment systems and online brokerage practices urge businesses to restructure themselves, transform their processes and set up new systems (Akar and Kayahan, 2010, pp. 41-42). Table 1 exhibits the panorama of e-finance in a framework which compares it to the old economy:

Table 1 . An Overview of the Comparison of New Economy to Old Economy in the Context of E-Finance

Old Economy	**New Economy**
Imperfect information	Perfect information
Fragmented markets	Globally integrated markets
High transaction costs	Low transaction costs
High marginal costs	Low marginal costs
Seller-oriented	Buyer-oriented
Paper bills	Online bills
Transactions: Highly time-consuming	Transactions: Instantly and in due time
Low productivity	High productivity
Slow price adjustment	Instant price adjustment
High number of suppliers	Restricted number of suppliers
Low economic growth	High economic growth
Low rates of earnings	High or negative rates of earnings
Specific valuation methods	Ambiguous valuation methods

Source: RAY, Russ. "E-Finance: Taxonomy, Pedagogy, Assimilation, Cited by Yardımcıoğlu and Özer, 2012, 1243.

Table 2 indicates data on numbers of customers using internet banking as of 2019.

Table 2. Numbers of Active Internet Banking Customers

	April-June 2019	July-September 2019
Total Number of Active Retail Customers (in Thousands)	45,714	48,100
Total Number of Active Commercial Customers (in Thousands)	2,009	2,048
Total Number of Active Customers (in Thousands)	47,723	50,148

Source:https://www.tbb.org.tr/tr/banka-ve-sektor-bilgileri/istatistiki-raporlar/Dijital,_Internet_ve_Mobil_Bankacilik_Istatistikleri/3814 (The last access date: November 13, 2019)

In July-September 2019, total number of active retail and commercial customers of digital banking was 50 million 148 thousands. Of these customers, 4 million performed 'only internet banking' transactions whereas 38 million carried out 'only mobile banking' transactions. The number of those conducting both internet and mobile banking transactions was approximately 8 million. Total number of active retail and commercial customers of digital banking increased by 2 million 426 thousand customers in comparison to the previous time period.

The use of new technologies enables providers of financial services to enter into the market at lower service costs, and existing financial institutions will be confronted with serious pressures on their profitability unless they reduce their transaction costs by offering service in electronic format. Low levels of profitability can give rise to grave problems especially in countries in which competition between financial institutions did not exist at sufficient level and which was dominated by physical organizations operating with high fixed costs, rather than virtual organizations. Risks imposed on revenues and profitability are associated with the speed of proliferation of e-finance transactions, cost advantages of providing e-finance services and the ability of existing financial institutions to adapt. On the other hand, e-finance activities induce financial institutions to enter into a more fierce competition when compared to previous years. Conventionally financial institutions can be categorized on the basis of their geographical locations and physical organizations. However, thanks to the development of e-finance activities and the possibility of having access to internet by big masses, no financial institution is able to dominate a local or regional market with its physical organization. Thus, each financial institution takes steps to develop its customer base through mergers and acquisitions and differentiate its products and services (Kınık, 2002,p.4).

In general, e-finance had profound effect on two areas. The first pertains to the interaction between banking and financial services. Development of internet provoked a new transformation process in finance world, and moving away from the conventional perspective, different tools such as internet were used. The second is about that securities & bonds and foreign exchange transactions obtain a universal character and no more need physical space. These developments occupy a significant place in financial services sector. Another obvious feature of e-finance appertains to the transparency of prices and transformation of distribution channels. The increase in transparency enables the promotion of active competition (Yörük, 2003,pp. 303-304).

E-finance lays the groundwork for transforming the architecture of financial industry, developing a more competitive industry, redrawing border lines between different financial institutions and creating new financial products and services. Classical broker used to supply a limited number of customers with financial research reports and data, on the other hand, as modern broker got involved in financial transactions in digital environment, small investors could be benefiting from the same services enjoyed by big investors (Zekos, 2004, p.31). One of the most important institutions affected by e-finance was the securities exchange. Thus, there are capital increases and upward trend in the issuance of securities in global financial centers. Through e-broking services, money transfer mechanism reduces transaction costs, and small investors are encouraged to invest directly in markets of stocks (Fettahoğlu, 2017, p.21).

The aim of study is to determine the importance level of critical success factors for e-finance related decisions of individuals accommodating in Eskişehir and having portfolio size of more than 100.000 $.Remaining of the study is composed of four part. Literature review related to e-finance and critical success factors are presented in the first part. Intuitionistic fuzzy sets and DEMATEL technique are explained in the second part. Results of analysis are stated in the third section. Conclusions and future suggestions are described in the last section.

2.Literature Review

In the literature, there exist several academic studies on e-finance. Major studies are as the following: The study by Madhavan (2000) argues that e-finance will affect the transparency. With the democratization of information induced by internet, it is possible to have access to a better quality and larger data base at lower or no cost through old and new resources. The study by Sato et al. (2001) asserts that e-finance is structured on six layers, that is, online products, brokers, foreign exchange and trade systems, swap systems, legal and regulatory framework and communication platform. Litan et al. (2001) argues that developing countries are likely to be lagging behind developed countries on account of the revolutionary wave impact of e-finance on financial sector. Authors also add that it is essential that policy-makers learn how to monitor operational risks of institutions which use internet. Moreover, they suggest that it is likely that risk concentration problem of the financial sector will be deepened with the entry of foreign

investors. The study by Pomerleano and Vojta (2001) alleges that the use of fast-speed internet will make e-finance a highly attractive opportunity for foreign and local banks in developing countries despite the lack of infrastructure and weaknesses of legal and regulatory institutions. In the study performed by Kerem (2003) on critical success factors which had effect on the adoption of electronic banking in Estonia, it is deduced that the limited access to internet by certain consumer groups and the existence of growing digital gap between certain groups were associated with the insufficient level of consumer-driven consumption. The study by Saatcioğlu (2005) demonstrated that, thanks to e-finance, there was decrease in problems arising from asymmetric information such as adverse selection and moral hazard in relation to transactions between parties in the market. In the study by Çağlar (2008), e-currency as part of e-finance and its effects on the economy were evaluated on the basis of the relationship between technological development and economy, and it was claimed that new virtual economy was not alternative to conventional economy but complementary to it. The study by Karabıyık (2008) examined the structure of e-check which, as an element of e-finance, was likely to be an alternative means of payment and analyzed its applicability in Turkey. In this study, it is believed that e-check system which has almost the same attributes as paper-based check system is likely to be adopted by small and medium-size businesses which act as locomotives of economies and provide an important payment tool along with the increase in the volume of e-commerce transactions. The study performed by Topal and Kayahan (2009) on the perception of individual internet users about e-finance practices indicates that e-finance transactions were generally well-received by individuals and there was individual awareness about e-finance practices on the concentration map. In the study by Aytar et al. (2011), it was observed that, through e-finance practices, finance organizations had advantages of speed, effectiveness and cost in activity processes by successfully using opportunities presented by information technologies. In the study by Ratten (2012), it was highlighted that technological novelties of e-finance required individuals to be more proactive in mobile banking services, and besides, the more inclined persons were towards entrepreneurship in terms of mobile banking, the more likely they were to adopt mobile banking as a form of e-finance services. The study by Aytar et al. (2012) asserts that basic concerns which threaten the development process of electronic banking practices and induce certain persons to stay away from benefiting from these novelties pertain to the lack of sufficient information on the topic, the resistance to change and doubts about the safety of transactions. The study by Zengin and Güngördü (2013) proposes that, in order to ensure the adoption of new payment systems by consumers, it is essential to raise awareness about them, underline their benefits, support these novelties through legal regulations, prioritize electronic and mobile commerce, to promote personalization and to extend opportunities of these systems to consumers from every walk of life. The study by Bilir and Çay (2016) suggests that together with the disappearance of the need for depositing money into banks after the introduction of crypto currencies like Bitcoin, the need for brokers to transfer money between persons diminished significantly. It is believed that financial markets are likely to be more independent of central banks in the forthcoming years thanks to crypto currencies. Haddad (2018) states that infrastructure investments and technology and communication systems are needed in developing countries in order to establish e-finance system and these investments should be integrated with educational opportunities.

It is required to make arrangements and form new approaches in the fields of telecommunication, stocks, information and infrastructure for electronic transactions for developing countries. For this purpose market performances need to be improved by applying risk preventing arrangements (Claessens, 2001, p.4). Kuzic et al (2002) analyzed e-finance related CSFs for banks and financial institutions in Australia and found main challenges as technological costs,lack of e-commerce knowledge, budgeting, discovering talented personnel related to information technology and customer services. Additionally CSFs was determined as top management support, functional and user friendly website, cooperation with technology providers and effective project leader. Mia et al (2007) obtained the internet penetration as CSF for e-banking development. Hajibabaee et al. (2014) examined the CSFs for Mellat bank that provide electronical services in Iran. According to the results while behavioral success factors can predict the distinctive electronical services, it is not possible for structural and technical success factors.

In this study intuitionistic fuzzy sets and DEMATEL methods are used apart from the aforementioned studies. Thus decision makers can obtain more precise and accurate results than other techniques. According to the authors' view it is the first study that aims to prioritize the e-finance related critical success factors for individuals having the portfolio size of more than 100.000 $ via intuitionistic fuzzy set based DEMATEL method and contribute to the literature.

3.Methodology

3.1.Intuitionistic Fuzzy Sets

Intuitionistic fuzzy sets (IFS) as an extension of fuzzy set were proposed by Atanassov in 1986. IFS are characterized by membership and non-membership functions, and can handle indeterminate and uncertain judgments of human beings more flexible and efficiently than fuzzy sets. Also hesitancy degree of decision makers can be computed via IFS under unknown information. IFS describe the vagueness of aggrement, disaggrement and hesitation of a decision maker (Liu and Wang, 2007; Xu and Liao, 2013; Govindan, Khodaverdi and Vafandarnikjoo, 2015; Vafadarnikjoo, Mobin, Allahi and Rastegari, 2015; Vafadarnikjoo and Saeedpoor, 2014). IFS can be defined such as:

Let X be a fixed set. A IFS L is a mathematical object having the form as below:

$$L: \{< x, \mu_L(x), v_L(x) >; x \in X\} \qquad (1)$$

Where the function $\mu_L(x): x \to [0,1]$ represents the degree of the membership and $v_L(x): x \to [0,1]$ symbolizes the degree of non-membership of the element $x \in X$ to L respectively, for every $x \in X$,

$$0 \leq \mu_L(x) + v_L(x) \leq 1 \qquad (2)$$

IFS is characterized by membership and non-membership degrees whose sum is less than or equal to 1.

Additionally the hesitancy degree of $x \in X$, $(\pi_L(x))$ is calculated as follows:

$$\pi_L(x) = 1 - \mu_L(x) - v_L(x) \qquad (3)$$

An intuitionistic trapezoidal fuzzy number L with parameters $m_1 \leq l_1 \leq m_2 \leq l_2 \leq l_3 \leq m_3 \leq l_4 \leq m_4$ is shown as $L = \langle (l_1, l_2, l_3, l_4), (m_1, m_2, m_3, m_4) \rangle$ in the set of real numbers R. Membership and non-membership functions of the number L are described as below:

$$\mu_L(x) = \begin{cases} 0 & x < l_1 \\ \frac{x - l_1}{l_2 - l_1} & l_1 \leq x \leq l_2 \\ 1 & l_2 \leq x \leq l_3 \\ \frac{x - l_4}{l_3 - l_4} & l_3 \leq x \leq l_4 \\ 0 & l_4 < x \end{cases} \qquad (4)$$

$$v_L(x) = \begin{cases} 1 & x < m_1 \\ \frac{x - m_2}{m_1 - m_2} & m_1 \leq x \leq m_2 \\ 0 & m_2 \leq x \leq m_3 \\ \frac{x - m_3}{m_4 - m_3} & m_3 \leq x \leq m_4 \\ 1 & m_4 < x \end{cases} \qquad (5)$$

When $m_2 = m_3$ and $l_2 = l_3$ intuitionistic trapezoidal fuzzy number L transforms into the intuitionistic triangular fuzzy number.

Let $L_1 = \langle (l_1, l_2, l_3, l_4), (m_1, m_2, m_3, m_4) \rangle$ and $L_2 = \langle (n_1, n_2, n_3, n_4), (p_1, p_2, p_3, p_4) \rangle$ be two intuitionistic fuzzy numbers and $\lambda > 0$, then the operations on these two IFNs are described as below (Nehi and Maleki, 2005):

$L_1 + L_2 = \langle (l_1 + n_1, l_2 + n_2, l_3 + n_3, l_4 + n_4), (m_1 + p_1, m_2 + p_2, m_3 + p_3, m_4 + p_4) \rangle$ (6)

$$\lambda L_1 = \langle (\lambda l_1, \lambda l_2, \lambda l_3, \lambda l_4), (\lambda m_1, \lambda m_2, \lambda m_3, \lambda m_4) \rangle \quad (7)$$

Let $L = \langle (l_1, l_2, l_3, l_4), (m_1, m_2, m_3, m_4) \rangle$ be an intuitionistic fuzzy number and its expected value is computed as Eq. (8) when $\frac{x-l_1}{l_2-l_1}, \frac{x-l_4}{l_3-l_4}, \frac{x-m_2}{m_1-m_2}, \frac{x-m_3}{m_4-m_3}, m_1 \leq l_1 \leq m_2 \leq l_2 \leq l_3 \leq m_3 \leq l_4 \leq m_4$ (Grzegrorzewski, 2003):

$$EXVL(L) = \frac{1}{8}(l_1 + l_2 + l_3 + l_4 + m_1 + m_2 + m_3 + m_4) \quad (8)$$

3.2. DEMATEL Technique

DEMATEL (The Decision Making Trial And Evaluation Laboratory) which was developed between the years of 1972-1976 for the purpose of analyzing complex and intertwined problems (Fontela and Gabus, 1974, pp. 67-69). DEMATEL as a structural model shows the causal relationships between the factors by using diagram and matrices (Bai and Sarkis, 2013, p. 285). Elements of system are visualized by using diagram and matrices with respect to strength of the influence (Tseng and Lin, 2009, p.525). The DEMATEL method involves indirect implicit relationships consist of compromising cause and effect model. Relationship between cause and effect factors is transformed into an intelligible structural model by using the DEMATEL method (Wu and Lee, 2007, p.501).

Steps of DEMATEL technique are stated as below (Tsai and Chou, 2009, pp. 1444-1455; Wu and Lee, 2007, pp. 501-502):

Step 1: Creating the direct relationship matrix

Direct relation matrix is formed by using the pair-wise comparison scale composed of linguistic terms identified by decision makers. The initial direct relation matrix D_{nxn} in terms of influences and directions between criteria where d_{ij} denotes as the degree to which the criterion i affects the criterion j and can be represented as below:

$$D_{nxn} = \begin{bmatrix} (\mu_{11}, v_{11}) & \cdots & (\mu_{1j}, v_{1j}) \\ \vdots & \ddots & \vdots \\ (\mu_{i1}, v_{i1}) & \cdots & (\mu_{ij}, v_{ij}) \end{bmatrix} \quad (9)$$

Step 2: Acquiring normalized direct relation matrix

Normalized direct relation matrix is formed by using Eq. (10):

$$X = \frac{1}{max \sum_{j=1}^{n} d_{ij}} x D_{nxn} \qquad 1 \leq i \leq n \quad (10)$$

Step 4: Producing the total-relation matrix

The total-relation matrix T can be acquired by using Eq. (11), where the I is represented as the identity matrix.

$$T = X(I - X)^{-1} \quad (11)$$

Step 4: Creating causal diagram and analyzing results

The sum of columns and the sum of rows are used to acquire vector R and vector D within the total relation matrix T by using Eqs. (12), (13), and (14) respectively. After that the horizontal axis vector (D+R), called "Prominence", is formed by adding D to R, which indicates the level of importance of the criterion. The vertical axis (D-R) called "Relation", is formed by subtracting D from R, which divides the criteria into a cause group and an effect group. If (D-R) >0 the criterion belongs to the cause group; otherwise, it belongs to the effect group. Therefore, the causal diagram can be derived by mapping the dataset of (D+R, D-R), that provides valuable insights for making decisions.

$$T = \left|t_{ij}\right|_{nxn} \quad (12)$$

$$D = \left[\sum_{i=1}^{n} t_{ij}\right]_{nx1} = |t_{i.}|_{nx1} \quad (13)$$

$$R = \left[\sum_{j=1}^{n} t_{ij}\right]_{1xn} = \left|t_{.j}\right|_{1xn} \quad (14)$$

4.Analysis

Critical success factors for e-finance are stated as speed, accessibility, convenience, privacy, reliability and being customer specific respectively and can be coded as Table 3.

Table .3 Critical success factors for e-finance

Critical Success Factors	**Coding value**
C1	Speed
C2	Accessibility
C3	Convenience
C4	Privacy
C5	Reliability
C6	Being customer specific

A survey was prepared for finding the importance level of critical success factors of e-finance based on five point intuitionistic fuzzy linguistic scale converting DEMATEL comparison scale to intuitionistic trapezoidal fuzzy numbers. DEMATEL technique is selected for prioritizing the critical success factors of e-finance due to having inter-influenced and interdependent elements for e-finance. Intuitionistic fuzzy sets are applied for better considering the vague judgments of decision makers rather than fuzzy sets. Five point intuitionistic fuzzy linguistic scale consisting expected crisp value for each intuitionistic trapezoidal fuzzy number is showed in Table 4.

Table 4. Intuitionistic fuzzy linguistic scale (Vafadarnikjoo & Saeedpoor, 2014)

Definition	**Influence score**	**Intuitionistic trapezoidal fuzzy numbers**	**EXVL**
No influence	0	⟨(0,0,0,0), (0,0,0,0)⟩	0
Very low influence	1	⟨(0,0.1,0.2,0.3), (0,0.1,0.2,0.3)⟩	0.15
Low influence	2	⟨(0.3,0.4,0.5,0.6), (0.2,0.4,0.5,0.7)⟩	0.45
High influence	3	⟨(0.7,0.8,0.9,1), (0.7,0.8,0.9,1)⟩	0.85
Very high influence	4	⟨(1,1,1,1), (1,1,1,1)⟩	1

As a result surveys were filled from 43 decision makers having expertise with respect to e-finance in Eskişehir. While 15 decision makers are female, remaining are male. In addition 19 decision makers have expertise in e-finance with more than 5 years. 24 decision makers have expertise in e-finance with less than 5 years. A questionnaire that aims to prioritize the critical success factors related to e-finance based on pairwise comparisons was designed and applied to 43 decision makers. Equal weights are assigned to each decision maker. Geometric mean is applied for aggregating the each decision maker's judgments.

Then a direct relationship matrix consisting of crisp values is created and seen in Table 5.

Table. 5 Direct relationship matrix consisting crisp values

Criteria	C1	C2	C3	C4	C5	C6
C1	0	0.55655	0.479954	0.399393	0.358843	0.548836
C2	0.564985	0	0.541856	0.428351	0.427606	0.386513
C3	0.589486	0.409625	0	0.519961	0.338596	0.595296
C4	0.543771	0.474956	0.497143	0	0.442882	0.561849
C5	0.618537	0.61782	0.600857	0.449481	0	0.369095
C6	0.525148	0.526367	0.463535	0.450171	0.71576	0

Normalized direct relation matrix is formed by using Eq.(10) and then the total relation matrix T is obtained via Eq.(11) and seen in Table 6.

Table. 6 Total relation matrix

Criteria	C1	C2	C3	C4	C5	C6
C1	2.214045	2.217402	2.192333	1.945348	1.953723	2.141091
C2	2.387279	2.043651	2.207826	1.951986	1.966265	2.097517
C3	2.484876	2.262251	2.123063	2.052312	2.024116	2.237056
C4	2.528175	2.330621	2.330993	1.934553	2.096591	2.274770
C5	2.638186	2.450594	2.442103	2.15159	2.022588	2.302658
C6	2.656744	2.468645	2.446261	2.186307	2.277708	2.214709

Prominence (horizontal) and relation (vertical) axes represented by (D+R) and (D-R) are computed for acquiring the causal diagram. Computations for these axes can be shown in Table 7.

Table. 7 Prominence and relation axes computations for causal diagram

Criteria	D+R	D-R
C1	27.57325	2.24536
C2	26.42769	1.11864
C3	26.92625	0.55890
C4	25.71780	-1.27361
C5	26.34871	-1.66672
C6	27.51817	-0.98257

According to the Table 7 criteria 1 named speed was found as the most considered cause criteria having the prominence value of 27.57325. On the contrary criteria 5 named reliability was obtained as the most considered effect criteria having the relation value of -1.66672.

Decision makers need to pay more attention to the cause criteria group due to its impact on the whole system and goal. Also they achieve a high level of performance via controlling and focusing on cause group criteria. Speed (C7) is identified with the highest D-R score with '2.24536' meaning that C7 has a greater level of impact on the whole system than it does when receiving from other criteria. The degree of importance (D+R) score for criteria C7 is 27.57325, which ranks the first among all cause criteria. For that reason C7 has been determined as remarkable impact on other criteria and an ancitipated improvement of C7 will lead to the recovery of the whole system.

Criteria with the second highest D-R score is identified as C2, namely accessibility with a score of 1.11864. The degree of importance (D+R) score for criteria C2 is 26.42769 that ranks the fourth place among all criteria. Degree of influential impact (D) of C2 is 13.773166 and is ranked as

second place among all criteria. The degree of influenced impact (R) of C2 is 12.65452 means that the smaller impact it receives from others values examined and ranked as the last ultimately leads to a small value for the degree of importance (D+R). Therefore C2 needs to be handled as crucial impact on other criteria and improvement of C2 will lead to the recovery of whole system.

The features for each affected criterion needs to be evaluated to identify which factor would prove important for e-finance, despite being easily impacted by other criteria. From among all criteria within effect group, reliability (C5) having the lowest D-R score of -1.66672 and can be identified as the most affected by other criteria. But with a lower degree of influence and the degree of influenced impact values, lead to a lower degree of importance (D+R) value of 26.34871. This criterion can be improved upon by adjusting other examined criteria, so it is not considered as an essential component for e-finance.

Criteria with the second lowest D-R score is determined as C4 namely privacy with a score of -1.27361. Also C4 has the smallest degree of importance (D+R) value of 25.7178. Privacy can be improved by arranging other criteria and not be handled as important one.

Criteria with the third lowest D-R score is defined as C6 namely being customer specific with a score of -0.98257. On the contrary the degree of importance (D+R) score for C6 is 27.51817 that ranks the second place among all criteria due to having the highest degree of influenced impact (R) value as 14.25038 meaning that the larger impact it receives from others values examined. Therefore C6 needs to be examined as vital impact apart from cause criteria groups.

The causal diagram in terms of CSFs for e-finance as Figure 1.

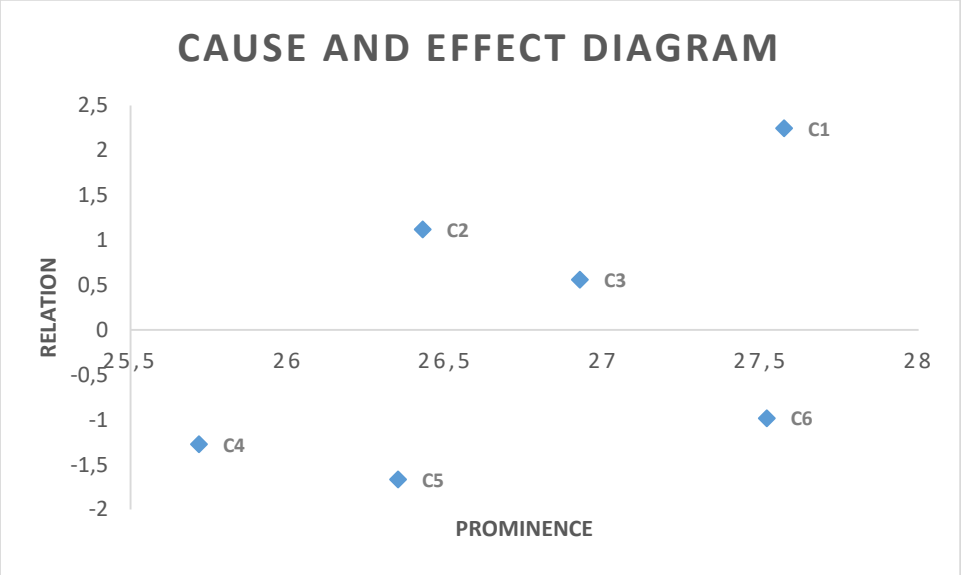

Figure 1. Cause and effect diagram for CSFs of e-finance

Criteria are divided into cause (C1, C2 and C3) and effect (C4,C5 and C6) criteria groups by relationship values (D-R). According to Figure 1 CSFs affecting e-finance can be identified as C1, C2 and C3. On the other hand CSFs that were affected from the e-finance are determined as C4,C5 and C6.

5.Discussion and Conclusion

New products and services are occurred in the financial markets with the development of information and communication technologies since 1980s. E-finance has been appeared as a new

application and service for financial markets due to proliferation of internet in the past decades. E-finance can be defined as financial services based electronic activities and transactions. Electronic activities can be applied via internet, dial-up, e-banking, atms and telephone banking. E-finance activities consist concepts of cash management, payments, currency activities, financing, e-brokerage, investments and information flow. CSFs have been considered as important issue for e-finance and need to be examined. For this purpose CSFs for e-finance are prioritized from the intuitionistic fuzzy sets based DEMATEL method. Factors are analyzed by dividing into cause and effect groups according to their relationships values (D-R). Speed (C1) was found as the most essential cause criteria by having greater level of impact on the whole system than it does when receiving from other criteria. On the other hand reliability (C5) was acquired as the most considerable effect criteria by easily affected by other criteria in terms of e-finance. As generally stated the factors of speed, accessibility, convenience and being customer specific are given higher importance by decision makers in e-finance process. Decision makers can invest based on more precise and consistent knowledge related to e-finance. Thus they can gain profit in the lowest risk levels via elasticity and diversification. According to the authors' knowledge it is the first study from the viewpoint of examining CSFs for e-finance in uncertainty via intuitionistic fuzzy sets based DEMATEL. Decision makers can express their judgments more flexible than fuzzy sets. CSFs for e-finance can be diversified and being analyzed by using other hybrid techniques in future studies.

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Araştırma Makalesi

Quantitative Analysis in Prioritizing Critical Success Factors for E-finance: A Case Study in Eskişehir

E-finansta Kritik Başarı Faktörlerinin Ağırlıklandırılmasına İlişkin Niceliksel Bir Analiz: Eskişehir'de Bir Örnek Olay Çalışması

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Genişletilmiş Özet

Giriş

Bir finansal kuruluşun dâhil olduğu ve internet aracılığıyla yapılan herhangi bir işlem e-finans olarak kabul edilmektedir. Bu bağlamda; kişilerin ya da finans dışı müesseselerin internet kullanmak suretiyle gerçekleştirdikleri finansal işlemler elektronik finans işlemi olarak tanımlanabilir (Erdoğdu, 2002:82).

Elektronik finans, finansal hizmetlerle birleşen elektronik faaliyet ve işlemler olarak tanımlanmaktadır. Elektronik faaliyetler, internet aracılığı ve dial-up, e-bankacılık, bankamatik ve telefon bankacılığı ile uygulanmaktadır. E-Finans faaliyetleri içerisinde nakit yönetimi, ödemeler, döviz faaliyetleri, finanslama, e-komisyonculuk, yatırımlar ve bilgi akışı gibi konular yer almaktadır (Ban vd. , 2003: 205).

Kişi ve kurumların açık ağ ortamında (internet) veya sınırlandırılmış sayıda kullanıcı tarafından ulaşılabilen kapalı ağ ortamında (intranet) sayısal bilgilerin işlenmesi, iletilmesi, saklanması ve sonuçta bir ticari faaliyet amaçlı veya sonucuna yönelik kullanılması elektronik ticaret (e-ticaret) olarak tanımlanmaktadır.

E-finans uygulamaları ile özellikle bankacılık ve finans konularında doğru ve hızlı bilgi sahibi olmak kolaylaşır. Geleneksel finans yöntemlerinde yaşanabilecek muhtemel personel hata riski azalır. Ayrıca birimlerin iş yükünü azaltmak mümkündür. Bunlara ilaveten düşük maliyetler, istenildiği zaman ve yerde erişilebilirlik, mahremiyet ve tüketiciye verdiği güven hissinin yanı sıra tüketicilere pek çok alternatif sunabilmektedir. Bunların yanısıra elektronik finans, işlem maliyetlerini azaltarak asimetrik bilgi sorununun çözümüne bilgiye ulaşabilme olanakları bakımından fayda sağlamaktadır. E-finans piyasasındaki yeni finansal ürünler riskleri düşürürken risklerin transferini kolaylaştırıcı etkilere de sahiptir. Piyasaların likidite gereksinimine yeni bir boyut kazandırması ise e-finansın çarpıcı özelliklerinden biridir (Kınık, 2002: 1).

Finansal sektörde internet kullanımının kısa sayılabilecek bir geçmişi olmasına rağmen, online kanallar kısa sürede önemli bir dağıtım kanalı olarak kabul görmüştür. Açık bilgisayar ağının (network) yaygın olarak kullanılmaya başlanması ve e-finans altyapısının ana çatısını oluşturan bu mimari üzerinde e-finans uygulamalarının düşük maliyetlerle ve kolayca kurulabilmesi olanakları küçük şirketlerin de B2B pazarına girmesinin yolunu açmıştır. E-finans uygulamaları

ile şirketler banka hesaplarının yönetimi, fatura ödemeleri, fon (aktif) yönetimi ve sigorta ürünleri gibi farklı ve geniş alanlarda bütün finansal ihtiyaçlarına uygun internet tabanlı sistemleri kullanmaya başlamıştır. İnternet kullanımının ileri düzeyde kullanıldığı OECD'ye bağlı gelişmiş ekonomilerde yapılan incelemeler küçük ve orta ölçekli kurumların en az yarısının finansal hizmetleri online olarak aldıklarını göstermektedir. Başta bankacılık olmak üzere finans alanında faaliyette bulunan kuruluşlar e-finansa önemli yatırımlar yapmakta ve yeni müşteri edinme ve mevcut müşteriyi elde tutmak için elektronik dağıtım kanallarını etkin olarak kullanmaktadır. Özellikle, ticari bankacılık ve bağlı hizmetler (Checking accounts; debit and credit card; payment services), aracılık (brokerage) ve bağlı güvenlik hizmetleri, fon (aktif) yönetimi, ipotek finansı ve sigortacılık alanlarında e-finans önemli bir gelişme göstermektedir (Erdoğdu, 2002: 82-83).

Yeni teknolojilerin kullanımı, finansal piyasalarda bu tür hizmet sunanların daha düşük hizmet fiyatlarıyla piyasaya girmesini sağlamakta, mevcut finansal kuruluşlar ise elektronik ortamda hizmet sunarak faaliyet giderlerini düşürmedikleri takdirde karlılıkları üzerinde ciddi baskılarla karşılaşmaktadır. Düşük karlılık oranları özellikle finansal kuruluşlar arasında rekabetin gelişmediği ve yüksek sabit maliyetlerle çalışan fiziki örgütlenmelerin yoğun olduğu ülkelerde ise önemli problemlere neden olabilmektedir. Gelirler ve karlılık üzerinde oluşan risk, elektronik finans faaliyetlerinin yaygınlaşma hızı, elektronik finans hizmetleri sağlamanın maliyet avantajı ve mevcut finansal kuruluşların uyum sağlama yeteneğiyle bağlantılıdır. Diğer taraftan, e- finans etkinlikleri finansal müesseselerin önceki senelere kıyasla daha ciddi bir rekabet ortamına girmelerine neden olmaktadır.

Genel olarak değerlendirildiğinde e-finansın iki alanda önemli etkisi olmuştur. Birincisi: bankacılık ve finansal hizmetler alanındaki etkileşimidir. İnternetin gelişimi finans dünyasını da yeni bir dönüşüm sürecine sokmuştur. Geleneksel bakış açısından uzaklaşılarak internet gibi farklı araçlar kullanılmıştır. İkincisi:, menkul kıymet ve tahvil, döviz işlemlerinin evrenselleşmesi fiziksel alana ihtiyaç duymamasıdır. Yaşanan bu gelişmeler finansal hizmet ve pazar sektöründe önemli yere sahiptir. E-finansın diğer belirgin özellikleri ise fiyat şeffaflığı, dağıtım kanallarının şekil değiştirmesidir. Şeffaflığın artışı aktif rekabetin artışını sağlamaktadır (Yörük, 2003: 303-304).

E-finans, finans endüstrisinin mimarisinin değişmesinde, daha rekabetçi bir endüstri, farklı finansal kurumlar arasındaki sınırların değiştirilmesi ile yeni finansal ürün ve hizmetlerin yaratılmasına zemin hazırlar. Klasik anlamda broker, sayılı müşterilerine araştırma ve bilgilerini sunarken, broker'in elektronik ortamda işlem yapmasıyla birlikte küçük yatırımcılar da aynı imkanlardan istifade edebilir hale gelmiştir (Zekos, 2004:31).

E-finanstan etkilenen en önemli kurumlardan biri de menkul kıymet borsalarıdır. Bu sayede küresel finans merkezlerinde sermaye artırımı ve menkul kıymet ihracında artış görülmektedir. E-broking hizmetleri ile para aktarma mekanizması işlem maliyetlerini azaltmakta, küçük yatırımcıları hisse senedi piyasasına doğrudan yatırıma yöneltmektedir (Fettahoğlu, 2017:21).

Yöntem

Bulanık kümelerin bir uzantısı olan sezgisel bulanık kümeler Atanassov tarafından 1986 yılında ortaya atılmıştır. Üye olma ve olmama fonksiyonları ile karakterize edilen sezgisel bulanık kümeler karar vericilerin belirsiz ve kesin olmayan yargılarını bulanık kümelere nazaran daha esnek ve etkili olarak ele alır. Ek olarak karar vericilerin belirsiz bilgi altında hassasiyet dereceleri de sezgisel bulanık kümelerle hesaplanabilmektedir.

DEMATEL karmaşık ve birbiriyle bağlantılı problemleri analiz etme amacıyla 1972-1976 yılları arasında geliştirilmiştir. Yapısal bir model olarak DEMATEL faktörler arasındaki ilişkileri diyagram ve matrislerden yararlanarak gösterir. Sistemin bileşenleri etki gücü bağlamında diyagram ve matrisler yardımıyla görselleştirilir. DEMATEL yöntemi neden sonuç modelini içeren dolaylı ilişkileri dikkate alır.

E-finans için kritik başarı faktörleri hız, ulaşılabilirlik, kolaylık, gizlilik, güvenilirlik ve müşteriye özel olma olarak sıralanmıştır. Buna ilişkin bir anket hazırlanmış olup sezgisel yamuk bulanık

sayılardan oluşan beşli sezgisel bulanık dilsel ölçekten oluşmaktadır. E-finansa ilişkin kritik başarı faktörlerinin birbirini etkileyen ve birbiriyle bağlantılı olmasından dolayı ağırlıklandırmada DEMATEL yöntemi tercih edilmiştir. Ayrıca karar vericilerin belirsiz yargılarını bulanık kümelere göre daha iyi değerlendiren sezgisel bulanık kümeler uygulanmıştır.

Sonuç olarak Eskişehir'de e-finans konusunda uzman 43 karar vericiye anket uygulanmış olup her birine eşit ağırlık atanmıştır. Karar vericilerin görüşlerinin birleştirilmesinde geometrik ortalamadan yararlanılmıştır.

Bulgular

Hız kriteri 27.57325 önem değerine sahip olarak en önemli neden kriteri bulunmuştur. Buna karşılık güvenilirlik ise -1.66672 ilişki değeri ile en öenmli sonuç kriteri olarak elde edilmiştir. Karar vericiler tüm sistem ve hedef üzerindeki etkisinden dolayı neden kriter grubuna daha çok önem vermelidir. Ayrıca neden kriter grubuna odaklanarak ve kontrol sağlayarak yüksek düzeyde performansa ulaşılabilir. Hız kriteri 2.24536 ile en yüksek D-R değerine sahiptir ve bu durum hızın tüm sistem üzerinde diğerlerine göre daha büyük etkiye sahip olduğunu gösterir. Hız için önem değeri olan D+R 27.57325 olup tüm neden kriterleri arasında ilk sırada yer almaktadır. Bu sebeple hız diğer kriterler üzerinde dikkate değer etkiye sahiptir ve bu kriter üzerinde önceden tahmin edilebilecek bir artış tüm sistem üzerinde iyileşmeye neden olacaktır.

Diğer kriterler tarafından kolayca etkilenebilecek olmasına rağmen e-finans için önem arz etmesi nedeniyle her bir etkilenen kriterin de dikkate alınması gereklidir. Etkilenen kriter grubu arasında güvenilirlik -1.66672 ile en düşük D-R değerine sahip olup diğer kriterler tarafından en çok etkilenen konumundadır. Düşük etki değeri aynı zamanda düşük önem değerine (D+R) yol açmaktadır. Bu kriter diğer ele alınan kriterler üzerinde düzenlemelerin yapılması ile geliştirilebileceğinden e-finans için önemli bir bileşen olarak dikkate alınmalıdır.

Genel olarak bakıldığında kriterler ilişki değerleri olan D-R'ye göre neden ve sonuç kriter gruplarına ayrılırlar. E-finansı etkileyen kritik başarı faktörleri hız, erişilebilirlik ve kolaylık olurken etkilenen faktörler ise gizlilik, güvenilirlik ve müşteriye özel olma olarak sıralanabilir.

Tartışma

1980'lerden beri bilgi iletişim teknolojilerindeki gelişmelerle birlikte finansal piyasalarda yeni ürün ve hizmetler ortaya çıkmıştır. Son yıllarda internetin yaygınlaşması nedeniyle e-finans finansal piyasalar için yeni bir uygulama ve hizmet olarak belirginleşmiştir. E-finans elektronik faaliyetler ve işlemlere dayalı olan finansal hizmetler olarak tanımlanabilir. Elektronik faaliyetler internet, çevirmeli ağ, e-bankacılık, atmler ve telefon bankacılığı aracılığıyla uygulanmaktadır. E-finans faaliyetleri nakit yönetimi, ödemeler, döviz işlemleri, e-brokerlık, yatırımlar ve bilgi akışı gibi kavramları içermektedir. Kritik başarı faktörleri bu kapsamda e-finans için önemli olup dikkate alınmalıdır. Bu amaçla e-finans için kritik başarı faktörleri sezgisel bulanık küme tabanlı DEMATEL yöntemiyle ağırlıklandırılmıştır. Faktörler ilişki değerlerine göre neden ve sonuç gruplarına ayrılmıştır. Hız en önemli neden kriteri olup tüm sistem üzerinde diğerlerine göre daha büyük etkiye sahiptir. Diğer taraftan güvenilirlik ise e-finans bağlamında en kolay etkilenen sonuç kriteri olarak bulunmuştur. Genel olarak hız, erişilebilirlik, kolaylık ve müşteriye özel olma e-finans süreci kapsamında karar vericiler tarafından büyük önem verilen kriterlerdir. Bu çalışma e-finans için kritik başarı faktörlerini belirsizlik ortamında sezgisel bulanık küme tabanlı DEMATEL yöntemiyle incelemesi nedeniyle özgündür. Karar vericiler bu yöntem ile görüşlerini bulanık kümelere göre daha esnek olarak açıklama şansına sahip olmuşlardır. Gelecek çalışmalarda e-finans için kritik başarı faktörleri farklılaştırılabilir ve diğer hibrit tekniklerden yararlanılabilir.