Yayına Geliş Tarihi:29-11-2022
Yayına Kabul Tarihi: 07-12-2022
DOI: 10.54410/denlojad.1211835

Araştırma Makalesi

Mersin Üniversitesi
Denizcilik ve Lojistik
Araştırmaları Dergisi
Cilt: 4 Sayı:2 Yıl:2022
Sayfa: 254-286
E-ISSN: 2687-6604

HUMAN RESOURCES MANAGER SELECTION BASED ON FUZZY AND INTUITIONISTIC FUZZY NUMBERS FOR LOGISTICS COMPANIES

Karahan KARA[1]
Sercan EDİNSEL[2]
Galip Cihan YALÇIN[3]

ABSTRACT

Qualified managers are needed for the systematic functioning of logistics management applications. In logistics companies, the human resources manager takes part in determining the amount of personnel needed, supplying personnel, and creating personnel task forms. For successful human resources management, a qualified human resources manager should be selected. In the literature, it is seen that the manager selection problem is handled with multi criteria decision making (MCDM) methods. The aim of this research is to determine the problem criteria of human resources manager selection for logistics companies and to apply them with hybrid MCDM methods. With the in-depth literature review, ten criteria were determined for the logistics company human resources manager selection problem. The intuitionistic fuzzy weighted averaging (IFWA) method was used to weight the criteria. The fuzzy multi attribute ideal-real comparative analysis (F-MAIRCA) method was applied for the ranking of the four candidate managers. The application

[1]Ass. Prof., Artvin Çoruh University, Hopa Vocational School, logistics Program, Artvin Turkey, https://orcid.org/0000-0002-1359-0244, karahan.kara@artvin.edu.tr
[2]Ass. Prof., OSTİM Technical University, FEAS, Department of Business Management, Ankara, Turkey, https://orcid.org/0000-0003-2831-7504, sercan.edinsel@ostimteknik.edu.tr
[3]PhD. Candidate, Kırıkkale University, Institute of Science and Technology, Department of Mathamatics, Kırıkkale, Turkey, https://orcid.org/0000-0001-9348-0709, pgcy2014@gmail.com

was made on a logistics company operating in Turkey. Research methods are based on fuzzy and intuitionistic fuzzy numbers. As a result of the study, the most important criterion in the selection of logistics human resources manager was determined as the experience criterion. Among the four candidates, the first candidate was seen as the best manager candidate. Suggestions have been developed for logistics companies, human resources manager candidates and researchers based on the research outputs. In addition, with this research, the IFWA and F-MAIRCA hybrid method has been brought to the literature.

Keywords: *Manager Selection Problem, Fuzzy Logic, Intuitionistic Fuzzy Numbers, IFWA, F-MAIRCA*

LOJİSTİK ŞİRKETLER İÇİN BULANIK VE SEZGİSEL BULANIK SAYILARA DAYALI İNSAN KAYNAKLARI YÖNETİCİSİ SEÇİMİ

ÖZ

Lojistik yönetim fonksiyonlarının sistematik işlemesi için nitelikli yöneticilere *ihtiyaç duyulmaktadır. Lojistik firmalarda insan kaynakları yöneticisi personel ihtiyacının belirlenmesi, personel temini ve personel görev formlarının oluşturulmasını rol almaktadır. Başarılı insan kaynakları yönetimi için nitelikli insan kaynakları yöneticisi seçimi yapılmalıdır. Literatürde yönetici seçim problemini çok kriterli karar verme yöntemleriyle ele alındığına rastlanmaktadır. Bu araştırmanın amacı lojistik firmalar için insan kaynakları yöneticisi seçim problem kriterlerinin belirlenmesi ve hibrit ÇKKV yöntemleriyle uygulanmasıdır. Derinlemesine yapılan literatür incelemesi sonucunda lojistik firma insan kaynakları yöneticisi için on kriter belirlenmiştir. Kriterlerin ağırlıklandırılmasında IFWA yöntemi uygulanmıştır. Dört aday yöneticinin sıralamasında ise F-MAIRCA yöntemi uygulanmıştır. Araştırmaya ait uygulama Türkiye'de faaliyet gösteren bir lojistik firma üzerinde yapılmıştır. Araştırma yöntemleri bulanık ve sezgisel bulanık sayılara dayalı ele alınmıştır. Çalışma sonucunda lojistik insan kaynakları yönetici seçiminde en önemli kriter tecrübe kriteri olarak belirlenmiştir. Dört aday arasından birinci aday en iyi yönetici adayı olarak görülmüştür. Araştırma sonucunda lojistik firmalara, insan kaynakları yönetici adaylarına ve araştırmacılara yönelik öneriler geliştirilmiştir. Ayrıca bu araştırmayla IFWA ve F-MAIRCA hibrit yöntemi literatüre kazandırılmıştır.*

Anahtar Kelimeler: *Yönetici Seçim Problemi, Bulanık Mantık, Sezgisel Bulanık Mantık, IFWA, F-MAIRCA*

1. INTRODUCTION

An organization's success depends on having best human resources. Businesses that cannot keep up with the change and competition may run the danger of failing financially due to aggressive mergers and acquisitions, high speed e-communication, quick technical advancements, and demographic and societal shifts (Kaygın et al., 2016; Lipiec, 2001). The selection of qualified employees, particularly managers, is critical to an organization's success (Kelemenis and Askounis, 2010). To manage and govern an organization or certain staff groups, managers are essential. The success or failure of an organization is determined by the decisions taken by manager. To deal with any challenges, a manager must possess essential abilities and knowledge (Kelemenis et al., 2011). Business owners must appoint managers with these knowledge, skills, and abilities to the top of their organizations due to the congruence of all functions. Humans are known to be subject to prejudice, even if more seasoned managers often are less impacted by it. This is a drawback of the conventional approach (Marlowe et al., 1996). It is crucial for businesses to select the best human resource manager without prejudice for future positions. Academia investigates numerous computer-aided decision-making techniques, including fuzzy logic, decision trees, and rough set theory. in which the performance of the candidates is assessed using a variety of measures. Researchers also try to make a judgement that closely resembles the real findings by integrating these ratings (Bonissone et al., 2009).

Logistics service providers are service-oriented companies that provide added value in ensuring material flow within the supply chain. Although logistics activities are based on autonomous systems day by day, they should be managed based on human capital. This importance of the human factor brings along the necessity of qualified personnel in logistics companies. The selection of qualified personnel depends on successful managers. At this point, it can be mentioned that the success of human resources management of logistics companies directly affects the quality of logistics service. As in other industries, the manager selection problem is important for logistics companies. For this reason, the human resources manager selection problem should be determined by scientific decision-making approaches. In this research, it is aimed to determine the selection criteria, criterion weighting and candidate selection method by considering the human resources manager selection problem of logistics companies. In this context, it is planned to determine the human resources manager selection criteria in this research, to weight the decision maker and criteria with the intuitionistic fuzzy weighted averaging (IFWA) method, and to rank the manager candidates with the fuzzy multi attribute ideal-real comparative analysis (F-MAIRCA) method. Thus, a methodological approach is developed to the literature regarding the human resource manager selection problem of logistics companies. Two basic research questions were developed within the scope of the research:

- Research Question 1: Can human resources manager selection criteria be established for logistics companies?
- Research Question 2: Can the IFWA and F-MAIRCA hybrid method be used in the human resource manager selection problem for logistics companies?

To answer the research questions presented above, in the second part of the research, a literature review of the selection criteria is made and manager selection criteria for logistics companies are presented. In the third part, IFWA and F-MAIRCA methods are explained step by step. In the fourth part, an application of the human resources manager selection problem of a logistics company has been made. In the fifth part, the results of the research are presented. In the sixth part, suggestions are presented to logistics companies, executive candidates, and researchers.

2. LITERATURE REVIEW AND CRITERIA SELECTION

It is well known that one of the most crucial aspects of human resources management is personnel selection problem. Selection of personnel is related to the input quality of the workforce. The selection of the manager has been done using MCDM in the literature. Regarding the manager selection criteria, researchers have their own perspectives. Jereb et al. (2005) used knowledge-based software implementing decision expert (DEXi) method for both selecting and weighting for manager selection. Chen and Cheng (2005) conducted information system (IS) project manager selecting problem with using fuzzy multi-criteria group decision (F-MCGD) support system for selecting and weighting. Six criteria were used to select the best IS project manager in the study. Xing and Zhang (2006) used the fuzzy analytic hierarchy process (F-AHP) method for selecting the best project manager. For global manager selecting Wu and Lee (2007) used the fuzzy decision making trial and evaluation laboratory (DEMATEL) method. Eight criteria were chosen for the selection of the best global manager in the study. Complex proportional assessment of alternatives with grey relations

(COPRAS-G) method used by Zavadskas et al. (2008) for both selecting and weighting method to select project manager. Six criteria were considered for the selection of the best project manager in the research.

Zhao et al. (2009) tried to find best project manager with using fuzzy comprehensive evaluation (FCE) method. Four criteria were used to select the best project manager in the study. 2-tuple linguistic variable and fuzzy preference ranking organization method for enrichment evaluation (F-PROMETHEE) method used for selecting by Chen et al. (2009) to select best overseas marketing manager. The research was carried out based on four criteria. Intuitionistic fuzzy technique for order preference by similarity to ideal solution (IF-TOPSIS) method used both for weighting and selecting by Boran et al. (2011) to select sales manager. The research was conducted with six criteria. Kelemenis et al. (2011) used twelve criteria for selecting best manager. Rashidi et al. (2011) used fuzzy logic model for selecting and weighting. Four criteria were chosen in the study. AHP method used for weighting and COPRAS-G method used for selecting by Zolfani et al. (2012) to select quality control manager. Seven criteria were used in the study. Zavadskas et al. (2012) used AHP for weighting and additive ratio assessment (ARAS) for selecting project manager. The research was carried out based on three criteria. Gilan et al. (2012) used three criteria for selecting project manager.

Baležentis and Zeng (2013) applied type 2 fuzzy multi-objective optimization on the basis of ratio analysis plus full multiplicative (MULTIMOORA) method for both weighting and selecting research and development manager. The research was based on five criteria. Wan et al. (2013) used fuzzy vlsekriterijumska optimizacija i kompromisno resenje (F-VIKOR) method for selecting manager. Six criteria were considered for the selection of the manager in the study. Jazebi and Rashidi (2013) benefited fuzzy rule system to find best project manager. In the research, the best project manager was calculated with four criteria. AHP method used for weighting and the international project management association (IPMA) competence baseline used for selecting project manager by Varajão and Cruz-Cunha (2013). Three criteria were also used in the study. Sabina and Davood (2013) try to find best human resources manager with using F-TOPSIS for both weighting and selecting. Four criteria were also chosen in the study. Logarithmic fuzzy preference programming (LFPP) method used for weighting and TOPSIS method used for selecting by Javadein et al. (2013) to select human resource manager. Afshari and Yusuff (2013) used fuzzy integral for both weighting and selecting best project manager. Four criteria are also proposed for the selection problem.

Sadeghi et al. (2014) used interval valued goal programming (IV-GP) for weighting and IV-TOPSIS for weighting best project manager with knowledge competencies, performance competencies and behavioral competencies criteria. Dodangeh et al. (2014) used F-MCDM method and applied basic requirements, project management skills, management skills and interpersonal skills criteria. İbicioğlu and Ünal (2014) preferred AHP method for both weighting and selecting human resource manager. Fuzzy competency rating used to find best project manager by Manaan et al. (2014). Özbek (2014) used F-AHP for selecting non-governmental organization manager. The research was also conducted based on eleven criteria. Afshari (2015) used fuzzy linguistic evaluation for weighting and Delphi method for selecting best project manager. Four main criteria and thirteen sub-criteria were used in the study. F-AHP used for weighting and F-TOPSIS used for selecting by Kusumawardani and Agintiara (2015) to select human resource manager. The research was applied with ten criteria. Özbek (2015) used AHP for weighting and MULTIMOORA for selecting academic unit manager. Fifteen criteria come to the fore in the research. Sadatrasool et al. (2016) used AHP and principal component analysis (PCA)-TOPSIS method for selection with three criteria.

Chaghooshi et al. (2016) used F-DEMATEL method for weighting and F-VIKOR for selection with five criteria. Afshari and Kowal (2017) used fuzzy linguistic evaluation procedure and PROMETHEE for selecting the best information and communication technology project manager with eight criteria. The multi-objective optimization ratio analysis (MOORA) method used both for weighting and selecting by Uğur (2017) to select construction project manager with eight criteria. Urosevic et al. (2017) applied the stepwise weight assessment ratio analysis (SWARA) and the weighted aggregated sum product assessment (WASPAS) methods for selecting sales manager with seven criteria. Cetin and Icigen (2017) used SWARA and MOORA for weighting and selecting, respectively with five criteria. Akça et al. (2018) conducted research for finding finance manager by using analytic network process (ANP) method. Celikbilek (2018) used Grey AHP for selecting project manager with five criteria. Thakre et al. (2018) preferred AHP for weighting and AHP-fuzzy linear programming for selecting branch manager. Four criteria were highlighted in the study. Erdin (2019) applied F-TOPSIS method for selecting site manager with seven criteria. The literature review regarding the methods and criteria used for various manager selection problem is presented in Table 1.

Table 1: Previous Studies on Selecting Manager with MCDM.

Authors	Position	Methods	Criteria
Jereb et al. (2005)	Manager	DEXi	Work experience, personnel characteristics and other (3 criteria)
Chen and Cheng (2005)	IS project manager	F-MCDG	Analysis and design skills, programming skills, interpersonal skills, business skills, environment skills and application skills (6 criteria)
Xing and Zhang (2006)	Project manager	F-AHP	Knowledge, capability, character, and body (4 criteria)
Wu and Lee (2007)	Global manager	F-DEMATEL	Cognitive IQ, emotional IQ, political IQ, cultural/social IQ, organizational IQ, network IQ, innovative IQ and intuitive IQ (8 criteria)
Zavadskas et al. (2008)	Project manager	COPRAS-G	Personal skills, project management skills, business skills, technical skills, quality skills and time of decision making (6 criteria)
Zhao et al. (2009)	Project manager	FCE	Site management capacity, technical level, level of leadership and personal qualities (4 criteria)
Chen et al. (2009)	Overseas marketing manager	F-PROMETHEE	English ability, work experience, market ability and communication ability (4 criteria)
Boran et al. (2011)	Sales manager	IF-TOPSIS	Oral communication skills, experience, general aptitude, willingness, self-confidence and first impression (6 criteria)
Kelemenis et al. (2011)	Manager	F-TOPSIS	Creativity/Innovation, problem solving/decision making, conflict management/negotiation, empowerment/delegation, strategic planning, specific presentation skills, communication skill, team management, diversity management, self-management, professional experience,

			educational background (12 criteria)
Rashidi et al. (2011)	Construction project manager	Fuzzy c-means clustering	Technical and professional background, educational background, demographic features, and general management abilities (4 criteria)
Zolfani et al. (2012)	Quality control manager	AHP, COPRAS-G	Knowledge of product and raw material, experience and educational background, administrative orientation, behavioral flexibility, risk evaluation ability, payment, teamwork (7 criteria)
Zavadskas et al. (2012)	Project manager	AHP, ARAS	Education, experience, and personal skills (3 criteria)
Gilan et al. (2012)	Project manager	MCDM	Technical competencies, behavioral competencies, and contextual competencies (3 criteria)
Balezentis and Zeng (2013)	R&D manager	F-MULTIMOORA	Proficiency in identifying research areas, proficiency in administration, personality, experience, self-confidence (5 criteria)
Wan et al. (2013)	Manager	F-VIKOR	Moral character, work attitude, leadership, cultural level, oral communication, and experience (6 criteria)
Varajao and Cruz-Cunha (2013)	Project manager	AHP, AHP-IPMA	Technical competence, behavioral competence and contextual competence (3 criteria)
Sabina and Davood (2013)	Human resources manager	F-TOPSIS	Scientific, psychological, behavioral, and apparent characteristics, functional characteristics and medical (4 criteria)
Javadein et al. (2013)	Human resources manager	LFPP, TOPSIS	Analytical thinking, respect to others, willingness, responsibility, appearance, being competitiveness, effective listening, creativity, foreign language, principles of management, organizational behavior, change management and decision making (13 criteria)
Afshari and Yusuff (2013)	Project Manager	F-Integral	Basic requirements, project management, management skills and interpersonal skills (4 criteria)

Sadeghi et al. (2014)	Project manager	IV-GP, IV-TOPSIS	Knowledge competencies, performance competencies and behavioral competencies (3 criteria)
Dodangeh et al. (2014)	Project Manager	F-MCDM	4 main criteria and 14 sub-criteria
İbicioğlu and Ünal (2014)	Human resources manager	AHP	7 main criteria and 35 sub-criteria
Özbek (2014)	Non-Governmental Organization Manager	F-AHP	Honesty and reliability, education, general culture, volunteering, sense of mission, initiative and decision making, responsibility, social and human relations, verbal and written expression ability, team awareness, objectivity and well adjusted (1 criteria)
Kusumawardani and Agintiara (2015)	Human resources manager	F-AHP, F-TOPSIS	Assessment center score, level of education, major at school/university, stream march, length of time on stream, talent cluster index, performance index, competence index, length of time on position band and disciplinary sanction (10 criteria)
Özbek (2015)	Academic Unit Manager	AHP, MULTI MOORA	Self-Confidence, reliability, objectiveness, honesty, personality, volunteering, analytical thinking ability, risk management, vision, task awareness, team awareness, decision-making ability, communication knowledge, understanding and expressing ability and social relations (15 criteria)
Sadatrasool et al. (2016)	Project manager	AHP, PCA-TOPSIS	General management, project management and petroleum project management (3 criteria)
Chaghooshi et al. (2016)	Project manager	F-DEMATEL, F-VIKOR	Site management capacity, technical level, level of leadership, personal qualities and contextual competences (5 criteria)
Uğur (2017)	Construction Project Manager	MOORA	School of graduation, active engineering period, age, number of projects completed, foreign language, reference, communication ability, fee request (8 criteria)

Urosevic et al. (2017)	Sales manager	SWARA, WASPAS	Communication skills, leadership skills, flexibility, decision making, negotiating skills, analytical skills and consistency (7 criteria)
Cetin and Icigen (2017)	Front office manager	SWARA, MOORA	Work experience, foreign language knowledge, education, computer skills and personal characteristics (5 criteria)
Celikbilek (2018)	Project manager	Grey AHP	Basic criteria, character criteria, software criteria, project criteria and energy criteria (5 criteria)
Thakre et al. (2018)	Branch manager and cashier	AHP, AHP-FLP	Management knowledge/skills, technical knowledge/skills, banking knowledge/skills and marketing knowledge/skills (4 criteria)
Erdin (2019)	Site Manager	F-TOPSIS	Creativity, self-confidence, problem solving and decision making, education, critical approach, human relations, experience (7 criteria)

In the literature review for the manager selection problem, it is observed that various criteria are used with different methods and the best manager candidate is determined. It is clearly understood that MCDM methods are mostly preferred in weighting the criteria and ranking the candidates. In this research, the human resources manager position in companies providing logistics service providers is discussed. The main purpose is to determine the criteria that come to the fore in the selection of human resources managers for logistics companies. Among the manager selection criteria obtained because of the literature review, the most suitable criteria for logistics companies were determined. In this determination process, a jury consisting of managers of a logistics service provider company was formed. As a result of the interviews with the formed jury, the criteria to be considered for the company and the definition of these criteria are presented in Table 2.

Table 2: Selected Criteria

Criteria	Definition	References
Interpersonal communication skills (C1)	It indicates the success of interpersonal communication needed to increase the efficiency of	Chen and Cheng (2005), Wu and Lee (2007), Zavadskas et al. (2008), Zhao et al. (2009), Chen et al. (2009), Boran et al. (2011), Kelemenis et al. (2011), Wan et al.

	companies providing logistics services.	(2013), Afshari and Yusuff (2013), Dodangeh et al. (2014), İbicioğlu and Ünal (2014), Özbek (2014), Afshari (2015), Özbek (2015), Urosevic et al. (2017), Akça et al. (2018), Erdin (2019).
Analytic thinking skills (C2)	It refers to the analytical thinking skills needed to produce effective solutions in the management of human resources in companies providing logistics services.	Chen and Cheng (2005), Javadein et al. (2013), Dodangeh et al. (2014), İbicioğlu and Ünal (2014), Özbek (2015), Urosevic et al. (2017).
Computer skills (C3)	It refers to the computer skills of the human resources manager candidate.	İbicioğlu and Ünal (2014), Kusumawardani and Agintiara (2015), Sadatrasool et al. (2016), Akça et al. (2018), Celikbilek (2018).
Human resource manager experience (C4)	It refers to the experience of working as a human resources manager in companies providing logistics services.	Zhao et al. (2009), Chen et al. (2009), Boran et al. (2011), Kelemenis et al. (2011), Rashidi et al. (2011), Zolfani et al. (2012), Zavadskas et al. (2012), Gilan et al. (2012), Balezentis and Zeng (2013), Wan et al. (2013), Dodangeh et al. (2014), İbicioğlu and Ünal (2014), Afshari (2015), Afshari and Kowal (2017), Cetin and Icigen (2017), Akça et al. (2018), Erdin (2019).
Management skills (C5)	It refers to human resource management skills in companies providing logistics services.	Chen and Cheng (2005), Wu and Lee (2007), Zavadskas et al. (2008), Boran et al. (2011), Rashidi et al. (2011), Gilan et al. (2012), Balezentis and Zeng (2013), Jazebi and Rashidi (2013), Afshari and Yusuff (2013), İbicioğlu and Ünal (2014), Özbek (2015), Sadatrasool et al. (2016), Thakre et al. (2018).
Educational degree (C6)	It refers to the education level of the human resources manager candidate.	Kelemenis et al. (2011), Rashidi et al. (2011), Zolfani et al. (2012), Zavadskas et al. (2012), Jazebi and Rashidi (2013), Dodangeh et al. (2014), İbicioğlu and Ünal (2014), Özbek (2014), Afshari (2015), Kusumawardani and Agintiara (2015), Cetin and Icigen (2017), Akça et al. (2018), Erdin (2019).
Decision making skills (C7)	It refers to successful decision-making skills in determining and selecting personnel needs in companies providing logistics services.	Wu and Lee (2007), Kelemenis et al. (2011), Javadein et al. (2013), Dodangeh et al. (2014), Özbek (2014), Afshari (2015), Özbek (2015), Urosevic et al. (2017), Erdin (2019).

Leadership skills (C8)	It refers to the leadership skills required for the successful management of human resources in companies providing logistics services.	Zavadskas et al. (2008), Wan et al. (2013), İbicioğlu and Ünal (2014), Chaghooshi et al. (2016), Urosevic et al. (2017).
Foreign language skills (C9)	It refers to the foreign language skills of the human resources manager candidate.	Zhao et al. (2009), Chen et al. (2009), Javadein et al. (2013), İbicioğlu and Ünal (2014), Afshari and Kowal (2017), Uğur (2017), Cetin and Icigen (2017).
Personality traits (C10)	It refers to the state of having the personality traits needed for human resource management.	Jereb et al. (2005), Chen and Cheng (2005), Zhao et al. (2009), Chen et al. (2009), Gilan et al. (2012), Wan et al. (2013), Afshari and Kowal (2017), Akça et al. (2018).

3. METHODOLOGY

3.1. Intuitionistic Fuzzy Sets

Intuitionistic fuzzy sets (IFS) were first introduced to the literature by Atanassov (1986). In the literature, it is seen that IFS is used in different decision making problems. Such as; resilient-green supplier selection problem (Xiong vd., 2020), selection of quality methods (Gojković et al., 2021), green supplier selection (Kumari and Mishra, 2020), coronavirus vaccine selection (Ecer, 2022), wastewater treatment plans selection (Zhou et al., 2018), sustainable supplier selection (Turk, 2022), lean six sigma project selection (Singh et al., 2021), healthcare waste treatment technologies selection (Salimian and Mousavi, 2022), site selection (Gao et al., 2021), supplier selection (Nakiboglu and Bulgurcu, 2020; Rahimi et al., 2021), IT personnel selection (Mishra et al., 2020), call center performance measurement (Oztaysi et al., 2020). Intuitionistic fuzzy set can be written as Eq (1) (Boran et al., 2009):

$$d = \{\langle x, \mu_d(x), \vartheta_d(x)\rangle | x \epsilon X\} \quad (1)$$

"where $\mu_d(x)$, $\vartheta_d(x)$: X→ $[0,1]$ are membership function and non-membership function, respectively, such that Eq (2)":

$$0 \leq \mu_d(x) + \vartheta_d(x) \leq 1 \ (2) \quad (2)$$

"A third parameter of IFS is $\pi_d(x)$, known as the intuitionistic fuzzy index or hesitation degree of whether x belongs to A or not (Eq. (3))":

$$\pi_d(x) = 1 - \mu_d(x) - \vartheta_d(x) \tag{3}$$

"It is obviously seen that for every $x \in X$ (Eq. (4))":

$$0 \leq \pi_d(x) \leq 1 \tag{4}$$

"If the $\pi_d(x)$ is small, knowledge about x is more certain. If $\pi_d(x)$ is great, knowledge about x is more uncertain. Obviously, when $\mu_d(x) = \pi_d(x) = 1 - \vartheta_d(x)$ for all elements of the universe, the ordinary fuzzy set concept is recovered."

3.2. Intuitionistic Fuzzy Weighted Averaging (IFWA)

Decision maker weights and criteria weights are calculated with the IFWA method developed by Xu (2007). Intuitionistic fuzzy numbers and symbols are shown in Table 3. Evaluations of the criteria and decision makers are based on the linguistic expressions in Table 3. In Table 3, $\mu(x)$ denotes membership degree, $\vartheta(x)$ denotes non-membership degree, $\pi(x)$ denotes hesitancy level (Boran et al., 2009; Schitea et al., 2019).

The steps of the IFWA method are as follows (Ecer et al., 2022):

Step 1-1: The decision matrix is created, which includes the linguistic items of the decision makers and criteria. Then, the decision matrix containing the linguistic items is transformed into intuitionistic fuzzy numbers.

Step 1-2: The weights of the decision makers (φ_d) are calculated by Eq. (5).

Step 1-3: Decision matrices created by the decision makers are aggregated. Aggregated decision matrix elements ($\hat{T}$) are calculated by Eq. (6).

Step 1-4: Using the positive ideal solution $\left(\Lambda^{+} = (1,0,0)\right)$ and non-positive ideal solution values $\left(\Lambda^{-} = (0,1,0)\right)$, positive ($\delta^{+}$) and negative ($\delta^{-}$) distance measures are calculated by Eq. (7) and Eq. (8), respectively.

Step 1-5: The closeness coefficients (CC) are calculated by Eq. (9). Criterion weights are calculated by normalizing the obtained values.

Table 3: A Scale Regarding the Assessment of Criteria and Experts

Symbol	Definition	Intuitionistic Fuzzy Numbers		
		$\mu(x)$	$\vartheta(x)$	$\pi(x)$
VI	Very important	0,88	0,08	0,04
I	Important	0,75	0,20	0,05
M	Medium	0,50	0,45	0,05
UI	Unimportant	0,35	0,60	0,05
VU	Very unimportant	0,08	0,88	0,04

$$\varphi_d = \frac{\left(\mu_d+\pi_d\cdot\left(\frac{\mu_d}{\mu_d+\vartheta_d}\right)\right)}{\sum_{d=1}^{s}\left(\mu_d+\pi_s\cdot\left(\frac{\mu_d}{\mu_d+\vartheta_d}\right)\right)}, d = \{1,2,.,,,s\} \tag{5}$$

$$\hat{T} = [1-\prod_{d=1}^{s}(1-\mu_T)^{\varphi_d}, \prod_{d=1}^{s}(\vartheta_T)^{\varphi_d}, \prod_{d=1}^{s}(1-\mu_T)^{\varphi_d} - \prod_{d=1}^{s}(1-\vartheta_T)^{\varphi_d}], \hat{T} = (\mu_{\hat{T}}, \vartheta_{\hat{T}}, \pi_{\hat{T}}),\ \pi_{\hat{T}} = 1-\mu_{\hat{T}} - \vartheta_{\hat{T}} \tag{6}$$

$$\delta^+ = \sqrt{(\mu_{\hat{T}} - \Lambda^+)^2 + (\vartheta_{\hat{T}} - \Lambda^+)^2 + (\pi_{\hat{T}} - \Lambda^+)^2} \tag{7}$$

$$\delta^- = \sqrt{(\mu_{\hat{T}} - \Lambda^-)^2 + (\vartheta_{\hat{T}} - \Lambda^-)^2 + (\pi_{\hat{T}} - \Lambda^-)^2} \tag{8}$$

$$CC = \frac{\delta^-}{\delta^+ + \delta^-} \tag{9}$$

3.3. Fuzzy Multi Attribute Ideal-Real Comparative Analysis (F-MAIRCA)

The MAIRCA method was developed by Pamučar et al. (2014). This method is based on determining the gap between ideal and empirical weights. Fuzzy MAIRCA method was also developed by Boral et al. (2020). In this method, the alternative with the lowest gap value is determined as the best alternative.

The steps of the F-MAIRCA method are as follows (Boral et al., 2020; Gul and Ak, 2020;):

Step 2-1: Using the items in Table 4, decision makers evaluate each alternative ($i = 1, 2, \ldots, m$) according to each criterion ($j = 1, 2, \ldots, n$). Thus, decision matrices containing linguistic items of each decision maker are obtained (Eq. (10)). Then the linguistic items are converted to triangular fuzzy numbers.

Table 4: Linguistic Expressions and Triangular Fuzzy Number Values (for F-MAIRCA)

Symbol	**Definition**	**Triangular Fuzzy Numbers**		
		l	m	u
VL	Very low	0,1	0,2	0,3
L	Low	0,2	0,3	0,4
ML	Medium low	0,3	0,4	0,5
M	Medium	0,4	0,5	0,6
MH	Medium High	0,5	0,6	0,7
H	High	0,6	0,7	0,8
VH	Very High	0,7	0,8	0,9

$$\tilde{X}^{(z)} = \begin{bmatrix} \tilde{X}_{11}{}^{(z)} & \cdots & \tilde{X}_{1j}{}^{(z)} & \cdots & \tilde{X}_{1n}{}^{(z)} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{X}_{i1}{}^{(z)} & \cdots & \tilde{X}_{ij}{}^{(z)} & \ldots & \tilde{X}_{in}{}^{(z)} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{X}_{m1}{}^{(z)} & \cdots & \tilde{X}_{mj}{}^{(z)} & \ldots & \tilde{X}_{mn}{}^{(z)} \end{bmatrix} \tag{10}$$

Step 2-2: The decision matrices created by the decision makers are aggregated with Eq. (11). Thus, the aggregated decision matrix ($\tilde{X}$) in Eq. (12) is obtained.

$$\tilde{X}_{11} = \frac{\tilde{X}_{11}{}^{(1)} + \tilde{X}_{11}{}^{(2)} + \cdots + \tilde{X}_{11}{}^{(z)}}{k} \tag{11}$$

$$\tilde{X} = \begin{bmatrix} \tilde{X}_{11} & \cdots & \tilde{X}_{1j} & \cdots & \tilde{X}_{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{X}_{i1} & \cdots & \tilde{X}_{ij} & \ldots & \tilde{X}_{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{X}_{m1} & \cdots & \tilde{X}_{mj} & \ldots & \tilde{X}_{mn} \end{bmatrix} \tag{12}$$

Step 2-3: The probability of decision makers selecting alternatives (P_{A_i}) is determined by Eq. (13). Since the decision makers are unbiased, it is assumed that the probability of selecting alternatives is equal.

$$P_{A_i} = \frac{1}{m};\ \sum_{i=1}^{m} P_{A_i} = 1; i = 1, 2, \dots, m \tag{13}$$

Step 2-4: The matrix of fuzzy theoretical ponder ($\tilde{T}_{P_A}$) is obtained by Eq. (14). This matrix is obtained by multiplying the P_{A_i}values with the criterion weights.

$$\tilde{T}_{P_A} = \begin{bmatrix} \tilde{T}_{P_{11}} & \cdots & \tilde{T}_{P_{1j}} & \cdots & \tilde{T}_{P_{1n}} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{T}_{P_{i1}} & \cdots & \tilde{T}_{P_{ij}} & \dots & \tilde{T}_{P_{in}} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{T}_{P_{m1}} & \cdots & \tilde{T}_{P_{mj}} & \dots & \tilde{T}_{P_{mn}} \end{bmatrix} \tag{14}$$

Step 2-5: The cost criteria and benefit criteria are normalized by Eq. (15) and Eq. (16), respectively. The normalized decision matrix ($\tilde{N}$) is shown in Eq. (17).

$$\tilde{N}_{ij} = \left(\frac{X_{ij}^{l-}}{X_{ij}^{u}}, \frac{X_{ij}^{l-}}{X_{ij}^{m}}, \frac{X_{ij}^{l-}}{X_{ij}^{l}}\right), X_{ij}^{l-} = \min_i X_{ij}^{l}, for\ cost\ criteria \tag{15}$$

$$\tilde{N}_{ij} = \left(\frac{X_{ij}^{l}}{X_{ij}^{u+}}, \frac{X_{ij}^{m}}{X_{ij}^{u+}}, \frac{X_{ij}^{u}}{X_{ij}^{u+}}\right), X_{ij}^{u+} = \max_i X_{ij}^{u}, for\ benefit\ criteria \tag{16}$$

$$\tilde{N} = \begin{bmatrix} \tilde{N}_{11} & \cdots & \tilde{N}_{1j} & \cdots & \tilde{N}_{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{N}_{i1} & \cdots & \tilde{N}_{ij} & \dots & \tilde{N}_{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{N}_{m1} & \cdots & \tilde{N}_{mj} & \dots & \tilde{N}_{mn} \end{bmatrix} \tag{17}$$

Step 2-6: The matrix of fuzzy actual ponder ($\tilde{T}_{R_A}$) in Eq. (18) is obtained by multiplying the normalized decision matrix elements ($\tilde{N}$) and the matrix of fuzzy theoretical ponder elements ($\tilde{T}_{P_A}$).

$$\tilde{T}_{R_A} = \begin{bmatrix} \tilde{T}_{R_{11}} & \cdots & \tilde{T}_{R_{1j}} & \cdots & \tilde{T}_{R_{1n}} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{T}_{R_{i1}} & \cdots & \tilde{T}_{R_{ij}} & \dots & \tilde{T}_{R_{in}} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \tilde{T}_{R_{m1}} & \cdots & \tilde{T}_{R_{mj}} & \dots & \tilde{T}_{R_{mn}} \end{bmatrix} \quad (18)$$

Step 2-7: The total gap matrix elements (g_{ij}) are obtained by Eq. (19).

$$g_{ij} = \sqrt{\frac{1}{3}\left[\left(T^{l}_{P_{ij}} - T^{l}_{R_{ij}}\right)^2 + \left(T^{m}_{P_{ij}} - T^{m}_{R_{ij}}\right)^2 + \left(T^{u}_{P_{ij}} - T^{u}_{R_{ij}}\right)^2\right]} \quad (19)$$

Step 2-8: By summing the gap values, the ranking of the alternatives (Q_i) is obtained by Eq. (20). The alternative with the lowest gap value is considered the best alternative.

$$Q_i = \sum_{j=1}^{n} g_{ij} \quad (20)$$

4. APPLICATION

In this research, the human resources manager selection problem of a logistics service company is discussed. Also, the application flows chart is presented in the Figure 1. The criteria for the manager selection criteria were obtained from the research in the literature. The criteria in the criteria pool were evaluated by the logistics company's top managers and experts. As a result of the evaluation, ten basic criteria were determined. There are four manager candidates for the human resources manager position of the logistics company. To determine the best manager candidate, four decision-making experts were determined by university-company cooperation. One of them is a professional expert in the field of management (DM-1), two of them are company senior managers and consultants (DM-2 and DM-4), and one is an academician in the field of management (DM-3). Managerial experience and academic proficiency levels of the decision makers were considered. Thus, the evaluations made by DM-1 were accepted as “very important”, the evaluations made by DM-2 and DM-4 as “important”, and the evaluations made by DM-3 as “medium”. In this context, IFWA methods were used to determine the criteria weights and F-MAIRCA methods were used to rank the manager candidates. The application steps are as follows:

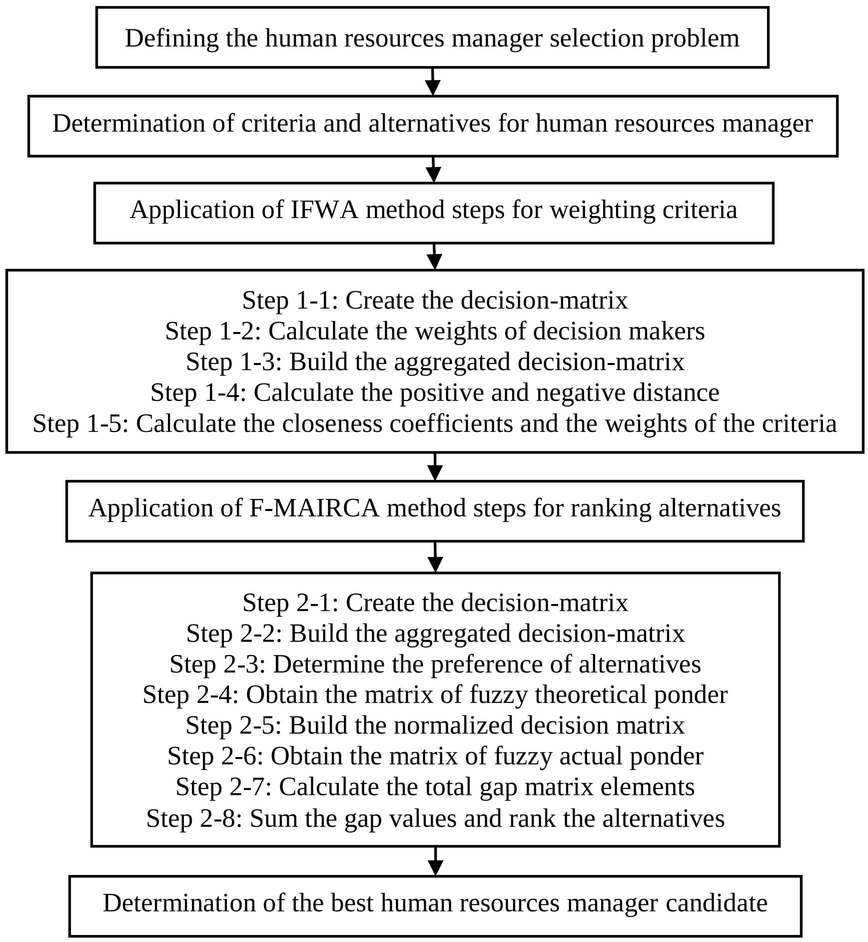

Figure 1 Application Flow Chart

Step 1-1: The linguistic items and intuitionistic fuzzy numbers of the decision makers are presented in Table 5. The linguistic items given to the criteria by the decision makers are presented in Table 6. The intuitionistic fuzzy numbers of the criteria are presented in Table 7.

Step 1-2: The weights of the decision makers were obtained by Eq. (5). It is presented in Table 8.

Step 1-3: The aggregated decision matrix elements are calculated by Eq. (6). The matrix is shown in Table 9.

Step 1-4: Positive and negative distance measures were calculated by Eq. (7) and Eq. (8). It is presented in Table 10.

Step 1-5: The closeness coefficients (CC) values were calculated by Eq. (9). The criteria weights are presented in Table 11.

Table 5: The Experts' Linguistic Items and Intuitionistic Fuzzy Numbers

DM	DM-1	DM -2	DM -3	DM -4
Linguistic items	VI	I	M	I
IF Numbers	[0,88;0,08;0,04]	[0,75;0,20;0,05]	[0,50;0,45;0,05]	[0,75;0,20;0,05]

Table 6: Linguistic Items That Decision Makers Give to Criteria

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
DM-1	VI	I	I	VI	I	I	VI	I	UI	M
DM-2	VI	VI	M	VI	VI	M	I	M	M	M
DM-3	I	M	M	VI	VI	M	I	M	UI	I
DM-4	M	M	UI	I	I	M	I	I	I	UI

Table 7: Intuitionistic Fuzzy Numbers That Decision Makers Give to Criteria

	C1			C2			C3			C4			C5		
	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π
DM-1	0,88	0,08	0,04	0,75	0,20	0,05	0,75	0,20	0,05	0,88	0,08	0,04	0,75	0,20	0,05
DM-2	0,88	0,08	0,04	0,88	0,08	0,04	0,50	0,45	0,05	0,88	0,08	0,04	0,88	0,08	0,04
DM-3	0,75	0,20	0,05	0,50	0,45	0,05	0,50	0,45	0,05	0,88	0,08	0,04	0,88	0,08	0,04
DM-4	0,50	0,45	0,05	0,50	0,45	0,05	0,35	0,60	0,05	0,75	0,20	0,05	0,75	0,20	0,05
	C6			**C7**			**C8**			**C9**			**C10**		
	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π
DM-1	0,75	0,20	0,05	0,88	0,08	0,04	0,75	0,20	0,05	0,35	0,60	0,05	0,50	0,45	0,05
DM-2	0,50	0,45	0,05	0,75	0,20	0,05	0,50	0,45	0,05	0,50	0,45	0,05	0,50	0,45	0,05
DM-3	0,50	0,45	0,05	0,75	0,20	0,05	0,50	0,45	0,05	0,35	0,60	0,05	0,75	0,20	0,05
DM-4	0,50	0,45	0,05	0,75	0,20	0,05	0,75	0,20	0,05	0,75	0,20	0,05	0,35	0,60	0,05

Table 8: φ_d Scores

	DM-1	DM-2	DM-3	DM-4
Weight of DMs	0,3033	0,2612	0,1742	0,2612

Table 9: The Aggregated Intuitionistic Fuzzy Numbers Decision Matrix

C1			C2			C3			C4			C5		
μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π
0,802	0,147	0,051	0,721	0,224	0,055	0,566	0,379	0,055	0,855	0,102	0,044	0,818	0,134	0,047
C6			**C7**			**C8**			**C9**			**C10**		
μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π	μ	ϑ	π
0,595	0,352	0,053	0,800	0,151	0,049	0,662	0,285	0,053	0,527	0,418	0,055	0,525	0,421	0,053

Table 10: $\delta^+ \ and \ \delta^-$ scores

Criteria	C1	C2	C3	C4	C5
δ^+	0,252	0,362	0,579	0,183	0,231
δ^-	1,172	1,061	0,842	1,241	1,192
Criteria	**C6**	**C7**	**C8**	**C9**	**C10**
δ^+	0,539	0,256	0,445	0,633	0,637
δ^-	0,881	1,167	0,976	0,787	0,784

Table 11: CC Values and Criterion Weights

Criteria	C1	C2	C3	C4	C5
CC	0,823	0,745	0,593	0,872	0,838
w_j	0,1159	0,1049	0,0834	0,1227	0,1179
Rank	3	5	8	1	2
Criteria	**C6**	**C7**	**C8**	**C9**	**C10**
CC	0,620	0,820	0,687	0,554	0,552
w_j	0,0873	0,1155	0,0967	0,0780	0,0777
Rank	7	4	6	9	10

Step 2-1: The decision matrix (linguistic expressions) created by the decision makers using the expressions in Table 2 is presented in Table 12. Triangular fuzzy number values are presented in Table 13 (Eq. (10)).

Step 2-2: The combined decision matrix is obtained by Eq. (11). It is shown in Table 14 (Eq. (12)).

Step 2-3: The probability of selecting an alternative ($P_{A_i} = \frac{1}{4}$) is determined by Eq. (13).

Step 2-4: The fuzzy matrix of theoretical ponder using the criterion weights obtained in "Steps 2-3" is shown in Table 15 (Eq. (14)).

Step 2-5: The normalized decision matrix was obtained by Eq. (17). It is shown in Table 16.

Step 2-6: The matrix of fuzzy actual ponder (Eq. (18)) obtained by multiplying the normalized decision matrix and the matrix of fuzzy theoretical ponder elements is shown in Table 17.

Step 2-7: The total gap matrix obtained by Eq. (19) is shown in Table 18.

Step 2-8: The gap values obtained by Eq. (16) and the ranking of alternatives are shown in Table 19.

Table 12: Decision Matrices of Decision Makers (Linguistic items)

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
DM-1	**A1**	H	H	MH	H	MH	M	MH	H	ML	ML
	A2	H	MH	M	VH	VH	M	H	ML	ML	M
	A3	MH	MH	M	MH	MH	H	MH	M	M	M
	A4	M	M	MH	M	ML	M	M	M	ML	ML
DM-2	**A1**	H	MH	M	H	MH	M	M	MH	M	ML
	A2	H	M	M	VH	H	ML	MH	L	L	ML
	A3	MH	M	M	M	M	H	H	ML	ML	L
	A4	MH	M	M	MH	M	MH	MH	ML	ML	ML
DM-3	**A1**	MH	MH	M	MH	H	MH	H	M	M	ML
	A2	H	ML	M	VH	H	ML	H	ML	L	M
	A3	M	M	M	MH	MH	M	MH	M	M	M
	A4	M	MH	M	MH	ML	ML	ML	ML	M	ML
DM-4	**A1**	H	H	H	MH	MH	L	H	M	ML	ML
	A2	H	MH	M	VH	H	ML	MH	L	ML	L
	A3	MH	MH	MH	H	H	M	M	L	ML	ML
	A4	M	M	MH	M	M	ML	M	ML	ML	ML

Table 13: Decision Matrices of Decision Makers (Triangular fuzzy number values)

		C1			C2			C3			C4			C5		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
DM-1	A1	0,6	0,7	0,8	0,6	0,7	0,8	0,5	0,6	0,7	0,6	0,7	0,8	0,5	0,6	0,7
	A2	0,6	0,7	0,8	0,5	0,6	0,7	0,4	0,5	0,6	0,7	0,8	0,9	0,7	0,8	0,9
	A3	0,5	0,6	0,7	0,5	0,6	0,7	0,4	0,5	0,6	0,5	0,6	0,7	0,5	0,6	0,7
	A4	0,4	0,5	0,6	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6	0,3	0,4	0,5
		C6			C7			C8			C9			C10		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
	A1	0,4	0,5	0,6	0,5	0,6	0,7	0,6	0,7	0,8	0,3	0,4	0,5	0,3	0,4	0,5
	A2	0,4	0,5	0,6	0,6	0,7	0,8	0,3	0,4	0,5	0,3	0,4	0,5	0,4	0,5	0,6
	A3	0,6	0,7	0,8	0,5	0,6	0,7	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6
	A4	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6	0,3	0,4	0,5	0,3	0,4	0,5
		C1			C2			C3			C4			C5		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
DM-2	A1	0,6	0,7	0,8	0,5	0,6	0,7	0,4	0,5	0,6	0,6	0,7	0,8	0,5	0,6	0,7
	A2	0,6	0,7	0,8	0,4	0,5	0,6	0,4	0,5	0,6	0,7	0,8	0,9	0,6	0,7	0,8
	A3	0,5	0,6	0,7	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6
	A4	0,5	0,6	0,7	0,4	0,5	0,6	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6
		C6			C7			C8			C9			C10		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
	A1	0,4	0,5	0,6	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6	0,3	0,4	0,5
	A2	0,3	0,4	0,5	0,5	0,6	0,7	0,2	0,3	0,4	0,2	0,3	0,4	0,3	0,4	0,5
	A3	0,6	0,7	0,8	0,6	0,7	0,8	0,3	0,4	0,5	0,3	0,4	0,5	0,2	0,3	0,4
	A4	0,5	0,6	0,7	0,5	0,6	0,7	0,3	0,4	0,5	0,3	0,4	0,5	0,3	0,4	0,5
		C1			C2			C3			C4			C5		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
DM-3	A1	0,5	0,6	0,7	0,5	0,6	0,7	0,4	0,5	0,6	0,5	0,6	0,7	0,6	0,7	0,8
	A2	0,6	0,7	0,8	0,3	0,4	0,5	0,4	0,5	0,6	0,7	0,8	0,9	0,6	0,7	0,8
	A3	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6	0,5	0,6	0,7	0,5	0,6	0,7
	A4	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6	0,5	0,6	0,7	0,3	0,4	0,5
		C6			C7			C8			C9			C10		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
	A1	0,5	0,6	0,7	0,6	0,7	0,8	0,4	0,5	0,6	0,4	0,5	0,6	0,3	0,4	0,5
	A2	0,3	0,4	0,5	0,6	0,7	0,8	0,3	0,4	0,5	0,2	0,3	0,4	0,4	0,5	0,6
	A3	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6	0,4	0,5	0,6	0,4	0,5	0,6
	A4	0,3	0,4	0,5	0,3	0,4	0,5	0,3	0,4	0,5	0,4	0,5	0,6	0,3	0,4	0,5
		C1			C2			C3			C4			C5		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
DM-4	A1	0,6	0,7	0,8	0,6	0,7	0,8	0,6	0,7	0,8	0,5	0,6	0,7	0,5	0,6	0,7
	A2	0,6	0,7	0,8	0,5	0,6	0,7	0,4	0,5	0,6	0,7	0,8	0,9	0,6	0,7	0,8
	A3	0,5	0,6	0,7	0,5	0,6	0,7	0,5	0,6	0,7	0,6	0,7	0,8	0,6	0,7	0,8
	A4	0,4	0,5	0,6	0,4	0,5	0,6	0,5	0,6	0,7	0,4	0,5	0,6	0,4	0,5	0,6
		C6			C7			C8			C9			C10		
		l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
	A1	0,2	0,3	0,4	0,6	0,7	0,8	0,4	0,5	0,6	0,3	0,4	0,5	0,3	0,4	0,5
	A2	0,3	0,4	0,5	0,5	0,6	0,7	0,2	0,3	0,4	0,3	0,4	0,5	0,2	0,3	0,4
	A3	0,4	0,5	0,6	0,4	0,5	0,6	0,2	0,3	0,4	0,3	0,4	0,5	0,3	0,4	0,5
	A4	0,3	0,4	0,5	0,4	0,5	0,6	0,3	0,4	0,5	0,3	0,4	0,5	0,3	0,4	0,5

Table 14: The Fuzzy Aggregated Decision Matrix

	C1			C2			C3			C4			C5		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,575	0,675	0,775	0,550	0,650	0,750	0,475	0,575	0,675	0,550	0,650	0,750	0,525	0,625	0,725
A2	0,600	0,700	0,800	0,425	0,525	0,625	0,400	0,500	0,600	0,700	0,800	0,900	0,625	0,725	0,825
A3	0,475	0,575	0,675	0,450	0,550	0,650	0,425	0,525	0,625	0,500	0,600	0,700	0,500	0,600	0,700
A4	0,425	0,525	0,625	0,425	0,525	0,625	0,450	0,550	0,650	0,450	0,550	0,650	0,350	0,450	0,550
	C6			**C7**			**C8**			**C9**			**C10**		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,375	0,475	0,575	0,525	0,625	0,725	0,475	0,575	0,675	0,350	0,450	0,550	0,300	0,400	0,500
A2	0,325	0,425	0,525	0,550	0,650	0,750	0,250	0,350	0,450	0,250	0,350	0,450	0,325	0,425	0,525
A3	0,500	0,600	0,700	0,500	0,600	0,700	0,325	0,425	0,525	0,350	0,450	0,550	0,325	0,425	0,525
A4	0,375	0,475	0,575	0,400	0,500	0,600	0,325	0,425	0,525	0,325	0,425	0,525	0,300	0,400	0,500

Table 15: The Fuzzy Matrix of Theoretical Ponder

	C1			C2			C3			C4			C5		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A2	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A3	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A4	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
	C6			C7			C8			C9			C10		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A2	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A3	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012
A4	0,201	0,037	0,013	0,180	0,056	0,014	0,142	0,095	0,014	0,214	0,025	0,011	0,205	0,034	0,012

Table 16: The Fuzzy Normalized Decision Matrix

	C1			C2			C3			C4			C5		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,719	0,844	0,969	0,733	0,867	1,000	0,704	0,852	1,000	0,611	0,722	0,833	0,636	0,758	0,879
A2	0,750	0,875	1,000	0,567	0,700	0,833	0,593	0,741	0,889	0,778	0,889	1,000	0,758	0,879	1,000
A3	0,594	0,719	0,844	0,600	0,733	0,867	0,630	0,778	0,926	0,556	0,667	0,778	0,606	0,727	0,848
A4	0,531	0,656	0,781	0,567	0,700	0,833	0,667	0,815	0,963	0,500	0,611	0,722	0,424	0,545	0,667
	C6			**C7**			**C8**			**C9**			**C10**		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,536	0,679	0,821	0,700	0,833	0,967	0,704	0,852	1,000	0,636	0,818	1,000	0,571	0,762	0,952
A2	0,464	0,607	0,750	0,733	0,867	1,000	0,370	0,519	0,667	0,455	0,636	0,818	0,619	0,810	1,000
A3	0,714	0,857	1,000	0,667	0,800	0,933	0,481	0,630	0,778	0,636	0,818	1,000	0,619	0,810	1,000
A4	0,536	0,679	0,821	0,533	0,667	0,800	0,481	0,630	0,778	0,591	0,773	0,955	0,571	0,762	0,952

Table 17: The Matrix of Fuzzy Actual Ponder

	C1			C2			C3			C4			C5		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,144	0,031	0,012	0,132	0,049	0,014	0,100	0,081	0,014	0,131	0,018	0,009	0,130	0,025	0,010
A2	0,150	0,032	0,013	0,102	0,039	0,011	0,084	0,070	0,012	0,166	0,023	0,011	0,155	0,029	0,012
A3	0,119	0,026	0,011	0,108	0,041	0,012	0,089	0,074	0,013	0,119	0,017	0,009	0,124	0,024	0,010
A4	0,107	0,024	0,010	0,102	0,039	0,011	0,094	0,077	0,013	0,107	0,016	0,008	0,087	0,018	0,008
	C6			**C7**			**C8**			**C9**			**C10**		
	l	m	u	l	m	u	l	m	u	l	m	u	l	m	u
A1	0,080	0,060	0,011	0,140	0,032	0,012	0,116	0,061	0,013	0,084	0,085	0,014	0,075	0,080	0,013
A2	0,069	0,053	0,010	0,147	0,033	0,012	0,061	0,037	0,009	0,060	0,066	0,011	0,081	0,085	0,013
A3	0,106	0,075	0,013	0,133	0,030	0,011	0,080	0,045	0,010	0,084	0,085	0,014	0,081	0,085	0,013
A4	0,080	0,060	0,011	0,107	0,025	0,010	0,080	0,045	0,010	0,078	0,081	0,013	0,075	0,080	0,013

Table 18: The Total Gap Matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
A1	0,033	0,028	0,026	0,048	0,043	0,043	0,035	0,029	0,030	0,036
A2	0,029	0,046	0,036	0,027	0,029	0,050	0,031	0,063	0,047	0,031
A3	0,047	0,043	0,033	0,055	0,047	0,026	0,039	0,052	0,030	0,031
A4	0,055	0,046	0,029	0,062	0,069	0,043	0,054	0,052	0,034	0,036

Table 19: The Gap Values and Ranking of Alternatives

Alternatives	**A1**	**A2**	**A3**	**A4**
The gap values	0,350	0,390	0,402	0,479
Rank	1	2	3	4

5. RESULTS

Companies must successfully implement management functions to obtain maximum efficiency from their human capital. For this, successful human resources management and managers are needed. For service providers, service quality is achieved by integrating personnel skills with company objectives. Like other service providers, the human factor also comes to the fore in the service quality of logistics service providers. The employment of the right human resource depends on the success of human resource management. Since the human resources manager is in a decision-making position in this process, they play an active role in bringing the personnel needed by the companies to the company. In this research, the human resources manager selection problem for logistics companies is discussed.

It is based on the correct determination of the basic criteria and candidates in decision making problems. Making selections based on many criteria at the same time increases the preferability of MCDM techniques in the decision-making process. In the literature, it is seen that MCDM methods are frequently used in research on manager selection. the human resources manager selection problem for logistics companies was carried out with MCDM methods in this study. Various criteria were found in the literature review for the determination of manager selection criteria. The preferred criteria in the selection of human resources managers for logistics companies were selected among the determined criteria. In the process of determining the criteria, the opinions of both human resources manager professionals and academicians were considered. As a result of the evaluations, ten criteria were determined. IFWA method was preferred for weighting decision makers and criteria, and F-MAIRCA method was selected for ranking manager candidates.

This research was carried out in two stages. In the first stage, criterion weights were determined. In the second stage, four executive candidates were ranked. According to the criterion weighting findings, the criterion with the highest significance level is “experience” ($w_4 = 0{,}1227$). The importance levels of the other criteria are as follows: Management skills ($w_5 = 0{,}1179$), interpersonal communication skills ($w_1 = 0{,}1159$), decision making skills ($w_7 = 0{,}1155$), analytic thinking skills ($w_2 = 0{,}1049$), leadership skills ($w_8 = 0{,}0967$), educational degree ($w_6 = 0{,}0873$), computer skills ($w_3 = 0{,}0834$), foreign language skills ($w_9 = 0{,}0780$), personality traits ($w_{10} = 0{,}0777$). As a result of the ranking of the alternatives, the most suitable alternative was determined as the first candidate manager. Finally, the best candidate was selected for the logistics service provider company.

6. SUGGESTIONS AND LIMITATIONS

In this research for the selection of human resources manager, suggestions have been developed for logistics companies, human resources manager candidates and researchers. Suggestions for logistics companies are as follows: (i) The human resource manager selection problem should be considered as a decision-making problem and the selection problem should be solved with MCDM techniques. (ii) In the selection of human resources manager, logistics companies should give more importance to the experience of the candidates compared to other criteria. (iii) Fuzzy-based MCDM methods should be preferred in manager selection. (iv) Manager candidate pool and selection criteria should be specified correctly. (v) Expert opinions should be used in the selection of managers. Suggestions for manager candidates are as follows: (i) Skills should be developed according to the ten criteria required for the logistics company human resources manager. (ii) Because of the high level of importance of the experience criterion, managerial experience should be acquired. (iii) Management, decision making, analytical thinking, leadership, communication, foreign language, computer skills should be developed. (iv) Must have a high level of education and managerial personality traits. Suggestions for researchers are as follows: (i) The criteria used in this research can be applied with different MCDM methods. (ii) For the human resources manager selection problem, a selection problem based on different criteria can be made. (iii) Sector-specific criteria can be determined by considering the human resources selection problem in different sectors. (iv) This research can be reconsidered by expanding the number of decision makers.

The limitations of this research are as follows: (i) The research was addressed with ten criteria, four decision makers and four candidates. Different results can be obtained by using different numbers of decision makers, criteria, and candidates. (ii) Fuzzy-based MCDM techniques were applied in the research. Application of different MCDM techniques can create differences in results. (iii) In this research, managers were selected for logistics companies. Manager selection problem can be handled in different sectors. (iv) This research was conducted on a logistics company operating in Turkey. Application results may differ in different countries. Finally, with this research, the criteria that can be preferred in the selection of human resources to logistics companies are presented and the application steps of the selection problem based on MCDM techniques are explained.

REFERENCES

Afshari, A. (2015). Selection of construction project manager by using Delphi and fuzzy linguistic decision making. *Journal of Intelligent & Fuzzy Systems*, *28*(6), 2827-2838. https://doi.org/10.3233/IFS-151562

Afshari, A. R., & Kowal, J. (2017). Decision Making Methods for the Selection of ICT Project Manager. *Gospodarka, Rynek, Edukacja*, *18*(4), 19-28. http://dx.doi.org/10.2139/ssrn.3118075

Afshari, A. R., & Yusuff, R. M. (2013). Fuzzy integral project manager selection. *Australian Journal of Multi-Disciplinary Engineering*, *9*(2), 149-154. https://doi.org/10.7158/14488388.2013.11464855

Akça, N., Sönmez, S., Gür, Ş. Yilmaz, A., & Tamer, E. (2018). Kamu hastanelerinde analitik ağ süreci yöntemi ile finans yöneticisi seçimi. *Optimum Ekonomi ve Yönetim Bilimleri Dergisi*, *5*(2), 133-146. https://doi.org/10.17541/optimum.390536

Atanassov K. (1986). Intuitionistic fuzzy sets. *Fuzzy Set And Systems Journal*, 20, 87–96.

Baležentis, T., & Zeng, S. (2013). Group multi-criteria decision making based upon interval-valued fuzzy numbers: an extension of the MULTIMOORA method. *Expert Systems with Applications*, *40*(2), 543-550. https://doi.org/10.1016/j.eswa.2012.07.066

Bonissone, P. P., Subbu, R., & Lizzi, J. (2009). Multicriteria decision making (MCDM): a framework for research and applications. *IEEE Computational Intelligence Magazine*, *4*(3), 48-61. https://doi.org/10.1109/MCI.2009.933093

Boral, S., Howard, I., Chaturvedi, S. K., McKee, K., & Naikan, V. N. A. (2020). An integrated approach for fuzzy failure modes and effects analysis using fuzzy AHP and fuzzy MAIRCA. *Engineering Failure Analysis*, *108*, 104195. https://doi.org/10.1016/j.engfailanal.2019.104195

Boran, F. E., Genç, S., Kurt, M., & Akay, D. (2009). A multi-criteria intuitionistic fuzzy group decision making for supplier selection with TOPSIS method. *Expert systems with applications*, *36*(8), 11363-11368. https://doi.org/10.1016/j.eswa.2009.03.039

Boran, F. E., Genç, S., & Akay, D. (2011). Personnel selection based on intuitionistic fuzzy sets. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *21*(5), 493-503. https://doi.org/10.1002/hfm.20252

Cetin, E. I., & Icigen, E. T. (2017). Personnel selection based on step-wise weight assessment ratio analysis and multi-objective optimization on the basis of ratio analysis methods. *International Journal of Economics and Management Engineering*, *11*(11), 2718-2722. https://doi.org/10.5281/zenodo.1314471

Chaghooshi, A., Arab, A., & Dehshiri, S. (2016). A fuzzy hybrid approach for project manager selection. *Decision Science Letters*, *5*(3), 447-460. https://doi.org/10.5267/j.dsl.2016.1.001

Chen, K. S., Wang, C. H., & Tan, K. H. (2019). Developing a fuzzy green supplier selection model using six sigma quality indices. *International Journal of Production Economics, 212*, 1-7.

Chen, L. S., & Cheng, C. H. (2005). Selecting IS personnel use fuzzy GDSS based on metric distance method. *European journal of operational research*, *160*(3), 803-820. https://doi.org/10.1016/j.ejor.2003.07.003

Chen, C. T., Hwang, Y. C., & Hung, W. Z. (2009). Applying multiple linguistic PROMETHEE method for personnel evaluation and selection. In *2009 IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 1312-1316). IEEE. https://doi.org/10.1109/IEEM.2009.5373021

Celikbilek, Y. (2018). A grey analytic hierarchy process approach to project manager selection, *Journal of Organizational Change Management*, *31*(3), 749-765. https://doi.org/10.1108/JOCM-04-2017-0102

Dodangeh, J., Sorooshian, S., & Afshari, A. R. (2014). Linguistic Extension for Group Multicriteria Project Manager Selection. *Journal of Applied Mathematics*, *2014*, 1-8. https://doi.org/10.1155/2014/570398

Ecer, F. (2022). An extended MAIRCA method using intuitionistic fuzzy sets for coronavirus vaccine selection in the age of COVID-19. *Neural Computing and Applications*, *34*(7), 5603-5623. https://doi.org/10.1007/s00521-021-06728-7

Ecer, F., Böyükaslan, A., & Hashemkhani Zolfani, S. (2022). Evaluation of cryptocurrencies for investment decisions in the era of Industry 4.0: a borda count-based intuitionistic fuzzy set extensions EDAS-MAIRCA-MARCOS multi-criteria methodology. *Axioms*, *11*(8), 404. https://doi.org/10.3390/axioms11080404

Erdin, C. (2019). Bulanık Topsis Yöntemiyle Yönetici Seçimi. *Yıldız Sosyal Bilimler Enstitüsü Dergisi*, *3*(1), 37-50.

Gao, J., Guo, F., Ma, Z., & Huang, X. (2021). Multi-criteria decision-making framework for large-scale rooftop photovoltaic project site selection based on intuitionistic fuzzy sets. *Applied Soft Computing*, *102*, 107098. https://doi.org/10.1016/j.asoc.2021.107098

Gigović, L., Pamučar, D., Bajić, Z., & Milićević, M. (2016). The combination of expert judgment and GIS-MAIRCA analysis for the selection of sites for ammunition depots. *Sustainability*, *8*(4), 372. https://doi.org/10.3390/su8040372

Gilan, S. S., Sebt, M. H., & Shahhosseini, V. (2012). Computing with words for hierarchical competency-based selection of personnel in construction companies. *Applied Soft Computing*, *12*(2), 860-871. https://doi.org/10.1016/j.asoc.2011.10.004

Gul, M., & Ak, M. F. (2020). Assessment of occupational risks from human health and environmental perspectives: a new integrated approach and its application using fuzzy BWM and fuzzy MAIRCA. *Stochastic Environmental Research and Risk Assessment*, *34*(8), 1231-1262. https://doi.org/10.1007/s00477-020-01816-x

İbicioğlu, H., & Ünal, Ö. F. (2014). Analitik hiyerarşi prosesi ile yetkinlik bazlı insan kaynakları yöneticisi seçimi. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*, *28*(4), 55-78.

Javadein, S. R. S Fathi, M. R., Behrooz, A., & Sadeghi, M. R. (2013). Human Resource Manager Selection Based on Logarithmic Fuzzy Preference Programming and TOPSIS Methods. *International Journal of Human Resource Studies*, *3*(2), 14. https://doi.org/10.5296/ijhrs.v3i2.3591

Jazebi, F., & Rashidi, A. (2013). An automated procedure for selecting project managers in construction firms. *Journal of Civil Engineering and Management*, *19*(1), 97-106. https://doi.org/10.3846/13923730.2012.738707

Jereb, E., Rajkovic, U., & Rajkovic, V. (2005). A hierarchical multi-attribute system approach to personnel selection. *International Journal of Selection and Assessment*, *13*(3), 198-205. https://doi.org/10.1111/j.1468-2389.2005.00315.x

Kaygin, C. Y., Tazegül, A., & Yazarkan, H. (2016). Estimation Capability of Financial Failures and Successes of Enterprises Using Data Mining and Logistic Regression Analysis. *Ege Akademik Bakis*, *16*(1), 147.

Kelemenis, A., & Askounis, D. (2010). A new TOPSIS-based multi-criteria approach to personnel selection. *Expert systems with applications*, *37*(7), 4999-5008. https://doi.org/10.1016/j.eswa.2009.12.013

Kelemenis, A., Ergazakis, K., & Askounis, D. (2011). Support managers' selection using an extension of fuzzy TOPSIS. *Expert Systems with Applications*, *38*(3), 2774-2782. https://doi.org/10.1016/j.eswa.2010.08.068

Kumari, R., & Mishra, A. R. (2020). Multi-criteria COPRAS method based on parametric measures for intuitionistic fuzzy sets: application of green supplier selection. *Iranian journal of science and technology, Transactions of Electrical Engineering*, *44*(4), 1645-1662. https://doi.org/10.1007/s40998-020-00312-w

Kusumawardani, R. P., & Agintiara, M. (2015). Application of fuzzy AHP-TOPSIS method for decision making in human resource manager selection process. *Procedia computer science*, *72*, 638-646. https://doi.org/10.1016/j.procs.2015.12.173

Lipiec, J. (2001). Human resources management perspective at the turn of the century. *Public Personnel Management*, *30*(2), 137-146. https://doi.org/10.1177/009102600103000201

Manaan, O. A., Ahadzie, D. K., Panford, J. K., & Proverbs, D. G. (2014). Competency-based evaluation of project managers' performance in mass house building projects in Ghana–the fuzzy set theory approach. *Journal of Science and Technology (Ghana)*, *34*(1), 46-62. https://doi.org/10.4314/just.v34i1.5

Marlowe, C. M., Schneider, S. L., & Nelson, C. E. (1996). Gender and Attractiveness Biases in Hiring Decisions: Are More Experienced Managers Less Biased. *Journal of Applied Psychology*, *81*(1), 11.

Mishra, A., Sisodia, G., Raj Pardasani, K., & Sharma, K. (2020). Multi-criteria IT personnel selection on intuitionistic fuzzy information measures and ARAS methodology. *Iranian Journal of Fuzzy Systems*, *17*(4), 55-68. https://doi.org/10.22111/IJFS.2020.5406

Nakiboglu, G., & Bulgurcu, B. (2021). Supplier selection in a Turkish textile company by using intuitionistic fuzzy decision-making. *The Journal of the Textile Institute*, *112*(2), 322-332. https://doi.org/10.1080/00405000.2020.1747675

Oztaysi, B., Onar, S. C., Kahraman, C., & Gok, M. (2020). Call center performance measurement using intuitionistic fuzzy sets. *Journal of Enterprise Information Management*, *33*(6), 1647-1668. https://doi.org/10.1108/JEIM-04-2017-0050

Özbek, A. (2014). Yöneticilerin çok kriterli karar verme yöntemi ile belirlenmesi. *Journal of Management and Economics Research*, *12*(24), 209-225. http://dx.doi.org/10.11611/JMER314

Özbek, A. (2015). Akademik birim yöneticilerinin MOORA yöntemiyle seçilmesi: Kırıkkale üzerine bir uygulama. *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *1*(38), 1-18.

Pamučar, D., Vasin, L., & Lukovac, L. (2014). Selection of railway level crossings for investing in security equipment using hybrid DEMATEL-MARICA model. In *XVI international scientific-expert conference on railway, railcon* (pp. 89-92).

Rahimi, M., Kumar, P., Moomivand, B., & Yari, G. (2021). An intuitionistic fuzzy entropy approach for supplier selection. *Complex & Intelligent Systems*, *7*(4), 1869-1876. https://doi.org/10.1007/s40747-020-00224-6

Rashidi, A., Jazebi, F., & Brilakis, I. (2011). Neurofuzzy genetic system for selection of construction project managers. *Journal of Construction Engineering and Management*, *137*(1), 17-29.

Sabina, M. N., & Davood, H. Z. (2013). Designing a fuzzy model for decision support systems in the selection and recruitment process. *African Journal of Business Management*, *7*(16), 1486-1491. https://doi.org/10.5897/AJBM11.2803

Sadatrasool, M., Bozorgi-Amiri, A., & Yousefi-Babadi, A. (2016). Project manager selection based on project manager competency model: PCA–MCDM Approach. *Journal of Project Management*, *1*(1), 7-20. https://doi.org/10.5267/j.jpm.2017.1.004

Sadeghi, H., Mousakhani, M., Yazdani, M., & Delavari, M. (2014). Evaluating project managers by an interval decision-making method based on a new project manager competency model. *Arabian Journal for Science and Engineering*, *39*(2), 1417-1430. https://doi.org/10.1007/s13369-013-0631-0

Salimian, S., & Mousavi, S. M. (2022). The selection of healthcare waste treatment technologies by a multi-criteria group decision-making method with intuitionistic fuzzy sets. *Journal of Industrial and Systems Engineering*, *14*(1), 205-220.

Schitea, D., Deveci, M., Iordache, M., Bilgili, K., Akyurt, I. Z., & Iordache, I. (2019). Hydrogen mobility roll-up site selection using intuitionistic fuzzy sets based WASPAS, COPRAS and EDAS. *International Journal of Hydrogen Energy*, *44*(16), 8585-8600. https://doi.org/10.1016/j.ijhydene.2019.02.011

Singh, M, Rathi, R, Antony, J & Garza-Reyes, JA (2021). Lean Six Sigma Project Selection in a Manufacturing Environment Using Hybrid Methodology Based on Intuitionistic Fuzzy MADM Approach. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2021.3049877

Thakre, T.A., Chaudhari, O.K. and Dhawade, N.R. (2017). Recruitment of personnel in a bank using AHP-FLP model. *Advances in Modelling and Analysis A*, *54*(3), 407–423.

Turk, S. (2022). Taguchi Loss Function in Intuitionistic Fuzzy Sets along with Personal Perceptions for the Sustainable Supplier Selection Problem. *Sustainability*, *14*(10), 6178. https://doi.org/10.3390/su14106178

Uğur, L. O. (2017). MOORA optimizasyon yaklaşımı ile inşaat proje müdürü seçimi: Çok kriterli bir karar verme uygulaması. *Politeknik dergisi*, *20*(3), 717-723. https://doi.org/10.2339/politeknik.339408

Urosevic, S., Karabasevic, D., Stanujkic, D., & Maksimovic, M. (2017). An Approach to Personnel Selection in the Tourism Industry Based on the SWARA and the WASPAS Methods. *Economic Computation and Economic Cybernetics Studies And Research*, *51*(1), 75-88.

Wan, S. P., Wang, Q. Y., & Dong, J. Y. (2013). The extended VIKOR method for multi-attribute group decision making with triangular intuitionistic fuzzy numbers. *Knowledge-Based Systems*, *52*, 65-77. https://doi.org/10.1016/j.knosys.2013.06.019

Wu, W. W., & Lee, Y. T. (2007). Developing global managers' competencies using the fuzzy DEMATEL method. *Expert systems with applications*, *32*(2), 499-507. https://doi.org/10.1016/j.eswa.2005.12.005

Xing, B., & Zhang, A. D. (2006, October). Application of fuzzy analytical hierarchy process in selecting a project manager. In *2006 International Conference on Management Science and Engineering* (pp. 1417-1421). IEEE. https://doi.org/10.1109/ICMSE.2006.314252

Xiong, L., Zhong, S., Liu, S., Zhang, X., & Li, Y. (2020). An Approach for Resilient-Green Supplier Selection Based on WASPAS, BWM, and TOPSIS under Intuitionistic Fuzzy Sets. *Mathematical Problems in Engineering*, *2020*, 1-18. https://doi.org/10.1155/2020/1761893

Xu, Z. (2007). Intuitionistic fuzzy aggregation operators. *IEEE Transactions on fuzzy systems*, *15*(6), 1179-1187. https://doi.org/10.1109/TFUZZ.2006.890678

Varajão, J., & Cruz-Cunha, M. M. (2013). Using AHP and the IPMA Competence Baseline in the project managers selection process. *International Journal of Production Research*, *51*(11), 3342-3354. https://doi.org/10.1080/00207543.2013.774473

Zavadskas, E. K., Turskis, Z., Tamosaitiene, J., & Marina, V. (2008). Selection of construction project managers by applying COPRAS-G method. *Computer Modelling and New Technologies*, *12*(3), 22-28.

Zavadskas, E. K., Vainiūnas, P., Turskis, Z., & Tamošaitienė, J. (2012). Multiple criteria decision support system for assessment of projects managers in construction. *International journal of information technology & decision making*, *11*(02), 501-520. https://doi.org/10.1142/S0219622012400135

Zhao, L., Guo, Y., & Cui, W. (2009). The application of fuzzy comprehensive evaluation methods in the selection of a project manager. In *2009 Fourth International Conference on Computer Sciences and Convergence Information Technology* (pp. 1387-1391). IEEE. https://doi.org/10.1109/ICCIT.2009.233

Zhou, Z., Dou, Y., Zhang, X., Zhao, D., & Tan, Y. (2018). A group decision-making model for wastewater treatment plans selection based on intuitionistic fuzzy sets. *Journal of Environmental Engineering and Landscape Management*, *26*(4), 251-260. https://doi.org/10.3846/jeelm.2018.6122

Zolfani, S. H., Rezaeiniya, N., Aghdaie, M. H., & Zavadskas, E. K. (2012). Quality control manager selection based on AHP-COPRAS-G methods: a case in Iran. *Economic research-Ekonomska istraživanja*, *25*(1), 72-86. https://doi.org/10.1080/1331677X.2012.11517495