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DECISION SUPPORT FOR APPLICATION SELECTION IN SMART FARMING

SUMMARY

This paper examined the issue of selecting smart farm management applications using the Farmland agribusiness company from Brčko District Bosnia and Herzegovina (BiH) as an example. Fuzzy multi-criteria decision-making techniques, SiWeC (simple weight calculation), and the novel CORASO method (compromise ranking from alternative solutions) were applied in this case study. The research is based on expert decision-making and predetermined criteria. The results of applying the fuzzy SiWeC method showed that the most important criteria for choosing an application are data precision, ease of use and application efficiency, while the ranking results using the fuzzy CORASO method indicate that A1 is the highest rated application. These results demonstrated that all business sectors of the farm in question must be covered and that applications should have more options so that a farm or business may be operated with a single application. The significance of the research lies in the successful application of the innovative multi-criteria fuzzy method for the evaluation of applications for managing smart farms (smart farming), as well as the determination of key parameters and further guidelines that affect modern management in agricultural production.

Keywords: Smart farming; application; fuzzy logic; SiWeC method; CORASO method.

INTRODUCTION

The agricultural sector has changed as a result of digitization and technological advancement (Oliinyk, 2024). As advanced technologies are incorporated into traditional agriculture, smart farm management is being developed (hereinafter: smart farming). This concept incorporates technologies such as the Internet of Things (IoT), big data analysis, artificial intelligence and the application of sensors and various smart tools such as drones (Li *et al.*, 2024). Furthermore, smart farming makes use of artificial intelligence, which is becoming more and more popular (Borissov & Hristozov, 2024). The concept of

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smart farming is applied to improve the efficiency, sustainability and profitability of agricultural production. This is carried out in a way that allows for accurate process monitoring and management in agricultural production, which aims to maximize resources, reduce the impact on the environment and increase yields, which affects the increase in the profitability of agricultural production. Smart technologies are used to accomplish all of this (Lipianina-Honcharenko *et al.*, 2024).

The key characteristic of smart farming is the ability to use data from different sources. The data is obtained from sensors that are placed in the fields and provide data on soil moisture, temperature, light level and crop condition, and it is also possible to use drones to obtain additional information. Once the information is collected, it must be processed, and this is done using specialized applications (Faqishafyee *et al.*, 2024). These applications make it possible to provide decision support in real time (Kucena & Kaderabkova, 2023), thus enabling farmers to act preventively. In addition, it is possible for applications to make autonomous decisions if they have support for this (Baydaş *et al.,* 2024). Without farmers' involvement, support for automated decision-making is now being used more and more as artificial intelligence advances (Genç *et al.,* 2024). In this way, smart farming makes use of contemporary technologies and applications to increase the effectiveness of climate change adaptation, which has a major impact on agricultural production yield.

The use of applications in smart farming helps with resource management and enables adequate irrigation and crop nutrition (Hussain, 2024). In this way, the impact on the environment is reduced and sustainability is applied in agricultural production. Using smart farming opens up new opportunities in agricultural production and improves competitiveness in rural areas.

The use of applications in smart farming is necessary because it is necessary to analyse a large amount of data that provides support for timely decision-making. The digital market has a large number of applications that offer a variety of functions (Wahyuningjati & Purwanto, 2024). Application selection presents challenges for farmers. They strive to get the application that will best meet their needs (Hussain & Ali, 2024). Using an innovative methodology, this research will support farmers in deciding which application to purchase for monitoring agricultural production. Based on this, the goal of this research is to provide a methodological foundation for selecting an application to meet the requirements of smart farming. The application will be selected based on its example, and the company Farmland will be used to accomplish this.

The decision-making process in this work is reduced to the application of multi-criteria decision-making (MCDM), because it is necessary to rank certain alternatives based on criteria (Çalikoğlu & Łuczak, 2024), that is, because it is necessary that the applications meet the needs of farmers, considering that there are a large number of these on the market application (Matić Šošić, 2024). In this way, several criteria are used to decide which application to acquire (Topal & Ulutaş 2024). Recently, more and more studies have been based on the application of multi-criteria methods in agricultural production and business, as well as on the application of fuzzy logic (Puška *et al*., 2023; Nedeljković *et al*., 2022). The methodological basis of this work is based on the use of a fuzzy approach that tries to bring the decision-making process closer to human thinking (Gazi *et al*., 2025). T

his is done by applying linguistic terms for evaluating criteria and observed alternatives (Mishra & Rani, 2025). In order to apply the fuzzy approach, fuzzy methods will be used namely the fuzzy SiWeC (simple weight calculation) and the fuzzy CORASO method. The fuzzy SiWeC method will determine the importance of the criteria for the selection of applications, while the fuzzy CORASO method will evaluate the applications in the form of a ranking order. Based on this, this paper will contribute to the following:

-Selecting the key criteria that will be used to evaluate the application for smart farming,

-Determining the importance of the criteria for making a decision on the choice of application,

-Evaluation of observed applications using selected criteria,

-Providing guidelines for improving the decision-making process in smart farming,

-Developing a flexible methodological basis for decision-making processes in smart farming.

-Based on everything, the motivation of this research lies in providing a practical framework for evaluating applications by implementing fuzzy methods in the decision-making process.

MATERIAL AND METHODS

In the research, the methodological basis for the selection of applications for the application of smart farming will be carried out on the concrete example of the Farmland Company.

The Farmland Company is a relatively new business that focuses on producing and selling agricultural goods, mostly in Bosnia and Herzegovina. This business is beginning to invest in cutting-edge technology (sensors in this case) in order to increase agricultural output. The right application is required in order to monitor the data that will be received from the sensors. The research was conducted in December 2024, on the example of this company, whose seat is in Brčko District of BiH. Figure 1 displays the application selection for the Farmland Company’s requirements. The first step in this methodology is to select criteria and potential applications. A total of ten criteria (table 1) and ten applications were selected.

The names of the applications will not be used not to advertise or anti-advertised some; instead, they will be identified by an application code ranging from 1 to 10.

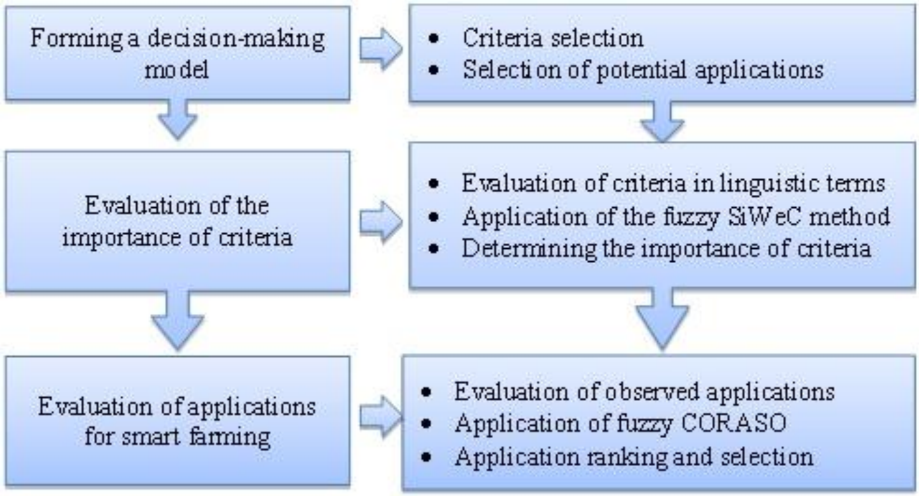

Figure 1. Methodology for choosing an application to change smart farming

The characteristics of these applications are as follows:

- Application 1 (A1) enables the monitoring of agricultural production, stocks, costs and yields, making farm management more efficient.
- Application 2 (A2) provides precision farming tools and automatic machine control systems to optimize yields and reduce costs.
- Application 3 (A3) provides options for monitoring animal health, nutrition, production and supplies, and enables simple management and planning of activities on the farm.
- Application 4 (A4) enables monitoring of all operations on the farm and performs reporting and various analyses in order to better manage the farm.
- Application 5 (A5) covers all aspects of farm management and enables generating reports and conducting various analyses.
- Application 6 (A6) is used for organizing tasks and monitoring progress, as well as planning activities. It can be used to track daily tasks on the farm.
- Application 7 (A7) enables farm management by offering crop data analysis that enables monitoring and optimization of farm yields.
- Application 8 (A8) is specialized for animal husbandry and enables monitoring of finances and reporting on realized activities.
- Application 9 (A9) helps in monitoring all aspects of agricultural production and offers various analyses and reports that enable more efficient decision-making.
- Application 10 (A10) enables the optimization of agricultural operations in real time.

The following table 1 shows the types of selected criteria as well as their description.

Table 1. Research criteria

Id	Criterion	Description
C1	Ease of use	Simple and easy use of application
C2	Upgradability	Ability to upgrade the application with additional options
C3	Application content	Options that are contained in the application
C4	Efficiency of the application	The impact of the application on increasing the efficiency of agriculture
C5	Accuracy of data	Obtaining accurate and precise data for decision-making
C6	Availability of support	Availability of support when working with the application
C7	Transparency of the application	Ability to quickly find the necessary options
C8	Popularity of the application	Popularity of the application with other farmers
C9	Additional services	Additional options offered by applications
C10	Costs of using the application	Total costs of purchasing and maintaining the application

After the criteria and applications that will be observed have been determined, the evaluation of the criteria and applications follows using linguistic terms ranging from "very low" to "very high" with seven levels. In order to facilitate the assessment, the same linguistic terms will be used for the assessment of criteria and applications (Božanić *et al*., 2022; Lukić, 2024). The fuzzy SiWeC and fuzzy CORASO methods are used after the experts have gathered the assessments. Since fuzzy numbers and fuzzy logic have so far shown great success in solving problems with some ambiguities (Imran *et al*., 2024; Zulqarnain et al., 2021), the application of fuzzy numbers is contingent upon the presence of uncertainty in the decision-making process (Özdağoğlu *et al*., 2024).

The fuzzy SiWeC method is used for the subjective assessment of the importance of criteria based on the application of linguistic terms. The steps of this method are (Puška *et al*., 2024a):

Step 1. Evaluation of the importance of criteria.

Step 2. Transformation of grades into fuzzy numbers.

Step 3. Data normalization.

$$\tilde{n}_{ij} = \frac{x_{ij}^{l}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{m}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{u}}{max\ x_{ij}^{u}}$$

Whereby $max\ x_{ij}^{u}$ is the maximum value for all criteria.

Step 4. Calculation of standard deviation ($st.dev_j$).

Step 6. Multiplication of normalized scores with standard deviation values.

$\tilde{v}_{ij} = \tilde{n}_{ij} \times st.dev_j$

Step 7. Calculating the sum of complexity for individual criteria.

$\tilde{s}_{ij} = \sum_{j=1}^{n} \tilde{v}_j$

Step 7. Calculating the criteria complexity.

$$\widetilde{w}_{ij} = \frac{s_{ij}^l}{\sum_{j=1}^{n} s_{ij}^u}, \frac{s_{ij}^m}{\sum_{j=1}^{n} s_{ij}^m}, \frac{s_{ij}^u}{\sum_{j=1}^{n} s_{ij}^l}$$

The innovative fuzzy CORASO method will be used to evaluate applications based on ranking. The method was developed by Puška *et al.* (2024b) and has the following steps:

Step 1. Evaluation of alternatives.

Step 2. Transformation of scores into fuzzy numbers.

Step 3. Normalization of fuzzy numbers.

$$n_{ij} = \frac{x_{ij}^l}{\max x_j^u}, \frac{x_{ij}^m}{\max x_j^u}, \frac{x_{ij}^n}{\max x_j^u}\text{; for benefit criteria}$$

$$n_{ij} = \frac{\min x_j^l}{x_{ij}^n}, \frac{\min x_j^l}{x_{ij}^m}, \frac{\min x_j^l}{x_{ij}^l}\text{; za cost kriterije}$$

Whereby: $x_{j\ min}$ is the minimum value of each criterion, and $x_{j\ max}$is the maximum value of each criterion.

Step 4. Calculation of alternative solutions, namely the maximum alternative solution ($max\ AS$), which is the highest value of alternatives for individual criteria, while the minimum alternative solution ($min\ AS$), which is the lowest value of alternatives for individual criteria.

Step 5. Pondering of normalized data.

$\tilde{v}_j = \widetilde{w}_j \cdot \tilde{n}_{ij}$

Step 6. Calculation of aggregate values of pondered alternatives.

$\tilde{S}_j = \sum_{i=1}^{n} \tilde{v}_j$

Step 7. Calculating deviations from alternative solutions.

$$\tilde{R}_j = \frac{\tilde{S}_j}{\tilde{S}_{j\ max\ AS}}$$

$$\widetilde{R'}_j = \frac{\tilde{S}_{j\ min\ AS}}{\tilde{S}_j}$$

Step 8. Dephasification

$$R_{j\ def} = \frac{R_i^l + 4R_i^m + R_i^u}{6}$$

$$R'_{j\ def} = \frac{R'^l_i + 4R'^m_i + R'^u_i}{6}$$

Step 9. Calculating the value of the CORASO method.

$$Q_i = \frac{R_j - R'_j}{R_j + R'_j}$$

Cluster analysis for the level of changeability revealed a different division into three groups compared to the previous parameter (Fig. 2). Unlike previous cases with other mutagens, it can be mathematically justified that the estimate based on the level of changeability is more accurate than the general rate of changes.

RESULTS

When evaluating the criteria and applications, the linguistic terms defined in the work of Puška *et al.* (2024b) were used. First, six selected experts evaluated the criteria and then the observed applications. For this reason, the importance of the used criteria for experts will be calculated first. Experts evaluate the importance of the criteria using linguistic terms (table 2), and then the steps of the fuzzy SiWeC method are carried out.

Table 2. Evaluation of the importance of criteria

CRITERIA	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Expert 1	G	M	MG	VG	VG	G	M	ML	MG	MG
Expert 2	VG	G	M	VG	VG	MG	G	G	MG	G
Expert 3	VG	M	G	VG	G	M	G	G	G	G
Expert 4	G	M	G	G	G	MG	MG	MG	G	M
Expert 5	VG	M	MG	G	VG	MG	MG	MG	G	MG
Expert 6	MG	MG	MG	G	VG	M	G	ML	M	M

First, linguistic terms are transformed into fuzzy numbers, and these values are normalized. Then, the standard deviation values for the experts' ratings are calculated and these values are multiplied with normalized fuzzy numbers. At the end, the overall grades are calculated, and the weight value of the criteria is calculated (table 3).

Based on the experts' evaluations and the results of the SiWeC method, the most important criterion is C5 criterion - Accuracy of data, followed by C1 criteria - Ease of use and C4 criterion - Application efficiency. The least important criterion according to these results is C2 criterion - Possibility of upgrading. However, when all the results of the criteria are considered, it can be concluded that there is no significant deviation in these weights. All criteria have an impact on the selection of applications.

Table 3. Results of the importance of criteria

Criteria	w_{ij}
C1	(0.08, 0.12, 0.17)
C2	(0.04, 0.08, 0.13)
C3	(0.06, 0.10, 0.15)
C4	(0.09, 0.12, 0.17)
C5	(0.09, 0.13, 0.17)
C6	(0.05, 0.09, 0.15)
C7	(0.06, 0.10, 0.16)
C8	(0.05, 0.08, 0.14)
C9	(0.06, 0.10, 0.16)
C10	(0.05, 0.09, 0.15)

When evaluating the observed applications by experts with linguistic terms (table 4), the steps of the fuzzy CORASO method are implemented.

Table 4. Evaluation of applications by experts

Expert 1	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
A1	VG	MG	G	G	G	MG	MG	G	MG	MG
A2	G	MG	MG	G	MG	M	MG	MG	G	G
A3	G	MG	M	MG	G	MG	MG	G	MG	MG
A4	MG	M	MG	MG	G	MG	G	MG	G	MG
A5	M	M	ML	M	MG	M	M	ML	M	M
A6	M	MG	MG	G	G	M	MG	M	M	M
A7	M	M	MG	MG	MG	MG	MG	G	M	MG
A8	M	MG	MG	M	MG	G	MG	M	M	M
A9	G	G	G	MG	G	VG	MG	M	MG	MG
A10	G	M	M	L	MG	MG	MG	G	G	MG
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Expert 6	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
A1	VG	VG	VG	G	G	VG	VG	G	G	G
A2	VG	VG	MG	G	MG	G	MG	MG	G	VG
A3	VG	MG	G	MG	G	G	MG	G	MG	G
A4	G	MG	MG	G	G	G	G	MG	G	MG
A5	G	M	M	G	MG	M	MG	G	M	G
A6	G	MG	MG	MG	G	MG	MG	MG	M	MG
A7	VG	M	M	MG	MG	MG	MG	G	M	MG
A8	VG	MG	G	G	MG	G	MG	MG	MG	VG
A9	G	G	G	MG	MG	VG	G	M	MG	MG
A10	MG	VG	M	M	MG	G	MG	ML	G	G

Linguistic terms are transformed into fuzzy numbers, and these numbers are normalized, and alternative solutions are found. These are the solutions that have the maximum values, that is, the minimum values of the alternatives for each criterion. Pondering is then performed, where the normalized and alternative solutions are multiplied by the appropriate weights. After that, the aggregate values for the alternatives and alternative solutions are calculated, so the deviation from the alternative solutions is calculated. After that, dephasification is performed and the final results are obtained using the fuzzy CORASO method. The results of applying this method show that the best ranked application is A1, followed by application A3, while the worst ranked alternative is A10 (table 5).

Table 5. Results of application ranking using the fuzzy CORASO method

	$\tilde{S}_j$	$\tilde{R}_j$	$\tilde{R}'_j$	$R_{j\ def}$	$R'_{j\ def}$	Q_i	Rank
A1	(0.43, 0.80, 1.37)	(0.28, 0.91, 2.96)	(0.16, 0.63, 2.44)	1.149	0.854	0.147	1
A2	(0.36, 0.72, 1.34)	(0.24, 0.82, 2.89)	(0.17, 0.70, 2.87)	1.070	0.974	0.047	4
A3	(0.38, 0.76, 1.38)	(0.25, 0.86, 2.97)	(0.16, 0.67, 2.70)	1.111	0.925	0.091	2
A4	(0.35, 0.71, 1.36)	(0.23, 0.81, 2.94)	(0.17, 0.71, 2.98)	1.069	0.999	0.034	5
A5	(0.27, 0.60, 1.25)	(0.18, 0.69, 2.69)	(0.18, 0.84, 3.84)	0.936	1.231	-0.136	10
A6	(0.32, 0.67, 1.33)	(0.21, 0.77, 2.87)	(0.17, 0.76, 3.29)	1.023	1.079	-0.027	8
A7	(0.30, 0.64, 1.27)	(0.20, 0.73, 2.74)	(0.18, 0.79, 3.43)	0.978	1.127	-0.071	9
A8	(0.33, 0.69, 1.31)	(0.22, 0.78, 2.83)	(0.17, 0.74, 3.11)	1.031	1.039	-0.004	6
A9	(0.37, 0.73, 1.36)	(0.24, 0.84, 2.93)	(0.17, 0.69, 2.85)	1.085	0.963	0.060	3
A10	(0.33, 0.68, 1.28)	(0.21, 0.77, 2.77)	(0.18, 0.75, 3.19)	1.011	1.060	-0.023	7

DISCUSSION

Applications are becoming increasingly significant as smart agriculture advances (Kousar & Kousar, 2025). The study by Altalak *et al.* (2022) supports this, emphasizing that applications have been incredibly successful due to their ability to use data from various sources. These applications can therefore make use of data from sensors that measure soil moisture, data from drones that analyze fruit and trees, data from meteorological data that is readily available online, and various other devices that are typical of smart farming. Selecting a particular application to be utilized in this farming system is essential because there are numerous applications available on the market that can be used in smart farming (Adamides, 2020). Additionally, farmers must select an application that will give them pertinent data so they can make timely decisions. As a result, this study was carried out with the intention of offering a methodological framework and demonstrating how MCDM techniques can be applied to choose an application for smart farming implementation. Many authors have demonstrated the importance of using these techniques in smart farming such as Rouyendegh and Savalan (2022), Cagri Tolga and Basar (2021), Abualkishik *et al*. (2022), Ilieva and Yankova, (2022) as well as many others.

What makes this research significant is the application of these methods in the selection of an application that will monitor data from the farm and from the Internet and propose certain measures that the farmer should implement. The selection of these applications was based on ten criteria that should help the Farmland Company, that is, its production department (farms), to choose the application that best meets their goals. These criteria were selected in cooperation with certain experts who evaluated the importance of these criteria using linguistic terms. These terms are used because it is easier to determine whether something is good or bad than to determine the exact value of their importance. However, in order to use these terms, it was necessary to use a fuzzy approach (Trung *et al.,* 2024). This approach uses a membership function to transform these terms into fuzzy numbers and uses fuzzy methods (Mehdiabadi *et al.,* 2025). Among the possible methods for subjective weight determination, the fuzzy SiWeC method was used in this research. This approach is more recent, and its selection was influenced by its application promotion first, followed by its uniqueness that sets it apart from other approaches of a similar nature. Results from the application of this technique and the assessments of experts indicate that the applications use accurate data that is user-friendly and that the data they use contributes to the efficiency of agricultural production.

After the weights of the criteria are determined, the observed applications are ranked. First, ten applications were selected that can be used in the territory of Bosnia and Herzegovina and that were recommended by other farmers. In order to rank these applications, the evaluation procedure was repeated by experts and the fuzzy CORASO method was used. This method has been used so far only in one study, in the selection of drones (Puška *et al.,* 2024b), where it showed good results compared to other similar methods. Also, in this work it was shown that this method can be used during selection in smart farming, since drones are devices that are currently expanding in use (Guebsi *et al*., 2024), especially on small farms. The results of this research showed that application A1 achieved the best results and was the first choice for the Farmland Company. This should be explained by the fact that this application can be used to increase agricultural production's yield and efficiency. It can also be used to track raw material and agricultural product stocks. Additionally, this application allows for the management of financial indicators, which enables the company to sustain a profitable outcome. This application leads to the conclusion that it is critical that it has a broad range of applications in order to be utilized in all areas of a farm's business, that is, an agricultural company.

CONCLUSIONS

For the application of smart farming, it is necessary to use applications in order to collect all data from the device. This research is focused on application selection process employing fuzzy MCDM methods. The application of the fuzzy approach enabled a more accurate assessment, taking into account subjectivity and ambiguity in decision-making. The findings of the analysis demonstrated the importance of the functional criteria. The evaluation of the apps revealed that in order to cover a wider range of Farmland's operations, the applications needed to include a number of alternatives.

The application of the used approach with the fuzzy SiWeC and CORASO methods showed good flexibility, and this approach can be used in all other research where it is necessary to make a subjective decision. The results of this research provide guidelines for the development of future research where the choice of applications is made. This is particularly significant due to the emergence of digitization in all areas, including agriculture. Because of this, farmers must adapt to new trends and use applications to improve their business. Future studies need to be focused on specific sectors within agriculture, as well as on new applications coming to the market.

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REFERENCES

Abualkishik, A. Z., Rasha, A. & Thompson, W. (2022). Evaluating Smart Agricultural Production Efficiency using Fuzzy MARCOS method. Journal of Neutrosophic and Fuzzy Systems, 3(1), 8-18. https://doi.org/10.54216/jnfs.030101

Adamides, G. (2020). A Review of Climate-Smart Agriculture Applications in Cyprus. Atmosphere, 11(9), 898. https://doi.org/10.3390/atmos11090898

Altalak, M., Ammad uddin, M., Alajmi, A., & Rizg, A. (2022). Smart Agriculture Applications Using Deep Learning Technologies: A Survey. Applied Sciences, 12(12), 5919. https://doi.org/10.3390/app12125919

Baydaş, M., Kavacık, M., & Wang, Z. (2024). Interpreting the Determinants of Sensitivity in MCDM Methods with a New Perspective: An Application on E-Scooter Selection with the PROBID Method. Spectrum of Engineering and Management Sciences, 2(1), 17-35. https://doi.org/10.31181/sems2120242b

Borissov, B., & Hristozov, Y. (2024). Potential for Using Artifical Intelligence in Public Administration. ECONOMICS - Innovative and Economics Research Journal, 12(3), 409-423. https://doi.org/10.2478/eoik-2024-0034

Božanić, D., Pamučar, D., Milić, A., Marinković, D., & Komazec, N. (2022). Modification of the Logarithm Methodology of Additive Weights (LMAW) by a Triangular Fuzzy Number and Its Application in Multi-Criteria Decision Making, Axioms, 11(3), 89. https://doi.org/10.3390/axioms11030089

Cagri Tolga, A., & Basar, M. (2021). The assessment of a smart system in hydroponic vertical farming via fuzzy MCDM methods. Journal of Intelligent & Fuzzy Systems, 42(1), 1–12. https://doi.org/10.3233/jifs-219170

Çalikoğlu, C., Łuczak, A. (2024). Multidimensional assessment of sdi and hdi using topsis and bilinear ordering. International Journal of Economic Sciences, 13(2), 116-128. https://doi.org/10.52950/ES.2024.13.2.007

Faqishafyee, N. J., Sadiq, E. H., & Taha, H. M. (2024). Mitigating Non-Technical Losses and Electricity Theft Through Smart Meters: A Case Study of the Akre District Power Distribution Network. Journal of Intelligent Systems and Control, 3(3), 135-151. https://doi.org/10.56578/jisc030301

Gazi, K. H., Raisa, N., Biswas, A., Azizzadeh, F., & Mondal, S. P. (2025). Finding the Most Important Criteria in Women's Empowerment for Sports Sector by Pentagonal Fuzzy DEMATEL Methodology. Spectrum of Decision Making and Applications, 2(1), 28-52. https://doi.org/10.31181/sdmap21202510

Genç, E., Keleş, M. K., & Özdağoğlu, A. (2024). A hybrid MCDM model for personnel selection based on a novel Gray AHP, Gray MOORA and Gray MAUT methods in terms of business management: An application in the tourism sector. Journal of Decision Analytics and Intelligent Computing, 4(1), 263–284. https://doi.org/10.31181/jdaic10024122024g

Guebsi, R., Mami, S., & Chokmani, K. (2024). Drones in Precision Agriculture: A Comprehensive Review of Applications, Technologies, and Challenges. Drones, 8(11), 686. https://doi.org/10.3390/drones8110686

Hussain, I. (2024). FEGAO: A Revolutionary Method for Enhancing Defective Fuzzy Images with Non-Linear Refinement. Information Dynamics and Applications, 3(4), 258-269. https://doi.org/10.56578/ida030405

Hussain, I. & Ali, R. (2024). Robust Leaf Disease Detection Using Complex Fuzzy Sets and HSV-Based Color Segmentation Techniques. Acadlore Transactions on AI and Machine Learning, 3(3), 183-192. https://doi.org/10.56578/ataiml030305

Ilieva, G., & Yankova, T. (2022). IoT System Selection as a Fuzzy Multi-Criteria Problem. Sensors, 22(11), 4110. https://doi.org/10.3390/s22114110

Imran, R., Ullah, K., Ali, Z., & Akram, M. (2024). A Multi-Criteria Group Decision-Making Approach for Robot Selection Using Interval-Valued Intuitionistic Fuzzy Information and Aczel-Alsina Bonferroni Means. Spectrum of Decision Making and Applications, 1(1), 1-32. https://doi.org/10.31181/sdmap1120241

Kousar, S., & Kausar, N. (2025). Multi-Criteria Decision-Making for Sustainable Agritourism: An Integrated Fuzzy-Rough Approach. Spectrum of Operational Research, 2(1), 134-150. https://doi.org/10.31181/sor21202515

Kucera, O., & Kaderabkova, B. (2023). Consumers´ Decision-Making under Salop´s Model: Key Study on Starbucks Prague and Richmond business model. International Journal of Economic Sciences, 12(1), pp. 85-115. https://doi.org/10.52950/ES.2023.12.1.005

Li, W. Q., Han, X. X., Lin, Z. B., & Rahman, A. (2024). Enhanced Pest and Disease Detection in Agriculture Using Deep Learning-Enabled Drones. Acadlore Transactions on AI and Machine Learning, 3(1), 1-10. https://doi.org/10.56578/ataiml030101

Lipianina-Honcharenko, K., Komar, M., Melnyk, N., & Komarnytsky, R. (2024). Sustainable Information System for Enhancing Virtual Company Resilience Through Machine Learning in Smart City Socio-Economic Scenarios. ECONOMICS - Innovative and Economics Research Journal, 12(2), 69-96. https://doi.org/10.2478/eoik-2024-0022

Lukić, R. (2024). Evaluation of trade performance dynamics in Serbia using ARAT and Rough MABAC methods. Oeconomica Jadertina, 14 (2), 34-44. https://doi.org/10.15291/oec.4559

Matić Šošić, M. (2024). Content marketing: Gender and age differences in generation Z. Oeconomica Jadertina, 14 (2), 19-33. https://doi.org/10.15291/oec.4555

Mehdiabadi, A., Sadeghi, A., Karbassi Yazdi, A., & Tan, Y. (2025). Sustainability Service Chain Capabilities in the Oil and Gas Industry: A Fuzzy Hybrid Approach SWARA-MABAC. Spectrum of Operational Research, 2(1), 92-112. https://doi.org/10.31181/sor21202512

Mishra, A. R., & Rani, P. (2025). Evaluating and Prioritizing Blockchain Networks using Intuitionistic Fuzzy Multi-Criteria Decision-Making Method. Spectrum of Mechanical Engineering and Operational Research, 2(1), 78-92. https://doi.org/10.31181/smeor21202527

Nedeljković, M., Puška, A., Suzić, R., & Maksimović, A. (2022). Multicriteria model of support for the selection of pear varieties in raising orchards in the Semberija region (Bosnia and Herzegovina), Sustainability, 14(3), 1584. https://doi.org/10.3390/su14031584

Oliinyk, A. (2024). Comparative Study of Digitalization Impact on Global Goods and Services Markets in Advanced and Developing Economies. ECONOMICS - Innovative and Economics Research Journal, 12(2), 195–218. https://doi.org/10.2478/eoik-2024-0026

Özdağoğlu, A., Keleş, M. K., & Şenefe, M. (2024). Evaluation of banks in terms of customer preferences with fuzzy SWARA and fuzzy MOORA integrated approach. Journal of Decision Analytics and Intelligent Computing, 4(1), 216–232. https://doi.org/10.31181/jdaic10007122024o

Puška, A., Lukić, M., Božanić, D., Nedeljković, M., & Hezam, I.M. (2023). Selection of an insurance company in agriculture through hybrid multi-criteria decision-making, Entropy, 25(6), 959. https://doi.org/10.3390/e25060959

Puška, A., Nedeljković, M., Božanić, D., Štilić, A., & Muhsen, Y.R. (2024b). Evaluation of agricultural drones based on the COmpromise Ranking from Alternative SOlutions (CORASO) methodology. Engineering Review, 44 (4 - SI 2024), 77-90. https://doi.org/10.30765/er.2653

Puška, A., Nedeljković, M., Pamučar, D., Božanić, D., & Simić, V. (2024a). Application of the new simple weight calculation (SIWEC) method in the case study in the sales channels of agricultural products. MethodsX, 13, 102930. https://doi.org/10.1016/j.mex.2024.102930

Rouyendegh, B. D., & Savalan, Ş. (2022). An Integrated Fuzzy MCDM Hybrid Methodology to Analyze Agricultural Production. Sustainability, 14(8), 4835. https://doi.org/10.3390/su14084835

Topal, A., & Ulutaş, A. (2024). Evaluating the Logistics Performance of G8 Nations Using Multi-Criteria Decision-Making Models. Journal of Intelligent Management Decision, 3(3), 150-158. https://doi.org/10.56578/jimd030302

Trung, D. D., Dudić, B., Dung, H. T., & Truong, N. X. (2024). Innovation in financial health assessment: Applying MCDM techniques to banks in Vietnam. ECONOMICS - Innovative and Economics Research Journal, 12(2), 21-33. https://doi.org/10.2478/eoik-2024-0011

Wahyuningjati, T. & Purwanto, E. (2024). Exploring the Influence of Electronic Word of Mouth and Customer Reviews on Purchase Decisions: The Mediating Role of Trust in the Shopee Marketplace. MindVanguard: Beyond Behavior, 2(2), 11-28. https://doi.org/10.56578/mvbb020201

Zulqarnain, R. M., Siddique, I., Ali, R., Pamucar, D., Marinkovic, D., & Božanic, D. (2021). Robust Aggregation Operators for Intuitionistic Fuzzy Hypersoft Set with Their Application to Solve MCDM Problem, Entropy, 23(6), 688. https://doi.org/10.3390/e23060688