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Analysis of Digital Skills in European Union Countries with IQRBOW-Based Multi-Moora Approach

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ABSTRACT

This study aims to examine the digitalization levels of European countries from the perspective of individuals' digital skills. It aims to fill a gap in the literature by emphasizing the importance of the human element, which is the main component in digitalization processes. Based on the Digital Skills Indicator data published by Eurostat, components such as ICT users, ICT specialists and ICT training included in the analysis. IQRBOW-based Multi-MOORA approach is applied in the study. This unique methodology has increased the validity of the analysis results by providing more economical and reliable weighting in multi-criteria decision-making problems. Based on 28 sub-criteria, a comprehensive assessment was carried out and 36 countries were compared. The findings of the analysis revealed that Finland ranked highest in terms of digital skills, while Romania ranked last. The results allow for a review of the European Union's digitalization strategies and recommendations for policymakers.

Keywords: *Digital Skills, IQRBOW, Multi-MOORA, Digitalization, Decision-Making.*

Avrupa Birliği Ülkelerinde Dijital Becerilerin IQRBOW Tabanlı Multi-Moora Yaklaşımı ile Analizi

ÖZET

Bu çalışma, Avrupa ülkelerinin dijitalleşme düzeylerini bireylerin dijital becerileri perspektifinden incelemeyi amaçlamaktadır. Dijitalleşme süreçlerinde ana bileşen olan insan unsurunun önemini vurgulayarak literatürdeki bir boşluğu doldurmayı hedeflemektedir. Eurostat tarafından yayınlanan Dijital Beceriler Göstergesi verileri temel alınarak BİT kullanıcıları, BİT uzmanları ve BİT eğitimi gibi bileşenler analize dahil edilmiştir. Çalışmada IQRBOW tabanlı Multi-MOORA yaklaşımı uygulanmıştır. Bu özgün metodoloji, çok kriterli karar verme problemlerinde daha ekonomik ve güvenilir ağırlıklandırma sağlayarak analiz sonuçlarının geçerliliğini artırmıştır. 28 alt kriter baz alınarak kapsamlı bir değerlendirme yapılmış ve 36 ülke karşılaştırılmıştır. Analiz bulguları, Finlandiya'nın dijital beceriler açısından en üst sırada yer aldığını, Romanya'nın ise son sırada yer aldığını ortaya koymuştur. Sonuçlar, Avrupa Birliği'nin dijitalleşme stratejilerinin gözden geçirilmesine ve politika yapıcılar için tavsiyelerde bulunulmasına olanak tanımaktadır.

Anahtar Kelimeler: *Dijital Beceriler, IQRBOW, Multi-MOORA, Dijitalleşme, Karar Verme.*

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1. INTRODUCTION

The European Union strives to lead the global digital transformation (Pinto, Nogueira & Vieira, 2023, p.24). The process of digitalization is of utmost importance for Europe's economic expansion, ability to compete, and long-term sustainable progress. Key factors in influencing Europe's future include digital technologies, cutting-edge business models, data-driven decision-making, and the cultivation of digital skills.

The European Union employs the Digital Economy and Society Index (DESI), a comprehensive metric, to gauge the extent of digitalization in its member states and to carry out comparative analysis (Bruno et al., 2023, p.2). The DESI evaluates digital performance across five primary dimensions: connection, digital literacy, internet usage by citizens, integration of digital technologies, and provision of digital public services (DESI, 2022). DESI scores enable Member States to assess and evaluate their digital performance both among themselves and against the average performance of the European Union. Countries with poor scores can identify their deficiencies, reassess their digitization strategy, and implement the appropriate measures. The European Union formulates its digitalization policy and provides suggestions to member states based on the findings of the DESI research.

The DESI data also contribute to academic studies and research. The objective is to gain a deeper understanding of the social consequences of digitalization by examining the progress of digital skills (Stofkova et al., 2022, p.2), economic growth (Olczyk and Kuc-Czarnecka, 2022, p.777), inequalities (Bodor, Grünhut and Horeczki, 2014, p.108), and other related matters (Bruno et al., 2023, p.3). By adopting this approach, it is possible to formulate policy proposals that are grounded in facts and tangible evidence, so facilitating the advancement of Europe's digital transformation. While several studies on digital sustainability rely on data from specific regions (Fidan, 2023), academic research often use DESI data. Conversely, the dimension of digital skills is highly significant as it specifically pertains to the process of humans becoming digitalized. This dimension assesses proficiency in fundamental digital abilities as well as sophisticated computer and coding skills. Factors such as the proficiency of people in digital skills, the capabilities of the workforce in digital competences, and the percentage of information and communication (ICT) professionals are considered. Digitalization policies prioritize the goal of establishing a "digital society" as the foundation of digitalization (Wagner and Ferro, 2020). The objective of this vision is to guarantee equitable access to the advantages of digital transformation, leaving no one excluded. The digital society encompasses the extensive utilization of information and communication technologies (ICTs), the cultivation of digital literacy, and the enhancement of digital competencies. Effectively overseeing this procedure unquestionably relies on scrutinizing digital competencies (Bakır and Demirel, 2024, p.60).

The evaluation of digital competencies is highly significant in the current era of information technology. Cultivating these abilities guarantees that societies are prepared for digital revolution and can assimilate into the emerging economic paradigm that accompanies technological advancements. Nevertheless, policy makers and academics require accurate and thorough data in order to discern successful tactics in this field. The current endeavors of the European Union are commendable. The Union has been collecting data across a vast geographical area to uncover the digital skills profiles of its member states. This process involves the development of indices. This process encompasses fundamental and advanced digital skills, the proficiency levels of the workforce, the percentage of ICT specialists, and other crucial metrics (Eurostat, 2024). Undoubtedly, compiling a complete and complicated data set on a regular basis is a tough endeavor.

However, the significance of this endeavor for academia and politicians cannot be exaggerated. The collected data enables researchers to further investigate the connections between digital skills, economic growth, employment, inequalities, and other related matters. These assessments enhance comprehension of the societal, economic, and cultural effects of digitalization processes. Furthermore, the empirical evidence assists in formulating policy recommendations based on data and designing roadmaps for digital transformation (Balcıoğlu, 2024, p.119; Liu, 2022, p.2).

Hence, the efforts of the European Union in this domain not only provide insight into the present condition of its member states, but also serve as a crucial foundation for attaining digitalization objectives. The implementation of thorough and consistent data collection procedures enables the identification of deficiencies in digital abilities, pinpointing areas of concern, and formulating strategies to effectively tackle them. Europe's digital revolution is centered around the development of digital skills (Vey et al., 2017, p.23). The primary objective of the Union is to enhance the digital literacy levels of all individuals, with a specific focus on enhancing the digital competencies of young individuals and the working population. Simultaneously, there is support for ICT education and vocational training programs, with efforts being made to enhance digital competences (Chohan and Hu, 2022, p.17).

The objective of this study is to analyze and evaluate digital abilities in 36 member or candidate countries of the European Union in a comparative manner. Proficiency in digital skills is crucial for the digitization efforts of nations. Hence, assessing the status of countries in this domain is crucial for evaluating and enhancing digitalization policy. The investigation seeks to uncover the situation of each country in the realm of digital abilities. Consequently, it would be feasible to ascertain the countries that are more proficient in the development of digital abilities and the countries that exhibit deficiencies in this domain. This comparative evaluation provides countries with the chance to identify their areas of expertise and areas for improvement.

The study formulates the research problem in the following context:

Can the digitization capabilities of the member or candidate countries of the European Union be assessed based on the skills, training, and expertise of individuals?

The research problem succinctly establishes the study's focal point and delineates the components to be analyzed. The proficiency of citizens in both fundamental and advanced digital skills is a crucial determinant of a country's level of digitalization (Satı, 2024, p.5).

The objective of this study is to address a significant deficiency in the existing body of research on digitalization. Typically, digitalization studies primarily examine infrastructure, hardware, and technological equipment, but they do not adequately address the human aspect (Fidan, 2024b; Pashchenko, 2022; Lang and Lang, 2021). Nevertheless, individuals are the primary recipients and intended audience of digitization (Parviainen et al., 2017, p.64). Hence, it is crucial to evaluate the digital competencies, educational background, and specialized knowledge of individuals in order to ensure the effectiveness of digitalization initiatives. This study seeks to address a significant deficiency in the existing literature by conducting a comprehensive analysis of the digital human resources in European countries. Evaluating individuals' digital competencies, educational opportunities, and ICT knowledge will yield a comprehensive understanding of countries' performance in adapting to digitalization. Furthermore, this study presents a significant methodological advancement. This research applies the Multi-MOORA (Multi-Objective Optimization on the basis of Ratio Analysis) (Brauers and Zavadskas, 2010, p.8) approach, which is based on IQRBOW (InterQuartile Range-Based Objective Weights) (Fidan, 2024a, p.7), for the first time in the field of digitalization. This innovative method seeks to enhance the credibility of analysis outcomes by offering more precise and dependable weighing in multi-criteria decision making challenges.

Following the previous parts, the study includes the Methodology section, which provides a detailed explanation of the data gathering procedures and analysis methodologies employed, and the Findings section, which presents the outcomes of the analysis. The Conclusion section provides a comprehensive analysis of the research findings, presents a concise summary of the main outcomes, and formulates recommendations for policy makers. Additionally, the paper examines the constraints of the study and proposes prospective avenues for future investigation.

2. METHODOLOGY

2.1. Ethical Aspect of the Research

Since individual rights should be protected during the research, the Helsinki Declaration of Human Rights was adhered to. The data was compiled from publicly available data from the European Statistical Office (Eurostat). The research does not require data collection from individual respondents. Since reliable secondary type data is used, there is no need to obtain any ethics committee approval.

2.2. Data Source and Properties

The study utilizes data sourced from the data repository and reports provided by Eurostat. The data can be accessed by the public through the appropriate links on Eurostat's website (Eurostat, 2024). The primary dataset included in the study is the Digital Skills Indicator

2.0 (DSI) data. Eurostat collects these data under the sub-categories "ICT users", "ICT specialists", and "ICT training" inside the broader category of "digital economy and society".

The DSI is a comprehensive measure derived from particular activities undertaken by individuals aged 16-74 in five distinct domains (information and data literacy, communication and collaboration, digital content production, security, and problem solving) that are related to internet or software usage. This metric assesses the proficiency of persons in digital skills and enables the comparison of skill levels. The study presents the data kinds and data codes in Table 1.

Table 1. Types of Data and Codes Used in the Study.

ICT Users	ICT Specialists	ICT Training
Individuals' level of computer skills (9 sub-criteria) [U1]	Employed ICT specialists – total [S1]	Enterprises - ICT functions performed by size class of enterprise [T1]
Individuals' level of digital Skills [U2]	Enterprises that recruited or tried to recruit ICT specialists by size class of enterprise [S2]	Persons with ICT education by labour status (2 sub-criteria) [T2]
Evaluating data, information and digital content (9 sub-criteria) [U3]	Enterprises that employ ICT specialists by size class of enterprise [S3]	Enterprises that provided training to develop/upgrade ICT skills of their personnel by size class of enterprise (3 sub-criteria) [T3]

Reference: Created by the author based on Eurostat data.

The dataset encompasses a collective of 36 countries. The entities encompassed in this group consist of 27 member states of the European Union, 8 countries that are candidates for membership, and the United Kingdom. The extensive geographical coverage enables a comprehensive investigation of digital skills across Europe. Eurostat conducts these measures periodically and consistently throughout a specific timeframe. Measurements are conducted either once a year or once every two years. By monitoring the progression of countries' digital skills development over time, one may track the course of their advancement. While the paper and online data tables may display certain measurements for the year 2022, it is important to note that the data utilized in this research pertains exclusively to the year 2021. Given that the data from 2021 contains a comprehensive collection of data for all variables, the analysis is conducted using this year's data.

2.3. Data Scope and Data Preprocessing

The study included data that was updated by Eurostat in 2024, but it is derived from data collected in 2021. It is crucial to own a comprehensive dataset that includes all factors. Several of the 28 sub-criteria contain incomplete data. The missing data were filled up by employing either linear regression or linear interpolation techniques, utilizing time series data. While there is data available on ICT users across all age groups, the data that is most comprehensive is the one that covers the age range of 16-74. The data obtained from businesses was classified based on the size of the organization, specifically the number of employees. The category with the highest level of inclusivity, "10 or more employees", was utilized in the analysis.

These factors were considered to enhance the dataset's reliability, comprehensiveness, and representativeness. By filling in the missing data and selecting comprehensive age and enterprise size categories, a more reliable analysis was made possible. Furthermore, the utilization of 2021 data guaranteed that the latest available data was accessible throughout the study's execution. The research findings are derived from current data, ensuring their relevance, and the policy recommendations aim to accurately represent the present circumstances.

2.4. Proposed Method

The study challenge was addressed by adopting the Multi-Criteria Decision Making (MCDM) approach to compare countries. The primary challenge faced in the MCDM approach is determining the appropriate mechanism for calculating the weights of the criteria. The criteria weights can be determined using three perspectives: objective, subjective, and hybrid techniques. The primary drawback of hybrid and subjective approaches is their potential to yield biased outcomes and significantly escalate research expenses. In this study, the objective criterion weighting approach was chosen due to this specific reason. The objective criteria weighing methods often employed in the literature include Entropy (Hwang and Yoon, 1981), Standard Deviation (Roth et al., 1994), CRITIC (CRiteria Importance Through Intercriteria Correlation) (Diakoulaki, Mavrotas and Papayannakis, 1995), and MEREC (MEthod based on the Removal Effects of Criteria) (Keshavarz-Ghorabaee et al., 2021). Furthermore, the IQRBOW (Fidan, 2024a) method, which relies on a fundamental statistical approach, was chosen in this study because of its simplicity and reliability in producing consistent outcomes. In order to calculate the criteria weights with IQRBOW, the following steps should be followed respectively (Fidan, 2024a).

a. Decision matrix

In the first step of the process, a decision matrix, which is also known as a data matrix, is constructed in order to include the pertinent criteria and the values that correspond to each choice. In Eq. 1, the decision matrix is shown. The rows of the matrix include the options, and the columns contain the criteria about the choice. For this aim, Eq. 1 assumes that there are n different choices and m different criteria.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

b. Data Normalization

The normalization procedures specified in Eq. 2 are performed on the data in the decision matrix based on whether they have a positive ($\mathcal{B}$) or negative ($\mathcal{B}'$) impact on the problem. In this case, "beneficial (positive)" means that the decision-maker has a strong preference for criteria that have a high value. Non-beneficial (negative) refers to a scenario in which the decision-maker favors a criterion that has a low level of value.

$$N_{ij}^{x} = \begin{cases} \dfrac{x_{ij}}{\max\limits_{k} x_{kj}} & if \quad j \in \mathcal{B} \\ 1 - \dfrac{x_{ij}}{\max\limits_{k} x_{kj}} & if \quad j \in \mathcal{B}' \end{cases} \tag{2}$$

Therefore, a normalized data matrix (N) is obtained, which has the same dimensions as the original data matrix.

c. The Interquartile Range

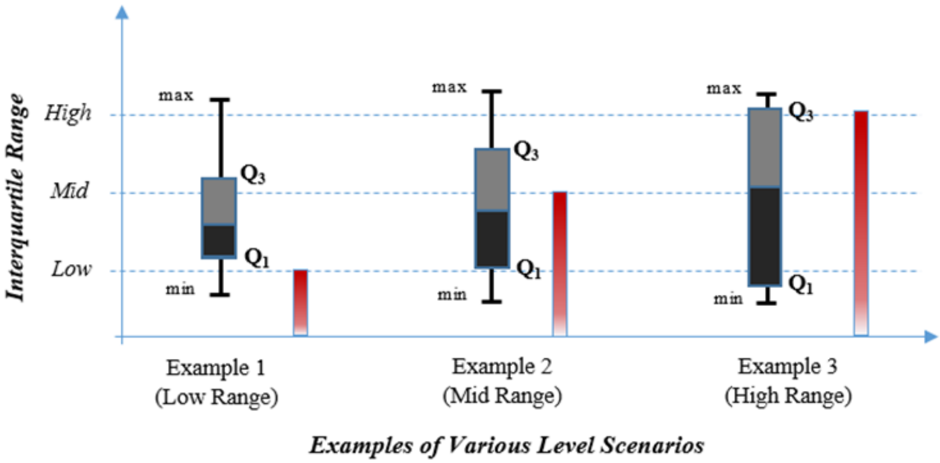
The interquartile range (IQR) is a statistical measure commonly employed to quantify the extent of dispersion within a dataset. When the data set is separated into quartiles, three distinct points of separation are detected, namely the lower quartile (Q_1), the median (Q_2), and the upper quartile (Q_3). Eq. 3 is utilized to calculate the interquartile range value for each criterion. The $Iqrbow_{Cj}$ value represents the interquartile range of the j-th criterion:

$$\underset{N}{Iqrbow}\ C_j = Q_{3\,(cj)} - Q_{1\,(cj)} \tag{3}$$

Figure 1 displays boxplots illustrating the distribution and variability of three distinct data sets. These examples illustrate data sets with low, moderate, and high interquartile range (IQR) values. The interquartile range (IQR) is a statistical measure that quantifies the dispersion of the central 50 percent of a dataset and is often used as a reliable metric. The first example is a dataset with a small interquartile range (IQR). In this scenario, the data has a narrow range and the disparity between the first quarter (Q1) and the third quarter (Q3) is minimal. The second example depicts a dataset that has a moderate interquartile range (IQR). In this instance, the magnitude of the difference between Q1 and Q3 indicates a considerable dispersion. The third example depicts a dataset characterized by a substantial interquartile range (IQR). Within this dataset, the interquartile range (IQR) is greater, suggesting a broader dispersion of data.

A box plot displays the lowest, first quartile (Q1), median, third quartile (Q3), and maximum values of a given data set.

Figure 1. Illustrative representations of the interquartile range of criteria.



Reference: Fidan, 2024a, p.8

Ultimately, the ultimate weights of the criteria are computed. The w_j value in Eq. 4 indicates the weight of the C_j criterion derived using the IQRBOW approach.

$$w_j = \begin{cases} \dfrac{1}{m} & , \quad if\ all\ Iqrbow_{Cj}'s\ are\ zero \\ \dfrac{Iqrbow_{Cj}}{\sum_{j=1}^{m} Iqrbow_{Cj}} & , \quad others \end{cases} \tag{4}$$

In this section, the importance (weights) of the criteria determined by the IQRBOW method, which is the previous stage, is examined in more detail with the Multi-Moora method, which is frequently used in multi-criteria decision making problems. Multi-Moora is a hybrid method that combines three different approaches to provide decision-makers with a more comprehensive evaluation. These approaches are the Ratio Approach (comparisons based on ratios), the Reference Point Approach (distance to the ideal solution) and the Full Multiplicative Form (product of all criteria). The integrated ranking result obtained by combining these three methods was used to determine the final ranking of the alternatives.

The initial three stages of the Multi-Moora method, which are shared by all methodologies, are presented in Eq. 5-9. For the Ratio Approach (Brauers and Zavadskas, 2006); to normalize the decision matrix, Eq. 5 is applied to the matrix in Eq. 1.

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{n} x_{ij}^{2}}} \tag{5}$$

A weighted normalized decision matrix is created using Eq. 6. Here, "w_j" represents the weight of the j-th criterion.

$$v_{ij} = w_j \, . x_{ij}^* \tag{6}$$

The final preference values derived by utilizing Eq. 7. Here, the variable j takes values from 1 to g, representing the criteria that need to be maximized. On the other hand, when j takes values from g+1 to n, it represents the criteria that need to be minimized.

$$y_i^* = \sum_{j=1}^{g} v_{ij} - \sum_{j=g+1}^{n} v_{ij} \tag{7}$$

The results are ranked by arranging the values in descending order.

For the Reference Point Approach (Brauers et al., 2008); reference points, denoted as r_j, are established for each individual criterion. When selecting reference points, the maximum values are picked for criteria that need to be maximized, while the minimum values are chosen for criteria that need to be minimized. The distance between the alternatives and the reference points is computed, and the optimal alternative is chosen using Eq. 8.

$$\min_i\{\max_j(|w_j r_j - v_{ij}|)\} \tag{8}$$

The best alternative is established by first finding the maximum distance values of each alternative to the reference points under all criteria, as stated in Eq. 8. From these values, the minimum one is chosen. The final ranking of the alternatives is determined by arranging the maximum distance values in ascending order.

For the Full Multiplicative Form (Brauers and Zavadskas, 2010); the multiplicative ranking index (U_i) for each alternative is determined using Eq. 9.

$$U_i = \frac{A_i}{B_i} \tag{9}$$

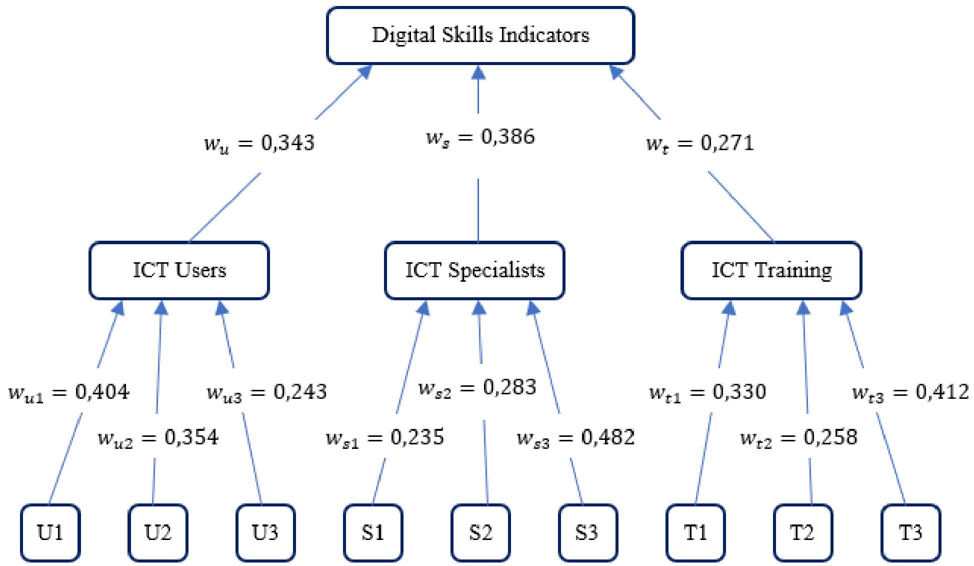
A_i is the result of multiplying the highest possible values together, while B_i is the result of multiplying the lowest possible values together.

The Multi-Moora approach utilizes the dominance theory to derive a final ranking from three separate rankings achieved by the Ratio System, Reference Point Approach, and Full Multiplicative Form (Brauers and Zavadskas, 2011).

3. FINDINGS

In the first stage of the study, the weighting process for the criteria and sub-criteria was carried out. In this context, weight values were calculated using the IQRBOW method and the results are presented visually in Figure 2.

Figure 2. IQRBOW Scores for Criteria and Sub-Criteria



Reference: Created by the author.

When the weight values of the sub-criteria are analysed, it is seen that sub-criteria U1 (Individuals' Computer Skill Level), S3 (Enterprises Employing ICT Specialists) and T3 (Enterprises Providing Training to Develop / Upgrade ICT Skills of Their Personnel) have the highest difference in the weight distributions within themselves. This shows that these sub-criteria have a more significant importance in the calculation of the criteria weights.

The values calculated in the weighting process constituted the basic inputs for the next step of the multi-criteria decision-making analysis. In order to reach the final result of the Multi-MOORA method, the values of the Ratio Approach, the Reference Point Approach and the Full Multiplicative Form Approach were calculated within the steps of Equations 5-9. In each of these three different approaches, the normalized criteria values were weighted by multiplying them with the weighting coefficients obtained previously. Thus, the performance of each country was evaluated by considering the relative importance of the criteria. The final results of the calculations are presented in detail in Table 2.

The data shown in Table 2 is derived from a comprehensive evaluation of European nations, which takes into account many factors like digital skills, ICT professionals, and education. The evaluation was conducted by using several MOORA methodologies, including the Ratio Approach, the Reference Point Approach, and the Full Multiplicative Form Approach. Each technique made a contribution to the final ranking by evaluating the performance of the nations from several viewpoints.

Table 2. MOORA Ranking Results of Countries by Digital Skills

	Ratio Approach	**Reference Point Approach**	**Full Multiplicative Form Approach**	**Multi-MOORA**
Belgium	4	10	4	4
Bulgaria	34	30	34	34
Czechia	21	18	21	21
Denmark	3	3	3	3
Germany	5	15	5	5
Estonia	23	32	23	23
Ireland	9	6	9	9
Greece	27	19	27	27
Spain	11	8	11	11
France	12	7	12	12
Croatia	20	24	20	20
Italy	31	31	26	31
Cyprus	18	13	18	18
Latvia	32	27	32	32
Lithuania	29	33	29	29
Luxembourg	13	11	13	13
Hungary	19	14	19	19
Malta	6	5	6	6
Netherlands	2	1	2	2
Austria	15	12	15	15
Poland	17	17	17	17
Portugal	22	20	22	22
Romania	36	34	36	36
Slovenia	24	23	24	24
Slovakia	28	28	31	28
Finland	1	2	1	1
Sweden	8	9	8	8
Iceland	16	36	16	16
Norway	10	21	10	10
Switzerland	7	4	7	7
Bosnia and Herzegovina	26	26	25	26
Montenegro	14	16	14	14
North Macedonia	35	35	35	35
Albania	25	25	28	25
Serbia	30	22	30	30
Türkiye	33	29	33	33

Reference: Created by the author.

Finland is ranked first in terms of digitization capabilities, according to the statistics. Finland achieved the top position in all aspects, demonstrating its status as a leading nation in terms of digital skills, ICT professionals, and education. The Netherlands and Denmark are both regarded as prominent digital frontrunners in Europe.

Conversely, nations like Romania, North Macedonia, and Bulgaria are situated at the lowest positions in the list. These nations have significant deficiencies in digital skills, ICT experts, and education, resulting in a delay in their digitalization efforts.

The results also demonstrate significant disparities across nations. For instance, there is a discrepancy of 30 positions between Belgium and Bulgaria. This underscores the magnitude of the digital disparity in Europe. Switzerland and North Macedonia have a notable disparity in performance.

4. DISCUSSION and CONCLUSION

The objective of this study is to assess the level of digitalization achieved by European nations, specifically in relation to the digital skills possessed by people. The study used a multi-criteria approach and implemented the IQRBOW-based Multi-MOORA technique. The analytical results unequivocally demonstrated the disparities in nations' progress in developing digital skills.

The survey found that countries such as Finland, the Netherlands, and Denmark were rated at the highest positions. Their achievements are propelled by robust education systems, substantial investments in information and communication technology (ICT), and the exceptional digital skills possessed by their inhabitants. Finland is notable for its emphasis on the development of digital skills and its regulations in this domain.

Conversely, nations such as Romania, North Macedonia, and Bulgaria are positioned at the lowest ranks in the list. This indicates that these nations possess significant deficiencies in their digital transformation procedures. The insufficient educational infrastructure, limited employment of ICT professionals, and low levels of digital literacy among residents have a detrimental effect on the performance of these nations.

The study's findings indicate that Türkiye, although making significant strides in the process of digitization, is positioned at a comparatively low rank among the nations that were analysed. Türkiye is ranked 33rd out of 36 nations, indicating significant weaknesses, particularly in the area of digital skills. The reasons for this may be ascribed to several issues, including the inadequate focus on digital literacy skills within Türkiye's educational framework, insufficient allocations of resources towards information and communication technology, and challenges related to internet accessibility in rural regions. To enhance Türkiye's competitiveness in the global arena and expedite the process of digital transformation, it is imperative to address these shortcomings and formulate comprehensive strategies to enhance proficiency in digital skills.

The analytical findings demonstrate the magnitude of the digital divide in Europe. There are notable disparities between the nations at the top and bottom. This presents a significant challenge for the European Union in attaining its digitization objectives. The results have significant consequences for policymakers. Countries with inadequate performance levels should undertake education system reforms, provide resources to the information and communications technology (ICT) industry, and establish initiatives aimed at enhancing the digital skills of their inhabitants. In contrast, nations that are achieving exceptional results must intensify their efforts, adjust to emerging technology, and provide conducive conditions that facilitate the process of digital transformation, thereby ensuring the continuity of their present achievements.

The study's methodological contribution should not be disregarded. The IQRBOW based Multi-MOORA technique was used for the first time in this domain and produced favourable results. Future study may explore other weighting strategies and multi-criteria decision-making methodologies to enhance the trustworthiness of the analysis findings.

To summarize, this research has thoroughly analysed the digital skills profiles of European nations and uncovered the variations in their digitalization processes. The results serve as a significant point of reference for policymakers and scholars. Subsequent research will further explore the scholarly discourse sparked by this study and provide insights into the digital future of Europe.

Statement of Research and Publication Ethics

In all processes of the article, the principles of research and publication ethics of the Journal of Manisa Celal Bayar University Graduate School of Social Sciences were followed.

Contribution Rates of Authors to the Article

The entire article was written by Üzeyir Fidan.

Declaration of Interest

The author has no conflict of interest with any person or organization.

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