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Assessing the Urban Competitiveness of European Cities Using LOPCOW-RAWEC Methodologies

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Abstract: Urban competitiveness is an essential determinant of the long-term sustainability and economic development of cities, influencing not only local prosperity but also national growth. The accurate measurement of urban competitiveness is critical for policymakers, as it provides insights into the strengths and weaknesses of cities, informing strategic development. This study evaluates the competitiveness of 17 European cities through an integrated Multi-Criteria Decision-Making (MCDM) framework, combining the Logarithmic Percentage Change-driven Objective Weighting (LOPCOW) method for criteria weighting with the Ranking of Alternatives with Weights of Criterion (RAWEC) method for city ranking. The dataset utilised in this analysis was derived from the 2024 Global Power City Index (GPCI), a comprehensive report assessing various urban performance dimensions. The LOPCOW methodology revealed that the livability (L) criterion holds the highest weight in determining urban competitiveness, whereas research and development (R&D) emerged as the least influential factor. Using the RAWEC method, cities were ranked based on their overall competitiveness, with London identified as the most competitive urban centre, while Istanbul was ranked lowest. The findings highlight the importance of livability in enhancing urban competitiveness and suggest that cities should prioritise improvements in R&D to foster more balanced and sustainable competitiveness. This research contributes to the growing body of literature on urban performance measurement, offering a novel methodological approach that integrates both objective weighting and ranking techniques, which can be applied to further studies on global urban competitiveness.

Keywords: Urban competitiveness; Performance measurement; Multi-Criteria Decision-Making methods (MCDM); Logarithmic Percentage Change-driven Objective Weighting (LOPCOW); Ranking of Alternatives with Weights of Criterion (RAWEC)

1 Introduction

Competitiveness is of critical importance for individuals, businesses and countries to achieve sustainable success in today's rapidly changing economic and social dynamics. Competitiveness is not limited to increasing market share; it also refers to a broader value creation process by bringing together elements such as innovation, efficiency, quality and cost advantage. Porter [1, 2] states that gaining sustainable competitiveness in the global economy is possible through increasing locality, where competitors cannot respond.

Urban competitiveness refers to the capacity of a city to compete with other cities at national and international levels by achieving sustainable growth in economic, social and environmental areas. This concept has strategic importance for cities in an era when globalization, urbanization and technological transformation processes are accelerating [3, 4]. The economic success of cities is directly related to the effective combination of multidimensional elements such as infrastructure quality, social resilience and environmental sustainability [5]. For example, Porter's "diamond model" took the productivity and income generation capacity of cities as the main elements of competitiveness. However, this approach is determined by new practices that emphasize growth in the evaluation of social and growth factors beyond economic growth [6]. In recent years, global crises such as the COVID-19 pandemic have forced the reconsideration of the relationship between sustainability and continuous competitiveness. The pandemic has tested the social development, economic adaptability and development of cities, and the need for long-term sustainability has once again emerged [5]. In this context, it is essential to adopt a holistic approach to increase the competitiveness of cities. Determining and implementing the necessary strategies to increase the competitiveness of cities requires the cooperation of various actors, from local governments to international institutions. With this approach, economic growth and social inclusion are brought together, making cities more resilient [6].

International indices such as the GPCI provide an important reference by measuring the global competitiveness of cities in a multidimensional manner. The GPCI report reveals how cities perform in six key performance areas: economy, research and development (R&D), cultural interaction, livability, environment and accessibility [7]. Therefore, the assessment of urban competitiveness requires a multidimensional approach.

This study aims to examine the urban competitiveness components of cities in Europe using MCDM methods, based on the GPCI report. In the study, 17 European cities included in the GPCI report were examined with the six basic performance indicators (economy (E), research and development (R&D), cultural interaction (CI), livability (L), environment (ENV) and accessibility (A)) included in the report. In the study, the LOPCOW method was utilized to prioritize the criterion and the RAWEC method was utilized to rank the cities.

The rest of the study is organized as follows. In the second chapter, studies that evaluate the competitiveness of cities using MCDM methods will be examined. In the third chapter, the methods utilized in the study will be introduced. In the fourth chapter, the methods that determine the competitiveness of European cities will be listed. In the conclusion chapter, the detections obtained will consequently be interpreted, and a discussion section will be included.

2 Literature Review

The evaluation of the competitiveness of cities involves a delicate and complex process as it includes many criteria. Therefore, it is necessary to use flexible and analytical decision-making methods in such problems. MCDM methods have been used in many studies from different perspectives in order to increase the competitiveness of cities, to spread sustainable development and to determine priorities in economic, social and environmental areas. Some of the recent studies are as follows. Ozkaya and Erdin [8] integrated ANP and TOPSIS methods in the assessment of 44 smart and sustainable cities around the world. Consequently, in the assessment, Tokyo, London and New York were in the top three in the ranking. Liu et al. [9] used the DEMATEL method in the evaluation of the sustainable development of 21 port cities in China. The results obtained determined that the sustainability levels of port cities in China were moderate. Hajduk and Jelonek [10] evaluated 21 smart cities from 6 world regions in terms of urban energy using Entropy and TOPSIS methods. As a result of the assessment, Porto showed the best performance, and Buenos Aries showed the worst performance. Chakraborty et al. [11] integrated DEMATEL and MABAC methods in the performance assessment of 98 smart cities in India. Consequently, of the assessment, the best-performing smart city was Aizawl, and the worst-performing smart city was Warangal. Činčikaitė and Meidutė-Kavaliauskienė [5] used SAW, TOPSIS and COPRAS methods in the assessment of the competitiveness of the Baltic capitals for the period 2015-2020 in the context of the impact of COVID-19. As a result of the SAW and TOPSIS evaluation methods, Tallinn showed the best performance in 2016-2019. As a result of the COPRAS method, Tallinn had the best performance in 2016, 2019 and 2020, while Vilnius showed the best performance in 2015, 2017 and 2018. Raheja et al. [12] integrated AHP, CODAS and TOPSIS in evaluating the air quality of 7 cities in India. As a result of the assessment, Delhi ranked first among 7 cities, while Noida ranked seventh. Adali et al. [13] integrated Grey LBWA and Grey EDAS methods in evaluating the competitiveness of 17 smart cities in Europe. As a result of the Grey LBWA method, the essential criteria were determined as Economy and Livability, while the non-essential criterion was determined as Environment. According to the Grey EDAS method results, London showed the best performance and Istanbul the worst performance. Kutty et al. [14] integrated AHP and EDAS methods in a global fuzzy environment to evaluate the sustainability, resilience and livability performance of 35 high-tech European smart cities. As a result of the assessment, London showed the best performance and Bologna the worst performance. Gelmez and Özceylan [15] evaluated 118 smart cities by integrating Entropy, ARAS and COPRAS methods in technological and structural contexts. As a result of ARAS and COPRAS methods, Zhuhai showed the best performance in technological terms, and Abuja showed the worst performance. From a structural perspective, Abu Dhabi showed the best performance and Sao Paulo showed the worst performance. Taş and Alptekin [16] assessed the smart city performance of 30 major cities in Turkey by integrating MEREC and MARCOS techniques. As a result of the assessment, Istanbul showed the best performance. Komasi et al. [17] integrated Entropy, TOPSIS, MABAC and EDAS methods in the evaluation of the socio-cultural competitiveness of 15 cities in Iran with a population of over 500 thousand. As a result of the assessment, the city with the best performance was determined to be Kerman. Brodny et al. [18] integrated CRITIC, SD, EDAS and WASPAS methods in the assessment of the level and quality of living conditions in the 29 largest cities of Poland. The best performance was in Warsaw and the worst in Gorzow Wielkopolski.

3 Methodology

In this section, the urban competitiveness of European cities will be evaluated by integrating the LOPCOW and RAWEC methods. In this decision-making approach, the LOPCOW method was utilized to rank the criteria weights. The obtained criteria weights were transferred to the RAWEC method, and the competitiveness of European cities was evaluated and ranked. Some practical implications of the present article assessing the multidimensional competitiveness of European cities are as follows:

• The first practical contribution of the research is the development of a new, holistic and hybrid decision-making approach to assess the multidimensional competitiveness of European cities.

• The proposed decision-making method has a simple but effective mathematical structure that does not require complex mathematical operations.

• The determined holistic and hybrid model helps to produce more ideal, consistent and reliable results. This has been proven by the comparative analysis.

Besides the advantages of the model proposed in the research, there are also some limitations.

• Increasing the number of criteria and alternatives may cause deviations in the results.

• If subjective data is used, differences in the results may occur.

3.1 LOPCOW Method

It was developed by Ecer and Pamucar to calculate the weights of the criteria in 2022. The advantages of the LOPCOW method are listed below [19].

I. It minimizes the difference between the weights of the essential criteria and the non-essential criteria. Thus, more acceptable results are obtained.

II. Criteria with negative values are directly included in the analysis.

III. There is no limit on the number of criteria to be utilized in the study.

The LOPCOW method has been used by Ecer and Pamucar [19], in the analysis of sustainability performance in the banking sector, Bektaş [20], in the analysis of the performance of the Turkish insurance sector in the period 2002-2021, Ulutaş et al. [21], in the selection of natural fibers among insulation materials, Ecer et al. [22], in the sustainability performance analysis of micro mobility solutions in urban transportation, Simic et al. [23], in the selection of material handling technology in the smart and sustainable warehouse management system, Ecer et al. [24], in the selection of agricultural unmanned aerial vehicles, Ulutaş et al. [25], in the selection of third-party logistics companies for automobile manufacturing companies, Kahreman [26], in the analysis of the economic performance of countries in D8 in the period 2011-2020. There are 4 basic steps in the method [19]:

Step 1. The decision matrix is composed according to the obtained data. The composed decision matrix is given in Eq. (1).

$$D = [d_{ij}]_{m\times n} \tag{1}$$

Step 2. The values in the decision matrix are normalized using Eq. (2) and Eq. (3). Eq. (2) is calculated for beneficial criteria, and Eq. (3) is calculated for cost (non-beneficial) criteria.

$$p_{ij} = \frac{d_{ij} - \min(d_{ij})}{\max(d_{ij}) - \min(d_{ij})} \tag{2}$$

$$p_{ij} = \frac{\max(d_{ij}) - d_{ij}}{\max(d_{ij}) - \min(d_{ij})} \tag{3}$$

Step 3. The % values (PVI_{ij}) of the criteria are calculated by applying Eq. (4).

$$PVI_{ij} = \left| \ln\left(\frac{\sqrt{\frac{\sum_{i=1}^{m} p_{ij}^2}{m}}}{\sigma} \right) \cdot 100 \right| \tag{4}$$

σ in Eq. (4) represents the standard deviation.

Step 4. The weights of the criteria are determined by applying Eq. (5).

$$w_j = \frac{PV_{ij}}{\sum_{i=1}^{n} PV_{ij}} \tag{5}$$

3.2 RAWEC Method

The RAWEC method was developed by Puška et al. [27] in 2024 to rank the alternatives. The advantages of the LOPCOW method are listed below [27].

I. Making the decision-making process simple, steps away from complexity.

II. Calculating the weighted normalized decision matrix found in other MCDM methods and the deviation processes from the weight of the criteria in a single step.

Since the RAWEC method is a new method, it has been used in very few studies. Puška et al. [27], used the RAWEC method in the evaluation of locations for the establishment of agricultural distribution centers; Dündar [28], in the performance evaluation of IPARD-II Rural development plans; Do [29], in the evaluation of the top 10 universities in Vietnam; Petrovic et al. [30], in the assessment of the sustainability of transportation modes in the EU; Mohamed et al. [31] in the selection of materials. The steps of the method are as follows [27]:

Step 1. The decision matrix is organized according to the data. The decision matrix is expressed in Eq. (1).

Step 2. The decision matrix is normalized using double normalization.

$$n_{ij} = \frac{d_{ij}}{d_{j\max}}, and\ n'_{ij} = \frac{d_{j\min}}{d_{ij}} for\ benefit\ criteria, and \tag{6}$$

$$n_{ij} = \frac{d_{j\min}}{d_{ij}}, and\ n'_{ij} = \frac{d_{ij}}{d_{j\max}}, for\ cost\ criteria \tag{7}$$

Step 3. Deviation from criterion weight is calculated. The calculation of the weighted normalized decision matrix and deviation from ideal and anti-ideal values are combined in this step.

$$v_{ij} = \sum_{i=1}^{n} w_j \cdot (1 - n_{ij}) \tag{8}$$

$$v'_{ij} = \sum_{i=1}^{n} w_j \cdot (1 - n'_{ij}) \tag{9}$$

w_j, in Eqs. (8) and (9) represents the criterion weight.

Step 4. The value of the RAWEC method is calculated.

$$Q_i = \frac{v'_{ij} - v_{ij}}{v'_{ij} + v_{ij}} \tag{10}$$

The alternative with the highest Q_i value is selected as the best alternative.

4 Application

In this section, the proposed methodology will be applied to assess the competitiveness of cities in Europe. The data to be used to assess the competitiveness of cities is obtained from the GPCI report published in 2024 [7]. In the GPCI report, the competitiveness of 48 cities was examined in detail according to 6 urban criteria. 17 cities belonging to Europe were selected from a total of 48 cities in the report. This selection limited the scope of the study to focus on European cities. In order to test the methodology proposed in the study, the relevant cities were evaluated according to the economy (E), research and development (R&D), cultural interaction (CI), livability (L), environment (ENV) and accessibility (A) criteria included in the report. The criteria used were usefully taken into consideration since they increase the competitiveness of the cities. In the GPCI report, the economy criterion is calculated by considering 6 main factors (market size, market attractiveness, economic vitality, human capital, business environment and ease of doing business) and 13 indicators. The R&D criterion is calculated by considering 3 main factors (academic resources, research environment and innovation) and 8 indicators. The cultural interaction criterion is calculated by considering 5 main factors (trendsetting potential, tourism resources, cultural facilities, visitor amenities and international interaction) and 16 indicators. The livability criterion is calculated by considering 5 main factors (working environment, cost of living, security and safety, well-being and ease of living) and 14 indicators. The environment criterion is calculated by considering 3 main factors (sustainability, air quality and comfort and urban environment) and 9 indicators. The accessibility criterion is calculated by considering 4 main factors (international network, air transport capacity, inner-city transportation and transport comfortability) and 10 indicators. The data provided by GPCI for each criterion is compiled on these indicators that directly contribute to a better understanding of their effects on the competitiveness of cities. The European cities whose competitiveness was evaluated in the study are given in Table 1.

Table 1. Cities evaluated for competitiveness

City	Country
Dublin	Ireland
London	England
Milan	Italy
Helsinki	Finland
Stockholm	Sweden
Copenhagen	Denmark
Vienna	Austria
Berlin	Germany
Madrid	Spain
Frankfurt	Germany
Paris	France
Amsterdam	Holland
Zurich	Switzerland
Geneva	Switzerland
Barcelona	Spain
Brussels	Belgium
Istanbul	Türkiye

4.1 Determination of Criteria Weights

In the study, the criteria weights were determined by applying the LOPCOW methodology. The initial decision matrix required for the application of the LOPCOW methodology is given in Table 2.

Since all the criteria in the decision matrix are benefit-oriented, the normalized decision matrix was obtained through Eq. (2) and is shown in Table 3.

Percentage values and weights of the criteria were calculated through Eqs. (4) and (5). The results of the LOPCOW method are shown in Table 4.

Table 2. Initial decision matrix

	E	R&D	CI	LI	ENV	A
Dublin	299.1	36.2	79.7	342.9	175.6	130.5
London	306.4	187.1	355.3	370.9	186.3	249.4
Milan	173.8	34.1	119.7	369.4	158.5	153.3
Helsinki	222.8	35.2	45.5	367.6	206.7	133.1
Stockholm	239.8	54.1	89.5	363	221	144
Copenhagen	264.9	49.3	77.9	362.4	223.6	150.2
Vienna	189.3	43.6	137.9	362.1	210.7	167.6
Berlin	196.7	78.6	175.2	378.9	190.3	151.9
Madrid	185.3	36.3	186.9	387.8	184.9	172.1
Frankfurt	203	30.4	71.6	364.1	186.8	203.2
Paris	243.5	115.1	297.3	404.8	151.4	210.9
Amsterdam	243.7	58.7	144.9	362.4	178.9	196.7
Zurich	290.3	55.9	46.4	360.3	205.6	124.9
Geneva	268.9	55.4	41.8	342.6	202.3	105.9
Barcelona	175.7	35.3	168.2	382.4	156	174.4
Brussels	185	63	121.8	364.4	156.1	148.4
Istanbul	133.4	44.8	190.8	310.5	142.7	183.4

According to the LOPCOW method results in Table 4, the prioritization order of the criteria was: livability (L)> accessibility (A)> economy (E)> environment (ENV)> cultural interaction (CI)> research and development (R&D). The obtained criteria weights were transferred to the RAWEC method and the competitiveness of European cities was ranked.

4.2 Evaluation of the Competitiveness of Cities

The RAWEC method, which is new in the literature and rarely used, was used in the evaluation of the competitiveness of cities. Benefit and cost normalizations were obtained by applying Eqs. (6) and (7) to the initial decision matrix in Table 2. Table 5 indicates benefit normalization, while Table 6 indicates cost normalization.

The calculation of an element in the n_{ij} matrix is shown below.

$$n_{11} = \frac{299.1}{306.4} = 0.9762$$

Table 3. Normalized decision matrix

	E	R&D	CI	LI	ENV	A
Dublin	0.9578	0.0370	0.1209	0.3436	0.4067	0.1714
London	1	1	1	0.6405	0.5389	1
Milan	0.2335	0.0236	0.2485	0.6246	0.1953	0.3303
Helsinki	0.5168	0.0306	0.0118	0.6055	0.7911	0.1895
Stockholm	0.6150	0.1512	0.1522	0.5567	0.9679	0.2655
Copenhagen	0.7601	0.1206	0.1152	0.5504	1	0.3087
Vienna	0.3231	0.0842	0.3065	0.5472	0.8405	0.4300
Berlin	0.3659	0.3076	0.4255	0.7253	0.5884	0.3206
Madrid	0.3000	0.0377	0.4628	0.8197	0.5216	0.4613
Frankfurt	0.4023	0	0.0951	0.5684	0.5451	0.6780
Paris	0.6364	0.5405	0.8150	1	0.1075	0.7317
Amsterdam	0.6376	0.1806	0.3289	0.5504	0.4475	0.6328
Zurich	0.9069	0.1627	0.0147	0.5281	0.7775	0.1324
Geneva	0.7832	0.1595	0	0.3404	0.7367	0
Barcelona	0.2445	0.0313	0.4032	0.7625	0.1644	0.4774
Brussels	0.2983	0.2080	0.2552	0.5716	0.1656	0.2962
Istanbul	0	0.0919	0.4753	0	0	0.5401

Table 4. LOPCOW method results

	E	R&D	CI	LI	ENV	A
PVI_{ij}	64.5005	24.9991	45.0116	100.1119	64.3395	65.3672
w_j	0.1770	0.0686	0.1235	0.2748	0.1766	0.1794
Rank	3	6	5	1	4	2

Table 5. Benefit normalization n_{ij}

$\mathbf{n}_{ij}$	E	R&D	CI	LI	ENV	A
Dublin	0.9762	0.1935	0.2243	0.8471	0.7853	0.5233
London	1	1	1	0.9163	0.8332	1
Milan	0.5672	0.1823	0.3369	0.9125	0.7089	0.6147
Helsinki	0.7272	0.1881	0.1281	0.9081	0.9244	0.5337
Stockholm	0.7826	0.2892	0.2519	0.8967	0.9884	0.5774
Copenhagen	0.8646	0.2635	0.2193	0.8953	1	0.6022
Vienna	0.6178	0.2330	0.3881	0.8945	0.9423	0.6720
Berlin	0.6420	0.4201	0.4931	0.9360	0.8511	0.6091
Madrid	0.6048	0.1940	0.5260	0.9580	0.8269	0.6901
Frankfurt	0.6625	0.1625	0.2015	0.8995	0.8354	0.8148
Paris	0.7947	0.6152	0.8368	1	0.6771	0.8456
Amsterdam	0.7954	0.3137	0.4078	0.8953	0.8001	0.7887
Zurich	0.9475	0.2988	0.1306	0.8901	0.9195	0.5008
Geneva	0.8776	0.2961	0.1176	0.8463	0.9047	0.4246
Barcelona	0.5734	0.1887	0.4734	0.9447	0.6977	0.6993
Brussels	0.6038	0.3367	0.3428	0.9002	0.6981	0.5950
Istanbul	0.4354	0.2394	0.5370	0.7670	0.6382	0.7354

The calculation of an element in the n'_{ij} matrix is shown below.

$$n'_{11} = \frac{133.4}{299.1} = 0.4460$$

Table 6. Cost normalization n'_{ij}

n'_{ij}	E	R&D	CI	LI	ENV	A
Dublin	0.4460	0.8398	0.5245	0.9055	0.8126	0.8115
London	0.4354	0.1625	0.1176	0.8372	0.7660	0.4246
Milan	0.7675	0.8915	0.3492	0.8406	0.9003	0.6908
Helsinki	0.5987	0.8636	0.9187	0.8447	0.6904	0.7956
Stockholm	0.5563	0.5619	0.4670	0.8554	0.6457	0.7354
Copenhagen	0.5036	0.6166	0.5366	0.8568	0.6382	0.7051
Vienna	0.7047	0.6972	0.3031	0.8575	0.6773	0.6319
Berlin	0.6782	0.3868	0.2386	0.8195	0.7499	0.6972
Madrid	0.7199	0.8375	0.2236	0.8007	0.7718	0.6153
Frankfurt	0.6571	1	0.5838	0.8528	0.7639	0.5212
Paris	0.5478	0.2641	0.1406	0.7670	0.9425	0.5021
Amsterdam	0.5474	0.5179	0.2885	0.8568	0.7977	0.5384
Zurich	0.4595	0.5438	0.9009	0.8618	0.6941	0.8479
Geneva	0.4961	0.5487	1	0.9063	0.7054	1
Barcelona	0.7592	0.8612	0.2485	0.8120	0.9147	0.6072
Brussels	0.7211	0.4825	0.3432	0.8521	0.9142	0.7136
Istanbul	1	0.6786	0.2191	1	1	0.5774

Table 7. RAWEC method results

City	v_{ij}	v'_{ij}	Q_i	Rank
Dublin	0.3207	0.2607	-0.1032	12
London	0.0525	0.4556	0.7933	1
Milan	0.3591	0.2459	-0.1871	14
Helsinki	0.3341	0.2245	-0.1962	15
Stockholm	0.2859	0.3242	0.0628	7
Copenhagen	0.2711	0.3276	0.0944	5
Vienna	0.2938	0.3214	0.0449	8
Berlin	0.2798	0.3412	0.0989	4
Madrid	0.2815	0.3207	0.0651	6
Frankfurt	0.3057	0.2802	-0.0435	9
Paris	0.1676	0.4001	0.4095	2
Amsterdam	0.2584	0.3590	0.1629	3
Zurich	0.2988	0.2585	-0.0723	11
Geneva	0.3412	0.1979	-0.2658	16
Barcelona	0.3187	0.2822	-0.0607	10
Brussels	0.3502	0.2732	-0.1235	13
Istanbul	0.3847	0.1942	-0.3291	17

The results of the RAWEC method calculated by applying Eqs. (8)-(10) are shown in Table 7. Calculating the v_{ij} value for Dublin city.

$$v_{11} = 0.1770.(1 - 0.9762) = 0.0042$$
$$v_{12} = 0.0686.(1 - 0.1935) = 0.0553$$
$$v_{13} = 0.1235.(1 - 0.2243) = 0.0958$$
$$v_{14} = 0.2748.(1 - 0.8471) = 0.0420$$
$$v_{15} = 0.1766.(1 - 0.7853) = 0.0379$$
$$v_{16} = 0.1794.(1 - 0.5233) = 0.0855$$
$$v_{ij} = 0.042 + 0.0553 + 0.0958 + 0.0420 + 0.0379 + 0.0855 = 0.3207$$

Calculating the v'_{ij} value for Dublin city.

$$v'_{11} = 0.1770.(1 - 0.4460) = 0.0981$$
$$v'_{12} = 0.0686.(1 - 0.8398) = 0.0110$$
$$v'_{13} = 0.1235.(1 - 0.5245) = 0.0587$$
$$v'_{14} = 0.2748.(1 - 0.9055) = 0.0260$$
$$v'_{15} = 0.1766.(1 - 0.8126) = 0.0331$$
$$v'_{16} = 0.1794.(1 - 0.8115) = 0.0338$$
$$v'_{ij} = 0.0981 + 0.0110 + 0.0587 + 0.0260 + 0.0331 + 0.0338 = 0.2607$$

Calculating the Q_i value for Dublin city.

$$Q_i = \frac{0.2607 - 0.3207}{0.2607 + 0.3207} = -0.1032$$

As a result of the RAWEC method, the city with the best competitive power was determined as London. Other ranking results were as follows: Paris> Amsterdam> Berlin> Copenhagen> Madrid> Stockholm> Vienna> Frankfurt> Barcelona> Zurich> Dublin> Brussels> Milan> Helsinki> Geneva> Istanbul.

4.3 Comparison with Other MCDM Approaches

The results obtained with the decision-making approach proposed in the study were compared with other alternative assessment approaches such as WASPAS, ARAS, COPRAS and EDAS. The comparison results are given in Figure 1.

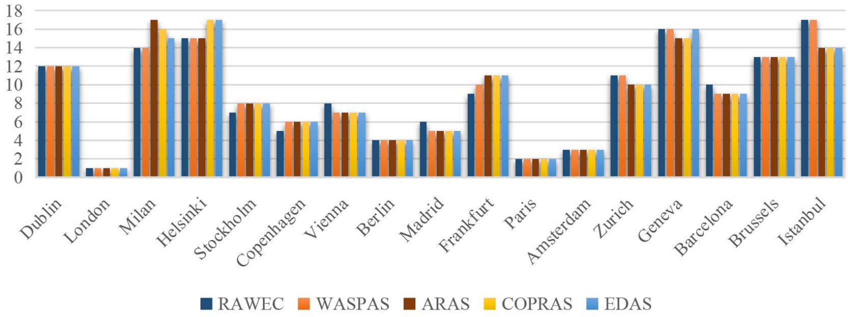

Figure 1. Comparison results

Note: This figure was created by the authors

Figure 1 shows that the results collected with alternative decision-making approaches are quite similar and the proposed approach yields consistent results.

5 Discussion and Conclusions

The assessment of the competitiveness of cities is an important process for policy makers, researchers and the public, where the development of multi-faceted dynamic features related to the components of the modern world is better investigated. This study evaluated the competitiveness of 17 European cities included in the GPCI 2024 report using the LOPCOW and RAWEC methods, which are MCDM methods. The GPCI report presents the performance of cities in line with 6 criteria (economy, R&D, cultural interaction, livability, environment and accessibility). The LOPCOW method was used in the study to calculate the weights of the six criteria determined. The ranking of the criteria according to the importance level as a result of the LOPCOW method was as follows: livability (L)> accessibility (A)> economy (E)> environment (ENV)> cultural interaction (CI)> research and development (R&D).

According to the application of the RAWEC method, London ranked first as the city with the highest competitive power. This city was followed by Paris, Amsterdam and Berlin. These cities show their superior performance especially in livability(L), accessibility (A) and economy (E) criteria. On the other hand, Istanbul ranked last as the city with the lowest competitive power. This city was followed by Geneva, Helsinki and Milan with low competitiveness performances. It can be said that Istanbul and these cities with low competitiveness fell behind the cities of London, Paris and Amsterdam, which are at the top due to their low performances in livability (L), accessibility (A) and economy (E) criteria. The poor competitiveness performance in these cities may be due to a combination of factors such as infrastructure deficiencies, high costs of living, lack of economic diversification, inadequate social services and transportation problems. Therefore, in order to increase their competitiveness, these cities need to make strategic investments and make improvements in these areas, especially by prioritizing livability (L), accessibility (A) and economy (E) criteria.

The results obtained with the proposed decision-making approach in the study were compared with other alternative assessment approaches such as WASPAS, ARAS, COPRAS and EDAS. It was observed that the results collected with alternative decision-making approaches were quite close and the proposed approach gave consistent results. However, considering different years in the study, changing the number of alternatives and criteria and using expert opinions may cause differences in the results of the proposed decision-making approach.

The study results are consistent with the assessment of the competitiveness of European cities by Adali et al. [13]. According to the results of Adali et al. [13], the most important criteria are Economy (E) and Livability (L), while the importance of research and development (R&D) and Environment (ENV) are determined as the lowest criteria. In the competitiveness ranking of European cities, the city with the highest competitiveness is London, followed by Paris and Amsterdam. On the other hand, Istanbul is again in the last place as the city with the lowest competitiveness, followed by Geneva, Helsinki and Milan in terms of lowest performance.

Although the study provides a comprehensive analysis, it also has some limitations. First, the study evaluates the competitiveness of European cities only with objective data without consulting any expert opinion. Second, the data used in the study is limited to the criteria and data in the GPCI report. Third, the study only evaluated the competitiveness of European cities and did not include cities in other continents.

It is not enough to evaluate the data used in the study independently, but also to conduct analyses that take into account the dynamics of cities and their interactions with each other, allowing for more accurate and reliable results. Such an approach strengthens the validity of the data and helps us understand the differences between the competitiveness of different cities more deeply. The relationships between cities and local dynamics are important factors that shape competitiveness, and considering these factors increases the accuracy and reliability of the analyses, allowing for a more comprehensive assessment. Therefore, future studies can consider the dynamics of cities. At the same time, they can evaluate the competitiveness of cities by using expert opinions, considering criteria such as innovation, urban resilience and sustainability in the GPCI report, including cities located in other continents in the evaluation scope, and using fuzzy and gray logic in the study. They can also use the LOPCOW and RAWEC methods in different decision-making problems.

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Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflict of Interests

The authors declare that they have no conflicts of interest.

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