Keywords: AHP; multicriteria method; smart sustainable transportation index; GIS application

Hamid Ahmed AWAD[1], Khalid Hardan MHANA[2], Firas ALRAWI[3]*, Grzegorz SIERPIŃSKI[4], Marcin STANIEK[5]

AHP-BASED CONSTRUCTION OF A SMART SUSTAINABLE TRANSPORTATION INDEX FOR THE RAMADI DISTRICTS

Summary. This study presents the analytical hierarchy process method to evaluate the impact of social, economic, environmental, traffic, and road criteria on the smart sustainable transportation index. Several incremental steps comprise the strategy for finding a solution. Initially, we establish the criteria used to evaluate sustainability. This method utilizes the analytical hierarchy process to organize and evaluate the criteria. During the second phase, we evaluate the viability of the transportation measure and collect data from various sources, including government reports, environmental reports, transportation department reports, and field surveys. This information has been gathered expressly to evaluate certain criteria. We use a smart, sustainable transportation index to determine the level of sustainability that the city possesses during the third phase of the project. In the fourth phase, we assess the impact that the specified criteria have on the score of the smart sustainable transportation index. These factors include population (C1), car ownership (C2), air pollution (C3), traffic volume (C4), and road density (C5). The sensitivity analysis revealed that traffic volume (C4) is the most influential criterion, while population (C1) has the weakest impact on the final index score. With a value of 9.33%, the Al-Nasr district has the most impact on the smart sustainable transportation index, while the Euthman Bin Eafaan district has the weakest influence (9.77%).

1. INTRODUCTION

A key topic in contemporary talks about public policy is the concept of a sustainable and intelligent city. This is due to the concept's broad scope, encompassing a variety of topics and facets. The first UN-HABITAT organized the Seventh World Urban Forum (WUF7), which highlights cities as major institutions capable of offering solutions to global challenges. Within the context of a sustainable future, equality, and quality of life, this group places a high priority on the relevance of cities. The World Urban Forum Seven (WUF7) declaration included a specific section that underscored the importance of incorporating sustainable cities and human settlements as essential topics in the post-2015 Development Agenda. As a result of its inception in the 1990s, the concept of a smart and sustainable city has gained substantial popularity since the beginning of the 2000s. Global assessments of urban growth consider

[1] University of Anbar, College of Engineering; 55, 55431 Ramadi, Iraq; e-mail: hamid.awad@uoanbar.edu.iq; orcid.org/0000-0003-1626-1945
[2] University of Anbar, College of Engineering; 55, 55431 Ramadi, Iraq; e-mail: khalid.hardan@uoanbar.edu.iq; orcid.org/0000-0001-9925-1667
[3] Arizona State University, School of Geographical Sciences and Urban Planning; 79CG+3C7, Coor Hall, 5th floor. 975 S. Myrtle Ave. Tempe, AZ 85287, USA; e-mail: fhamodi@asu.edu; orcid.org/0000-0002-1242-5175
[4] Silesian University of Technology, Faculty of Transport and Aviation Engineering, Krasińskiego 8, 40-019 Katowice, Poland; e-mail: grzegorz.sierpinski@polsl.pl; orcid.org/0000-0002-0146-3264
[5] Silesian University of Technology, Faculty of Transport and Aviation Engineering, Krasińskiego 8, 40-019 Katowice, Poland; e-mail: marcin.staniek@polsl.pl; orcid.org/ 0000-0002-2503-080X
* Corresponding author. E-mail: fhamodi@asu.edu

the presence of several megacities, such as those in Asia, Latin America, and Africa, with populations exceeding 20 million. They are responsible for more than 80% of the gross domestic product (GDP) of the entire planet. In addition to this, they are responsible for at least 70% of the world's carbon emissions and account for 80% of the world's total energy usage.

The United Nations Population Fund published research in 2008 that predicted that 70% of the world's population would reside in metropolitan regions by 2050. Approximately 828 million people are currently living in housing conditions that are considered substandard, and this number is rising considerably [3, 4]. These concerns complicate the development, construction, and operation of the city. Therefore, while drafting their action plans, city and nation administrators must devise intelligent strategies to enhance economic activities, energy consumption, environmental conditions, and quality of life in their respective cities.

The term "smart city" refers to urban areas that utilize information and communication technology (ICT) infrastructure to deliver services. In addition, the development of sustainable and intelligent cities requires the provision of adequate and adaptable employment and entrepreneurial opportunities, secure and affordable housing, a more participatory society, a transparent governance approach, and an efficient economy. Furthermore, it involves allocating resources toward improving public transportation, expanding environmentally friendly areas, and implementing urban planning and governance systems that promote the participation of all existing residents [5, 6]. The concept of a smart city intertwines with other concepts of cities, including information cities, sustainable cities, talent cities, wired cities, digital cities, and eco-cities [7].

This study intends to provide an understanding of the specific areas that require investment and development in their design, as well as to describe the fundamental criteria of smart and sustainable standards. Additionally, the research will contribute to the field of sustainable development, enabling researchers to calculate the smart sustainable transportation index. At the same time, we believe that decision-makers in Ramadi City will utilize the comparison data of these districts to identify specific areas and criteria that require improvement.

2. LITERATURE REVIEW

The concept of smart cities emerged around the beginning of the 21st century, driven by the widespread adoption of ICT. To enhance various aspects of urban life, including transportation, energy, governance, and public services, the concept of a "smart city" encompasses a broad range of initiatives that leverage ICT [8]. Smart cities comprise a multitude of interconnected components, each contributing to the formation of a more effective and environmentally friendly urban environment [9-13]. Here are some noteworthy parts:

- ICT: Because it enables the seamless exchange of data across a wide variety of urban processes and stakeholders, the ICT infrastructure is the backbone of smart cities.
- Internet of Things (IoT) devices, embedded in urban infrastructure and everyday objects, are becoming increasingly common to enable real-time monitoring and optimization of city activities, such as traffic management and waste collection.
- Instances of smart sustainable transportation index solutions that support ecologically friendly and efficient urban transportation include ride-sharing platforms, electric cars, and intelligent traffic management systems. These are all examples of intelligent mobility solutions.
- The three most crucial elements in reducing energy consumption and greenhouse gas emissions in smart cities are sustainable energy sources, energy-efficient buildings, and smart grids.
- Citizens can now actively participate in urban planning and policy creation because of the proliferation of digital platforms and participatory decision-making procedures. The phrases "governance" and "citizen involvement" are interchangeable.

Residents and local governments stand to gain a tremendous deal from the implementation of smart city technology, which may include the following:

- Automation and optimization of urban processes can achieve increased efficiency. This reduces the consumption of resources and congestion while improving the delivery of services.

- Smart cities support the use of clean energy, effective waste management techniques, and sustainable urban design, all of which mitigate climate change. Smart cities also encourage the use of sustainable urban architecture.
- Investing in smart infrastructure fosters innovation and attracts firms and creates employment opportunities in emerging areas such as the technology and renewable energy sectors.
- Ultimately, smart city projects aim to foster a higher standard of living for inhabitants by enhancing public safety, accessibility to healthcare, educational opportunities, and cultural amenities throughout the city.

Technology, sustainability, and innovation create smart cities, which address the challenges faced by metropolitan areas and improve the quality of life of their residents. Citizens of smart cities emphasize education, innovation, and civic participation, all of which are crucial for the development of a knowledge-based economy and participatory government. A concept known as “smart living” involves the integration of technology into everyday life to enhance aspects such as housing, healthcare, and overall quality of life. For example, Internet of Things (IoT)-based smart houses and telemedicine apps are transforming urban life by enhancing efficiency and providing access to crucial services. In a similar vein, smart settings promote sustainability by reducing pollution, maximizing resource efficiency, and ensuring climate resilience. The implementation of initiatives, such as the adoption of renewable energy and smart grids, is essential to achieving environmental objectives in metropolitan areas. Smart economies, on the other hand, are characterized by their emphasis on promoting innovation, digital entrepreneurship, and efficient financial systems. The concept of smart mobility, which emphasizes multimodal integration, intelligent transportation systems (ITS), and the implementation of environmentally friendly transportation technologies, is responsible for transforming transportation systems in smart cities. Some examples of these innovations are real-time traffic monitoring, electric automobiles, and shared mobility platforms. Lastly, smart governance provides transparency, efficiency, and public involvement by using open data initiatives and e-government platforms. These technologies enable people to participate in decision-making and enhance the level of trust between citizens and government bodies. The integration of these components, including smart people, living, environment, economy, mobility, and governance, creates a comprehensive framework for sustainable urban development. This framework aligns with global aspirations for inclusive and resilient cities [14-17].

A multi-criterion decision-making problem demands evaluation in terms of a large number of competing criteria. This challenge involves prioritizing the priorities (weights) of being a smart and sustainable city. Making a decision involves selecting from various options to achieve a specific objective. Multi-criteria decision-making is the foundation of the advanced version of the analytical hierarchy process (AHP). Our article proposed a network process to weight the characteristics and factors of the smart sustainable transportation index, which required consideration of interactions and feedback between various indicators, as well as expert opinions and perspectives on the indicators. This paper distinguishes itself from previously published studies. Research indicates that the AHP is the most frequently used strategy for multi-criteria decision-making. One of the reasons people respect these strategies is their ability to assign weights to criteria and define priorities. A variety of fields, including smart city performance modeling, have utilized and demonstrated the benefits of both the AHP and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approaches [18]. A model for smart cities [19], a framework for evaluating ubiquitous cities [20], and an evaluation of smart cities using the AHP-TOPSIS technique are developed [21]. Our paper discusses all these topics. The study uses the TOPSIS method to investigate how well smart cities work in China [22], how long smart cities last in India [23], how well smart living technology strategies work when combined with the AHP [24], and how an integrated design strategy can help with regional development [25]. The auto insurance industry makes use of a fuzzy AHP to create a weighted RFM model for client segmentation [26]. Other research [27] suggests a novel approach to the management of ecosystems as a priority. Regarding the aviation industry, the study recommends the use of AHP to allocate weights to the priorities of operational and financial performance indicators [28]. Regarding the prioritization of PV/T systems, the research [29] suggests an AHP model that considers both cost and efficiency techniques. A different study [30] focuses on developing a quality evaluation model for diesel engines, utilizing the AHP and

TOPSIS methodologies. A study using TOPSIS also evaluated the creation of smart cities, focusing on the city groups of Beijing, Tianjin, and Tangshan [31].

3. STUDY AREA

The city of Ramadi is located in the western region of Iraq, specifically in the province of Al-Anbar. Ramadi has a large territory of 318,088 square kilometers, with a developed area of 7,375 hectares, as stated by the Anbar Statistics Directorate at the time of writing. It is a bustling center for activity among communities, and it has a considerable concentration of large government offices. This is because the city is both centrally located and administratively significant. Additionally, the city is a significant transportation hub, strategically placing several transportation routes, including major highways and international roads such as 10 and 12, close to each other. This makes it a crucial intersection for traffic between Iraq's eastern and western regions. Continuous traffic was able to occur throughout the year due to the city's fortunate geographical position. This gives the city regional significance, greatly aiding its development and expansion. Fig. 1 divides the city of Ramadi, located in the Al-Anbar province of Iraq, into 36 districts.

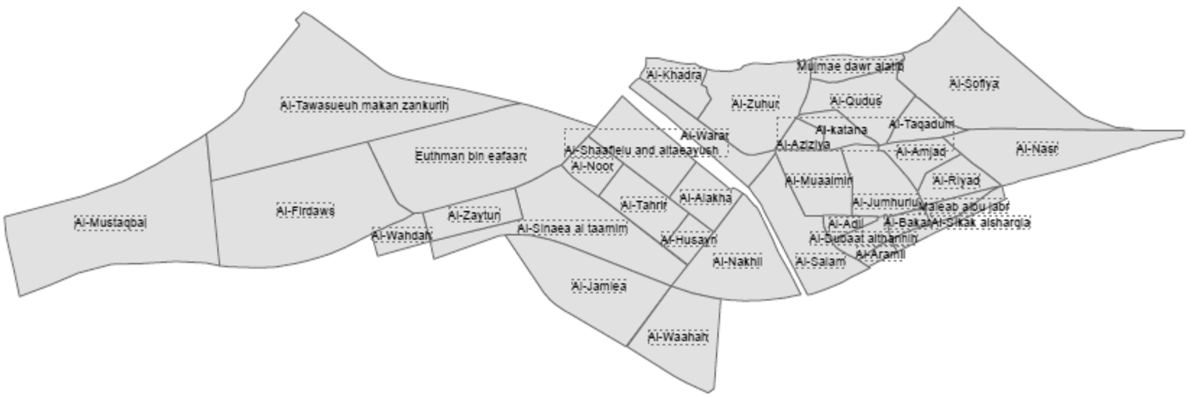

Fig. 1. Implementation of GPS in small, medium and large transportation enterprises

4. METHODOLOGY

The smart sustainability evaluation of the Ramadi districts uses an advanced step-by-step AHP method. Below is a detailed explanation of each of the numerous procedures:

- Step 1: Selection of criteria

A list of criteria is prepared to evaluate the transportation measures. These criteria are based on a review of the relevant literature as well as brainstorming sessions that involve participants in the project. City transportation specialists use the AHP method to organize and assess the criteria. They also select additional criteria relevant to traffic and road aspects, complementing the primary social, economic, and environmental criteria used in evaluating sustainable development. The criteria are selected based on these primary criteria.

- Step 2: Raw data collection

Multiple sources of information, including surveys and government resources, were utilized to collect data for the five criteria.

- Step 3: Normalized raw data

Normalization was applied to help homogenize the units of the various criteria and sub-criteria to ensure that all index values are displayed in a consistent unit. This approach also established a sequential association between the index values. The outcome specifies that the normalized range of values falls between 0 and 1:

$$N_V = [(xi(k) - min.\ xi(k)) / (max.\ xi(k) - min.\ xi(k))]\ , \quad (1)$$

where:
Nv: Normalized data for selected criteria
xi(k): The value of selected criteria before normalization
min. xi(k): minimum value of xi(k).
max. xi(k): maximum value of xi(k).

- Step 4: Weight of criteria

After choosing the evaluation criteria, we developed a decision hierarchy. The highest level of the decision hierarchy was assigned to determine the purpose of the problem. This study evaluates Ramadi's 36 districts based on the smart sustainable transportation index. The following equation is used to determine the smart sustainable transportation index for each district:

$$SSTI = SUM[(C_1*W_{C1}) + (C_2*W_{C2}) + (C_3*W_{C3}) + (C4*W_{C4}) + (C5*W_{C5})]\ , \quad (2)$$

where:
C: Value of Criteria,
WC: Weight of Criteria.

- Step 5: Sensitivity analysis

Sensitivity analysis investigates the impact of even minute changes to the specific weights allocated during the pair-wise evaluation process on the conclusion. One can answer this question by making minute weight changes and watching how they affect the decision. This comes particularly handy in situations where uncertainties surround the determination of the significance of several different aspects. The purpose of this study is to conduct a sensitivity analysis to evaluate the importance of the weights of the criteria on the performance of transportation measures with the smart sustainable transportation index. The findings guide the development of a uniform framework that integrates information and data from diverse sources to assess the examined smart sustainable transportation index measures. Information for Ramadi districts is obtained from a wide variety of available sources to determine the smart sustainability of the transportation index. The reports from the government, the environmental department, the transportation department, and the field survey are the sources referred to here.

5. RESULTS

For the adopted methodology, subsequent steps of analysis were carried out.

- Step 1: Selection of criteria

After conducting a literature review, we construct a set of criteria (Fig. 2) to assess the smart sustainable transportation index. The city transportation specialists utilize the AHP method to organize and assess the criteria.

- Step 2: Raw data collection

Obtaining a wide range of information regarding the social, economic, environmental, traffic, and road features of the 36 districts that make up Ramadi. Table 2 contains the raw data for each of the 36 districts of Ramadi city.

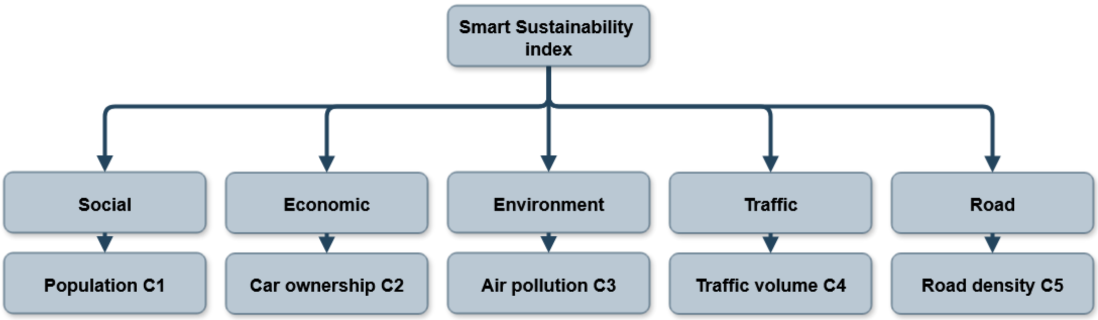

Fig. 2. Selection of criteria

Table 1

Criteria definitions

Criteria	Code	Definition
District Population Index	C1	Number of populations in each district (in thousands)
Car Ownership Index	C2	Percentage of the population that has at least one vehicle in each district
Air Pollution Index	C3	Amount of CO gas emission in each district (ppm)
Traffic Volume Index	C4	Average traffic volume in each district (veh/hr)
Road Density Index	C5	The area of the road network in each district km^2

- Step 3 Normalized raw data

Normalization was carried out to homogenize the units of the various criteria and sub-criteria, ensuring that all index values are presented in consistent units throughout the entire process. This method enabled the establishment of a sequential correlation between the index values, which was another advantage of the strategy. As a result, the strategy produces a normalized range of values between 0 and 1. Table 3 contains the normalized raw data for each of the 36 districts of Ramadi city.

- Step 4: Weight of criteria

The matrix used for pairwise comparisons based on the opinions of specialists for the C1, C2, C3, C4, and C5 criteria is presented in Table 3.

Table 2

Raw data

District	C1	C2	C3	C4	C5
Al-Sofiya	3.75	3.94	1.17	915	138.25
Al-Taqadum	0.53	1.63	6.52	875	200.31
Al-Qudus	1.41	9.28	0.24	822	83.98
Al-Katana	0.45	2.00	0.34	981	171.62
Al-Aziziya	0.31	2.30	4.45	1002	115.85
Al-Nasr	2.20	0.46	0.86	629	192.88
Al-Amjad	0.62	3.34	0.92	800	189.91
Al-Riyad	0.67	5.68	2.79	562	206.46
Al-Jumhuriu	1.16	1.63	2.46	685	420.72
Al-Muaalmin	1.16	6.14	1.33	836	1289.1
Al-Salam	1.74	1.45	1.35	712	828.92

cont. table 2

Al-Sinaea Al Taamim	2.99	6.66	2.50	606	116.68
Al-Noor	0.57	3.36	1.74	859	316.92
Al-Tahrir	0.99	2.19	1.50	682	263.27
Al-Husayn	0.38	1.28	1.36	888	129.67
Al-Nakhil	2.17	3.94	2.76	568	320.60
Al-Shaafieiu and Altaeayush	1.44	5.24	0.25	489	108.57
Al-Alakha’	0.74	3.56	0.83	462	132.69
Al-Warar	0.92	0.54	13.49	618	2328.5
Al-Khadra'	0.73	2.64	3.77	836	206.94
Al-Zuhur	2.22	6.32	6.23	725	132.83
Mujmae Dawr Alatiba’	0.51	5.11	2.51	406	185.81
Al-Zaytun	0.84	2.34	1.06	635	271.88
Euthman Bin Eafaan	4.38	5.62	7.66	416	275.51
Al-Jamiea	2.51	1.23	22.70	625	3120.4
Al-Firdaws	5.00	1.94	20.72	439	1141.4
Al-Wahdah	0.42	1.35	1.43	516	136.49
Al-Mustaqbal	5.39	7.46	19.05	527	327.49
Al-Waahah	1.81	4.22	6.03	420	331.11
Al-Adil	0.24	1.03	1.09	399	103.73
Al-Dubaat Althannih	0.39	2.00	0.75	398	35.00
Al-Sikak Alsharqia	0.37	1.33	0.50	521	23.34
Al-Bakar	0.23	6.23	3.22	866	166.48
Maleab Albu Jabr	0.29	1.10	0.75	466	131.64
Al-Aramil	0.14	0.39	0.12	292	21.56
Al-Tawasueuh Makan Zankurih	6.25	0.14	0.14	102	13.65

Table 3

Normalized raw data

District	C1	C2	C3	C4	C5
Al-Sofiya	0.416	0.416	0.047	0.903	0.040
Al-Taqadum	0.163	0.163	0.284	0.859	0.060
Al-Qudus	1.000	1.000	0.005	0.800	0.023
Al-Katana	0.204	0.204	0.010	0.977	0.051
Al-Aziziya	0.237	0.237	0.192	1.000	0.033
Al-Nasr	0.035	0.036	0.033	0.586	0.058
Al-Amjad	0.350	0.350	0.036	0.776	0.057
Al-Riyad	0.606	0.606	0.118	0.511	0.062
Al-Jumhuriu	0.164	0.163	0.104	0.648	0.131
Al-Muaalmin	0.657	0.657	0.054	0.816	0.411
Al-Salam	0.144	0.144	0.055	0.678	0.262
Al-Sinaea Al Taamim	0.714	0.714	0.106	0.560	0.033
Al-Noor	0.352	0.353	0.072	0.841	0.098
Al-Tahrir	0.224	0.225	0.061	0.644	0.080
Al-Husayn	0.126	0.125	0.055	0.873	0.037
Al-Nakhil	0.416	0.416	0.117	0.518	0.099

cont. table 3

Al-Shaafieiu And Altaeayush	0.559	0.558	0.006	0.430	0.031
Al-Alakha'	0.375	0.375	0.032	0.400	0.038
Al-Warar	0.045	0.044	0.592	0.573	0.745
Al-Khadra'	0.274	0.274	0.162	0.816	0.062
Al-Zuhur	0.676	0.676	0.271	0.692	0.038
Mujmae Dawr Alatiba'	0.544	0.544	0.106	0.338	0.055
Al-Zaytun	0.241	0.241	0.042	0.592	0.083
Euthman Bin Eafaan	0.600	0.600	0.334	0.349	0.084
Al-Jamiea	0.120	0.120	1.000	0.581	1.000
Al-Firdaws	0.197	0.197	0.912	0.374	0.363
Al-Wahdah	0.133	0.133	0.058	0.460	0.040
Al-Mustaqbal	0.801	0.801	0.838	0.472	0.101
Al-Waahah	0.447	0.447	0.262	0.353	0.102
Al-Adil	0.098	0.097	0.043	0.330	0.029
Al-Dubaat Althannih	0.204	0.204	0.028	0.329	0.007
Al-Sikak Alsharqia	0.131	0.131	0.017	0.466	0.003
Al-Bakar	0.666	0.666	0.137	0.849	0.049
Maleab Albu Jabr	0.105	0.105	0.028	0.404	0.038
Al-Aramil	0.028	0.028	0.004	0.211	0.010
Al-Tawasueuh Makan Zankurih	0.015	0.013	0.019	0.014	0.019

Table 4

Criteria weight

Criteria	C1	C2	C3	C4	C5	Weight %
C1	1	0.5	0.5	0.33	0.33	8.90
C2	2	1	1	0.5	0.5	15.79
C3	2	1	1	0.5	0.5	15.79
C4	3	2	2	1	1	29.76
C5	3	2	2	1	1	29.76
CR = 0.003						

Fig. 3 presents the weights of the key criteria that were used to evaluate the effectiveness of C1, C2, C3, C4, and C5 on the smart sustainable transportation index in the 36 districts of Ramadi city.

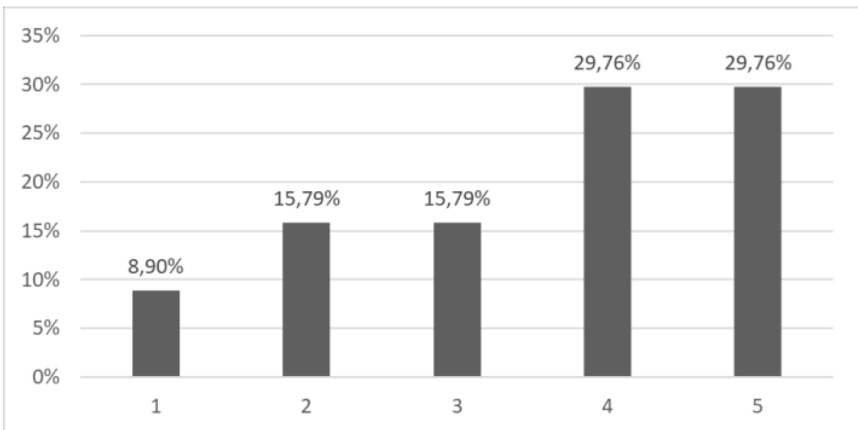

Fig. 3. Weight of criteria

- Step 4: Estimation of the district of the smart sustainable transportation index

Table 4 presents the values of C1, C2, and C3, along with the total score of the smart sustainable transportation index, which is derived from the weights of the components in Table 5.

Table 5

Smart sustainable transportation index

District	C1	C2	C3	C4	C5	SUM
Al-Sofiya	0.037	0.066	0.007	0.269	0.012	0.391
Al-Taqadum	0.015	0.026	0.045	0.256	0.018	0.359
Al-Qudus	0.089	0.158	0.001	0.238	0.007	0.493
Al-Katana	0.018	0.032	0.002	0.291	0.015	0.358
Al-Aziziya	0.021	0.037	0.030	0.298	0.010	0.397
Al-Nasr	0.003	0.006	0.005	0.174	0.017	0.206
Al-Amjad	0.031	0.055	0.006	0.231	0.017	0.340
Al-Riyad	0.054	0.096	0.019	0.152	0.018	0.339
Al-Jumhuriu	0.015	0.026	0.016	0.193	0.039	0.289
Al-Muaalmin	0.058	0.104	0.008	0.243	0.122	0.536
Al-Salam	0.013	0.023	0.009	0.202	0.078	0.324
Al-Sinaea Al Taamim	0.064	0.113	0.017	0.167	0.010	0.370
Al-Noor	0.031	0.056	0.011	0.251	0.029	0.378
Al-Tahrir	0.020	0.036	0.010	0.192	0.024	0.281
Al-Husayn	0.011	0.020	0.009	0.260	0.011	0.311
Al-Nakhil	0.037	0.066	0.018	0.154	0.029	0.305
Al-Shaafieiu and Altaeayush	0.050	0.088	0.001	0.128	0.009	0.276
Al-Alakha’	0.033	0.059	0.005	0.119	0.011	0.228
Al-Warar	0.004	0.007	0.094	0.171	0.222	0.497
Al-Khadra'	0.024	0.043	0.026	0.243	0.019	0.355
Al-Zuhur	0.060	0.107	0.043	0.206	0.011	0.427
Mujmae Dawr Alatiba’	0.048	0.086	0.017	0.101	0.017	0.268
Al-Zaytun	0.021	0.038	0.007	0.176	0.025	0.267
Euthman Bin Eafaan	0.053	0.095	0.053	0.104	0.025	0.330
Al-Jamiea	0.011	0.019	0.158	0.173	0.298	0.659
Al-Firdaws	0.018	0.031	0.144	0.112	0.108	0.413
Al-Wahdah	0.012	0.021	0.009	0.137	0.012	0.191
Al-Mustaqbal	0.071	0.127	0.132	0.141	0.030	0.501
Al-Waahah	0.040	0.071	0.041	0.105	0.030	0.288
Al-Adil	0.009	0.015	0.007	0.098	0.009	0.138
Al-Dubaat Althannih	0.018	0.032	0.004	0.098	0.002	0.155
Al-Sikak Alsharqia	0.012	0.021	0.003	0.139	0.001	0.175
Al-Bakar	0.059	0.105	0.022	0.253	0.015	0.454
Maleab Albu Jabr	0.009	0.017	0.004	0.121	0.011	0.162
Al-Aramil	0.003	0.004	0.001	0.063	0.003	0.074
Al-Tawasueuh Makan Zankurih	0.001	0.002	0.003	0.004	0.006	0.016

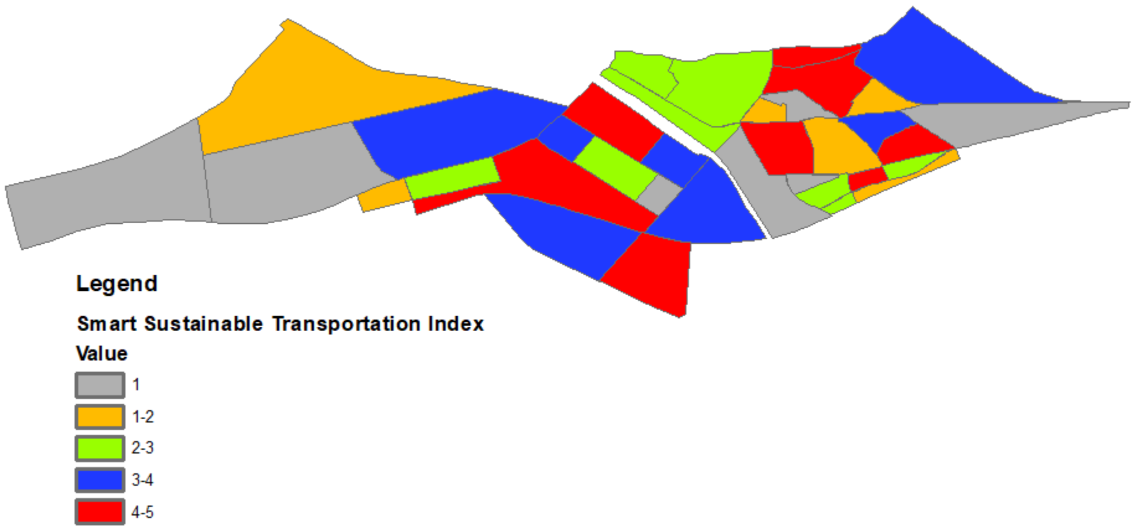

Fig. 4. Weight of criteria

Fig. 4 shows that:

- The gray color has the lowest value of the smart sustainable transportation index, while the red color has the highest value of the smart sustainable transportation index.
- Al-Jamiea, Al-Muaalmin, Al-Mustaqbal, Al-Warar, Al-Qudus, Al-Bakar, and Al-Zuhur have the highest smart sustainable transportation index values.
- Al-Wahdah, Al-Sikak Alsharqia, Maleab Albu Jabr, Al-Dubaat Althannih, Al-Adil, Al-Aramil, and Al-Tawasueuh Makan Zankurih have the lowest smart sustainable transportation index values.
- Step 5: Sensitivity analysis

A sensitivity analysis was carried out to determine how the results of the smart sustainable transportation index will be affected by alterations to the weights of C1, C2, C3, C4, and C5. Table 6 displays the results of the sensitivity analysis performed on C1, C2, C3, C4, and C5 for each district.

Table 6

Sensitivity analysis of C1, C2, C3, C4, and C5 criteria

District	C1	C2	C3	C4	C5
Al-Sofiya	0.94%	1.65%	0.19%	6.44%	0.30%
Al-Taqadum	0.40%	0.71%	1.23%	6.65%	0.50%
Al-Qudus	1.77%	3.11%	0.02%	4.61%	0.14%
Al-Katana	0.50%	0.89%	0.04%	7.52%	0.42%
Al-Aziziya	0.53%	0.93%	0.76%	6.99%	0.25%
Al-Nasr	0.15%	0.27%	0.25%	7.82%	0.83%
Al-Amjad	0.91%	1.60%	0.16%	6.36%	0.49%
Al-Riyad	1.57%	2.75%	0.55%	4.30%	0.54%
Al-Jumhuriu	0.50%	0.89%	0.56%	6.26%	1.33%
Al-Muaalmin	1.08%	1.90%	0.16%	4.34%	2.23%
Al-Salam	0.39%	0.70%	0.27%	5.86%	2.35%

cont. table 6

Al-Sinaea Al Taamim	1.69%	2.96%	0.45%	4.32%	0.27%
Al-Noor	0.82%	1.45%	0.30%	6.22%	0.76%
Al-Tahrir	0.70%	1.25%	0.34%	6.39%	0.84%
Al-Husayn	0.36%	0.63%	0.28%	7.72%	0.36%
Al-Nakhil	1.20%	2.11%	0.60%	4.82%	0.96%
Al-Shaafieiu And Altaeayush	1.77%	3.10%	0.03%	4.44%	0.33%
Al-Alakha'	1.44%	2.53%	0.22%	4.96%	0.50%
Al-Warar	0.08%	0.14%	1.85%	3.32%	4.27%
Al-Khadra'	0.68%	1.21%	0.72%	6.41%	0.52%
Al-Zuhur	1.39%	2.44%	0.99%	4.60%	0.27%
Mujmae Dawr Alatiba'	1.77%	3.11%	0.62%	3.62%	0.61%
Al-Zaytun	0.80%	1.40%	0.25%	6.19%	0.92%
Euthman Bin Eafaan	1.59%	2.79%	1.57%	3.05%	0.76%
Al-Jamiea	0.16%	0.29%	2.34%	2.56%	4.33%
Al-Firdaws	0.42%	0.75%	3.38%	2.63%	2.55%
Al-Wahdah	0.62%	1.09%	0.48%	6.70%	0.61%
Al-Mustaqbal	1.40%	2.46%	2.58%	2.73%	0.60%
Al-Waahah	1.36%	2.40%	1.42%	3.53%	1.05%
Al-Adil	0.63%	1.10%	0.49%	6.66%	0.62%
Al-Dubaat Althannih	1.16%	2.04%	0.29%	5.95%	0.13%
Al-Sikak Alsharqia	0.66%	1.17%	0.15%	7.36%	0.05%
Al-Bakar	1.29%	2.27%	0.48%	5.28%	0.32%
Maleab Albu Jabr	0.57%	1.01%	0.27%	6.92%	0.69%
Al-Aramil	0.34%	0.60%	0.09%	7.88%	0.40%
Al-Tawasueuh Makan Zankurih	0.82%	1.25%	1.82%	2.51%	3.37%

Table 6 shows that:

- C4 has the most significant impact on the smart sustainable transportation index, with an average change of 5.39%, whereas C1 has the least significant impact, with an average change of 0.90%.
- The district of Al-Nasr has the highest influence on the smart sustainable transportation index, (9.33%), while the district of Euthman Bin Eafaan has the smallest effect on the overall smart sustainable transportation index (9.77%).

4. CONCLUSIONS

It is becoming increasingly common for governments and politicians to investigate new investment and policy topics to improve the long-term viability and productivity of their respective cities. The concept of a smart and sustainable city has been interpreted in various ways, and this has led to the development of several distinct approaches and measures. An increasing number of city administrators and officials have shown a significant interest in evaluation strategies that use quantitative data. Because of this, individuals can decide the most effective way to distribute their time and resources to achieve their business goals.

Using the AHP pairwise comparisons method, this research presents a comprehensive decision-making approach that incorporates the two approaches. The objective of this method is to evaluate the impact that the following parameters have on the smart sustainability of Ramadi districts: population (C1), automobile ownership (C2), air pollution (C3), traffic volume (C4), and road density (C5). To implement the methodology, one must first select the appropriate assessment methods. In this study, a smart sustainability transport index was utilized, and its impact was taken into consideration. Sensitivity analysis was conducted to assess the impact of the weights assigned to the criteria on the decision-making process related to transportation.

The purpose of this study was to explore the influence that the chosen characteristics have on the overall score of the smart sustainable transportation index. The population (C1), the number of people who own cars (C2), the amount of pollution in the air (C3), the volume of traffic (C4), and the density of roads (C5) are the relevant factors. The findings of the sensitivity analysis indicate that the effect rate of traffic volume (C4) is the strongest (5.39%), while the effect rate of population (C1) is the weakest (0.90%). This is because C4 is the most significant of the four. When it comes to the smart sustainable transportation index, the district of Al-Nasr has the most significant impact, accounting for 9.33% of the total. Meanwhile, the district of Euthman Bin Eafaan has the least significant impact, accounting for 9.77% of the total.

In the context of further developing and increasing the precision of the proposed smart sustainable transportation index, future research plans to expand the vehicle ownership criterion. While the current work is effective, it is utilized as an aggregate value. However, to fully capture the environmental impact of transportation, the model will be refined in the next iteration to incorporate more differentiated data. The universality of the analytic hierarchy process (AHP) allows for the flexible inclusion of detailed sub-criteria, such as fuel type (petrol, diesel, gas, electric vehicles) and vehicle service life/age. The introduction of these elements will enable a more dynamic and realistic weighting of the fleet's impact on air pollution and infrastructure wear, thereby enhancing the accuracy and sensitivity of the entire Index to changes in transportation policy and fleet demographics. The inherent ability of the AHP method to easily adapt and recalibrate weights when new criteria are introduced is a key testament to its flexibility in supporting the evolving concept of sustainable development.

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