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Saudi Arabia's City-Ranking Index (SACRI) methodology executed: Preliminary findings

Abstract

Aim/purpose – Saudi Arabia is rapidly urbanizing, where the number of urban residents, currently exceeds 80% of the population. Many cities in the country face challenges of sustainability, livability, resilience, and thus global reputation. Therefore, measuring city performance is crucial in assessing urban complexity in order to improve development potential. As stated in Vision 2030 of the Kingdom of Saudi Arabia, attempts at improving the global competitiveness and reputation of cities are of prime importance. This attempt aims at developing a culturally sensitive city ranking methodology, testing the method with relevant statistics, and presenting the preliminary results for further discussions, deliberations, and extensions.

Design/methodology/approach – In this context, an index named Saudi Arabia's City-Ranking Index (SACRI) was developed, which proposes a three-dimensional assessment, incorporating livability, competitiveness, and environmental sustainability with 58 indicators (widely used or culturally specific). This exercise is carried out in 17 future cities, considering the feasibility criterion.

Findings – Riyadh emerged as the most preferred city with the first rank, followed by Jeddah, Dammam, Madina, and Al Baha in order. Najran ranks 17, the last, preceded by Jazan, Al Qatif, Arar, and Al Taif.

Research implications/limitations – This ranking of Saudi Arabia's cities seeks importance in planning, improving, and promoting livability, competitiveness, and environmental sustainability to grab prominent places on a global scale.

Originality/value/contribution – This exercise is unique for Saudi Arabia, with specific cultural dimensions that could be replicated in the neighboring Arab countries.

Keywords: city ranking, urbanization, livability, competitiveness, environmental sustainability.

JEL Classification: J10.

1. Introduction

Varieties of indices to rank cities at the global, regional, and national levels are executed involving intensification of cross-border mobility including goods, services and finance in addition to labor, human resources, and technology (Giap et al., 2014; Leff & Petersen, 2015; Uszkai, 2016). As a result, the livability of cities and competition for global reputations grew in demand creating challenges in investment, skilled labor, tourism, and international business leading to assessments of strengths and weaknesses pressurizing cities to formulate development goals to increase visibility (Begg, 1999; Giffinger et al., 2007; Uszkai, 2016).

City ranking as an industry has methodologies and structures not only in Europe and America but also in Japan, China, India, Singapore, and Chile crafted by large economic monitoring agencies, financial institutions, professional service firms, and media outlets with full-fledged industry experts and academic leaders (Giap et al., 2014; Leff & Petersen, 2015; Moonen & Clark, 2013). On the positive side, such exercises serve as perspectives on monitoring mechanisms and effective evaluation tools helpful in promoting livability, opportunities, sustainability, business orientation, economic vibrancy, competitiveness, and decision-making (The Mori Memorial Foundation, 2016; UN-Habitat, 2015).

Urbanization occurs in tandem with globalization and economic development, as experienced in countries, including Saudi Arabia, where the proportion of the urban population increased from 58.4% (1974) to 83.0% (2010), along with the economy and associated labor markets. Such economic progress is characterized by rapid migration of the native population, in turn bringing expatriates to meet labor demands, particularly in major cities of Riyadh, Jeddah, Makkah, Madinah, and Dammam (Abdelatti et al., 2017; Al-Khraif et al., 2022;

Choguill, 2008; Khraif, 2007, 2000; Khraif et al., 2016; Salam, 2022; Shukri et al., 1996; Susilawati & Al-Surf, 2011). Eventually, such an urban concentration leads to unprecedented growth harming the quality of living – resilience, and environmental hygiene (Choguill, 2008; United Nations, 2009).

Urbanization poses issues of native unemployment, shortage of housing, service infrastructure, and healthcare deficiencies (Al-Surf et al., 2013; Khraif, 2009). As pointed out, an important concern in this regard is home ownership (only 47% of native families own homes); not only in metropolitan areas such as Riyadh and Makkah but also in all other places in the country due, mainly, to high prices, limited availability of affordable housing, and temporary settlements (Karam, 2010; Salam et al., 2014; Saudi Vision 2030, 2013). Such issues hinder urban expansion, urban planning, potable water, and traffic, especially in societies with a demographic dividend (Aljazira Capital, 2013; Al-Khraif et al., 2022; Choguill, 2008; Clemence & Fowler, 2017; Khraif et al., 2015; Looney, 2004). A concern in this context of urban growth is the environmental impacting on built-up areas, solid waste disposal, and water supplies causing erosion of green spaces and agricultural land impacting livelihoods as well as environmental sustainability (Abdelatti et al., 2017).

This research is being carried out, in this context, to develop a culturally sensitive city ranking methodology. Thereafter, collected relevant data and tested the method to obtain results – considered to be preliminary. Results are presented here for discussions, deliberations, and extensions to facilitate urban development and city profiling.

This manuscript introduces the concept of city ranking, the Saudi Arabian city scenario, and the position of cities in the international ranking system. A conceptual development section is prepared, after stating the aims and objectives. This section is followed by a description of dimensions, indicator groups, and indicators (variables) used in the ranking procedures with benchmarking, definitions, and calculations with weights assigned. Subsequent to this, there are the results obtained, considered to be preliminary. Thereafter, the concluding remarks and limitations are explained.

2. Conceptual development

In order to accomplish this, the process of developing SACRI with reliable and comprehensive documents such as Vision 2030, Saudi Arabia's National Spatial Strategy, and other relevant development strategies and previous research are reviewed. Thereafter, a conceptual framework was developed taking

into account dimensions of livability, competitiveness, and environmental sustainability as key themes measuring achievement (ARCADIS, 2016; Leff & Peterson, 2015) (Figure 1).

Figure 1. Conceptual framework of Saudi Arabia's City-Ranking Index (SACRI) in alignment with Vision 2030
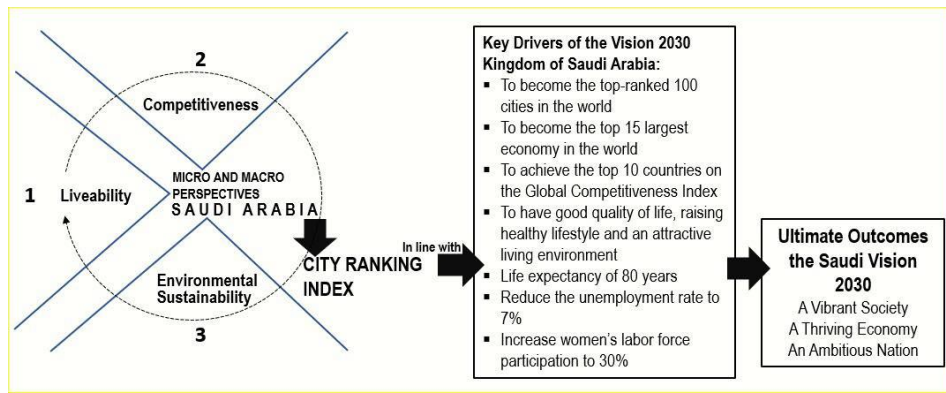
Livability refers to the creation of an ecosystem containing a high standard of living with infrastructure (housing, amenities, mass transit, education, healthcare, safety; and telecommunication technologies including broadband internet service) and a process of identifying areas of progress allocating resources and services to improve living conditions – social, economic, and environmental (Ballas, 2013; Giap et al., 2014; Goldberg et al., 2012; Kapoor & Garg, 2012; Sassen, 1991; Węziak-Białowolska, 2016).

Competitiveness is referred to as a city's reach in terms of economic potential, performance and progress, and, thus, economic resilience and prosperity (adopted from World Economic Forum [WEF], 2017). Moreover, it might influence capacities to host events, accommodate stable tourism, and maintain activities and attractions that meet the needs of residents and visitors (Glaeser, 2011; Jiang & Shen, 2010).

Environmental sustainability is a necessity for development that covers environmental changes influencing physical, social, and economic development playing a dualistic relationship between people and their ecosystem (Jiang & Shen, 2010; Kaklauskas et al., 2017; Morelli, 2011; World Commission on Environment and Development, 1987).

3. Research methodology

Dimensions relevant to the strategic issues of Saudi cities on the world map are livability, competitiveness, and environmental sustainability aligned with the key aspirations of Vision 2030: a vibrant society, a thriving economy, and an ambitious nation. SACRI, in this context, intended to empower governmental development policies and strategies, enlightening municipal authorities and stakeholders considering city-ranking indexes in a global context (Giap et al., 2016; Huang, 2017; Jiang & Shen, 2010).

This exercise identified 58 indicators of three dimensions – livability (9 subsets of 36 indicators), competitiveness, 4 subsects of 12 indicators, and environmental sustainability (2 subsects of 10 indicators) through brainstorming and literature review (Table 1).

Table 1. Benchmarking dimensions, groups, and indicators of SACRI

No.	Dimensions/Indicator groups/ Set of indicators/	MGPCI	PCO	UNHCPI	WGC I	SUKCI	ASCI
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Livability Dimension							
a. Education Vitality Sub Index							
1	Literacy rate		●	●			●
2	Percentage with a university degree or higher		●		●	●	●
3	Percentage of kindergarten students						
4	Number of international school students in 2020	●					
5	Number of universities	●	●				●
6	QS University Rankings in 2021	●	●				●
b. Demographics							
7	Population in 2015		●				
8	Population growth rate*						
9	Percentage of expatriates						
10	Population density	●	●	●			
c. Housing							
11	Proportion of apartments						
12	Percentage of concrete buildings						
13	Proportion of own houses	●	●				
d. Housing Infrastructure							
14	Percentage of housing units with electricity connection			●	●		●
15	Percentage of housing units connected to the water network	●	●	●	●		●
16	Percentage of housing units connected with sewage network		●	●	●		●

Table 1 cont.

1	2	3	4	5	6	7	8
e. Communication							
17	Average broadband speed		●	●	●		●
18	Percentage of persons with internet access			●			
f. Transportation							
19	Number of passengers traveling through airports		●		●		●
20	Number of international flights	●	●				
21	Number of domestic flights		●				
22	Average daily travel time			●			
23	Use of public transport	●	●	●			
24	Railway availability		●		●		●
g. Health Services							
25	Life expectancy rate	●		●	●	●	●
26	Medical doctors/1000 persons	●	●	●			
h. Culture and entertainment							
27	Public libraries/100,000 persons		●	●			
28	Attraction sites	●					
29	Fine dining restaurants	●					
30	Number of museums	●					
31	Number of festivals	●					
32	Number of stadiums	●					
33	Number of sports clubs						
h. Security							
34	Murder rate	●	●	●	●		●
35	Theft			●			
36	Road deaths						
Competitiveness Dimension							
a. Economic Vitality							
37	City product per capita	●	●	●	●		●
b. Human Capital							
38	Old age dependency			●			●
39	Proportion of women in the labor force		●		●		
40	Unemployment rate	●		●			●
c. Tourism							
41	Tourism nights	●	●				●
42	4+ star hotel rooms, 2020	●					
43	Holy places						
d. Urban Environment							
44	The percentage of treated wastewater			●			●
45	Solid waste collection			●			
46	Percentage of solid waste recycling	●	●	●			●
47	The per capita share of green spaces m^2		●	●			●
48	Sea shores						

Table 1 cont.

1	2	3	4	5	6	7	8
	Environmental Sustainability Dimension						
a. Weather							
49	Average rainfall (mm) (1985-2010)						
50	Blows of dust (days) (1985-2010)						
51	Days of occurrence of sand/dust storms (1985-2010)						
52	Climate comfort index (winter)	●					
53	Climate comfort index (spring)	●					
54	Climate comfort index (Summer)	●					
55	Climate comfort index (autumn)	●					
b. Air Pollution							
56	Air pollution 2019 (CO - ug / m^3)	●	●	●		●	●
57	The concentration of particulate matter in air (+10 μg / m^3) pm10						
58	Concentration of sulfur dioxide						

* The newly proposed indicators for the SACRI which are not available in the benchmarks.

Note: MGPCI – MORI Global Power City Index; PCO – PwC: Cities of Opportunities; UNHCPI – UN-Habitat City Prosperity Index; WGCI – WEF: Global Competitiveness Index; SUKCI – Sustainable UK Cities Index; ASCI – ARCADAS: Sustainable Cities Index.

A three-stage process of city ranking adopted includes weighting the dimensions and indicator groups, determining and standardizing score, and dimension-specific rankings, and overall composite score. The first one employs a multi-criteria decision analysis, which weighs the dimensions using a pairwise comparison matrix (PCM) through Analytic Hierarchy Process to strengthen the ranking method (Saaty, 1980; Saaty & Kearns, 1985). Such a technique, relatively easy and effective, relates decision-making with urban development strategies (Malczewski, 1999). Accordingly, the pairwise comparison matrix deals with positive reciprocal matrices employed by the equation,

$$\frac{n(n-1)}{2} \tag{1}$$

where n is the total number of dimensions/indicator groups being compared. For example, the size of pairwise comparison table is calculated as $n = 3$ (dimensions), so $3 \times (3 - 1) \div 2 = 3$ (Table 2).

Table 2. Indicators defined and described

No.	Dimensions/Indicator groups/ Set of indicators/	Definition	Weight
1	*2*	*3*	*4*
	Livability dimension		**67.0**
	a. Educational Vitality Sub Index		10.4
1	Illiteracy rate	Number of people who cannot read and write to the total population	1.6
2	Percentage with a university degree or higher	Persons with at least a university-level education to a population aged 15+	2.0
3	Percentage of kindergarten students	Children of age below 6 attending kindergarten to children below that age, 2020	1.8
4	Number of international school students	Number of international schools at primary and secondary levels, 2020	1.5
5	Number of universities	Total number of universities (public and private) in the country, 2017	1.5
6	QS University Rankings	The number of universities with an in QS rank, 2021	2.0
	b. Demographics		5.3
7	Population	Number of persons, including migrants, 2015	1.0
8	Annual population growth rate	Increase in the population size within a census period by average, 2010	1.0
9	Percentage of immigrants	Number of immigrants to the native population, 2010	2.0
10	Population density	Population size by total land area, 2010	1.3
	c. Housing		6.1
11	Proportion of apartments	Number of apartments to housing units, 2010	1.8
12	Percentage of buildings with a gunman	Number of buildings with a gunman to 100 buildings, 2010	2.8
13	Proportion of own houses	Number of houses owned by one of the residents to total housing units, 2010	1.5
	d. Housing Infrastructure		5.6
14	Percentage of housing units with electricity connection	Number of houses with public electricity connection to 100 houses, 2010	2.0
15	Percentage of housing units with municipality water supply	Number of houses with municipal water supply to 100 houses, 2010	1.8
16	Percentage of housing units with government sewage facility	Number of houses with government sewage facility to 100 total houses, 2010	1.8
	e. Communication		4.2
17	Average broadband speed	Speed of internet connection, 2014	2.0
18	Percentage of persons with internet access	Number of persons having internet facility to 100 persons, 2014	2.2
	f. Transportation		8.4
19	Number of passengers traveling through airports	Total number of airport passengers in an year, exit and entry, 2020	1.0
20	Number of international flights	International flights take-off and landing, 2020	1.0
21	Number of domestic flights	Domestic flights take-off and landing, 2020	1.0
22	Average daily travel time	Minutes spent in traveling in a day by a person	1.4
23	Use of public transport	Number of persons using public transport out of 100 persons	2.0
24	Railway availability	Availability of railway lines in the city	2.0

Table 2 cont.

1	2	3	4
g. Health Services			10.0
25	Life expectancy at birth	Number of years a person is expected to live under the prevailing demographic and health conditions	4.5
26	Medical doctors/1000 persons	The number of registered medical doctors available to a population of 1000.	5.5
h. Culture and Entertainment			12.0
27	Public libraries/100,000 persons	Number of libraries to every 100,000 persons	1.5
28	Attraction sites	Number of sites attracting public attention	2.0
29	Fine dining restaurants	Number of restaurants with a good ambiance	2.0
30	Number of museums	Number of museums in the city	1.5
31	Number of festivals	Number of festivals of any type held in a year	2.0
32	Number of stadiums	Number of stadiums meant for sports of any type	1.5
33	Number of sports clubs	Number of clubs for sports activities	1.5
i. Security			5.0
34	Murder rate	Homicide per 100,000 persons	2.5
35	Theft	Theft crime rate per 100,000 persons	1.5
36	Road deaths	Traffic fatality per 100,000 persons	1.0
Competitiveness dimension			**18.0**
a. Economic Vitality (weighted to 40% of the total)			8.0
37	City product per capita	GDP per person, 2014	8.0
b. Human Capital			5.0
38	Old age dependency	Persons of age 60 years and above per 1000 persons of working age (15-60 years), 2010	2.0
39	Proportion of women in the labor force	Number of women in the labor force to the total labor force	2.0
40	Unemployment rate	Number of unemployed people to 100 persons in the labor force, 2010	1.0
c. Tourism			5.0
41	Tourism nights	Number of tourists multiplied by the number of nights stayed, 2019	1.5
42	4+ star hotel rooms, 2020	Number of available hotel rooms of four-star and above, 2020	1.5
43	Holy places	Number of holy places attracting Muslims from other countries, 2020	2.0
Environmental sustainability dimension			**15.0**
a. Urban Environment			6.25
44	The percentage of wastewater treated	Sewage water treatment percentage, 2020	1.0
45	Solid waste collection	Percentage of solid waste collected	1.0
46	Percentage of solid waste recycling	Solid waste recycled out of collected	1.0
47	The per capita share of green spaces m^2	Green Area per person, 2014	1.5
48	Seashore	Seashore in meters	1.75

Table 2 cont.

1	2	3	4
b. Weather			4.25
49	Average rainfall (mm) (1985-2010)	Amount of rainfall in the city averaged for the reference period	2.0
50	Blows of dust (days) (1985-2010)	Number of days of dust averaged for the reference period	0.25
52	Days of occurrence of sand/dust storms (1985-2010)	Number of days of sand/dust storms averaged for the reference period	0.25
52	Climate comfort index (winter)	An index of temperature and humidity in the winter season (average for 1985-2010)	0.25
53	Climate comfort index (spring)	An index of temperature and humidity in the spring season (average for 1985-2010)	0.25
54	Climate comfort index (summer)	An index of temperature and humidity in the summer season (average for 1985-2010)	0.25
55	Climate comfort index (autumn)	An index of temperature and humidity in the autumn season (average for 1985-2010)	0.25
c. Air Pollution			4.5
56	Air pollution (CO – ug/m³)	Contents of particles in air 2019	1.5
57	The concentration of particulate matter in the air (+10 μg/m³) pm10		1.5
58	Concentration of sulfur dioxide		1.5

The second step, scoring is a crucial aspect because a city's ranking depends on strengths, performances, and reputation. Like in other indexes, higher scores reflect better performance. Indicators were then standardized by means of uniformity in judgment and comparisons, following methods such as creating additive scores, ratio-scale scores (the score range procedure), and interval-scale scores (maximum scores), as stated by Voogd (1983). The SACRI used a score range procedure by employing Equation 2,

$$z_j = \frac{x_j - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \qquad (2)$$

where z_j is the standardized score of the jth indicator, x_j is the raw score of the jth indicator, and $x_j^{\min}$ and $x_j^{\max}$ are the minimum and maximum scores of the jth indicator. The numerator computes the difference between the jth value and the minimum, and the denominator computes the difference between the jth value and the maximum. Thus, z_j is a standardized value. The standardized scores range from zero to one, and higher standardized scores indicate higher raw scores.

The third one relates to calculations by summing weighted average scores of dimensions; in order to obtain an overall score, the index demonstrates the city's strengths and weaknesses on the dimensions – of livability, competitiveness, and environmental sustainability.

4. Research findings and discussions

This exercise resulted in a ranking of future Saudi Arabian cities where Riyadh is the top city followed by Jeddah, Dammam, Madina, and Al Baha in the order (Table 3). Individual ranks vary in such a way that on the basis of livability Riyadh scores highest followed by Jeddah, Dammam, Madina, and Al Ahsa; on competitiveness, Makkah scores the highest followed by Riyadh, Dammam, Al Ahsa, and Al Qatif; and on environmental sustainability, Abha scores highest followed by Al Baha, Arar, Al Hail, and Sakaka in the order. Here, not only the bigger cities but also the smaller upcoming cities receive aspiring ranks. At the bottom of this ranking is Najran, followed by Jazan, Al Qatif, Arar, and Al Taif. The order changes on livability (Najran, Al Taif, Arar, Al Hail, and Al Qatif); on competitiveness (Al Hail, Jazan, Abha, Al Baha, and Najran); and on environmental sustainability (Jazan, Al Qatif, Jeddha, Dammam, and Al Ahsa).

Table 3. Preliminary results of the ranking exercise

City	Overall		Livability		Competitiveness		Environmental sustainability	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Riyadh	36.7	1	25.5	1	3.6	2	7.6	11
Jeddah	32.1	2	23.8	2	2.5	6	5.8	15
Dammam	28.5	3	19.3	3	2.8	3	6.5	14
Al-Madina Al-Monawarah	27.8	4	17.1	4	2.3	7	8.4	9
Al Baha	27.0	5	13.6	7	1.6	14	11.9	2
Buraydah	26.7	6	14.9	6	2.0	10	9.7	6
Abha	26.1	7	11.8	10	1.5	15	12.7	1
Makkah Al-Mokaramah	24.8	8	13.5	8	4.0	1	7.3	12
Al Ahsa	24.5	9	15.1	5	2.7	4	6.7	13
Sakaka	23.9	10	11.8	1	2.3	8	9.9	5
Tabouk	23.8	11	12.1	9	2.2	9	9.5	7
Al Hail	22.8	12	11.5	14	1.2	17	10.1	4
Al Taif	22.6	13	10.5	6	2.0	11	10.1	3
Arar	21.9	14	0.7	5	1.9	12	9.3	8
Al Qatif	19.8	15	11.6	3	2.7	5	5.5	16
Jazan	18.3	16	11.8	12	1.4	16	5.1	17
Najran	18.1	17	8.6	17	1.8	13	7.8	10

Note: Data for this analysis were collected from official records of various governmental agencies, ministries, and municipalities.

The results of the rankings could be interpreted at the city level separately on dimensions such as livability, competitiveness, and environmental sustainability constructively and positively. These scores, on the other hand, pave way for inferring the strengths and weaknesses. At the same time, they suggest the need to progress in order to achieve the goals of Vision 2030.

Moreover, on global reputation and competitiveness, Saudi cities are upcoming, not only among Arab cities but also among others (Table 4). For example, Riyadh (the capital city) is among the top 10 cities on unprecedented business performance overlooking Milan and São Paulo on corporate relocation (Moonen & Clark, 2013). With the current pace of development, no doubt, Riyadh might raise to compete with London, New York, Paris, and Tokyo on multifaceted ranking, sooner or later.

Table 4. Position of Riyadh and Jeddah from the top cities of the MENA countries in the selected world ranking indexes[*]

Cities – Country	ATK-GCI	ATK-GCO	EIU - GLI[a]	MQLS	Z/Y-GFCI[a]	MCG-DCI[a]	ASCI
Dubai – UAE	27	32	75	74	19	1	52
Abu Dhabi – UAE	69	20	79	78	38	4	58
Doha – Qatar	61	66	85	110	55	–	72
Riyadh – Saudi Arabia	67	85	107	164	105	2	76
Kuwait City – Kuwait	76	67	83	126	83	–	70
Cairo – Egypt	66	114	121	177	–	5	99
Manama – Bahrain	112	95	–	136	68	–	–
Tehran – Iran	96	118	130	199	96	6	–
Jeddah – Saudi Arabia	75	84	111	168	–	–	81
Muscat – Oman	99	58	–	105	–	–	–
Baghdad – Iraq	122	120	–	231	–	–	–
No. of cities in benchmarks	130	130	140	231	114	10	100

[*] Not available data due to having no position in the corresponding indexes.

Note: ATK GCI – ATK Global Cities index 2019; ATK GCO – ATK Global Cities Outlook 2019; EIU GLI – EIU Global Livability Index 2015; MQLS – Mercer's Quality of Living Survey 2019; Z/YGFCI – Z/Yen Global Financial Centres Index 2021; MCGDCI – Mastercard's Global Destination Cities Index 2016 (MENA Countries); ASCI – ARCADAS: Sustainable Cities Index 2016.

Riyadh, the capital city of Saudi Arabia, gained a promising position on the basis of seven influential global city-ranking indexes among eight other largest cities of the region. Riyadh performed noticeably well in the Global Cities Index (27 of 130 cities), but relatively low on Mercer's Quality of Living Survey (164

of 231 cities), the latter considering only the immigrant population. Moreover, results vary with the target population and selected indicators (Giffinger et al., 2007; Leff & Peterson, 2015; Węziak-Białowolska, 2016). However, Riyadh ranks impressively high on global financial competitiveness and moderately on sustainability and livability.

5. Conclusions

This ranking confirms with the established international city ranking exercises where Riyadh, Jeddah, and Makkah are recognized. Additional variables of cultural and traditional importance make this ranking different; bringing up a few upcoming cities such as Al Baha, Buraydah, and Abha as important cities of higher quality of life: livable, competitive, and environmentally sustainable.

With this methodology, Saudi Arabian cities are ranked where the capital city and major metropolises of prestigious living environments have received attention and ranks, the appeal of developments and offering on lives and perception of people. Gaining lessons from this exercise, it is essential to focus on service utilities and other demands to fulfill the ambitions of residents, travelers, and visitors based on the three dimensions of livability, competitiveness, and environmental sustainability As a next step, more cities of Saudi Arabia, other Arabian Gulf countries, and other Arab countries could be included. As this research is a new attempt, it has the limitations of data update. So, these results may undergo further evaluations, appraisals, and updates with an aim to improve cities and add up to the achievement of Vision 2030. This inspires hope that the country invests more and more to build quality not only in the major cities but also in the upcoming cities and townships.

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