Designing a Framework for Ranking Iranian Universities and Higher Education Institutions

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Abstract

Determining the criteria and indicators based on which Iranian universities are evaluated is essential in university ranking systems. This study aims to identify criteria and indicators appropriate to Iranian universities and to develop a local framework for ranking Iranian universities and higher education institutions. This study was carried out using the fuzzy Delphi technique in six stages: the first stage was to identify the existing rankings, the second stage was to extract criteria and indicators, the third stage was to adjust the indicators based on frequency, and the fourth stage was to use the fuzzy Delphi technique to obtain expert panel opinions, the fifth step is to use the Analytic Hierarchy Process (AHP) for weighting and ranking indicators, and the sixth step is to present a schematic view of the framework obtained. According to findings, 145 studied rankings, 17 criteria, and 2709 indicators were identified. After removing the overlaps and homogenizing the indicators, 17 criteria and 180 indicators were selected to enter the study checklist. Finally, based on the fuzzy Delphi technique and AHP results, the appropriate ranking framework for Iranian universities, which includes 11 criteria and 94 indicators, was developed. The presented framework is designed according to the needs of Iranian universities to produce science and knowledge, create innovation and entrepreneurship, and produce technological products.

Introduction

Universities and higher education institutions are responsible for educating and training specialized personnel, producing knowledge, and conducting research. The growth and development of societies depend on their higher education system (Karimyan, Salehi & Naderi, 2013). On the other hand, the various tasks and functions of universities and higher education institutions have made the university a multidimensional role (Mapulanga, 2013). Accordingly, maintaining, improving, and enhancing the quality of the higher education system and, consequently, universities and higher education institutions as its main components should be a priority in the actions and planning of each country.

Ranking systems are one of the main factors in evaluating the performance and quality of universities (Bastedo & Bowman, 2010); governments, policymakers, news media, investment agencies, and financial institutions use them as a tool to assess the performance and quality of universities (Baldock, 2013; Benito & Romera, 2011). On the other hand, academic rankings allow universities and higher education institutions to recognize their position based on what they are and what they should be (Sanoff, Usher, Savino & Clarke, 2007). They also help students and their parents gain insights from universities by comparing the national, regional, or international universities in terms of age, rank, investment, and career prospects (Çakır, Acartürk, Alaşehir & Çilingir, 2015).

Today, many global, regional, and national ranking systems evaluate and rank the performance of universities and educational and research institutions. From the beginning of the formation of academic ranking systems, experts debated and disagreed about which criteria and indicators could measure quality realistically (Rahimi, Parand, Mohammadi & Yadegarzadeh, 2002).

Literature Review

Studies on the ranking of universities have been conducted from different perspectives. Some researchers have examined the concept of a "world-class university" and the strategy of universities to become world-class (Chaeddhananan & Dhirathiti, 2022; Deem, Ho-Mok & Lucas, 2008; Mok & Chan, 2008). Some have compared ranking systems (Aguillo, Bar-Ilan, Levene & Ortega, 2010; Altakhaineh & Zibin, 2021; Hushyar Sherwani, 2018; Olcay & Bulu, 2016; Pakzad, Khaledi & Teymouri, 2012; Rahmanpour, Yaghoubi, Ahmadi & Bibi-Zamani, 2014; Shahi & Moghaddam, 2017), Some have ranked university rankings (Stolz, Hendel & Horn, 2010; Taylor & Braddock, 2007), and others have criticized the rankings (Farasatkhah 2008; Feyzpur, Khanalizadeh & Dehmobed, 2011; Kaidesoja, 2022; Marginson, 2016; Robinson-García, Torres-Salinas, Delgado López-Cózar & Herrera, 2014; Safiei, Amini & Aboeiarkani, 2016; Zare-Banadkooki, Vahdatzad, Owlia & Lotfi, 2016).

Other studies have focused on appropriate models, criteria, and indicators for ranking universities. The conceptual model Alma, Coşkun and Övendireli (2016) presented included six components: education, research, faculty members, students, international situation, and general situation. In the study of Doulati, Jafari-Tehrani and Habib-Pour (2013), the indicators influencing the ranking of Iranian universities were budget, motivational factors, scientific interaction with other universities, practical thinking, profound approach to research, provision of necessary equipment, research opportunities, non-human relations (equipment, internet, etc.), formal support for research, commitment, fostering research spirit, and feedback and

corrective actions. Fakher, Aziz and Zaranezhad (2010) used indicators of human and research resources, students, educational and research courses and programs, cost and budget, information and communication technology, educational and research facilities and equipment, educational and welfare assistance, and graduates. García, Guijarro and Oliver (2021) emphasized the criteria of Per capita academic performance of an institution (PCP), alumni, award, publications, papers published in Nature and Science, highly cited researchers, international outlook, industry income, teaching, research, citations, number of students, percentage female, and staff per students. Giannoulis and Ishizaka (2010) used nine indicators to rank UK universities, including student satisfaction, research assessment, entry standards, staff/student ratio, academic services spent, facilities spent, good honors, graduate prospects, and completion. Lukman, Krajnc and Glavič, (2010) presented a new model for ranking and evaluating the performance of universities based on research, educational, and environmental dimensions. In Nisel and Nisel's study (2013), the criteria of the number of articles, the number of citations, the number of doctoral students, and the ratio of faculty members to students were used to evaluate the performance of Turkish universities. Sohrabi, Yousefi, Fazaeli, Mohebifar, Moradi and Azimi (2011) ranked Iran's universities of medical sciences based on the criteria of efficiency in education, including technical and managerial efficiency. Wu, Chen, Chen and Zhuo (2012). proposed criteria of teaching resources, internationalization, discipline and guidance, general education, administrative support, faculty members, teaching, and research to evaluate universities in Taiwan. The criteria of education, research and technology, social and cultural influence, entrepreneurship and wealth creation, contribution to sustainable development, and international and cross-sectoral interactions were introduced by Zare Banadkooki et al. (2016) for the ranking of Iranian universities.

These studies examine education, research, students, faculty members, international status and interactions, entrepreneurship and wealth creation, academic funding, environmental improvement, environmental attention, etc. as ranking criteria.

Context and problems

In Iran, as in other countries, the quality of higher education and universities is discussed and is of concern to many experts, officials, and university professors. A large number of universities and educational institutions, as well as a large number of unemployed graduates, doubles the need to address the issue of the quality of universities. Accordingly, the ranking of universities and higher education centers in Iran has always been considered.

In Iran, universities and institutes of higher education and scientific productions of scientists in Islamic countries have been ranked by the Islamic World Science Citation Center (ISC) for several years. This center has two ranking systems, one at the national level for ranking Iranian universities and the other at the regional level for ranking universities and higher education institutions in Islamic countries. Recently, the center has provided another ranking to monitor and evaluate the scientific status of universities worldwide. On the other hand, the Ministry of Science, Research, and Technology of Iran and the Ministry of Health, Treatment, and Medical Education of Iran have also developed rankings to evaluate the performance of affiliated universities. Most of the indicators in these rankings have been designed to finally improve the rank and position of Iranian universities in the world rankings. On the other hand, each university and institute of higher education individually develops

internal procedures and introduces the criteria by which it can improve its academic position among its domestic and foreign counterparts.

Some of these ranking indicators of Iranian universities have been compiled without considering the differences between different disciplines and scientific fields. Also, some criteria do not apply to all universities. In general, the ranking indicators in Iran are not much different from those of other national, regional, and global ranking systems. Even though to be international, Iranian universities must be in line with international indicators and scales, it is necessary to develop indicators based on the country's conditions. Most of Iran's scientific products are in Persian, which is often not indexed in international databases and needs their criteria for evaluation.

Therefore, this study aims to identify criteria and indicators appropriate to Iranian universities and develop a local framework for ranking Iranian universities and higher education institutions.

Materials and Methods

The present study was performed using the fuzzy Delphi technique. The fuzzy Delphi method is derived from the traditional Delphi technique and fuzzy set theory. Using the fuzzy Delphi method for group decision-making can solve the ambiguity of a common understanding of experts' opinions (Saffie & Rasmani, 2016). The algorithm for implementing the fuzzy Delphi technique includes the following steps: identifying the appropriate spectrum for fuzzifying verbal expressions, Fuzzy summation of fuzzed values, De-fuzzification of values, Selection of threshold intensity and screening criteria (Izadyar, Habibi & Sarafrazi, 2015). The research population included 1) all university ranking systems, including international, regional, and national, and 2) Experts, faculty members of Iranian universities who were experts in scientometrics, evaluation, and ranking of universities and were familiar with the principles and processes of academic evaluation and ranking as, Iranian scientists who had a top global percentage based on the ESI database in all subject disciplines, and had the highest number of citations or the highest H index in their field or discipline.

The sampling method was purposeful, and based on this, 34 international rankings, 23 regional rankings, and 88 national rankings were examined to extract their indicators and criteria. Also, 30 specialists in scientometrics, evaluation, and ranking of universities, and 30 top 1% scientists were selected to enter the study.

Data collection was first done by referring to the official website of each ranking. After studying the methodology related to each ranking, criteria and indicators were extracted and written on the worksheets. Also, to obtain experts' opinions to select and prioritize the criteria and indicators, a researcher-made checklist was prepared based on the extracted indicators and criteria. The checklist had six options (non-essential, very low necessity, low necessity, medium necessity, high necessity, and very high necessity) and was designed based on the fuzzy Delphi method.

To determine the face and content validity, the research tool was provided to 16 faculty members and experts in scientometrics, evaluation, and ranking, and they were asked to check the validity of the tool. After reviewing and applying their opinions, the final checklist was prepared. The incompatibility rate was calculated for the data collection tool's reliability. Since this value was zero and less than 0.1, there was no need for expert review.

The present study was conducted in six steps. In the first step, by reviewing the literature and the websites of the organizations that are actively auditing the university rankings at the global level, Like the IREG website[1], the desired rankings were identified. In the second step, by referring to the ranking website, the criteria, indicators, and weights assigned to them, if any, were extracted from the ranking methodology and recorded in separate files. To unify and eliminate data overlap, it was entered into Excel software. In the third step, the indicators were arranged in order of frequency. Due to many indicators, those with a frequency of less than 3 were removed with the opinion of subject experts. Then, based on the remaining indicators, an initial checklist was designed and provided to experts to determine the validity. After making the necessary corrections, the final format of the research tool was prepared and a list containing 17 criteria and 180 indicators was prepared.

In the fourth step, the Single-stage fuzzy Delphi method was used to screen the indicators and select the most essential ones .For fuzzy analysis, the variables in the research checklist were defined as triangular fuzzy numbers according to Table 1.

Table 1
Verbal expressions of triangular fuzzy numbers

Verbal expressions	Fuzzy numbers
non-essential	0, 0, 0.2
very low necessity	0, 0.2, 0.4
low necessity	0.2, 0.4, 0.6
medium necessity	0.4, 0.6, 0.8
high necessity	0.6, 0.8, 1
very high necessity	0.8, 1, 1

Then, the collected data were aggregated using the following formula:

$$F_{AGR} = \left(min\{l\}, \left\{ \frac{\sum m}{n} \right\}, max\{u\} \right)$$

Then the formula F = (L + M + U) / 3 was used to defuzzification of the values.

The average score of the indicators, which was 0.53, was considered a threshold for screening items, and the results obtained for acceptance or deletion were matched with this threshold. Finally, the accepted criteria and indicators were extracted based on experts' opinions, and the appropriateness of the position of the indicators in the relevant criteria was confirmed.

In the fifth step, using the Analytic Hierarchy Process (AHP), the weights of each criterion and indicator were calculated and their rank was determined. In the last step, a schematic view of the research framework was presented, along with a framework that shows the criteria and indicators of the research in order of their rank.

Descriptive statistics such as frequency, frequency percentage, cumulative frequency, and cumulative frequency percentage were used to analyze the quantitative data of the research. Microsoft Office Excel 2013 was used to perform calculations due to the ease of entering large volumes of data.

Results

Out of 145 studied rankings, 17 criteria and 2709 indicators were identified. After removing the overlaps and homogenizing the indicators, 17 criteria and 180 indicators were selected to enter the study checklist. The checklist was sent to 60 experts, and finally, 49 people responded (response rate of 81.7%). After collecting the views of experts, the results were analyzed using the Single-stage fuzzy Delphi technique to screen the criteria and indicators and select the most important ones. (Table 2)

Table 2
Results of fuzzy Delphi calculations

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
University reputation and brand	Educational reputation	1.000	0.583	0.000	0.528	Delete
	Research reputation	1.000	0.621	0.000	0.540	Accept
	Scientific and academic reputation	1.000	0.596	0.000	0.532	Accept
	The attractiveness and popularity of the university among university applicants, students, companies, and organizations	1.000	0.591	0.000	0.530	Accept
	Vision and general image of the university as a scientific and educational institution in the community	1.000	0.604	0.000	0.535	Accept
	Reputation of employers who hire university graduates	1.000	0.571	0.000	0.524	Delete
Education	The ratio of faculty members to students	1.000	0.604	0.000	0.535	Accept
	The ratio of students to faculty members with doctoral degrees	1.000	0.571	0.000	0.524	Delete
	Number of Ph.D. graduates and doctoral degrees	1.000	0.536	0.000	0.512	Delete
	Internship programs and practical training available	1.000	0.604	0.000	0.535	Accept
	Number of full-time and part-time faculty members	1.000	0.557	0.000	0.519	Delete
	Rates of students participating in continuing education courses	1.000	0.505	0.000	0.502	Delete
	Number of e-learning and distance learning courses	1.000	0.498	0.000	0.499	Delete
	The ratio of doctoral and master's degrees to bachelor's degrees	1.000	0.491	0.000	0.497	Delete
	Curricula and courses according to different educational levels	1.000	0.542	0.000	0.514	Delete
	Number of accredited curricula according to different educational levels	1.000	0.636	0.000	0.545	Accept
	Educational awards and rankings obtained in national and international student Olympiads and competitions	1.000	0.663	0.200	0.621	Accept
	Special characteristics of educational groups that indicate their educational ability; Like the leading educational group in the country	1.000	0.621	0.000	0.540	Accept

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	Number of credits in each field of study according to its type (theoretical/practical, optional/compulsory)	1.000	0.432	0.000	0.477	Delete
	Ability of the University to evaluate, obtain feedback, review, improve and enrich the courses and curricula offered	1.000	0.569	0.000	0.523	Delete
	Success rates of students and graduates in various scientific exams held inside and outside the university	1.000	0.566	0.000	0.522	Delete
	Growth rate of university titles and degrees awarded by the university	1.000	0.507	0.000	0.502	Delete
	Student dropout rate at different levels of education	1.000	0.474	0.000	0.491	Delete
	Clarity of criteria, requirements, conditions, selection, and admission of students in the courses offered at the university	1.000	0.547	0.000	0.516	Delete
	Evaluation of training courses and curricula by university graduates and students	1.000	0.579	0.000	0.526	Delete
	University actions to promote job opportunities, job training programs, growth and development of student's professional skills and abilities for employment and entrepreneurship during their studies	1.000	0.621	0.000	0.540	Accept
	Self-study opportunities created by the university	1.000	0.540	0.000	0.513	Delete
	Applicability of professional knowledge and job skills of university graduates	1.000	0.626	0.000	0.542	Accept
	Tools and measures taken by the university to create integration and appropriateness of theoretical and practical phases in educational courses and curricula of different educational levels	1.000	0.552	0.000	0.517	Delete
	Number of courses available at the university in which students have graduated	1.000	0.493	0.000	0.498	Delete
	Number of postdoctoral degrees	1.000	0.561	0.000	0.520	Delete
	The ratio of first to third-grade students at the university and national level to the total number of university students	1.000	0.609	0.200	0.603	Accept
	Number of scientific and educational centers of the university at the national and regional levels	1.000	0.633	0.000	0.544	Accept
	Acceptance and validity of diplomas awarded by the university at the national and international levels	1.000	0.665	0.000	0.555	Accept
	Teachers' innovations in teaching and evaluating students, such as the use of new teaching methods	1.000	0.626	0.000	0.542	Accept
	Compatibility of content, approach, methods, and educational activities with the content of training courses and curricula	1.000	0.582	0.000	0.527	Delete

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	University programs and measures to improve the quality of graduate education	1.000	0.596	0.000	0.532	Accept
	Organizing university curricula (based on feedback from students and faculty)	1.000	0.524	0.000	0.508	Delete
Faculty Members	The ratio of faculty members according to their educational levels to all faculty members of the University	1.000	0.568	0.000	0.523	Delete
	Ratio of faculty members by university ranks such as assistant professor, associate professor, and professor to all faculty members of the university	1.000	0.639	0.000	0.546	Accept
	University programs, and strategies to empower faculty and staff	1.000	0.631	0.000	0.544	Accept
	Number of national awards won by university faculty members, including educational, research, etc.	1.000	0.683	0.200	0.628	Accept
	The number of faculty members who have won international awards (such as the Nobel Prize and the Fields Medal), or those on the Thomson Reuters list of highly cited researchers	1.000	0.677	0.200	0.626	Accept
	Educational and research competencies of university faculty members	1.000	0.668	0.000	0.556	Accept
	Number of faculty members who are members of academies, associations, scientific and educational committees at the national and regional levels	1.000	0.595	0.000	0.532	Accept
	Average teaching experience of university faculty members	1.000	0.595	0.000	0.532	Accept
	Ratio of faculty members and lecturers with national titles (such as national top professor, top educational professor, top research professor) to all university faculty members	1.000	0.684	0.200	0.628	Accept
	Pleasure and attractiveness of university professors from the students' point of view	1.000	0.580	0.000	0.527	Delete
Application for university admission and quality of volunteers	Rank of candidates in the university entrance exam	1.000	0.583	0.000	0.528	Delete
	Student admission rate to university applicants	1.000	0.561	0.000	0.520	Delete
	Foreign language skills of applicants and candidates	1.000	0.557	0.000	0.519	Delete
	Proportion of accepted volunteers who have the highest rank of all university students in high school at the class and school level	1.000	0.544	0.000	0.515	Delete
	Proportion of university entrance candidates who had the highest score in the national university entrance exam of all university students	1.000	0.583	0.000	0.528	Delete
Students	Students' judgment and satisfaction with the quality of education provided through the survey	1.000	0.543	0.000	0.514	Delete
	Total number of university students	1.000	0.516	0.000	0.505	Delete

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	The ratio of university students by different educational levels to the total number of students	1.000	0.530	0.000	0.510	Delete
	The ratio of university students by subject areas, courses, and different educational groups to the total number of students	1.000	0.458	0.000	0.486	Delete
	The ratio of newly enrolled students in terms of different academic levels to the total number of university students	1.000	0.385	0.000	0.462	delete
	The ratio of adult students (students over 25 years old) to the total number of students	1.000	0.340	0.000	0.447	Delete
	The ratio of first-generation students to the total number of students	0.800	0.291	0.000	0.364	Delete
	The ratio of students who are satisfied with the development of skills acquired through university studies to the total number of students	1.000	0.502	0.000	0.501	Delete
	Repayment rate and non-payment of student loans by students and graduates of the university	1.000	0.363	0.000	0.454	Delete
	Student tuition and fees	1.000	0.326	0.000	0.442	Delete
	University programs to help and support Indigenous and special students such as exchange students, minority students, new students, and students with different abilities	1.000	0.420	0.000	0.473	Delete
	Providing academic counseling, information services, and educational support to students during different stages of education (from the beginning to the end)	1.000	0.540	0.000	0.513	Delete
	Student Survival Rate: The percentage of students who have enrolled in their university in the second year of study and have remained	1.000	0.507	0.000	0.502	Delete
	Teacher evaluation by students	1.000	0.533	0.000	0.511	Delete
	Student participation and activities such as student participation in professional, scientific and educational conferences, etc.	1.000	0.569	0.000	0.523	Delete
	Easy access for students to teachers	1.000	0.540	0.000	0.513	Delete
Diversity and inclusion of the university community	Gender balance of faculty and university students	1.000	0.369	0.000	0.456	Delete
	Number of students and university graduates with low family income	0.800	0.331	0.000	0.377	Delete
	Number of enrolled native and non-native students according to different educational levels	1.000	0.374	0.000	0.458	Delete
	Ethnic and racial diversity of university students	1.000	0.343	0.000	0.448	Delete
	Infrastructure and resources for the blind and disabled	1.000	0.507	0.000	0.502	Delete
	Ethnic and racial diversity of faculty members	1.000	0.347	0.000	0.449	Delete
International ization	The ratio of international faculty members to all university faculty members	1.000	0.596	0.000	0.532	Accept

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	The ratio of international students to total university students in terms of different educational levels	1.000	0.558	0.000	0.519	Delete
	Student exchange rates with foreign universities	1.000	0.608	0.000	0.536	Accept
	joint Courses and study programs with foreign universities	1.000	0.608	0.000	0.536	Accept
	Number of foreign language courses and university curricula offered in foreign languages at different levels of education	1.000	0.600	0.000	0.533	Accept
	Number of memorandums and agreements between the university and international universities	1.000	0.643	0.000	0.548	Accept
	Number and continuation of the university's international cooperation with other universities	1.000	0.696	0.200	0.632	Accept
	Number of sabbaticals provided for faculty members and students	1.000	0.696	0.000	0.565	Accept
	Exchange of professors and researchers with foreign universities	1.000	0.664	0.200	0.621	Accept
	Global ranking of university site on Similar Web, Alexa, etc.	1.000	0.613	0.000	0.538	Accept
Graduates	Employment rate of university graduates	1.000	0.634	0.000	0.545	Accept
	University graduation rates by different educational levels	1.000	0.526	0.000	0.509	Delete
	Salary of university graduates at the beginning of employment	1.000	0.405	0.000	0.468	Delete
	The expected rate of study period versus the actual graduation rate	1.000	0.471	0.000	0.490	Delete
	Graduation rate at the appointed time and no increase in students' academic years	1.000	0.484	0.000	0.495	Delete
	Proportion of graduates admitted to higher education levels to the total number of university graduates	1.000	0.564	0.000	0.521	Delete
	Assessing the professional quality of university graduates	1.000	0.617	0.000	0.539	Accept
	Evaluation of university students and graduates of the ability of university graduates to acquire new knowledge and skills and the quality of their careers in the labor market	1.000	0.573	0.000	0.524	Delete
	Number of university graduates who have managerial positions in organizations and companies	1.000	0.609	0.000	0.536	Accept
	Number of university graduates who have won international awards (such as the Nobel Prize or the Fields Medal)	1.000	0.683	0.000	0.561	Accept
	Achievements of university graduates (such as companies established by them, activities performed and their performance after graduation, etc.)	1.000	0.661	0.000	0.554	Accept
	Relative unemployment rate of university graduates at different levels of education	1.000	0.578	0.000	0.526	Delete

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	University Support for Graduates to Employ and Find Jobs (University Support / Entrepreneurship Programs)	1.000	0.600	0.000	0.533	Accept
Research	Total number of articles published by faculty members, staff, and students per year	1.000	0.654	0.000	0.551	Accept
	Ratio of citations to all university publications including books, articles, etc. per year	1.000	0.683	0.000	0.561	Accept
	Number of university articles among 1% of most cited publications	1.000	0.696	0.000	0.565	Accept
	Number of highly cited university articles among 0.1% of the top and hot publications	1.000	0.692	0.000	0.564	Accept
	Normalized citation effect	1.000	0.683	0.200	0.628	Accept
	Number of university articles in international databases such as Web of Science, Scopus, PubMed, etc. per year	1.000	0.654	0.000	0.551	Accept
	Number of university articles in internal databases per year	1.000	0.566	0.000	0.522	Delete
	University activities and research performance in the year of evaluation	1.000	0.662	0.000	0.554	Accept
	University h index	1.000	0.654	0.000	0.551	Accept
	Number of doctoral dissertations at the national and international levels in the evaluation year	1.000	0.600	0.000	0.533	Accept
	Number of books published by the university in the evaluation year	1.000	0.600	0.000	0.533	Accept
	Number of conferences and seminars held by the university at the national and international levels in the evaluation year	1.000	0.579	0.000	0.526	Delete
	Number of citations to university publications by national and international evaluation year	1.000	0.630	0.000	0.543	Accept
	Number of university papers published in prestigious and influential journals Q1, Q2, Q3, and Q4 in various subject areas on the Web of Science	1.000	0.643	0.000	0.548	Accept
	Number of citations to university publications in the last 11 years	1.000	0.613	0.000	0.538	Accept
	Number of articles that its corresponding author is from the university (scientific leadership)	1.000	0.643	0.000	0.548	Accept
	Quality of journals published by the university based on Impact Factor (IF) or scientific rank of journals	1.000	0.642	0.000	0.547	Accept
	Number of university papers, published in Nature and Science	1.000	0.692	0.000	0.564	Accept
Innovation and technological impact	Number of national and international university patents	1.000	0.717	0.000	0.572	Accept
	Facilities and performance of the university in the field of innovation and entrepreneurship	1.000	0.664	0.000	0.555	Accept
	Number of growth centers and science and technology parks of the university	1.000	0.655	0.000	0.552	Accept
	Special advantages of the about research and development	1.000	0.626	0.000	0.542	Accept

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
	Number of university spin-off companies	1.000	0.630	0.000	0.543	Accept
	Number of university publications cited in patents	1.000	0.667	0.000	0.556	Accept
	Total services provided by the university in the field of innovation	1.000	0.635	0.000	0.545	Accept
Academic collaboration	Number of treaties, licenses, memoranda, and cooperation agreements of the university for research and development	1.000	0.636	0.000	0.545	Accept
	Percentage of university inventions that have succeeded in obtaining an operating license	1.000	0.702	0.000	0.567	Accept
	Number of publications resulting from university cooperation at the national, regional, and international levels	1.000	0.671	0.000	0.557	Accept
	Number of publications obtained from the cooperation of the university with industries, companies, and domestic organizations	1.000	0.675	0.000	0.558	Accept
	Dissertations obtained from cooperation with companies, organizations, and industries	1.000	0.650	0.000	0.550	Accept
	Cooperation and connection of the university with industries, companies, and organizations	1.000	0.667	0.000	0.556	Accept
	University cooperation with employers and contractors	1.000	0.626	0.000	0.542	Accept
Facilities and equipment	Educational tools and equipment, physical facilities and technical equipment of Lecture halls, seminar rooms, classrooms, studios, workshops and workstations, and students' workplaces	1.000	0.670	0.000	0.557	Accept
	Library facilities and services	1.000	0.650	0.000	0.550	Accept
	Quality of university website	1.000	0.643	0.000	0.548	Accept
	Laboratory facilities available at the university	1.000	0.688	0.000	0.563	Accept
	Sports facilities available on campus	1.000	0.596	0.000	0.532	Accept
	University building area (square meters)	1.000	0.569	0.000	0.523	Delete
	Status of IT infrastructure in the university	1.000	0.661	0.000	0.554	Accept
	Status of university buildings (the number of physical spaces available)	1.000	0.591	0.000	0.530	Accept
	University green space area (square meters)	1.000	0.568	0.000	0.523	Delete
College Life	The quality of the university campus for students' lives	1.000	0.583	0.000	0.528	Delete
	Student housing status	1.000	0.518	0.000	0.506	Delete
	Number of federations, clubs, organizations, unions, communities, and student centers in the university	1.000	0.522	0.000	0.507	Delete
	Consumption of useful and harmful drinks and drugs among university students	1.000	0.482	0.000	0494	Delete
	Extracurricular activities to fill students' leisure time	1.000	0.549	0.000	0.516	Delete
	Interaction and participation of the university with the community	1.000	0.536	0.000	0.512	Delete

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
Socio-cultural factors	Number of cultural and artistic events and activities, holding official exhibitions, concerts and official performances, theater, orchestras, etc. held by the university	1.000	0.541	0.000	0.514	Delete
	The ratio of university expenses to support and development of the community and investment in the local community to the total university credits	1.000	0.516	0.000	-.505	Delete
Environmental factors	University programs regarding traffic and organizing the public transportation system in the university	1.000	0.523	0.000	0.508	Delete
	University programs for the sustainability and greenery of the campus	1.000	0.545	0.000	0.515	Delete
	University programs for the protection and optimal use of water, electricity and energy in the university	1.000	0.587	0.000	0.529	Delete
	Orientation and practice of the university regarding the preservation and sustainability of the environment	1.000	0.587	0.000	0.529	Delete
	University programs on waste disposal at the university level	1.000	0.573	0.000	0.524	Delete
Financial factors	Total subsidies, grants, and scholarships awarded to students	1.000	0.600	0.000	0.533	Accept
	External grants and funding provided to the University for research and development	1.000	0.638	0.000	0.546	Accept
	Total income from university research	1.000	0.635	0.000	0.545	Accept
	Total research grants awarded by the university to faculty members and researchers	1.000	0.634	0.000	0.545	Accept
	International research grants	1.000	0.634	0.000	0.545	Accept
	University incomes	1.000	0.651	0.000	0.550	Accept
	Total university tuition fees	1.000	0.570	0.000	0.523	Delete
	Total university research costs	1.000	0.583	0.000	0.528	Delete
	University budget per student	1.000	0.596	0.000	0.532	Accept
	University income in proportion to the number of faculty members	1.000	0.613	0.000	0.538	Accept
	The ratio of salaries, bonuses, and benefits of faculty members to the total university budget	1.000	0.506	0.000	0.502	Delete
	University fees for facilities, library resources, and student services per student	1.000	0.574	0.000	0.525	Delete
	Total direct and indirect financial aid and grants awarded to the university	1.000	0.600	0.000	0.533	Accept
	University research and development programs and costs	1.000	0.600	0.000	0.533	Accept
	Income from university education such as receiving tuition, income from continuing education, and so on	1.000	0.457	0.000	0.486	Delete
	Financial stability and lack of financial crisis in the university	1.000	0.587	0.000	0.529	Delete
	Number of student loans	1.000	0.513	0.000	0.504	Delete
	University research budget per faculty member	1.000	0.609	0.000	0.536	Accept

Criteria	Indicator	Fuzzy value			Definite amount	Result
		Upper line	Middle line	lower line		
Governance, leadership, and management of the university	Existence of accreditation committees and evaluation system and internal quality assurance in the university and continuous monitoring of university performance, through self-evaluation, internal and external evaluation	1.000	0.634	0.000	0.545	Accept
	Existence of organizational and managerial perspectives of the university as a whole and separately	1.000	0.618	0.000	0.539	Accept
	Results of accreditations and the presence of the university in various university rankings at the international level	1.000	0.685	0.000	0.562	Accept
	Times of accreditation at the university	1.000	0.595	0.000	0.532	Accept
	Annual evaluation of faculty members and staff	1.000	0.613	0.000	0.538	Accept
	Existence of a suitable salary and reward system in the university for faculty members and staff	1.000	0.596	0.000	0.532	Accept
	Clarity and measurability of the goals and strategic plans of the university by units	1.000	0.613	0.000	0.538	Accept
	Addressing all issues and problems, including financial, personnel, and other issues by the university administration and management	1.000	0.564	0.000	0.521	Delete
	University actions to hire talented and qualified staff and empower staff	1.000	0.553	0.000	0.518	Delete
	Precise definitions of responsibilities and decisions and the role of committees and the individual role of managers and employees	1.000	0.547	0.000	0.516	Delete

According to Table 2, for each indicator, three fuzzy numbers (upper limit, medium limit, and lower limit) are defined. The arithmetic means of the fuzzy numbers are calculated to de-fuzzy and convert it to a definite value. Then, considering that the threshold was 0.53; therefore, the indicators whose definite value was less than 0.53 were deleted. Accordingly, 86 indicators were deleted. Also, six criteria of "college life", "students", "diversity and inclusion of the university community", "socio-cultural factors", "application for university admission and the quality of volunteers", and "environmental factors" were deleted.

AHP technique was used to weigh and prioritize the approved criteria. Finally, based on the fuzzy Delphi technique and AHP results, the appropriate ranking framework for Iranian universities, which includes 11 criteria and 94 indicators, was developed. Figure 1 shows the final pattern with the weight assigned to the criteria and the number of indicators in each criterion.
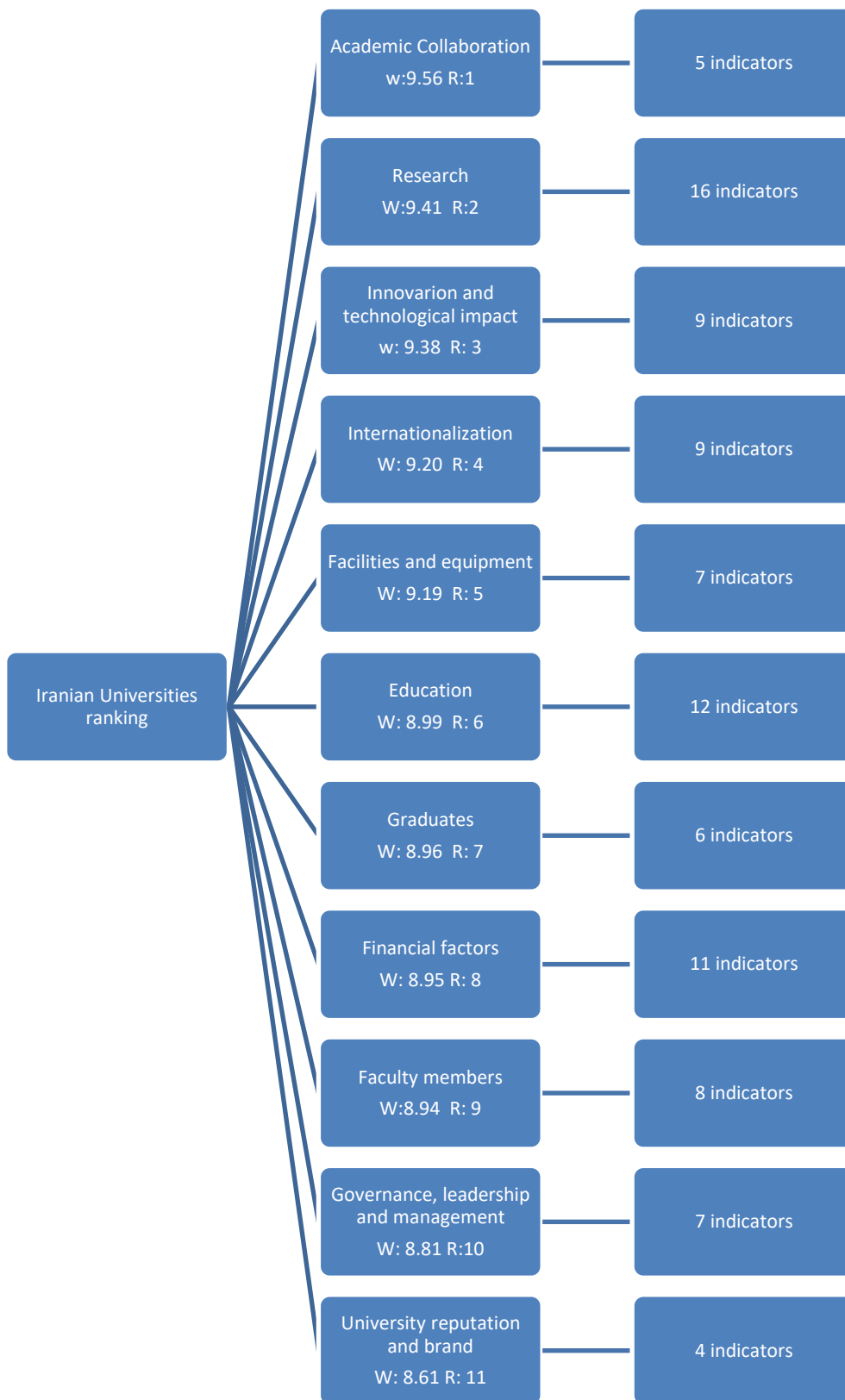
Figure 1: The Modified Ranking Framework of Iranian Universities

Discussion

The present study was conducted to design a native framework for ranking Iranian universities. Accordingly, the checklist extracted from the interaction of criteria and indicators in the global, regional, and national university rankings methodology was compiled after making the necessary adjustments. The checklist included 17 criteria and 180 indicators. To check the validity and select the appropriate indicators for the evaluation and ranking of Iranian universities, the checklist was sent to 60 experts. After collecting the checklists, the one-stage fuzzy Delphi method was used to determine the appropriate indicators. The threshold was considered 0.53 for screening the indicators, finally identifying 11 criteria and 94 indicators.

The global rankings also include all 11 approved criteria in the present study. Also, in the global university ranking systems, as in the present study, there is no criterion for "application for university admission and quality of volunteers".

In general, many of the criteria identified in this study are consistent with global and regional rankings. The results of the present study are in line with the results of Alma et al. (2016), Who identified the criteria of "education", "research", "faculty members", "students", and "internationalization" as influential criteria in the rankings. In the study of Lukman et al. (2010), "Research" and "education" are mentioned as the most important factors in the evaluation and ranking of universities. Briggs (2006) also mentioned reputation and facilities as the most important indicators for selecting universities, which is consistent with the results of the present study. The findings of this study are also consistent with the studies of Doulati et al. (2013), Who have identified the category of facilities and equipment as one of the main and most important indicators influencing the ranking of universities.

The weighting and prioritization of selected criteria and indicators showed that "academic collaboration" with the highest weight, has gained the first rank. Then the criteria of "research", "innovation and technological impact", "internationalization", "facilities and equipment", "education", "graduates", "financial factors", "faculty members", " Governance, Leadership, and Management of the university", and "University Reputation and Brand" were placed respectively. It should be noted that almost all of the selected criteria were important from the participant's point of view, and addressing the status of the criteria is merely to show the degree of emphasis on the criteria.

The modified and final framework of the present study has 11 criteria and 94 indicators. "Academic collaboration" is at the forefront of research criteria, which can be justified by its close relationship with research, education, and internationalization criteria. This shows that in the higher education system, scientific, research, and educational cooperation, and its expansion at the national and international levels, is highly emphasized. Academic cooperation in global and regional ranking systems is also emphasized.

The criteria of "research" and "innovation and technological impact" were ranked second and third, respectively, which indicates the importance of these criteria from the perspective of experts in the present study. In Ouhadi's study (2008), the criteria of education and research were more emphasized. Also, in the study of Zarehbanadkuki et al. (2016), Demand-driven research, demand-driven education, and international cooperation were among the priorities. Taylor and Braddock's (2007) study considered the research criterion more than education. According to Alma et al. (2016), The criteria of "education", "research", and "internationalization" were among the first five criteria. In the study of Rahimi, Parand,

Mohammadi and Yadegarzadeh (2002), Education and research criteria were among the priorities. These studies' findings align with this part of the present study.

The emphasis on the criterion of "innovation and technological impact" is important in the present study. This criterion is in third place. This indicates that the idea of turning Iranian universities into third and fourth-generation universities is accepted and important among experts. Therefore, in the next few years, Iranian universities should strengthen innovation, entrepreneurship, and technological impact in addition to research. In other words, university research should move towards applied research with a problem-solving approach. Because innovations, technologies, and entrepreneurship are solutions that can provide employment, increase productivity, economic development, and promote social welfare.

"Internationalization" was the fourth criterion. The findings of this part of the present study align with the findings of Alma et al. (2016), In which the "international situation" was one of the criteria considered. Therefore, knowing other nations, cultures, and the international community is essential to internationalizing Iranian universities. "Facilities and equipment "came in fifth. In the study of Khadivi and Seyed Kalan (2018), Facilities were also in a high position.

According to the findings of this study, "education" ranked sixth. This means that the evaluation and ranking of today's universities should not focus only on the educational aspects. Because if a university wants to succeed in its other functions, it must strengthen its educational dimension. On the other hand, conducting quality research that leads to creation and innovation requires quality education. In other words, education without research and research without training do not make sense in today's universities, and strengthening the other functions of the university affects strengthening this dimension. Placing the criterion of "graduates" in the next position is also important, considering their role in providing feedback to universities. Having scientifically, professionally, and socially successful graduates has been considered the university's success in performing the functions and training of the human resources needed by society; this helps to increase the prestige and reputation of the university.

The criteria of "financial factors", "faculty members", "governance, leadership and management of the university", and "university reputation and brand" were ranked next. However, the weights assigned to them are close to the weights of the criteria emphasized more by experts. Perhaps the reason for placing these criteria in the lower positions is due to the connection and overlapping of these criteria with the criteria that have been emphasized more. For example, internationalization requires having a capable and experienced human force, which in universities is mainly made up of faculty members. Therefore, having powerful faculty members is one of the requirements for scientific partnerships and collaborations of a university with other organizations and universities at the international level. However, the study results of Aletaha, Jabbari and Azari (2019) showed that financial factors are among the most important and influential factors in ranking universities. According to Feyzpur et al. (2011), the emphasis was on "the quality of academic staff members". Montilla (2004) also stated that "quality of faculty members" and "university reputation" are among the factors that affect students' decisions and perceptions and university choice.

Conclusion

University ranking systems should use criteria and indicators that help indirectly improve the status of universities and help solve society's problems.

Nowadays, the transition of Iranian universities from education-oriented and research-oriented universities to entrepreneurial and innovative universities that serve society is highly considered by experts to evaluate the performance of universities. It seems that shortly, a university should move towards third and fourth-generation universities even to gain a suitable position at the national level. In other words, Iranian universities should take steps towards applying and commercializing their scientific research to help solve the problems of society and the country in addition to earning money and wealth for themselves. The requirement of Iran's society and universities at present is to move in the direction of creation, invention, innovation, entrepreneurship, and production of technological products to achieve economic development, employment, and social welfare in the country.

Endnote

1. https://ireg-observatory.org/en

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