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Strategic Analysis of International Scientific Collaboration of Iranian Top Universities from their Faculty perspective, Using FBWM

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Abstract

Background and Objective: Asymmetric distribution of knowledge and technology in globalization era, and the necessity of global interactions for universities have led them to enter into international scientific collaboration (ISC) and strategic evaluation of status quo is required for effective participation in it. Therefore, the aim of this study was to evaluate the ISC of top Iranian universities using SWOT analysis.

Materials and Methods: This was an applied descriptive survey. 432 faculty members of the top 12 universities were selected through a stratified sampling. The data-collection tool was a researcher-made questionnaire whose content validity was confirmed by experts and counterparts and its reliability was calculated using Cronbach's alpha equal to 0.816. Data analyzed through Fuzzy BWM.

Results: The most important strengths included increasing presence of researchers at international conferences, and the existence of suitable international development platforms in universities; weaknesses included inadequacy of faculty annual grants, and university administrators' lack of knowledge about ISC; opportunities included the youthfulness of Iran's population, the lifting of some sanctions against Iran and international community's new appetence to acceptance of Iran in international academic consortia and finally important threats included the economic downturn in most countries; lack of political platform for ISC and the spread of Islam and Iran phobia around the world.

Conclusion: International Scientific Collaboration is required for meeting many objectives of the Iran development plans, and is strongly influenced by the specific cultural, political, religious and international conditions of Iran. Top universities must meet the international academic standards and audit the requirements of international community.

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Introduction

The asymmetric distribution of knowledge and technology resources along with the requirements of the age of globalization has forced universities to engage in international interaction to achieve their goals. Accordingly, networks of international collaborations have been developed to meet the goals of universities at the national and international levels for sharing knowledge, capabilities and organizational resources (1). In the last two decades, academic activities have been fully internationalized and focused on international collaborations (2). International Scientific Collaboration (ISC) as one of the predominant forms of internationalization of higher education consists of a wide range of joint international activities, including student and professor exchange (3). Yamada (4) defines the ISC, regardless of its contractual forms, as joint educational and research projects at the institutional level. Chan considers the ISC to include scholarly exchanges, joint curriculum development, research cooperation, and comparative benchmarking. He believes its aims at developing countries could be strengthening private sector, developing educational infrastructure, edutourism, human resources and economic growth (5). Increase in gross national income, tourism prosperity, entry of foreign currency into the country, export of educational services, enhancing of scientific profile of the country (7), the introduction of peaceful Iranian culture, the integration of thoughts and ideas; development and enrichment of knowledge and skills of specialists; creating competitive advantages for universities, raising the level of income and welfare of elites and educators through the acquisition of international reputation (8), developing the intercultural exchanges, gaining more market share, more market entry, accessing invaluable scarce resources (5), achieving a balanced world with a fair distribution of knowledge and technology (9), and the possibility of infinite improvement for academics are only a small part of benefits that ISC will bring to the country. Inadequate funding and utilization of the cooperative atmosphere by academics (10), poor understanding on international relations, the critical attitude of Iran and the West toward each other, political conflicts (11), failure to guarantee the ISC memoranda (12), lack of staff skills, structural constrains, neglect of economic inequality between nations and non-commitment to globalization (11) could be mentioned as ISC challenges. The factors contributing to the development

of the ISC also include the organization's strategy, goals of the units, internal structures and the educational management style (13), adequate financial resources (14), countries' level of science and technology (2) management support, quality assurance, long-term planning and balanced development (9), political and cultural attitudes of countries toward each other (2), government support, university privatization (14) partners' characteristics and relationship (13), partners' credibility and position (6), growth of research capacity in some countries, elite migration as a referent group of scientific community, development of communication and travel systems, expansion of international financial systems, and the networking of academic activities (15). Reviewing the research background, a systematic approach for measuring ISC as a multifaceted phenomenon was not found in general. The number of international students across the world has been doubled between 2000 and 2015, and now there are more than 5 million international students all over the world (16). China with 801187, India with 255030, Germany with 116,342, France with 80,635, Kazakhstan with 77,965 students, respectively, are the first five countries in student exporting, and Iran, with 51,395 students ranked behind Malaysia and Italy in the eighth place (17). Iran's share of the acceptance of international students is also very limited to the Muslim community or Afghan students. Based on this, in order to meet the country's needs for scientific development in the region and the world, it is necessary to study the strategic planning in this area and to analyze the status quo. Therefore, the present study seeks to answer the following questions:

1. How are ISC management strengths prioritized at Iranian top universities?
2. How are ISC management weaknesses prioritized at Iranian top universities?
3. How are ISC management opportunities prioritized at Iranian top universities?
4. How are ISC management threats prioritized at Iranian top universities?

Materials and Methods

This study is applied in terms of purpose, quantitative in terms of approach and data collection, non-experimental in terms of controlling variables and descriptive-survey in terms of method. The statistical population included 10725 faculty members of 12 top universities -4 comprehensive universities, 4 medical universities and 4 industrial universities- introduced by ISC in 2017 (18).

Sampling method was ratio stratified sampling. Based on the Cochran formula, the sample size was 370 and regarding probable drop, a ratio of about 5% of each university was selected as in Table 1. Finally, 432 questionnaires returned and were used as sample. Data collection tool was a researcher-made questionnaire. To determine its reliability, 40 faculty members attended in a pilot implementation eliminating 8 items and its alpha equaled 0.816. In addition to face validity of the apparent structure, the approval of research counterparts was used to determine the content validity.

Table 1: Distribution of statistical sample

University type	University name	Community	Sample number	Return number
Comprehensive	Tehran	2050	110	84
	Tarbiat Modarres	727	40	31
	Tabriz	800	45	32
	Shahid Beheshti	805	45	37
Medical	Tehran	1689	85	64
	Shahid Beheshti	1301	65	54
	Isfahan	853	40	29
	Shiraz	782	35	26
Industrial	Sanati Sharif	484	30	22
	Amirkabir	473	30	21
	Elmo Sanat	394	25	18
	Khaje Nasir	367	20	14
Total		10725	570	432

The fuzzy best-worst method (FBWM) presented by Guo and Zhao (19) was used to analyze the research data due to its better compatibility rate. In this method, the paired comparisons of criteria were implemented using the verbal phrases in Table 2 and converted to corresponding fuzzy numbers.

Table 2: Verbal phrases, corresponding fuzzy numbers and compatibility index

Verbal phrases (a_{Bw})	fuzzy numbers	FBWM Compatibility Index
Equal Importance	(1,1,1)	3
Low Importance	(0.67,1,1.5)	3.8
Relative Importance	(1.5,2,2.5)	5.29
High Importance	(2.5,3,3.5)	6.69
Absolute Importance	(3.5,4,4.5)	8.04
Compatibility rate= $\frac{\xi^*}{\text{compatibility index}}$		

Result

In this method, it is better to develop a nonlinear optimization model first, but in models with more than three criteria, it is better to turn the model into a linear one (19), which was done by Lingo software. The fuzzy weight of the main criteria was directly obtained from the model, and then these were converted to definite weight by the relation $R(\tilde{a}_i) = \frac{l_i+4m_i+u_i}{6}$ and the results were given in Table 3. At the end, each weight was divided into total weight to normalize the weights. The compatibility rate of 0.052 also was calculated which indicates a high compatibility of comparison.

Table 3: Verbal phrases, corresponding fuzzy numbers and compatibility index

Criterion name	Fuzzy weight	Definite weight	priority
Weaknesses	(0.119,0.182,0.202)	0.175	3
Strengths	(0.116,0.144,0.114)	0.139	4
Opportunities	(0.248,0.356,0.356)	0.338	2
Threats	(0.292,0.356, 0.356)	0.345	1
Compatibility rate= $\frac{0.198}{3.776} = 0.052$			

Question 1: How are ISC management Strengths prioritized at Iranian top universities? To answer this question, similar to the main criteria, the optimization model was developed for sub-criteria (C1), and after it was solved, the results were noted in Table 4 with respect to the priority and weights of each sub-criterion.

Table 4: Weight and Priority of Strength Sub-criteria (C1)

Criterion name	Fuzzy weight	Definite weight	Rank
Increasing attendance and interaction of students and academics in international conferences.	(0.105,0.113,0.113)	0.112	1
Existence of facilities and appropriate international development opportunities at universities.	(0.102,0.110.0.110)	0.109	2
Qualitative and quantitative expansion of higher education.	(0.097,0.107,0.107)	0.105	3
Expansion of non-state and free universities.	(0.097,0.107,0.107)	0.105	3
Issuing new directives to facilitate the ISC.	(0.087,0.098,0.098)	0.096	4
Expanding international cooperation on dissertations.	(0.058,0.079,0.093)	0.078	5
Expanding the use of modern educational technologies.	(0.054,0.071,0.083)	0.070	6
Increasing number of Iranian articles in international journals.	(0.051,0.067,0.083)	0.069	7
Establishment of international units of universities.	(0.033,0.049,0.058)	0.048	8
Extending willingness to international academic co-authorship	(0.037,0.044,0.050)	0.044	9
More attention of universities to the ISC center and its headquarters	(0.030,0.042,0.047)	0.041	10
Development of new and popular courses	(0.026,0.034,0.037)	0.033	11
Promoting the academics' level of technology literacy	(0.025,0.033,0.035)	0.032	12
Increasing number of international scientific journals	(0.028,0.031,0.033)	0.031	13
Expanding international scientific and research centers	(0.024,0.027,0.028)	0.027	14
Compatibility rate= $\frac{0.403}{7.93} = 0.051$			

Question 2: How are ISC management weaknesses prioritized at Iranian top universities?

In order to nswer this question, the first question was followed exactly and the optimization model was developed for the sub-criteria of the weaknesses (C2) and the results were listed in Table 5.

Table 5: Weight and Priority of weaknesses Sub-criteria (C2)

Criterion name	Fuzzy weight	Definite weight	Rank
The inadequacy of the annual grant of professors.	(0.084,0.098,0.099)	0.096	1
University administrators' lack of knowledge on ISC.	(0.072,0.098,0.098)	0.094	2
Laxation and dispersion in ISC Policies.	(0.080,0.081,0.098)	0.084	3
The limited access of Iranian academics to international databases.	(0.068,0.080,0.083)	0.079	4
Existence of traditional attitudes in academic activities.	(0.054,0.074,0.080)	0.072	5
Lack of ISC experts among those in charge.	(0.053,0.074,0.080)	0.071	6
The conclusion of memoranda without real guarantees.	(0.055,0.067,0.087)	0.069	7
Inappropriate position of Iranian universities in global rankings.	(0.066,0.066,0.071)	0.067	8
The lack of suitable mechanisms for introducing educational institutions	(0.044,0.056,0.068)	0.056	9
Lack of comprehensive database for students on the existing courses, professors' fields, etc.	(0.038,0.050,0.058)	0.049	10
The weak use of international languages by Iranian academics	(0.035,0.050.0.056)	0.048	11
State dependency of universities in ISC decision making.	(0.027,0.042,0.046)	0.040	12
Lack of procedural unity regarding ISC at universities.	(0.026,0.039,0.042)	0.037	13
The lack of academic freedom in Iranian universities.	(0.023,0.033,0.034)	0.032	14
Training-oriented education without attention to research process.	(0.025,0.029,0.039)	0.030	15
The extreme concentration in Iranian academic management system and strong dependence of universities on government.	(0.022,0.025,0.031)	0.026	16
Weakness of the process of hiring faculty members.	(0.021,0.024,0.029)	0.024	17
Lack of standardization of education, research and evaluation according to accepted international criteria.	(0.021,0.024,0.024)	0.023	18
Compatibility rate = $\frac{0.366}{7.676} = 0.048$			

Question 3: How are ISC management opportunitiesprioritized at Iraniantop universities?

Table 6: Weight and Priority of Opportunities Sub-criteria (C3)

Criterion name	Fuzzy weight	Definite weight	Rank
Youngness of the population of Iran and their tendency to change international interactions.	(0.080,0.089, 0.089)	0.088	1
Lifting some scientific sanctions against Iran.	(0.071,0.89,0.089)	0.086	2
More acceptance of Iran in international academic consortia.	(0.071,0.087,0.087)	0.084	3
Investing of Iran in new and internationally recognized fields and disciplines.	(0.066,0.084,0.084)	0.081	4
More international approach in people's activities and demand for strengthening it by universities.	(0.071,0.081,0.082)	0.080	5
Paying special attention to ISC on supreme documents.	(0.066,0.076,0.077)	0.075	6
Increasing the influence of communication technologies in people' life	(0.058,0.068,0.070)	0.067	7
Increase in tendency to study in Iran among neighboring countries	(0.042,0.058,0.065)	0.057	8
Increasing societal demand for high quality and internationally valid higher education	(0.036,0.048,0.059)	0.048	9
Increase in people's information about the status of life, culture and economy in other countries.	(0.036,0.047,0.058)	0.047	10
The existence of religious leaders with a wide range of international relationships.	(0.031,0.040,0.046)	0.040	11
Promotion in scientific status of Iranian experts in different fields of science.	(0.028,0.037,0.043)	0.037	12
Universities' tend to improve their international profile and awarding internationally recognized degrees.	(0.027,0.037,0.042)	0.036	13
Expanding international cooperation spirit among academics.	(0.022,0.030,0.034)	0.029	14
Having same-language and same-religion neighboring countries.	(0.021,0.028,0.032)	0.028	15
Expanding international virtual and distant higher education	(0.020,0.027,0.031)	0.027	16
Priority of international cultural and scientific interactions for Islamic revolution of Iran.	(0.020,0.024,0.024)	0.023	17
Islamic orders for acquisition of sciences beyond borders.	(0.020,0.023,0.023)	0.023	18
Hospitality and knowledge-friendly culture of Iranians.	(0.019,0.023,0.023)	0.022	19
Ancient Iran's records of international scientific cooperation.	(0.019,0.022,0.023)	0.021	20
Compatibility rate= $\frac{0.277}{8.041} = 0.034$			

Question 4: How are ISC management threats prioritized at Iranian top universities?

Table 7: Weight and Priority of Threats Sub-criteria (C4)

Criterion name	Fuzzy weight	Definite weight	Rank
Economic turndown in some countries.	(0.074,0.081,0.081)	0.080	1
Lack of political platforms for ISC in Iran.	(0.070,0.078,0.078)	0.077	2
Spread of Iran and Islam phobia in the world.	(0.067,0.076,0.077)	0.075	3
Obligation of observing special religious orders such as hijab, fasting and interactions for foreigners in Iran.	(0.066,0.076,0.076)	0.074	4
Weakness of IT infrastructures regarding low speed, bandwidth, site filtering, etc.	(0.065,0.074,0.074)	0.073	5
Legal constraints on admission of foreign academics in Iran.	(0.054,0.076,0.076)	0.072	6
Need for intelligence check to communicate with foreign countries.	(0.046,0.065,0.072)	0.063	7
Presence of strict legal constraints in some countries for scientific cooperation with Iran	(0.043,0.058,0.069)	0.057	8
A peripheral attitude toward international cooperation in scientific policies.	(0.039,0.052,0.066)	0.052	9
High inflation rate that impacts on the development of ISC	(0.036,0.046,0.059)	0.047	10
Governors' emphasis on controlling English language and cultural hegemony.	(0.036,0.046,0.059)	0.047	10
Impact of sanctions on ISC and high-tech imports.	(0.035,0.046,0.058)	0.046	11
Restriction of Iranian academics for travelling to some countries and vice versa.	(0.029,0.036,0.042)	0.036	12
Excessive emphasis on monopoly and scientific competition rather than collaboration.	(0.028,0.035,0.042)	0.035	13
Negative effect of brain drain on the mentality of international academics about Iran.	(0.027,0.032,0.036)	0.032	14
Failure to create and maintain interbank transactions with foreign banks.	(0.026,0.032,0.036)	0.031	15
The chronic weakness of the value of the national currency against international currencies.	(0.024,0.029,0.032)	0.029	16
International students' tendency to education in several low-cost countries regardless of quality aspect.	(0.023,0.026,0.028)	0.026	17
Degree-orientation and tendency to obtain degrees from some invalid universities.	(0.022,0.025,0.027)	0.025	18
Authorities' disapproval of international documents in direction of higher education.	(0.017,0.020,0.020)	0.020	19
Compatibility rate= $\frac{0.439}{7.676} = 0.057$			

Discussion

Prioritizing the strengths of the ISC has highlighted the role of managerial and executive components. Existence of facilities and appropriate international development platforms at universities, quantitative and qualitative development of higher education and nongovernmental universities were particularly emphasized. Fazeli and Shams (11) also argue that the development of postgraduate education will increase the country's contribution to world-class knowledge production, which in turn can increase the attraction of new faculty members, expand academic publications, and so forth. Arasteh and Esmaeilnia (21) also argue that universities can solve the educational problems when there is a balance in their quality and quantity. Malekzadeh (22) has presented visa facilitation for attending seminars as one of the most important factors of ISC development and "the impact of international conferences on the development of ISC" was also well-accepted by Arasteh (21), Ayubi, Alhabibeh (23) and Chan (5). The enhancement of technology literacy and the use of communication and educational technologies among academics have also contributed to the development of ISC. Increasing the number of Iranian articles in international journals, increasing desire for international co-authorship among academics and increasing number of Iranian scientific journals are examples of research strengths which have been confirmed by Arasteh and Esmaeilnia (21), Fazeli and Shams (11). Regarding ISC in theses, if payments for foreign professors and the use of other languages at universities increased, the amount of ISC would greatly promoted. Development of new, popular and internationally recognized fields of study along with other factors can attract foreign students, and the synergy of the cooperation of domestic and foreign researchers will occur more appropriately through expansion of international scientific and research centers.

Among the weaknesses identified for ISC, the first is the inadequacy of the annual grant of the faculty, which weakens the financial support of the presence of a foreign consultant professor in dissertations or the support of the student for attending conferences and presenting papers. Lack of knowledge of university administrators on ISC and the misjudgment on its necessity and attitude towards it as part of their inconsiderable tasks are among the main problems of ISC that is also confirmed by Siah (24). Non-uniformity in dealing with ISC by universities has led

them to incorrect ways. On the other hand, entering the international arena and competing with reputable universities in the world requires an integrated organizational framework, facilities and expert manpower that is unfortunately not found in most universities. Ratanawijitrasin (28) has focused on effective management of ISC, and found that they were successful when senior management, faculty members and employees voluntarily participated in. Ostadzadeh (12) also considered lack of knowledge of university administrators on ISC and the conclusion of unguaranteed agreements as the most important ISC weaknesses. The limited access of Iranian academics to international databases, along with domestic self-filtering has led to the isolation of researchers and limited access to articles and dissertations that is also confirmed by Fathi Vajargah et al (25) and Ostadzadeh (12). The inappropriate position of Iranian universities in international rankings, especially in the international profile, and the presence of traditional attitudes toward training are also known as ISC weaknesses which are also confirmed by Arasteh and Esmaeilnia (21). The lack of comprehensive databases of the professors and their research interests will reduce their student referrals. The lack of international standardization of education, research and evaluation and the use of Persian as the only language of teaching in universities are also ISC weakness factors as it is underlined by Siah (24), Arasteh and Esmaeilnia as well (21).

Among the 20 approved ISC opportunities, the youngness of country's population and their tendency to change the way of international interactions is of the most importance. An international approach in people's activities and demand for strengthening it by universities is the result of more international trade exchanges, ICT promotion, economic growth, immigrating and studying abroad, etc. The removal of some scientific sanctions has somewhat changed the views of the world over Iran's supposedly warfare nature -promoted by the West. According to this fact and due to the scientific capacity of the Iranian academics, the international community has become more willing to accept Iran in international academic consortia. One of the other reasons for ISC unsuccessfulness is international sanctions against Iran (12). Fazeli and Shams (11) believe the country's investment in new internationally recognized disciplines can provide a good opportunity for attracting foreign researchers. Ratanawijitrasin (31)

considers sharing new knowledge as the most important motivation to participate in international strategic alliances. More tendencies of neighboring countries to study in Iran, along with the hospitality and knowledge-friendly culture of Iranian scholars and celebrities provide the opportunity to attract more international students as one of the most fundamental aspects of the foreign policy of the Islamic Republic of Iran. Siah (24) believes that ISC not only has positive educational, economic and industrial benefits, but also canincrease the mutual understanding of countries from their international partners. Velayati and Nowroozi (27) also described the characteristics of Iran's neighbors as an opportunity for fostering ISC. Improving the scientific position of Iranian academicsinthe globalarenaascitedin international rankings and indexes and the spread of ISC morale among academics has provided an additional opportunity for its development.

Among the threats of ISC, the economic downturn in most countries of the world has been assessed as the most important threat, which has led to lower incomes and lower investment rates, including overseas education. The chronic weakness of the value of the national currency against international currencies and the rise in inflation and its impact on the development of ISC have also reduced the possibility of some international financial commitments over a period of time. Yamada (4) and Welch (15) regard the lack of financial support by senior management and the economic downturn as the main ISC challenges. The lack of political platforms for ISC, restrictions and sanctions, and failure to create and maintain interbank transactions with foreign banks are the other ISC challenges which are also confirmed by Ostadzadeh (12). The spread of international terrorism and Islam phobia over the world and the restriction of Iran's transit to other countries are among the political threats posed by the emergence of unwanted phenomena such as radicalism in the region and the world, the traces of Muslim citizens in the world terroristic crimes, the status of the countries of the region and so forth. Velayati and Nowroozi (27) have confirmed the impact of the war on ISC with neighboring countries. A peripheral attitude toward ISC, excessive emphasis on monopoly and scientific competition rather than collaboration and countering the hegemony of English language are some other important threats of ISC. Velayati and Nowroozi (27), Fathi and Zare (25) also described low English proficiency as one of the biggest obstacles to the

development of the ISC. Negative impact of brain drain on the mentality of international scholars on Iran is one of other ISC threats that is confirmed by Ratanawijitrasin (28), when he considers brain drain in developing countries to be one of the greatest threats of the coming years, especially in Asian countries. The rejection of international documents for direction of higher education by the authorities is also one of the major threats to globalization and international standardization of education and research- the examples of which are clearly reflected in rejection of UNESCO's 2030 document. Kato and Ando (2); Lao and Lyn (3) also believe that the political angle in attitudes of the countries' authorities has a direct relationship with their ISC.

Conclusion

The increasing growth of global communications and the major role of international scientific and research exchanges in knowledge accumulation and development of societies in today's knowledge-based world have highlighted ISC as an essential means of meeting the Iran's macro-level goals in such a way that achieving a large share of them such as autonomy and self-sufficiency are impossible, unless through international collaboration in the global village. Given the specific cultural, political, religious, national and international conditions of Iran, top universities must identify and audit the requirements of the international community with regard to ISC. They should also have a strategic plan to comply with internationally accepted standards in various educational, research and cultural areas. However, unfortunately, non-systematic increase and reductionist view has led to an inconsistent growth which is not in line with top universities' capacities in this regard. Therefore, it is necessary to clarify the weaknesses, strengths, opportunities and threats of the ISC from the perspectives of managers, specialists, investors and all stakeholders in this field in order for presenting diverse study models to enhance the ISC platforms in a systematic and scientific way, eliminate the existing barriers, be aware of opportunities available and encounter reasonably with different threats in this area.

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