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Original article

Identifying Effective Factors on Science Production to Move toward Third-Generation Universities

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Abstract

Introduction: Proper knowledge of the factors affecting science production is essential to accelerate scientific progress and achieve the goals of the country's vision document and comprehensive scientific map. The present study aimed to identify the factors affecting the science production to move toward third-generation universities.

Methods: In this descriptive-analytical survey, the sample was based on a stratified random sampling of 270 people selected from 918 faculty members of the Iran University of Medical Sciences. The research tool was a questionnaire designed based on available literature. The collected data were analyzed by SPSS software version 23 using descriptive statistics, Student's t-test, and Friedman test.

Results: The results revealed that all managerial, structural, cultural, and human factors were influential in discussing science production from the faculty members' perspective ($P < 0.05$). Also, from the faculty members' perspective, the essential components of the above-mentioned factors include the university innovations management, scientific structure, communication and collaboration, entrepreneurs, and innovative, entrepreneurial, and community-oriented managers, respectively.

Conclusion: From the faculty members' perspective, all the studied factors were effective in producing science. Therefore, paying more attention to these factors to move toward the goals of third-generation universities can improve the status of the university.

Introduction

Today, universities, in addition to pursuing education and research goals due to developing the present age and managing the scarcity of natural resources for future generations, have taken steps to build wealth. Hence, they turn the produced knowledge into a product and gain profit (1). In sustainable development, science production and knowledge as a driver of economic growth and a factor in increasing productivity have been emphasized bygovernments, universities, and industry. On the other hand, science production, in addition to its dissemination and application, has also become a global goal in economics. Many countries worldwide are looking for ways to transfer knowledge and technology from academic research through entrepreneurship channels for the economic developmentof their country (2). Therefore, to align with local, regional, and international economic development, universities and the higher education system need to move from the traditionalrole of science production to its application and, consequently, to third-generation, i.e., entrepreneurial universities (3).

Entrepreneurial university means a university in which all activities of the units such as education, research, technology, and other related departments are managed and implemented in such a way that the university is considered an economic entity or quasi-corporation. This means that the direction of these activities is to be profitable and gain competitiveeconomic advantages (4). The scientific literature emphasizes the development of industry based on science production and innovation, and without being at the forefront of these two factors, no country will be prosperous in rapidly following the path of industrial development. Universities can play a role in this field and increase the production of applied science, encourage innovation and entrepreneurship by producing science and its proper management in universities to achieve entrepreneurial goals (5). Therefore, one of the factors that play a role in the movement of universities towards entrepreneurship is to pay attention to the science production and the factors affecting achieving the goals of entrepreneurial universities.

The researchers' review of the available literature showed that some studies were conducted in line with the presentstudy. In this regard, Niazazari et al. examined the relationship between the entrepreneurial university and the dimensions and components of futurism and science production. They concluded that an entrepreneurial university significantly affects the Iranian educational system's futuristic techniques and science production (6). In the study of Fadayi et al., the dimensions and components of science production in the entrepreneurial university were mentioned as motivation, structure, university support, education-oriented, integrated knowledge management system, research cooperation spirit, and limitation in financing (7). Ghorbani et al. also concluded that the structural requirements of the third-generation universities in medical sciences universities included macro-structural requirements (institutional requirements) and micro-structural requirements (organizational requirements). Among these, knowledge management and translation, including production, evaluation, and combination of knowledge, were mentioned as one of the organizational requirements of the third-generation university (8).

On the other hand, Iran is one of the countries with many universities and research centers in the area of the medical sciences that constitute a significant part of the country's scientific production in the health area (9). However, the issue of entrepreneurship in the medical sciences has not been studied much; a look at upstream documents such asthe Third Economic, Social, and Cultural Development Planof the Iran, shows the development of entrepreneurship. The entrepreneurship development plan has also been approvedin the Iran's medical sciences universities. According to the issue mentioned above, in addition to role-playing in science production, the entrepreneurial university has a crucial role in developing entrepreneurship and business (10). However, in a complex and ambiguous environment and the emergence of new technologies, the continuation of the traditional role of medical universities by relying on the two goals of education and research does not confirm their long-term survival (11). Therefore, to achieve third-generation universities by applying the knowledge produced is essential.

Regarding the importance of the research topic, the difference between the third-generation universities and previous generations is the application of knowledge produced in society, which leads to job creation, wealth creation, and knowledge dynamics. The third-generation university will not depend on natural resources and government budget and is itself a source of entrepreneurship and production of financial resources. At the same time, the second-generation university and before is based on education and research, the quantity and quality of its appearance. Hence, students in third-generation universities will be creative, innovative, and wealth creator. However, universities are influenced by that country's specific factors and characteristics, and naturally, Iran is no exception.

Accordingly, and considering that no research has been done to identify the factors affecting the production of science in the country's medical universities to move forwards third-generation universities, the present study aimed to identify the factors influencing the science production to achieve the entrepreneur university from the faculty members' perspective of Iran University of Medical Sciences (IUMS). The results of this research can be a prelude to entering the path of developing the capacity of science and applying them to achieve the goals of the 20-year vision document. Identifying the factors affecting the process of science production and applying them at the university level will also improve and accelerate the application of scientific research results.

Methods

The present applied study was descriptive-analytical and cross-sectional. The purpose of this study was to identify the effective factors of science production to achieve the goals of the entrepreneur university from the faculty members' perspective of IUMS. The study's statistical population included all 918 faculty members of IUMS. Sampling was random-stratified, and 270 people were included in the study. Research classes included instructor, assistant professor, associate professor, and professor. The data collection tool was a researcher-made questionnaire designed based on a literature review (12-18). The first part of the questionnaire was the information and demographic characteristics of the respondents (gender, age, work experience, place of work,and academic rank). The second part of the questionnaire consists of 68 questions related to managerial factors (seven components and 21 questions), structural (two componentsand 14 questions), cultural (four components and 22 questions), human (three components and 11 questions) affecting the science production, obstacles and challenges of entrepreneurial university (16 questions). Scoring was based on a 5-point Likert scale with strongly disagree (one) and strongly agree (five). The content validity of this questionnaire is based on the opinion of five experts of the medical library and information science. In addition, its reliability was confirmed by 20 people with Cronbach's alpha of 0.87. The link to the designed questionnaire was providedto the faculty members of IUMS via email, and the professors who wished to participate in this research completed and returned the questionnaire. According to the sample size, the researchers collected the questionnaires until they reached the desired number (according to the sample size). Then, the data were analyzed using SPSS software version 23 basedon descriptive statistics of frequency, mean, frequency percentage, and standard deviation. Also, Student's t-test and Friedman test were used to confirm and rank the factors.

Results

Of the 270 participants, 98 were female, and 172 were male. Most participants (79.3%) were in the age group of 41-50 years and after. 76% of the participants had more than 15 years of work experience, 69 were assistant professors, 114 were associate professors, 13 were instructors, and 74 were professors.

The results related to the faculty members' perspective of IUMS regarding the factors affecting the science production are shown in Table 1. Given that the Likert scale is used to score questions; therefore, the number 3.00, which indicates the average level measured, was used to confirm the effective components. The mean of faculty members' opinions was compared with the theoretical value (3.00) by t-test. If the score of the required component is more than the theoretical value (3.00), the desired component has been approved from the faculty members' perspective.

According to Table 1, all the management, structural, cultural, and human factors and components raised from the perspective of faculty members were effective in discussing science production ($P < 0.05$). The results of the Friedman test showed that the crucial management component was "university innovation management," the essential structural component was "scientific structure," the essential cultural component was "communication and collaboration," and the crucial human component was "employing and promoting innovative, entrepreneurial and community-oriented human resources."

Table 1. Evaluation of the faculty members' perspective of IUMS regarding the factors affecting the science production

Factor	Component	Mean	SD	Mean Rank	Priority
Management factors	University innovations Management	4.13	0.78	5.08	1
	Management of the evaluation and quality assurance of the capabilities of the third-generation university	4.15	0.82	4.70	2
	Knowledge management at the university	4.07	0.77	4.53	3
	Development of the vision and strategies of the third-generation university	4.05	0.79	4.15	4
	Proper research leadership	3.81	1.11	3.60	5
	Establishment of strategic relationships with relevant stakeholders	3.83	0.94	3.42	6
	Sustainable and diversified financial management	3.56	0.72	2.51	7
Structural factors	Scientific structure	3.61	1.02	1.54	1
	Organizational structure	3.69	0.93	1.46	2
Cultural factors	Communication and collaboration	3.98	0.95	2.99	1
	Creativity and innovation	3.87	0.67	2.46	2
	Value of applied research work	3.76	0.92	2.28	3
	Risk-taking	3.67	1.00	2.26	4
Human factors	Employing and promoting innovative, entrepreneurial, and community-oriented managers and human resources	4.01	0.56	2.11	1
	Educational empowerment to move forward third-generation university	3.97	0.82	2.03	2
	Empowerment of research to move forward third-generation university	3.92	0.81	1.86	3

Discussion

The purpose of this study was to determine the factors affecting the science production to move toward third-generation universities from the faculty members' perspective of IUMS. According to the results, all the managerial, structural, cultural, and human factors raised in discussing science production were effective from the faculty members' perspectives. In the study of Fadayi et al. in 2018, it was found that the model of creating an entrepreneurial university based on science production techniques and futurism requires management dimensions and components such as integrated knowledge and management in providing financial resources and structural factors. Cultural factors such as the spirit of collaboration are also mentioned in this study (7). The findings of the 2019 study by Secundo et al. showed that knowledge management in an entrepreneurial university could lead to collaboration and knowledge creation in education and knowledge-based development support (19). In the research of Karimi and Naveh Ebrahim in 2020, it was found that there are several managerial and structural factors

in discussing science production (20). In the study of Zamani Moghaddam et al. in 2019, managerial, structural, and human factors were among the effective factors in improving the quality of science production in Sanandaj and Kermanshah Azad universities (12). The research of Ghorbani et al. in 2020 indicated that one of the requirements for IUMS to become a third-generation university is to pay attention to structural requirements at the micro and macro levels. Besides, one of the components of structural micro-requirements is the issue of knowledge management and translation, dealing withthe production, evaluation, and combination of science and knowledge (8). In the study of Bagheri et al. in 2015, structural factors such as coordination between scientific and research departments, purposeful planning, appropriate policies, and establishing an integrated system in the university were identified as effective in promoting the culture of science production. This study addresses the alignment of educational and research topics at the university level as an influential factor in science production (18). Shahbazi in 2020 indicated the role of scientific communication and academic culture as effective factors in science production and its promotion (21). The Gerbin and Drnovsek study in 2020 showed that academic researchers actively collaborate and share knowledge to ensure that knowledge transfer policies are adequately implemented at the university (22). The study conducted by Mirnezami in 2020 showed that collaboration with researchers with research grants could increase scientific output (23). A study by Fini et al. in 2021 found that an academic entrepreneur can influence the science production process. Also, new topics in scientific production can empower the entrepreneur (24).

The fundamental feature of the second-generation university has two fundamental roles of education and research and is evaluated based on the quantity and quality of education and research. Therefore, the obtained results revealed that management factors could affect science production and its transformation into a product in the third-generation university. The support of the university administrators in the form of providing educational, economic, and cultural infrastructure will make the university an entrepreneurial entity. On the other hand, reviewing the results of this study and comparing it with previous studies showed that the flexibility of the structure of an educational system, including organizational and scientific structure, is of significant importance for achieving the goals of an entrepreneurial university. In addition to managerial and structural factors, cultural factors will also affect the production of science. A dynamic organizational environment requires institutionalizing a culture of research and entrepreneurship. Along with all these factors, creative and innovative human resources are an entrepreneurial university's fundamental secret. Eventually, combining these factors will create an entrepreneurial university that innovates and creates wealth.

Conclusion

In general, according to the obtained results, all the factors mentioned in discussing science production including managerial, structural, cultural, and human factors were effective for IUMS to move forwards the third-generation university from the faculty members' perspective. Given that the realization of these goals may face challenges, so more efforts are needed to improve the status of the university and advance the goals of third-generation universities. Paying more attention to the factors mentioned in this study can improve this situation.

Declarations

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Conflicts of Interests

The authors declared no conflict of interest in this study.

Ethical statement

This article is a part of the master's thesis entitled "Factors affecting the science production to achieve the goals of third-generation universities from the faculty members' perspective of IUMS", approved by IUMS in 2020 with IR.IUMS.REC.1400.179 code of ethics, obtained from the National Committee for Ethics in Biomedical Research.

The authors considered it their duty to protect the personal information and privacy of each research participant. Therefore, they refused to provide the names and surnames of the individuals and an exclusive code was considered for each questionnaire.

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Authors' contributions

All authors contributed to designing, running, and writing all parts of this project.

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