Identifying Indicators of Change Management in Medical Education With a Focus on Third-Generation Universities

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Abstract- Transforming universities into third-generation universities is a prerequisite for future development. Therefore, awareness of the factors, structures, and practices that exist in higher education institutions and affect the potential emergence of entrepreneurship enables managers to plan to achieve specific results. It seems that the first step in managing this change is to identify the indicators that medical education and medical universities should have in the future. This study was conducted with the aim of identifying the indicators necessary to manage the change in medical education, Shahid Beheshti University of Medical Sciences, on the path to transition to third-generation universities. This study was conducted using a qualitative method and the two-stage Delphi method was used to conduct the research. The research tool was a questionnaire derived from literature on the concepts and components of third-generation universities, which was conducted with the participation of 15 key informants from Shahid Beheshti University of Medical Sciences regarding the research topic in 1403. The results showed that the university's support index for staff and student exchanges between the university and industry and organizations outside the university scored the highest with a score of 52, followed by entrepreneurship as a major part of the university's strategy with a score of 50, and internationalization as an important part of the university's entrepreneurial strategy with a score of 30. The lowest score was obtained. Medical universities are forced to move towards third-generation universities for their survival, and in this direction it is necessary to change their functions and structures, therefore, awareness of activities and changes in this direction is necessary and essential, both in order to change and improve the structure and in order to improve performance. It should be noted that creating entrepreneurial universities is not easy and "entrepreneurship and innovation" is complex, chaotic and lacks any linear concept. Universities can start working based on their conditions by changing a number of indicators and move in this direction and continue until the indicators are fully established.

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Introduction

The present age is the age of change and transformation. No organization, business or industry is exempt from these changes and is forced to change and evolve in order to adapt to the various needs of its stakeholders (1). The history of higher education also shows that the university itself is an institution that society has created to meet a series of its expectations (2). Naturally, the expectations and needs of societies have changed over time, and consequently, a third mission has been defined for universities, of which entrepreneurship and participation in the realization of a knowledge-based economy can be considered one of the most important. Of course, the importance of the first characteristic, namely entrepreneurship, has been more prominent, to the point that many experts and authorities have considered the third-generation university synonymous with the

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entrepreneurial university (3).

In fact, a third-generation university is a university with a third mission. The third mission, broadly defined, reflects the university's participatory role in the socio-economic development of society (4).

The third-generation university has the ability to create a focused strategic direction, both in formulating academic goals and in translating the knowledge produced in the university into economic and social tools.

In other words, the third mission of universities is linked to the economic and social development of society, and the concepts of innovation and entrepreneurship play an integral role in this developmental path. This third mission includes all activities that are linked to the creation, application, application and disclosure of knowledge and other capabilities of the university in the outer circle of the academic environment (3). In fact, universities can be considered as centers of entrepreneurship with multiple and integrated knowledge-based functions, ranging from the traditional development of pure knowledge and technology, participation in innovative ecosystems, to their role as catalysts of innovation performance and participation in society. But since this change is a movement from the current state to a desired state in the future and the consequences of the change are determined in the future (5) and unpredictability, ambiguity and uncertainty are inherent characteristics of the future, therefore this change is future-oriented and accompanied by ambiguity and uncertainty (6). And this makes the change management process one of the main organizational issues in universities.

Change management is the implementation of methods that change the internal and external processes of an organization. These methods include preparing and supporting employees, creating the necessary steps for change, and monitoring pre- and post-change activities to ensure the successful implementation of the changes. Change management includes processes, tools, and techniques used to manage the individual aspect of change and achieve the desired results. Effective communication is one of the most important factors for success in change management. All people involved must understand the progress at different stages and see the results. The clearer the changes are and the more everyone understands them, the faster and more fundamental the change will be (7).

In fact, university change management is an opportunity for active participation in the development of society, in which knowledge becomes a right and obligation for all, and provides a formula for the institutional development of the university, in which it develops new departments and activities of the university in accordance with the demands of society and leads to structural changes. Which ensure a better capacity of the university to respond to changes.

Although proactive activities have been initiated for some time regarding the achievement of third-generation universities, it is still unclear what policies or structures are necessary to effectively strengthen the transfer of academic knowledge, support start-ups, and ultimately contribute to socio-economic development.

In fact, there is no "unique" approach in this field(8) . Perhaps the first and most important step in aligning with the new academic generations is to re-engineer academic structures and create a platform for changing perspectives at the macro-level of policymaking and creating positive and transformative attitudes towards traditional university structures.

In Iran, the first developments towards the formation of third-generation universities began in the Ministry of Science, Research and Technology (9). With some delay, the Ministry of Health, Treatment and Medical Education also came to the conclusion that if medical universities did not open their doors to entrepreneurship, they would suffer stagnation (10).

In this change of attitude, government officials have accepted that moving towards a third-generation and entrepreneurial university is not an option; rather, it is an undeniable necessity, and medical universities, along with the changes and developments in other higher education institutions, are required to move from education-oriented universities to entrepreneurial institutions (11).

Universities that want to change from the second generation to the third generation face many challenges, and unless the university management provides a well-balanced and detailed plan for the transformation of the university to the third generation, the attempt to create change will only lead to frustration and confusion, and instead of improving the situation, it will make the situation worse than before. Change management is very difficult and this is one of the important aspects for the successful implementation of university transformation programs to the third generation (12).

Therefore, since the transformation of universities into third-generation universities is a prerequisite for future development (11). Awareness of the factors, structures, and practices that affect the potential emergence of entrepreneurship, and enable managers to plan to achieve specific results in this direction is essential (13) and since change management provides

facilitating factors for organizations in their activities for change, and in fact, mapping the organization's movement from the current situation to the desired future situation and determining priorities, tasks, and participation of individuals in the change process are among the functions of a change management program (14). It seems that the first step in change management is to identify the indicators that medical education and medical universities should have in the future, so in this study, the necessary indicators for managing the change of medical universities towards third-generation universities were examined.

Materials and Methods

The present study is applied research in accordance with the purpose of the study. First, in order to identify the factors and indicators of third-generation universities, an extensive literature review was conducted without time limits in relevant databases, and experimental and theoretical works in English and Persian were studied. The focus was on articles related to the concepts, requirements, indicators, and models of third-generation universities.

Then, using the identified factors and indicators and paying attention to upstream documents and instructions related to the movement of medical universities towards third-generation universities, a researcher-made questionnaire with 25 components was designed.

In order to validate the researcher-made research tool to assess content validity, two coefficients, Content Validity Ratio (CVR) and Content Validity Index (CVI), were used.

In the next stage, to finalize the extracted indicators, the expert opinion quantification method was used using the Delphi method to distribute the questionnaire.

The Delphi method was developed in the 1950s as a tool for forecasting the future for military and economic purposes. The Delphi method is used in a variety of situations and circumstances for decision-making in the field of health and medicine, which is carried out in multiple stages, which usually begin with a questionnaire being sent to panel members who anonymously complete the questionnaire, the responses are analyzed and reviewed, and the results are sent to the members and they are asked to complete the questionnaire again. This process occurs repeatedly, until the opinions of the interested categories are aligned and there is no need to make changes to the items (15-17).

The statistical population of this section includes experts and key informants in the subject under study, namely change management with a focus on entrepreneurial universities (third-generation).

Accordingly, in the present study, 15 professors and experts from Shahid Beheshti University of Medical Sciences who had experience and expertise in the field of entrepreneurial universities and were active in the scientific working groups of entrepreneurial universities and growth centers were selected using a non-random purposeful sampling method. Considering the high workload of the participants and the multiplicity of tasks, in addition to the spatial distance between the individuals, it was suggested that the surveys be conducted in person. In this Delphi study, two rounds were conducted.

The research tool in this study was a questionnaire that was extracted through reviewing reliable and relevant sources and texts, and included two parts of the participants' demographic information, and the second part included a table consisting of a column of indicators extracted from the texts and a column of importance, based on a 5-point Likert scale including completely inappropriate (1), inappropriate (2), relatively appropriate (3), appropriate (4), and completely appropriate (5); it was sent to the panel members; in the first round, a list of extracted indicators was provided to the members and they were asked to express their opinions about the proposed indicators and also to present their ideas and suggestions regarding the indicators that were not on this list. After presenting the indicators in the first round, suggestions and points of view were received regarding the integration of some indicators, and all suggestions and comments were reviewed and revised by the research team members. Finally, the final indicators were compiled and sent to the panel members. In the second round of Delphi, the panel members were asked to state the level of importance for each item on a 5-point Likert scale. Then, the scores obtained by each item were summed up and priorities were determined. Of the 15 questionnaires sent to the participants, 12 questionnaires were returned and entered the data analysis stages.

Results

In this study, first, through an extensive literature review without time limitation, indicators of change management in the path to achieving third-generation universities were extracted, and 25 indicators were extracted and provided to the participants for the first round of Delphi. After the questionnaires from the first round of Delphi were returned, based on the comments and suggestions of the participants, the indicators that were conceptually close to each other were merged, and

finally 12 final indicators were entered into the second round of Delphi. Of the 15 questionnaires sent to the participants, 12 questionnaires were returned and entered the data analysis stages.

The results of the analysis are presented in Table 1 in order of the score obtained, and it shows that the index of exchange of staff and students between the university and industry and organizations outside the university and the index of recruitment and attraction of people with entrepreneurial attitude, behavior and experience. With a score of 52, they obtained the highest score, and also internationalization, as an important part of the university's entrepreneurial strategy. With a score of 30. They obtained the lowest score.

Table 1. Final prioritized indicators for change management towards third-generation universities

Rank	Indicator	Description	Total Score (Max=60)
1	Staff/Student Exchange with Industry & External Organizations	Facilitating temporary exchange of personnel and students between the university and industry/outside organizations to enable continuous knowledge and experience transfer.	52
1	Recruitment of Entrepreneurial Talent	Hiring and attracting faculty and staff with entrepreneurial attitudes, behaviors, and prior experience.	52
3	Entrepreneurship as a Core University Strategy	Explicitly integrating entrepreneurship into the university's mission, vision, strategic goals, and performance indicators.	50
4	Knowledge Capitalization Mechanisms	Leveraging university-industry-community relations, incubators, science parks, and other external centers to convert academic knowledge into marketable products and economic activities.	49
5	Access to Incubator Facilities	Providing university staff and students with access to the resources, mentoring, and support structures of startup incubators and growth centers.	47
6	University Autonomy	Granting greater decisional, organizational, and financial independence to the university and its units to foster innovation and resource allocation flexibility.	45
6	Support and Encouragement for Entrepreneurial Staff	Implementing reward systems, recognition programs, and supportive structures to encourage and facilitate entrepreneurial activities among staff and faculty members.	45
8	Stakeholder Participation in Teaching & Learning	Involving external stakeholders (e.g., industry experts) in designing and delivering curriculum to teach and learn entrepreneurial skills, ensuring alignment with real-world needs.	44
9	Interdisciplinary & Entrepreneurial Education	Providing entrepreneurship education to all staff and students, integrating interdisciplinary studies, innovation studies, and real-world business challenges into the curriculum.	42
10	Organizational Structures for Entrepreneurship	Establishing dedicated organizational units (e.g., technology transfer offices, entrepreneurship centers) and assigning clear responsibilities to support entrepreneurial activities.	38
11	Reward System for Knowledge Commercialization	Implementing formal reward systems and incentive structures that recognize and compensate faculty and staff for activities related to knowledge commercialization and patenting.	35
12	Internationalization	Integrating an international dimension into the university's entrepreneurial strategy, including recruiting international entrepreneurial staff, participating in international networks, and adapting teaching/learning methods from a global environment.	30

Discussion

In the present study, the indicators of change management in medical education were determined based on the views of key informants, which are as follows.

The results of the study show that the exchange of staff and students between the university and industry and organizations outside the university is recognized as one of the indicators of change management with a score of 52.

Staff exchanges (experts, faculty members) are a powerful tool for the continuous exchange of knowledge and experiences between universities and industry. " Secondment " as staff exchange is a strong support mechanism for the effective transfer of knowledge and technology between universities and industry and, in its broader sense, varies from long-term placements to two-week visits and is widely used across universities, but is mostly embedded for staff exchanges of three months or more.

Benefits of secondment for universities

Understanding their research field, Access to real data, providing impactful examples, Expanding the range

of audiences, reducing workload by maintaining and nurturing relationships, Expanding the number of researchers involved.

Benefits of secondment for companies

Gaining and absorbing new capabilities, accessing non-core facilities and facilities, solving specific problems, accessing different thinking, building a wider network of audiences, anticipating new technologies and new directions, Assessing own capabilities.

Etzkowitz (2022) describes one of the proposed educational models for achieving third-generation universities as the professional professor model, suggesting that the appointment of a professional professor should be revised based on the idea that he is hired to work half-time within the university (i.e., 50%) and the other half-time outside the university (i.e., 50% in the company). Adherence to the dual role allows the idea and concept of professional professors to seamlessly transform the university from a purely educational option to a university with a research mission (18).

Chryssou (2020) examined the nature of existing university-industry interactions in Omani universities and identified barriers. One of the most important mechanisms that she points to for stimulating collaboration is regular staff and knowledge exchange, and in this regard, she suggests inviting industry guests to promote university-industry-related activities and participating in joint committees. Chryssou points out that the most important mechanism for collaboration is regular staff and knowledge exchange. However, although academic staff strongly believe that interaction should include designing industry-based curricula and encouraging industrial visits by students, industry staff place greater emphasis on informing university-related activities and including industry staff in university committees (19). This confirms the results of the present study and the importance of staff exchange between universities and industry.

In confirmation of the study results, we can refer to the study by Khaki Seddiq, which examined the metrics for measuring the distance between universities in the country and entrepreneurial universities, and stated that the performance in one of the metrics, titled external relations for the development of entrepreneurship (facilitation of the active presence of university members in bodies outside the university), was very low in universities in the country (20). This highlights the importance of staff exchange between universities and industry and the need for planners and policymakers to pay attention to this issue.

Another indicator that has the highest score in this study with a score of 52 is the recruitment and attraction of people with entrepreneurial attitude, behavior and experience.

It can be said that in order to help the growth and development of organizations, attracting people with innovative skills and also identifying the characteristics and suitable platforms for attracting and growing innovators and entrepreneurs is one of the most fundamental issues of the day for organizations (21).

The present study is consistent with the results of the study by Timurzadeh (2019) that examined the "innovation capabilities of Iranian universities of medical sciences." Timurzadeh cites the recruitment of qualified individuals as one of the factors of innovation in universities and points out that this is possible through updating laws and regulations and policymaking (22).

The European Commission has also included in its evaluation of universities the inclusion and recruitment of individuals with entrepreneurial attitudes, behaviours and experience as one of its criteria (23). In his study, O'Shea also states that MIT has a vision of being "a university of excellence"; thus, it has sought to attract the highest potential faculty and students. Indeed, a key element of MIT's success is its distinguished and distinguished faculty and their ability to innovate and Capitalization of Knowledge (24).

Another indicator of change management in medical education towards the third-generation university in this study is entrepreneurship as a major part of the university strategy, which has been scored with a score of 50.

In fact, universities should consider themselves as entrepreneurial organizations and environments, which are also linked by shared missions and values, and not strict control systems. In order to develop an organization's entrepreneurship, entrepreneurial activities should be reflected in the organization's strategy

Therefore, the university should have a mission statement that includes an entrepreneurial vision for the future. In addition, specific entrepreneurial goals, along with performance indicators related to the goals, should be stated in the strategy. The strategy should be known throughout the university and considered a priority. And there should be a commitment from the university president or faculties to review and update the strategy (12).

In support of this conclusion, the Council of the European Union's approval of the inclusion of entrepreneurial phrases in university mission statements as one of the items for evaluating entrepreneurial universities can be cited (25).

Yazdani (2023) in his study entitled Designing and Presenting a Transition Model Towards Entrepreneurial and Innovative Medical Universities in the Islamic Republic of Iran with an Emphasis on Knowledge Service Innovation states that structural capital is one of the requirements for achieving service innovation in entrepreneurial medical universities and explains that this structural capital includes the institution's mission, vision, core values, and strategies, work systems, and internal processes (26).

On the other hand, Gibb states that the degree to which university leadership is trying to take responsibility for the above issues in faculties and departments is a major issue in the development of entrepreneurial universities (27).

Also, in confirmation of this study's result, it is possible to refer to the emphasis of Etzkowitz (2016) on considering the program and strategic direction of entrepreneurship in universities, that in the initial stage, an entrepreneurial university or an entrepreneurial academic institution must have a strategic view of its direction and acquire the ability to determine its priorities (23).

All of these points indicate the importance of considering entrepreneurship and programs and activities for the development of entrepreneurship as a university strategy and confirm the results of the present study.

Another indicator is capitalization of Knowledge exchange through university-industry and community relations, incubators, science parks and other centers outside the university, which is ranked next with a score of 49.

In general, university-industry interaction is an essential part of the entrepreneurial process, providing access to a rich source of information, opportunities and privileged resources and creating conditions for the effective exchange of information and resources, which in turn reduces uncertainty.

Therefore, communication should be considered as a core part of the entrepreneurial process and is very important in expressing any vision of an innovation and should be used to gain support from the rest of the organization and in developing intentions and action towards this vision, as well as to fertilize ideas (28).

Zhu *et al*., (2008) in a study titled: "Creating an Entrepreneurial University in the Evolution of the Triple Curve: A Case Study of Northeastern University in China" argue that the path of entrepreneurial universities is made possible through pressure from government, industry, and university collaboration, and this process can be strengthened through industry participation by investing in research with potential for industrial application (29).

Industry-university-government collaborations have different objectives, scope and organizational arrangements. They may focus on education or research and may be formal or informal. They may also vary in intensity from joint research and development (R & D) to interaction through scientific conferences. In more developed cases, industry may license intellectual property (IP) generated by universities, or may interact with universities through the transfer of human capital and publications. Interactions may also be short-term or long-term in nature. The former may take the form of problem-solving, on-demand through consultancy arrangements or contract research, while the latter may take the form of strategic partnerships between universities and industry. Accordingly, three types of knowledge exchange can be identified:

Type 1: Seminars, workshops, training, publications, grants and research grants, which constitute the initial stages of development and create and promote an environment of mutual understanding between the actors.

Type II: Contract research, academic consulting, and faculty exchange, longer than Type I interactions.

Type III: Science parks, incubators, spin-offs, and patent licenses, as well as opportunities for participants to interact more closely over longer periods (19).

One of the criteria for measuring the distance between the country's universities and entrepreneurial universities is external relations in the direction of university entrepreneurship development (20) and it is a confirmation of the necessity of interactions and communication in the transition of medical sciences universities towards entrepreneurial universities.

The Capitalization of Knowledge first started in England in the early 1980s and then the continent of Europe spread first in the Netherlands and then to other Northern European countries and recently to Southern European countries such as France and Italy (30).

Regarding the Capitalization of Knowledge, different definitions have been expressed, but in general, it can be defined as the process of converting theoretical knowledge available in academic (educational) institutions to some types of economic activities. In other words, it is a process in which knowledge produced in universities and educational and research centers is converted into marketable products of industrial processes (31).

Azari *et al*., (2020) in their study examined the impact of the research-based higher education system on entrepreneurship with the role of mediating knowledge

capitalization in universities to present a model. In this study, Azari emphasized the positive and meaningful role of knowledge capitalization on entrepreneurship in free universities in Mazandaran province and stated that research universities are inherently entrepreneurial foundations and by promoting knowledge and training graduates and faculty members needed by the industry, the interaction between industry and university facilitates the transfer of science and technology and increases insight into long-term strategic directions. Finally, the author suggests that Azad University managers and policymakers hold workshops, seminars, gatherings, and conferences to familiarize professors with knowledge capitalization and expand academic entrepreneurship infrastructure, including science and technology parks and growth centers (32). Which is consistent with the results of the present study and confirms the importance of knowledge capitalization for university entrepreneurship.

Also, in confirmation of the results of the present study, it is possible to refer to Etzkowitz (2000) who stated that capitalization is one of the methods that can link science with wealth generation and achieve the goals of the entrepreneurial university. To the extent that one of the main reasons for the rapid advancement of knowledge and technological development in advanced countries is the attention to the process of capitalization of university research results in these countries (33).

Our industry, trade and market and in general our economy lacks a scientific root and relies on modern knowledge, and our scientific productions are mostly locked in the shelves of libraries. And on the other hand, due to the conditions of competitive economy and rapid environmental changes, the issue of capitalization of academic knowledge and research has become one of the essential priorities of the Ministry of Science (34). Capitalization of knowledge can be considered in entrepreneurship and reaching third generation universities.

Based on the results, the possibility of accessing the facilities of the incubator for staff and students with a score of 47 is the next effective indicator in the management of change in medical education in the transition to third generation universities.

Incubators are used by universities to support start-ups and to build connections with industry. Incubators often provide access to laboratories, research facilities, IT services, mentoring, consulting, training, and access to investors. To get a high score, the university must have development centers that provide these services (12).

Etzekowitz *et al*., (2000) have considered granting licenses to operate incubators and the like as one of the characteristics of entrepreneurial universities (33).

Habibi Rezaei and Siah Mansouri (2012) also considered policy-making and organized measures to utilize the capacities of university growth centers through the promotion of a culture of innovation, creativity, and entrepreneurship essential for the realization of third-generation universities (21).

The findings of Shahvardiani's (2010) study also indicated that the development of incubators and innovation centers and science and technology parks in universities will lead them to move on the path of development and growth. Therefore, it is necessary to prioritize the establishment of these centers and parks in university development planning (35).

These studies confirm the results of the present study and emphasize that the entrepreneurial university should act in an entrepreneurial manner and organize incubators and science and technology parks, and help students create and launch businesses by participating in these structures (36).

Universities that are developing themselves to become third-generation universities should expand the provision of entrepreneurship education to all their staff and students (6).

One of the main issues that should be considered in the framework of the development of an entrepreneurship university is entrepreneurship education, and in this regard, the need to address a number of key issues, including: identifying the types of educational programs needed throughout the university, linking the dynamic of entrepreneurship education to University strategy, mission and goals; determining the location of these programs within the university; knowing how to create ownership with a trans-university approach; demonstrating how such programs can add value to the work of faculties and departments; developing the competence of staff to deliver new programs and training; expanding the role of student projects and work experience programs is essential (27).

Moghaddisi *et al*., (2015) in their study examined the factors affecting the transformation of medical universities into entrepreneurial universities in the higher education system and stated that one of these factors is university curriculum planning with the variables of offering optional courses, familiarity with entrepreneurship concepts, and changing teaching methods (conducting team activities in the classroom with an entrepreneurial approach related to the relevant course (37).

Etzkowitz *et al*., (2022) present an entrepreneurship

education program as an educational model to accelerate the transition to an innovative and entrepreneurial university: explaining that the program provides a framework for educating technically and socially literate entrepreneurs. The program is based on the premise that highly specialized degrees, appropriate for a relatively stable industrial society, are increasingly obsolete in rapidly changing societies, and that degrees designed to meet the specific needs of the industrial society are often perpetuated, and that instead of a set of knowledge and skills to cope with a stable environment, a broader range of knowledge and skills is needed to function in societies in flux.

The program is designed to produce graduates with a sound understanding in three areas:

-Interdisciplinary education within the traditional set of academic disciplines

-Entrepreneurship and innovation studies relevant to local and global contexts.

-Studies of languages and innovative cultures of countries other than one's own (18).

In confirming the participation with external stakeholders in teaching and learning entrepreneurship skills, we can refer to Brigal's study (2020), which states; Allowing companies to design and deliver the curriculum not only involves them in the primary mission of universities (i.e., teaching), but also aligns the curriculum with industry needs.

In confirming the participation with external stakeholders in teaching and learning entrepreneurship skills, we can refer to Brigal's study (2020), which states; Allowing companies to design and deliver curriculum not only involves them in the core mission of universities (ie teaching), but also aligns the curriculum with industry needs (38).

Universities and industry can create a real and effective learning environment by challenging students to work on real business problems, research experiments, or unsolved tasks that companies have yet to complete (39).

In confirmation of this result, we can refer to the results of Chryssou 's study, which states that curriculum design based on industry participation is one of the interaction mechanisms of Omani universities (19).

In Yazdani's (2023) study, the requirements that must be considered in transition to innovative medical universities include the participation of innovative individuals and specialists in teaching and learning innovation and empowering employees and innovative thinking skills (26). This is a confirmation of the results of the present study and the importance of stakeholder participation in teaching and learning entrepreneurial skills.

The results of the study show that the two indicators of autonomy of the university and other university units and support and encouragement of entrepreneurial employees, with a score of 45, are the next indicators of change management in the transition to a third-generation university.

In recent decades, governments have been encouraged to give universities greater autonomy for a number of reasons, including the growing demand for higher education and the increasing awareness of their role in society and in promoting economic development (40).

On the other hand, the main characteristics of third-millennium universities are summarized in institutional autonomy, the inseparability of education and training, academic freedom, and international awareness. This emphasizes the need for university autonomy in order to achieve third-generation universities.

In fact, the university should maximize the autonomy of its units and focus on the entrepreneurial event rather than the individual entrepreneur, and this entrepreneurial event involves relative autonomy, meaning that innovators need relative freedom to allocate resources. (12).

Aghatabar Roudbari *et al*., (2017) in a study titled "Investigating University Independence from the Perspective of University Experts" conducted on 50 experts from Noshirvani University of Technology and Babol University of Medical Sciences, states that university independence is one of its structural and functional requirements, because the specialized complexity of knowledge requires universities to be independent.

On the other hand, considering the announcement of various programs that are sometimes carried out unexpectedly and suddenly at different stages of each year and that medical universities are required to carry out, such as moving towards a third-generation university and other transformational programs, for the implementation and operation of these programs, independence is required in the dimensions of staff independence, true independence, organizational independence, academic freedom, and financial independence (51) And this is a confirmation of the results of the present study (41).

In Chryssou study (2020), one of the perceived barriers to industry engagement is the lack of autonomy of university units to work with industry (19). This emphasizes the need for autonomy of the university and university units as one of the indicators that should be

considered in the transition to third-generation universities.

In support of the results of the present study, it is possible to refer to the definition of the entrepreneurial university by Etzkowitz (2004), which states that the entrepreneurial university has the ability to innovate, identify and create opportunities, and as it educates students and sends them out into the world, the entrepreneurial university is a natural incubator that provides support structures for professors and students to initiate new intellectual and social ventures (42).

Other indicators of change management in medical education in the direction of third-generation universities that received the lowest scores in this study include internationalization, an important part of the university's entrepreneurial strategy, attracting entrepreneurial and international staff for education, research, and supporting the activities of departments and faculties in international networks.

One of the main characteristics of the third millennium universities is their international awareness and can be described as:

They operate in an internationally competitive market and actively compete for better academics, better students and better research contracts.

-They are network universities, in partnership with industry, private research and development, investors and professional service providers.

They are related to the whole world and act in an international situation and use English as the new mediating language for all courses (6,43).

Having an international perspective at all levels is recognized as one of the characteristics of the third - generation university. Since internationalization is widely associated with strategic processes, universities must be able to make informed decisions to institutionalize activities as well as evaluate and improve performance with respect to different objectives related to a wide range of international activities. A university cannot be third generation without being international, but it can be international without being third generation (12).

In his study (2021), Mobaraki examined the factors affecting the internationalization of the entrepreneurial university. The results of the study show that the internationalization of the entrepreneurial university leads to increased potential for job creation, innovation, and competitive advantage (44).

The university should make a clear effort to recruit entrepreneurial and international staff. The university could have special positions for international recruitment and have dedicated programs/resources for doctoral students organized by a central office. Recruitment should be done in a way that matches the requirements of the university (12).

Abbasside (2020) in his study presented a model for measuring the readiness of Urmia University to become a third-generation university and considered the internationalization of education as one of the factors for achieving third-generation universities and a broad response to globalization, explaining that if the internationalization of higher education is prioritized in our educational system, the issue of quality and funding will naturally be affected, because by implementing internationally accepted indicators for a university, the desired quality is ensured. Abbaszadeh concluded that there is a positive and significant relationship between internationalization and the quality of higher education, and that the university's source of income can also be changed from government budgets to dedicated revenues by attracting or sending labor to other countries (45).

Although the context and type of activities carried out in universities of medical sciences and universities of the Ministry of Science are different, the results of these studies show that considering the internationalization of education as one of the indicators that should be considered in order to achieve third-generation universities is important, and the fact that it has the lowest score in the present study may be due to the fact that, according to experts, universities of medical sciences are at the beginning of the transition to third-generation universities and still have a long way to go. First, the necessary structure and infrastructure must be created in the universities, and then in the next stages, they should move towards internationalization.

Contrary to the results of the present study, which gave a low score for internationalization, Maleknia *et al*., (2018) in their study mention increasing international scientific and academic exchanges as one of the solutions needed by the higher education system in response to the developments of the globalization era and explain that international academic scientific cooperation has become one of the tools of countries to advance foreign policy and can include improving the quality of education and research and scientific standards of universities, training graduates who are aware of international issues and sensitive to intercultural issues, improving and promoting the image of universities at the international level, and transferring and localizing advanced knowledge and technologies (46).

Access to new ideas of teaching and learning from an international environment can enhance a university's

ability to compete in the international marketplace. Therefore, a university should have a teaching and learning environment suitable for a global audience. This can include classroom activities with a global dimension, study abroad, international exchanges and internships (12).

In a study in the United States (2017), Paine pointed out that globalization is a major part of the current discourse on teaching, and that preparing students or introducing new teaching methods can be improved by learning from teaching methods elsewhere (47).

Bagheri (2019) conducted a study with the aim of identifying and validating the dimensions and components of improving the medical education system to an international level in Iran, and concluded that the internationalization of education is one of the dimensions of improving the medical education system. Bagheri points out that the internationalization of education requires, on the one hand, strategic and long-term policy-making for appropriate measures to improve research, educational and service activities, and on the other hand, coordination between different departments of a university is essential for internationalizing the activities of universities and creating a dynamic environment (48).

As it turned out, the internationalization index of medical education and entrepreneurial activities of medical universities at the international level, despite having a low score in this study, is of particular importance. It seems that it is necessary to take measures at the university level, as well as documents, programs, and higher-level policies, in this regard and allocate the necessary infrastructure and resources to advance this goal (index).

Medical universities are forced to move towards third-generation universities for their survival, but with all the efforts being made to find a suitable way to achieve the characteristics of an entrepreneurial university, one should not expect that the entire path will be completely transparent and the same for all universities in advance. Instead, one should be aware that creating entrepreneurial universities is not easy and that “entrepreneurship and innovation” is complex, chaotic, and lacking any linear concept. In this path, it is necessary for the functions and structures of universities to change, so awareness of activities and changes in this direction is necessary and essential, both in order to change and improve the structure and in order to improve performance. Universities can start working based on their own conditions by taking action to obtain a number of indicators and move along this path and continue until the indicators are fully established.

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