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Innovation capability in medical sciences universities: A qualitative study of Iran

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Abstract:

BACKGROUND: Innovation is a competitive advantage, with its preservation and continuity dependent on the organizational innovation capability. This study was conducted with the aim of determining the innovation capability dimensions and components in medical sciences universities of Iran.

METHODS: The present study is a qualitative study with content analysis approach, undertaken in 2016–2017. The data processing included 10 deep interviews with the experts of the health innovation domain in top management of the three types of the medicine sciences universities of Iran with >5 years of experience. Targeted data sampling was performed using snowball method and continued until the saturation of the data. Data analysis was performed using conventional content analysis method using Maxqda 12 software.

RESULTS: Data analysis resulted in the extraction of 28 categories and 8 main themes including communications and interactions, innovation climate, university setting, policy factors (policy-making, rules and regulations), organizational culture, organizational resources, management and leadership, and organizational learning in two university internal and external dimensions.

CONCLUSION: To accelerate innovation in medical sciences universities, recognizing the potential of innovation capability is essential.

Keywords:

Content analysis, innovation capability, Iran, medical sciences universities

Introduction

Innovation is the only possible way of survival and development of organizations in today's highly competitive markets.^[1] The innovation is effective in the socioeconomic and political status of the countries and is affected by the performance of the organizations' discipline.^[2] In a comprehensive definition, the innovation is defined as the organizational potential for rehabilitation of products, services, processes, strategies, and new managerial activities.^[3-5] Development, improvement of performance, and increasing the productivity of the organization are some

of the reasons for paying attention to the innovation.^[6-9] Innovation is not created by accident; it requires systematic management of the accessible influential components in the organization.^[10] An organization can create innovation only in case it has innovation capability.^[11] The innovation capability is the capability, talent, and competency of achieving innovation in the future.^[12,13] A set of organizational skills, knowledge, and experiences to compile and deployment of an innovation strategy including the creation, development, and optimization of resources for the innovation is called the innovation capability.^[14,15] The innovation capability can maintain the innovation currently existing as well as the future organizational innovation.^[16,17]

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Numerous factors affect the organizational innovation capability; the employees' experience, knowledge, and skill directly affects the organizational innovation capability.^[18] The innovation capability assigns widespread spectrum dimensions and components to itself in the literature. Personal and organizational learning, R&D, marketing, resources, and organizational strategy have been introduced as the organizational innovation capability components.^[19,20] Other potentials effective in organizational innovation capability include the organizational structure and strategy, market strategy, human resources management, culture, and sociopolitical factors.^[21,22] In each organization, the innovation capability as a competitive advantage is vital; further, the recognition and evaluation of innovation capability are seen as essential when focusing on the development of innovation capability.^[8] Considering that: (1) Despite the number of studies concerning the drivers and outcomes of innovation, research that encompasses all the relevant constructs in an integrated manner remains rather limited.^[23] (2) Because the nature of the innovation is intangible, therefore, its measurement is difficult.^[7] and (3) In different organizations and even in different parts of an organization, the components of the feature's capabilities can be different.^[24] Hence, according to the researchers' recommendations, all the academics and experts must focus on introducing a new method of innovation capability development.^[25] Adopting a comprehensive method of conceptualizing the innovation capability can effectively provide an opportunity for realization and management of innovation capabilities in the universities. This study, therefore, was undertaken with the aim of determining the dimensions and components of innovation capability in medical sciences universities of Iran.

Methods

This study is a qualitative study which has been conducted using a conventional content analysis method with inductive approach. In the conventional content analysis, themes of data are obtained simultaneously with text content analysis. In this approach, the researcher to obtain in-depth understanding of the phenomenon.^[26]

The study was conducted from June 2016 to July 2017. The study population included all the experts of the health innovation domain located at the Ministry of Health and Medical Education or universities of medical sciences and top management of the medical sciences universities with >5 years of experience from among them; 10 people were selected using purposeful snowballing sampling method.

The data were collected through deep interviews and all the interviews were performed through previous

appointment in a place convenient for the interviewees. Before the actual interview, the study objectives, confidentiality of the information, and voice recording of the interviews were described for the interviewees. Two primary and pilot interviews were conducted for the refinement of study questions or designing new questions. The interview started with an open question "What do you think of the innovation capability in medical sciences universities of Iran? Please describe?" and subsequently, the main questions of the study were asked including "what are the components and dimensions of innovation capability in medical sciences universities of Iran?" and "what elements, capacities, or factors in medical sciences universities can help the innovation?"

Data analysis results of one interview were used as a guide for the next interview. Accordingly, the sampling was performed continually until the data saturation and to the point where no new code was extracted. The saturation of data was achieved after eight interviews but was continued up to 10 interviews to be on the safe side. The time of interview was variable between 45 min and 90 min; considering the importance of time for the managers, however, the required time was agreed on with the interviewees before the actual interview, and he incomplete interviews were completed in the next session. The compliance with the ethical principles in the research process like the conscious consent, unanimity, confidentiality, and option to leave the study was observed in relation with the participants.

By prolonged engagement of the researcher with the research subject, the data and member check through which part of the interview together with the initial codes were reviewed and confirmed by the participants; the study credibility was achieved. The confirmability was measured through external checks familiar to the qualitative studies and innovation management; that is, parts of the interview together with the relevant codes and the emerged codes were reviewed and confirmed by two supervisors familiar with the qualitative studies and innovation management. The dependability criterion was obtained through immediate note-taking as well as accurate and complete recording of the research procedure so that the possibility is created for others to follow-up of the study. The transferability criterion was achieved through maximum sampling variation, which is the selection of participants with age, sex, positions, and university differences.^[27]

The data were analyzed in seven steps adopting Conventional Content Analysis Approach and using MaxQDA12.^[26,28,29] The interviews were carefully listened, then copied, and typed; all interviews were coded as the unit of analysis; words, sentences, or paragraphs of the

interview texts were taken as semantic units. Then the semantic units that were related to the original content were placed next to each other and labeled with a tag as code; reviewing the whole text after coding, comparing the codes in terms of similarity and difference, and categorizing them under categories and subcategories were performed with a more abstract tagline; Precise and deep reflection on the primary categories, the agreement of the researchers on the primary categories, subcategories and categories, the comparison of categories with each other was done; and finally, the latent content was extracted as the study theme.

Results

Most of the participants were male with the average age of 47.9 and the average management job experience of 16.3 years. Table 1 shows the demographic data of the participants. Data analysis resulted in 293 codes, 28 categories, and 8 themes, which were classified in two university internal and external dimensions. Tables 2 and 3 show the themes, categories, and a number of open codes extracted from the interviews of the managers regarding the innovation capability in medical sciences' universities of Iran.

Innovation capability/university external dimension

Two main themes, "the communication and interactions" and "innovative climate," pertaining to external dimension of the university were extracted from the interviews, as the innovation capability in Iranian medical sciences universities. Table 2 shows the themes and categories of external dimension as the innovation capability extracted from the interviews of managers at Iran's medical sciences universities.

External communication and interactions of the university

This item includes three "government," "other universities," and "industry" categories and 13 subcategories. The participants considered as important the communication and interaction with outside of the university for creating innovation in terms of ideas, financial and spiritual support, or facilitators of the steps taken to innovate the university. they believed that such interactions and communications were mostly of supportive and facilitating role but the intra-university capabilities play a key role in innovation. They assigned

significance to the relationship and interaction with the "government," "other universities," and "industry" which have been classified into three categories.

Governments category

Based on the study findings, it was determined that the governments' role in terms of the financial support, policy-making, and special incentives is more conspicuous in relation with the promotion of innovation.

Other universities category

The participants in this category have referred to the relationship with international universities, other medical sciences universities, and the Ministry of Sciences universities as the subcategory group. Interaction and communication with other universities with the goal of individual and organizational learning, acquisition of up-to-date knowledge, research and the use of facilities, and the creation and development of interdisciplinary courses can be considered an innovative feature.

- Participant number 2: "The communication of universities with science universities, leading to good ideas, would be effective in innovation"
- Participant number 3: "Many of the innovations come about from the confrontation of sciences, for example, medical physics."

Industry category

Communication with the industry helps the university's innovation. With the collaborative research, the gap between the university and industry can be reduced. Participants considered making the knowledge applied, solving the industry problems, commercializing the university products, and using the successful experiences as the most important objectives of communication with the industry.

Participant number 8: "The health sector body also will need to address some of its problems or requirements; and relationship with the industry is crucial for an idea to transform into product so that the problem could be resolved or the requirement could be fulfilled; and also such a relationship is a path toward innovation and creativity."

Innovative climate

The spirit and feeling of society dominate redeemed advertisements as the existing climate. The innovative climate of the society can act as a catalyst and encouragement

Table 1: Demographics of participants

Features	Number of participants (10 people)	Age (mean=47.9)	Management experience (mean=16.3)	Executive side (head of department or university deputy, senior director in the ministry)	Academic rank (associate professor, professor)	Research experience (research project, article, patent, and innovation)
Domain	8 men, 2 women	40-60 years old	8-25 years	5-25 years	3-20 years	H-index: 8-40

Table 2: Themes and categories of external dimension as the innovation capability at Iran's medical sciences universities

A number of open codes	Subcategories (n=24)	Categories (n=7)	Themes (n=2)
Grant	Financial support	Government	External communication and interactions of the university
Bank loans	Nonfinancial support		
National flourishing fund	Government policy		
Tax exemption			
Culture			
Promoting innovation			
Modeling and encouraging innovation			
National innovation system			
Policy Department of Presidential S and T			
Policy Department of Ministry of R and T			
SCCR policy			
The rules and regulations of knowledge-based companies			
Comprehensive scientific map of the country			
Policy of the Supreme Council of the Presidency			
General employment rules and regulations of the country			
Education			
Individual and organizational learning			
Acquire knowledge up-to-date			
Use of facilities and technology			
Creation and development of interdisciplinary courses			
Contribution to the training			
Collaborative research			
Student entrepreneurial environment			
	International communication	Other universities	
	Contact with the universities of the Ministry of Science		
	Contact with other medical universities		
	Contact with Islamic Azad Universities		
	Grant applying knowledge	Industry	
	Solve industry problems		
	Collaborative Research		
	Use successful experiences		
	Commercialization of university products		
Guarantee the purchase of the product	Social Welfare	Economic and social factors	Innovative climate
financial assistance	Life conditions		
R and T support funds	Culture		
Providing physical space			
Providing facilities, labs			
Family support			
Spiritual support			
	Community need	Environment opportunities	
	Community health		
	Urgent support for some technologies		
	National Flourishing Fund	Society support	
	Financial incentives		
	Insurance	NGO institutions' support	
	Health angels		
	Guaranteed companies		

SCCR: Supreme Council of the Cultural Revolution, NGO: Non-governmental organizations

Table 3: Themes, categories and a number of open codes of internal dimension as the innovation capability at Iran's medical sciences universities

A number of open codes	Subcategories (n=39)	Categories (n=21)	Themes (n=6)
The existence of different sciences	Diversity of disciplines	Environmental complexity	University setting (environment)
Many research centers	Diversity of technology	Environmental dynamics	
Many clinics	The breadth of science		
Easy access to samples	Interaction of various Sciences		
Interaction of many specialties	Competition		
Definition of innovation in the context of the university	Environmental monitoring	Policy intelligence	Policy factors (policy making, rules and regulations)
Embed innovation in education	Update policies and rules	Recruitment rules and regulations	
Value for innovation in education	Embed the criterion of personal and professional qualifications in recruitment	Job promotion regulations	
Embed innovation in research	Flexibility of employee upgrade criteria		
Value for innovation in research	Equalization of innovation activities		
Student education in the direction of innovation-Encourage Innovative Teacher	Organization priorities for innovation	Organization's dominant attitude	Organizational culture
Teacher Training Course for Innovation	The structure and regulations for innovation	Educational orientation	
Selection of Innovative Managers	Creative Student Training	Organizational learning orientation	
Innovative thinking	Management belief	Management	
Value to innovate	Organizational belief	Orientation	
		Risk taking ability of the organization	Organizational resources
		Valuation of the innovation	
Organizational equality	Motivational and health factors (incentives)	Human capital	
Management and policy	Professional qualifications	Technology and information capital	
The practical independence of the researcher	Personal qualifications	financial and physical resources	
Organizational climate	Data management		
Communication	Equipment and facilities		
Adequate wages	The budget		
Job security	Infrastructure		
The nature of work			
Job satisfaction			
The possibility of progression			
Freedom of expression			
Success in working			
Appreciation			
Knowledge			
Skills			
Experience			
Ability			
Motivation			
Ambition			
Will			
Accurate recording of information			
Creating data centers in hospitals			
Advanced Equipment			
Laboratory			
Internet			
Quick and easy access to information			
Raw materials			
Clinical Research Centers			
Correct building structure			
R&D units			

Contd...

Table 3: Contd...

A number of open codes	Subcategories (n=39)	Categories (n=21)	Themes (n=6)
Defining the organization's vision and employee commitment to it-group encouragement	Have a common corporate vision	Innovation management	Management and leadership
Creating Knowledge	Teamwork	Management duties	
Acquire knowledge	knowledge management	Manager characteristics	Management style
Sharing knowledge	Possibility to commercialize the product	Management style	
Dissemination of knowledge	Planning		
Use of knowledge	Organizing		
Marketing	Conducting and leadership		
Idea Market	Control and evaluation		
Setting a goal	Personality features of the manager		
Define priorities	Professional ability of the manager		
Having a long-term strategy	Project management		
Corporate Communications	Collaborative management		
Organizational Structure			
Encouraging Criteria			
Evaluation criteria			
Creativity			
Commitment			
Risk-taking			
Diligence			
Management knowledge			
Delegation of authority			
Employee participation in decision making			
Split the project into smaller units			
Innovation training	Coordination and integrity of all departments in the university	Transference and integration of knowledge	Organizational learning
Change the education system	Development of interdisciplinary courses	Open space experimentation	
Educational content	Opening of the university's growth centers doors toward the society people	Systemic view	
Training Needs Assessment	Educational development		
	Educational policy making		

for researchers and organizations to innovate. This category included four categories, "socioeconomic factors" "environment opportunities," "society support," and "NGO institutions' support" and 11 other subcategories.

Participant number 8: "We must create the initial necessary (innovation) climate in the universities; the feeling that I have done something those others have not."

Economic and social factors category

Economic and social factors affect both the employees as the intellectual capital of the organization and the working environment of the organizations.

Participant number 8: "Innovation is a multifaceted, socioeconomical issue. What does it mean? That is, it is formed under the effect of social and economic components or is suppressed. These are the main components. Now if we open the social component, there is education; health; and well-being."

Environment opportunities category

Exterior components can create opportunity; we must exploit the opportunities for empowerment of the innovation.

Participant number 5: "If an opportunity is created, the university, through its own management, can provide teaching and financial support in that same opportunity-maker structure. Provides support from the nongovernmental institutions; creates corporate structures and organs, such as aquariums, incubators, or startups. These are the opportunities that the university can create or can support it to be created."

Society support category

Participant number 6: "We need to push the society culture toward bringing forth the successful minds and experiences. We must encourage teamwork by creating teamwork culture."

Nongovernmental organization institutions' support category

The nongovernmental institutions' support category includes the insurance institutes, health angels, guaranteed companies, and the private and partnership companies that by providing financial and spiritual supports, granting physical spaces and facilities, etc., are regarded as innovation capability.

Innovation capability/intra-university dimension

Six main themes were extracted in intra-university dimension as follows: university setting, policy factors (policy-making, rules and regulations), organizational culture, organizational resources, management and leadership, and organizational learning.

Most participants believed that because they are controllable and manageable, the internal capacities of the university are the main components of the organization's innovation capability.

Participant number 5: "Using the universities' own capabilities for innovation is important for developing innovation and changing the academic research ranking of the university."

Table 3 shows the themes, categories, and a number of open codes of internal dimension as the innovation capability extracted from the interviews of managers at Iran's medical sciences universities.

University setting

The complexity and dynamism of the university environment are considered an innovation capability. The diversity of disciplines, equipment, the breadth of science, the interaction, and the engagement of the sciences with each other will be effective in creating new and innovative ideas.

Participant number 5: "The variety of disciplines from medical physics to other disciplines and the diversity of perspectives among the medical community, and the availability of advanced electronic devices and modern therapeutic equipment can create ideas and transforms into technology."

Policy factors (policy-making, rules, and regulations)

Most scholars considered this category very important for motivating and encouraging the innovative trend in employees. By adopting appropriate laws, qualified people will be selected at the time of recruitment, and by updating the rules and regulations of employee promotion, their motivation for innovation and creativity will continue. From the participants' point of view, the promotion criteria should be flexible and through the equalization, the innovative activities of the staff

should be rated. Policy sagacity, recruitment rules and regulations, and promotion codes were among the categories of this theme.

Participant number 7: "Policy sagacity should be considered in terms of environmental and technological changes so that policy-making is done taking into account the environmental conditions and changes, and the rules are corrected in line with the innovation."

Organizational culture

The prevailing thought and attitude of the organization, educational orientation, organizational learning orientation, management orientation, risk-taking ability of the organization, and valuation of the innovation were the six categories addressed in this theme.

Participant number 8: "If the innovation of thought and attitude prevails, the education heads toward that direction and the university priorities and the regulations structure will form in that framework."

Organizational resources (human capital, technology and information, and financial and physical resources)

Organizational resources are one of the main and important categories of innovation in the university. This item includes three categories: human capital, technology and information, and financial and physical resources.

Human capital category

Human capital is the most important innovation capability in any organization. Motivational factors (incentives), personal and professional qualifications were three important subcategories of this category.

Participant number 4: "The main component of university innovation is its human resource potential, above all, the faculty members, both in terms of idea developing and in terms of teaching innovative and creative students."

Motivational and health factors (incentives)

Organizational equality, management policy, practical independence of the researcher, organizational climate, communication, adequate wages, and job security were among the most important health factors that, according to the participants, could overshadow the staff activities and to enhance the employee's ability for innovation. The nature of work, job satisfaction, possibility of progression, freedom of expression, success in working, and appreciation were the motivational factors that the participants referred to.

Participant number 10: "Incentives will increase the internal and external motivation; both material and spiritual incentives are necessary and can affect the intrinsic motives of the individual."

Personal and professional qualifications

Knowledge, skills, experience, ability, motivation, and will are the capabilities that can lead the organization toward innovation. These features were categorized into two subcategories of individual and professional qualifications.

Participant number 6: "The driving force that drives humans is the will and motivation."

Participant number 1: "The knowledge, experience, and skill of each individual are considered as the organizational capital and an innovation capability."

Information and technology resources category

The results of the study indicate that correct data management through establishing registration and records centers at university departments, especially in hospitals, and accurate recording of data is considered an innovation capability in the medical sciences universities.

Participant number 7: "If we record the best practices accurately, it would be effective in creating knowledge and innovation."

Financial and physical resources

This category includes three subcategories: equipment & facilities, budget and infrastructure. R & D units, well-equipped clinics and laboratories, and the internet (fast and easy access to information) all contribute to the creation of innovation.

Participant number 2: "The facilities that can transform ideas into results; facilities like laboratories, equipment, materials, specialized training courses, work requirements, methods, and standards. These should be provided so that the innovation capability could be developed."

Management and leadership

There are four categories in this item: innovation management, management duties, manager features, and management style and 12 other subcategories.

Innovation management

In this category, we have "common vision," teamwork, knowledge management, and the "commercialization of product" as four subcategories.

Management duties

"Planning," "organizing," "conducting and leadership," and "control and evaluation" are four subcategories of this category.

Participant number 6: "Knowledge acquisition and provisioning-related sciences need planning. Macro-planning, a roadmap; each era needs its own planning and roadmap, requires its own powerful management."

Manager features

Creativity, commitment, risk taking and audacity are the four individual characteristics of the manager that participants considered essential for a manager to move the organization to innovation.

Management style

This category includes two subcategories: The "project management" and "collaborative management."

Participant number 6: "In a project, the importance of project management is more than the project itself. It's very important to know how to break a big project into small pieces like a puzzle, and the output turns into a goal product; this is very important."

Organizational learning

Transference and integration of knowledge, open space and experimentation, and systemic view are three categories of this category. The coordination and integrity of all departments, including education, research and technology, students and culture, health, food and medicine, treatment and development have the potential to be regarded an innovation capability in the medical science universities. Opening of the university's growth centers doors toward the society people and development of interdisciplinary fields were two subcategories of the openness and experimentation category. Educational development, particularly education of innovation and educational policy-making, were two main subcategories of the systemic view category that the participants emphasized upon.

Participant number 3: "Innovation comes about when you reach the wisdom degree. You are so immersed in a subject that you know something special is happening and you go toward innovation."

Participants believed that the current educational system of the medical sciences universities was not innovative and emphasized the educational system change.

Participant No 7: "Innovation emerges in an educational system constantly creating questions in the mind of the students and teaches them teamwork."

Discussion

The results of this study have shown that it could be possible to take into account the innovation capability of the university in two internal and external dimensions. The results of other studies also indicate the importance of these two dimensions in organizational performance and innovation.^[30-32] External communications and interactions can be regarded as a facilitator for university innovation capability. This finding is consistent with the results of

many other studies.^[33-35] Meanwhile, the industry and university participation proposes a special capacity to organizational innovation capability.^[33-36] Organizational climate is created by the collective experience of people from their work environment.^[37-39] The study findings are also indicative of the innovative climate on the organizational innovation.^[40-42] Of course, the difference between the results of the present study and the mentioned studies is that in our study, the climate governing the society outside the organization is mainly considered, which ultimately overshadows the performance of individuals and the organization, while most studies point to the intra-organizational space and work environment. Perhaps, the reason for this significant difference lies in the state-owned ownership of universities in Iran, which is influenced by the country's macro-policies and the climate governing the society.

The innovation capability assigns widespread spectrum dimensions and components to itself in the literature.^[43-47] The results of this study are indicative of six innovation capabilities in the intra-university dimension. Eleven factors have been introduced in the Performance Excellence Model, which is a framework for employee innovation excellence framework at all university levels to improve its performance.^[48] Smith *et al.* described nine factors affecting the innovation capability^[21] and Yaghoubi *et al.* identified eight organizational capacities that are effective in the organization's innovation capability.^[49] What matters is that in all of these models, the environment, culture, organizational resources, and management exist. Of course, with regard to the social, economic, and cultural conditions governing each individual organization, certain parts of these capacities have been raised.

Porter believed that the environment produced a positive effect on the enterprise performance through stimulating the internal innovation for outer competition.^[50] The complicated and dynamic environment as well as uncertainty and instability of the environment have positive effect on the organizational innovation capability through motivating the managers and researchers,^[51-53] which is consistent with the present study results.

The organizational culture is one of the essential components in the individuals' perception of the organizational objectives.^[54] Innovation needs an organizational culture that fosters and guides the innovation.^[55-57] In the future, innovative companies are those who have an appropriate organizational climate, high levels of interactivity and performance, and the lowest level of stress.^[58-59] The results of this study also indicated the participants' particular emphasis on the effect of the organizational culture of innovation and the need for appropriate culture building in Iran's medical sciences universities.

The most important capability as a major capital of each organization is its human resources.^[21,60] Knowledge, experience, technical and vocational skills, employee-driven learning, and idea developing are considered as intellectual capital and innovation capabilities of the organization.^[60-63] In the present study also, all the participants considered the human capital as the first and most important innovative capability in medical sciences universities.

Most of the participants emphasized the important role of the managers and introduced the management as a crucial innovation capability in Iranian medical sciences universities, which was consistent with the results of other studies.^[32,64] Of course, they believed that in Iranian medical sciences universities, the management did not do the right thing in respect with directing the university toward the innovation, which is consistent with the result of the study by Rosenbusch *et al.* about the failure of Asian managers, regarding the of influence the organizational orientation toward the innovation.^[65]

The results of the study indicated the need for expert managerial knowledge in the field of management and leadership, innovation management, knowledge management, and human resources management,^[66-71] which is consistent with the results of other studies. Further, in relation to the type of management style,^[72] this study emphasized the use of collaborative and project management styles. Although the results of some studies indicate the impact of collaborative management style on organizational innovation,^[12,63] no study was found confirming the effectiveness of use of project management style in the organizational innovation. Perhaps, the reason for emphasizing this style in Iranian organizations is the individual working of people in the organization, and teamwork has not yet been established in the organizations, especially in research units of Iran.

In this study, the policy factors were introduced as an innovation capability in Iranian medical sciences universities. Few studies have pointed to this component and considered it mostly as facilitator and incentive,^[73] perhaps because there are still no specific and established rules in Iran to support innovation. Moreover, due to the public-owned status of medical science universities in Iran, this component has a more significant role. The last capability in this study is the organization learning that is consistent with the results of most studies.^[8,20,32,62,74-78]

Conclusion

Recognizing and fostering innovation capabilities in any organization can accelerate the move toward the innovation. With all due respect to the experiences

of health managers, the tangible results of this study, having been obtained using a new methodology, provide the managers of medical sciences universities' with a more accurate understanding of the innovation capabilities so that they can use them to accelerate the progress of such capabilities in their own universities.

This research is cross-sectional in nature, which is a possible limitation of the research method employed. The data used in the study were collected with subjective measures based on the perceptions of universities managers. The use of perceptual data is another limitation of the research.

Because this study was conducted for the first time at the level of medical science universities, so this research contains some interesting findings that would provide a good starting point for further studies. First, as this research has been mainly qualitative and conceptual, it needs to be complemented by quantitative research. Another subject for future research is an empirical examination of the relationships between the determinants of innovation capability.

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Conflicts of interest

There are no conflicts of interest.

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