







Challenges and Barriers to Commercialization of Health Sciences Research Results: A Qualitative Study

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Abstract

Background: In today's world, due to intense competition and the rapid pace of production, exploiting knowledge and converting it into economic returns has become a critical management issue for academics and capital owners. Commercialization activities can impact the educational and research programs of universities, potentially leading to resistance against them.

Objectives: The current study was conducted to identify the challenges of the commercialization process in health science research.

Methods: This qualitative study was conducted between June and December 2022 in Tehran province, Iran. Data were collected using semi-structured interviews with 22 key individuals, including university management and technology experts, as well as CEOs and experts from knowledge-based companies, selected through purposive sampling. The interview guide was designed based on four in-depth interviews, theoretical foundations, and comparative study findings. The obtained data were analyzed using the conventional content analysis method in MAXQDA 10 software.

Results: The challenges of the commercialization process for health sciences research results were categorized into six main themes and 16 sub-themes. The main themes identified in this study were rules and regulations, societal culture, university management and infrastructure, human resources, financial systems, and organizational cooperation with industry.

Conclusions: Policymakers, especially senior health managers, can create a suitable platform for the optimal use of resources and the expansion of targeted relationships between universities and industries by incorporating economic insight into academic services. By compiling relevant laws and guidelines, optimizing resource management, achieving financial independence for universities, and increasing the productivity of health research, the high costs associated with the commercialization of academic research projects can be reduced.

Keywords: Commercializations, Research, Technology Transfer, Health Services, Medical Sciences, Challenges, Barriers, Iran

1. Background

Commercialization began in England in the early 1980s and spread to continental Europe, including the Netherlands, France, and Italy (1, 2). In advanced countries, the importance of commercialization is evident, and universities in these countries have included the commercialization of research results in their programs, alongside education and research (3).

The costs of commercialization exceed those of research and development (R&D), and less than five percent of ideas are successfully commercialized (4).

In the current era, the education process in Iran has consumed more than a quarter of the government's general budget (5). Issues such as the unemployment of 42% of university graduates, the lack of employment for 15 - 20 thousand doctoral graduates, and brain drain result in billions of dollars in damages and threaten

national interests (6). In response, Iran's universities of medical sciences have adopted the approach of reducing dependence on the public budget by becoming third-generation universities and through commercialization (7).

Commercialization activities can impact the educational and research programs of universities, potentially leading to resistance. As a result, the commercialization process may not be carried out efficiently (8). Identifying and eliminating barriers to the commercialization of research results is crucial for the effectiveness of university investment in entrepreneurship development. These factors vary across different societies, conditions, and types of universities (9).

Many studies in Iran have addressed the commercialization of health science research results. For example, Panahi et al. found that structural, managerial, legal, individual, cultural, and environmental factors significantly affect the commercialization of university research (10). Torkiantabar et al. showed that cultural-social, environmental-organizational, economic, and individual characteristics had the most significant impact on the commercialization of scientific research results in knowledge-based companies in the field of medical sciences (11). Pourahmadi et al. and Shahrabi et al. also demonstrated that components within the organization, external factors, philosophy, structural factors, and technology management significantly influence the commercialization of scientific research results in medical sciences universities (12, 13).

Studies show that the factors affecting commercialization in a country can only be fully understood by considering the local, cultural, economic, and social conditions of that country. Identifying these factors in an integrated format and according to the existing conditions is necessary to ensure the applicability of existing models and policies. This information can be used by policymakers and senior managers of the health system. Given the necessity of income generation and the entry of medical sciences universities into the commercialization of research results, the information obtained from previous studies and surveys on the commercialization process in medical sciences universities was not comprehensive and complete (14, 15).

2. Objectives

This qualitative study, based on interviews, identified the challenges and barriers to the commercialization of

research results from the perspective of health experts in Tehran province, Iran.

3. Methods

3.1. Study Design Setting

The present research is a qualitative study conducted between June and December 2022 in Tehran province, Iran. Data were collected using semi-structured interviews. The researchers, who had academic values and attitudes and experience in academic commercialization, decided to choose Tehran, Iran, and Shahid Beheshti Universities of Medical Sciences as the research environment after consulting with commercialization experts. These universities were selected because they are public institutions under the supervision of the Ministry of Health (MOH).

3.2. Study Participants

In this study, 22 experts in the commercialization of academic research were purposefully chosen in a non-homogeneous manner (16). Sampling continued until theoretical data saturation was reached. The inclusion criteria were:

- Management and university technology experts with at least three years of experience related to commercialization
- CEOs and experts of knowledge-based companies
- Willingness and ability to participate in the study
- Affiliation with Iran, Tehran, and Shahid Beheshti Universities of Medical Sciences

3.3. Data Collection Tool and Technique

Individual semi-structured interviews were used to collect the data. The interview guide was designed based on theoretical foundations and findings from comparative studies. Additionally, four pilot interviews were conducted to optimize the questions and enhance the validity of the research. The interview guide included 14 open-ended questions, ranging from general to specific, regarding the factors and variables affecting the relationship between universities and industry, methods of commercialization of research results, and background factors for improving commercialization (Appendix 1). A voice recorder was used to record the interviews with participants' consent, and notes were taken during the interviews. The interview guide was made available to each participant before beginning the interview.

The average duration of the interviews was 60 minutes. Within 24 hours after each interview, the recorded interviews were carefully listened to and transcribed multiple times by one of the research partners. The written content of the interviews and the main codes extracted for the study were provided to the participants, who were asked to review and confirm the extracted codes and suggest modifications, deletions, or additions if necessary.

3.4. Data Analysis

For data analysis, conventional content analysis was used, a tool that has become popular in health studies for obtaining deep and rich information from participants. This specialized method collects new cognitive and subjective interpretations of textual information directly from participants through a systematic categorization process (17). The data analysis and coding process involved the following steps: Familiarization with the text and identification of data, extraction of main codes and identification of themes, review of the identified themes and naming, recoding and renaming some themes, and ensuring code validity. To analyze and manage the data, MAXQDA 10 software was used.

3.5. Trustworthiness

To ensure the trustworthiness of the data, Guba and Lincoln's criteria, including validity, reliability, confirmability, and transferability, were used (18). To ensure the validity of the data, ample time was allotted for data collection, notes were taken during the interviews, transcribed interviews were returned to the participants for verification, and the accuracy of the coding was confirmed with the assistance of two other coders in a few preliminary interviews.

The reliability of the data was confirmed by recording the research details and taking notes during the interviews. For confirmability, the research steps were documented, the details of the research method were recorded, and contradictory cases were examined to understand the reasons for these contradictions. To confirm transferability, the opinions of several people who did not participate in the research were obtained. Additionally, the study's limitations, data collection and analysis methods, participant selection, and subject descriptions were clearly stated to improve the study's transferability, enabling other researchers to continue this work.

3.6. Ethical Considerations

An ethics code (IR.IJMS.REC.1398.543) was obtained from the Iran University of Medical Sciences Ethics Committee. Other measures taken included acquiring informed consent, asking permission to record interviews, ensuring the freedom to participate in the interview and the right to withdraw at any time, and maintaining confidentiality (e.g., using the letter "P" with a code number).

4. Results

Most participants were male (64%) and between 36 - 45 years old (50%), with a PhD degree (54.5%) and expert status (45.5%) (Table 1).

Based on the thematic analysis results, the challenges and barriers to the commercialization of health sciences research include six main themes, 67 sub-themes, and 211 codes (Figure 1).

After analyzing the participants' opinions, 211 obstacles and challenges for the commercialization of academic research results were identified. After removing duplicates and merging similar items, 67 challenges and obstacles were categorized into six main themes and 16 sub-themes. The theme of university management and infrastructure was the most frequent, with 16 items. The main themes identified were laws and regulations, societal culture, university management and infrastructure, human resources, financial system, and organizational cooperation with industry (Figure 2 and Table 2).

4.1. Main Theme

4.1.1. Rules and Regulations

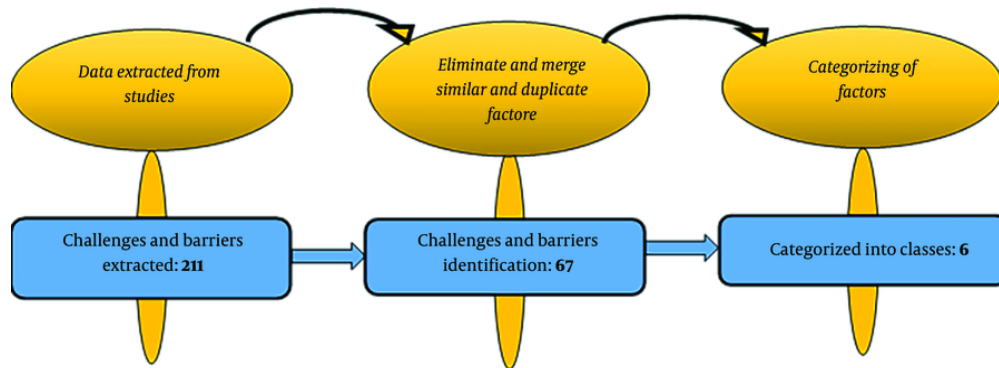
Regarding the theme of rules and regulations, most interviewees believed that the lack of clear and transparent laws and guidelines, lengthy legal processes, and inappropriate political tools are the most critical challenges in this field. P11 stated: "...the lack of specific instructions causes even people interested in this path to stop working and become confused. From the beginning, the path could be clearer to them. These are all other harms..."

Similarly, P7 mentioned: "...many academic staff members, even though they are valued and provided with facilities and conditions to participate in projects related to the industry, still find these projects difficult because the bureaucracy is too much..."

Interestingly, some university technology managers, unlike managers of knowledge-based companies, pointed out that significant steps have been taken in

Table 1. Demographic Characteristics of Participants

Demographic Characteristics	No. (%)
Gender	
Male	14 (64)
Female	8 (36)
Age (y)	
25 - 35	1 (4.5)
36 - 45	11 (50)
≥ 46	10 (45.5)
Educational level	
Bachelor	0 (0)
Master	10 (45.5)
PhD	12 (54.5)
Experience (y)	
<10	9 (41)
10 - 20	9 (41)
21 - 30	2 (9)
> 30	2 (9)
Participant's status	
University Technology Affairs Management	2 (9)
Managing Director of Knowledge Base Company	4 (18.5)
Expert (Office of Industry and Society Relations, intellectual property, translation and commercialization of knowledge, Incubator Center)	10 (45.5)
Faculty members with a history of commercialization	2 (9)
Secretary and members of the Technology Council of the Incubator Center	3 (13.5)
Responsible for Science and Technology Park	1 (4.5)

**Figure 1.** The process of identifying, screening, selection and categorization of factors

drafting new regulations to facilitate the commercialization process. P12 noted: "...we wrote an excellent regulation that allows all academic staff members to provide consulting, educational, laboratory, routine, and research services and easily sign contracts with the industry. Then, money will come to the university..."

4.1.2. Society Culture

All participants stated that the entrepreneurial atmosphere and educational and cultural styles are among the most critical challenges in fostering a culture of entrepreneurship and commercialization in

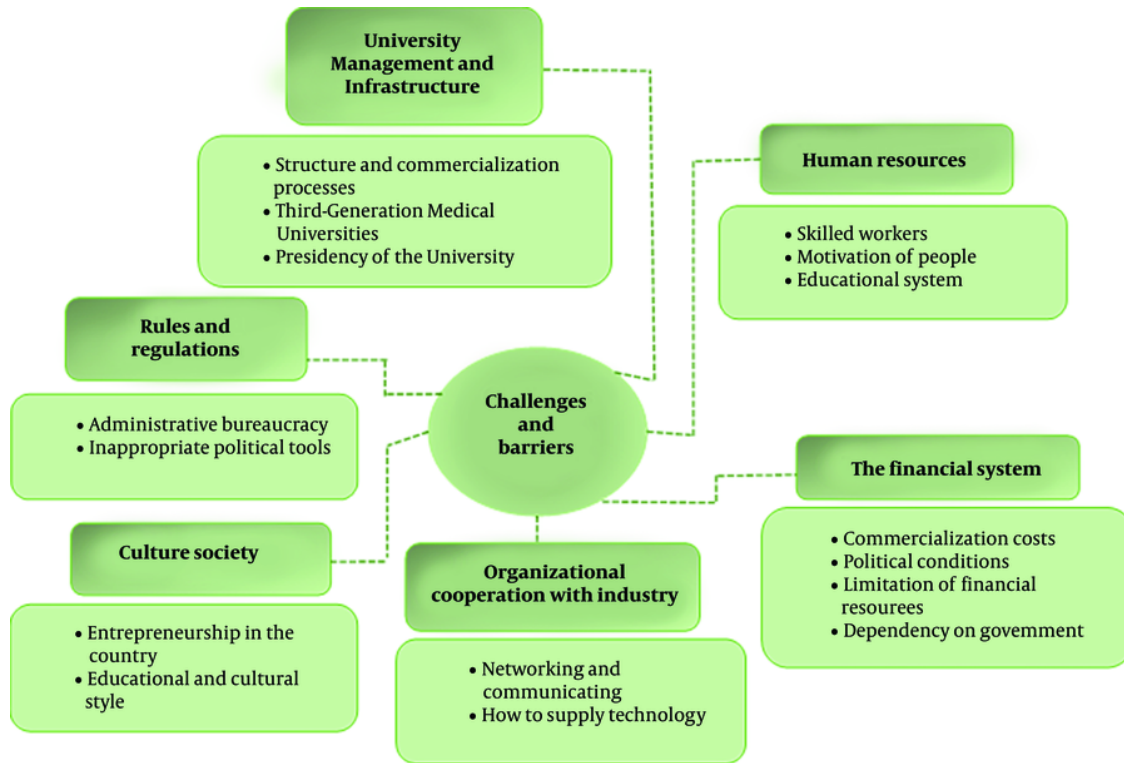


Figure 2. Challenges and barriers to commercialization of health sciences research results

the country. P10 mentioned: "...I see the main challenge as the culture of inertia where professors are used to doing research that results in a defense or an article or two. Hopefully, with the incentives we are creating this year, this may change..."

P6 added: "...we have a good trend in the field of services and establishment of companies, but we need to culturally support this trend and be more informed so that colleagues express their products in this commercial way..."

P22 commented: "...we have these weaknesses in the country where people do not form good teams, do not conduct feasibility studies, do not make business plans, do not have capital, and then it is unclear what they want to do. There is often only one idea that fails..."

4.1.3. University Management and Infrastructure

One of the most important issues facing commercialization in the field of management and infrastructure of medical sciences universities in the country, as acknowledged by the majority of

interviewees, is the structure and processes of commercialization, third-generation medical sciences universities, and the deanships of universities. These elements can sometimes confuse researchers and technologists, dissuading them from continuing their efforts. P14 stated: "...we are now spending our resources on a different model. Maybe we did not feel the need before because universities are maturing. At one point, it was only education, then it was research, and now they are reaching the maturity of their technology..."

P3 added: "...the assistants who came to this office (research and technology assistant) are more research-oriented than technology-oriented, and this has increased our challenges a bit. It is not that they do not show intention; the technology field is new anyway..."

Another critical topic in this theme was the complexity of the commercialization process and its structure. Opinions among the participants varied on this issue. Some participants found the process sufficient and responsive, while others found fault with it. P9 mentioned: "...it is true that we have different units, but the important thing is that we have a

Table 2. The Main Themes, Sub-themes and Related Codes of Explored Challenges and Barriers

Main Themes	Related Codes
Rules and regulations	
Administrative bureaucracy	Strict rules in adjudicating technological projects, improper support for start-up businesses, lack of legal platforms, strict domestic patent registration rules
Inappropriate political tools	Lack of specific guidelines in the commercialization of university scientific research, a lack of transparent patent and commercialization laws, a lack of transparency of the content of industry regulations for faculty members, and supporting rules for technological dependence abroad
Culture Society	
Entrepreneurship in the country	Weakness of the business environment in the country, lack of suitable environment for entrepreneurship and job creation, anti-technology environment
Educational and cultural style	Students' cultural and educational issues, financial dependence on parents, inadequate consumers' knowledge of technological products, the difficulty of alternative and innovative approaches in producing new technology, and cultural differences between university and industry
University Management and Infrastructure	
Structure and commercialization processes	Complexity and inflexibility, poor communication between research and technology departments, lack of desire of different deputies of the university, stationary site of knowledge translation, process systematic, inappropriate information, time-consuming process
Third-generation medical universities	Being clinical, the nature of service delivery, forgetting the primary mission of the university and meddling in the industry, the transition of universities towards innovation maturity, the geographical location of universities
Presidency of the university	Lack of attention to commercialization, research-oriented managers and vice-chancellors of the research department, lack of proper feasibility and need assessment studies, ignoring technological activities in promoting people's careers
Human resources	
Skilled workers	Lack of specialists in emerging technologies, poor ideation, family teams, brain drain
Motivation of people	Lack of motivation of experts to develop contacts with industry, lack of motivation for people to pursue technological activities, lack of motivation for people to attend extracurricular courses, personal benefit, and lack of encouragement of technologists
Educational system	Insufficient information of professors and students about commercialization and business environment, lack of knowledge of faculty members and students in selling technical knowledge, lack of people in group work, gradualism, level of unrealistic expectations of commercialization
The financial system	
Commercialization costs	High costs of commercialization-related activities, weakness of academics in attracting investors, difficulty determining the cost of price and product marketing, and increasing the cost of producing knowledge-based products
Political conditions	Conditions of economic sanctions, inflation, high risk of technology commercialization
Limitation of financial resources	Method of allocation of university funds, lack of financial and equipment facilities of the deputy for research and technology, using inappropriate strategies in the field of financial payment
Dependency on government	Imposing pressure on the government to purchase high-priced products, insufficient support and financial payments of technologists by the Ministry of Health, the uncertain share of the private sector
Organizational cooperation with industry	
Networking and communicating	Lack of knowledge of industry and universities about each other's capabilities and needs, mass industrial production without the presence of research and development units, lack of motivation of industries and academics to communicate with each other
How to supply technology	Expansion of rival markets, fragile capital markets, the difference between industry and university goals, lack of preparedness of standard institutions, traditional supply of technology from abroad by industry, problems in technology demand by industry

knowledge translator working for himself, the growth center working for itself; each of them is working in their area. The coherence and coordination between their works are not seen..."

P13 added: "...our model is particular in the form of the definition that I made to create companies and export industry..."¹

4.1.4. Human Resources

Most participants stated that the most critical factors in human resources were skilled and expert forces, people's motivation, and the educational system. P21 said: "...since 2016, I have been holding training

workshops here for companies, faculty members, and students. Faculty members and students are far removed from the business environment, in their own imaginary space, and if you bring them into the business, they will destroy themselves and the people around them..."

P11 stated: "...an individual's motivation is important; they must be persistent and follow through with their work. Many people came here, lacked perseverance, and had ideas but didn't follow through. For example, whenever there was a problem, they got upset and left..."

P13 said: "...part of it is the training of personnel that is being done at the university, but in my opinion, the personnel in the university should be more skilled. We

currently have a skill weakness, which can train skilled personnel for the industry..."

4.1.5. Financial System

The participants stated that the commercialization and production of technological products, like all activities in the field of business, require sufficient financial resources. Commercialization costs, political conditions, resource limitations, and dependence on the government are important issues in this area.

P13 mentioned: "...in commercialization, one of the important issues is financial support, which sometimes requires hefty expenses..."

P7 noted: "...sanctions have made the export issue very difficult. We have knowledge-based companies, and through this, we can communicate. It becomes challenging when we are under sanctions and cannot exchange currency..."

P1 added: "...in the discussion of commercialization, they say that you have produced it, you must get a certificate, ISO, CE; CE now costs nearly 300 million. Shall I get ISO?"

4.1.6. Organizational Cooperation with Industry

Organizational cooperation with the industry is another central theme emphasized by the participants. Networking, communication, and how to provide technology are crucial in this field, and attention to these factors can significantly impact the organizational cooperation of medical universities with industry.

Regarding the importance of communication in commercialization, P10 stated: "...in commercialization, communication is essential. If communication with the industry is not established, what is the point of our efforts? We should look for internal and external communication as much as possible...."

P17 added: "...there are many elements behind the discussion of commercialization; it is not just an idea. The idea must be there, the investment must be well-made, the marketing must be formed, the target market must be identified, and all these are fragile. Anything can be damaged, although some things can help this quickly. For example, some events like the Coronavirus cause some businesses to grow, while others are disrupted. This indicates that the capital market is becoming more fragile..."

5. Discussion

The present study investigated the challenges of commercializing the results of scientific health research

in the country. This qualitative study utilized semi-structured interviews with experts in the field of health sciences commercialization. The identified challenges and obstacles were classified into six main themes and 16 sub-themes.

One of the most critical challenges identified in this research is the management and infrastructure of universities. This challenge encompasses the complexity of commercialization structures and processes, the transition of universities toward third-generation institutions without sufficient infrastructure and geographical consideration, and the lack of attention from managers and research-oriented universities. A study conducted in 2021 on the systemic evaluation of healthcare centers showed that management and leadership impact other factors and their improvement enhances the overall performance of organizations (19).

The results of Nassiri-Koopaei et al.'s research have shown that management and policymaking are the most critical factors in the successful commercialization of scientific research. Procedural reforms, transparency, focus on legislation, setting standards, market control, and prioritization are the most critical factors related to policymaking (20). A study conducted in Iran also showed that universities should change their structure, goals, approaches, views, and intra-organizational and extra-organizational communications to move toward an entrepreneurial university (21).

Now is the time for universities to explore how entrepreneurship education can play a more significant role in shaping the entrepreneurial university model to exploit its benefits (22). Being clinical-oriented and providing services is part of the mission of medical sciences universities. This issue has created a deep gap between these institutions and society, which can be addressed through needs assessment and feasibility studies (23). A study conducted in Indonesia was also consistent with our findings, showing that the lack of a suitable business plan for the commercialization of university products and the gap between research and the beneficiaries of the products in the market causes universities to be ineffective (24).

In the present study, the time-consuming process of commercializing university projects was identified as a significant challenge. Al Mamun et al. showed that commercialization activities are tedious, time-consuming, and labor-intensive processes that initially require substantial investments in hiring human resources, registering the company, and marketing (25). Another major challenge is the relationship between industry and academia, which hinders successful commercialization for several reasons. O'Dwyer et al.

found that university-industry interaction creates meaningful partnerships, necessitating much attention and the implementation of special measures (26). The study by Gianiodis and Meek in 2020 also showed that the commercialization of technologies and scientific research results is affected by the gap between stakeholders, including scientists, university administrators, industry, and the government (27).

Two of the main themes identified in this study, as with all business activities, were human and financial resources (28, 29). Studies show that with stable financial resources, culture, and laws supporting technological activities, many projects related to the industry and the production of technological and knowledge-based products will come to fruition (30, 31). The results of studies conducted in 2019 and 2021 indicated that financial and non-financial rewards are necessary and effective in motivating and strengthening the collaborative culture in research activities (32, 33). Rasli and Kowang also showed that insufficient financial support and lack of investment in new technologies are serious challenges for academic researchers in commercializing research results (34).

The results revealed that the actions taken toward commercialization are superficial and do not consider proper infrastructure. Inadequate communication between related units and the lengthy bureaucracy of instructions, regulations, and laws were among these infrastructure issues. A systematic literature review conducted in England was consistent with our findings, showing that commercialization is a process that creates added value, and all possible potentials, such as the labor force, organizational structure, rules and regulations, and technology, should be utilized (35). In the present study, the geographical location of universities was another identified challenge. Borah et al. showed that the university's location in big cities can affect the commercialization of research results due to the stronger presence of industries. These universities have unique opportunities to connect with industry due to their geographical location, communication, and social networks (36).

5.1. Limitations and Strength of the Study

This interview-based study gathered the opinions of various actors from medical universities and knowledge-based companies' experts regarding commercialization. As such, this is one of the few studies that has used a bidirectional perspective from academia and industry to highlight challenges in the current commercialization of health research. As with qualitative studies, the number of participants was

relatively small, and some participants were conservative in freely expressing their opinions. Despite this, telephone and internet interviews were utilized, and all participants were experienced, knowledgeable, and fully familiar with all research concepts.

5.2. Conclusions

Today, commercialization is a crucial pillar for the development and expansion of innovation in societies, prompting health system administrators and policymakers to adopt a systematic approach to its various dimensions. Given the complexities of this process, identifying the challenges to research commercialization in medical sciences universities can be a foundational step toward entrepreneurial activities, enabling academics to participate in and benefit from research results in global markets. By identifying and addressing these challenges, universities can maximize their unique advantages, moving beyond the creation of organizational structures and physical facilities. Universities can establish infrastructures such as formulating appropriate laws, utilizing integrated and robust information and communication technology to facilitate internal and external communication with the industry, creating stable and reliable financing structures, empowering human resources, and fostering a culture of innovation.

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Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: Concept and design, Sogand Tourani and Mona Moghimi; acquisition of data, Mona Moghimi; analysis and interpretation of data, Mehdi Jafari and Mona Moghimi; drafting of the manuscript, Mona Moghimi and Naser Derakhshani; critical revision of the paper for important intellectual content, Iravan

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