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Original article

Foresight of Libraries of Medical Sciences Universities: Uncertainties and Scenarios

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Abstract

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Introduction: University libraries play a crucial role in education and research, often serving as essential consultants. Foresight enables these libraries to pinpoint key challenges and actively shape their future. This study aims to outline possible scenarios for the future of libraries at selected medical universities in Tehran over the next 20 years.

Methods: The research unfolded in two stages: identifying fundamental uncertainties and developing scenarios. Initially, uncertainties were identified through a review of existing studies and expert opinions collected via questionnaires. The consensus and significance of each uncertainty were assessed, leading to the identification of two primary uncertainties. In the second stage, scenarios were crafted using the Intuitive Logics method based on these uncertainties.

Results: Ten uncertainties were identified in the initial phase. The uncertainties of “independent versus dependent administration” and “free vs. non-free services” emerged as fundamental. Four scenarios were then developed: “Library as a Center for Interaction and Implementation,” “Active Libraries,” “Library as a Center for Development and Support,” and “Productive Libraries.”

Conclusion: Depending on future developments, each of these four scenarios could potentially unfold. University libraries must be prepared to adapt to any of these possibilities.

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Introduction

Libraries play a crucial role in providing access to the vast expanse of human knowledge and facilitating the exchange of ideas in today's world. This is particularly true for the libraries in Iran's medical sciences universities, which are vital for

the educational and research support they offer to students, faculty, and various centers. Effective planning to enhance their future performance is essential for serving their community of users. Currently, the managers of these libraries can



better prepare for future challenges by developing and implementing strategic plans with a clear vision. By taking a proactive approach, libraries can significantly contribute to shaping the future, ultimately benefiting both library users and parent organizations. Conversely, lacking a clear vision for the libraries could result in missed opportunities to make well-informed and timely decisions.

Possessing knowledge and insight into the future equips us with the ability to navigate uncertainties and enhances our understanding of potential future occurrences. This foresight empowers planners to strategize across various domains (1). A common challenge developing nations face is the need for a well-defined vision and a long-term strategy to guide decision-making and resource distribution (2). Organizations can adopt either a passive or an active approach when confronted with future transformations. In a passive response, the organization merely accepts changes as they arise. In contrast, an active response involves the organization being cognizant of emerging events and proactively preparing to address them (3).

Foresight is the exploration of the future, aiming to understand and anticipate possible, probable, and preferable scenarios. It involves analyzing trends and uncertainties to identify various potential futures, enabling organizations to prepare for the complexities of an uncertain environment (4). Several definitions of foresight exist, with one of the most well-known provided by Ben Martin, a leading researcher in futurology. He describes foresight as a systematic effort to explore the long-term future across knowledge, technology, economy, environment, and society. The goal is to identify emerging technologies and determine which sectors offer the most potential for economically and socially beneficial investment (5, 6).

Foresighting methods are varied and rely on different assumptions. One popular approach is scenario writing, which encourages organizations to consider how future possibilities might impact their missions. Typically, scenario writing covers time frames of 20 to 50 years. A single scenario cannot predict an organization's future on its own. Instead, it is essential to create a set of scenarios that incorporate

various conditions the organization might encounter (7). This method offers several advantages. It helps identify and manage uncertainties and risks, explores potential futures, prepares organizations to respond to different possibilities, aids in setting priorities, and enhances and refines existing strategies (8).

Using scenario writing for library foresight can significantly assist managers and decision-makers. This method enables libraries to directly identify their key challenges and actively participate in shaping their future. Numerous studies have been conducted on foresighting in various libraries. Research within the country focuses primarily on foresighting the future of public libraries (9-13).

For instance, Azizkhani and Ismaeilpour have explored the impact of future research trends on the operations of Iran's public libraries (3). Bakhtiari has delved into the foresight of information technology within these libraries (9). Ghafari-ghadir, Roshandel Arbatani, and Ziyaei have developed imagined scenarios for the future of Iran's public libraries (10). Esfandiyari-Moghadam & Akbari have worked on identifying the future landscape of public libraries (11). Additionally, there have been efforts to develop strategic plans for libraries (12) and to identify future research methods within them (13).

Globally, studies have been conducted to understand how library managers make decisions about the future of their organizations and how they can shape upcoming changes (14). These studies aim to identify trends to help develop the roles of librarians in research libraries (15), create scenarios for American research libraries (16), and establish strategic priorities and changes in academic libraries (17). Additionally, research has focused on innovative librarians reshaping how libraries envision the future (18), reflecting on the future of academic and public libraries (19), and implementing scenario planning (20) and practical solutions in libraries.

Research has been conducted in Iran on information technology foresight within university libraries (21). However, researchers have noted a gap, as studies have yet to specifically address this issue in the country's libraries of medical sciences universities. As a result, researchers have decided

to explore the future of libraries at selected medical sciences universities in Tehran, Iran, aiming to develop scenarios for the next 20 years.

Methods

The current research is qualitative type. In general, this research has been done in two phases, which are explained in detail below:

Phase 1: Identifying Basic Uncertainties

Six uncertainties were identified through reviewing of researches witch previously published (22). Additionally, four more uncertainties were identified based on expert opinions. The expert panel comprised four library and information

specialists with research experience in future studies, and two experts in the future studies. The panel validated a questionnaire featuring ten uncertainties. This finalized questionnaire was then distributed to the research community. The research community included the deans of selected university libraries of medical sciences in Tehran (Tehran, Iran, and Shahid Beheshti University of Medical Sciences). It also included faculty members and doctoral students from these universities' medical library and information science, totaling 41 individuals. Ultimately, 29 participants (70.73%) completed the questionnaire. The demographic details of the respondents are presented in the table below.

Table 1. Demographic characteristics of the respondents

Characteristics		Number	Percentage
Gender	Female	20	69
	Male	9	31
Academic degree	MA, MS	4	13.8
	Ph.D.	25	86.2

Respondents were asked to express their level of agreement regarding various uncertainties (consensus index). Furthermore, they were tasked with assessing the significance of each uncertainty on a four-point scale (significance index). To determine their level of agreement, participants were presented with the following questions and options for each uncertainty:

Which of the following situations do you agree with?

- A) I strongly agree with the first situation.
- B) I somewhat agree with the first situation.
- C) I strongly agree with the second situation.

D) I somewhat agree with the second situation.

E) I consider both situations to be the same (refused).

F) I am uncertain.

To calculate the significance level, the following question was asked for each uncertainty:

How important is choosing one of the above two modes for policy making in this area?

A) High B) Moderate C) Low D) None

Ultimately, with the help of the following formulas, consensus index and significance index were calculated for each uncertainty.

$$\text{consensus index} = \frac{(\text{Number of answers A} \times 2) + (\text{Number of answers B} \times 1) + (\text{Number of answers C} \times 2) + (\text{Number of answers D} \times 1)}{\text{Total number of responses to A,B,C,D}}$$

$$\text{significance index} = \frac{(\text{Number of answers A} \times 100) + (\text{Number of answers B} \times 50) + (\text{Number of answers C} \times 25) + (\text{Number of answers D} \times 0)}{\text{Total number of responses to A,B,C,D}}$$

Phase 2: Developing the Scenario

During this phase, four distinct scenarios were created utilizing the scenario matrix tool alongside the two-by-two model, representing four potential futures over the next two decades. The foundation of the scenario matrix is built upon the two primary uncertainties identified in the initial phase. In this matrix, the future conditions of each uncertainty are illustrated at their most damaging and positive extremes along the vertical and horizontal axes. Subsequently, the scenarios were positioned within the four quadrants of the scenario matrix. Additionally, a cause-and-effect diagram was employed to construct the narratives for each scenario. Ultimately, each scenario was articulated in narrative form. To compose the narrative for each scenario, concise text modules were developed and interconnected based on the uncertainties outlined in the cause-and-effect diagrams.

The result is a matrix featuring two axes of uncertainty and four scenarios (Figure 1). This approach has led to conceptualizing four potential futures for the libraries of selected medical sciences universities in Tehran.

Results

The research identified ten fundamental uncertainties, each with two distinct scenarios. Here is a breakdown of one of these uncertainties:

Uncertainty 1: Physical Space vs. Virtual Space

- **Situation 1:** A well-designed physical space is the primary reason for visiting medical science university libraries.
- **Situation 2:** A well-developed virtual space is the main draw for using these libraries.

Uncertainty 2: Physical vs. Virtual Resources

- **Situation 1:** Users tend to use physical resources.
- **Situation 2:** Users tend to use virtual resources.

Uncertainty 3: Independent vs. Affiliated Library Administration

- **Situation 1:** In this setup, the libraries of medical sciences universities operate under an affiliated administration. Here, the universities actively participate in all library activities, ensuring seamless integration with academic goals.
- **Situation 2:** Alternatively, the libraries function with independent administration. In this case, universities take on a supervisory role, offering oversight without direct involvement in daily operations.

Uncertainty 4: Centralized vs. Decentralized Organizational Structure

- **Situation 1:** The central library will continue to operate, while all other services will be offered electronically and remotely.
- **Situation 2:** University libraries will maintain their existing structures, including the central library, faculty libraries, hospital libraries, research center libraries, and others.

Uncertainty 5: Free vs. Paid Services

- **Situation 1:** Due to budget constraints, university libraries charge fees for various services offered to users.
- **Situation 2:** Because of their integral role within the university, libraries provide services for free, funded by university resources.



Uncertainty 6: Impact of Economic Sanctions and Rising Costs on the Viability of University Libraries

- **Situation 1:** Economic sanctions, coupled with the rising expenses associated with university libraries—particularly the subscription fees for databases and journals—will progressively hinder their capacity to deliver services effectively.
- **Situation 2:** In response to embargoes and escalating costs, academic libraries will increasingly seek alternative methods, enhancing their role in delivering services to users over time.

Uncertainty 7: Enhancing Service Delivery or Decreasing Service Requests from the Library through Implementing Information Technology.

- **Situation 1:** The advancement of information technology and the variety of information resources, including social media platforms, may lead to a decline in the demand for services offered by university libraries.
- **Situation 2:** The expansion of information technology and its integration within academic libraries will promote greater accessibility to the services provided by these libraries.

Uncertainty 8: Local vs. Broad Service Offering

- **Situation 1:** University libraries aim to deliver

their services explicitly tailored to the needs of their university users.

- **Situation 2:** Academic libraries strive to offer their services on a broader scale, catering to the needs of all universities.

Uncertainty 9: Expert or Non-Expert Staffs

- **Situation 1.** Librarians and individuals with degrees in related disciplines can deliver services within libraries.
- **Situation 2.** Specialized staff will be required to offer services in libraries.

Uncertainty 10: Existence or Non-existence of University Libraries in Relation to Competing Entities

- **Situation 1:** The proliferation of information content providers and the introduction of new competitors will pose a challenge to the relevance of university libraries.
- **Situation 2:** Despite the rise of new competitors and the variety of information content providers, university libraries' competitive advantages will enhance their visibility.

Next, for each uncertainty, the level of agreement (consensus index) and the level of importance (significance index) from the respondents' perspective were calculated. The findings are presented in Tables 2 and 3.

Table 2. Respondents' agreement level with each of the options

Component	Percentage of answer A	Percentage of answer B	Percentage of answer C	Percentage of answer D	Percentage of answer E	Percentage of answer F	Consensus index
Uncertainty 1	0	14.3	17.85	42.85	25	0	0.607
Uncertainty 2	0	7.14	25	46.43	21.43	0	-0.893
Uncertainty 3	32.14	25	21.43	21.43	0	0	-0.25
Uncertainty 4	24.14	27.58	6.90	31.03	6.90	3.45	-0.321
Uncertainty 5	31.03	24.14	13.79	27.59	3.45	0	-0.310
Uncertainty 6	22.22	7.41	25.93	40.74	3.70	0	-0.407
Uncertainty 7	3.58	7.14	53.57	28.57	7.14	0	-1.214
Uncertainty 8	3.45	20.69	31.03	41.38	3.45	0	-0.759
Uncertainty 9	58.62	24.14	6.90	10.34	0	0	-1.172
Uncertainty 10	6.90	20.69	27.59	41.37	0	3.45	0.643

Table 3. Importance of uncertainties from the respondents' point of view

Component	Percentage of answer A	Percentage of answer B	Percentage of answer C	Percentage of answer D	Consensus index
Uncertainty 1	21.43	57.14	17.85	3.58	79.28
Uncertainty 2	28.57	53.57	17.86	0	82.14
Uncertainty 3	39.29	42.86	17.85	0	84.29
Uncertainty 4	34.48	48.28	17.24	0	83.45
Uncertainty 5	41.38	44.83	13.79	0	85.52
Uncertainty 6	40.74	40.74	18.52	0	84.44
Uncertainty 7	46.43	35.71	14.29	3.57	85.00
Uncertainty 8	27.59	44.83	20.68	6.90	78.62
Uncertainty 9	51.72	37.93	6.90	3.45	87.59
Uncertainty 10	35.71	57.15	3.57	3.57	85.00

Two criteria based on absolute values were employed to identify the primary uncertainties: the consensus index and the significance index. Regarding the absolute value of the consensus index, a value approaching zero indicates a higher level of importance for the uncertainty. Consequently, uncertainties 1, 3, 4, 5, and 6 were deemed more fundamental.

The second criterion is the significance index: the higher the index, the more significant the uncertainty. According to this index, uncertainties

3, 5, 6, 7, 9, and 10 (with uncertainties 7 and 10 scoring equally) are considered more important than others. By integrating these criteria and identifying their commonalities, uncertainties 3 and 5 emerged as critical uncertainties for the future of libraries in selected medical universities in Tehran. Consequently, these two uncertainties—“independent vs. affiliated administration” and “free vs. paid services”—were used as the basis for developing scenarios, as illustrated in Figure 1 of the uncertainty matrix.

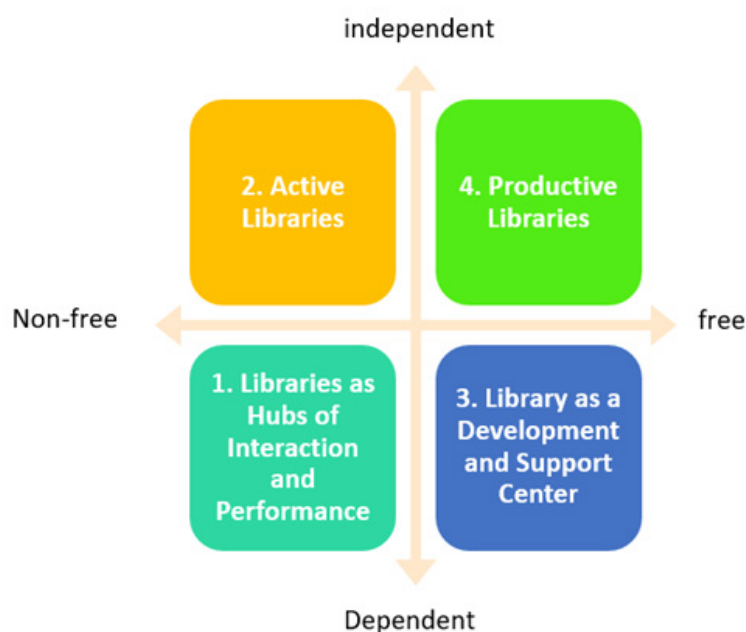
**Figure 1.** Matrix of uncertainties and scenarios

Figure 1 illustrates four scenarios developed from two key uncertainties, detailed below:

Scenario 1: Libraries as Hubs of Interaction and Performance

Over time, the landscape of library management and services has transformed significantly. These changes have diminished the autonomy of academic libraries, prompting universities to take a more hands-on approach to overseeing and managing them. University administrators often opt to limit the authority of libraries, preferring to maintain direct oversight of their operations. In this context, strategic planning and defining the roles of libraries fall under the jurisdiction of higher administrative bodies, while library staff are tasked with executing these predetermined duties. This level of oversight influences hiring criteria and the selection of library managers, often aligning with the perspectives of these administrative entities. Consequently, librarians are sometimes hired with minimal qualifications and without expert supervision. This approach paves the way for competitors to step in, offering services and performing tasks that academic libraries are fully capable of handling. The limited presence of libraries on the web and their minimal use of information technology further exacerbates the situation, leading to a decline in demand for services from university libraries. Conversely, the robust online presence of competitors boosts the demand for their offerings, highlighting the need for libraries to adapt and innovate in the digital space.

The limited budgets of universities have also impacted their libraries, leading them to impose fees on users, other institutions, and libraries. The funds allocated by medical universities to their libraries are minimal, as priority is often given to education, healthcare, and research activities. Consequently, libraries find themselves sidelined and must increase charges to continue offering services. Additionally, academic libraries are expanding collaborations with other libraries and cultural institutions to sell services and generate revenue. However, the primary mission of a university library remains to cater to the information needs of its university community, and any partnerships are pursued with this goal

in mind. Economic sanctions in recent years, combined with rising costs such as database and magazine subscriptions, are gradually diminishing the libraries' ability to provide services.

Meanwhile, leaders of higher-level institutions are pushing university libraries towards a centralized structure. This means that the central library makes significant activities and management decisions centrally, reducing the autonomy of subordinate libraries, such as those in colleges and hospitals. Despite these challenges, libraries remain a haven for students and researchers, offering a conducive environment for study and collaboration. The thoughtful design of library spaces, with ample light and greenery, makes them popular gathering spots. Physical resources continue to be in demand, as many users still prefer printed materials despite the availability of digital resources. They believe engaging with physical books allows for a deeper understanding and appreciation of details.

Scenario 2: Active Libraries

The idea of independent management is a dominant idea in university libraries, and the heads of libraries are trying their best to achieve it. The presence of managers and employees of university libraries in specialized meetings for planning and decision-making in the field of libraries is more prominent than in the past. However, the economic sanctions and lack of a university budget prevent allocating sufficient funds to the library. In this situation, many library services are provided by collecting money from users. Academic libraries are trying to compensate for their lack of budget by providing more services. They also try to introduce and provide their services to the users of other universities. All these services are done by getting money from the users. Also, due to the lack of funds, the recruitment of specialized human resources has also faced a challenge, and the libraries are forced to provide more extensive services to their current employees, which has also caused dissatisfaction among the library employees. To solve this problem, library duties are divided between the central library and sub-libraries. Also, academic libraries try to overcome their competitors with the help of

information technology and presence in the web environment. However, this goal is not always possible.

Despite the importance of printed resources and users' interest in using them, library managers have realized that they must expand their digital resources to remain competitive. This has led to the expansion of virtual resources and the necessary facilities to access them, including bandwidth and related software. For this reason, virtual spaces are given as much importance as physical spaces in libraries.

Scenario 3: Library as a Development and Support Center

University libraries continue to rely on higher institutions for their operations. Many personnel within medical science universities lack the capacity to engage effectively in management roles, primarily due to past recruitment errors and insufficient expertise. Nevertheless, the involvement of library managers and staff in specialized meetings focused on planning and decision-making has become increasingly significant. This enhanced participation lays the groundwork for providing services and establishing new responsibilities for libraries. By executing these responsibilities at a lower cost than external competitors, university administrators are more inclined to delegate these tasks to the libraries. Additionally, as the workload of the central library increases, the management of college and hospital libraries is partially assigned to them, along with specific responsibilities.

Libraries' undertaking of new responsibilities results in the allocation of funds, enabling them to offer complimentary services to university patrons. Furthermore, a substantial portion of expenses is recouped by providing services to other libraries and related organizations, which can then be reinvested into the library's growth and service enhancement. This development has broadened the scope of service provision to users from other universities and mitigated the impact of economic sanctions. University libraries also strive to expand their reach and comprehensively deliver services to a broader audience through information technology.

Despite the growing significance of the online

environment and digital resources, printed materials remain valuable and are actively utilized by library patrons. The physical library space remains a vital resource for users. However, the extensive availability of library services online has led some users to turn to the virtual environment to fulfill their information needs.

Scenario 4: Productive Libraries

Through meticulous planning and the recruitment of skilled personnel, university libraries have successfully secured the approval of higher institutions for autonomous management, and universities are only responsible for supervising their activities. Library managers actively participate in university management meetings, where their insights and perspectives significantly influence the development of future strategies and budget allocations. By ensuring adequate funding for libraries, offering complimentary services to users becomes feasible. Furthermore, libraries have expanded their service offerings to their university and others by leveraging various resources, enhancing their revenue streams. The integration of information technology has facilitated the introduction of additional library services, with medical science libraries nationwide and numerous affiliated organizations utilizing these offerings, which further contributes to the library's income. As the range of services provided by libraries expands, specific responsibilities are delegated to college and hospital libraries, highlighting their increasingly prominent role in library management and planning compared to previous years. This evolution has also diminished the presence of many competitors, allowing university libraries to stand out and maximize their community engagement.

To effectively deliver services on a broader scale, libraries must ensure the availability of printed materials in diverse formats and allocate sufficient space and bandwidth for information exchange. Additionally, introducing new services has sparked interest among users nationwide, prompting libraries to shift their focus towards electronic resources and virtual platforms, thereby instigating a transformative change within the library landscape.

Discussion

This study has examined the prospective developments of medical sciences university libraries in Tehran over 20 years. The results of this investigation led to the identification of ten uncertainties and the formulation of four scenarios based on two primary uncertainties. The selected fundamental uncertainties for this research were “independent vs. affiliated administration” and “free vs. non-free services.” The uncertainty regarding “independent administration versus affiliated administration” was highlighted by experts and recognized as a critical factor in this study. No other research has identified this uncertainty, suggesting a unique focus on the conditions of medical sciences university libraries in the country and the particular interest of professionals in medical library and information science regarding this matter. In contrast, the research conducted by Ghafari-ghadir et al. mentions “local vs. national administration” as a relevant uncertainty in public libraries (10). Concerning the uncertainty of “free versus non-free services”, the study found that budgetary considerations significantly influence the provision of library services. While Ghafari-ghadir et al. acknowledged free versus paid services as an uncertainty in Iran’s public libraries, it was not deemed fundamental (10).

Besides, recent research highlights the significant role of information technology in enhancing or diminishing library services, ranking it as the third most important factor. According to Hariri and Rezaei’s study on the future of IT in academic libraries, these institutions are expected to expand their networks and infrastructure, particularly in leveraging the Internet. The study also notes a positive trend in increased investment in information technology, while reducing university budgets is seen as having no impact in this area (21).

Azizkhani and Ismailpour identify the overarching trend of technology growth as the critical factor in shaping the future operations of public libraries (3). Similarly, research by Ludwig and Starr points out that changes in information technology will be fundamental to the development of future libraries (23). Tanloet and Tuamsuk’s findings further confirm

that IT rapidly expands within public libraries (24).

One of the uncertainties highlighted in this research is the use of virtual versus physical resources, emphasizing the need for university libraries to consider the different types of resources their users rely on. Hariri and Rezaei have noted in their study that Iran’s university libraries are expected to expand their electronic resources in the future (21). This trend is also reflected in other studies focused on public libraries. Esfandiari-Moghadam and akbari in their research suggested that digital public libraries featuring digital resources will become an essential aspect of future public libraries (11). Similarly, Bakhtiari et al. indicate that the growth of electronic resources represents the future of technology for Iran’s public libraries (9). Ghafari-qhadir’s research identifies electronic resources as a significant uncertainty compared to traditional resources in public libraries (25). Akbari’s findings further support this, predicting the emergence of digital public libraries equipped with digital resources (26). Research by Huysmans and Hillebrink also confirms that future public libraries will increasingly utilize electronic and digital resources (27).

Another uncertainty identified is the choice between centralized and decentralized organizational structures, which ranks third in the consensus index. Zolfagharzadeh et al.’s research recognizes “organizational structure” as a common uncertainty regarding the future of Iran’s public libraries (28).

What sets this research apart is the development of four potential scenarios for the libraries of selected medical science universities in Tehran, Iran. Each scenario is based on possible future events and can serve as a guide for these libraries to plan and set future goals and objectives within each scenario context.

Conclusion

Identifying uncertainties and establishing two fundamental uncertainties for the medical sciences university libraries in Tehran have resulted in the development of four potential scenarios for these libraries over the next two decades. The scenarios include “Library as a Center for Interaction and Implementation”, “Active Libraries”, “Library as a



Development and Support Center”, and “Productive Libraries.” Each scenario is plausible in light of future developments and can serve as a framework for these libraries to strategize and define their future objectives and responsibilities. Furthermore, given the absence of prior research on the future of university libraries in the country, this study can serve as a reference model for these institutions.

Declaration

Acknowledgment

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Conflict of Interest

The authors declared no conflicts of interest.

Ethical Statement

This article forms part of the research initiative titled "Foresight of libraries of universities of medical sciences in Tehran over a 20 years' horizon"

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Authors' Contribution

Zahedi R: Proposing the initial idea and designing the study, collecting Data and analysis, Interpretation of results, and preparing the initial manuscript. Nemati-Anaraki L: Collecting Data and analysis, Assessment of methodological quality, Interpretation of results, Preparation and editing of final manuscript. Goharinezhad S & Shahraki-Mohammadi A: Data extraction and analysis, Assessment of methodological quality.

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