

Status of Central Libraries at Iranian Universities of Medical Sciences for Joining an Integrated Network of Medical Libraries

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Abstract

The aim of the study is to offer integrated access to information and data sources in the libraries of Iranian universities of medical sciences (UMS) as an important feature enhancing the quality and quantity of research. Thus, it is essential to study the status of Iranian libraries of UMS in terms of integration features. Accordingly, the main objective of the present study was the identification of integration in libraries of Iranian UMS in terms of metadata, digital contents, software, hardware, and human force. The quantitative study was conducted with an analytic survey method. The statistical population consists of 66 Iranian UMS, of this, 59 libraries completed the researcher-made questionnaire. To ensure the accuracy of data, interviews and, in some cases, observations were also performed. Statistical estimates of frequency, percentage, cumulative frequency, and diagrams were utilized for data analysis. The results demonstrated that the library software programs of UMS do not have a desirable status in terms of content, human force, software infrastructure, and integration features. These libraries enjoyed an optimal status in terms of hardware which was, however, not properly used. To create integrated access to the contents of libraries of Iranian UMS, it is essential to provide the required infrastructure, including integration features, human force, and appropriate contents such as the metadata and digital contents of data sources.

Keywords: Academic Libraries, Universities of Medical Sciences, Interoperability, Information Exchange Protocols, Standard Metadata, Iran

Introduction

The identification of and access to data sources has become a major challenge due to their expansive production and facilitated dissemination of information. Specialists and large institutions active in this domain direct their efforts to the identification of solutions for facilitating access to information and data sources. These efforts include the empowerment of search, metasearch, and specialized search engines (e.g. Google Scholar).

Libraries have long been active in providing the public with access to information by employing novel technologies. Accordingly, they attempt to offer desirable access to all users with the help of all the facilities available to them. The major problems, however, include the limited budget, increased price and expansion of data sources, and diversity of media which dissemination information. As a result, libraries cannot provide all the required information sources (Alipour-Hafezi 2010 & 2012; Mohsenzadeh, Radad & Alipour-Hafezi, 2017). To solve this, they have attempted to create union catalogs of bibliographical information and where to find sources in libraries across regions in order to facilitate the identification of sources. They have also tried to provide integrated access to sources in one library through other libraries using the information exchange feature. Emerging digital libraries (DL) help the libraries and information services to work more effectively on the integrating of different information systems. In additions, integration of DLs facilitate automation and empower users (Leidig & Fox 2014) and save researchers' time (Deb, 2006).

Numerous projects on the integration of heterogeneous information systems have so far been conducted, including the Colorado/Collaborative Digitization Program (CDP) funded by the Library Services and Technology Act (LISTA), the National Science Digital Library (NSDL) project by the US National Science Foundation, the Digital Library Federation's Aquifer (DLFA) project by the Digital Library Federation, the Online Computer Library Center (OCLC) WorldCat project, and the Iranian Consortium of National Content (Alipour-Hafezi, 2010).

Medical sciences are managed in Iran by the Ministry of Health and Medical Education (MoHME) whose major responsibility in the domain of information is the management of information and libraries and providing integrated access to data across the country. Integration and integrated access to information and data sources are vital for medical libraries considering the expansion and range of topics covered by them. With regard to the dispersion of libraries across universities of medical sciences (UMS) and their dispersed facilities, it is essential to integrate these facilities in order to offer integrated access to data sources. To this end, the status quo of libraries of Iranian UMS must be examined in terms of integration, appropriate protocols for metadata exchange, accessibility of digital data sources, and desirable metadata standards for integration.

The present study attempted to identify the status of Iranian medical libraries in terms of metadata, digital contents, software, hardware, and human force. For this purpose, challenges and threats to the integration of digital libraries of Iranian UMS were also identified, and the status and level of preparedness of these libraries for integration were examined.

Literature Review

"Integration" has always been one of the concerns of DL's professionals and researchers, because integrated information systems are more effective for information retrieval and users can easily search the needed information in these systems. Hence, various studies have been done on integration in the DL field. However, there are three groups of studies in the integration

of DL field. The first group of studies have tried to investigate integrating DL into other systems. For example, Owusu-Ansah, Rodrigues & van der Walt (2019) through a systematic literature review examined various efforts to integrate DL into distance education (DE) courses. They concluded that integrating DL into the DE curriculum will highlight the role of DL as significant agents of transformative learning in the academic community. They also adopted strategies for integrating DL into DE. Integrating DL into Wikipedia (Orlowitz, 2018), collection management systems (Fay, 2010), linked open data systems (Latif, Schrep & Tochtermann, 2016), e-learning systems (He, Peng, Mao, & Wu, 2010; Secker, 2005; Han and Han, 2005), eScholarship systems (Coleman, 2009) are more examples of the first group of “integration” studies.

Another group of researchers sought to integrate other systems in digital form. For example Ekmekcioglu & Brown (2001) suggested linking online learning environments with DL. Their findings showed different parties view integrating online learning environments into DL improves the performance of the UK education sector. However, institutional infrastructure and politics, inter-professional communication and collaboration, resources and funding, pedagogy, staff development, access and content are key issues in integration of online learning environments into digital library resources and services. Integrating research data management platforms (Amorim, Castro, da Silva & Ribeiro, 2017), visual search interfaces (Gaona-Garcia, Martin-Moncunill & Montenegro-Marin, 2017), reference services (Chowdhury 2002), Instagram metadata and hashtags (Ibba & Pani, 2016), digital humanities (Zhang, Liu & Mathews, 2015), Web 2.0 technologies (Lwoga, 2014), data from unstructured ecological sites (Barros, Laender, Goncalves, & Barbosa, 2008), external systems and tools (Ivanyukovich, Marchese & Giunchiglia, 2008; Han, 2006), ontologies (DeRidder, 2007; Zhang, 2004), text categorization and summarization tools (de Buenaga, Mana, Gachet & Mata, 2006), electronic pathfinders (Wang & Hubbard, 2004), heterogeneous data of distributed databases (Di Giacomo, Martinez & Scott, 2004) into DL are other subjects that have been studied by DL researchers.

In a more recent research, Cao, Liang & Li (2018) studied the integration of smart technologies, such as internet of thing (IoT) technologies, in DL. According to their findings, integrating such technologies at three layer (e.g. perceptual, computing and communication) is required for creating smart libraries. Finally, the third group of the researchers have worked on the integration of different (and heterogeneous) types of DL. For example, according to Liu and Zeng (2016), sometimes the integration of multiple DL is required for creating more efficient information retrieval system, but merging results from different DL will result in duplication of the items. Then, they proposed a holistic solution (includes achieving automatic training set, holistic attribute mapping, and weight of attribute training) for solving this problem.

Through a literature review, Alipour-Hafezi (2014) proposed a framework for integration of digital library applications in syntax level. Models, protocols, metadata formats, and context layers are building blocks of this framework. Foster Evans and Thomas (2007), also proposed several solutions for Implementation of an integrated information management system at the National Library of Wales, namely, Virtua, iPortal, and Vital. According to their conclusion, “the majority of the problems encountered during implementation can be traced to the complexity of the varying sets of data involved”. In another project, China Academic Library and Information System (CALIS) tried to create China Networked Digital Library of Theses and Dissertations (CNDLTD) through integrating different digital library of theses and

dissertations around the country. CALIS has faced with several issues during this project, including metadata standards, OAI metadata harvesting protocol, standard document format and intellectual property protection (Jin, 2004).

Since heterogeneous metadata has been always a one of key challenges in integrating multiple digital libraries, Chen & Ke (2013) proposed FRBRoo, which can play a role to achieve heterogeneous metadata integration and semantic query. In additions, Kondylakis, Doerr & Plexousakis (2006) presented a mapping language for information integration under a common knowledge representation model (LAV approach) in merging heterogeneous database. For addressing problems of integration of DL, some researchers proposed a comprehensive framework; 5S framework, for example, which includes societies, scenarios, spaces, structures, and streams (Shen, Goncalves & Fox 2013; Shen, Goncalves & Fox, 2008).

According to Leidig & Fox (2014), building and intelligent DL requires integrating different DL and systems at different layers. Their findings showed that 5S, 5SGen, and SimDL frameworks they proposed can be used to produce instances of intelligent DL and information systems. In additions, Kim, Choo & Chen (2010) have emphasized on integrating DLs to build a Meta-DL system, which helps users to locate, explore and use the resources. Dahl, Banerjee & Spalti (2006) pointed out some key issues in integrating DLs, including standards, interface, architecture, metadata, content providers, interoperability, digital assets, and authentication, identity management and security.

As it's obvious, the matter of "integration" is one of the important subject in DL field, in theory and practice. In particular, in recent years, that information system's academic and professionals have concentrate on building smart/ intelligent DL to make a robust tool helping users to find their information resources more easily, integrating DLs is inevitable. This paper presents lessons of an experience of integrating multiple DLs in a specific science, medical, domain. In this regard, this study's endeavor is to identify the content and infrastructure status of UMS universities in order to find their challenges and threats in integration. So this study investigated the UMS universities in metadata, digital content, software and hardware and also human force aspects. Consequently, a suitable model for this circumstances were finally presented.

Materials and Methods

The present study was quantitative and applied, employing various methods. The library research method was adopted for the literature review and the identification of the components of interest. In the next step, the analytic survey method was applied to identify the quantity, quality, and type of contents and facilities offered by digital libraries of UMS. Firstly related literature should be studied to identify related attributes to study UMS digital libraries. SO in the first phase using the library research method, practical and important databases, including Emerald, Elsevier, IEEE, LISTA, and Information Science and Technology Abstract (ISTA) were searched in order to collect data. Afterwards, relevant resources were selected by reading the abstracts of the retrieved sources. In the next phase, the selected sources were carefully examined, from among which highly relevant resources were chosen. In the second phase, via the analytic survey method, data were collected using a questionnaire, and the accuracy of responses to some items was checked using a checklist and observations. As no similar study at this level had been conducted on medical sciences in Iran, and since no similar instrument was available for this purpose, the researchers developed a questionnaire and a checklist based

on data sources, the literature, and available instruments. The questionnaire comprised five sections: the identification of the digital library in question and the date of examination, data collection on the content available in the digital library under study, identification of the status of software to present the output formats of data, hardware facilities in digital libraries, and the status of specialized human force in the digital libraries under study. To ensure the accuracy of results, the researchers directly contacted the officials of digital libraries over the telephone and modified the responses through direct observation of the capabilities of software programs. Thus, in this process, some collected data were modified based on observations, thereby enhancing the reliability of data. To ensure the validity of the instrument, the researchers sought the opinions of five experts on Information Sciences and Knowledge Studies familiar with information technology. Based on these opinions and upon applying the recommended modifications, a new version of the questionnaire was developed. After receiving the opinions of specialists and their sample responses, final modifications were applied and the final version of the questionnaire was prepared. As the data required for this study were nominal, no test could be performed to examine the reliability of the questionnaire.

The statistical population in the first phase comprised relevant data sources examined to gain familiarity with the literature. In the next phase, the integration status of digital libraries of UMS was evaluated. In total, from among 66 libraries of UMS identified at the outset of the study, 59 libraries (89%) completed the questionnaire. The research population was examined in terms of interactivity using the researcher-made questionnaire. The collected data were described, and statistical estimates of frequency, percentage, cumulative frequency, and diagrams were obtained using Microsoft Excel, thereby answering the main research questions.

Results

Data were collected using a questionnaire and a checklist, and results are described in the order of research questions.

Research Question 1: What is the status of the libraries of Iranian UMS in terms of digital contents?

To answer this question regarding the priority of offering sources to users based on source type, questions tapping into the following domains were posed to 59 medical libraries: the level of use of scanned sources (analog-to-digital conversion) in terms of the type of source, adherence to the copyright law in providing digital sources and scanning of sources, existence of a codified manual or process for scanning, estimated number of traditional library sources digitalized in different formats, estimated number of sources born digital (except for those resulting from the sharing of databases), frequency of digital sources with which services could be offered based on the copyright law, and the capability of searching scanned digital sources based on the type of source.

Books and theses/dissertations ranked the first in the type of sources offered in libraries, followed by research articles, magazines, educational contents and research projects, and video files, respectively. In general, electronic books (49%) and technical reports (2%) were the most and least important sources, respectively. In terms of source scanning (analog-to-digital conversion), theses/dissertations (29%) and books (17%) ranked the first and second, respectively. Furthermore, 56% of the libraries adhered to the copyright law in the provision and scanning of digital sources, whereas 64% of the medical libraries did not use a codified

manual or process for scanning resources.

Moreover, only 22 libraries (Baqiyatallah, Shahed, Shahid Beheshti, Isfahan, Bandar-e Abbas, Tabriz, Zanjan, Kordestan, Kerman, Guilan, Lorestan, Mazandaran, Mashhad, Neyshabur, Gonabad, Arak, Yasuj, Hamadan, Birjand, and Shiraz University of Medical Sciences; the University of Social Welfare and Rehabilitation Sciences; and the Faculty of Nursing and Midwifery of Qazvin University of Medical Sciences) offered their traditional library sources in various digital formats as well. Still, even these 22 libraries provided a limited number of traditional sources in the digital format, of which books, theses/dissertations, and research projects ranked the highest. The remaining 37 libraries had made no attempt in this regard. Thus, the libraries of Iranian UMS have maintained their traditional nature with very limited efforts for converting their library into the electronic format. Moreover, only 18 libraries (AJA, Urmia, Tabriz, Shahrud, Kordestan, Sarab, Kermanshah, Mashhad, Gonabad, Shahr-e Kord, Bushehr, Yasuj, Hamadan, Birjand, Behbahan, and Ilam Universities of Medical Sciences; and the University of Social Welfare and Rehabilitation Sciences) had prepared a limited number of resources in the born-digital form. Thus, the development of electronic collections by purchasing electronic sources is not popular among the examined libraries.

Based on results, a high percentage of libraries (48 libraries) provided access to their digital content by a 100% adherence to the copyright law, followed by six libraries (AJA, Shahrud, and Kermanshah Universities of Medical Sciences; the University of Social Welfare and Rehabilitation Sciences; Gonabad, and Bushehr Universities of Medical Sciences). Meanwhile, five newly established libraries or those lacking library software (Torbat-e Jam, Khalkhal, Khomein, Shushtar, and Gerash Universities of Medical Sciences) did not have a codified policy on adherence to the copyright law as they had not prepared digital sources yet. The searchability of scanned digital sources using optical character recognition (OCR) based on the type of source was zero in most cases (48 libraries), and six libraries (Tehran, Zanjan, Shahrud, Fasa, Kashan, and Lorestan Universities of Medical Sciences) did not answer the corresponding item on the questionnaire. Babol University of Medical Sciences was the most successful in this regard, making 100% of its sources in different formats searchable. This was followed by the University of Social Welfare and Rehabilitation, and Gonabad, Hamadan, and Birjan Universities of Medical Sciences, respectively. According to Norouzi & Jafarifar (2017), the major flaw of OCR software is that it does not support the Persian writing system. The use of OCR software has recently begun in Iran. However, due to the problems of the Persian writing system, including its cursive script, it may take a long time before an OCR software will be developed for this language. Therefore, it can be claimed that libraries offering the search feature for scanned digital sources using OCR have limited this search to English sources.

Results also indicate that the common method for describing data sources was the use of metadata (78%). English (83% coverage) was the language of most digital libraries in the population, followed by Persian (81%). The most popular format was PDF for text files (68%) and JPEG for image files (36%). On the contrary, according to Seifi (2011) and Aghababaei (2013), the format of Tiff is the most common format for saving scanned sources and the most popular among the public, often used as the basic file. With regard to audio files, MP3 (17%) and, with regard to video files, MP4 (5%) were the most popular formats in libraries of Iranian UMS.

Research Question 2: What is the status of the libraries of Iranian UMS in terms of software?
 Results on the status of software programs are given in Table 1.

Table 1
Frequency Distribution and Percentage of Library Software Programs Utilized in the Statistical Population (and Their Features)

Name of the library software	Number	Percentage	Programming language			Level of service provision			Access to metadata using public and specialized search engines		
			SQL	JAVA	Not specified	Location of network	Local	Web-based	Not available	Not available	Not specified
Azarsa (Pars Azarakhsh Company)	18	31		*				*	*		
Digilib (Pars Azarakhsh Company)	12	20	*				*			*	
Digilib Portal (Pars Azarakhsh Company)	9	15	*				*	*		*	
Sana 2.0 (Payam-e Mashreq Company)	5	8	*					*	*		
Hanan (Payam-e Hanan Company)	3	5		*				*	*		
Open-source Kooha	3	5		*				*	*		
Simorgh (Nosa Company)	1	2			*		*	*		*	
Digilib (Ava Afraz Shiraz Company)	1	2			*			*		*	
Aftabgardan	1	2			*	*				*	
Fara Kavosh (Kavosh Company)	1	2			*			*		*	
Parvan (Parvan Pajoooh Company)	1	2		*			*	*	*		
Mava (Islamic Republic of Iran Army)	1	2	*				*			*	
No software	3	5	--	--	--	--	--	--	--	--	--

Based on Table 1, the majority of the studied libraries (66%) utilized various versions of the software program developed by Pars Azarakhsh Company, followed by Sana 2.0 (Payam-e Mashreq) (8%). The other programs were minimally used by the studied libraries. Azarsa (Pars Azarakhsh) (18 libraries), Hanan Digital Library (Payam-e Hanan) (three libraries), and the open-source Kooha (Roz System) (three libraries) employed the Java programming language. In other words, 24 software programs used Java. Moreover, Digilib (Pars Azarakhsh) (12 libraries), Digilib Portal (Pars Azarakhsh) (nine libraries), Sana 2.0 (Payam-e Mashreq) (5 libraries), and MAVA (The Islamic Republic of Iran Army) (one library) used the SQL programming language. It must be noted that Digilib Portal (Pars Azarakhsh) (nine libraries) and Sana 2.0 (Payam-e Mashreq) (five libraries) show content on the Web as they use a web-based portal.

Based on the results, the majority of libraries (53%) implemented the “user identification, search, metadata, full text” order of access to sources. Of these, two methods of “user identification, search, full text” and “search, user identification, full text” (3%) were the least frequently used ones. Most libraries (46%) utilized the SQL language in the database of their

library software program, and Java¹ (n=24) was employed by 41% of libraries. Results also demonstrated that there is access to the database in 51% of the libraries. Moreover, 22 libraries (37%) provided indexing and access to metadata through public or specialist Web-based search engines, whereas 18 libraries (31%) did not have such a capability. In terms of offering digital content to users on the Web, 51 libraries, i.e. the majority of libraries studied here (86%), offered access to full-text and multimedia sources for credible users after identification, of which only 21 libraries (36%) succeeded in providing this capability in the Web-based form as well. Finally, 58% of libraries provided access to digital libraries through online requests in the user interface. In this way, they prepare access for users to retrieve and extract metadata in their User Interface (UI).

Research Question 3: What is the status of the libraries of Iranian UMS in terms of hardware?

Based on survey, the most commonly used facilities were servers (76%), scanners (73%), hard disks (71%), and Web servers (69%), while book scanners (5%) were the least commonly used facility. Factually, no advanced tools are used in UMS digital libraries for producing digital contents.

Research Question 4: What is the status of the libraries of Iranian UMS in terms of specialized human force?

Results indicated that 41% of the libraries have more than four digital librarians, with the rest having fewer digital librarians. Result presents the level of skills of librarians in order to determine the quality of their specialty. Specialties are arranged in terms of Likert scale in which “no answer” was scored 0, “low” 1, “moderate” 2, and “high” 3. The total Likert score was calculated by summing these scores and the mean was then computed. The optimal status was calculated as the median of three high scores (1.5). As all the items mentioned in the questionnaire received a score higher than 1.5, it was concluded that all items had an optimal status.

Research Question 5: What integration models, protocols, and standards are supported by the software programs utilized in the libraries of Iranian UMS?

Results on the information exchange infrastructure are presented in Table 2.

Table 2

The Frequency Distribution and Percentage of Types of Metadata Outputs Pre-Defined in the Studied Library Software Programs

Metadata outputs	Name of standard	Number	Percentage
Context-based layer	ISO text	43	73
	Structured text	1	2
	XML	7	12
	ODBC interface	0	0
	HTML	5	8
Descriptive metadata	MARC	44	75
	XMLMARC	8	14

¹ Modules that produced by Java

Metadata outputs	Name of standard	Number	Percentage
	DC	21	36
	MODS	16	27
Managerial metadata	METS	18	31
	None	5	8
	No answer	3	5

Based on Table 2, ISO text (73%) was the most frequently used context-based layer standard, whereas MARC (75%) was the most frequently used descriptive metadata. From among the studied libraries, only 18 utilized METS¹, and five libraries did not support any information exchange standard. Results also showed that MARC 21 (75%) is the most frequently used version of MARC in the libraries of Iranian UMS, followed by UNIMARC (66%) and MARC IRAN (26%). Based on results, 53% of libraries did not employ Dublin Core, and only 36% applied the first edition of Dublin Core. Only 32% of libraries had the feature of changing the structure of metadata formats in the library software system, and 44% did not have such a feature. Moreover, the feature of receiving metadata output by librarians existed in 69% of the studied libraries. However, 7% did not provide such a feature. The channels of receiving the outputs of library programs were located at the site of the library in 95% of cases; available through the local network of the library in 90%; and available through the Internet in 51%. Of various types of connecting to metadata output from the database with the source file in the library system, 81% of libraries employed the method of meta-text in the metadata, and no relationship between metadata and full text in output formats existed in four libraries. Furthermore, the majority of libraries (68%) employed the Z39.50 information exchange protocol at the level of the service receiver, and no information exchange protocol was utilized by nine libraries. Finally, 18 libraries used OAI and SRU/W in addition to Z39.50 at the level of service receiver.

Discussion and Conclusion

Contents in digital libraries are prepared in diverse text, image, audio, and video formats using the two methods of analog-to-digital conversion and born digital. Databases, which are always considered as a subsidiary collection for other sources, are among digital born sources. Still, accessibility to databases is not provided through digital library applications, and users have to directly visit the collection and use it online. In fact, this needs knowledge of how to act, search and retrieve, with each application.

Examination of the performance of libraries under study revealed that their main focus is on theses/dissertations and books, and other information resources do not receive much attention. Currently, very limited resources are prepared and offered in the digital form. Data sources become accessible by creating metadata and connecting them to digital files. Therefore, in the digital libraries of Iranian UMS, there are few digital sources, mostly scanned theses/dissertations and books, and making access to them is available through the traditional method of metadata generation. The content of metadata in most cases have numerous problems in terms of the digital format of information resources due to being converted from traditional

¹These 18 libraries used Azarsa (Pars Azarakhsh).

to digital formats. Furthermore, the formats used in service provision include PDF for text files and JPEG for image files. The only important digital resources include shared databases which have been made accessible to all libraries by the MoHME. Thus, a major problem in the studied libraries is the shortage of digital resources and access to these resources through the traditional method of metadata (lacking in digital features) in distributed heterogeneous library systems.

The software program is a major component of digital libraries as it offers the possibility of content management, serving as a communication channel among libraries. It was found in the present study that the majority of libraries (66%) use software programs developed by a known Company. Of these, only 18 libraries utilized a digital content management version which could interact with search engines. Moreover, 12 libraries employed other digital content management programs which could interact with other programs (by default settings and in a non-continuous form in most cases). Thus, approximately 50% of programs managed to interact with other programs through default settings.

Access to digital data resources is available through the identification of members and their access level. The database management software program is SQL or Java in 87% of libraries. These results indicate that detailed and comprehensive planning is needed for integrating the content and providing access to it. The employed programs, except for Azarsa which uses Z39.50 Web service protocol, cannot provide contents to other programs; therefore, a service provider protocol must also be created and implemented in order to obtain a network of interacting libraries. On the other hand, many libraries (about 50%) use software programs without the interactivity feature which cannot interact with other information systems. Of course, the examination of the content of libraries revealed that most of them do not enjoy rich and good information resources anyway. Findings by Alipour-Hafezi (2010) showed the same data in Iran. This revealed that DL applications in Iran do not changed their solution and way of application improvement in near a decade.

Evaluation of the status of hardware facilities in the studied population revealed that libraries enjoy the minimum hardware facilities required, such as scanners (73%), hard disks for the storage of digital contents (7%), servers for hosting the digital library management software (76%), and Web servers for offering contents and information resources on the Internet (69%). Consequently, in converting the format of information resources and managing digital resources on the Internet, these libraries enjoy the necessary facilities and do not have any limitation in this regard.

Results of examining the presence of specialized human force indicated that the studied libraries have an optimal status in terms of specialists needed for digital libraries. Still, based on the prior experience and previous studies of the researchers, this is in fact not true: Librarians have very limited knowledge in the domain of digital libraries, cannot manage systems, and are not specialized in digital libraries. Therefore, to cooperate in the domain of digital libraries, they require preliminary training on scanning, working with content management programs, human-information interaction, working with accessory software, portal management, and more importantly, protection of digital information. Nevertheless, it seems that librarians in the noted libraries are motivated to work in the digital library environment, which directs them towards gaining the required knowledge.

Results also showed that MARC 21 descriptive metadata and ISO output exist in about 75% of the studied libraries. There is communication between metadata and information resources through the meta-text feature in the metadata. The Z39.50 server protocol exists in

31% of the studied libraries. Therefore, the federated search and information harvesting model (due to the capabilities of the OAI protocol in these programs) can be used in 31% of the studied libraries. As the information harvesting and federated search model exists in 18 libraries, other libraries cannot exchange information with other information systems. These 18 libraries also support MARC 21 metadata ISO output. Still, the XML markup language which is currently the most efficient language in information exchange among information systems, has been neglected. The feature of using MARC 21 and its conversion to MODS (an appropriate standard for metadata exchange) is available in about one-third of the studied libraries. As a result, two-thirds of the studied population cannot exchange and integrate information resources. These 18 libraries must be equipped with up-to-date digital library integration standards, and integration must be provided for the remaining two-thirds, so that a virtual library can be established with maximum participation of libraries of UMS.

Results of the present study revealed that the libraries of Iranian UMS enjoy a motivated human force and appropriate hardware facilities. In terms of software, the homogeneity in using Azarsa (about 31%) and the software programs developed by a single company will contribute to integration, although integration is not limited to forcing libraries to use the same content management software. Still, this homogeneity may lead to homogenous metadata formats, thus decreasing problems in the translation of metadata. Despite all this, there are numerous challenges to the integration of these libraries, the most important of which are listed below. The below mentioned challenges were extracted from the current status of the UMS digital libraries in case of integrating. In fact results in each sections demonstrate the status of the studied DLs. So the poor results indicate that there is a challenge in that area.

- *Very limited content of libraries:* Libraries are far from rich in terms of content. In this situation, the importance and value of integration are doubted. Still, specialists and faculty members in the studied universities constantly require information resources, justifying the necessity of integration. Integration will facilitate access to information resources in all Iranian UMS, thus directly affecting the quality of publications and education of faculty members.

- *Text format and dependence on PDF:* Results showed that the studied libraries neglect information storage formats in the cyberspace. This may pose problems to the provision of digital services to users in other universities and lead to numerous constraints.

- *Lack of attention to multimedia resources:* Results demonstrated that the studied libraries do not pay attention to information resources other than theses/dissertations and books, especially new formats of information resources in the digital space. However, those in need of information resources, especially in the domain of medical sciences, require multimedia resources more than ever. Thus, it is essential to address this problem.

- *Lack of search feature for scanned files:* As part of the resources of digital libraries are converted from the analog to the digital format, they convert to image files after being scanned. As a result, it is necessary to add the search feature for the content using the OCR process. As some resources, especially theses/dissertations and books, have been converted from the print format to the digital version, it is vital to offer the search feature for their content.

- *Deficiencies in metadata:* Some of the metadata prepared and used in digital libraries have been transferred from traditional libraries, and several necessary fields and elements have not been designed for them in digital libraries. Thus, there is a major fault in metadata, posing a challenge to the integration and creation of virtual libraries.

- *Existence of separate collections of library resources and databases:* In most libraries

studied here, access to shared databases has been offered by the MoHME which, in most cases, is presented as a separate collection entitled "digital library". Access to and use of these collections are separate from those of the library collection, forcing users to repeatedly search both databases.

- *Provision of PDF files for users or limiting users to reading sources online:* Another problem in the studied libraries is the existence of PDF files. Some programs limit access to these files and merely provide their online reading feature due to the copyright law and lack of user-friendliness.

- *Diversity of software programs and their limitation for the integration and provision of continuous information outputs:* The heterogeneity of software programs used across organizations is a serious challenge to the integration of information systems. This is exacerbated if standards in various domains of software are not met, and it is impossible for programs to offer information through a Web service.

- *Limited access to library software contents:* Some library software programs used in the studied universities do not give search engines and other information systems access to the content of their databases. This causes a big challenge to the integration of and access to contents for other systems.

- *Lack of attention to integration standards among data systems:* Some software programs used for the management of the content of libraries of Iranian UMS lack the standards of integration with other information systems, causing a major problem for the integration and creation of a virtual medical library.

- *Inappropriate use of existing hardware and facilities:* Results showed that optimal hardware facilities exist in some libraries, but they have failed to exploit these facilities due to the shortage of specialized human force, skills, and planning, thus wasting the resources.

- *Shortage of specialist human force in the domain of digital libraries:* Contrary to the claim made by most libraries as to the presence of a specialist human force, further examinations in this study revealed that there are few specialists in the domain of digital libraries with the required skills, and the rest do not have the qualifications necessary for managing digital contents and providing digital services with the added value.

- *Lack of attention to digital services:* The studied libraries neglect services, especially in the electronic and online domain, while users look for electronic services. In most cases, libraries are limited to the provision of software or digital content and are not familiar with electronic services, making users lose interest in visiting libraries for meeting their information needs.

According to the abovementioned challenges, the following suggestions in the diverse sections of integration are presented. In terms of the poor content, it is suggested the libraries try to improve their quantity and quality of their content. In this regard they should work in different areas. They should try to prepare their own contents in digital format and also strive to prepare other scientific contents in regards to copyright issues. Moreover they should improve the quality of their content, for instance they should have plan to make their content searchable and accessible. In the terms of software, The DLs should improve their digital content management software so as to be applicable to import and extract standard metadata solely or in group in prevalent integration protocols. Their library management systems should support integration protocols in harvesting and/or federated search. In the case of human force, they should improve their digital librarians' knowledge in working in the process of integration

services. In this regard holding workshops and preparing educational booklets would be applicable. Moreover DLs should edit their workflows in order to support integrated DL services.

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