Evaluation of Open Utilization of Digital Archives Information System

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***Abstract*—The research on open sharing and ubiquitous intelligent services of digital archive information based on mobile devices has unique academic value and important practical significance for the archival career in China. By the analysis of domestic and foreign archive applications and smart services, this paper studies the open sharing of digital archive information and ubiquitous intelligent service strategies, and a hierarchical analysis model for the evaluation of open utilization of digital archives was proposed. Its purpose is to provide a reference for reducing the risk brought by the physical archives. During the use of archives,and based on the evaluation results,the practical preventive measures can be taken to improve the research level of open sharing of digital archive information and ubiquitous intelligent services based on mobile devices.**

Keywords-Digital Archives; Ubiquitous Intelligent Services; Open Sharing of Archive; Hierarchical Analysis; Hierarchical Analysis Model

I. INTRODUCTION

In recent years, the archives APP developed by foreign archives has become mature and diversified. However, compared with the use of digital resources in libraries, there are still a lot of disadvantages in the use of archives and the sharing of information resources. Taking the World Digital Library Project as an example, this project is aimed at providing services for digital resources of libraries and archives worldwide. Among the 96 agencies that actually contributed data resources, only 6 departments are involved in them, and archives only accounted for 6.3%. Among the 3378 institutions that contributed data resources for the Cornucopia project in the UK, only 44 file departments are participated, and archival agencies accounted for only 1.9%[1].

In China, the “Shenzhen Archival Bureau Mobile Portal”, which is on-line in June 2013.There are five first-level columns for information disclosure, service guides, online services, interactive communication, and archival culture [2]. For the electronic magazine of “Haidian District Revolution Historical Remains” of Haidian District Archives in Beijing, the content of the APP is limited to the archives information of the Historical archaeological archives of Haidian District, and the degree of attention to livelihood archives close to life is low[3].In April 2016, Wenzhou Archives Office in Zhejiang Province released the “File Cloud Reading” mobile APP platform. In June 2017, Shaoxing City Archives also released the "Shaoxing Archives” APP for the remote use of the people's livelihood archives. Citizens only need to download the "Shaoxing Files" APP and they can make an appointment to check on the files.

Looking at the situation of domestic archival agencies in the use of digital archive resource services, although there are certain practices in digital and intelligent services, there is very little to provide open sharing of digital archive information and ubiquitous intelligent services. Therefore, it is necessary to carry out research on the open sharing of digital file information and ubiquitous intelligent services based on mobile devices.

II. DIGITAL ARCHIVE INFORMATION OPEN SHARING AND UBIQUITOUS INTELLIGENT SERVICE STRATEGY

The so-called Ubiquitous Intelligent Service refers to the way anyone can obtain personalized smart services at any time and any place. As human society develops extensively into information and knowledge economy,as well as the awakening of the people’s right to information, the sharing of archives information resources has become a social demand, and it is the development requirement of the times and a general trend.

A. The digital management services of the archive

The definition of the archives can be expressed as the record of information which formed in the social activities with real credentials [4]. It is a true reflection of all kinds of historical activities of various units, and archival materials are relatively precious. The digital storage of archive resources, and using the network and other equipment to query archive information is the main means of modern archives management.

Using the software of that digital file management system, according to the archival requirements of different types of files, all file departments complete the data input and management of their own files. Under the secure account management system, all types of personnel can retrieve, manage, and maintain files at any time and place, which not only improves the efficiency of file management, but also makes file retrieval more convenient. The resources of distributed files are integrated through the digital file management system. This completes the digital management services of the archives.

B. Information sharing

With the advent of the information society, the integration and sharing of archive information resources has

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become an inevitable trend. That is， changing a single information access to database access and standardizing the database construction, switching access to a one-stop information service, and gradually establish a nationwide archives resource system to meet the needs of different users for digital file information.

Based on the needs of users, publicly available archive information and documents should be released in a timely manner. Archive information can be queried by the software platform. The archives directories and full-text information can be regularly published and opened. For archive information with public welfare, it should be a proactive serve approach to maximize social sharing of archive information.

The second development of archives information can be performed by the reorganization, analysis and processing of archives information. It can enrich the content of archives information services so as to serve leadership decisions, serve the society, service information sharing. To play a role as a staff and assistant for the management of various units.

C. *The ubiquitous intelligent services*

Starting from the reality of archival work, constantly expanding its service area around the theme of service is one of the main modes for developing ubiquitous digital archives services. Ubiquitous intelligent services are an innovative activity in the process of resolving user problems by applying archive information to archive services after secondary development. There are various problems encountered by users in the mobile network environment, and the solutions required are different. Therefore, ubiquitous intelligent services are dynamic and personalized services that the secondary development of archive information is needed and provided to users.

After proactive and accurate analysis of user needs, re-dissolve, integrate, and integrate fragmented file information in order to innovate new file products, provide archive resources, further carry out mobile services and reference consulting services. Ubiquitous intelligent services can be classified into passive ubiquitous services and active ubiquitous services.

1) *Passive Ubiquitous Services*

The passive ubiquitous services mainly refer to traditional file utilization services, which is a service based on the use of physical files, such as: file reading and borrowing, file copying, and file certification, etc. This kind of service does not require archivists to perform secondary development on the files. The user only come to the archive rooms and file personnel can provide them with the required file materials. Even if a message or reservation is made via the Internet, the appointment is also made by the user first request and then it can be completed with the help of management personnel.

2) *Active Ubiquitous Services*

Active ubiquitous services are based on the digital archive ubiquitous intelligent service platform services, and are modern archival services to face the society based on the unit. In addition to actively understanding current user needs and market trends and also increasing the initiatives of services. The development of the archives industry is predictable and forward-looking.

The current work focus must be grasped, consciously provide archive information services, consciously provide archival information services, purposefully carry out archive service work, provide valuable reference for all departments to better carry out work. The value of archive work is fully reflected in the active service for users.

III. THE ANALYTIC HIERARCHY MODEL OF ARCHIVES UTILIZATION ASSESSMENT

In the study of open sharing of digital archive information and ubiquitous intelligent services based on mobile devices, using the analytic hierarchy process to assess the risk of archival utilization, which can reduce the risk brought by the use of physical files. Because the AHP has the advantages of being systematic, concise and practical, the qualitative relationship is theoretically transformed into a quantitative relationship. It quantifies the degree of risk in the use of archives, and provides a scientific basis for determining the weight of risk indicators for file utilization [5].

According to the basic steps of the AHP and the rules of thinking and psychology, through the introduction of node classification, combining qualitative and quantitative decisions, the decision-making process is layered and quantified by analyzing the characteristics of the archives utilization risk.

The analysis of the archives utilization evaluation model established is shown in Fig.1.

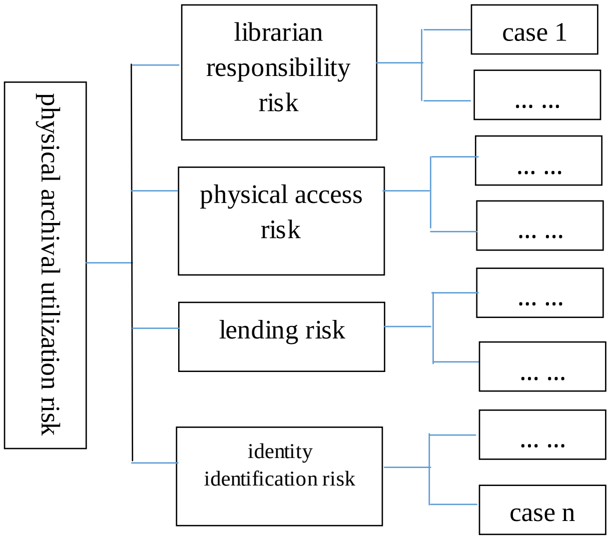
physical archival utilization risk
librarian responsibility risk
physical access risk
lending risk
identity identification risk
case 1
... ...
... ...
... ...
... ...
... ...
... ...
case n

Figure 1. Analytic hierarchy analysis model of archives utilization

A. *The construction of pairwise comparison judgment matrix*

In the hierarchical model of archive utilization assessment, for the overall goal of physical archival utilization risk, according to the degree of importance, it is to take a method of assigning certain numerical values for various risk elements in order to perform a pairwise comparison. The 1-9 scale method is generally used, which means that the ratio of the evaluation factors is 9,7,5,3,1,1/3,1/5,1/7,1/9, respectively. The former is more important than the latter: extremely important, very important, important, slightly important, equal, not very important, not important, very important, extremely insignificant. The median of the neighboring evaluations is 8, 6, 4, 2, 1/2, 1/4, 1/6, 1/8, respectively, which forms judgment matrix A[6].

For the use of physical archives, the overall risk is Matrix A, including librarian responsibility risk A_1, physical access risk A_2, lending risk A_3, and identity identification risk A_4.

$$A=\begin{bmatrix}1 & 2 & 1/3 & 3\\ 1/2 & 1 & 1/3 & 2\\ 3 & 3 & 1 & 4\\ 1/3 & 1/2 & 1/4 & 1\end{bmatrix} \tag{1}$$

B. The calculation of the feature vectors and maximum eigenvalues

The square root method is used to judge the particularity of the matrix and calculate the feature vector in this paper. Multiplicative product P_i of each row in the matrix and the new vector are C:

$$P_i=\prod_{j=1}^{k}a_{ij} \qquad \text{I,j=1,2,}\cdots\cdots\text{,k} \tag{2}$$

$$C_i=\sqrt[k]{P_i} \tag{3}$$

$$C=(C_1,C_2...,C_k)^T$$

After normalizing C_i, the weighting factor W_i is:

$$W_i=C_i/\sum_{i=1}^{k}C_i \tag{4}$$

Feature vector：

$$W=(W_1,W_2...,W_k)^T \tag{5}$$

The above calculation results are shown in Table 1.
Here $k=4$

TABLE I. CALCULATION RESULTS

Product of each row of elements		New vector		Feature vector	
P1	2.00	C1	1.19	W1	0.25
P2	0.33	C2	0.76	W2	0.16
P3	36.00	C3	2.45	W3	0.51
P4	0.04	C4	0.45	W4	0.09

The maximum characteristic value $\lambda_{\max}$ is:

$$\lambda_{\max}=\sum_{i=1}^{n}\frac{(AW)_i}{nW_i}=4.09 \tag{6}$$

C. Verify the consistency

Consistency index CI:

$$CI=\frac{\lambda_{\max}-n}{n-1}=\frac{4.09-4}{4-1}=0.03$$

It was found in the literature [7]: for the 4th-order matrix, the average random consistency index $RI=0.90$, and the consistency check ratio can be obtained by the following formula:

$$CR=\frac{CI}{RI}=\frac{0.03}{0.90}=0.03 \tag{7}$$

Because of $CR<0.1$, it is considered that the utilization risk matrix A of the constructed physical archives has passed the consistency verifying, which explain that the value is reasonable and the weights obtained are also reliable.

For the overall risk of physical archives utilization, if the degree of risk is represented by a percentage, then the risk of librarian liability is 25%, the physical reading risk is 16%, the lending risk is 51%, the risk of identification is 9%. This shows that the risk of physical archives utilization should focus on prevention from the lending risk. To prevent in advance, the effective measures should be taken in order to minimize the loss that the risk may bring. For qualified archival agencies, the important and precious archives should be should make into miniatures or copies to replace the originals in order to prevent risks and reduce risks.

When the risk changes, “risk adjustments” can be made by adding or subtracting nodes to assess the impact of various risk changes on the physical archives utilization. Finally, the evaluation results are relatively objective and reasonable.

IV. CONCLUSION

The research on open sharing and ubiquitous intelligent services of digital archives based on mobile devices has unique academic value and important practical significance for the development of archives in China. Based on the analysis of domestic and foreign archive applications and intelligent services, this paper studies the open sharing of digital archive information and ubiquitous intelligent service strategies, a hierarchy analysis model for file utilization assessment was proposed. Its purpose is to provide a reference for reducing the risk brought by the physical archives During the use of archives, and based on the evaluation results, the practical preventive measures can be taken to improve the research level of open sharing of digital archive information and ubiquitous intelligent services based on mobile devices.

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