Study on the Realization of Information Rights of University Library Users from the Perspective of Smart Service Quality Evaluation

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The purpose of this study is to explore the realization of users ' information rights (IRs) in the smart service of university libraries. Based on the LibQUAL model, principal component analysis (PCA) is used to measure the quality of smart services in university libraries. The contribution weight of various services to the realization of IRs is calculated by analytic hierarchy process (AHP), then the degree of IR realization is obtained. Users have the highest right to express information, the lowest right to equality, and other rights tend to be moderate. Suggestions to improve the realization of IRs are put forward at the end.

Introduction

Citizen's information right (IR) has become the basic right of every citizen in modern society. The protection of citizen's IRs has been paid attention to by governments in recent years (Peled and Rabin, 2010). The Chinese constitution clearly states that every citizen has the right to know, the right to express, and the right to intellectual property, all of which belong to the scope of IRs. The reform program promulgated by the European Union in 2012 also gives citizens a new IR: "the right to be forgotten," which gives citizens the freedom to halt the dissemination of their own information on the Internet (Rosen, 2012). In 2016, the U.S. government made changes to the Freedom of Information Act to further improve the relevant legal provisions (Jay Wagner, 2021). These government measures seek to protect citizens' control and use of information resources in the Web 3.0 era. From the perspective of institution building, these initiatives are the basis for improving the public cultural service system in society. As the most important public cultural service institution, the service quality of public libraries is directly related to the degree of users' IR realization. Especially, university libraries have strong knowledge service functions, and the lack of IRs will negatively affect the efficiency of academic research. In addition, the value return of information cannot be realized in the process of information flow. However, the process of IR realization is the process of objective things acting on the subject's perception, which is more subjective and there is no specific measurement standard. When users perceive that their information needs are satisfied, their

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IRs are guaranteed. Therefore, finding a measuring scale for the degree of IR realization can provide a more scientific reference for university libraries to improve the user right protection mechanism (KC, 2023).

Service is the process of interaction between libraries and users in order to meet user needs, and its most basic purpose is to meet users' information needs (Claude, 2002). The purpose of service is the necessary conditions for the realization of IRs, and high quality of service can reflect the degree of users' IR realization, so the evaluation and assessment criteria of library service quality can be used as a tool to quantify the degree of users' IR realization. This is the theoretical premise of this study (Metzl, 1996).

At present, university libraries have realized the upgrade from traditional service to smart service. Smart service refers to the combination of information technology with innovative concepts to integrate and upgrade various systems and services of libraries, to improve the efficiency of resource utilization, and to optimize the management and service of libraries (Shi, 2019). Smart service is based on traditional service and has the characteristics of traditional service, so the evaluation of the quality of smart services can rely on the evaluation methods of traditional library service (Samek, 2014).

This study will reorganize the service quality evaluation questionnaire based on the core questions of the LibQUAL questionnaire, aiming to accurately reflect the content of users' IRs. In addition to adjusting the questionnaire questions, it is necessary to redefine the evaluation dimensions, mainly using the method of principal component analysis (PCA). The division of evaluation dimensions is based on the specific type of service that users can perceive. Using specific service types as the basis for dimensionality reduction allows experts to judge more clearly the contribution weight of various types of services to the realization of IRs (Abdi and Williams, 2010).

After finding the service quality evaluation score of university libraries, how is it possible to establish the logical relationship between the service quality score and the degree of IR realization? There are various types of IRs, and the realization of each type of right is not reflected by only one kind of service content. Rather, there are various types of IRs intersecting with various kinds of service content, and each type of right requires multiple services to cooperate for its successful realization. Therefore, the key issue of measuring the degree of right realization is to compare the importance of different services in the process of right realization, that is, to calculate the proportion of contribution of each type of service to the realization of rights. The analytic hierarchy process (AHP), which measures the relative importance between criteria that are difficult to quantify through the empirical judgment of decision makers (Vaidya and Kumar, 2006), is suitable for the abstract concept of IR.

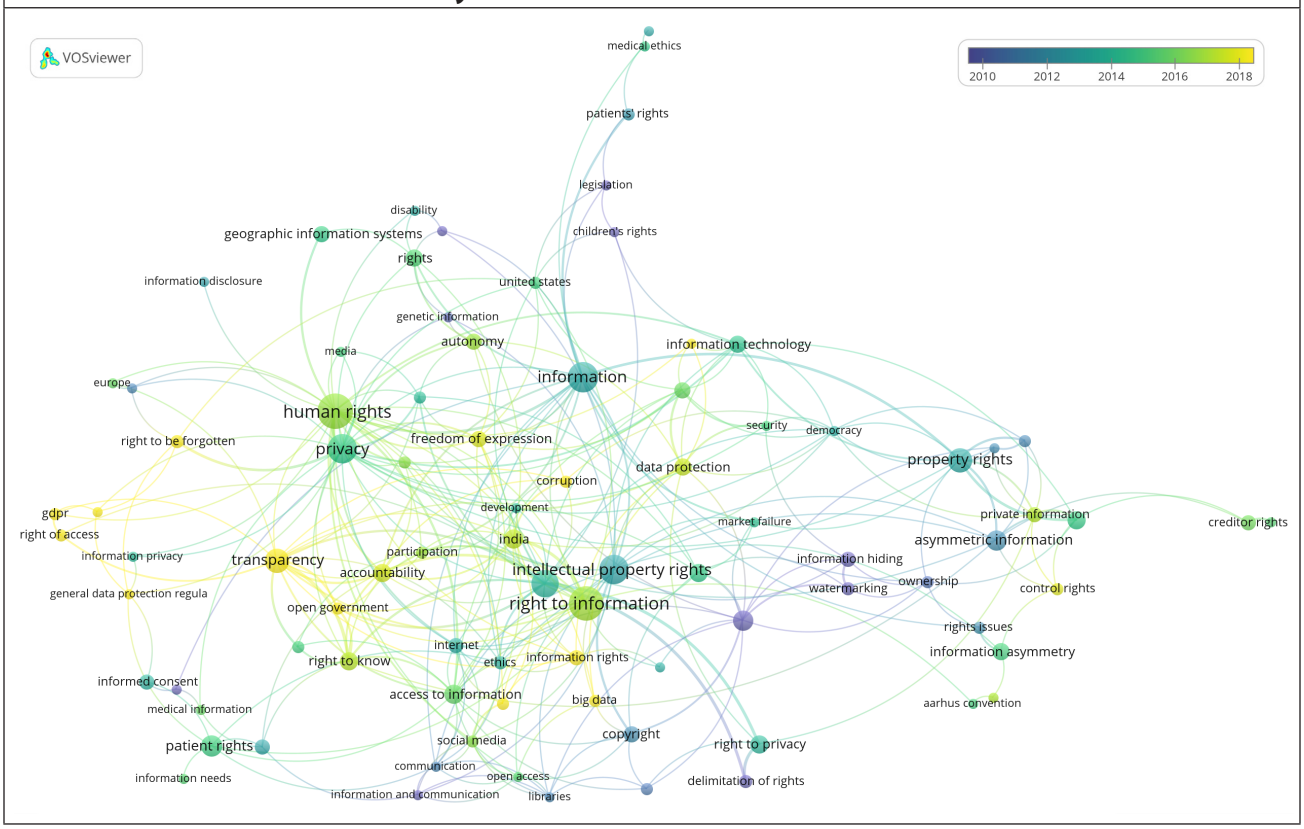
In summary, the research idea of this paper is to evaluate the quality of smart service of university libraries based on the LibQUAL questionnaire, to determine the scores of each type of service through PCA, and use AHP to determine the weight of contribution of each type of service to the realization of each type of IR. This study seeks to find the degree of users' IR realization and to provide reference for the construction of library users' right protection mechanism.

Literature Review

The study of IR is based on information ethics (Ess, 2006). Information ethics refers to the ethical requirements, ethical guidelines, ethical statutes involving information development, information dissemination, management and utilization of information, and the new ethical

relationships formed on this basis. With the development of information technology, the research content of IR has been expanded (Mathiesen, 2004). Figure 1 shows the co-occurrence network of keywords in the Web of Science core collection database containing the keyword "information right." The node size indicates the frequency of keyword occurrence, and the connecting line indicates the relationship of keyword co-occurrence in the article, and the color indicates the average year of keyword occurrence (van Eck and Waltman, 2010).

FIGURE 1
Keyword Co-occurrence Network



An analysis of the keyword co-occurrence network shows that the current research on IR has gone through three stages of development: information intellectual property, information security, and information transparency (Moore, 2005).

Information ethics is the philosophically grounded counterpart of computer ethics (Floridi, 2006), which aims to address the disparity in human right treatment brought about by the digital divide (Floridi, 1999). IR is a legal concept generated by information ethics for the protection of the right and interests of information subjects (Kitch, 1980), and the background of its emergence is that information resources have become a crucial factor of production in the internet era. Therefore, the protection of the added value of information is the beginning of IR research.

Changes in the rules of information dissemination have changed the benefits of information production in a systematic and predictable manner, and information intellectual property right is patent protection for laborers who create information value (Benkler, 2002). As people's natural property right should not be sacrificed for the sake of promoting technological innovation and realizing social benefits, information intellectual property right is supposed to serve as a reward for the laborers who create information value (Spinello, 2003). After the value of

information has been fully affirmed, how to protect the security of information has become the focus of research. The development of the internet has increased the speed of information dissemination but also increased the risk of information leakage (Kruck et al., 2002; Queiroz and de Queiroz, 2010). The privacy of personal information in this context has become the most basic IR (Acquisti, 2004). In the process of social interaction, how to meet the simultaneous needs of maintaining privacy and revealing personal information is the key issue of research (Milberg et al., 1995), and the solution to this problem should start from both legal (Zhang, 2014) and user awareness (Benson et al., 2015). With the development of big data, users play an increasingly significant role in the interaction of information service and raise higher requirements for information transparency, so users' right to know, express and use information resources are also included in IRs (Schudson, 2015).

With the expansion of the connotation of IRs, the theoretical framework has basically taken shape. More scholars began to focus on the practical research of IRs. For example, Srivastava (2010) analyzes the right to information-related laws in India and concludes that guaranteeing citizens' right to information is conducive to reducing public corruption and the gap between rich and poor (Srivastava, 2010). Alkhalidy et al. (2021) find that the right to know is not fully guaranteed in Arab countries due to the prevalence of a culture of secrecy (Kamel Jomaah Alkhalidy and Binti Abdul Halim, 2021). In addition to examining IRs in each country or region, scholars have also focused on different social agents, such as government departments (Dan et al., 2022), individual businesses (Yankovskaya et al., 2019), public libraries (Okuonghae and Obadare, 2020), and so on. Libraries, as important information service institutions in society, are the most important object of research (Alfino and Pierce, 1997). However, most of the existing studies have analyzed the information ethical behavior of staff from the library perspective, and the methods are mostly deductive and inductive, lacking data support (Fallis and Einar Himma, 2007; Ferguson et al., 2016).

There has also been research on enriching the connotation of IR from point to point and applying IR protection to social practice, which provides an important reference for the improvement of the IR guarantee system. When libraries are the focus of this kind of research, the methods of right protection finally point to the improvement of library service. In other words, service is the way to realize the right of library users. Therefore, it is feasible to measure the degree of IR realization from service quality, and it can fill the research gap of examining IRs from the perspective of users' perceptions.

An adequate understanding of IR should be approached from a jurisprudential perspective because IRs are essentially a legal bundle of right with information as an object, which has the dual functional advantages of explanatory and institutional nature as a type of right (Roberts, 2010). From a jurisprudential point of view, IR can be defined as:

> a legal right type that takes information satisfying certain conditions as the object of the right, and it is a legal right bundle composed of several sub-rights. These sub-rights include the right to information property, the right to know, the right to information privacy, the right to freedom of information dissemination, the right to information environment, and the right to information security (Singh, 2010).

If IRs are included in the social ideology, IR can be defined as an institutional arrangement chosen by a democratic government to guarantee citizens' rights relating to information (Raju, 2006).

The social responsibility assumed by IRs in the current digital environment is even more significant (Murthy and Murthy, 2022). IRs in the digital era are concentrated on the two key aspects of access to and distribution of information resources, and the claims of IR are specifically expressed as the right to access information opportunities, the right to use information technology, the right to distribute information resources, and the right to freedom of personal information (Jenkins and Goetz, 2010). The basic principles of IR protection based on right expression can be summarized as the principles of non-discrimination, skewness, and balance of interests (Janssen, 2012). Based on these principles, more diverse classifications of users' IRs can be made. The more conventional classifications include the right to information access, the right to information equality, the right to information choice, the right to information participation, and the right to information security (Roberts, 2001). This classification is based on previous scholars' research on the content framework of IRs and is combined with legal and social ethical and moral requirements (Darbishire, 2010).

The right to access information refers to the user's right to access necessary information in the process of experiencing smart service; the right to information equality refers to the user's right to use all kinds of information and resources in the library without being treated differently by the library; the right to use information technology refers to the user's right to use the means and media for accessing information; the right to use information resources refers to the user's right to use documents and data provided by the library for academic research or related normative benefits; the right to information privacy means that the personal information provided by users to the library should be legally protected; the right to information expression means that users have the right to ask questions to the library to ensure the orderly implementation of library service (Bhattacharyya, 2014).

This paper subdivides the IRs of university students, teachers, and scholars, taking into account the social identity and main responsibilities of university libraries. Considering there is no more authoritative concept of IR content for such groups in academia, the scope of IRs in this paper is defined as right of access to information, equal right to information, right to use information technology, right to use information resources, information privacy right, and right to express information, taking into account the research contents of IR by the authors of the above literature and the current situation of smart service contents of university libraries (Singh, 2012).

Research Methodology

LibQUAL Model

LibQUAL is a survey tool of service quality developed by the Association of Research Libraries. It is an online web-based survey in the form of a questionnaire with 22 core questions that measure users' perceptions of service in three dimensions: effect of service, information control, and library as place. The LibQUAL survey has been successfully implemented in libraries in 35 countries. Therefore, the LibQUAL questionnaire can be used as the basis for service quality assessment in this study (Greenwood et al., 2011).

However, there is a clear disconnect between the original content of the LibQUAL questionnaire and the purpose of this study, which is mainly reflected in the following aspects.

In terms of service form, the investigation of service effectiveness in LibQUAL is reflected through offline interpersonal behavioral interaction, especially the personal behavior of librarians; however, the development of information technology has currently enabled librarians to

shift their work form from offline to online (Vijayakumar and Vijayan, 2011). LibQUAL does not fully take into account such changes in communication methods and communication media.

In terms of service content, besides providing basic library service such as book searching, reading, and lending, university libraries should also focus on subject service such as printing, online public access catalog (OPAC), literature retrieval, electronic information resources, etc. The content of subject service is considered in LibQUAL, but due to the differences of the university management system, these contents are not fully in line with Chinese users' behavioral habits in . Further, the object of this study is primarily smart service, and there are great differences in resource contents, service methods and evaluation criteria (Cao et al., 2018).

In terms of survey purpose, the purpose of LibQUAL is to enable libraries to better understand users' experience. However, the purpose of this study is to examine the degree of users' IR realization through service quality scores, which requires formulating questions to both highlight the right realization, and to generate a certain degree of psychological implication with the subjects so that they can form an image perception of the content of IRs in the questions.

Based on the core content of LibQUAL model, it is possible to make a more accurate evaluation of the quality of smart service of university libraries. The results of adjusting the questionnaire questions according to the behavior habits of users in China (Su and Li, 2021), the characteristics of smart service of university libraries, and the connotation of IRs are shown in Table 1 (Zhang, 2021; Zhao, 2020).

Principal Component Analysis (PCA)

PCA is a multivariate statistical method that uses the idea of "dimensionality reduction" to transform multiple indicators into a few composite indicators, where the composite indicators are the principal components. Each principal component is a linear combination of the original variables, independent of each other, and retains most of the information of the original variables. The essence of this method is to seek a comprehensive substitute for the relevant variables through the correlation of the original variables, and to ensure that the information loss in the transformation process is minimized. Based on this principle, the improved evaluation indicator system can be re-dimensioned by PCA, and more specific dimensions can be used to explain the content of smart services of university libraries. In order to facilitate the experts for the weight of IRs in various types of services, this study gives up the abstract evaluation dimensions in LibQUAL but hopes to summarize the content of the main service in the university library smart service with evaluation dimensions.

Analytic Hierarchy Process (AHP)

AHP is a combination of quantitative and qualitative weight calculation method. The advantage of this method is it gives a relatively objective weight to the unmeasurable variables through systematic comparison (Saaty, 1987; Samek, 2014). According to the nature of the problem and the total goal to be achieved, AHP breaks down the problem into different constituent factors, and then gathers and combines factors at different levels according to their interrelated influence and affiliation. This creates a multi-level analysis structure model, so that the problem finally boils down to the determination of the relative importance weights of the lowest level (solutions, measures, etc. for decision making) relative to the highest level (total goal) or the ranking of relative advantages and disadvantages.

TABLE 1
Indicator Improvement Process

LibQUAL Dimension	Indicator	Adjusted Indicator
Service Effectiveness	Employees who instill confidence in users.	Users' personal browsing history and other information is protected.
	Employees who are consistently courteous.	
	Willingness to help users.	When users log in to the lending system, they can push relevant books and magazines to them through their lending records.
	Readiness to respond to users' questions.	Consulting service can be independent of time and space.
	Employees who have the knowledge to answer user questions.	AI computer customer service can meet most of the needs of users.
	Employees who deal with users in a caring fashion.	Provide effective orientation service to familiarize users with smart devices in the library.
	Employees who understand the needs of their users.	You can regularly send users information about the library's recent new book announcements, borrowing status, lecture activities, etc.
	Giving users individual attention.	Ability to push information resources of interest to users.
	Dependability in handling users' service problems.	Security assurance when logging in to "My Library."
Information Control	Making electronic resources accessible from my home or office.	Mobile OPAC service (Library Public Access System) is able to cover all types of groups in need within the university.
	Modern equipment that lets me easily access needed information.	
	The printed library materials I need for my work.	Self-service book loan service.
	The electronic information resources I need.	Construction of the library's own resource base: subject knowledge base, intelligence knowledge base, think tank, etc.
	A library Web site enabling me to locate information on my own.	Online reading and retrieval of digital resources.
	Easy-to-use access tools that allow me to find things on my own	The library's knowledge service can meet the specialized and customized needs of users.
	Making information easily accessible for independent use.	Self-service book return service.
	Print and/or electronic journal collections I require for my work.	Library knowledge service can meet the professional learning, research, and teaching needs of faculty and students.

TABLE 1
Indicator Improvement Process

LibQUAL Dimension	Indicator	Adjusted Indicator
The Library As a Place	Library space that inspires study and learning.	Self-service support service: application for certificates, documents and printing, payment of fees, etc.
	Quiet space for individual activities.	Applying intelligent robots to help users with information queries.
	A comfortable and inviting location.	Online consulting platform construction service is comprehensive.
	A getaway for study, learning, or research.	Library website with a clear menu of features and guided tours.
	Community space for group learning and group study.	Self-service leisure service: telephone, vending machine, audio-visual experience, etc.

The degree of contribution of each type of service to the realization of IRs is one such variable that is difficult to measure directly, and therefore the contribution weight of each type of service to the realization of IRs can be assessed using AHP.

Smart Service Quality Evaluation

Questionnaire Design and Data Collection

At present, the smart service construction of university libraries in Hebei Province, China is at a medium development level compared with universities in other Chinese provinces. The existing service with high popularity includes the construction of special digital resources, online reference consultation service, online electronic library journals, inter-library loan and document delivery, navigation service, and platform mobile service. At present, most universities in Hebei Province have formed a more complete smart service system (Han and Quan Liu, 2010). At the same time, the distribution of the development of smart services in the libraries of various universities in Hebei Province is more balanced, and the gap among the universities is not very large, so the distribution characteristics can further ensure the accuracy of the data collected by the questionnaire (Si et al., 2011).

The questionnaire consists of two parts: one is the basic personal information of users, including gender, age, identity, etc.; the second is the part of users' service quality evaluation of university library smart service, which sets 20, five-level Likert scale questions. Users score their satisfaction with each indicator in each dimension according to their own experience and feeling about the university library smart service, and the satisfaction is divided into "very dissatisfied," "dissatisfied," "average," "satisfied," and "very satisfied." In the scale, "1" means "very dissatisfied," and "5" means "very satisfied." The number changes from "1" to "5" indicates the incremental relationship of satisfaction.

Distribution of Questionnaires

The questionnaires were distributed virtually to students, teachers, and researchers in general full-time universities in Hebei Province from August 2021 to October 2021. We ensured that all participants were anonymous and at no risk.

The questionnaire used a random sampling method, and the survey sample covered all age groups and identities. The age distribution of users was mainly 18-50 years old, accounting for 84.89% of the total sample size, and 50-70 years old accounted for 15.11% of the total sample size. The proportion of males was 56.47% and 43.53% of females. Students made up 44.24% of respondents, teachers were 42.47%, and the remaining 13.29% of respondents were full-time researchers. According to the configuration of various groups within the university, the sample oriented by this questionnaire has good representativeness and can be used to illustrate the general characteristics of users when they are oriented to the smart service of university libraries and to ensure the objectivity of the analysis of the survey results.

Reliability and Validity Analysis

Reliability tests were performed on the collected questionnaire data, and the Cronbach alpha coefficient based on standardized items for this group of data was obtained as 0.891, indicating that the questionnaire is highly reliable and that the scale data have good stability.

TABLE 2
Reliability Test

Cronbach Alpha	Cronbach Alpha Based on Standardized Items	Number of Items
0.890	0.891	20

The content validity test of this questionnaire was chosen to use KMO value and Bartlett's sphericity test. The final KMO value was 0.738, and the *p*-value in Bartlett's sphericity test was significantly less than 0.05, indicating that the overall content validity of this questionnaire is high and that the settings of each individual item can effectively express the information of the corresponding variables.

TABLE 3
Content Validity Test

Kaiser-Meyer-Olkin (KMO)		0.738
Bartlett's Sphericity Test	**Approximate Chi-Square**	3621.194
	Degrees of Freedom	190
	p	<0.001

Dimensionality Reduction Process

If there is a correlation between variables, direct inclusion in the analysis may not lead to correct conclusions due to multivariate covariance. A linear combination of the original 20 indicators was made as a new composite indicator, and this composite indicator is a principal component. In order to maximize the amount of information contained in each principal component, the maximum variance method was used for PCA. That is, the larger the variance value of each linear combination, the more information it contains. The total variance explained after the analysis by SPSS is shown in Table 4.

The eigenvalue is an indicator of the influence strength of the principal component, representing the amount of information of original variables that can be explained on average after the introduction of this principal component; generally the eigenvalue is required to be > 1. The explained variance ratio indicates the proportion of the variance of the principal

TABLE 4
Total Variance Explained

Components	Initial Eigenvalue			Extraction of the Sum of Squares of Loadings		
	Total	Explained Variance Ratio	Cumulative %	Total	Explained Variance Ratio	Cumulative %
1	6.952	34.761	34.761	6.952	34.761	34.761
2	1.886	9.429	44.190	1.886	9.429	44.190
3	1.643	8.215	52.405	1.643	8.215	52.405
4	1.446	7.228	59.633	1.446	7.228	59.633
5	1.263	6.315	65.949	1.263	6.315	65.949
6	1.028	5.319	71.088	1.028	5.319	71.088
7	0.882	4.408	75.496			
8	0.799	3.996	79.492			
9	0.744	3.722	83.214			
10	0.676	3.381	86.595			
11	0.563	2.813	89.408			
12	0.447	2.237	91.645			
13	0.344	1.719	93.364			
14	0.319	1.593	94.957			
15	0.248	1.241	96.198			
16	0.195	0.976	97.174			
17	0.181	0.907	98.081			
18	0.154	0.770	98.852			
19	0.127	0.635	99.486			
20	0.103	0.514	100.000			

component in the total sample variance, and the larger the value, the greater the amount of information of the original variables carried. The cumulative explained variance ratio refers to the explained cumulative ratio of the first *k* principal components. This is how much original information is extracted from the first *k* principal components in descending order of explained variance ratio. Based on the size of the eigenvalues, it is determined that the original variables should be divided into six dimensions, and the cumulative explained variance ratio is more than 70%, which can better explain the information in the original variables.

After determining the number of principal components, the classification of indicators is determined by factor loading. Factor loadings indicate the importance of indicators in the principal components with 0.5 or more indicating that the indicators are suitable for subordination to that principal component. Results of the classification are shown in Table 5.

After the dimensionality reduction of the indicators, each principal component is named according to the content of the indicators. The purpose of PCA is to outline the content of smart services in university libraries, and various division methods have emerged in academia for the specific content of smart services. The functions of libraries can be divided into four parts: resource service, knowledge service, connection service, and value-added

TABLE 5
Factor Loadings After Rotation

	Component					
Indicator	**1**	**2**	**3**	**4**	**5**	**6**
1				0.918		
2				0.585		
3				0.649		
4				0.550		
5		0.524				
6		0.954				
7		0.790				
8		0.620				
9	0.654					
10	0.632					
11	0.802					
12			0.802			
13			0.932			
14			0.535			
15						0.637
16						0.904
17						0.701
18					0.594	
19					0.538	
20					0.534	

service (Hou, 2020). From the role played by artificial intelligence in library service, library smart service can be divided into six categories: mobile service, self-service, intelligent consultation service, personalized recommendation service, knowledge service, and intelligent navigation service (Ziming and Peng, 2015). Scholars have a high degree of consistency in the interpretation of the content of library smart service; they analyze the traditional library service from a horizontal perspective and classify the content of library smart service from the combination of information technology and library service.

Through the interpretation of the literature related to library smart service, the content of each indicator is combined. In this study, the six main components are named as: personalized recommendation service (PRS), self-service (SS), knowledge service (KS), mobile service (MS), intelligent consultation service (ICS), and intelligent navigation service (INS) (Chen and Zhang, 2016). The classification result is shown in Table 6.

TABLE 6
Evaluation Indicator System of Smart Service Quality of University Libraries

Dimension	**Code**	**Indicator**
PRS (Jing, 2021)	A1	You can regularly send users information about the library's recent new book announcements, borrowing status, lecture activities, etc.
	A2	Ability to push information resources of interest to users
	A3	Users' personal browsing history and other information is protected
	A4	When users log in to the lending system, they can push relevant books and magazines to them through their lending records.
SS (Lagerborg, 1997)	B1	Self-service book loan service
	B2	Self-service book return service
	B3	Self-service support service: application for certificates, documents and printing, payment of fees, etc.
	B4	Self-service leisure service: telephone, vending machine, audio-visual experience, etc.

TABLE 6
Evaluation Indicator System of Smart Service Quality of University Libraries

Dimension	Code	Indicator
KS (Aswath and Gupta, 2009)	C1	Construction of the library's own resource base: subject knowledge base, intelligence knowledge base, think tank, etc.
	C2	The library's knowledge service can meet the specialized and customized needs of users
	C3	Library knowledge service can meet the professional learning, research and teaching needs of faculty and students
MS (Little, 2011)	D1	Mobile OPAC service (Library Public Access System) is able to cover all types of groups in need within the university
	D2	Online reading and retrieval of digital resources
	D3	Security assurance when logging in to "My Library"
ICS (Thompson and Edelstein, 2004)	E1	Consulting service can be independent of time and space
	E2	AI computer customer service can meet most of the needs of users
	E3	Online consulting platform construction service is comprehensive
INS (Rennick, 2019)	F1	Library website with a clear menu of features and guided tours
	F2	Provide effective orientation service to familiarize users with smart devices in the library
	F3	Applying intelligent robots to help users with information queries

Smart Service Quality Score Calculation

After determining each principal component, the service quality score of each principal component needs to be calculated as the basis for calculating the degree of IR realization. First, the weight of each indicator in the principal component is calculated, then the average score of the indicators within the principal component is weighted and totaled, resulting in the service quality score of each principal component. The principle of PCA lies in information concentration. The greater the concentration of information, the greater the indicator weights can be, and it is by using this principle that the indicator weights can be calculated. The extent of information enrichment is expressed by the value of factor loading. In calculating the indicator weights, there are three steps:

1. Calculation of the linear combination coefficient (i.e. the factor loading divided by the square root of the corresponding eigenvalue). The linear combination coefficient can be used to express the magnitude of information enrichment.
2. Calculating the composite score coefficient with the formula: cumulative (linear combination coefficient * explained variance ratio)/cumulative explained variance ratio (i.e. the linear combination coefficient is multiplied by the explained variance ratio respectively, then totaled, and then divided by the cumulative explained variance ratio).
3. Calculate the importance weights and normalize combined score coefficients to obtain the weight values of each indicator.

According to the above method, the importance weights of indicators in each principal component are obtained, as shown in Table 7.

Relying on the weights of each indicator, the average values of indicators in each principal component (Table 8) were weighted and totaled to obtain the service quality scores of each dimension: 3.74 for PRS, 3.59 for SS, 3.69 for KS, 3.65 for MS, 3.59 for ICS, and 3.57 for INS.

TABLE 7
Indicator Weights

Indicators	Weighting	Indicators	Weighting
A1	14.93%	C3	34.45%
A2	24.90%	D1	24.46%
A3	35.98%	D2	29.88%
A4	24.18%	D3	45.66%
B1	24.95%	E1	47.29%
B2	25.63%	E2	27.81%
B3	23.30%	E3	24.90%
B4	26.12%	F1	38.16%
C1	32.57%	F2	34.18%
C2	32.98%	F3	27.67%

TABLE 8
Average of Indicator Measurements

Code	Mean	Standard Deviation	Number of Cases
A1	3.80	0.992	278
A2	3.38	1.005	278
A3	3.93	0.917	278
A4	3.78	0.862	278
B1	3.65	0.864	278
B2	3.58	0.903	278
B3	3.85	0.864	278
B4	3.30	1.067	278
C1	3.65	0.802	278
C2	3.55	1.061	278
C3	3.85	0.700	278
D1	3.58	0.984	278
D2	3.60	0.841	278
D3	3.73	0.905	278
E1	3.70	0.853	278
E2	3.35	0.975	278
E3	3.63	0.925	278
F1	3.55	0.904	278
F2	3.70	0.723	278
F3	3.43	1.035	278

Weighting of the Contribution of Each Type of Smart Service to the Realization of Right

After getting the quality evaluation score of smart services of university libraries, the next step is to analyze the degree of IR realization in the service.

The service provided by university libraries contains the content of IR realization, but the relationship between each service and each IR is not one-to-one because the realization of IR involves the intersection of several services. Therefore, it is necessary to determine the weight of each service's contribution to the realization of rights first.

In this study, different types of IRs are analyzed separately using AHP, and the importance of various smart services under each IR is compared two by two. Then, a judgment matrix is constructed, from which the contribution weights of the compared service types to the realization of rights are calculated and tested for consistency. The weights obtained in this way are shown in Table 9.

TABLE 9
Weight of Contribution of Each Service to the Realization of IRs

Type of IR	Smart Service Dimension	Contribution weighting	Type of IR	Smart Service Dimension	Contribution weighting
Right of Access to Information	PRS	0.11	**Right to Use Information Resources**	PRS	0.06
	SS	0.15		SS	0.08
	KS	0.33		KS	0.29
	MS	0.20		MS	0.28
	ICS	0.09		ICS	0.15
	INS	0.12		INS	0.14
Equal Right to Information	PRS	0.11	**Information Privacy Right**	PRS	0.22
	SS	0.13		SS	0.18
	KS	0.10		KS	0.12
	MS	0.13		MS	0.17
	ICS	0.26		ICS	0.23
	INS	0.26		INS	0.09
Right to Use Information Technology	PRS	0.05	**Right to Express Information**	PRS	0.13
	SS	0.19		SS	0.13
	KS	0.11		KS	0.16
	MS	0.28		MS	0.10
	ICS	0.22		ICS	0.35
	INS	0.15		INS	0.15

IR Realization Score

The service quality evaluation scores of various types of smart service in university libraries and the contribution weights of each service to the realization of IRs were obtained by combining the above studies. The following formula was used in this study to calculate the realization degree of each type of IR:

$$A_j = \sum_{i=1}^{6} E_i C_i$$

Where A_j denotes the realization degree of various IRs, E_i denotes the evaluation score of each dimension of smart service, and C_i denotes the contribution weight of each dimension of smart service to the realization of various IRs. The relational operation can place the IR realization score and the user's evaluation score of the university library smart service under the same dimension, with a minimum score of one and a maximum score of five, indicating the increasing relationship of the realization degree of right. The right realization scores of various IRs in all dimensions are summed up to obtain Table 10.

TABLE 10
IR Realization Score

Type of IR	Right Realization Score
Right of Access to Information	3.647
Equal Right to Information	3.581
Right to Use Information Technology	3.621
Right to Use Information Resources	3.641
Information Privacy Right	3.677
Right to Express Information	3.697

Using the final obtained scores of the realization degree of various types of IRs, we can analyze the status of guaranteeing users' IRs in the process of smart service of university libraries. In general, the users' IRs are well protected, and none are neglected, which means that libraries should pay attention to all kinds of IRs. However, this also means that there is no one prominent type of IR that makes users particularly satisfied, and there is still a lot of room for upward movement overall. The IR type with the highest degree of right realization is "right to express information." This shows that the process of smart service construction in university libraries has fully considered users' opinions and suggestions and has also given them more space to express themselves. This is also evidenced by the rising trend of user research in recent years, reflecting the increasingly important position of users in the construction of smart library services. The lowest degree of realization is equal right to information. This can be attributed to the fact that it is common for universities across the country to differentiate rights of users and give them different degrees of authority for different groups. This differentiation system can effectively save money and improve efficiency; is the best way to allocate data resources in university libraries. Given that the realization of information equality right is more abstract than other types of IRs, the guarantee of such right should be more expressed in making users have a good cognitive and emotional image of library service.

Discussion

Next, this paper summarizes the six types of IRs, analyzes the advantages and disadvantages of each user's IR protection, and provides suggestions for the optimization of IR protection in the process of smart service construction.

Right to Express Information

Right to express information is mainly realized through the intelligent consultation service. The score of right to express information realization is 3.697, which is the highest compared to other types of IRs. This reflects that library management fully respects users' opinions; the intended users of university libraries have considerable ability, so the suggestions provided by users to university libraries have certain reference significance.

The most important indicator in the evaluation of users' satisfaction with the content of intelligent consultation service is, "Consulting service can be independent of time and space,"

and the indicator with the lowest score is, "AI computer customer service can meet most of the needs of users." This suggests that the libraries need to: further improve the online consultation service; fully understand the users' demands; make the users solve more problems through intelligent customer service; and improve the level of consultation service while protecting the users' right to express information.

Information Privacy Right

Information privacy right has the strongest correlation with the personalized recommendation service. Users' information privacy realization score is 3.677, which is higher than the realization of several other types of IRs, but still does not reach a level that makes users feel more satisfied overall.

At present, Chinese university libraries actively support information protection laws and social ethics and they fully respect users' information privacy right; however, this may also limit the analysis of users' preferences by smart service. The use of big data and the protection of users' personal information have been controversial in recent years, and there is no easy solution to this problem; it can only be solved by technological progress, or by the improvement of the content of privacy agreements between libraries and users.

Right to Use Information Technology

The main service content associated with the right to use information technology is self-service. At present, Chinese users' use of the equipment is limited to lending books, and the level of utilization of equipment functions is low. If the level of interaction between the technical information involved in the self-service process and the users can be improved, it can not only further guarantee the realization of users' rights to use information technology, but also improve user satisfaction with the self-service.

Right of Access to Information

The right of information access is the basic guarantee for users to exercise their IRs. To fully guarantee users' IRs in the process of smart service construction, university libraries should strive to improve the content system of knowledge service, which is not only the basic function of university library service, but also an important content for users to effectively exercise their IRs.

Right to Use Information Resources

Knowledge service and mobile service have the strongest correlation with the right to use information resources. Knowledge service provides an information resource repository and mobile service provides access, and both are indispensable to guarantee users' right to use information resources together.

Equal Right to Information

The intelligent navigation service contributes a high weight to the realization degree of users' equal right to information. The degree of acceptance of the smart service system varies among different groups due to their knowledge, age, and other factors. To further improve users' equal right to information through intelligent navigation service, it is necessary for university libraries to ensure the accuracy and clarity of intelligent navigation service while focusing

on the improvement of database resources. This requires university libraries to use targeted guidance service when weighing different groups. To realize users' equal right to information, improving the intelligent navigation service is a key process that needs to be developed based on technologies and oriented to the characteristics of user groups.

Conclusion

The service quality of university library smart service in mainland China is good. Users have the highest degree of information expression right realization and the lowest degree of information equality right realization. Information access, information technology use, information resource use, and information privacy rights tend to be moderate in the process of receiving university library smart service; however, there is still much room for upward movement overall.

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