Development and construction of China's higher education libraries[①]

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Abstract   Libraries in China's higher education institutions have been developing in keeping pace with the flourishing development of China's higher education. This article aims to make an introduction to the construction of China's higher education libraries, especially the recent three decades' achievements since China's reform and opening-up in 1978. In this article, the authors draw a general picture of the development of libraries in China's higher education institutions, covering such eight aspects as management, types and positioning, organizational structure and personnel, expenditure and buildings, reader service, building and sharing of resources as well as automation system.

Keywords   Universities and colleges library, Library in China's higher education institutions, Library cause, Library construction, Academic Library

Since the first higher education library, St. John's higher education library, was established in Shanghai in 1879, libraries in China's higher education institutions have been developing in keeping pace with the flourishing development of China's higher education with a history of more than 120 years[1]. The article gives an overview to the construction of China's higher education libraries, especially with an emphasis on the achievements of the recent three decades since China's campaign for reforms and opening-up since 1978.

1   Management of China's higher education libraries

Taking management as a science, management activities can be described at both macroscopic level and microscopic level, with no exception to the management of higher education libraries. Macroscopically speaking, the management of higher education libraries refers to management activities related to all higher education

libraries, which means, to formulate regulations with the guidance of the higher education library management policy, to construct systems under which efforts are made in terms of personnel, finance, administration and business.

1.1   Management regulations of China's higher education libraries

The "*Presented School Regulation*", promulgated by the government of Qing Dynasty in 1903, is the earliest legal document concerning libraries in China's higher education institutions, which claries major issues such as the management system of higher education libraries[1].

After the 1911 Revolution which toppled the Qing Dynasty, especially after the May 4th New Culture Movement, the higher education libraries in China became increasingly standardized. A dozen of state laws and regulations were issued in succession by the Northern Warlords Government and the Government of Republic of China, such as "*General Regulations of Library*" Rule 11 and "*Charter of Library*" Rule 11, "*Revised Regulations of Library*" Rule 33 and "*Library Regulations*" Rule 34 published in 1915, 1939 and 1947 respectively by the Education Department of the Government of Republic of China[2].

Since the founding of the People's Republic of China in 1949, a series of regulations have been promulgated in order to regulate and enhance the management of the higher education libraries. The 1st National Working Conference on the Higher Education Libraries was held in 1956, drawing out the "*Proposed Regulations on the National Plan of the Higher Education Libraries* (Draft)", the "*Interlibrary Borrowing of the Higher Education Libraries* (Draft)", the "*Provisional Measures on Transfer of Books and Periodicals of the Higher Education Libraries* (Draft)" and "*Several Regulations on Replenishment of Books and Periodicals of the Higher Education Libraries* (Draft)", which played an important role in regulating the working of higher education libraries in China, strengthening the communication and cooperation between them, adjusting properly the collected books and making full use of books and periodicals. Besides, it occupied a significant position in the history of higher education libraries in China[3].

China has begun strengthening regulatory management and legislation of higher education libraries since the 1980s. Some more laws and regulations were issued by the Ministry of Education, such as the "*Opinions of Enhancing Higher Education Libraries*" in 1978, "*Working Regulations of the Higher Education Libraries of the People's Republic of China*" in 1981, which was later revised and renamed as "*Regulations on Ordinary Higher Education Libraries*" in 1987, and "*Revised Regulations on Ordinary Higher Education Libraries*" in 2002. Under the backdrop that there is no library law in China so far, the promulgation of "*Regulations on Ordinary Higher Education Libraries*" plays a vital part in regulating the working of the higher education libraries as well as adjusting various social relations with the higher education libraries, and marks a new era of the legal management of China's higher education libraries [4].

In 1991, an assessment was made on the ordinary higher education libraries in accordance with the documents issued by the Ministry of Education, under which

the "*Assessment Indicators on Ordinary Higher Education Libraries* (*Soliciting Opinions*)" served as the basis for the assessment of the higher education libraries. It not only specified assessment indicators, but also classified the library assessment into four levels: national level, regional level, university level and library level[5]. The assessment has greatly promoted the development of higher education libraries in all aspects and improved the infrastructure, internal and external environment as well as management of the higher education libraries.

1.2   Management system of China's higher education libraries

The Imperial University of Peking was founded and run by the government of Qing Dynasty under the pressure of the Constitutional Reform and Modernization in 1898. The "*Articles of Incorporation of the Imperial University of Peking*" placed high emphasis on the construction of the book-collection building, and drew up many regulations on the management system of the building, which might be the earliest and the most complete regulations concerning library construction in the modern history of Chinese library, particularly in the history of the higher education library. As the predecessor of library of Beijing University, the Book-collection Building of the Imperial University of Peking was officially opened in 1902, the first higher education library in China. Serving the dual roles as both the best university and the education administrative organ in China, the Imperial University of Peking set an example to all the universities and colleges in China with its new school-running method and library management[4].

Before the 1990s, China carried out a management system of higher education collectively planned by the central government and invested by the ministries and commissions under the State Council or the provincial governments. The management system consisted of three types: university libraries under the Ministry of Education, university libraries under other ministries as well as provincial (municipal) libraries. In 1992, China launched the reform of the higher education management system, transferred the management of universities and colleges under the ministries to local governments, and established the new management system that libraries are managed by both central and local governments while the local government plays the major part. Therefore, China's higher education libraries have mainly two kinds of management systems: higher education libraries under the Ministry of Education and higher education libraries under provincial or municipal government.

In September 1981, the Ministry of Education held a working conference on national higher education libraries and established the National Higher Education Library Working Committee and its secretariat as the organs in charge of the higher education libraries nationwide. Soon after that, similar organs were set up by 19 ministries and commissions as well as 27 provinces, municipalities and autonomous regions. In November 1986, the State Education Commission established the Managing Office of Teaching Materials, Libraries and Information (merged into the Condition Equipment Department at the beginning of 1989) conducting the macro-management of the library and information work of China's universities, colleges and schools, and adjusted the National Higher Education Library Work Committee

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into an organ to make coordination, consultation, business guidance and research on the library and information work under the lead of the State Education Commission[5]. In the 1990s, the National Higher Education Library Work Committee was affiliated to Beijing University according to the organizational structure reform of the government. In August 1999, the Higher Education Information Work Guiding Committee was established and the "*Regulations of the Higher Education Library Information Work Guiding Committee*" issued by the Ministry of Education to further strengthen the information cause of the higher education library, give full play to the coordination, consultation, research and guidance of experts and scholars, make higher education libraries better perform their education and information functions so as to render excellent services for teaching and researching[4]. The new Higher Education Library Information Work Guiding Committee is no longer an institution helping the educational administrative departments to manage the higher education library work in nature, but a virtual organization of experts. It exerted great efforts in revising the "*Regulations on Ordinary Higher Education Libraries*", building and sharing documentation resources, making use of computers, building teams, training users as well as conducting periodical research and coordination activities, which as a whole has fostered the integrity and sense of belonging for higher education libraries[4].

The Higher Education Library Subcommittee was founded in October 2004. It is the 8th subcommittee of the Library Society of China and a public academic organization of China's higher education libraries.

2   Types and positioning of China's higher education libraries

2.1   Types of China's higher education libraries

The higher education libraries emerged with the development of universities and colleges[6]. China's first self-run university began with the first-class school of the Tientsin University founded in 1895 when the book collecting building of the Tientsin University was constructed[7]. And during the following fifty-odd years until 1949, there established 205 higher education institutions and 132 higher education libraries with small sizes and few types. The founding of the People's Republic of China pushed the development of China's higher education into a new period. The number of higher education institutions reached 598, 1,080, 1,867 respectively in 1978, 1994 and 2005 in China, and the number of higher education libraries 598, 1,073 and 1,608 in the above three years respectively (Fig. 1). According to the statistics of 2006 in the *Yearbook of China's Education*, China's higher education institutions could be classified into comprehensive universities, universities and colleges of science and technology, agriculture, forestry, pharmacy, language, finance, law, sports, fine arts, normal universities, universities for nationalities and private-run universities. The classification of libraries goes with the types of higher education institutions. Generally speaking, higher education libraries are divided into comprehensive libraries, special libraries, libraries of liberal arts and libraries of science.
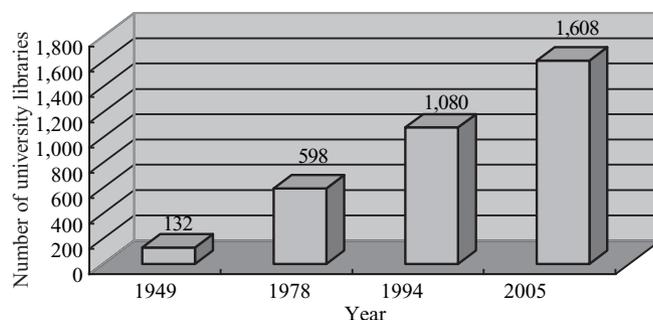
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Fig. 1   Number of University libraries during 1949–2005.

In July 1994, the "*Opinions on Implementation of China's Education Reform and Development*" was promulgated by the State Council to make higher education institutions play a more important role in the national science and technology and to carry out the "Project 211" which put stress on building about 100 universities and colleges as well as a batch of key disciplines and consisted of three parts: improvement of the general conditions of universities, construction of key disciplines and establishment of public service system of the higher education where the higher education libraries belong to. Thus, the higher education libraries can be divided into key higher education libraries under the "Project 211" and ordinary higher education libraries.

2.2   Positioning of China's higher education libraries

Regardless of types, the higher education library is an important integral part of university teaching and scientific research as well as an indispensable factor for building higher education institutions. The "*Regulations on Ordinary Higher Education Libraries* (Revised)" promulgated by the Ministry of Education in 2002 specifies the functions of the higher education library that the higher education library is the documentation and information center of colleges and universities, the academic organization for teaching and scientific research, and the information base of universities and the whole society. The higher education library is the key component of teaching and scientific research in the higher education institutions. Thus, the development of the higher education libraries, which symbolizes the over-all teaching level of the universities, should keep abreast with the advance of the universities. The higher education libraries ought to perform the functions of education and information service, try every possible means to meet the readers' demands and provide documentation and information services in an effective manner for the teaching and scientific researching of higher education institutions. Before the library law of China comes into force, the "*Regulations on Ordinary Higher Education Libraries* (Revised)" shall be the criteria on which the evaluation of all working activities of the higher education libraries shall be based. It is applicable to all the higher education libraries but key libraries under the "Project 211" with more requirements. Subject

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to the general objective of the "Project 211", the key higher education libraries are supposed to keep a leading position in China, afford an example to all the higher education libraries, and give strong support to sustainable development of higher education and setup of key disciplines.

3   Organizational structure and personnel of higher education libraries

3.1   Organizational structure of higher education libraries

The initial organizational structure of China's higher education libraries was a multi-layered hierarchy divided by functions and specified in relevant laws and regulations of governments. For example, according to the "*Trial Regulations on the Higher Education Libraries of the People's Republic of China* (Draft)" published in 1956, collection and recording department (team), cataloging department (team) and circulation management department shall be set up in the higher education libraries, and more offices, departments (teams) of collection and recording, cataloguing, reference reading, circulation management, periodical, methodology research and special collections shall be established according to specific conditions and different scale of libraries. Libraries with large scale can even set up branches. All in all, although the higher education libraries vary in the number and names of the departments, they set up departments within the framework stipulated in the "*Trial Regulations on the Higher Education Libraries of the People's Republic of China* (Draft)", which is a typical example for organizational structure of the traditional higher education libraries[8].

Since the 1970s and the 1980s, the rapid growth of electronic documentations and the Internet has changed the way readers use documentations unprecedentedly. Traditional organizational structure can no longer keep up with the development of the library business. Thus, the reorganization concept frequently used in the field of enterprise management has been introduced into the management of libraries in time. In the late 1990s, for the convenience of readers, quite a few libraries were reorganized by simplifying business division, integrating overlapping departments, strengthening or adding new departments of information consultation, database construction, electronic reading and system operation, and forming dedicated working groups for a certain project or special task when needed. This flat and task-centered organizational structure, with less need of management, more interoperability among departments, more active and creative personnel, and more flexibility and adaptability, can be adjusted from time to time to meet the every changing environment and readers so as to provide the best services[4].

Besides, with combination of many universities and colleges, the multi-campus and multi-libraries layout has made the headquarter-branch library system possible in the newly built universities. Owing to different ways of combination, three modes come into being gradually: i.e., comparatively independent library, such as Beijing University; centralized and unified library, such as Shanghai University; the headquarter library responsible for management and coordination of branch libraries,

such as Zhejiang University. Whatever the mode is, the headquarter-branch library system makes it easier for coordination and communication within the library, avoids repeated acquisition of resources, allows for effective use of expenses and optimizes the resource allocation of the campus[4].

Subject to the "*Regulations on Ordinary Higher Education Libraries* (Revised)", most higher education institutions set up the library working committee as a consulting and coordination organization of documentation and information services and to supervise, evaluate and guide the library work effectively.

3.2   Personnel of higher education libraries

According to the personnel management system in China, the librarians of higher education libraries are usually taken as the teaching assistants. Before the professional title system of librarians (the later professional and technical position) was carried out in the 1980s, there were no specific requirements on the qualification of librarians, which resulted in low quality personnel of most libraries — poor education background, unreasonable knowledge structure and few people with special training of library information. However, the situation has changed a lot in recent years. According to the statistics of 1980, there were 17,297 librarians in China's higher education libraries, among whom there were 6,170 staff above the junior college level, accounting for 35.8%[10]. Most librarians were not capable of developing documentation resources, or providing information consulting service or science and technology retrieval, or conducting special researches. With the "*Working Regulations on the Higher Education Libraries of the People's Republic of China*" issued by the Ministry of Education in 1981, the higher education libraries began to promote the selection of the university graduates to work in the libraries and establish the training system that the university graduates who did not major in the library information were obliged to receive half or one year special training of the library information when they came to work in the libraries. A series of such measures has improved the university librarians' working ability rapidly. Then, the number of the librarians above the master level keeps increasing, and many large higher education libraries only recruit the people above the master level. In 1999, according to the spot check of 533 higher education libraries in China, there were 21,217 librarians, among whom there were 37 persons with doctor degree, taking up 0.17% of the total; 441 masters, accounting for 2.07%; 7,770 undergraduates, 36.62%; and 12,969 librarians below the undergraduate level, 61.3% of the total. According to the spot check of 371 higher education libraries of China in 2005, there were 19,596 librarians, among whom there were 98 with doctor degree, 0.5% of the total; 1,201 masters, accounting for 6.17%; 8,360 undergraduates, 42.66%; and 9,928 librarians below the undergraduate level, accounting for 43% (Fig. 2).

The professional and technical position of the higher education librarians has five levels: junior librarian, assistant librarian, librarian, deputy research librarian and research librarian. The junior librarian, a title of an undergraduate student, is responsible for some supporting work to management of ordinary library materials; the assistant librarian, a title of a graduate with master degree, is required to have a good command of the basic theories and special knowledge on library materials and

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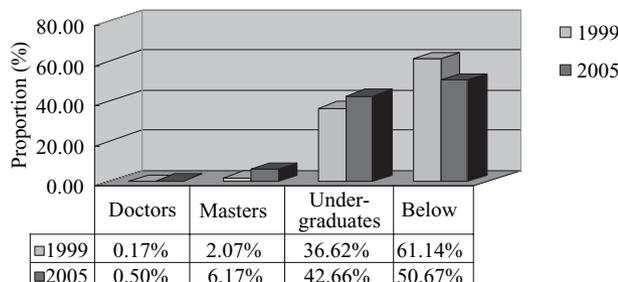|	Doctors	Masters	Under-graduates	Below
1999	0.17%	2.07%	36.62%	61.14%
2005	0.50%	6.17%	42.66%	50.67%

Fig. 2   Comparison of librarians with different academic levels in 1999 and in 2005.

be capable of undertaking some specific job; the librarian, a title of a graduate with doctor degree, is required to master the basic theories and special knowledge on library materials and be capable of undertaking one or more jobs on his own; the deputy research librarian or the senior research librarian, a title granted on condition that the librarian has worked for five or more years or graduated with a doctor degree for more than two years, has systematic theoretical knowledge and a deep research on the science of library or some other specialty, and has published some innovative articles or books, is required to have a good command of a foreign language, and be able to take charge of various professional work as well as some research projects[1].

4   Expenses and library building construction of China's higher education libraries

4.1   Expenses of higher education libraries

The expenses of higher education libraries in China are generally composed of: expenses on buying documentation materials, expenses of office work, facilities and others. Most of the expenses come from the university budget, i.e., the government investment in education, including:

- Education operation expenses. Allocated by the university from its yearly education operation expenses for the purchase of the library documentation and materials;
- Scientific research expenses. Allocated by some universities from their scientific research expenses for the purchase of the library documentation and materials;
- Special facility expenses. Earmarked by the university from the university expenses on the instruments, facilities as well as furniture for the purchase of the library's technical and conventional equipment[1].

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And with the reform and opening-up as well as the diversified school-running methods, social donations and the students' tuition fee come to have a share in the library's expenses.

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The expenses are the financial pillar of all kinds of the library work, among which, the expenses of documentation materials shall decide, more or less, the scale of the library's collection, collection structure, types of resources and the extent to which the library fulfills readers' demands. From the late 1940s to the early 1950s, China's higher education libraries were beset by difficulties such as a small number of libraries, a small collection of books, shabby library buildings and shortage of expenses. Since the 1980s, the State has been taking a series of policies and measures to increase funding to accelerate the development of the higher education library industry in China (Table 1)[11].

With the implementation of the science and education strategy, China has increased its investment in higher education since 1990. First, the "Project 211" initiated by the former State Education Commission to set up 100 universities in the 21st century has enlarged the investment in the selected universities. In May 1998, the General Secretary Jiang Zemin made a speech on knowledge innovation and establishment of the world's first-class university on the 100th Anniversary of the Beijing University, where the "Plan 985" was launched with an aim to build the first-class universities of the world and many a university was included in the development list of the plan. Moreover, some provinces also mapped out education plans and put in more money on universities and colleges so as to encourage the development of higher education. With these projects and plans, the expenses required of the higher education libraries are gradually increasing. In the past, the annual expenses of China's key higher education libraries were no more than 10 million yuan each, which exceeded 10 million yuan in the late 1990s[3]. In 2005, the documentation expenses of Beijing University library reached up to 19.09 million yuan and that of Tsinghua University library amounted to 18.85 million yuan. Through spot check, the documentation expenses of 371 ordinary higher education libraries in 2005 arrived at 1.37296 billion yuan, averaging 3.7 million yuan per library [12]. The documentation expenses of 50 key higher education libraries were 564.97 million yuan, averaging 11.29 yuan per library.

Furthermore, in order to keep up with the market economy, the higher education libraries in China have accepted the idea of financing. Raising funds from the society has become one of the important strategies for the higher education libraries to collect expenses. Many higher education libraries have succeeded in obtaining the donations from friends and foundations of Hongkong, Taiwan areas and other foreign countries to construct new buildings, buy new furniture, equipment and documentation. Some

Table 1   Expenses on literature purchase from 1956 to 1997

Year	Expenses/RMB ($\times 10^4$)
1956	1,344
1978	5,216
1987	14,708
1990	21,284.91
1995	37,476.50
1997	46,150.31

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of the higher education libraries also manage to raise money through granting the name right of libraries or reading rooms to enterprises as well as releasing the right of advertisement on walls, bookshelves, desks and chairs. It has become one of the vital aspects in the library financing how to attract high-tech enterprises to sponsor or invest in constructing digital libraries. Multi-channel financing has injected energy to the development of China's higher education libraries[4].

4.2   Construction of the higher education library buildings

The library buildings are the most basic facilities of the library. The buildings of China's higher education libraries keep developing in terms of floor area, construction structure and functions. In 1980, there were 675 higher education libraries in China with over-all areas of 1.32 million m^2, and many a universities had no independent buildings. Since the 1980s, with the recovery of the national economy, further development of the higher education and continuous increase of various financing channels, the construction of China's higher education library building has stepped into an unprecedented period, owing to large quantities of investments put by the central government and local governments at all levels as well as positive changes in the organizational structure, laws, regulations and expenses. Particularly since the 1990s, a big batch of new library buildings with new functions and varied styles have been constructed or expanded.

According to statistics of the Construction and Equipment Subcommittee of the Academic Research Committee of the Library Society of China, there were at least 115 newly-built and enlarged libraries in China, among which there were 70 higher education libraries, accounting for 60.9% of the total. For instance, Tsinghua University Library, Tongji University Library and Beijing University Library are 3 times, 1.5 times and 1.5 times more than the original ones in size respectively after being expanded. These new buildings are becoming landmarks in the university campuses with their high-quality architecture and design, beautiful environment, special campus culture and excellent appearance[3].

According to the statistics, the total area of China's higher education library buildings in 2005 grew to 25.05 million m^2, 4 times than that of 1995 (Fig. 3)[12].
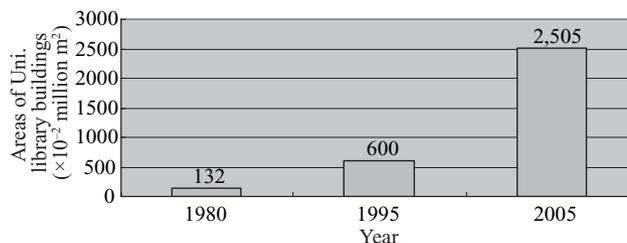

Fig. 3   The areas of the university library buildings in 1980, 1995 and 2005.
Resource from the educational statistics of the Education Ministry of the People's Republic of China.
http://www.moe.edu.cn/.

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Before the 1980s, most of higher education library buildings in China took the mode of rigid function and hybrid structure technology with monotonous shape, separate space between book-collection room and reading room, poor flexibility, adaptability and expansibility, and lacking interconnections among the rooms. Taking the library buildings of the Agriculture University of China for example, both the newly-built and expanded library buildings are designed according to the international popular design of "unified columns, unified storey height and unified load". Most libraries recognize the influence that network environment has on libraries and forecast that the library of the new era should be a comprehensive intelligent building integrating building control automation, communication automation and office automation. Thus, in the libraries, new buildings are usually equipped with access control system and fire protection system, and special attentions are paid to the intelligent comprehensive wiring systems, and digital facilities such as network interfaces are installed everywhere. Besides, the new library buildings are more human-oriented and take into account the readers' feeling and aesthetic demands in space design, external and internal environment, and try to make it easier for the disabled with more barrier-free designs [4].

5   Documentation resources of China's higher education libraries

The "*Regulations on Ordinary Higher Education Libraries*" issued in 1987 stipulates that the collection of documentation materials shall fulfill mainly the needs of political education, teaching, scientific research, and other needs. Efforts shall be made to keep the integrity and continuity of important documentation materials and pay attention to collect the publications and academic documentation of the university, and shall reexamine and select documentation materials. The "*Regulations on Ordinary Higher Education Libraries* (Revised)" published in 2002 takes the documentation resources as an independent chapter to elaborate that the collection of documentation materials shall pay attention to paper documentation, electronic documentation as well as documentation of other carriers and both the documentation materials and the use rights are important. It shall be required to keep the integrity and continuity of important documentation materials and special resources and attach importance to collecting the publications and academic documentation of the university or concerned with the university. High education libraries shall build special digital resources and virtual network resources, integrate actual resources with virtual resources to establish an online unified collection system in accordance with the requirements of teaching and scientific research, and the book-collection features, the division of labor in the regional or industrial documentation guarantee system. Thus, from the differences between the original and the revised "*Regulations*", we can see the development trend and changes in the positioning of the documentation resources of China's higher education libraries in recent 20 years.

5.1   Current situation of the documentation resources

The documentation resource construction of China's higher education library has undergone a rapid development from a small number to a huge number. According

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to statistics, at the very beginning of the founding of the People's Republic of China, there were altogether 132 higher education libraries in China with a collection of 7.94 million books, averaging 60,200 books per library. In 1978, the number of the higher education libraries grew to 598, of which there were 35 higher education libraries with a collection of more than 1 million books each. In 1980, there were 675 higher education libraries with a collection of 193.62 million books, averaging 286,000 books each. From the 1980s to the mid-1990s, the higher education libraries have developed very rapidly. In 1994, there were 1,080 higher education libraries in China with a collection of 415.7696 million books, averaging 387,000 books each. In 1995, the number of book collected amounted to 439.0694 million[10]. When entering the 21st century, great strides have been made in higher education libraries, in particular the documentation resource of key higher education libraries. According to the statistics of 2005, the number of documentation materials of 371 higher education libraries reached 527.0156 million, averaging 1.4129 million books each, 3.65 times the average of 1994 and 23.47 times the average of 1949. The spot check of 50 key higher education libraries under the "Project 211" in 2005 showed that the average number of collected books of these 50 libraries was 2.897 million books, twice the average of 371 higher education libraries (Fig. 4).

Meanwhile, the popularization of network stimulates the explosion of information and there come more and more forms of documentation resources. In the past, the non-printed materials collected by libraries included only audio-visual materials and microform materials, while at present the proportion of electronic resources such as electronic books and electronic periodicals to the overall library resources grows bigger and bigger (Figs. 5 and 6). According to the statistics of 531 higher education libraries in 1999, there were no electronic resources at all and the non-printed resources merely contained audio-visual materials of 2.5469 million accounting for 1%, and microform materials of 1.0012 million accounting for 0.4%. In 2005, electronic resources developed rapidly. As for the statistics of 371 higher education libraries in 2005, there were 101.1842 million electronic books accounting for 19%, 91.9626 million electronic periodicals accounting for 17%, which were much bigger than the proportions of the audio-visual materials and microform materials.

At the same time, the construction of the library's special resource database has been paid much attention and developed quickly. The "Special Resource Database of

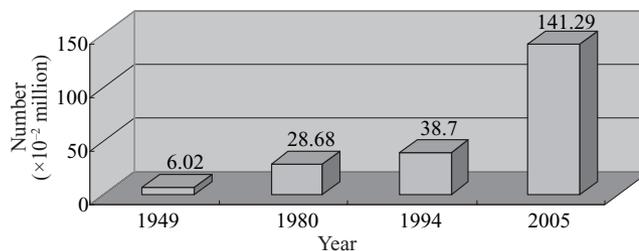National Science Library,
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Fig.4   Average amount of literature resources of higher education libraries.

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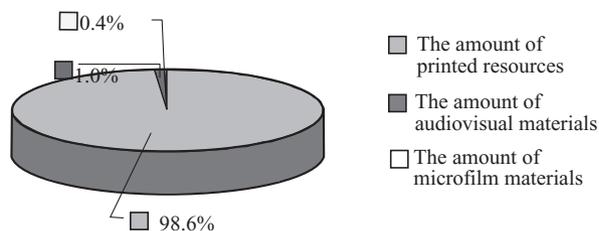
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Fig. 5   The proportions of non-printed resources in 1999.
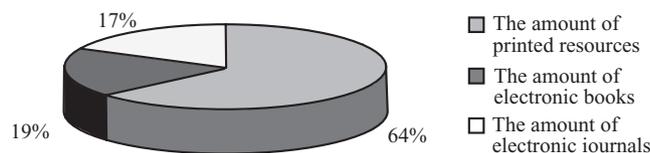Resource from the fact database of China's university libraries.

Fig. 6   The proportions of electronic resources to the overall resources in 2005.
Resource from the fact database of China's university libraries.

China's Higher Education Institutions" is one of sub-projects of the China Academic Library & Information System (CALIS) "10th Five-Year Plan" initiated in 2003 involved 61 colleges and universities. To date, 50 databases are available for use online[13].

According to the spot check of 371 higher education libraries, the self-built databases reached up to 115,438 GB, averaging 311.15 GB per library and the self-built databases of 50 key universities amounted to 41403.77 GB, averaging 828.08 GB each, 2.7 times the average of the 371 libraries. Therefore, some achievements have been made in the construction of key higher education libraries, which shall drive the development of the higher education libraries.

5.2   Organization of documentation resources

With significant increase of the library documentation resources, organization of the resources also develops smoothly in terms of theory, system and science. In 1974, Professor Liu Guojun in the Department of the Library Science of the Beijing University, took the initiative in introducing the computer cataloguing, machine readable catalogue (MARC), of the American Congress Library into China, which started the catalogue automation of China's libraries. Higher education libraries took the lead among other libraries in introducing card catalogue, machine readable catalogue and metadata.

When the automation of higher education libraries became popular in 1990, computer cataloguing and MARC took the place of manual cataloguing and card catalogue, and retrospective bibliographic databases were carried out in a large scale.

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Since 2000, most of the higher education libraries have owned electronic bibliography and all Chinese books but ancient books and some foreign documentation materials have catalogue data. With the deepening of the resource-sharing concept, the higher education libraries began to build the unified catalogue database. The most influential achievement made by the China Academic Library & Information System (CALIS) is the unified catalogue database of China's higher education institutions.

The CALIS unified catalogue database was built in 1997 under the organization of CALIS Online Cooperative Catalogue Center and involved 470 university member libraries. By May 2008, it has accumulated more than 2.3 million pieces of catalogue and 25 million pieces of book-collecting information, including various documentation types such as printed books, book series, electronic periodicals and ancient books. The languages include Chinese, Spanish, Japanese and Russian. The contents of the catalogue database cover 71 secondary disciplines and 226 tertiary disciplines in the "Catalogue of Higher Education Discipline" issued by the Ministry of Education[14]. The CALIS Online Cooperative Catalogue Center has established its mirror service stations in South China, Southeast China, Middle China, and Southwest China and plans to, during the "10th-Five-Year Plan" period, develop the unified catalogue database focusing on books and periodicals into a multimedia unified database with the bibliographic information focusing on printed books and periodicals, including electronic resources, ancient rare books, non-book materials and maps, capable of having access to pictures, images and full-text database[14].

6   Services of the higher education libraries

6.1   Readers service of the higher education libraries

The higher education libraries in China are mainly aiming to serve teachers and students. Since 1980, the higher education libraries have realized computer-based management and information services including circulation of books, reading and information consultation. In 2005, most higher education libraries have set up their own websites based on campus networks. The scope and contents of online services have been expanded continuously, and the efficiency of library services has been greatly improved.

- Opening hours have been prolonged.   According to the statistics of 1986, the opening hours of China's higher education libraries averaged 70 hours per week[10]. While according to a spot check of 371 higher education libraries made in 2005, the opening hours averaged 86.5 hours per week, up by 16.5 hours. The Northwest Polytechnic University Library and the Southwest Finance University Library in particular reached up to 100 opening hours per week.
- Open-shelf reading has become popular.   Influenced by the idea of putting stress on book collection instead of reading, close-shelf reading was the main service mode of higher education libraries before the 1980s. After that, open-shelf reading, for the convenience of readers, has become popularized rapidly. According to the statistics of 530 higher education libraries in 1999, the number

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of books lent reached up to 53.59 million, averaging 101,000 books per library; while in 2005, the statistics of 371 higher education libraries showed that the number of books lent amounted to 109.94 million, averaging 296,000 per library, more than twice of that in 1999 (Fig. 7).

- Duplication of documentation information has become popular. All higher education libraries were equipped with duplicators, and some even bought advanced duplicators to build their own duplication center [15].
- The audio-visual and microform technologies have been widely applied. Sixty percent of China's higher education libraries have provided readers with audio-visual and microform services. Many higher education libraries have set up their own audio-visual rooms[15].
- The information service and management of libraries have been computerized. The information service and management of higher education libraries such as book circulation, reading and information consultation have been gradually computerized since the 1980s. In 2005, the online resources of libraries were open to the public 24 hours a day, and online book renewal, reservation and return have become popular.
- The information consulting service has been enhanced constantly. Thanks to digitalized documentation information resources, the SDI service, information analysis and science and technology retrieval have reached a new level. Since 2003 when the Ministry of Education established 57 science and technology retrieval workstations in some higher education libraries by three batches, which have completed 5,497 projects in 2004, 8,732 projects in 2005 and 11,088 projects in 2006, providing decision-making references to the establishment of projects and results assessment, and helping the management of higher education institutions make decisions in a scientific manner.

Recently, the higher education libraries in China have been attaching more importance to enhancing the quality and benefits of their services, continuing to develop new methods and modes of services, and endeavoring to provide services to the schools nearby, social users, long-distance users and online users, such as document delivery service via Internet, e-mail service, report on discovery of network information resources, online interlibrary borrowing, online documentation subscription, online information navigation and user training service. According to the statistics of 371 universities in 2005, the number of online users reached 560 million persons.
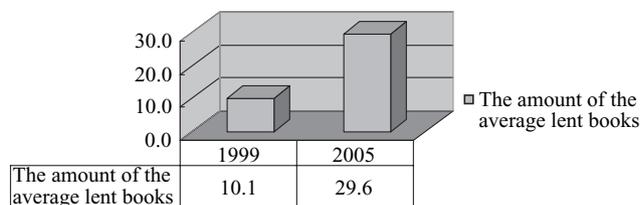
The amount of the average lent books	1999	2005
	10.1	29.6

Fig. 7   The comparison of the amount of the averaged lent books in 1999 and 2005 ($\times 10^{-2}$ million).

6.2   Information quality education of the higher education libraries

Reader education is one of the important aspects of the library services and has been put stress on by China's higher education libraries for long. The "*Opinions on Higher Education Institutions Opening Documentation Retrieval and Utilization Course*" promulgated by the Ministry of Education in 1984 requires colleges and universities to provide students with training of how to use books and documentation materials. It is also stipulated in the "*Opinions*" that the higher education libraries shall be responsible for the training task. With more than two decades of construction and development, the course has been developed into a multi-level education system with graduates, undergraduates, junior college students and adult students. According to the statistics of 1986, 532 higher education libraries in China established the course and the number of students taking the course amounted to 600,000. While in the late 1990s, the development of information technology and network technology have brought remarkable changes to information source carriers and retrieval methods so that the course had to start with a reform: not only turning the focus from manual retrieval to computerized retrieval, but innovating the teaching methods through information technology. For example, the elective course "Electronic Resource Search and Utilization" set up by Beijing University library is designed to introduce the retrieval and utilization of electronic information resources of all kinds via Internet by use of online teaching, online answering questions, online delivery of homework and exam papers, which attracts many students to select and enjoys a good reputation all over Beijing University, or even all across China. Another example, the East China University of Science and Technology has developed a practical online curriculum for the documentation retrieval course, which as a result ranked high in the course assessment of the university[16]. Up to 1995, the students taking this course in China added up to 1.5–2.0 million. In 1997, more than 700 universities set up this course with a team of 2000-plus teachers and 400-odd textbooks and cultivated more than 2 million students in total.

In 2002, the National Symposium on the University Information Quality Education (the former Symposium on Teaching of the Documentation Retrieval and Utilization Course) organized by the Higher Education Library Information Work Guiding Committee of the Ministry of Education was held in the Heilongjiang University. The new name showed that the teaching of documentation retrieval has stepped into a new period focusing on enhancing the information quality of the students[17]. According to the statistics of 371 universities in 2005, the teachers of this course added up to 3,588 and the students of this course totaled 899,203.

7   Resource sharing of China's higher education libraries

With the development of automation, China's higher education libraries started to share resources, then continued to expand the contents and scope of shared resources, and later turned from interlibrary borrowing of paper documents to delivery of electronic documents. Through constant practices, they have explored a resource-sharing road with Chinese characteristics.

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The higher education libraries in China began sharing resources in the mid 1950s. In 1956, the "*Interlibrary Borrowing Methods among Higher Education Libraries*" was issued by the Ministry of Education, stressing the idea of resource sharing. In 1957, the "*Coordination Plan of Books in China*" was issued by the State Council in a bid to set up national and regional library committees to coordinate the purchase of books, which marked the beginning of the resource sharing among Chinese libraries. During the next 20 years, some higher education libraries conducted a series of cooperation and coordination activities on their own, such as coordinating the purchase of books and periodicals, building unified catalogue, interlibrary borrowing and cooperative book collection, which laid a foundation for advancing the resource sharing among higher education libraries.

From the 1980s to the early 1990s, systematic research and exploration on resource sharing was made in China. The investigation on the documentation resources of China from 1987 to 1989 pushed the study of resource sharing into a new period. A general concept and starting plan was put forward by the Ministry of Education to establish disciplinary documentation centers and develop an open resource-sharing network. Tsinghua University Library and other 12 Foreign Teaching Materials (including technology, medicine and agriculture) Center of the State Education Commission were set up in 1985, and Beijing University library and 14 other Documentation and Information Center for Liberal Arts of the State Education Commission were set up in 1992. Since then, the resource sharing of the higher education libraries started the from-top-to-bottom development road with united planning, providing theoretical and practical guidance for sharing resources among China's higher education libraries.

In 1999, the CALIS of "Project 211" was initiated by the Ministry of Education, integrating abundant documentation resources of higher education libraries, building a three-level documentation guarantee system consisting of 4 national centers, 7 regional centers and all higher education libraries under the "Project 211" in the mode of both centralization and separation so that the higher education library resources could be built together and shared with each other. During the "10th-Five-Year Plan" period, there were over 800 member libraries among which 100-plus member libraries have participated in the cooperative construction and the libraries benefiting from various subprojects added up to 1,000 or so[18]. By May 2005, the centers of CALIS have organized more than 600 universities to buy foreign documentation databases in groups, introducing 91 databases from 19 companies[19], creating resource-sharing platforms as the "Unified Catalogue Database of the Universities' Foreign and Chinese Books and Periodicals", the "Database of Dissertations and Theses" and the documentation delivery system. In 2006, the digital resources of CALIS amounted to 180 TB and became one of the largest public digital documentation and information resources home and abroad[18]. The resource-sharing libraries under the "Project 211" enjoy prominent advantages and have made good achievements. According to the spot check of 371 higher education libraries in 2005, the volume of documentation delivered from all the universities and colleges in China was 13.8 million articles, and the volume of interlibrary borrowed books

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reached 4.23 million books, while the volume of documentation delivered from the key 38 higher education institutions under the "Project 211" was 15.1 million articles and the volume of interlibrary borrowed books was 7.16 million books. The volume of documentation delivered from Shanghai Jiaotong University library alone reached 13,070 articles and the volume of interlibrary borrowed books of Nanjing University library alone arrived at 8,776 books[20]. In 2004, the "China Academic Social Sciences and Humanities Library (CASHL)" under the Ministry of Education was established jointly by Beijing University library and Fudan University library as the national humanities and social sciences information platform providing strategic guarantee for the national humanities and social sciences research. The CASHL is committed to introducing foreign periodicals of humanities and social sciences in a systematic manner by integrating the advantages of some higher education libraries in disciplines, documentation resources and services, and providing high-quality documentation materials for teaching and researches of humanities and social sciences by documentation delivery. The platform is operated very smoothly and the operation cost is decreasing gradually. The searches of the periodical database reach 10 million times per year. Besides, the electronic resources available in March 2007 have been searched for 1.27 million times, 1.19 million articles have been downloaded, the amount of documentation delivered arrives at more than 240,000 articles and the annual amount of documentation delivery services reaches 70,000 times. The satisfaction rate is increasingly growing and reaches up to 90%.

In addition to co-building and sharing system of national documentation resources, many provincial/municipal higher education libraries and documentation information organizations are also making efforts to explore the mode of co-building and sharing of regional documentation resources (e.g. universities in Jiangsu Province). These systems vary in name and scale, some of which even break through the barriers between industries and systems to build cross-industry and cross-system regional documentation resource guarantee systems, effectively enhancing the sharing rate of China's libraries resources, for example, Shanghai Information Resources Network established in 1994 and Shanghai Electronic Library established in 2000. In 2007, the Beijing Academic Library and Information System (BALIS), under which there are four centers — documentation delivery, interlibrary borrowing, resource coordination as well as training, was initiated and made full use of the abundant collection resources of the higher education libraries in Beijing and the convenient networks to supply the university readers in Beijing with the interlibrary borrowing service in the way of combining centralized portal platform with distributed services. As an integral part of CALIS during the "10th-Five-Year Plan" period, the Tianjin Academic Library and Information System, with five years of efforts, has established several documentation information centers so as to form a documentation guarantee system with convenient networks, large sharing, perfect services and high efficiency, which, rated as a model for universities to build and share resources collaboratively, pushes the higher education libraries in Tianjin to step into a period of digitalization and realize co-building, sharing, joint development and utilization of the documentation information resources.

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8   Automation of China's higher education libraries

The automation of China's higher education libraries has made prominent accomplishments through constant practices and hard efforts. It can be divided into the following three steps.

8.1   Automation of single business management of libraries

The automation of libraries was officially launched after Premier Zhou Enlai approved the "Chinese Character Information Processing Project" in 1974. Then, the reform and opening-up of 1978 promoted the development of libraries greatly. In 1978, the retrieval system of foreign books (abbreviated as ndts) was completed by the Nanjing University library. In the 1980s, some of the higher education libraries worked out a few small systems such as information retrieval system, management system of book lending, and library automation system so that the automation of single business management has been achieved. Generally, the automation of the higher education libraries advanced from theory to practice step by step.

8.2   Construction and development of automation integration system

According to the statistics of the National Committee on Library and Information Service of University, up to late 1987, there have been 234 higher education libraries using computers at different levels. Most computerized systems were cataloguing, circulation and purchase systems, as well as systems of bibliography retrieval, periodical management and unified cataloguing, such as "Foreign Books Purchasing System" of Beijing University library, "Foreign Books Bibliographic Searching System" of Tsinghua University library and "Laser Barcode Computer System for Chinese Books" of Nanjing University Library (abbreviated as NDTLT)[10].

In 1988, under the support of the Ministry of Culture, Shenzhen Library started making research and development of library automation integration system. Through three years of efforts, a Library Automation Integration System (ILAS) with independent intellectual property was developed successfully and has up to 4,000 users in China so far, which becomes an important milestone in pushing forward the automation of Chinese libraries.

After that, some other higher education libraries such as Beijing University library, Beijing University of Posts and Telecommunications library and Nanjing University library undertook the key "9th-Five-Year Plan" project of making research and development in the library automation. NLIS, MELINETS and Huiwen Web systems have been developed, which enriched the market of the library automation system and made up for the shortage of independent development of library automation integration system. By the end of 2000, all of the 211 higher education libraries have applied the advanced domestic or foreign automation integration managing systems, computerized the library's traditional business flow, opening a new era for higher education libraries[22].

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8.3   Standardization, network-based and large scale development

Since the implementation of CNMARC and development of network technology in the early 1990s, the library automation system has stepped into a period of standardized and network-based development. With the initiation of many projects, a series of standardized and network-based automation integration systems come out successively and play a more and more important role in the higher education libraries. CALIS, a project starting from 1998, has yielded such fruits as unified catalogue system, system of documentation delivery and interlibrary borrowing, unified book retrieval platform, and resource registration and scheduling system, which form an integrated network of the documentation and information resource service and offer unprecedented development opportunities to the automation of higher education libraries. The once-distributed and independent higher education digital libraries have become more integrated and standardized.

Development of information technology, diversified types of resources and management of electronic and digital resources have promoted the library automation to a higher level. Some advanced library system including resource integration retrieval system, academic information linking system, digital asset management system, digital legacy preserving system and resource discovery and access system are all open to the public. The higher education library automation system has been gradually improved and developed from single business to diversified functions and played a bigger and bigger role.

In 1995, the concept of "digital library" came to China. Since then, the construction of higher education digital libraries has been attached great importance to by the Ministry of Education. With the initiation and operation of a series of digital library projects, such as China Academic Digital Library Information System (CADLIS) and China-America Digital Academic Library (CADAL), the higher education digital libraries are developing in a healthy and orderly manner.

In conclusion, since the founding of the People's Republic of China over 50 years ago and especially the reform and opening-up 20 years ago, with the reform and development of China's higher education and the deepening of "Project 211", the higher education libraries in China have made great achievements in the fields of documentation resources, readers service and automation system, which lend big support to the rapid development of the higher education in China. Still, there are some deficiencies and difficulties on the way: for example, the development of higher education libraries is unbalanced, there is a big gap between ordinary higher education libraries and key higher education libraries, and the higher education libraries of different regions vary in fund input; the hardware facilities of the higher education libraries have been improved a lot but there is still a long way to go to keep abreast with developed countries. In recent years, the library personnel are more capable and qualified than ever before, but it still has much room for improvement in the light of the future tasks. All in all, regardless all these hardships in the construction of China's higher education libraries, we believe that through our joint efforts, we can overcome these hardships and bring the development of higher education library to a bright future.

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