The Role of Information Technology in Academic Libraries' Resource Sharing in Western China

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Abstract

This essay examines the work of China Academic Library and Information System (CALIS), an academic library community that has established resource sharing in a network environment. More specifically, it examines CALIS's work in the developed Eastern and the underdeveloped Western regions in China and considers how CALIS has used information technology to narrow the gap between academic library communities in these distinct regions. It also attempts to promote professional understanding about academic libraries in China's Western region, especially around the ways in which these libraries have used information technology and digital databases of local culture to help transform communities across their regions.

Introduction

Chinese academic libraries have changed in the past 30 years. As economic reforms swept through China, academic libraries have transformed their infrastructure, work modes, service patterns, and service concepts. These libraries have abandoned a traditional model of librarianship in favor of a modern model (Zhang, 2011, p. 219). Nowadays, academic libraries function as university-based documentation and information centers (Wang, 2001, p. 40). As of 2010, according to official statistics, there were 1,800 academic libraries in China (Wang & Chen, 2010, p. 29). In 2009, the CPC Central Committee and the State Council held an education conference and officially published a *National Outline for Medium and Long-term Education Reform and Development (2010–2020)*. This document was a blueprint for the continued development of higher education and academic libraries. After the publication of that document, Chinese academic libraries received funding-support advancements in their information technology

infrastructure. During this time, nearly all academic libraries in China created institutional websites (Han & Liu, 2010, p. 44).

The China Academic Library & Information System (CALIS) project was one of two public service systems in the "211 Project" and was approved by the State Development and Planning Commission of China in 1998 (Zhu, 2003, p. 401). It is a national academic library consortium. Funded primarily by the central government, its mission is to provide document and information services—through the China Education and Research Network (CERNET)—to universities that receive funding from the central government. It is an important facet of a broad-based program to reform existing traditional university libraries through the development and sharing of information resources (Li, 2003, p. 261; Wang, 2001, p. 40; Yao & Chen, 2005, p. 471). It offers multiple resource-sharing functions to its participating libraries—including online searching, interlibrary loan, document delivery, digitization of resources, and coordinated purchasing and cataloging (Dai, Chen, & Zhang, 2000, p. 66).

CALIS is similar to the many library consortia that exist in the United States (Bostick, 2001, p. 7; Dai et al., 2000, p. 66; Zhu, 2003, p. 403). It arose from a need for sharing when resources or funding for those resources were scarce. CALIS also helps institutions identify and address information technology and electronic resources needs (Davis, 2007, p. 9; Kopp, 1998, p. 7; Potter, 1997, p. 416). It helps libraries respond to the recent advances in computer, information, and telecommunication technologies that have dramatically revolutionized the way in which information is acquired, stored, accessed, and transferred (Dai et al., 2000, p. 66). CALIS has made digital resources more prevalent in China's academic libraries (Yao & Chen, 2005, p. 473). After more than a decade of developing a high-tech information infrastructure, the CALIS resource-sharing network is well developed. It is crucial to the functioning of academic libraries and offers critical support to higher education and scholarly research. CALIS's ongoing mission includes organizing, promoting, maintaining, and improving library resources and sharing strategies and providing scholarly information services for Chinese educational institutions and the public (Wang & Chen, 2010, p. 29). As of 2012, according to internal data, 901 of China's of 1,800 universities are members of CALIS (National Bureau of Statistics, http://www.stats.gov.cn; Wang & Chen, 2010, p. 29).

As a national resource-sharing consortium CALIS is a long-term, strategic endeavor (Dai et al., 2000, p. 68). CALIS developed over three phases (Phase I: 1998–2000, Phase II: 2002–2006, Phase III: 2010–2011), during which it fully utilized information technology to implement resource-sharing functions for member libraries. CALIS's Union Catalog database has developed into the largest online bibliographic database in China, and as of 2005 contained merged bibliographic records from forty CALIS member libraries as well as holding records from 200 member

libraries (Yao & Chen, 2005, p. 473). CALIS's collaborative virtual reference system integrates its member libraries' reference services (Yao & Chen, 2005, p. 475). The network has also built a new-generation digital library network system—the China Academic Digital Library Information System (CADLIS). This system is a nationwide, distributed, federated digital library for HEIs and academic libraries that uses advanced technology such as cloud computing (Wang & Chen, 2010, p. 29).

Community Informatics

Community informatics (CI) examines the roles of information and communication technologies in community development and sustainability. CI can assist library and information science professionals in serving dynamic communities (Williams, Han, Yan, & Alkalimat, 2012, p. 118). Community informatics focuses on how communities interact with digital technology, both how they create technology and how using it impacts their social and individual lives (Williams, Bishop, Bruce, & Irish, 2012, p. 218).

CI is relevant to this study of the role of information technology in academic libraries' resource sharing in the underdeveloped Western region of China. Few scholars have studied how local academic libraries have used CALIS to take advantage of emerging IT trends. The purpose of this report is to discuss how CALIS utilizes information technology to support resource sharing and meet the academic libraries' needs in the Western region—and in so doing, to narrow the gap between academic library communities in developed and undeveloped regions. This report also attempts to promote professional understanding about academic libraries in the Western region and explores how libraries have utilized information technology to develop digital databases of local culture to promote resource sharing across the region.

Methodology

For this report, we collected and collated data from CALIS, the Ministry of Education of the Library, and the Information Command Council. We also drew data from the published literature on these issues (from sources written mostly in Chinese). A review of China's national policies on economy and education, specifically as they relate to the Western region, offered insight into the issues studied. We also examined CALIS's preferential policies with regard to the Western region and conducted interviews or e-mail correspondence with library staff in three Western academic libraries.

According to the system of geographical division used by the Chinese government, China consists of three macro regions: Eastern, Central, and Western. In this report, we only cover the Eastern and Western regions. As shown in table 1, the Eastern (coastal) region includes three municipali-

Table 1. Geographical Distribution in the Eastern and Western Regions

Region	Province/Autonomous Region/Municipality
Eastern region (n = 13)	Beijing Municipality, Tianjin Municipality, Shanghai Municipality, Helongjiang Province, Jilin Province, Liaoning Province, Hebei Province, Shangdong Province, Jiangsu Province, Zhejiang Province, Fujian Province, Guangdong Province, Hainan Province
Western region (n = 12)	Chongqing Municipality, Inner Mongolia Autonomous Region, Ningxia Hui Autonomous Region, Xinjiang Uygur Autonomous Region, Tibet Autonomous Region, Guangxi Zhuang Autonomous Region, Shanxi Province, Gansu Province, Qinghai Province, Sichuan Province, Guizhou Province, Yunnan Province

Source: Baide Baike (*West*, n.d.); Clarke, Yu, Yu, & Fu, 2011, p. 25.

ties and eleven provinces, while the Western (far inland) region includes one municipality, five autonomous regions, and six provinces.

Economic Inequalities in the Eastern and Western Regions
The Western region encompasses 5.38 million square kilometers, which is 56 percent of China's geographical size. It currently has a population of about 287 million, which is approximately 22.99 percent of China's total population. In other words, the Western region is vast, and its population density is lower than the other two regions. Due to its remote locations and poor transportation, Western China has had a slower information flow than is the case the Eastern region (Zeng & Kun, 2008, p. 75). The Western region contains five minority autonomous regions, 30 autonomous prefectures, and the vast majority of the autonomous counties. In addition, 92.7 percent of China's ethnic minority groups live there—including Mongolians, Hui, Tibetans, Uighurs, and the Manchu. The Western minority population accounts for 87.6 percent of China's total minority population (Cui & Yan, 2005, p. 84).

Due to natural, historical, and social barriers, the economic development of the Western region lags well behind that of the other two regions. The region's GDP per capita is two-thirds of the national average and less than 40 percent of the average in the Eastern region (*West*, n.d. § 3.1). In 2008, the Western region's economic growth was 12.7 percent, in contrast to the Eastern region's more robust 14 percent (Zeng & Kun, 2008, p. 75). China's 65 million poor citizens are concentrated in the Central and West regions, with the latter being especially economically disadvantaged. Three hundred and seven—or 51.9 percent—of the nation's 592 poverty-stricken counties are in the Western region (Qu, 1999, p. 7). Wang and Li (2010, p. 1) illustrate the digital divide between the Eastern, Western, and Central regions. We present their data for the Eastern and Western regions in table 2. There is a great need for technology professionals in the Western region (Cui & Yan, 2005, p. 83; Xiang, 2002, p. 41).

Table 2. The Digital Divide in Both Regions

Region	GDP per Capita Index	Newspaper Subscribers Index per Capita	Telephone Access Index	Internet access Index	Per Capita Telecom Services Index	Telecommunications Infrastructure Investment per Capita Index
Eastern region	149.4	138.37	141.44	197.30	181.90	156.4
Western region	61.4	67.65	57.85	32.00	49.01	64.8

Source: Wang & Li, 2010, p. 1.

Historically, China's development priorities have focused on the Eastern region. As a result, the Eastern region has always been more economically developed and modernized than the Western region (Hao & Wei, 2010, p. 182; Sun & Dutta, 1997, p. 851). The Eastern region has the nation's highest average income (Clarke, Yu, Yu, & Fu, 2011, p. 25), comparable to that of moderately developed countries (Zeng & Kun, 2008, p. 75). Traditionally, the major financial and industrial centers, such as Beijing, Shanghai, and Tianjin and the major seaports and airports, as well as the country's most prosperous province, Guangdong, are concentrated in the Eastern region (Clarke et al., 2011, p. 25; Sun & Dutta, 1997, p. 849). After the recent reforms and opening up, national economic policies shifted— from a balanced regional development strategy to one that gave priority to the development of the Eastern region (Clarke et al., 2011, p. 25; Sun & Dutta, 1997, p. 843). As a result, a great deal of domestic and foreign capital flowed into the Eastern region and stimulated its rapid economic development (Qu, 1999, p. 7). During this period, interregional economic disparity widened markedly (Sun & Dutta, 1993, p. 853; Qu, 1999, p. 7). Scholars have raised concerns about this rising gap. Recent studies reveal that a large number of complex factors are responsible for regional inequality (e.g., Hao & Wei, 2010, p. 182; Khan & Riskin, 2001, p. 532; Liu & Li, 2006, p. 450; Rodrik, Subramanian, & Trebbi, 2004, p. 132). Liu and Li (2006, p. 450) suggest that inequalities in technology are partially responsible for the inequality in regional income growth.

These inequities have impacted the development of academic libraries in the Western region (Xiang, 2011, p. 152). The economic disparity between the Eastern and Western regions is clearly reflected in the levels of funding for their universities and libraries. This disparity has also translated into a widening regional gap in terms of the financial resources that are available to local governments (Gang, 2007, p. 216); local governments often have few funds to allocate annually to academic libraries. Shortage of funding is common in academic libraries and further restricts

their technological development (Cui & Yan, 2005, p. 83; Qian, 2012; Zeng & Kun, 2008, p. 75). For these reasons, the progress of library automation and acquisition of information technology in the Western region has been slow.

ACADEMIC LIBRARIES' INEQUALITIES IN THE WESTERN AND EASTERN REGIONS

Academic Libraries in the Western Region

Researchers have observed several factors hindering sustainable development of academic libraries in the Western region (especially in minority areas): the shortage of funding, poor information technology infrastructure, a lack of technical and professional talent, and old-fashioned management (Chen, 2003, p. 47; Xiang, 2011, p. 153; Yu, 2010, p. 69). Academic libraries in minority areas face even more difficulty due to their limited staff, small and out-of-date collections, and substandard library buildings (Yu, 2010, p. 69).

In order for an academic library to make effective use of information technology, it must have adequate funding to enable it to acquire computer equipment and software; to build network infrastructure; to develop databases, electronic resources, and union catalogs; and to train technical services staff (Cui & Yan, 2005, p. 84; Fang, 2002, p. 69). But academic libraries in the Western region receive far less funding support than those in the Eastern region. Of the one hundred universities selected for funding from the 211 Project, only twenty-four are in the Western region. Top-tier universities in the 211 Project allocate funds to their libraries out of the funding the universities receive from the central government. But most universities in the Western region operate at the city or provincial level; that is, under the control of local—not national—government. Thus they are primarily financed and administered by a tier of the local government's Department of Education (Cui & Yan, 2005, p. 83; Fang, 2002, p. 68). This lack of funding means that academic libraries still operation in a traditional library mode, with limited information technology infrastructure. They are slowly transitioning into a modern library. But some university leaders in the region believe that developing a digital library is such a long-term, costly, and labor-intensive undertaking that they do not support doing so (Wen & Chen, 2003, p. 93). Some academic libraries, especially those in the Western ethnic minority areas, only have funding to pay the wages of the library staff. They cannot afford to construct new information infrastructure or the update their technological equipment. The small number of computers and other modern equipment in the libraries simply cannot meet the needs of a modern economy or of social information networks (Yu, 2010, p. 69; Xiang, 2002, p. 40). Thus computers in many academic libraries in the Western region

can only be used for simple functions such as registering new patrons (Chen, 2003, p. 47).

Academic libraries need a large number of highly skilled librarians (Chen, 2003, p. 47; Cui & Yan, 2005, p. 83; Fang, 2002, p. 69; Wen, 2002, p. 53; Xiang, 2011, p. 153; Yu, 2010, p. 69). Unfortunately, the level of training of academic librarians in the Western region, especially in ethnic minority areas, is far below the national average. Few library staff members have library and information science degrees or professional training (Chen, 2003, p. 49; Fang, 2002, p. 70; Yu, 2010, p. 69; Xiang, 2011, p. 153; Wen & Chen, 2003, p. 93). Most academic library staff lacks technical and professional knowledge and qualifications. Staff members do not have basic knowledge about information technology, hardware, and software, and thus would not be able to develop library networks. Overall, the personnel infrastructure of the academic libraries in the region is weak; few library employees have professional or subject knowledge. This greatly impedes the development of these libraries.

A consequence of being severely underfunded is that academic libraries in the Western region are without adequate information resources, electronic resources, network databases, and reference resources to support readers' needs in the information network age (Qian, 2012; Yan & Xie, 2008, p. 67; Zeng & Kun, 2008, p. 75). Most academic libraries in the Western region hold approximately 400,000 volumes—a number that lags far behind the holdings of libraries in the Eastern region (Chen, 2003, p. 48). Indeed, there is data indicating that more than 300 academic libraries (most of which are located in ethnic minority areas of the Western region) did not purchase a single book over the course of a year. Academic libraries' operational budgets in the Western ethnic minority areas tend to be just over 100,000 RMB a year (Yu, 2010, p. 69).

Collections of electronic resources are similarly insufficient (Wen & Chen, 2003, p. 93). During the large-scale development of the Western region, investment in university network construction far exceeded investment in library databases. For example, in Guizhou Province, 400 million (RMB) was earmarked for the college campus's network construction in 2003. But in the same period, earmarks for the academic library's database did not exceed 100 million (RMB) (Chen, 2003, p. 47). According to a 1995 survey, there were 1038 databases in China's academic libraries. Among them, 716 (69 percent) were in Eastern region libraries, while only 165 of them (16 percent) were in Western region libraries (Qu, 1999, p. 8). The collections in most of the libraries in the Western region are outdated (Xiang, 2011, p. 152). Thus, usage of the collections continues to drop. According to statistics, the average usage of the academic libraries' collections in the Western region is 40 to 50 percent (Cui & Yan, 2005, p. 83). Finally, local union network catalogs have instituted their own systems. Cataloging standards at the regional and national levels are not in

line with international standards. Limited resources in the local area networks in the Western region make it challenging for them to share with other LANs (Cui & Yan, 2005, p. 83; Yu, 2010, p. 70).

Academic Libraries in the Eastern Region
Most of China's regional policies are focused on the inland (Western region) and coast (Eastern region) (Hao & Wei, 2010, p. 184). This is reflected in national educational and library policies. Thus academic libraries in the Eastern region are already far ahead in terms of funding, collection size, information technology, provision of Internet access, level of staff training, quality of services, and resource sharing (Xiang, 2011, p. 152). The best library service in the nation is found in Beijing, Shanghai, Tianjin, and Liaoning, all of which are in the Eastern region. The GDP per capita of these four places is correspondingly high ranked (Jia, Chang, & Shen, 1991, p. 58).

To modernize the higher education system in China and bring it up to world-class standards, the central government has supported various national policies and initiatives, including the launch of the 211 Project, mentioned earlier. Of the top one hundred universities in the nation included in the 211 Project, the central government identified thirty-nine highest-ranking Chinese universities under the direct control of the Minister of Education to join the "985 Project." Both are important strategic development projects for higher education institutions in China. But the projects' emphasis is on the Eastern region, as table 3 shows.

Seventy-five Eastern region universities, three times more than the 24 in the Western region, are included in the 211 Project. Of the top thirty-nine universities in the 985 Project, twenty-six—a majority—are in the Eastern region, while only seven are in the Western region. The elite universities and libraries have achieved their first-class standing thanks to extravagant investment by the central government. But most academic libraries in the country are still in great need of information technology development and funding (Han & Liu, 2010, p. 44; Yan & Xie, 2008, p. 67). As of 2010, libraries in the Western region lagged far behind the top ten academic libraries in China in both regions combined in terms of total digital storage, planned construction area (m²), library staff, and total floor area (m²) (see table 4). And within this region, an interprovincial imbalance is noticed; none of these libraries is in Tibet, for example.

Table 3. Universities in the "211 Project" and the "985 Project" by Region

National Funded Project	Eastern Region	Western Region
211 Project	75	24
985 Project Phases I and II	26	7
Total	101	31

Source: CALIS.

Table 4. Comparison of Top Academic Libraries in Both Regions

图书馆存储总量 Total Digital Storage (GB)				图书馆在建馆舍设计总面积 Planning Construction Area (m²)			
Eastern Region		Western Region		Eastern Region		Western Region	
深圳大学图书馆 Shenzhen University Library	274,432	重庆大学图书馆 Chongqing University Library	800,000	河北工业大学图书馆 Hebei University of Technology Library	50,000	贵州大学图书馆 Guizhou University Library	50,000
首都师范大学 Capital Normal University	100,000	西安交通大学图书馆 Xi'an Jiaotong University Library	81,200	河北科技大学图书馆 Hebei University of Science and Technology Library	49,959	西安石油大学图书馆 Xi'an Shiyou University Library	45,000
上海海事大学 Shanghai Maritime University	89,108	西南科技大学图书馆 Southwest University of Science and Technology Library	64,000	福建江夏学院图书馆 Fujian Jiangxia Academy	47,300	贵州财经学院图书馆 Guizhou University of Finance and Economics Library	44,000
同济大学图书馆 Tongji University Library	88,000			天津理工学院图书馆 Tianjin University of Technology Library	45,800	西北民族大学图书馆 Northwest University for Nationalities Library	43,000
海南医学院图书馆 Hainan Medical College	66,560			河北师范大学图书馆 Hebei Normal University Library	45,300		
上海理工大学图书馆 University of Shanghai for Science and Technology library	65,000			中国人民大学图书馆 Renmin University of China Library	45,000		
Average	113,850	Average	315,066.7	Average	47,226.5	Average	45,500

图 书馆工作人员 Library Staff (Number of People)				图书馆馆舍总面积 Total Floor Area (m²)			
Eastern Region		Western Region		Eastern Region		Western Region	
浙江大学图书馆 Zhejiang University Library	466	四川大学图书馆 Sichuan University Library	360	扬州大学图书馆 Yangzhou University Library	95,453	电子科技大学图书馆 University of Electronic Science and Technology of China Library	66,974
上海财经大学图书馆 Shanghai University of Finance and Economics Library	422			浙江大学图书馆 Zhejiang University Library	86,376	重庆大学图书馆 Chongqing University Library	64,547
南京大学图书馆 Nanjing University Library	395			上海交通大学图书馆 Shanghai Jiaotong University Library	82,599		
山东大学图书馆 Shandong University Library	391			南京大学图书馆 Nanjing University Library	73,100		
北京交通大学图书馆 Beijing Jiaotong University Library	379			同济大学图书馆 Tongji University Library	68,721		
福建农林大学图书馆 Fujian Agriculture and Forestry University Library	333			厦门大学图书馆 Xiamen University Library	67,221		
深圳大学图书馆 Shenzhen University Library	327			大连理工大学图书馆 Dalian University of Technology Library	67,000		
上海交通大学图书馆 Shanghai Jiaotong University Library	322						
Average	379.375	Average	360	Average	77,210	Average	65,760.5

CALIS Members in the Eastern and Western Regions
CALIS members are distributed throughout twenty-seven provinces, cities, and autonomous regions in China as presented in fig. 1.

Sixty-three academic libraries from the 211 Project joined CALIS membership when it started. Most of them were from the developed Eastern region. More libraries were later encouraged to join the CALIS Union Cataloging Group. By the end of 2006, the number of CALIS members had reached 809, and two years later the number had grown to 1,005 (Wang & Chen, 2010, p. 29). The imbalanced distribution of CALIS members in the two regions is shown in table 5 and fig. 1. Of the 902 CALIS member libraries and the 2172 colleges and universities served by CALIS and the Ministry of Education in 2012, 716 CALIS libraries and 1573 colleges and universities were in the Eastern and Western regions. There were 498 CALIS libraries and 1049 colleges and universities in the Eastern region, and 218 CALIS libraries and 524 colleges and universities in the Western region. The Eastern region has more than twice as many member libraries and colleges and universities as the Western region. Generally, CALIS member libraries are larger-scale, with more patrons and greater financial support (Li, 2003, p. 264).

Figure 1. Geographical distribution of CALIS members in both regions.

Table 5. Distribution of Colleges and Universities and CALIS Member Libraries in Both Regions

	Eastern Region			Western Region	
Location	CALIS Member	Colleges and Universities	Location	CALIS Member	Colleges and Universities
Beijing	44	83	Inner Mongolia Autonomous Region	22	46
Tianjin	23	45	Ningxia Hui Autonomous Region	8	14
Shanghai	26	62	Shanxi Province	29	78
Heilongjiang Province	37	77	Gansu Province	11	37
Jilin Province	39	49	Xinjiang Autonomous Region	14	35
Liaoning Province	42	92	Qinghai Province	5	8
Hebei Province	24	95	Tibet Autonomous Region	2	6
Shandong Province	68	124	Sichuan Province	26	86
Jiangsu Province	62	128	Chongqing	23	53
Zhejiang Province	45	80	Guizhou Province	20	41
Fujian Province	31	76	Yunnan Province	18	59
Guangdong Province	48	121	Guangxi Autonomous Region	40	61
Hainan Province	9	17			
Total	498	1,049	Total	218	524

Sources: CALIS, 2012 http://www.calis.edu.cn/educhina/libnav.do?page=libnavbycalis; Ministry of Education, 2012. http://www.moe.gov.cn/public files/business/htmlfiles/moe/moe_229/201205/xxgk_135137.html

CALIS's organizational structure requires that member libraries provide funding and staff support, share their abundant collections in their respective discipline areas, and offer direct support to information users (Zhu, 2003, p. 404). CALIS itself has thirteen centers (five national and seven regional centers), which are maintained by full-time staff of the libraries in which they are located (Zhu, 2003, p. 404). Five of these National Information Centers were set up in the leading university libraries of the Eastern region (Dai et al., 2000, p. 6; Zhu, 2003, p. 401). Among the seven regional centers, only two, Sichuan University Library and Xi'an Jiaotong University, are in the Western region. Fifteen Provincial Information Centers were set up in universities in 2004. Seven of these hosting academic libraries are located in the Eastern region, while only four are in the Western region.

CALIS is committed to sharing resources and responding to its members' needs. Since its inception in 1998, CALIS has relied on several information technology tools to allow it to share resources needed by member libraries. However, libraries participate in CALIS's resource sharing differentially. As shown in table 6, only thirteen libraries in CALIS from the Western region have participated in Interlibrary Loan, the Provincial Literature Information Service Center, or the University Reference Knowledge Database Project. The lead participant in the University Reference Knowledge Database Project (the Distributed Collaborative Virtual Reference Service—DCVRS) is Shanghai Jiaotong University (Jia et al., 1991, p. 57). This project's six-member management team consists mostly of staff from university libraries in the Eastern region—Peking University, Tsinghua University, Shangdong University, and South East University (in Jiangsu Province). None of the Western regional libraries participate. Likewise, the fifteen-member audit and assessment team come mostly from universities in the Eastern region; only two represent the Western region (Xi'an Jiaotong University in Shanxi Province and Sichuan University in Sichuan Province).

Evidently, although it has covered a small number of academic libraries in the Western region whose universities are part of the 211 Project CALIS's strategic focus has been on the Eastern region. Constrained by the national strategic focus that privileges the Eastern region's libraries and hindered by economic underdevelopment, the Western region's academic libraries' participation in resource sharing is disappointingly

Table 6. CALIS Members Participating in CALIS Services in Both Regions

CALIS Service	Eastern Region	Western Region
University Reference Knowledge Database Project (Distributed Collaborative Virtual Reference Service—DCVRS)	12	1

Source: CALIS.

limited. The development of academic libraries often lags behind economic development, and so it is not surprising that the libraries of the Western region have not kept pace with those of the Eastern region. As a result, the inequality between the regional and academic libraries seems inevitable (Jia et al., 1991, p. 57; Xiang, 2011, p. 152). The "digital divide" between academic libraries in the two regions persists, and CALIS faces tremendous challenges in trying to overcome the multifaceted barriers to improve resource sharing in the Western region.

CALIS's Preferential Treatment of Academic Libraries in the Western Region
CALIS has acknowledged these interregional disparities. In order to address them, CALIS has included member institutions from the Western region in its developmental Phase I and II. In Phase III, CALIS's preferential policies have been in-line with those of the Large-Scale Development of the Western region initiated by the central government and the Ministry of Education. CALIS takes into consideration the limitations on Western libraries' budgets, resources, library staff people, and an overall lack of development, offering them additional help in the form of special funds, grants, allowances, and preferential policies. For example, CALIS has allocated special funds for resource construction to Tibet and Xinjiang. Funding for librarian training in the Western region exceeds 700,000 RMB. Interlibrary loan and document delivery services are completely subsidized for all academic libraries in the Western region during CALIS's three phrases. CALIS also offers a 75 percent subsidy for the libraries other than Tibet and Xinjiang; these two receive a 100 percent subsidy.

Recognizing the disadvantages these libraries face in terms of human resources, CALIS also conducts trainings in new technology. Allowances are only provided to eleven selected academic libraries in the Western region. CALIS also formed the Western Region Speech Touring Committee, which invites library subject experts, especially subject librarians, to give lectures and conduct trainings in the Western region. Familiar with the most innovative management ideas, these speakers share best practices and discuss how to apply management models to the field of library and information science. (Table 7 presents the training programs that CALIS conducted in Phase III.) The Western Region Speech Touring Committee alone trained 288 librarians and 112 libraries. To train more library staff from the Western region, CALIS is in the process of establishing multilayered professional training networks through regional resource-sharing centers.

State of Information Technology Infrastructure
As of 2003, 247 universities in China had Internet access. Of these, fifty were in the Central and Western regions (Wen & Chen, 2003, p. 92). In 2010, as shown in table 8, the network bandwidth in the top-ranked librar-

Table 7. CALIS Training Programs for Librarians in the Western Region

Training Category	Librarians	Libraries
Subject Librarian	322	197
Library Director Advanced Training	212	186
Visiting Librarian	53	53
Western Region Speech Touring Committee	288	112
Total	875	548

Source: CALIS.

ies in the Western region was comparable to that of their counterparts in the Eastern region.

The data in table 8 indicates that the state of information technology infrastructure is improving with increased investment in the academic libraries in the Western region. This was made possible by the large-scale development of the Western region. A dramatic transformation of these academic libraries has occurred within just one or two years (Chen, 2003, p. 48). The Western Education and Research Network Expansion Project—especially the large-scale construction of the CERNET provincial network and the implementation of the Western Campus Network Program—continue to support the construction of a library information network. Thus, libraries are becoming college and university information network centers (Yu, 2010, p. 70). Now academic libraries can exchange information easily through the Internet.

Community Informatics in the Academic Libraries of Western Region
Academic libraries in the Western region recognize that information technology holds great promise for serving the diverse ethnic minority and dispersed population that form their constituencies (Wang & Shen, 2008,

Table 8. Library Backbone Network Bandwidth in Both Regions

Library Backbone Network Bandwidth (M)

Eastern Region		Western Region	
Northeastern University Library	10,000	Chengdu Aeronautic Vocational and Technical College Library	10,000
Dalian Polytechnic University Library	10,000	Southwest University Library	10,000
Shanghai Jiaotong University Library	10,000	Xi'an Technological University	10,000
Nanjing University of Science and Technology Library	10,000		
Jiangsu Polytechnic University Library	10,000		
Jiangsu University Library	10,000		
Shantou University Library	10,000		
Average	10,000	Average	10,000

Data source: The Ministry of Education in University Libraries Facts Database, http://www.tgw.cn:18080/, which is a self-reporting system in which academic libraries in China participate.

p. 92; Fang, 2002, p. 69). They facilitate resource sharing and knowledge preservation; provide an essential network for information and communication exchange within the academic libraries community and other institutions; and enable learning and skills building by the library staff and its users. To take full advantage of information technology, it is imperative that these libraries, regardless of size, have meaningful involvement with the relevant technology to effectively define their community needs. They should express their aspirations by developing resource sharing and community empowerment projects based in and focused on the Western region. They should work at the grassroots level. As the use and impact of information technology increases, the role of information technology in academic libraries' resource sharing in the Western region will be strengthened, contributing to further development of higher education and community infrastructure in the region.

Wang and Shen (2008, p. 92) performed a SWOT analysis of the academic libraries in the Western region. They listed several key areas as strengths. The introduction of new technology increases the speed of processing information. It also improves the quality of information products and helps expand the scope of library services. Geographical advantages can help establish features collections and feature databases of local culture that display Western geographical, economic, historical, and ethnic characteristics of information resources system. Special services associated with these collections and databases can be developed and offered (Cui & Yan 2005, p. 83; Wang & Shen, 2008, p. 93; Wen, 2002, p. 54; Zhao, 2004, p. 11). These strategic strengths echo CALIS's preferential policies, which provide these academic libraries with discounts to make these libraries' acquisition of knowledge products and databases more affordable.

Harris (2007, p. 30) points out that the process of local content production (through technology) not only empowers the individual, it also fosters community engagement, creates social capital, and builds communities. Harris's statement seems to be true in the case of academic libraries in the Western region. To further examine the role of information technology in these academic libraries, we found the community informatics model of Actuality → Virtuality → Actuality and the research framework for community informatics (as shown in fig. 2) to be relevant and informative (Williams, K., et al., 2012, p. 11) to our report.

We use this model and framework (see table 9), along with interviews and correspondence with three individual libraries, to illustrate the state of community informatics in the Western region academic libraries. As we discussed earlier, historically these libraries have had limited or little information technology (*Actuality*). With targeted investment from the central government and CALIS, these libraries started to develop technology infrastructure—for instance, offering public computing and access to the Internet in the libraries (*Virtuality*). More importantly, they have
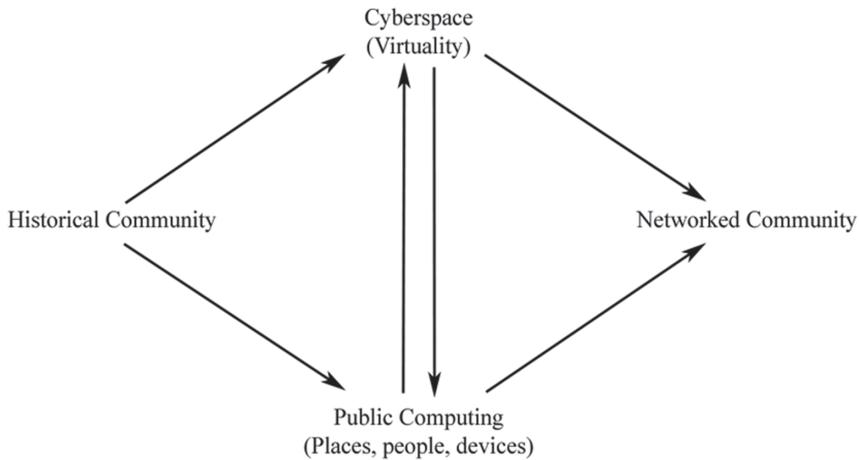
Figure 2. Research framework for community informatics.

worked strategically to develop digital databases and collections of local culture (Bao & Wan, 2003, p. 60; Wen & Chen, 2003, p. 92) that they share through the networked community of CALIS and the local library community. These libraries also learned to provide local technical and management support around the maintenance of these databases (Bao & Wan, 2003, p. 60; Zhao, 2004, p. 11). To provide quality information services to their users, these libraries have made every effort to stay current with digital trends (Fang, 2002, p. 67). In that spirit, they have changed and empowered their community.

Some of these databases are directly supported by CALIS's Subject Feature Database Project—a project led by the Wuhan University Library. The multimedia Dunhuang Studies Database (which was developed by this project) is funded by CALIS and connects to the Internet through CERNET. It is made accessible to Dunhuang domestic and international experts. The Mongolia Studies Database is also funded by CALIS. But most of the databases are locally funded and developed (Bao & Wan, 2003, p. 61). According to staff of the Lanzhou University Library, Lanzhou University Library has completed two projects on Dunhuang studies. The first two—the Dunhuang Studies Online Database and the Dunhuang Studies Digital Library—were designed and directed by former Director Shucheng Zhao. The projects were related and supported each other. But the scale of the Dunhuang Studies Digital Library is much larger than the Dunhuang Studies Online Database. Funded by CALIS and the Department of Science and Technology (approximately RMB 800,000), the projects had a shared mission of creating a web database. They were developed mainly by faculty and graduate students from the

Table 9. Community Informatics Features of Western Academic Libraries

Academic Library (Actuality)	Feature Digital Databases (Virtuality)	Contents (Virtuality)	Resource Sharing (Actuality)
Lanzhou University Library	Dunhuang Studies Database http://lib.lzu.edu/cn/dunhuang	Materials from predecessors, silk painting, plantars, grotto art heritage, research literature, and information on related research professionals and institutes	CALIS Networked Community
	Central Asian Research Literature Database http://lib.lzu.edu.cn/libzy-ca/zyzy.htm	Research literature, forum, institutes, peoples in Central Asia, memorabilia of Central Asia, and related websites	Local Networked Community
	Geographical Sciences Navigation Library http://lib.lzu.edu.cn/geodb/index.htm	Data about geoscience research, professionals, and periodicals in the Western region	Local Networked Community
	Northwest Ethnic Minority Studies Database http://lib.lzu.edu.cn/xibeishaoshu/doc/index1.htm	Literature on ethnic issues, ethnic minority history, and ethnic minority languages	Local Networked Community
Xi'an Jiaotong University Library	The Qian Xuesen Features Database http://202.117.24.24/html/xjtu/qxs/qxsdata.htm	Literature on Qian Xuesen, the father of China aerospace science	CALIS Networked Community
Inner Mongolia University Library	Mongolia Studies Database http://202.207.7.23/tsk.htm	China national bibliography of ancient books in Mongolian, Inner Mongolia University Mongolia Study Bibliography, ancient Chinese bibliography on Mongolia, International Mongolia Study bibliography, index of Korean scholars' Mongolia studies, modern Mongolian literature information database	CALIS Networked Community
	Life Science Database http://202.207.7.23/smkxtsk.htm	Inner Mongolia medicinal plants, Japanese books, bibliographic databases on Inner Mongolia, Inner Mongolia plant species catalog database, Mongolian Plateau grassland plant resources database	Local Networked Community

(continued)

Table 9. *(continued)*

Academic Library (Actuality)	Feature Digital Databases (Virtuality)	Contents (Virtuality)	Resource Sharing (Actuality)
Chongqing University Library	The Three Gorges Literature Database	Periodical articles and theses on the Three Gorges	Local Networked Community
Sichuan University Library	The Bashu Cultural Database http://202.115.40.213:7777	Language, character, literature, arts, religion, technology of and water conservation in Bashu area of South-west China	CALIS Networked Community
Sichuan Agricultural University Library	Panda Subject Database http://202.115.182/20:8088/was40/indexnd.jsp	Data on giant pandas from websites and other resources	Local Networked Community

Information School of Lanzhou University in partnership with the staff of the Dunhuang Research Institute. The third project, Dunhuang Studies Digital Database, is being organized by the Dunhuang Research Institute, Lanzhou University Library, and the International Dunhuang Project Organization (which is headquartered in Great Britain), and will attempt to integrate and improve the above two projects. The Lanzhou University Library staff summarized what they learned from the projects. To ensure their success, the project staff must analyze user needs, put subject expertise about Dunhuang and digital technology into place, obtain adequate funding support and copyright permission, and finally, keep abreast of current trends in the fields.

In addition, we interviewed Director Yang Changping at Sichuan Agricultural University Library about their Panda Subject Database in November 2012. The university is located at Ya'an, two hours away from Chengdu, the capital of Sichuan Province. This library is a member of the 211 Project which guarantees its funding. The library developed the panda project a few years ago and purchased Text Retrieval System (TRS) software to assist the development. Later, director Yang used the software as a platform for eight other subject databases. But her IT staff was not skilled enough to develop the library's own software. Director Yang acquired information on pandas from external resources on the Internet, but she has faced challenges in updating the database. This has hindered the use of it. However, through the project, the library staff learned to use commercial software to develop specialized databases so they can serve faculty and students more effectively by combining the subject database with the Institutional Repository database. This effort supplements the university's programs in biology, plant science, biological informatics sci-

ence, forest, poultry, and wheat sterility. Director Yang emphasized that good ideas are a must and notes that commercially available information technology products can help libraries bring these ideas to fruition.

Zhang Shengqiang, the head of the Sichuan University Library Technology Center, was interviewed via e-mail on the development of the Bashu Culture Database in November 2012. According to Zhang, the Bashu Culture Database was started in 1999, originating with CALIS's direct support in Phase I. Sichuan University Library determined the project theme, based on their collections and geographical characteristics of Southwest China. During construction, the library received funding from Sichuan University and the Sichuan Provincial Education Department. Throughout the duration of the project, software platforms have been replaced several times, as has the database. The main software platform includes TRS and Fangzheng Desay 方正德赛. The compiled data is constantly being updated. Initially, the collection focused on bibliographies, abstracts, some full texts, and special collections (such as Sichuan Opera script directories and museum photographs). The most recent update has added some natural scenery images. Sichuan University Library is mainly responsible for the construction of the Bashu Culture database. The database was directly released on the platform of Sichuan University Library when it was completed. It was also shared with other libraries through CALIS. Faculty and researchers were impressed by the database, but expect more improvements. In particular, there is potential to integrate it with research in the humanities and social sciences. On the other hand, Zhang indicated that the number of visits to the database seems low; they are now attempting to figuring out why this is the case. Zhang personally felt that it might be due to the design of the project. In addition, Zhang and his staff have been paying close attention to Sichuan Opera as a subtheme and have been working with Sichuan Opera's professional organizations. They hope they will be able to create the network technology environment to offer a better user experience.

It should be noted that these three libraries have relied mainly on themselves in creating these digital databases. To make their feature databases richer and more diversified, academic libraries in the Western region are beginning to emphasize joint development and resource sharing with government agencies; local social, cultural, and science foundations; and private companies (Xiang, 2011, p. 152). Some have built regional consortia in their own provinces, such as the Library Association of Gansu Province, which consists of the academic libraries, the Science Academy Library and public libraries, and the Sichuan Academic Library Association —the libraries of all three-tier colleges and universities. To attract more funding support, some scholars have suggested including the development of feature databases in the nation's Western Information Infrastructure Plan with policies and rules in place (Bao & Wan, 2003, p. 63).

Others have proposed taking full advantage of new technology and new approaches to provide special services on the feature databases (e.g., Cui & Yan, 2005, p. 83; Wang & Shen, 2008, p. 94; Wen, 2002, p. 53; Xiang, 2011, p. 153; Yan & Xie, 2008, p. 68; Zeng & Kun, 2008, p. 75). This would contribute to the economic and social development of the region (Qu, 1999, p. 9) and attract talents with qualified subject knowledge and technical skills to this region (Yu, 2010, p. 70; Xiang, 2002, p. 40).

The progress of reforming academic libraries in the Western region depends on the guidance and investments from the central government (Cao, 2001, p. 90) in addition to CALIS's preferential policies and special financial subsidies. On the other hand, the academic libraries in the Western region must be the internal driving force for the reform and convert the support of the central government and CALIS into the motivating factor to stimulate domestic vitality of the region. The Western region needs to takes charge if it wants to gain more national support (Qu, 1999, p. 9; Yu, 2010, p. 70). This will help ensure sustainable development. The Western region academic libraries have learned to solicit donations from various organizations and actively broaden their revenue income (Wen & Chen, 2003, p. 93). For example, Northwest Normal University Library received a donation from Sir Run Run Shaw of four million RMB, and in two years they built Run Run Library. Lanzhou University also received a donation from Sir Run Run Shaw and built the Run Run Science Palace (Qu, 1999, p. 9). To fully maximize the power of information technology offers to academic libraries in Western China, it is crucial for librarians and leaders to maintain their connections with CALIS and continue to work with libraries in the region.

Conclusion

The data collected for this report indicate that there is a direct correlation between regional wealth, library funding, resources, information technology infrastructure, and CALIS membership in two regions. We conclude that while the potential role of information technology in Western Chinese academic libraries' resource sharing is huge, its implementation and realization require much more than a simple investment in technology. We argue that harnessing the resources and assistance made available by the central government and CALIS to grassroots initiatives to utilize the power of information technology may offer the most productive outcome and the best solution for resource sharing. This type of CI approach will have the most direct impact on local communities, broaden access, spread inclusivity, and alleviate regional inequality. It will also challenge CALIS and its members to think and act more proactively, to go beyond the traditional library boundaries, and to play a greater role in ensuring their end users' equal access to library services, regardless of where they live.

SUGGESTIONS FOR FURTHER STUDY

The role of information technology in resource sharing by academic libraries in Western China is worth further investigation, especially through a community informatics research framework. The professional literature on academic libraries in the Western region is miniscule. Most of the articles are in Chinese; few of them are evaluative or in English, and none approaches its subject from the CI angle. To better examine these libraries, we suggest that more in-depth research should be conducted. For example, qualitative and quantitative data on the role of information technology in the community's resource sharing should be collected. The users and member libraries' wants and needs should be investigated. The usage of information technology facilities by member libraries in relation to CALIS services should be studied. Additionally, the impact of CALIS's preferential policies and initiatives on these libraries should be further analyzed so the policies can be improved and new strategies can be formulated. This would generate better resource sharing and cooperation between libraries across all regions of China.

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Appendix. Interview Questions on Local Cultural Databases

1. Who started the database?
2. Why?
3. How did you do it?
4. Who paid for it?
5. How did you apply information technology to develop this database?
6. How did you collect the data of local culture?
7. Did you collaborate with other libraries?
8. How did the users use the database?
9. Do you plan to do other local cultural databases, such as Sichuan Opera?

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