CULTURAL HERITAGE CYBERINFRASTRUCTURE:

A GEOGRAPHIC CASE STUDY OF CHINA

by

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The Internet affects many aspects of daily life and economic activity in globalized economies. The network city thesis posits that the Internet enables disbursed methods of production and new forms of economic activity. Existing economic geography literature concentrates on revenue generating firms. The concept of Cultural Heritage Cyberinfrastructure (CHCi) is developed in order to account for economic activities of nongoverning and nonrevenue generating firms, and is tested against the online activities of libraries.

China, with its administratively homogeneous provincial library system and rapidly changing economy, is examined. The central government and provincial libraries are cooperatively building the National Digital Culture Network of China to provide information services to urban migrants and subsidize rural development efforts through CHCi. These projects are found to be more active in less-economically transitioned western provinces. CHCi is found to be a useful construct for studying non-governing, non-market segments of an economy.

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对我的太太。感谢您的耐心。

(For my wife. Thank you for your patience.)

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CHAPTER I

INTRODUCTION

1.1 Purpose of Study

Information technology is a key actor in modern society, and has been closely associated with many of the spatial, social, and economic changes that have accompanied globalization. The Internet has evolved into an infrastructure that is more than simply a set of hardware and software technologies. In this thesis I develop the concept of Cultural Heritage Cyberinfrastructure (CHCi); an ensemble of social actors that produce and disseminate information within the context of cultural heritage institutions. The concept has been derived through a geographic case study that examines how the components of CHCi vary regionally within the People's Republic of China (PRC). The study shows that the Chinese provincial library system's construction of CHCi is a microcosm of the complex interactions among economic development, state building, and regionalization that result from the government's adaptation of market reforms.

Starting in 1978, China abandoned much of the collectivist economic principles of Leninist-Marxism and began a series of experimental programs designed to grow the economy. Economic geography scholarship about China largely concentrates on the role that the one-party state plays in the economy, and the socio-

spatial impacts of the massive industrialization and urbanization that market reforms have brought. This concentration on the interaction of state and market neglects the importance of a sector that, by definition, exists largely outside the market: cultural institutions such as libraries, museums, and some other types of Civil Society organizations. To be more precise: these institutions lie at the intersection between the state and the market—depending equally on the largess of both for support, either through donations or taxes. They also lie at the intersection of state-approved high culture and consumer, or mass media, culture. State approved culture includes widely accepted historical narratives and elements of culture that are touted as 'authentic' or 'classical.' Every society attempts to maintain this sort of master narrative for itself. Equally important is the desire of a creative vanguard that attempts to push culture forward. Libraries are institutions where the master narrative comes into contact with actors who are creating new culture.

Through their use of Internet technologies to preserve and create culture, the provincial libraries are participating in the Chinese economic growth program without actually being market actors. While this is a general look at the Internet in libraries, I concentrate on a specific project, the National Digital Culture Network of China (全国文化信息资源共享工程 quánguó wénhuà xìnxī zīyuán gòngxiǎng gōngchéng),[1] referred to as the NDCNC from this point forward. The project is driven by National Library of China and the individual provinces' Departments of Culture.

[1]The official translation is National Cultural Information Sharing Project. I have used the alternate version as this was the official translation when I began researching the project. Note that the version that I use matches the URL of the project.

Begun in 2002, and planned through 2010, the NDCNC is digitizing cultural heritage objects, such as drawings and recordings of musical performances, from all over China, and compiling them into a centralized database. It is also creating rural computer facilities where local residents can access the collections of digital artifacts as well as digital information on agricultural techniques and other relevant public interest information.

The case study was conducted through a series of visits to Chinese libraries in 2007, extensive conversations with an ex-patriot Chinese librarian, and an examination of published and online information about and from the provincial libraries. It concludes that the libraries are simultaneously reflections and mitigators of uneven development in China.

First, the study shows how cyberinfrastructure in libraries does not correlate exactly to other measures of uneven development, even though individual provincial libraries are constrained by the larger economic conditions of the provinces in which they are located. Second, it shows how these state-sponsored institutions are mobilizing technology to help mitigate the effects of the uneven economic development that results from the intentionally territorialized nature of the market reforms. Finally, it shows how investment in CHCi is helping to drive human development in rural areas, and economic development in provinces that lack advanced commercial sectors. More generally, the study shows that analyses of the relationship between state and economy cannot be limited to market-sector actors

because the cultural sector actively participates in activities that are essential to contemporary economies.

1.2 A Changing China

Worldwide, China is the focus of much attention because of the massive economic and social changes that have unfolded there over the past thirty years. Growing cities and changing urban landscapes are spatial manifestation of these changes. After almost complete isolation during the Cultural Revolution, in 1978 the Chinese Communist Party (CCP) began to drop many of the collectivist ideologies of Leninism. Instead, China began to experiment with developing market-based trade and encouraging foreign investment into state and party-controlled enterprises. At the same time, the government dropped moralistic prohibitions on personal accumulation, setting the stage for a modern consumer society. Building on early success, the experiments have expanded to encompass almost every aspect of Chinese life, resulting in the massive changes now visible on every Chinese street corner (Fan 1997; Lin 1997; Friedman 2005).

China geography, that is, geography with a focus on China and the Chinese people,[2] during the past twenty years has grown as the PRC has become more politically and economically prominent in the global state system. Lin (2002) reports that much of the increase can be attributed to foreign researchers being allowed to work in China after decades of exclusion, and to ideological and political changes

[2]As opposed to Chinese geography, which would be geography practiced by Chinese geographers. This is as distinguished by Lin (2002).

within the CCP. A good portion of the new literature concerns itself with the Chinese economy's transition to for-profit manufacturing and, more recently, service-sector enterprises. South China (specifically Guangdong and Fujian provinces), Shanghai (and the surrounding areas of the Yangtze River delta) and Beijing are especially well covered by case studies that examine:

- individual industries and industrial agglomerations (Harwit 2005; J. Wang 2006; Walcott 2007)
- how foreign direct investment (FDI) has transformed the Chinese economy
- the spatial patterns of development in China, including how development was intentionally limited to specific areas in order to isolate spatially the experiment (Walcott 2003; Lin 2000)

Similar to geographers working in political economy, many China geographers concentrate on socio-spatial issuess, such as regionalization (Yao 2001; Jia 2006), urbanization (W. Wu and Yusef 2004; Ma and F. Wu 2005), and migration (Chan 1999; Knight 1999; Yang 2000).

Despite the rapid changes to the Chinese landscape and society, one thing that has remained constant through the reform period is the CCP governing apparatus and strong state control of the economy. With the exception of small rural villages that have direct elections, the CCP controls all positions within central and local governments. In economic matters, many commercial and industrial enterprises are still owned by municipal governments or the central government—either directly or via proxy holding companies that are primarily owned by party officials. Still, even with this continuity in government, institutions that are government-sponsored, but not

part of the governing apparatus, have changed considerably. Universities, museums, theater troupes, and libraries—all government entities in China--have been greatly affected by the economic changes. These cultural heritage institutions share a specific function: they are charged with preserving and advancing Chinese culture. And while they are all government run, they also have Civil Society functions that sometimes conflict with the CCP.

This study concentrates on one particular type of state-run Civil Society organization: the library. Libraries, particularly public libraries, have the explicit social function of collecting, preserving, and providing access to information resources for the betterment of their readers (Achleitner and Dimchev 2004). During the course of the study it was found that, while libraries are not completely independent entities, individual provincial libraries in China operate largely autonomously. In this way they are more similar to what would be considered third-sector institutions in the West than they are to government institutions. Still, this thesis finds them to be important actors for the state through, among other things, their tacit participation in the Chinese state building program that is seeking to legitimize CCP rule through participation in international entities such as the World Trade Organization, and internal development programs like the NDCNC and the Western Development Strategy.

1.3 The Case Study: Digital Libraries

Chinese libraries, as in the rest of the world, are creating information resources accessible via the Internet. Many of these projects focus on creating digital surrogates

of physical objects such as books and photographs, or in some cases, ephemera such as performances of music and theater. The NDCNC is one such project. The reported intent is typically twofold: first, to widen the audience for these cultural resources beyond the local communities where they are created; second, to preserve the resources, as many are in danger of disappearing. This preservation function exists not only because the physical objects are often frail (for example, newspapers printed on acidic wood-pulp paper), but also because many local cultures are disappearing due to increased contact with outsiders (such as local dramas and folk songs).

This is not a new function for libraries. Indeed, the Library of Congress's American Folklife Center came to prominence during the Great Depression by recording Appalachian music and interviewing rapidly aging former slaves and Civil War veterans. The Folklife Center's Archive of Folk Culture has always used new technologies in its work, starting with wax cylinder voice recordings and moving to today's digital technologies (Library of Congress, 2008). Today, an increasing amount of its materials are available online.

The NDCNC has a third focus: providing facilities for residents of rural areas to access digital information. Libraries as technology access centers—designed either to provide Internet access for those who cannot afford it, or, as in the case of the NDCNC, to provide technology services to rural areas that lack the necessary infrastructure—are a hallmark of the Internet age. The Gates Foundation, now best known for global public health efforts, funded Internet access for libraries in the

United States and Mexico throughout the late 1990s so that by 2003, 95% of American Libraries had Internet access (American Libraries 2003).

Building online content and providing technology services to readers requires a combination of back-office computer hardware and software, adequate Internet access to move the content from place to place, intellectual property law and administrative policies appropriate to the task, an audience with access to personal computers (or, increasingly, to handheld devices) and the Internet, and workers capable of building and maintaining all of these systems. While these systems are generally called information and communication technologies (ICTs), I prefer the term cyberinfrastructure. When combined with the library's traditional role of preserving and advancing cultural resources, cyberinfrastructure becomes Cultural Heritage Cyberinfrastructure. Examining how provincial libraries mobilize the array of people, technologies, policies, and knowledge that make up CHCi, and relating this process to the larger Chinese development project, is a primary object of this thesis.

I also show that this mobilization of technology is an additional type of development that can be studied using geographic techniques. As was initially suspected, CHCi development reflects, and is affected by, regional variations in standards of living and economic development. The Chinese government is attempting to mitigate this unevenness with a variety of strategies that have resulted in a state that:

- has a governing system where center-periphery relations are in a constant state of flux

- is mobilizing conservative cultural traditions to encourage modernization and legitimize the one-party system
- above all, is trying to expand economic growth to all areas of the country

Each of these strategies is reflected in the provincial library system. While other studies cover the same topics, setting this study in libraries provides a unique setting, where state, market, and cultural forces come together. There is little geographic literature about libraries. What I have found is restricted to studying their locations with respect to their roles as social service organizations being offered to communities (Carruthers and Ulfarsson [2003] examine how urban sprawl affects access to services) and to the cultural patterns revealed in their collections (Jory [2001] looks at the founding of the Thai state through the original collection of its national library). To the best of my knowledge, this is the first geographic study of libraries as socio-economic actors.

1.4 Neglected Actants in China Geography: An Organizing Theme

Several times already I have used the word *actors* to describe institutions and technology. Borrowing from Latour (1999), who prefers the more general term *actant*, I use this language not to anthropomorphize non-sentient beings, but to highlight just how important these non-human actors are to this study. Latour goes so far as to ascribe agency to things like soil, forests, and bacteria.

As already stated, non-market, non-governing, public-sector institutions are mostly absent from the literature. Through the course of this thesis, I discuss other

neglected actors, including scale, non-commodified cultural economies, and government agencies. In this last instance, Lin argues that the socialist party-state is too often treated as a "singular, coherent, and rational entity" (2002, 1820) and that not enough care is exercised when describing complex interactions between party entities and government agencies at different geographic levels of the spatial hierarchy. My goal in doing this is to describe an actor-network that adds a new dimension to China geography.

In short then, this thesis examines how the current state of CHCi in provincial libraries reflects larger development issues in China. The library sector, and the methodological approach adopted, accounts for actor networks that are frequently ignored by many economic geography studies. The examination of these ignored actors reveals that these non-market, non-governing sectors of the Chinese society are being mobilized for economic development and state-building purposes in poorer, western provinces.

CHAPTER II

SETTING THE STAGE

2.1 The Modern Chinese Nation-State

The hallmark of a state is "an ensemble of technologies of power concerned with the governmental production and management of a territorial space," an arrangement that Ó Tuathail (1996, 7) terms "geo-power." Although Ó Tuathail treats geopower as a strictly modern phenomenon, China had many of the characteristics of a state long before any of the currently existing European states emerged. While political geographers generally place the origin of the state system in late medieval Europe, most acknowledge earlier state-like entities. Such entities were kingdoms and empires that controlled large territories under a unified governing apparatus. China is arguably the oldest such entity that still exists. While the areal extent under the influence of imperial China's geopower varied from dynasty to dynasty, a core territory has remained since the Qin Dynasty first emerged in 221 BCE. Various dynasties gained and lost control of portions of coastal South China and far western China, but ever since the first Qin Emperor united the country, there has been more or less one place under a unified government called China.

Cartier (2005) notes that the ways the empire organized itself spatially into nested administrative hierarchies still stand. The county, China's most basic territorial

division, predates the Qin Dynasty and continues as one of the lowest levels in the administrative and spatial hierarchy. The provinces, whose boundaries largely match today's, emerged in the Yuan Dynasty (C.E. 1271 – 1388). Along with Confucianism and Buddhism, these administrative hierarchies helped unite imperial China into a state.

At the same time, there are serious regional differences within China and a long tradition of localism that leads some to argue that there is no Chinese nation and that China has always been a weak state.[3] South China retains its group of dialects distinct from the northern dialects that became standardized Putonghua (Mandarin Chinese). The religious and ethnic minorities of the far Western frontiers continue to resist integration into the Han dominated PRC. Common aphorisms such as 'the emperor is strong, but Beijing is far away' are indicative of these types of center-periphery tensions. This long history continues to flavor the political geography of China as it continues to integrate its western territories and build a modern state. If one accepts that empires do not qualify as states, then there is even an argument to the effect that China has never achieved statehood. During the late Qing Dynasty, much of China's economic output was controlled by European states that held treaty ports. The time between the fall of the Qing Dynasty in 1895[4] and the founding of the PRC

[3]Although this is not a universal point of view. In fact Saich (2000) takes the opposite position and concludes that China is currently strengthening state control in its strong regulation of social organizations that provide services, such as medical clinics and housing assistance, that have sprung up to take the place of some former state services that have been in decline since the beginning of market reforms.

[4]The last Qing emperor abdicated in 1912, after northern China declared a republic in 1911. However, China's losses in the 1895 Sino-Japanese War was effectively the beginning of a civil war that ended with the formation of the PRC in 1949.

was variously marked by civil war, occupation by the Japanese, and brief periods of republicanism that always failed to unite the entire country. Much of the ensuing fifty years has been a continuous process of state-building, but some critics argue that China continues to be on the verge of disintegration. Zheng (2007) presents a summary of these arguments, and uses the 'Hanification' of the western provinces as an example of one situation that continues to threaten the Chinese state. He argues that up until the twentieth century there was not even an effort to integrate these areas into the rest of China, and that the efforts of the last century have produced mixed results. Islamist attacks in Xinjiang (Yardley 2008), protesting monks in Tibet, Gansu, and Sichuan (Coonan 2008), and a Mongolian cultural revival (Lim 2008) are all examples of continued problems with integration. Zheng uses a particularly biting quote from Pye as a shortcut for these integration problems that continue to linger: China is a "civilization pretending to be a nation state" (Zheng 2007, 4).

Zheng's work describes two dichotomies that continue to work against a strong state and are themes that link imperial China to today's PRC. The first pits the autonomy of the individual against submission to state authority. The second is a pendulum of power that cyclically swings between central and local political bases. Both of these tensions appear repeatedly in this thesis.

The first dichotomy can be seen in the revival of Confucianism in today's China. Calligraphy is a classical art form that never fell from favor during Communist times, and provincial libraries have set about digitizing the works of many famous calligraphers—many of which consist of Confucian texts. At various times

encouraged or discouraged by the state, Confucian philosophy rhetorically links respect for traditional family hierarchies with respect for government authority and extols the virtues of honoring and submitting to these authorities. Under these values, individual desires always take a back seat to obligations to country. Both Mao and Confucius implore government officials to act rationally, conform to high moral values, and serve the people. When these two notions are combined, Confucianism becomes a powerful tool for the state. While Confucianism may have been suppressed during the Cultural Revolution, Mao was an admirer of the May 4th Movement, which advocated a rethinking of Confucian values based on European Enlightenment philosophies (Gray 2006). As provincial libraries disseminate newly digitized calligraphic texts, they play a supporting role in the mobilization of Confucianism for state-building ends.

The second dichotomy sits at the heart of this thesis: provincial libraries are at the middle level of China's administrative hierarchy, and have a front-seat view of China's dynamic center-periphery relations. Zheng (2007) outlines waves of decentralization and recentralization under Mao Zedong before exploring the recent devolution of economic decision making to local governments. He documents some of the changes in bureaucratic structures and practices that emphasize this new local control. These changes have often led local governments to start exercising greater political authority within the party-state.

Despite the devolution of significant economic decision making to local governments, China still has a very controlled economy. In the far western Xinjiang

Uyghur Autonomous Region (XUAR), the State Council has direct control over the largest development corporation, which uses a military administrative structure and has moved more than two million Han Chinese into an area previously dominated by ethnic minorities (Becquelin 2004). Entire sectors continue to experience direct central planning and oversight. While this might be expected in the defense and energy sectors, Mooney (2007) shows that state control extends even to setting enrollment targets in higher education, dictating how many students should be admitted to colleges from various regions around China. The banking sector also remains under strict central government supervision. Lin (2000) credits this tight control with enabling the Chinese economy to continue growing through the Asian currency crisis of the mid-1990s.

While the role of the central bank is clear within the context of the currency crisis, central government regulation of provincial libraries is an issue to which I was never able to bring much clarity over the course of my research. For example, some librarians report that that salaries are determined centrally, but one librarian reported that increasing salaries are allowing competition with private industry while another lamented that low salaries weaken libraries ability to compete.

2.2 The Geography of Economic Transition

In 1978, the Chinese government embarked on an experiment to re-introduce market economics after thirty years of collectivization. As I note in chapter 1, China

has since experienced massive political, economic, and social changes—all of which have spatial manifestations.

The changes have not gone unnoticed in the Western world. This past summer the modernized spaces of Beijing, featuring spectacular buildings designed by star European architects, were more than just a backdrop for the Olympic Games; they were a constant visual reminder of China's modernization and economic transition. Popular nonfiction books make various arguments about the new roles China is starting to play: an emerging market where Western-trained Chinese entrepreneurs are building hi-tech investment opportunities inside the world's most populous country (Fannin 2008); an upstart rival, threatening the political and economic hegemony of the major Euro-American world powers (Kynge 2006); or an exotic destination for post-college adventures, where any white woman can become a soap-opera star while interning for a financial services company (DeWoskin 2005).

Along with the world's popular imagination, scholarly work about China is also booming. Lin (2002) points to two primary reasons for the recent growth: the importance of China to the world economy and the new opportunity to conduct research in what, before 1978, had been a country completely closed to outside scholars and whose native scholars suffered dearly under the anti-intellectual campaigns of the Cultural Revolution.

2.2.1 Sociopolitical Implications of Economic Transition. Three phenomena have emerged during the thirty years of economic transition that will be highlighted in this

case study. Each has received considerable attention in the English-language geography literature during the economic transition. First: economic growth and social stability are the main goals of the CCP—subservient to any Marxist revolutionary theories. Second: this growth and stability is best implemented by devolving political and economic power to local governments. Finally, a revival of two key tenets of Confucianism has occurred:[5] a dependence on technical experts to run the country, and the previously cited respect for the institutions and rituals of traditional culture.

When the Cultural Revolution ended, China was in shambles. Lin describes an economy that "was 'moving forward toward the edge of structural collapse'" and a society "exhausted" by political and ideological struggles (Lin 1997, 45). The CCP responded to this crisis by implementing a series of experimental policies aimed at raising living standards and government revenue. The party started by adopting the 'household responsibility system,' whereby land was leased to individual farmers who were free to bring crops to market after meeting communal quotas.

At the Third Plenum of the 11th Central Committee of the CCP in late 1978, the farmers' experiment became codified in official policy. This process is typical of Chinese administrative reforms: allow a local experiment, evaluate its success, allow it to spread, and then rewrite policy to match practice. Ash (1988) reports that the some sixteen percent of Anhui province's agricultural production teams were already

[5]It should be noted that the first phenomenon that I cited, social stability, is also intimately associated with Confucianism, which teaches that the stability of culture trumps individuals' ambition.

engaged in some decollectivization of farmland. I even find evidence that this process is present in libraries.

At this same plenary meeting, Deng Xiaoping solidified his power and began the march towards industrial market reforms. Soon thereafter, Special Economic Zones (SEZs) were formed. In these areas, foreign enterprises were allowed to build manufacturing facilities jointly with domestic partners. These first four SEZs were all located on the south China coast, in areas that had centuries of experience with trade before the PRC severed foreign economic ties. Historically, these areas were also the source of outward migration to Indonesia, Malaysia, Singapore, and the United States. These emigrants retained family and village ties, and the party-state wanted to know if these could be converted back into business ties. The original four SEZs, shown in Map 1, were located immediately adjacent to Macao and Hong Kong (Zhuhai and Shenzhen) and across the straits from Taiwan (Shantou and Xiamen)—all financial and manufacturing powerhouses associated with, but not controlled by, China. Lin describes the intentional selection of the locations in detail, and goes on to explain how the SEZ program expanded as it became obviously successful. These early successes led to social pressure as migrants flooded to the SEZs. The southern cities had difficulty handling the growth, and housing resources began to fall short. As more cities were added to the program, the trend became one of mass urbanization, and the

Map 1. Special Economic Zones. The original four urban Special Economic Zones were designated in 1980, followed shortly by the designation of the entire island of Hainan as an SEZ.

hukou system[6] that had long separated urban and rural residents began to break down as growing manufacturing enterprises demanded more labor resources. Eventually, authorities largely stopped strictly enforcing it, and the pace of urbanization further increased. The hukou system continues to function, but now it largely separates those eligible for social insurance services from those who must compete on the open market for school tuition, health care, and housing (Nielsen and others 2007).

[6]Originating in ancient China, hukou (户口 hùkǒu) family registers were adopted by the CCP to control the movement of people between urban and rural areas. While tied to individual location, when referring to hukou status writers often simply use 'rural hukou' and 'urban hukou.'

The south China coast, site of the original SEZs, and a few other early opened areas, continue to experience economic advantages over other parts of China. Indeed, regional inequality is well documented and much studied (Jia 2006; Zhang and others 2008; Fan 1997). In 1999, under pressure from academics and provincial leaders, the CCP announced its Western Development Strategy, a far ranging set of development programs aimed at transferring wealth to interior portions of the country through industrial and infrastructure projects. Besides mitigating regional economic inequality, the explicit goals of this initiative are to reduce migration pressure on eastern cities and to promote social stability (Goodman 2004).

Other examples of efforts to promote social stability and continued economic growth include:

- the creation of non-profit organizations (under government sponsorship) that, among a vast array of other goals, provide social services for rural migrants (Saich 2000). One example is private schools that receive considerable assistance from foreign non-profits (Hvistendahl 2008)
- the adoption of a private housing market that has helped local governments monetize land resources and mobilize personal savings—both of which help to mitigate the pressure on cities created by their enormous growth (Davis 2005)
- a long term program to increase the number of technical and managerial workers that began in the 1980s with students attending overseas universities and continues with rapidly growing in college enrollments

Deng Xiaoping's ruling philosophy is often summarized by his quotation: "To get rich is glorious" (致富光荣 zhìfù guāngróng). However, the twin push for social

stability and economic growth is best explained by the full quotation: "Poverty is not socialism. To get rich is glorious," which is to say 'poverty creates social instability that threatens social order, therefore let us seek wealth.'

Along with this new push for stability through economic growth came the decentralization of economic decision-making authority. During the thirty years of reform, provincial and local governments have become greatly empowered. This devolution, like the SEZs, began as an experiment in local decision-making, and has expanded as local authorities have successfully developed local economies. Zheng (2007) calls this *de facto* federalism and argues that the central government engages in constant consensus building with local governments. *De facto* federalism also reinforces the experimental nature of the transitioning economy in China. Just as the household responsibility system was said to have "originated spontaneously from below" (Lin 1997, 55), Zheng provides numerous examples of successful local efforts replicated as national policy.

Another aspect of *de facto* federalism is that, even though the CCP controls provincial and local appointments, the central government cannot govern without the consent of these local officials. Neither can the central or local governments use only authoritarian approaches. Zheng cites this as a continuation of a long Chinese tradition of localism, and points out that in this patrimonial culture, there is no strong national identity; the masses have always identified more with clan, village, and local culture than they have with China as a whole.

A side effect of *de facto* federalism is that poorer provinces are now competing with each other for development projects sponsored by either the central government or wealthy coastal enterprises. Yunnan Province, for example, is attempting to leverage its natural water resources and border location with Vietnam, Laos, and Myanmar to attract both foreign and domestic investment. Yang (2006) cites a desire to create environmentally friendly industries coupled with an acknowledged lack of technical expertise as two challenges that are being met with a program to develop incentives for engineers and academics to migrate into the province. Xian, home to one of the libraries examined in this study, is capitalizing on existing electronics and machine tool expertise to attract research and industrial enterprises in its bid to become a western capitol (Walcott 2003).

Another factor contributing to the successful market transition has long roots in China's history. China's emperors depended on a huge civil service to manage the daily affairs of the vast empire, and a byzantine testing system ensured the quality of these mandarins—a term that has become synonymous with the concept of a scholarly government official. During the end of the imperial era, as China struggled against the limits of Treaty Ports and Japanese occupation, many contended that the only road to independence and modernization was to throw off the mandarin's overemphasis on literature and Confucian philosophy and adopt Western scientific and technological methods. During this period many advocated adopting Western political forms while preserving Chinese cultural practices—a variation on the model of Meiji Japan. Spence (1981) extensively outlines the efforts of Kang Youwei, particularly 1898's

Hundred Days' Reform, to adopt the practices of the Meiji Emperor, arguing that they would lead to rapid development in commerce, agriculture, and industry. Gray (2006) describes the later May Fourth Movement, which called for the adoption of European Enlightenment ideals viewed through the lens of Confucianism. The Movement, born of a student protest on its eponymous day in 1919, is noted as a foundational moment for the CCP. Both Spence and Gray point to the May Fourth Movement's advocacy of John Dewey's pragmatic advancement of society through science and education.

These themes are echoed today in the 500% increase in college enrollment that has occurred between 1998 and 2005 (Mooney, 2007). James Kynge (2006) describes huge investments in higher education, planned at $50 billion US per year for 2006 through 2016, as well as the importation of Western pedagogical models through joint ventures with American colleges. Efforts to mitigate uneven development also extend into the educational arena, as the national education ministry is starting to steer enrollment growth towards students from western provinces (Mooney 2007). These types of programs are commonly described as pragmatic Dengism.

None of this is meant to imply that Chinese society is now completely open nor that its economy is completely market based. However, there is widespread consensus that the pace of growth has been astonishing, that most people are enjoying a much higher standard of living than before 1978, and that restrictions on personal liberties have been greatly relaxed since the end of the Cultural Revolution.

2.2.2 Shortcomings of the Transition Literature. China's market transition and its accompanying social, political, and spatial changes has led to a cottage industry of western commentary on China's future. Too often, these writers assume that a market economy is an unquestionably desirous goal and that it will inevitably lead to democratic reform. Such commentators can be said to be viewing China through the lens of a linear development model that assumes the world progresses towards wealthy, liberal democracy produced by minimally regulated capitalism. This linear model depends on an overly normative political philosophy, which is epistemologically problematic (Blaikie 2000). Lin's 2002 review article offers some explanation for these problems, and presents some alternative directions that can help to mitigate these shortcomings.

He begins by noting that China is generally underrepresented in the human geography literature between 1970 and 2000. What writing exists is either historical geography or simplistically descriptive due to the logistical obstacles presented by China at the time. Because researchers could not easily travel to the country and statistical data was either absent or suspect, geography as a discipline failed to produce many scholars of China. For this reason, what few China geographers existed did not engage the wider discipline in the quantitative theory building of the 1960s and 1970s, nor in its more recent qualitative work. Lin challenges the validity of some research on China from this period because it depended on defectors and other dissatisfied expatriots, some of whom proved to be unreliable. He notes that a more balanced

view, one that does not assume that the CCP will inevitably cede or lose control, is starting to emerge.

Lin describes an increase of research output since the 1990s. He writes that this new work is more quantitative and theory-driven because China is developing a more dependable statistical infrastructure, Chinese academics are less bound by ideological constraints, and the country has started to engage the global academic community. Still, literature published by PRC academics often continues to use stilted, jingoistic language and many writers are prone to broad pronouncements backed neither by evidence nor argumentation. For example, the Yang (2006) article cited above begins with a four page recitation of statistics and lists. He points to the rich natural resources available ("Yunnan flourishes with water resource capacity in superior quality"), but laments the "inadequate infrastructure, irrational structure, low development and utility of water resources, and backwardness in development [that] characterise the western, south, and southeastern parts of Yunnan" (29). After a few more pages of statistics, he introduces his description of Yunnan's development strategy by saying that the first essential component is "to adhere to the policy of liberation of thoughts and being practical" (32).

Finally, China is too often treated as if it were a newly discovered land, with its rise to economic prominence described as if the country has never before been a global actor. All too often China geographers, both foreign and domestic, fail to link current developments with the past. When I described the three trends of China's transition period in the first part of this section, I linked each one to previous periods of Chinese

history. Each of these 'trends,' might be considered a revival of prior governing and cultural traditions. Rennstich (2008) extends this approach. While he builds a model of economics based on information transfer, he returns repeatedly to the Song Dynasty (960-1279) as the prototypical globalized information economy. Thus he argues that the Internet age is simply a reemergence of an "informational network economy" (71).

The people I encountered in my fieldwork are certainly very aware that China is re-emerging onto the world stage—as opposed to emerging for the first time. Some took pains to remind me of this fact. While at a museum, one host reminded me continually that not only did many of the artifacts predate the existence of the United States, but they also showed an advanced culture before any European state could claim existence. The spouse of this same host, an employee of a venture capital firm, boasted that Xian would become an important city *once again,* because it is too important historically to remain undeveloped.

Fortunately, this idea of re-emergence is not completely absent from the literature. For example, Wu and Yusuf (2004) discuss how Shanghai is *re*-claiming its status as a global city and reinforce the three sociopolitical trends of the transition period. They point out that the city has gained autonomy from the state and that much of the development was planned and executed by the Shanghai government, rather than being the result of central government programs. Shanghai is linked to leading global firms, such as IBM and General Motors, and can supply financial service expertise to any other firm that wishes to locate offices there. Finally, they discuss the economic prosperity of the Pudong New Area and how investment in transport,

housing, and other physical infrastructure makes for a stable social environment that guarantees a steady supply of "entrepreneurship, skills, and labor" (52).

Beijing, Shanghai, and the Pearl River Delta (Guangdong Province and Hong Kong/Macau) are extremely well studied—perhaps to the detriment of China geography as a whole. It is essential to move beyond these three economic, cultural, and political power centers, which account for only ten percent of China's population.[7] This is one of the primary reasons why I chose to examine provincial capitals outside of these extreme economic growth zones. Similarly, instead of concentrating on for-profit industrial and commercial sectors (or their declining, 'iron rice-bowl' state-owned counterparts), I have chosen to examine a sector that was state controlled before 1978, has remained so since, and is unlikely to be transitioned anytime soon. Library workers, even more than museum curators or performing artists in state-run theater troops, are likely to remain state (or province or municipal) employees.

Chapter 4 explains how investment in CHCi helps to build a workforce that has some of the skills that are needed in the emerging information economy—the sorts of workers that Shanghai is hoping to attract to its Pudong New Area: database managers, systems administrators, information architects. Counting the cultivation of these skills as 'development' may seem strange—especially if one associates development projects with clean drinking water and the eradication of malaria. This leads us to the question: what is development?

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[7]According to the 2007 *Statistical Yearbook of China*, the combined population of Beijing, Shanghai, and Guangdong Province is 127 million—almost exactly 10% of the overall population. Even if one adds the additional coastal provinces of Shandong, Fujian, and Jiangsu and the port municipality of Tianjin, the combined population of 'developed' China is 341 million—approximately one quarter of the national population.

2.2.3 Developmentalism, Uneven Development, and Statist Development. China's economic transition is clearly an economic development and modernization project. So far, I have used the word 'development' mostly as a generic term to describe economic growth, but it also connotes an increase in standards of living as evidenced by income growth, access to health care and education, and a host of intangible, difficult to measure, factors related to human well-being. The word is also used to describe a combination of neoliberal expansionism and poverty relief programs that normalize the sorts of Western European social values that Blaikie (2000) deems the purview of 'development professionals' who work for organizations such as the World Bank, the International Monetary Fund, and the United Nations Development Program. To distinguish between the two, I use the word 'Developmentalism' to distinguish this set of programs from China's economic transition projects.

When the transition projects started in 1978, China certainly did have much in common with countries that are targeted by Developmentalist projects. China was essentially two countries: one, a huge, expansive agricultural society, the other a collection of Fordist industrial cities. While the famines of the 1950s were over, there were few amenities in the countryside, and urban dwellers lived austerely under central planning (Chesneaux 1979). The agrarian society was by far the larger country: more than eighty percent of China's population lived in rural areas in 1978 (National Bureau of Statistics 2007, table 4-1). Agricultural production depended on massive amounts of manual labor. Urban dwellers were seen as privileged, and at the founding of the PRC in 1949, some cities were more privileged than others. Not only were

there cities that were traditional seats of government and cultural power, but some were also the home of industrial China. Cities in the northeastern provinces held large manufacturing plants that had been developed by Russian and Japanese occupiers. Treaty ports held various industrial complexes that had been developed by Europeans through the late nineteenth- and early twentieth-centuries. After the founding of the PRC, inland cities benefited from defense industries that were being placed in strategic 'Third Front' locations (Naughton 1988). While most urban residents were not well off, they were privileged in relation to the rural peasantry (Chexneaux 1979).[8] So China began its market reforms as a country that already had internal divisions, which persist today.

As China began its reforms in 1978, the world city system was also changing. Industrial infrastructure all over the world was transitioning as Fordist methods of production were abandoned, Simultaneously, since the 1960s, the globalized service economy had been growing in importance. New means of production required management and banking services that could travel seamlessly across state borders. ICTs are frequently cited as helping to enable this transition. Even though the Internet, per se, was not yet in use commercially, capital movement enabled by computer

[8]In China and in China geography, peasant remains a word in wide use, and refers generically to a smallhold farmer or other rural agricultural worker. Over the course of my research I spoke with enough people that spoke of 'peasants in the countryside' to ascertain that unskilled urban workers are also refered to as peasants, although I rarely heard the term applied. These urban workers were more often referred to by their job (construction worker, shop girl, waiter, maid, etc.), although often a hierarchy was detectable, as I often heard 'worker' and 'migrant' used as an alternate noun to describe these same people. My impression is that 'migrant' is now the generic term to describe a peasant in the city. This is likely because the Chinese word for peasant is basically the word farmer, and it would be a little silly to refer to a welder as a farmer.

technologies became increasingly important.[9] At the time, China was completely cut off from this evolving system, and the 1978 policy shifts can be read as an acknowledgement of its desire to participate in the global system. China needed to re-enter the world economy.

As China's SEZs grew through the 1980s, another, parallel, narrative was taking place involving Africa, Latin America, and southern Asia. As the Cold War drew to a close, the classical Developmentalist paradigm was breaking down. Described as "economic growth…inspired by humanitarian considerations," Watts (1993) notes that this sense of Developmentalism grew out of a nineteenth-century European idea of development that was inextricably caught up in Darwinian thinking. This proto-Developmentalist project is linked to an imperial desire to 'civilize' colonial possessions. After World-War II, the 'Third World' set about becoming 'the developing world,' but the Euro-American 'Development' program maintained its normative stance: if poor countries would build neoliberal economies, they would be able to 'move forward.' It was normative in the sense that its advocates saw the world inevitably moving down a path that resulted in "a linear theory of progress rooted in western capitalist hegemony." Watts claims that even those who presented "alternatives to classical [D]evelopment thinking—dependency, Marxisms of various sorts – frequently shared the economism, linearity, and scientism of 'developmentalism'" (259).

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[9]See especially chapter 4 of (Kaplan and others 2004).), Sassen's (2001) discussion of new geographies of centrality, and a wide ranging discussion of telecommunications, economy, and urbanity in (Wheeler, Aoyama, and Warf 2004).

Watts, writing in 1993, characterizes the critiques of Developmentalism as widespread, and by 2000, Blaikie suggests that the paradigm had been critiqued to death, and in turn criticizes the critics for not presenting any alternative models. Despite the rumors of Developmentalism's demise, programs such as the United Nations Development Program's Millennial Development Goals and others associated with the Washington Consensus continued to grow.

China is conspicuously absent from these discussions of Developmentalism. This can partially be attributed to its position within the colonial world in 1900. As the modernist nineteenth-century development projects took off, China was in the midst of violently shaking off the colony-like Treaty Port system, seriously diminishing the influence of European powers. While Western powers intervened during the civil war period of 1895 to 1949, the efforts were more about combat and political support than they were about development. As for the post-World War II 'classical development' period--obviously China did not participate, although a parallel system of aid from the Soviet Union served some of the same functions.

China provides a very interesting contrast, both to Developmentalists (who had set about adopting the neoliberal Washington consensus), and to those who criticized the paradigm (as normative, paternalistic, and overly dependent on Western notions of Civil Society). The contrast is striking, because as China might have started to become receptive to foreign aid, it was instead signing joint operating agreements with multinational manufacturing firms and receiving other forms of Foreign Direct

Investment from Western states. Moreover, this growth program began under exactly the sort of strong state supervision that the World Bank discourages.

Some attention to China might have prevented Watts from stating that events in the world economy in the 1980s "rendered alternative development strategies, as much as statist development initiatives, largely irrelevant" (1993, 258). While many of China's new economic policies fall well within the Washington Consensus list of recommendations, they deviate primarily in their statist aspects, including continued government ownership of business enterprises and tight central control over exchange and interest rates. Variously described as market socialism, capitalism with Chinese characteristics, and socialism with Chinese characteristics, China was putting a radically different face on development from that of the countries of Africa, Latin America, and South Asia on which the Developmentalist literature is preoccupied, and where the UNDP, World Bank, IMF, and OECD concentrate their aid.[10]

This is not to say that all China's programs have been a complete success. It remains two countries: one, a leading industrial and economic power that fully participates in the world economy; the other, a developing nation that depends on outside assistance.[11] According to economists, uneven development within an individual country appears to be an inevitable part of capitalism, but there is disagreement whether or not it is a permanent condition (Harris 2008). In China,

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[10]Interestingly, a colleague recently pointed out that Anglophone and Francophone states in Africa receive the lion's share of attention from academics and NGOs, leading me to ponder whether the lack of attention paid to China by the anti-developmentalists is the result of a language barrier.

[11] That second country is much less rural than it was in 1978. By 2004, the rural population fell to 58% of the total: an increase of urban residents of more than 500 million people while the rural population is smaller by 4 million (National Bureau of Statistics 2007).

Deng Xiaoping adopted the idea that the laws of economics demanded that some regions had to be allowed to develop first. Throughout the 1980s China "designed and implemented policies such as the 'coastal development strategy' … that focused development in the eastern region. But nowhere is the bias toward the eastern region more evident than a series of 'preferential policies' (*qingxie zhengce*) that heavily favor the eastern region at the expense of inland China" (Fan 1997, 625). Six specific policies are cited, including permission to retain foreign capital, lump sum payments to the state instead of percentages of revenue, and preferential pricing for finished goods.

As explained in section 2.2.1, market reforms were planned for where they were easiest to accomplish: in already industrialized locations that had natural connections to outside markets. This plan was generally followed, with the initial SEZs located in specific municipalities on the south coast, then other industrialized coastal areas. A few years later entire coastal provinces were allowed to participate in joint ventures with foreign firms, followed by all provincial capitals regardless of location. Finally, western provinces were allowed to participate, but they had already fallen so far behind that development did not take immediate hold.

Deng's original strategy was for coastal development to trickle down to the inland provinces. The central government officials use the term "ladder step" rather than trickle down (Holbig 2004, 338), but by the mid-1990s, even as the market programs were being expanded, Hu Angang (a professor in Beijing) and other academics were organizing conferences that pointed out that China's inland provinces

remained stuck on the bottom rungs. They warned that the uneven regional development that had resulted from privileging eastern provinces was leading to instability. Their agitations led to the late 1999 announcement by General Secretary Jiang Zemin that the central government would design a set of "Develop the West" economic policies in order to mitigate the growing divide (Goodman 2004, 317).

The Western Development Strategy (WDS) can be seen as China taking up Blaikie's suggestion to propose an alternative to existing development models. In a very real sense, China is now a state that is simultaneously a donor and recipient of aid, as some of the surpluses of eastern, industrial China are routed to the underdeveloped areas of western, rural China through programs like the WDS. China is starting to attempt to create one country out of two through programs that pour resources into rural areas and interior cities--the areas where China is economically weakest. Programs like WDS bring the central state into many sectors, including provincially controlled libraries, where it is largely absent in eastern provinces. One librarian that I visited described a common formula for centrally driven provincial library programs: middle provinces receive a 50% subsidy, western provinces receive a 100% subsidy, and eastern provinces must fund the projects from their own revenues.

Remittances and returning migrants are two other factors that are predicted to drive development in the western provinces. Writing just three years after the WDS began, Zhu (2003) suggests that these sources of investment will likely contribute more to the development of interior regions than foreign direct investment, which has been the main engine of coastal economic growth. He also points out that some of the

key early investors in the SEZs were the overseas Chinese: ethnic Chinese citizens of Indonesia, Singapore, and the United States in addition to the quasi-overseas investors from Taiwan and Hong Kong.

All three of these possibilities for western province development: state sponsored programs, remittances, and returning migrants, are alternatives to the standard Developmentalist paradigm which relies on aid from non-governmental organizations and World Bank loans to drive economic growth and improved standards of living. However, this paradigm is almost completely absent from the literature on China and it fails "to explain multiple, divergent capitalisms and postsocialist transitions" (Hart 2001, 816). This is a prime reason to study the state sector in China. While the transition to a market economy has strongly affected the entire country, the state still controls much of the economy either directly or indirectly. Studying only market actors paints an incomplete picture of the overall economy. If one examines how state institutions are operating outside of the market in China, and concentrates on how they contribute to economic growth and improved standards of living, one begins to explain the full extent of China's unique development narrative.

2.3 'Traditional' Internet Geography

It is difficult to overstate the impact that the Internet has had on everyday life for hundreds of millions of people in the last fifteen years. A wide range of academic writing has accompanied its rapid growth. In this section I examine some of the most basic types of Internet research: writing about the diffusion of Internet technology.

And because it is so often cited as a key technological actor driving globalization, I next turn to look at the Internet's prominent role in economic and urban geography. Later I argue that the Internet has spawned a new sub-discipline for geography, but in many ways it has behaved like any other new technology. Its growth fits nicely with Hägerstrand's diffusion of innovation theory, which itself is an extension of Sauer's work on cultural diffusion.[12] This theory describes how a new technology or idea propagates through space. Hägerstrand (1952) used automobiles and radios as examples of technologies that grew from isolated spatial clusters expanding along transport and population corridors until they finally reached some equilibrium point—essentially when everyone who wanted one had one. Most geographers would acknowledge that these patterns held true during the Internet era.

Research about the Internet can also be seen as an extension of "an entire literature devoted to the location of high technology firms and the formation of high technology complexes" (Florida 1991, 256) during the 1980s. In Florida's brief summary of this literature, these high technology agglomerations, or clusters, are treated as economic development miracles without regard to the harsh treatment of workers (a main subject of the Hayes book that Florida was reviewing). Hayes (1989), in turn, also discusses the spatial and social side-effects of these concentrations of high technology industry, but does not examine how they might differ from other commercial or industrial agglomerations.

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[12] *The Dictionary of Human Geography,* 4th ed., s.v. "Diffusion."

Beyond their tendency to cluster, ICTs industries are frequently cited as drivers of a new, transformative type of economic development. While ICTs generally, and the Internet specifically, have certainly transformed a number of industries (retail book and music sales come immediately to mind), the transformations discussed below are deeper. First, ICTs are closely linked with globalization, primarily through their ability to link geographically dispersed actors into one world system. Second, ICTs generally, and the Internet specifically, have created methods of communication that are almost entirely new, and these have, in turn, spawned entirely new commercial, industrial, and social practices.

2.3.1 The Diffusion of Internet Technologies. Hägerstrand's three phase propagation model generally held true in the Internet age. The first stage has small clusters adopting new technologies. During the second "proper diffusion stage," (1952, 16) growth within the clusters slows down while nearby areas catch up and new clusters appear. The third, "condensing stage" (17), shows evidence that the innovation in question is now commonly known. Pew surveys have shown this to be true for home Internet access, broadband access, and other Internet technologies. After initially becoming available in major cities, Internet connectivity rates for American households grew rapidly, finally plateauing at around 70% since 2005 (Pew Internet 2008a).

These connectivity studies are one type of diffusion research. Beyond "tracking changes in how Americans connect to the Internet [and] how often" (Pew

Internet 2008b), the Pew Internet and American Life Project also produces reports on what people are actually doing when they get online.

Some of these are thematic studies that attempt to qualify how people use the Internet and how it, in turn, affects people's lives. Its most recent report, as of this writing, shows that rather than isolating family members from each other, technology is enhancing communication among spouses and children. Beyond the constant contact offered by cellular phones, respondents to this survey indicate that they often browse the World Wide Web together, with a full 80% of American households with children reporting having shared "'Hey, look at this!' experiences" at least occasionally (Kennedy and others 2008, 29-30).

The China Internet Network Information Center (CNNIC) produces similar annual reports on the number of Internet users in various Chinese cities. Beyond providing estimates of the number of netizens (the term preferred by CNNIC), they describe in detail what people are doing online, the various places they connect, and what devices they use.

CNNIC and the Pew Center both conduct surveys and produce descriptive reports. Neither is engaged in theory building, although both can be said to write from a standpoint that more connectivity is good. The Digital Divide literature also works from a premise that more connectivity is always desirable. This is a more engaged research that tends to advocate universal, unfettered access to the Internet as an unqualified social good. Beyond its advocacy, this research often explores: the social and political ramifications of restricting information flows (Lynch 1999; Harwitt and

Clark 2001); structural issues of societies where a significant proportion of the population cannot afford to access technology or is not sufficiently literate to take advantage of it (Bray 2000); and the movements that seek to subvert censorship and political change (Zheng 2008). None of the research cited, and indeed no Internet diffusion writing that I have seen, lays out an argument as to why control of Internet content or restrictions on access are incontrovertibly bad. In an interesting twist, there is some research that shows Chinese netizens believing that government control and monitoring helps protect them from false advertising and other sorts of hucksterism (Wong 2003).

Similarly, in this thesis I do not attempt to deconstruct the idea that more connectivity is good, nor do I take a position regarding Chinese Internet censorship. Just as section 2.2.2 argued that economic geography literature must move beyond examining the most privileged areas of China, Internet geography must move being simply counting users and advocating for more of them. Instead, I concentrate on *how* the Internet is affecting China by examining how the provincial libraries push Internet technologies into rural areas and how this relates to regional trends in economic development.

2.3.2 Non-contiguous Clusters: The Network City Thesis. The development of Internet technologies enables the instantaneous, low-cost, and global communications that are the hallmark of globalization. ICTs are always cited as key factors in allowing capital to flow globally, which in turn enables post-Fordist industrial production (also referred

to as flexible accumulation). Urban geography often discusses the impact of ICT development on a city's business landscape as well as the global city system (Sassen 2001; Maeng and Nedovic-Budic 2004). This intersection of economy and urbanity is where a large bulk of Internet geography lies.

Hong Kong and the Pearl River Delta (PRD) region of China, provide a prime example of how post-Fordist production, the global city system, and ICTs have interacted. As Hong Kong began to specialize in management and financial services, its constrained geography pressured low-cost manufacturing enterprises to relocate to nearby cities in the Pearl River Delta. Front office business processes, such as design and finishing of garments, remained in Hong Kong, while manufacturing plants developed in the Shenzhen SEZ. As Shenzhen grew increasingly prosperous, it began to produce its own management expertise even as Hong Kong was becoming an increasingly important financial hub for all of Asia, and an increasingly expensive location for factories. Through the 1980s and 90s, Hong Kong's manufacturing sector shrank as its financial sector grew (Tao and Wong 2002). Today, Hong Kong capitalizes on its Common Law contracts system, close financial ties with European banks, and un-filtered Internet access to continue its global prominence. Shenzhen and the rest of Guangdong Province capitalize on their huge manufacturing and design industries, *and their close proximity to Hong Kong.* With twenty years of management experience, Shenzhen is now exporting its own manufacturing jobs to smaller towns further inland (Enright, Scott, and Chang 2005), and inland cities are vying to attract this industrial development and the supervisory and technical jobs associated with it in

order to grow their own consumer classes (Walcott 2003). In my case study, I find a related pattern—inland institutions becoming clients of coastal software developers.

Hong Kong is now one of what urban geographers in the 1970s began to call world cities. Large urban areas like London, New York, and Tokyo were said to have more in common with one another than with other cities in their own countries (Beaverstock, Smith, and Taylor 1999). However, the nested hierarchies of cities like Hong Kong, Shenzhen, and the smaller suppliers of Guangdong Province, are at the heart of the network city thesis. Linking them together are not Fordist supply chains (shoes produced in Shenzhen never touch the ground in Hong Kong), but computer networks that connect textile mills, assembly factories, designers, management, and financiers. A few theorists go so far as to disregard the physical infrastructure of the city when defining the network city, instead defining them as "a concentrated constellation of computers principally linked with other major cities." (Kaplan and others 2004, 126) This exaggerated definition helps to show why global cities *are* wired cities. These cities are closely studied—both for the role they play in driving their regional economies and for the powerful influence they assert on culture.

Studies of the regional economy of the Pearl River Delta are increasingly common, as individual municipalities become linked together into this metropolitan-region network. Geographers who study these phenomena often write comparative studies of metropolitan regions such, as Maeng and Nedovic-Budic's (2004) examination of Seoul and Chicago, which primarily concentrates on new land uses in exurban corridors. This concentration on regions, rather than central business districts,

is an indication that urban geography is changing along with urban landscapes. In the United States, more people now live in suburbs than in cities (Caplow, Hicks, and Wattenberg 2001). From an economic standpoint, the most wired corporations in global cities are in actually in former hinterlands: the physical gap between Highway 128 and Boston is large; Washington DC's high tech industry is actually Virginia's. Most think of Seattle as a prototypical wired city, but Microsoft and a great many other large ICT firms are actually in the nearby suburbs of Redmond and Bellevue. Despite its reputation as a high-tech city, "San Francisco … has become something of a suburb to Silicon Valley." It has fewer people (by far) than San Jose, and less than 10% of the region's largest companies (Kotkin 2000, 2).

So what is left for the central business district? Another trend often cited by network city theorists is that the core cities of these metropoltan regions are now intentionally developing their human, cultural, and physical cyberinfrastructures so that they can participate higher up in the network city hierarchy—just as Shenzhen and Guangzhou have competed to become more than just a cheap place to make sneakers and DVD players.[13] 'Spectacular development' projects, such as the Nanjing Library and Beijing's Olympic venues, are examples of this trend.

2.3.3 Measuring the Network City. But what about less-than-spectacular development? If globalization, post-Fordist production, and cyberinfrastructure are all models that persist at lower levels of the network city hierarchy, how does one describe and

[13]See Hall and Hubbard (1998) for an overview of entrepreneurial cities and Broudehoux (2007) for a discussion of deploying cultural amenities as a marketing strategy in China. Section 2.4.3 presents further information.

evaluate the differences between cities in the network? Are there spillover effects that can be observed? There are some efforts to measure these effects, but each one that I examined falls short.

Localizing connectivity studies has some potential to accomplish these tasks, and the Pew- and CNNIC-type survey approach would be easy to implement at the metropolitan level, but neither organization has produced research that attempts to measure differences between individual cities or neighborhoods. The Pew Center has released reports about regional (Spooner, Meredith, and Rainie 2003) and urban versus rural (Bell, Reddy, and Rainie 2004) rates of connectivity in the United States, and CNNIC breaks its data down by province in its annual reports. Neither of these, however, say much about what people are doing online, nor do they describe the capacity of any given city to enable an online society. For example, local content gives the Internet much of its richness. Creating local content requires a certain amount of cyberinfrastructure: software tools and people who know how to deploy them, graphic designers and editorial staff who are familiar with the local landscape and culture. A city could hardly be said to be wired without this sort of local content infrastructure, but descriptions of it are largely absent.

The popular business literature discusses Internet development using a compelling narrative style that often focuses on individual companies that are developing local content and services. However, they often deploy disappointingly simplistic analyses. For example, Rebecca Fannin's *Silicon Dragon: How China is Winning the Tech Race* (2008) presents a laundry list of Chinese Internet firms and

describes how they are creating or adopting business models at a furious pace and will inevitably overtake American companies. Many of the businesses she describes are unique to the Internet age, and are tied to American investors. Fannin seems to equate a developed ICT economy with the ability to raise capital and the level of management expertise that can be brought to bear on a business plan. In her vision of the networked world, Chinese netizens do not know that they want a product or service until an entrepreneur who has been trained at an American university and is backed by a prominent Silicon venture capital firm tells them that they want it. She fails to explain how the companies operate outside of their boardrooms and top executives, how people use the products that the companies produce, and how the companies operate within the contexts of the larger economy. She also never travels outside of the Beijing-Shanghai-Pearl River Delta city systems.

Early academic literature about the network city often talked about the end of geography and assumes "that networks of large metropolitan cities will gradually emerge to be some technological anachronism, as propinquity, concentration, place-based relations and transportation flows are gradually substituted by some universalized, interactive, broadband communications medium" (Graham 1998, 168). But in fact Internet development became concentrated in cities and has accompanied a global increase in urbanization. New Urbanism is digital urbanism: "The extended, polycentric regions that are resulting from current urbanization trends are, essentially, *giant engines of electronic communication.*" (emphasis mine) (Aurigi and Graham 2003)

In his critique of geographers who study economy, Jones reviews globalization literature that concentrates on the impact of transnational firms. He argues that many researchers insist too strongly that economic activity is inseparably embedded in social relations. Doing so hides some actors and masks the power of others, especially if they are not related to revenue production. He also condemns the stance of economic geographers who attempt to "purify the economic realm from everything else in the social world" (2008, 85). Jones concludes that even the middle ground misses too many actors and too many relationships, in part because analysts rely too much on the spatial proximity of economic actors in a world where multinational firms act across great distances.

Jones asks for a new model that will "redraw the conceptual boundaries" (75) between economy and society. He proposes that Actor Network Theory be used to study globalized business processes in order to achieve a richer view than either the purely economic or overly social and offers a model that takes into account some of the non-economic outcomes that social practices produce. The model consists of a typology of three practices: the operational practices of how firms (or institutions) perform their businesses; tracing how these firms exercise power and control over their workers, customers, and other actors; and finally examining how a firm creates, uses, and deploys knowledge and information.

It is exactly these three practices that I examine in this thesis, except that I am looking outside of the business world. Where Jones looks for actors who are not directly involved in revenue production inside of transnational firms, I look inside of

firms that are not directly involved in revenue production. Where Jones concentrates on how transnational business organizations create, use, and deploy knowledge and information, I examine sub-national and local actors that do the same. In my examination of CHCi, I look at actors who are specifically engaging in activities that have no direct economic outcomes, but some of these actors are themselves the outcomes of economic activity—namely, the overall economic status of a given library's province. Therefore CHCi is a reflection of the larger economy, rather than embedded in it.

2.4 An Emerging Internet Geography

There are four observations in this chapter, each of which leads to the conclusion that in order to successfully relate the use of the Internet to regional development trends in China, a new sort of Internet Geography is needed.

1. Connectivity studies show that, in many countries, Internet access is no longer a novelty. In a world where Internet access is becoming ubiquitous, we need a geography that looks at how the Internet affects people's lives—specifically how it affects their use of space and sense of place.
2. In a world with an increasing number of alternate capitalisms, we need a geography that explores development in a way that does not ignore China's unique post-socialist narrative.
3. Firms that leverage network technologies to create revenue are now commonplace. Rather than simply studying them as producers of revenue, we need an Internet geography that looks at the social processes of work, specifically how firms construct cyberinfrastructures.

4. And finally, quantitative measures of how the Internet affects economy paint only a limited picture, and in a rapidly changing environment, often an untimely one. We need a geography that supports the use of a narrative case study to fill the voids that purely monetary measures miss.

Fortunately, I am not the first to make these observations. Other geographers (and different types of social scientists) have already begun to work on these issues in a number of different contexts. In this section I take a look at those who concentrate on the Internet and its effect on society and economy. Specifically, I show how the Internet has enabled a new culture of production as well as new forms of cultural production. These two forces come together in the concept of Cultural Heritage Cyberinfrastructure.

2.4.1 The Internet Affects Place Creation. A variety of disciplines study how people, society, and technology interact. Among these are information science (which can be seen as the parent discipline of library science), human-computer interaction (a branch of computer science), science and technology studies (of which Latour can be said to be a founder), and social informatics (another child of information science).

What these disciplines have in common with each other, as well as with human geography, is an emphasis on social relationships—between people, between institutions, and between people and non-human actors such as computers and information. As the Internet has spread, increasing attention has been paid to how it might affect how people interact with each other. In the mid-1990s, some argued that computer use, as an activity performed alone, would lead to increasing social isolation,

and that corporate control of media would exacerbate this problem. Murthy (2006), a media studies scholar, cites Lefebvre, Virilio, and Baudrillard as post-modern theorists who have an anti-modern bias against technology. Those who mobilize these scholars have "become seduced by the monolithic pessimism" that leads to the conclusion that "corporate, state, and military interests channel individual human potential and creativity into a space so fully hegemonised by capital and information flows that the controllers recede into the background and much of the creativity is put to work for their interests" (under "Integrating Locative Technologies with Portable Devices").

There is an alternate narrative that views cyberspace as a liberating, creativity-enhancing actor. This narrative sees the Internet escaping from the confines of the computer screen and interacting with the landscape. Murthy uses pre-iPhone, pre-Google Maps projects such as Yellow Arrow (http://www.yellowarrow.net) and Urban Tapestries (http://urbantapestries.net) as examples of tools that enable individuals to create personal narratives that take place at the intersection of online activities and space. In Yellow Arrow, participants place stickers with identifying numbers into the landscape that refer observers to a website or a cell phone message that describes the location: either a story behind a place or a review of the restaurant at which the arrow points. This annotating of the real world with web objects is a type of augmented reality, or cyberspace physical space hybrid (Murthy 2006). Artists have improvised on these themes, combining the postmodernist dread of ever-present surveillance with the remix-ethic in works that transgress media spaces. Projects such as Jenny Holzer's intrusion into Times Square's *brandscape* embrace a sense of play that disempowers,

or deconstructs perhaps, Lefebvre's, Virilio's, and Baudrillard's misgivings about technology. The artistic instrusion into, and the locative virtual tagging of, physical space can be seen as liberating residents of the urban cyberspace / physical-space hybrid to *play* with technologies, becoming so comfortable with them that the hybrid aspects now seem normal. Researchers speak of a generation that is *born digital* for whom the boundary between the physical world, media, and technology simply does not exist. Perhaps more important for this study, the concepts of playing, learning, and working are now starting to blend. A long-term study from the Digital Youth Research project recently concluded that what appears to parents to be idle 'tinkering' with technology is in fact a complicated and effective trial-and-error form of learning (Ito and others 2008).

Cartier (2001) and Yang (2003) deploy similar ideas in their construction of a transnational Chinese sphere All of this points to a humanity that is starting to live not just a dual existence in cyberspace and the physical world, but an existence that seamlessly lives in both. Just how seamlessly has been the subject of some debate. In the mid-1990s, geographers were still working on the idea that ICTs were collapsing distance and reducing the friction of knowledge transfer. Adams (1995) was using Hägerstrand's time-geography and Janelle's personal extensibility work to determine that ICTs were indeed extending personal boundaries beyond the limits of physical space, but maintained that most interactions were still local. Still, he left open the possibility that technology associated with "globalization has the capacity to support non-place communities" (278). He seems to leave open the possibility, however, that

these non-place communities will perform place-like social support functions, as he switches between paranoia from an earlier age (citing Nietzsche's worries that widespread literacy would lower the quality of thought) and hopes from even earlier innovations (as in Eisenstein's linking of the printing press to European ideals of "individuality and personal initiative" (279). By 2003, Adams is still not willing to grant the Internet 'place' status, stating that "'place' implies a level of coherence that seems to be lacking in this collection of websites" (416). Instead he deploys the concept of a bridge*space* to study the ways in which the Internet provides a space for Indians living outside of India to keep culturally and economically connected to their homeland.

Cartier (2001) and Yang (2003) deploy similar ideas in their construction of a transnational Chinese sphere of influence. Cartier argues that globalization, technology, and a centuries long tradition of outward Han migration have come together in today's market transition. In this view, the thirty years of isolation that marked the first half of CCP rule in China are an anomaly in Chinese history. In the context of the Han people's long history of diaspora, Pye's quotation about Chinese civilization pretending to be a nation-state makes much more sense.

Whether recent emigrants or the descendants of those who migrated generations ago, these overseas Chinese have played an important role in promoting business development since 1978. Today, the Internet allows constant and instant communication between Chinese globally: for both business professionals and many

ordinary citizens. Yang (2003) attributes a new sense of transnational Chinese-ness to this constant communication.

While Cartier sees the reconnection of family and village ties between overseas and mainland Chinese as part of globalization, these relationships can also be seen as another revival of earlier Chinese cultural practices. Sun Yatsen appealed to Chinese living in the United States, Canada, and Japan for support and funding as he attempted to form the Republic of China (Spence, 1981). Today, organizations formed in the PRC sometimes move their operations overseas in order to escape CCP restrictions on civil society organizations.

Yang examines websites that were formed by PRC organizations, but are now operated independently in the United States. Mainland Internet users who wish to continue to participate in these organizations have developed complicated communication systems that are largely controlled by independent users. These online communities adopt on-the-fly strategies to circumvent Great Firewall[14] keyword filtering. These communities also self-police: leaders of these online communities (Bulletin Board System administrators, or sysops) are held accountable if they attempt to control speech by deleting individual messages. This practice even extends to forums that are explicitly apolitical: I have been told that international discussion boards for Chinese librarians segregate their discussions: bulletin boards that are reserved for discussions of technical issues and graduate education experiences steer discussions about freedom of expression and censorship to other venues.

[14]The latter is illustrated with the example of users inserting punctuation and tone numbers into their texts to disrupt automatic censoring of messages during a May 2000 online protest over the death of a Peking University student. Internet censorship is briefly outlined in section 3.1.

Unlike advocacy works such as *You've got Dissent* (Chase and Mulvenon 2002), neither Yang nor Cartier assume that the open communication enjoyed by the transnational Chinese cultural sphere will inevitably lead to political change. This is partially because the bulletin boards are used as often for expression of ultra-nationalist views as they are for democracy activists. Although Adams maintained in his 2003 article that cyberspace is not yet coherent enough to warrant place status, doesn't a riot require place? For example, there is a massively multiplayer online role-playing game, *Fantasy Westward Journey*, that is set in the Tang dynasty. In 2006, thousands of game players converged on a location in the game, after what was purported to be a Japanese flag was found decorating the wall of a 'government office.' Described as a 'virtual riot,' crowds gathered 'shouting' anti-Japanese obscenities in the virtual space, and clogged the company's customer support phone lines in the real world, condemning what they perceived to be a slight on Chinese sovereignty (Wang 2006). In this example, the Internet becomes a place for expressing nationalist sentiment fully in support of the Chinese government.

While some literature treats the Internet as just one more form of mass media or a person-to-person communication technology not much different from the telephone, the literature cited above shows that the intersection of physical space and cyberspace is a location of great interest. 2008 saw the launch of the location-aware iPhone with Google Street View built-in. While expensive, it is one of the first widespread consumer devices that can be said to offer an 'augmented reality' experience. Cartier, Castells, and Qiu (2005) look at cellphones at the opposite end of

the price spectrum, constructing a class of "information have-less," showing how these Little Smart phones are used by residents of second-tier Chinese cities and smaller towns to navigate everyday life. She picks up on the theme that the Internet makes people more mobile—not because their personal social networks get extended, but because they, like Adams' non-resident Indians, use technology to bridge the distance between their new urban locations and the rural villages from which they came. This same paper expands to include places devoted to computer use—net cafes in this case. It points out that net café workers are often college graduates who cannot find other work, and so trade low wage technical labor for unfettered Internet access. Having grown up digital and often having received advanced training in college, they are attempting both to remain connected and to maintain their skills. They feel a need to play and to hack.

2.4.2 The Networked Information Economy. The research cited in the previous section explores how individuals use technology, and suggests that technology is changing how we live. These technologies all depend on an infrastructure that is more than hardware and software. It is an assemblage of information, knowledge, people, and computer hardware. This infrastructure has coevolved, in part, with the network city system described in section 2.3.2. The economic equivalent of this infrastructure is not so much the much ballyhooed 'knowledge economy' as it is a new outgrowth of that economy: the networked information economy (NIE). The NIE, as laid out by Benkler (2007), is not intended to be a model that explains the current global capital

system, nor even an emerging replacement for it. Rather, it is a subset of that system; one that will help to explain CHCi.

In all of the discussions of a knowledge economy and networked information, working definitions of knowledge and information are always put forward early on. Information Science spends considerable effort on this issue (Buckland 1991). Without belaboring the point, we can say that information is data fixed in a tangible medium. It comes in the form of massive databases that track consumers' preferences, storehouses of financial, demographic, historic, literary, and fine art information, and the real-time monitoring information from a global array of earth sensors—ocean temperatures, river gauges, weather, and ground imagery. Knowledge is skill and ability. It is what is necessary to perform an act or create something from parts. It can be learned from experience or from information resources, like books. Many posit that it is primarily learned through person-to-person interactions. Knowledge is difficult to copy, and requires interpretation and negotiation in the act of transfer from one actor to another. To use another formulation: information is cheap and moves with little friction. Knowledge is expensive and is high friction (Karlsson, Johansson, and Stough 2006).

While the NIE helps to explain many current economic and social trends that are explored in this thesis, it still exists within the larger knowledge economy. The knowledge economy is a model that says that economic growth in the global world is largely due to mobilizing knowledge towards innovative products and services. It is a closely related concept to the network city thesis, and both are key actors in

globalization. The idea evolved in the 1960s and 70s as financial and management services became increasingly important. Building on Japanese management techniques, business scholars realized quickly that the emerging 'team management' model depended on effective communication of information between members of the team, and ICTs were beginning to play an important part enabling that communication. In this model, however, simple information is not what is being traded between actors who use it to produce revenues. Rather: knowledge is the key commodity upon which the system depends.

Rennstick (2008) argues that the global nature of the knowledge economy is not new—only the physical medium of the information transfer network has changed. Taking a long-term and macro view, he postulates that the current ICT-enabled wave of globalization is very similar to the wave of globalization represented by the merchant navies of the 15th and 16th centuries, when information was a much scarcer commodity, and knowledge transfer really did require face-to-face interaction. He concentrates on country-level economic and communication networks (which he does not strongly distinguish from each other), and uses a model of nested hierarchies so that there is a center and periphery to each national network. Actors at the middle layers of the hierarchies are the objects of Rennstick's analysis, and he concludes that countries whose middle actors have a predominance of inwardly-facing connections are not global; those with outward-facing networks are global. He repeatedly returns 12th and 13th century Song Dynasty China as the prototypical example of a globalized economy. He cites technical innovations in information technology, specifically

movable type and a blue water navy, as a key actor that helped China to become the first global economy, and is helping it to regain global prominence. Rennstick sees that today's ICT-driven globalization is simply a technologically evolved heir to these traditions.

Benkler's Networked Information Economy also contains a historical revival. At the core of the NIE is a combination of the information and knowledge economies: it takes shared knowledge to mobilize information (ie: to put it onto networks), thereby making it readily available. For much of the NIE, this shared knowledge rests inside of communities who interact mainly online—in an information commons. The revival for Benkler is this sense of a commons—a central, shared resource that suffers if neglected, but thrives when society works cooperatively. The creation of new knowledge requires not just intelligence, but also contact with others who are interested in similar questions. The Internet provides a medium whereby information flows with very little friction, is easily copied and stored, and communication over distance is inexpensive. He points to Internet projects such as open source software, Wikipedia, and the Creative Commons as the sorts of cooperative projects that amount to a new culture of knowledge production. He argues this "the rise of nonmarket production to much greater importance" (4) is one of the key drivers of recent innovation. The types of innovation he is observing revolve around the *social* production of resources that are nonproprietary and cooperative.

There are many places where this sort of nonmarket production is thriving: the Linux operating system and other open source software drive much of the Internet;

Internet governance itself, while ultimately dominated by American policy, is essentially a cooperative venture; self-published works like blogs are creating a shift from a mass-mediated public sphere to a networked public sphere with its own systems of authority and verification; Barack Obama's online fundraising and organizing efforts receive much credit for his election. Benkler says that the NIE is enabling, and enabled by this new culture of knowledge production.

Benkler concentrates specifically on the non-market economy, and while his model is interesting, it does not say much about how people can make a living in his NIE. Of course, many of the people in the ecosystem that he is exploring work for salaries. Linux developers run e-commerce websites and keep university email systems running. Google's employees receive 1 day a week to pursue personal projects. IBM supports its software developers by selling Linux consulting services. In other parts of the NIE, work-for-hire is more typical: web developers, graphic designers, the authors of technical manuals.

Finally, as more restrictive copyright and other intellectual property laws are enacted globally, musicians and authors are experimenting with increasing their audiences by distributing their works online for free. This is happening even as electronic commerce is becoming accessible to more and more obscure creative artists and digital rights management systems (re: copy prevention schemes) are becoming commonplace. The trend is for creative types to experiment with alternative ways of earning revenue that does not involve selling multiple copies of their work (Doctorow 2008). This is all, in effect, what Benkler describes as a new culture of production.

2.4.3 The Cultural Economy. The NIE is not a comprehensive economic theory. In fact it accounts for very little economic activity, even if it does explain a new culture of production that extends beyond the software development industry. Richard Lloyd's *Neo-Bohemia* (2006) explains economic and social phenomena that are required for the sorts of innovation that Benkler's NIE creates, and offers a case study for how this sort of creativity contributes to economic development. These phenomena occur in an environment filled with low paying, yet creatively engaging, jobs that are the foundation of post-industrial economies. Just as Cartier's net café workers get free Internet access with their low paying jobs, Lloyd's mid-1990s residents of Chicago's Wicker Park neighborhood are getting to live and work inside of a creative cultural milieu that is, according to his argument, the core engine of a new urban economy. Lloyd's argues that the gentrifying neighborhood has become a center of cultural production through its concentration of performance venues, art galleries, and other 'third place'-type locations that in turn helped larger economic forces to take root.

Lloyd's key point is that the neighborhood was an incubator for creativity in the 1990s; not a creator of it. The neighborhood sustained a young, college educated workforce that was willing to engage in cultural activities for minor economic gain in much the same way that Vermonters sustain the tradition of maple syrup production. In Vermont, large numbers of people participate in the sugar harvest, but few make their livings off of it. While the supplemental income may be important, the creative

activities are undertaken mainly to "define an identity and be part of the local community." (Hinrichs 1998, 509). The difference for Chicago is that this creative economy, both within the neighborhood and in downtown Chicago's CBD, transformed into economic growth at the same time as the Internet was enabling the formation of new businesses and transformed existing industries throughout the 1990s. So while the 'creative economy' itself might be difficult to measure quantitatively,[15] its affects on the NIE and the urban landscape are apparent. Just as Lloyd attributes the physical transformation of Wicker Park to a social group, Aurigi and Graham credit the Internet as "a medium of urban modernity which is closely bound up with the restructuring of old urban forms and the production of new ones" (2003, 490). These new urban forms are culturally produced, and become actors in their own right, attracting additional workers and enabling additional economic growth. The skilled labor force, cultural amenities, and associated economic activity combine into a cyberinfrastructure that moves beyond simple spillover effects: the cultural amenities spur additional economic growth through new and renovated residential construction, which in turn attract additional businesses. Each of these new additions to the neighborhood demand high speed Internet service and require automated business processes that spur additional IT development. "New urbanization trends, based around electronic interaction, reflect this: 'back-office' zones, multimedia districts, technopoles, 'intelligent' buildings, 'smart' communities, etc." (ibid.).

[15]A meta-analysis for Boston attributes between 1 and 49% of economic activity to the 'creative class' (Markusen and others 2008).

Lloyd very much argues that Wicker Park is the location of a new type of economic development unique to post-Fordist capitalism. In this capitalism, economic production is enmeshed with the production of culture, and each are tied to global cultural forces. Lloyd cites the year that MTV filmed its series *The Real World* in the neighborhood[16] as the tipping point at which Wicker Park became an unmistakably global actor. China is self-consciously promoting the 2008 Olympics as its global debut, but Beijing and Shanghai are home to arts districts that have a global creative economy and a narrative of gentrification at least equal to Wicker Park. Beijing's 798 gallery district, on the grounds of a disused factory, has become an international tourist destination, and in 2008 also became home to a Nike store cum art gallery.

Thus, wired cities are also cultural centers, and cultural institutions in these cities benefit from the economic growth that being a cultural center brings. Political actors in these cities often invest in cultural institutions as a form of spectacular development. While these projects might be sports complexes, such as the Beijing Olympic venues (Broudehoux 2007), they are as often new museums designed by prominent architects (Denver's by Daniel Libeskind, Balboa's by Frank Gehry) or sometimes big, beautiful new central libraries.

Cultural economies are not unproblematic. Not only are they hard to measure, but they are just as prone to social injustice as any other capitalism. Lloyd is particularly sensitive to the idea that not everyone gets to participate in the economic growth in Wicker Park, and even though some of the creative types engage in protest

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[16]In the same building as of one of the gentrifying neighborhood's founding coffee shops which had recently closed. As of this writing, the space is a fitness club.

activities against corporate development, the neighborhood is now largely unaffordable to the artists and service workers who attracted the development in the first place and the vibrant Puerto Rican community that was there before both the neo-Bohemians and the corporate development. Benkler also acknowledges that the NIE does not guarantee equitable distribution of resources, but he does argue that "information, knowledge, and culture are core inputs into human welfare" (302), and offers a chapter full of suggestions for way that commons approaches can help to mitigate uneven human development. The NDCNC projects explored in this thesis also seek to improve human welfare through the dissemination of information to underdeveloped rural areas.

2.4.4 Forming Cultural Heritage Cyberinfrastructure. The NDCNC, and all other digital library work, depends on the Internet and Internet-related technologies to accomplish its goals. Lloyd and Benkler would agree that their models would also not be possible without the Internet. Benkler's NIE needs the Internet to enable group work, and a lot of NIE-type work is the production of networking tools that fuel other economic activities (ie: database technologies that run financial services). Lloyd's artists and bandleaders need day jobs, and he cites a range of technology skills, from simple word processing that allows college graduates to do temporary office work to advanced web programming that had fueled a miniature dot com boom in Chicago at the time of his research. The Internet infrastructure on which these examples depend goes far beyond "a series of tubes" (Doctorow 2006).

Cyberinfrastructure includes the physical networking equipment of the Internet, but it also encompasses the human actors that make the technologies work together for a useful purpose. For example, broadband Internet access requires a utility (a cable TV franchise or a telephone company) with access to rights-of-way (in order to run cable to houses and businesses, or between cities in the case of backbone operators), as well as a customer base large enough to justify investing in network hardware. On a local level, once an insurance agent, real estate broker, or automobile mechanic has access to the Internet, they need to set up local area networks to link together the computers within their businesses; online accounting systems so that their suppliers are paid promptly; and websites so that customers can find them. These services are often provided by independent contractors who, in turn, also need Internet access, financial services, and advertising. These independent contractors depend on, and contribute to, Benkler's NIE for software tools and BBSs that provide continuing education materials. These actors have to be trained somewhere. Often they earlier worked for larger businesses, or perhaps they received formal training at a university or technical school. All the actors in this network need personal computers, printers, and telephones. All of these people, pieces of technology, and institutions are actors in the network called cyberinfrastructure, which is itself a new culture of production and a new form of cultural production.

The Internet geography literature often equates cyberinfrastructure with wired cities: "metropolitan regions…dominate the physical infrastructure of host computers and telecoms that make up the Internet." Aurigi and Graham go on to note that

contemporary urban life is reliant on access to ICTs and that "the Internet is, in essence, a medium of urban modernity" (2003, 490). Thus, the social networks of cyberinfrastructure often become urban networks. They do not necessarily have to be. If wired cities require social structures that mobilize business interests and depend on governments with enough "capacity to organize development" (Wu 2003, 1675), they do not necessarily have to be cities—they just need to have cyberinfrastructure. In the case of libraries, the Bill and Melinda Gates Foundation provided the hardware, software and training required for Internet access to many small town and rural American libraries through the late 1990s (Heuertz and others 2003). This initial effort, along with local philanthropy and public policy, have led to a situation where "public access computing in the nation's public libraries is now taken for granted as an expected and reliable service" (Bertot and others 2006, 15) regardless of whether the library is in a city or rural town. Now libraries, and the Gates Foundation, are turning their attention towards maintaining levels of service in institutions that lack the financial resources to constantly upgrade their computers.

Wired cities, entrepreneurial cities, and global cities all rely on the idea that contemporary, post-Fordist urban areas require a certain "institutional thickness" (Jones 2008, 83) to achieve collective action in the form of advanced technological development. But again, it does not follow that a city is the necessary venue to achieve this development nor is it the required scale at which this development needs to occur. Still, the collective action of cyberinfrastructure development is often accompanied by the renewal of a central business district (or building a new business

district from scratch (Gaubatz 2005)) or some other large public works project (such as the aforementioned new museums and central libraries), and these tend to be urban projects.

Cultural heritage projects in this context are little different from sports stadia or pedestrian malls, spaces that are "harnessed as a cultural resource that can be capitalized upon and repackaged for new rounds of capital accumulation and consumption" (Broudehoux 2007, 383). While the Olympic venues are the typical example of spectacular development meant to distract from less-glamorous aspects of the market transition, Broudehoux points out that the new National Theater was built as a self-indulgent monument to Jiang Zemin's leadership "in spite of popular protest against its futuristic design, its foreign architect, its proximity to the nation's symbolic heart at Tiananmen, and its price tag, evaluated at ten times the state's yearly spending on poverty alleviation" (ibid., 385).

The connection between spectacular development and cultural heritage is relatively undeveloped in the literature. More often, geographers writing about cultural heritage tend to emphasize the historic built environment and monuments commemorating historical events. For example, in the book *A Geography of Heritage: Power, Culture, and Economy* (Graham, Ashworth and Tunbridge 2000), every single photograph is of a ruin, a restoration, or a graveyard. While the book covers aspects of cultural heritage that are important to this thesis (such as how states manage heritage sites to reinforce their power and engage in restoration efforts in order to grow tourist economies), the volume fails to discuss how living cultures continue to construct

heritage and only briefly touches on how ordinary people consume culture and heritage.

While some of the provincial libraries' collections deal with spaces of cultural heritage, they concentrate more on historical objects. In the sense that I am exploring it, cultural heritage also includes the social groups that are:

- using those objects in a consumptive fashion (the tourists in the construction of Graham *et al.*)
- charged with preserving and displaying disseminating cultural heritage
- building new culture by using these objects as the source materials for art, scholarship, commerce, and economy

Museums and libraries are the most obvious sites of this sort of cultural heritage, and the online worlds that these institutions create are the virtual equivalents of the ruins, restorations, and graveyards with which Graham *et al.* are concerned. The creation and use of these online cultural heritage collections have their own sets of theory and scholarship, including work on authenticity, curation, and participation.[17] More important for this thesis, though, is to recognize that museums and libraries are institutions that have a strong mission to create and manage digital cultural heritage collections, and the methods that they use to do this are enmeshed in technological and social actor-networks. For example, libraries are often in a process of negotiation with three separate sets of actors: parent organizations, commercial entities that provide

[17]See Cameron and Kenderdine (2007) for an Australian-centric summary of the primary issues. There is an interesting overlap between this literature and that of geography and art theory that explores how the boundary between humans and technology is complex and constantly shifting. At the same time, technologists strive to make technology invisible, thereby making it ever more difficult to define that boundary.

services to libraries, and the users of libraries. This negotiation process is not unlike Zheng's *de facto* federalism.

Every library is responsible to some sort of parent organization Completely standalone libraries, and indeed standalone cultural heritage organizations of any kind, are rare. In the library world, every institution has some sort of a parent organization: municipal public libraries answer to a mayor or an elected library board, academic libraries live within universities. Provincial libraries in China compete for the attention of their Department of Culture with other agencies. While the parent institutions have their own cyberinfrastructure, agendas, power structures, and institutional norms, the child libraries are free to create and manage their collections with a large degree of latitude. Sometimes the library reinforces, and sometimes it resists, the norms of its parent. In this way, the parent organization is an actor in the library's network, even if it is somewhat on the periphery.

One particular negotiation process that the library engages in with its parent institution is curation: the intellectual process by which items are chosen to be included in a collection, and the technical work that goes into designing how those objects are accessed online. One part of this curatorial work requires striking a balance between presenting an accurate narrative and alienating the library's parent organization. Therefore, even though libraries can be observed as independent entities, their parents need to be seen as at least peripheral actors in their networks. Provincial libraries in China are agents of the government, and as documented in this thesis, they

are engaged in state building activities, even though they are not actually involved in the governing of the people.

For online collections, a large amount of curatorial expertise goes into choosing appropriate materials, selecting the best examples of those materials, managing the projects within technical and financial constraints, and designing an online user experience. Often, libraries and museums highlight individual items in heavily curated exhibitions prominently linked to from their main websites, such as the United States National archives cited above. The NDCNC website has its own such highly curated collection: a Flash-driven local opera site that features text, photographs, and video recordings of opera performances from each of China's administrative areas: including Taiwan, Hong Kong, and Macau. (See Figure 1).

Figure 1. Local opera web exhibition. *Source:* National Cultural Information Resources Sharing Project.

A more obvious example of libraries negotiating with outside actors is the interaction between libraries and commercial actors. In order to create an online collection, libraries must invest in a large number of software tools and develop the in-house expertise to build, manage, and disseminate the collections. Some of the tools are commercial products, vended either by for-profit companies or quasi-public entities. Others are open-source free products developed by those who use them. Either way, libraries need individuals with management expertise who can negotiate contracts for these commercial products or technical expertise to participate in open source development projects. In this way, libraries are actors both in the NIE and in the traditional market economy.

Libraries are as equally responsible to the their end users as they are to their parent organizations, but the point here is that CHCi is not simply the technical infrastructure of digital libraries. I have based my conception of CHCi on the idea that:

> Methodologically, the information have-less is a discursive concept and an analytical trope, a metaphor consciously used to draw attention to under-examined phenomena. Linguistic and literary theories recognize how metaphors work to constrain and enable meaning and how they are integral to understanding the development of ideas, communication, and technology. (Cartier, Castells, and Qiu 1005, 11)

CHCi is used in this thesis as a way to help explain how technology development is not just economic development. CHCi also helps to explain why looking at libraries, which at first glance might seem to have only a tenuous connection to economy and development, is a valid exercise. Without the use of such

a framework, Lloyd's neo-bohemia might boil down to [bars + art galleries = economic growth]. Instead, he is able to conduct a detailed analysis at the interaction of culture and economy. In this same way, without CHCi, one might accuse me of arguing that libraries can improve farm productivity by scanning old photographs and recording local musical theater.

CHAPTER III

CASE STUDY BACKGROUND

Chapter 2 examined the two main contexts of this study: China and the Internet. Historical characteristics of the Chinese state were related to strategies currently being employed by the CCP to maintain control of the government. These strategies, chief among them thirty years of market-oriented economic reforms, have driven dramatic social and spatial changes. Over the course of the same period, the world city system and global culture have adapted to the widespread implementation of Internet technologies. This chapter looks at the intersection between these two contexts and explains how examining them by way of the library brings a new perspective to geography.

3.1 China and the Internet

There are two aspects of the Chinese transition that should be kept in mind within the context of this section. First, the informatization of the Chinese government and economy is an official policy effort. Second, the creation of an online 'public life' or a civil society in China (or anywhere, for that matter) is almost completely non-economic. While pagers, cell phones, text messaging and the computer hardware necessary for accessing the Internet are all consumer goods whose purchase created

GNP, the online public sphere that is being (perhaps uniquely) created in China that depends on these goods is not something that has been monetized.

3.1.1 A Very Brief History of the Internet in China. In many ways, the history of the Internet in China is very similar to its history in the United States. For a time, China lagged a few years behind the United States in reaching certain milestones, but table 1 shows that gap closing for recent events. The Internet began in China by connecting together scientists in academic and government agencies in the early 1980s, roughly ten years after the original Arpanet project in the United States. Network access gradually became commercialized and available to the general public through the mid-1990s (Harwit and Clark 2001).

In its most recent annual report, CNNIC cites Everett Rogers' diffusion of innovation theory that describes the graphs of adoptation rates for an innovation as following an S-shape: they start slow, then reach a threshold of around ten percent where growth rapidly increases until a natural plateau is reached. Figure 2 shows this general pattern, while figure 3 shows China's Internet penetration rate starting to accelerate through ten percent.

CNNIC notes that if the pattern of growth in the number of Internet users continues to match Rogers' model, then China is currently in the fastest period of growth. China's Internet penetration reached the 10% threshold late in 2006 (after

Table 1. Internet milestones

Year	United States	China
1973	ArpaNet: Department of Defense experimental network	
1987		CRN academic network
1990	First commercial dialup service	
1994	Mosaic web browser	CSTNet connects to Internet. China is 71st country online
1995		First commercial dialup service
	Windows 95	
1996		Regulation authority given to State Information Leadership Group given authority to regulate. Future president Hu Jintao and Future premier Zhu Rongji are members.
1997	Google founded	CNNIC released first report
	FBI deploys Omnivore, email wiretap system	
1998		Content controls stepped up: coarse filtering of domains
1999		First Internet police force
		MSS collocates surveillance hardware at ISPs
		Baidu (search engine) launched
2001	Pew Internet & American Life surveys begin	
2002	Yahoo!...	...signs Public Pledge on Self-Discipline, agreeing to adhere to local regulations.
		Keyword filtering begins
		NDCNC begins
2005, July		100 million users
2005	IBM PC business ...	Sold to Lenovo.
2006	Google...	...agrees to policy that service providers must obey content filtering policies
2008, Jan.		# of Internet users surpasses US. 500 million cellphone users

Sources: (Loo 1993; Harwit 1993; Du 1999; Zheng 2008; *The Economist* January 31, 2008)

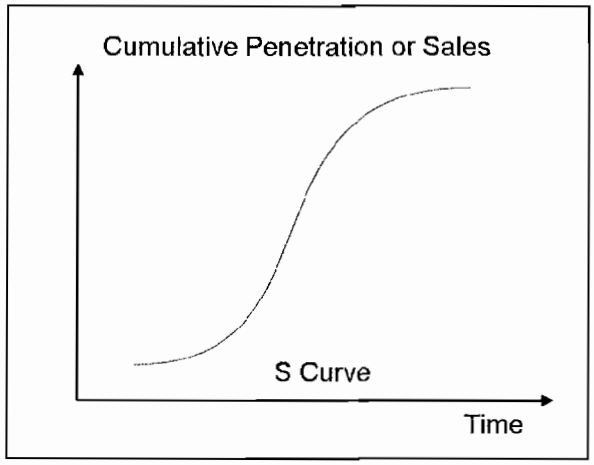

Figure 2. Rogers' Innovation Curve. *Source*: *Wikipedia*, s.v."Diffusion of innovations," http://en.wikipedia.org/wiki/Diffusion_of_innovations (accessed January 20, 2009).

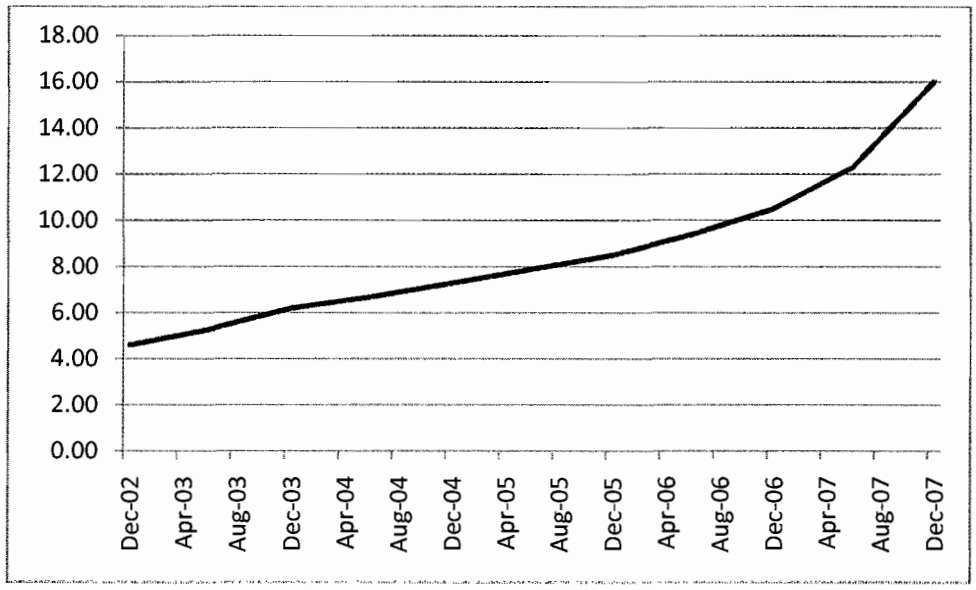

Figure 3. Internet Penetration Rate.Percent of Chinese population with Internet access. *Source*: CCNIC 2008.

adding less than 2% of its population each year for the previous several years), and then 5.5% of its population went online for the first time in 2007, an overall 50%

increase in users in one year. In early 2008, the Chinese Internet population passed that of the United States (CNNIC 2008). This growth pattern matches the S-shaped growth pattern perfectly.

This roughly matches Hägerstrand's three-stage diffusion of innovation model outlined in section 2.3.1, except that Hägerstrand adds a spatial aspect that is lacking in the CNNIC description. Spatially, China repeated a pattern of Internet diffusion seen in the United States, with the earliest Internet users concentrated in the financial and political centers of the Beijing, Shanghai, and Guangdong. As the technology became more common, the overall share of these three province-level units began to drop. However, Loo (2003) notes that Internet use remains disproportionately concentrated in coastal areas.

3.1.2 Relevant China Internet research. In this section I turn to research of a more social nature. This is closer to the examination of the interconnections between market actors, government institutions, individual elites, and end users that I ended the previous chapter arguing a need for. However, none of these studies examine the culture of Internet production, nor do any of them observe non-governing, non-market institutions.

The citations in the previous section are typical of Internet research that falls into the traditional category discussed in chapter 2: analyses of the build-out of the physical infrastructure of the network (connectivity studies), discussions about how adopting Internet technologies affects China's entry into the global production chain

(clusters and network cities), and writings about the structural economic transformations that accompany widespread ICT use. For example, Maeng's (2002) comparison of Seoul and Chicago does not discuss how housing, retail businesses, or local cultural resources interact with the ICT economies. Harwit (2005), on the other hand, cites a number of studies that examine these aspects for a number of cities, including Minneapolis-St. Paul, Atlanta, Phoenix, and London. However, he concentrated on one relationship: the interaction of market institutions and municipal government. Maeng's object of study can be considered hard cyberinfrastructure, Harwit's soft.

Both types are required. Walcott (2007) argues that "places need to assemble an attractive package of amenities to entice and hold people who produce … [innovative and commodifiable] ideas and connections" (134). The spatial effects of soft cyberinfrastructure are readily observed in China. In Beijing, for example, the Haidian district takes advantage of its prominent universities by developing office buildings, retail spaces, and other sorts of support infrastructure for foreign and domestic students and researchers. Global companies such as Sun Microsystems, Microsoft, and Google have taken up residence in Tsinghua University's research complex. A few blocks to the west sits an Indian restaurant whose Nepalese owner greeted me in English, admitted to speaking 'only kitchen Chinese,' and shared that his primary clientele were Indian software engineers from Microsoft. On the same block is a rock and roll venue owned and operated by an Anglo-American professor of

business at Peking University.[18] A few blocks to the east is Wudaokou, home to American and Korean-themed businesses that cater to the foreign technology workers and local international students.

Combining hard and soft development environments is not limited to Beijing. Walcott (2007) describes how Chengdu is mobilizing its universities and international connections more effectively than nearby Chongqing—even though the latter city's industrial output is larger. Instead, Chengdu is exploiting the presence of foreign consulates and, among other things, traditional Chinese medicine research to stimulate an atmosphere of innovation. Walcott attributes Chongqing's lack of foreign investment to an overemphasis on heavy manufacturing infrastructure to the detriment of soft infrastructure. An earlier study showed how Xian balances academic, commercial, and industrial resources with the development of amenity living spaces for foreign workers and an emerging entrepreneurial class (Walcott 2003).

Harwit's 2001 and 2005 studies of Shanghai's ICT industries show just how deeply the government can be involved in local development efforts. Through a thorough examination of intertwined regulatory agencies, Internet service providers, telephone companies, equipment manufacturers, financial holdings companies, and net cafés, Harwit shows how Shanghai ICT ventures have strong family ties to both the municipal and central governments. In the 2005 study he details how the central government funneled money to local enterprises through a financial holdings company

[18]Although 北京大学 (Běijīng Dàxué), literally, Beijing University, officially changed its English name several years ago, most logos continue to read Peking University and most people also use this archaic transliteration. I have noticed that even Chinese people abbreviate the name to PKU when typing using Latin characters. The Internet domain name is pku.edu.

that was controlled by the local telecommunications regulator, which helped to ensure that Shanghai would have a strong ICT infrastructure that would benefit from FDI, but remain firmly under the control of Chinese companies. The pivotal figure in Harwit's study is Jiang Mianheng, the son of Jiang Zemin. Jiang Zemin, the father, was the mayor of Shanghai in the 1980s during the first intensive round of telecommunications sector development. He went on to become president of the PRC. Jiang Mianheng, the son, has been at various times the head of the local telecommunications ministry (the Shanghai Posts and Telecommunications Administration), director of the local 'Baby Bell' Shanghai Telecom, and a vice-president of the Chinese Academy of Science. Shanghai Telecom was in turn owned by China Telecom, a state owned company. Jiang Mianheng also controlled a private holding company that received foreign funding from western companies such as Alcatel and AT&T—thus effectively having a hand in controlling fixed and mobile telephone networks, data networks, as well as local factories that produce network hardware.

A case study on a much more local scale attempts to examine the interplay between provincial regulators and local pig farmers who are starting to use the Internet in Anhui Province. Similar to rural telephony studies, Li Xuefang finds that those who have Internet access become information gatekeepers for others in their communities (CIRC 2008). At the national scale, Schlaefer (2008) shows how the Internet came to affect the privatization of China's coal markets. This study questions the dominant narrative that ending central control in the coal industry was a centrally planned transition. Instead, he concludes that annual face-to-face coal summits ended in favor

of an online marketplace because of a "complex interplay between ideas, institutions, and technologies in shaping institutional change." (2) Many of these are actors that may have been ignored in a purely economic analysis of the transitioning coal market.

Studies of coal markets, pig farmers, and the Shanghai telecommunications industry start to unravel the complex interplay between the emerging market economy and government. When he concludes his study by talking about the control of net cafes and web content, Harwit (2005) shows just how complex this interplay can be. Not content with 'controlling the pipes,' in 2000 Jiang Mianheng formed Eastday.com, which opened as a Shanghai-based web portal and news aggregator. Claiming to be the most popular local website within two months of its launch, Eastday.com offers the Shanghai government a great degree of control over local residents' information flow. The portal is the exclusive re-distributor of newswires and broadcast, both of which are also closely tied to the municipal government. Eastday.com went on to open a chain of net cafes in late 2001, which eventually controlled more than half of the rentable computer terminals in the city. So in many ways, the Shanghai municipal government has come to control ICT network infrastructure, equipment manufacturing, content, and access. At the same time, Shanghai exerts a huge influence on national affairs, producing a president of the PRC whose son is a powerful figure in the CAS.

Harwit's examination of the ICT sector in Shanghai focuses on commercial providers targeting middle class users. Li and Schlaefer concentrate on individual industries (albeit, at vastly different scales). Still missing from the discussion are the effects of uneven ICT development, the end result of which Castell's calls *dual cities*.

Cartier, Castells, and Qiu (2005) begin to fill this gap by examining ICT services for migrant workers and others at the low end of China's socio-economic ladder. They use the "analytical trope" (11) of the information have-less to explore how a large and dynamic segment of Chinese society is using ICTs to participate in the network economy even as they are excluded from the world of computer and smart-phone ownership.

This look at the information have-less starts to examine "how the digital divide is opening up in China to reveal a middle ground that may mitigate some of the informational and economic polarization that has characterized the dual city" (10). By examining workers at net cafes and users of Little Smart phones, Cartier, Castells, and Qiu show how lower-end technologies are helping this population to create cyberinfrastructure partially outside the dominant "informatization regime and the discourse of informationalism generally" (2005, 14). They contend that net cafes are middle- and worker-class spaces, and that these spaces are significant tools for mobility and communication for several segments of China's new society: migrant workers, students, and those laid off from state-sector factories. Net cafes have become places for young people, both to gather and to work. Young net café workers are fed and housed by café owners in a throwback to Iron Ricebowl days when SOE employees were dependent on their danwei (production brigades) for both work and sustenance. The twist is that net access is the new fringe benefit.

Along with net cafes, Little Smart phones and prepaid phone cards form a major part of the cyberinfrastructure most accessible to the demographic that

Cartier et al. are discussing. This is one of the first acknowledgements of the role that ICTs play in keeping urban migrant workers linked to their families in the countryside; how ICT development is different in second tier cities; and the working conditions of those at the lower end of the technical infrastructure.

Looking at the information have-less starts to explain the gap that NDCNC is trying to fill, but the analysis is still dominated by urban concerns. Still, when examining the efforts of the NDCNC to connect rural residents using CHCi, some of the same factors are found that affect provincial libraries in less developed regions, despite the assertion that

> China's state informatization project—which, under the direction of Ministry of Information Industry (MII), promotes development of information technology for the national economy, including Internet technology (IT) industry investment and the establishment of IT policy and regulation—the technologies and practices of the information have-less are not reliably supported by the state. (10)

Not only does this assertion contradict one of the conclusions of this study (that the state is actively involved in bringing Internet technologies to the countryside in an effort to bolster its power), but it also contradicts a recent *Tech News Review* item that says that the central government is the *only* actor involved in getting rural folks connected (2008).

Despite this shortcoming, the Cartier, Castells and Qiu piece is still relevant to this thesis in two important ways. First, it constructs a concept, the information have-less, around which to build an analysis. Just like CHCi, this is not a perfect concept, but it is a useful analytical trope. To paraphrase the quotation at end of chapter 2,

analytical tropes, as metaphors, work to constrain and enable meaning. They are integral to understanding how new technologies affect society. Second, Little Smarts offer limited mobility and functions just like the free net cafes that the NDCNC is building in the countryside. Technologies with limited functions are an essential step towards informatization in areas that cannot otherwise be fully wired. They can be considered a sufficing strategy: while not ideal solutions, they are achievable goals and will suffice until either the government or the market can provide affordable true Internet access.

3.2 A Cultural Geography of Libraries

Chapter 2 cited Lloyd (2006) as exploring how a local culture interacts with urban landscapes while it is transitioning to a knowledge economy. Benkler (2006) is used similarly to describe the types of work that contribute, sometimes non-monetarily, to such an economy. Studies like these are useful supplements to those that quantitatively evaluate ICT industries and individual firms (or individual clusters of firms). There are two particular gaps in the literature that this thesis is attempting to fill. The first is a thorough examination of ICTs in a single non-ICT industry. The second is a look at how Internet technologies are being used by non-profit and non-governing institutions.

It is widely agreed that the ICT sector affects regional development, and in turn, ICTs affect individual firms and entire sectors of economy. Case studies show how these individual firms or economic sectors reflect broader trends in regional, national,

and even transnational economics. Many of these studies deal exclusively with commercial enterprises. Literature cited in section 2.4 discussed how the Internet affects cultural production, but only Lloyd's construction of neo-Bohemia and Benkler's NIE deal to any extent with the interrelationships among ICTs, cultural production, and economy. What remains to be done is to investigate the interrelationships between ICTs, cultural production, and economy for an individual sector.

Libraries are a useful setting for this case study because of they lie at the intersection of government and market. But what roles do they play at this intersection? How do libraries operate in contemporary culture? Are they primarily repositories of information, or are they active partners in culture formation?

3.2.1 The Role of Libraries in Society. Since at least the 19th century, libraries have had a mandate to improve society. Andrew Carnegie, whose philanthropy vastly expanded the public library system in the United States, said that libraries are the "best agencies for improving the masses of the people" (Carnegie 1900). While there has been continuous debate whether this improvement takes place through self-edifying exposure to great literature or recreational reading of popular fiction, there is a broad consensus that public libraries have become "suppliers of books to the middle class and a symbol of culture in the community" (Levy 2000).

There are other purposes, *de facto* and explicit. Entertainment is prominent—as recreational reading is supplemented by audio recordings and video, as is public

Internet access—a role that has vastly expanded largely due to the groundwork of the Gates Foundation library efforts. Another commonly acknowledged role is the building of Civil Society, efforts that are self-consciously promoted in post-Socialist Eastern European states (Achleitner and Dimchev 2004). A remarkably stable function has been the showcase library that symbolizes not just the culture of the local community but the power of a dominant culture--monastic and royal libraries come immediately to mind, but the gothic revival academic libraries built by Carnegie's robber baron compatriots serve much the same function. This trend continued throughout the twentieth century, as cities built new central libraries as spectacular development projects to revitalize decaying city centers through the 1980s (Chicago's Harold Washington Library), and to showcase their participation in the global city network by hiring star architects (Seattle's Rem Koolhaus).

3.2.2 Libraries and CHCi. How do libraries build these technologies? Like any other institution, they form actor networks consisting of their workers, their sponsoring organizations, their users, and the cyberinfrastructures available to them. Most libraries participate in a variety of quite large networks. For example, Chinese provincial libraries each have about two hundred employees each, are part of their province's Department of Culture, librarians belong to provincial and national library societies, the National Library coordinates shared catalogs, and Tsinghua University (which, oddly, does not have a library school) vends digital collections management software. In short, libraries are technosocial actors， operating at the boundary

between technology and society, that mobilize ICTs both in support of everyday operations, and because they are responsible for, and participate in the formation of cultural heritage, CHCi is an actor that affects their practices. Libraries perform their tasks relatively unseen. The highest ranking librarian is a fairly low-level bureaucrat. In the United States, the Librarian of Congress is not nearly on a par with a cabinet member or even the director of the Congressional Budget Office. With the exception of Melvil Dewey, no librarian is a household name. Library projects rarely become mass media memes.[19] Over the course of this research, I found no evidence that China is any different.

Still, libraries produce and manage massive amounts of information. In section 2.4.4 I explained how the technical skills of library workers and the institutional structures that make up CHCi come together to produce this information. If libraries are a representative actor in the CHCi network, then evaluating them should give an indication of the state of CHCi development. Since the libraries that I examine are public entities in a state with a centrally planned, transitioning economy, they should, in turn, be particularly sensitive to the overall state of cyberinfrastructure in their provinces. This is why the main question of this thesis is: how does the state of CHCi, as observed in the NDCNC projects, relate to overall regional IT development?

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[19]With rare exceptions. When the Library of Congress's American Memory Project uploaded photographs to the commercial website Flickr, their appearance gathered quite a bit of attention (Matt Raymond, entry posted January 18, 2008 on the Library of Congress Blog). The National Archives' Digital Vaults website, which has an engaging interface, but only small photographs with little information attached to them, was named one of CNN/Time's 'websites of the year' for 2008 (*50 Best Websites 2008*)

3.2.3 Avoiding 'Soft Sociology.' The interaction of the state and economy is typically the realm of political economy. In recent years, political economy has been affected by the larger 'cultural turn' in geography, and a concomitant rise in the sorts of qualitative methods of which actor-network analysis is one. This trend does not come without pitfalls. Human geographers engaged in this work are at risk of engaging in what Jessop and Oosterlynnk (2008) term "soft sociology." Their solution is to bring the practices of semiotics into cultural political economy when examining the world's various capitalisms in order to highlight "the complex relations between meanings and practices" (1156) I have been acutely aware of the danger of performing a surficial analysis because I am examining the nexus of various institutions (provincial libraries, the National Library of Chinese, the CCP's central planning regime, ICTs) and the practice of librarianship, and attempting to relate them to a larger phenomenon (China's transitional economy). This is why chapter 2 laid out the parameters of CHCi without firmly drawing boundaries around the concept—border drawing being one of those things that Jessop and Oosterlynck warn against. This said, chapter 2 does present a framework for the types of library activities that are particularly pertinent to this thesis.

Drawing from Richard Lloyd's (2007) work in which an ethnography of a changing neighborhood was built through interviews with a wide range of residents, workers, business owners, and other users of the neighborhood, I developed a strategy that looks at the full range of job responsibilities that are involved with the NDCNC projects, as well as other digitizing projects inside the provincial libraries.

As part of a course in using qualitative methods, I selected three American research libraries and interviewed persons responsible for implementing digital collections. By using rankings available from the Association of Research libraries, which computes an index based on expenditures and size of collections and staffs, I was able to choose a representative from a top-, middle-, and low-tier library using my own professional network. The ARL annually ranks its 113 members using this index. I asked these librarians not only about their own direct responsibilities, but also about how the projects are planned, what the funding mechanisms are, and what other library departments share responsibility for the projects. I sought their opinion about why their libraries were choosing to digitize materials and how well they were doing so.

This pilot study confirmed my personal experience that managers rarely have full knowledge of work processes. Therefore when I went to China I was pleased to always meet with multiple librarians, as well as often meeting people who actually scan images and run servers during building tours. Somewhere in every library there is the equivalent of the minimum wage coffee barista –working on repetitive tasks that do take a certain amount of skill, but are not likely to be anyone's idea of a career goal. Higher up the career ladder, libraries offer jobs that demand higher skills, but do not necessarily command market-rate wages. It is possible that this situation is exacerbated in China, as it has transitioned many of its SOE employee's away from the low wage / subsidized life of the Iron Ricebowl system to the market. Libraries, because they are not engaged in commodifiable production, are in a gray area in the emerging system. Numerous librarians during my visit discussed wage increases that

were helping the situation, but did report losing employees, specifically technology workers, to private industry. One of my host translators even inquired about the career trajectories of entry-level employees in American libraries, lamenting that she was struggling between returning to school in order to advance within the library and taking her existing credentials into private industry.

Lloyd's neo-bohemians engage in a variety of work *and* personal pursuits. Librarians are no different, therefore I also look for connections to other cultural activities. I found one individual in the Anhui Library whose job was to digitally duplicate woodcuts of master calligraphers. His personal hobby is traditional brush calligraphy.

The practices of libraries are also connected to the Networked Information Economy. Libraries, public libraries especially, are inherently engaged in commons activities—they have an explicit mission to share information among their users, and often accomplish this by sharing information amongst themselves. Moreover, librarians globally are engaged in advocating for less restrictive intellectual property regimes and have been building lending programs for years that stretch the boundaries of copyright and licensing agreements.[20] While ICTs have augmented and accelerated these efforts, they mostly predate the Internet. Libraries also use and build technology tools that enhance information sharing and the tools themselves are often freely available open source projects. One *ad hoc* group, code4lib, has emerged that

[20]Interlibrary lending is one example of a 'network' practice that shares resources across institutional boundaries. While commonplace in the US, Chinese librarians are just now establishing the procedures to lend between institutions on a large scale (Rumei 2004).

both develops and shares software tools as well as openly advocates for increased use of open software within the libraries.

While libraries benefit greatly from free server software, they still have to pay for their PCs, and most large systems are still proprietary: there are few vendors of integrated library systems (the suite of software that run library catalogs and purchasing programs) in the United States. Collections of digital images and bibliographic indexes run on software that was originally developed by universities before becoming privatized (ContentDM by the University of Washington, TPI by Tsinghua University). An exploration of CHCi therefore cannot ignore either the abilities of the local staff to customize and maintain software systems or the local economic constraints on libraries. This is why this thesis examines HOW the provincial libraries operate WITHIN their local economic contexts.

These are just a few of the components of libraries' actor-networks. By undertaking my analysis Chinese provincial libraries with these parameters in mind, I feel that I avoid violating Jessop's tenet that in:

> CPE, technical and economic objects are always socially constructed, historically specific, more or less socially embedded in – or disembedded from – broader networks of social relations and institutional ensembles, more or less embodied and 'embrained' in individual actors, and require continuing social 'repair' work for their reproduction. (Jessop and Oosterlink 2008, 1157).

3.2.4 Traditional Library Roles in the Digital World. In the previous section I mentioned that libraries have been engaging in network activities for longer than

computer networks have existed. Similarly, many of the traditional work functions of libraries have direct analogs in the digital environment. Throughout this thesis, I avoid diving too deeply into the specifics of technical systems that make up CHCi because the most important parts of the analysis are the actor-networks that perform these traditional work functions. In some ways, the specifics of the technologies are unimportant. In the world of advanced computing, library systems are not especially complicated. Many of the platforms on which digital collections are built (including ContentDM, mentioned above) are mature technologies created by research programs in the mid-1990s. After 2000 the main challenge, according to Lynch (2002) became not to build collections platforms, but to sustain collections and construct relevant interpretive materials. Indeed, any library's digital presence (read: web page) will contain most of the same features:

- a library catalog, typically built on one of a limited number of 'intergrated library systems'
- a set of licensed and locally produced bibliographic databases
- locally produced content, ie: digital collections
- an obvious indication of the library's institutional parent and a description of the library's internal organizational structure
- links to ways to get synchronous and asynchronous assistance (ie: telephone numbers, reference desk hours of operation, email addresses, and help pages

There are any number of emerging trends and paradigms, but ninety percent of libraries' web pages will contain at least the above features. The actor-networks that underlie these features remain strongly tied to the traditional library functions of

collecting, acquiring, storing, and distributing information resources. Printed books, iTunes digital music files, and locally produced cultural heritage information are all managed using these same basic processes. Below I will detail these processes only in relation to building digital collections using local cultural heritage materials. In section 4.3.2, I use the same set of functions to present results of my fieldwork.

Collection. Collecting resources depends on previously determining the scope of what it is one wants to collect. Having clear goals (i.e.: a collection development policy) makes selecting individual specimens a fairly routine process. The policy is affected by external factors, such as the parent institution's goals, larger societal forces, and the budgetary constraints. These external factors are often visible in the resulting collections. One can frequently see political goals and cultural values reflected in the content that gets chosen for any particular collection.

Acquisition. In the analog world, this would simply be the business processes involved with purchasing materials. In a digital environment where content is being created from physical artifacts, this process is the actual creation of digital files—either by scanning two dimensional material, photographing three dimensional artifacts, or capturing audio files or video of performances (or post-processing existing analog recordings). This is a complicated enough process that careful orchestration and standardized procedures are required, but it is routine enough that published standards exist.

In evaluating digital collections, it might be less important to know which specific standard is being followed than it is to know that standards are being used and

those responsible for implementing procedures are aware of them. For example, in the pilot project described above, a librarian at a premier US academic library was not able to specify what sorts of equipment is used or what digitizing standards are used, but he was aware that his library's operation is well regarded, that the end-products are of extremely high quality, and that he had waited for the operation to mature enough such that he was able to obtain satisfactory results.[21]

Organization. Cataloging and storing materials may be the most traditional of library functions. Again, there are myriad published standards for describing materials (in fact, different genres have different standards: Dublin Core for digital files; VRA Core for reproductions of works of art; FGDC for geospatial information). Descriptive organizational schemes can be said to be what makes a library usable—without them, materials may as well be piled up on the floor.

Despite Lynch's contention that digital library systems are mature, one aspect of their architecture remains poorly developed. One survey of digital cultural heritage initiatives notes that a lack of planning for long term viability, heterogeneous data formats, and economic issues all affect the sustainability of digital collections (Zorich 2003). Beyond storing the digitized materials, projects also develop a variety of interpretive material, but "the nature and economics of sustaining primary material, once digitized, [is] quite different than sustaining presentations and packagings and interpretations of it" (Lynch 2002).

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[21]In this specific example, the librarian's personal standard was that the smallest text on a printed map that is legible with a hand lens must be legible on screen.

Distribution. To distribute a digital collection is to mediate access to it. While the overall availability of Internet connectivity is an issue that is largely out of the scope of a library organization, the retrieval system and design of the user interface often impacts how useful a digital collection is found to be. Other than the mechanical aspects of accessibility, libraries need to take into account who the target audience is for a digital project and what the level of their computer skills is in order to design a usable system. For example, the agricultural information that is such an important part of the NDCNC for the western provinces is in video format largely because the librarians were concerned that rural populations are not literate enough to use the information in written forms.

Each of these roles has its own specialized language, and indeed, sub-disciplines within library science can be described in terms of these roles. Within a library organization, different departments might be charged with managing one or another aspect. Coordinating the different roles is a managerial task that requires its own set of skills. However, every library is similar enough that all librarians can converse about local conditions. Using my personal knowledge as a librarian to compare Chinese provincial libraries to each other enabled me to conduct a more in-depth analysis of the situation, and gained me entrée into a set of Chinese institutions that might otherwise have remained closed. The following chapter presents my case study, and discusses how libraries in China operate within the context of the Chinese state and its transitioning economy.

CHAPTER IV

THE CASE STUDY

4.1 Introduction to the Case Study

The National Digital Culture Network of China (NDCNC), a project of the National Library of China, is building multimedia databases filled with cultural heritage information, as well as infrastructure for using that information. Each provincial library is charged with creating two-way streets of information creation and exchange. Hence they are not just selecting and digitizing local materials; they are communicating with rural residents about what kinds of information are considered to be unique, valuable, needed, or in danger of becoming lost. Many of the libraries are also designing mechanisms to deliver information, specifically agricultural information, to rural areas where Internet access is unavailable. These efforts will supplement other efforts that offer Internet access in public buildings such as local Culture Stations (文化站 wénhuà zhàn) and village schools. In effect, the NDCNC is a project both to create digital content and to develop a rural computing infrastructure.

The initial goal of this case study is to examine how a provincial library's ability to mobilize ICTs relates to that province's overall economic development. By explaining the nature of this relationship, light can be shed on how China's uneven economic development manifests itself outside of the market economy. These efforts

are closely aligned with the goals of the Western Development Strategy, which calls for central government revenues to be invested in interior regions of the country—in both market- and public-sector projects. In these less-developed provinces, libraries are also being encouraged to be actively involved with creating services for rural residents.[22]

4.1.1 Information Sources. My case study originated during a social visit in May of 2006 with a former coworker, Zhang Hui, who is a Chinese immigrant to Canada. He is currently an Internet entrepreneur, but he is a trained librarian with experience in the Chicago Public Library system as well as the Nanjing Library, which serves as the Jiangsu provincial library. During what turned into a daylong visit he introduced me to the NDCNC just as I was starting to develop the idea of looking at technology development in China. I was seeking a stand-alone technology project that I could examine with limited Chinese language skills and resources. The NDCNC is ideal for these purposes because:

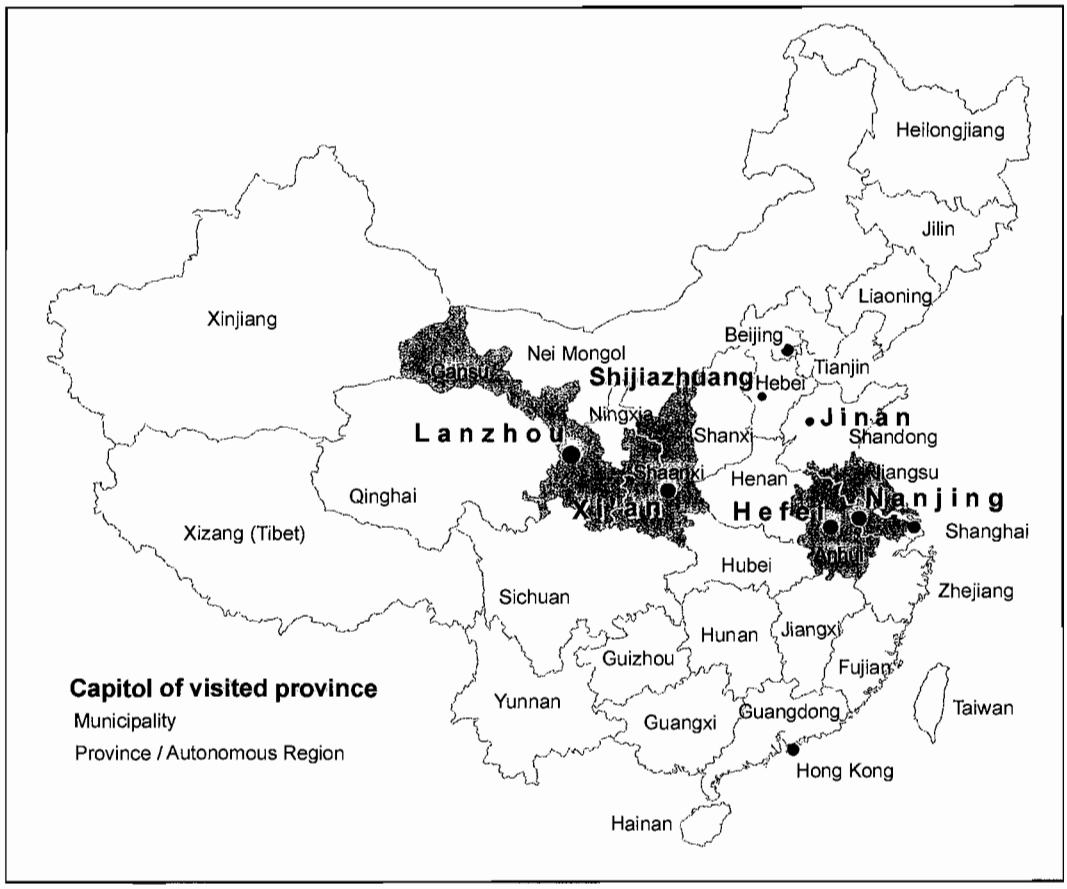
- it has national and local components
- provincial libraries are organizationally homogenous, especially when compared to academic libraries or US state libraries. Each sits in the same position within its provincial administrative hierarchy
- provincial libraries are all located in capital cities, which are easily accessible to foreigners

[22]This is an observation from my visits to provincial libraries. For the duration of this chapter, any factual item that is not specifically cited should be assumed to be information gathered in the field. Single quotation marks are used throughout because conversations were informal, unrecorded, and often in a combination of English and (on my end, poor) Chinese.

- my status as a librarian helped me to gain access to Chinese librarians that would not have been possible had I been studying some other industry

To conduct this case study I visited six of the 33 provincial libraries during the summer of 2007 (see map 2). Additional information was gathered from the websites of these, and a number of other provincial libraries, concentrating mainly on the posted results of the projects. Moreover, much of the information that was presented to me during the site visits had little or nothing to do with the NDCNC. Rather, every librarian was anxious to describe a variety of digital projects on which his or her institution was working. As a consequence, this case study became an examination of how provincial libraries are implementing Internet technologies more than a study about an individual digitizing project.

The initial conversations with Zhang Hui turned into a long-term correspondence about librarianship in China, introductions to Chinese librarians, and eventually, site visits that became the primary source of information used in developing this case study. These visits were arranged through Zhang Hui's personal connections, as conversations turned into BBS postings, visits to friends-of-friends, and third-hand introductions. I also attempted to conduct follow-up conversations via e-mail, but very little information was gathered from individuals after leaving China. While careful notes were taken during and immediately after each visit, the availability and ability of English-speaking staff and translators was somewhat limited. My own lack of literacy in Chinese also hampered analysis of websites. I did my best to



Map 2. Locations of library visits, summer 2007. Darker gray provinces were formally hosted visits.

capture each conversation and to observe the situation in each library carefully, and have taken care not to speculate about things that were unclear. Finally, accessing Chinese websites from the United States is difficult, with sporadic availability, and many dead links. Some of the problems are the result of the NDCNC being a work in progress, not scheduled for completion until 2010. Some of the inaccessible links are simply to content that has not yet been posted, and others involve a lack of functionality between Latin and Chinese character sets and versions of Microsoft Windows. Some access issues, particularly error messages due to slow response times,

might be due to the Great Firewall. A simple analysis of the path that data packets take to China shows that traffic really does always pass through the same point on its way into China, whereas domestic traffic between the same two points often travels different paths. Without being able to route around choke points, requests to web pages simply fail.

4.1.2 Analytic Approach: ANT and STS. Latour often uses case studies as extended metaphors to explore how 'doing' science or creating technologies is a social act.[23] Through naming all of the actors involved, including non-human actors, and then describing how they interact within a social network, Latour works toward showing how no one individual makes new knowledge. Rather, knowledge (or information systems or subway lines) emerges from a group of actants: scientists (never working alone), prior accepted knowledge, available technical and financial resources, and the cooperation of the people and things being studied. These actants do not just form actor-networks; rather, through complex interactions, they weave a net inside of which work gets done (Jablonski 2002).

Latour's goals are typically more ontological and social than they are about the logistics of any one scientific research project. Similarly, my goals are to describe the breadth and depth of the actor-networks in which the provincial libraries are embedded as they create online resources. My qualitative description of each province's actor-network is meant to be a proxy measurement, or a sample, of CHCi development for

[23]Beginning with 1979's *Laboratory Life: the construction of scientific facts*, Latour has examined various research and applied scientific enterprises, including microbiology, soil science, and the engineering of subway systems.

that province. The descriptions are then used to help explain how CHCi development reflects regionally uneven development across China as a whole.

Hence, during site visits I looked at how library workers, library departments, each individual provincial library, and the materials being digitized presented themselves as technosocial actors, always looking for the ways that these local actors relate to the national context, interact among themselves, and work together towards building successful digital collections.

One observation stands out that speaks to the success of this methodological stance. Chinese librarians are very aware, even apologetic, that their libraries are not as technologically advanced as American libraries, and see this as part of their operational context. In the Shaanxi library, one librarian actually told me I should not expect much from their project because (as I wrote and underlined in my field notes) "we are poor and undeveloped." The word 'development' was used any number of times, and the issue of China being undeveloped or underdeveloped came up during every site visit, even in libraries that are, in fact, quite advanced and even from individuals whose technical expertise far outweighs my own. Once, this observation came not during a conversation about library technology, but rather as a lament as my graduate student translator, her boyfriend, and I rode a bus that was crowded and lacked air-conditioning. The repeated expression that China is undeveloped is one of the strongest pieces of evidence that Developmentalism and the national economy are not just silent actors in Chinese provincial libraries, but speak loudly to library administrators, line librarians, and even college students.

4.2 Methods

This section is a summary of how I gathered information over the course of this project. These include direct observations of six provincial libraries, along with material gleaned from libraries' websites and conversations with Zhang Hui, one of which took place while co-browsing. An interesting point to note is that over the two years of observation, additional digital culture projects continued to come online as I would return to the provincial libraries' homepages. This should serve as a reminder that libraries are in a period of rapid change as the print era comes to an end and increasing amounts of information become available online. Any examination of them in the Internet age is a shot at a moving target.

4.2.1 Information Gathering Methods. I have already mentioned the four main sources of information used for this thesis: conversations and correspondence with Zhang Hui, site visits, website evaluations, and English-language library literature.

Zhang Hui proviced a basic introduction to contemporary librarianship in China, and provided extensive background information on how the profession has evolved during the thirty years of market transition. He emigrated from China in the early 1990s, part of a second wave of Chinese students who came to the United States for training not available at the time in China.[24] Now a Canadian citizen, he continues

[24]Students from the first, much smaller, wave in the 1980s are now national leaders in China: central bankers (Gao Xiqing, president of China Investment Corporation, manages $200billion of American treasury securities [Fallows 2008]) and directors of university programs (Hu Jie, who heads

to observe the Chinese library world, and actively participates in BBS discussions about literature and library science. Librarians in China during my visits, as well as in email exchanges, complimented Zhang's writings about contemporary technology trends as well as his stories of working in the Chicago Public Library system—both as a branch librarian and as a computer programmer. Zhang's descriptions of the administrative and bureaucratic structures that I would find when I visited China proved accurate.

Prior to my travel to China for language study during the summer of 2007, Zhang posted BBS messages describing my project and my desire to visit provincial libraries. Upon my arrival, I was fortunate to be assigned a tutor who is a graduate library science student at Peking University. She promptly began introducing me to doctoral students at PKU. Through these personal channels I was able to arrange visits to four provincial libraries: Anhui, Shaanxi, Gansu, and Jiangsu. These visits were held in late August and early September of 2007. These four provinces offer a broad demographic sample of contemporary China. I also visited the Shandong and Hebei Province Libraries on my own during a long weekend in my language program, but did not successfully converse with anyone. While this taught me not to drop in on libraries unannounced, visiting these two additional facilities help to confirm some of the observations in section 4.3.

Three of the four libraries offered an English-speaking staff member and an administrator to host a tour of their facilities. The fourth, Gansu Province Library

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an urban design group at Tsinghua University is a Princeton education landscape architect who visited the University of Oregon in 2008), and entrepreneurs (Fannin 2008)

(which happens to be the western-most and poorest province that I visited), warned that I might want to bring my own translator. The length of each visit ranged from two hours to two half-days. My first translator (a former employee of the PKU doctoral student who arranged my visit) emailed ahead of time requesting additional information about my project and a list of topics for discussion. The first visit worked well, so I continued the format, emailing a written summary ahead for each stop. In the end, each visit followed roughly the same format:

- an hour or two conversation with an administrator who discussed the structure of the library, the general status of libraries in China, and services on offer at that particular library, with an emphasis on digital projects
- a tour of the building, with an explanation of the function of each reading room
- a visit to departments specifically charged with creating digital collections
- and finally, lunch: once with my hired translator who went over my initial notes with me, once with my two hosts, and the third time with my staff translator who was an administrative assistant and former coworker of one of my librarian contacts

At least one staff member from each library offered to continue corresponding after the visit, although only a small of amount of additional information has been gathered during subsequent messaging. Immediately after each visit I compiled handwritten notes into word processing documents.

While the initial purpose of these site visits was to develop contacts and determine whether conducting a formal study of the NDCNC was feasible, upon my

return to the United States I had gathered enough information to complete this thesis. While an online survey or more in-depth study of the projects' websites might provide additional information, they would lack the richness of the conversations that produced much of the information in this thesis. Physically visiting the libraries, being able to speak with multiple staff members, co-browsing library websites, and hearing about future plans and logistical difficulties all have informed my conclusions. For example: while Zhang Hui told me that one of the goals of the NDCNC is to disseminate cultural information to rural areas, it was in-country librarians that told me that the real goal of the project is to improve agricultural productivity and public health through the creation of mechanisms to disseminate information to farmers. The librarians seem to consider digitizing cultural materials to be auxiliary. Therefore 'Digital Culture Network' that is under construction is not so much a collection of cultural heritage materials, as it is a network infrastructure being built by the national Ministry and provincial Departments of Culture. This observation is backed up by the presence of informational videos on job seeking and urban life skills for migrant workers on the main NDCNC website and the prominent placement of commodities prices on both the main and provincial sites. Finally, the interpersonal interactions helped to mitigate my own lack of language ability, allowing collaborative effort for translations (at one point all five of us in a room struggled with the word 'satellite,') and offering immediate follow up questions. The informal settings of meals also provided the opportunity to talk about the profession of librarianship and how it differs

between countries. I was also able to comment that the projects are exactly in line with the best efforts of American academic libraries.

Still, not all difficulties were overcome. I never managed to collect any written guidelines that the National Library may have distributed to the provincial libraries; I did not always learn how long individuals had been in their current positions and what their career paths look like (a parameter found to be important in the pilot study discussed in section 3.3.3); and I received mixed messages when I asked if the NLC might cooperate with my study, with some saying I should definitely contact them when I returned to Beijing, and others saying it would be a waste of time.

4.2.2 Site Descriptions. The four provinces where I spoke with librarians are demographically and economically diverse (see table 2). My selection of this particular set of libraries was based around having two locations selected via personal contacts. Knowing that I would visit these two provincial capitals, I gave a list of six other cities that I could feasibly visit to a contact at the NLC. This librarian arranged introductions to librarians at three libraries, only two of which I was able to visit.

As seen in map 2, these four provinces are nearly contiguous, and are arrayed along an east to west line. The two western provinces are closely tied to the Huang He (Yellow River), the two eastern provinces the Yangtze. Moving west, one passes through a cross-section of contemporary China: the rich, developed coastal provinces, the central provinces that were home to classical Chinese capitals, and the largely unpopulated and underdeveloped western provinces that extend onto the Tibetan

Plateau. From east to west, the conditions of the four provinces and their capital cities can be summarized as:

- Jiangsu Province (The Nanjing Library[25]): A developed, wealthy province. Nanjing benefits from being a prominent city historically (capitol during the Ming Dynasty), as well as from its proximity to globalized Shanghai. Nanjing served as capitol of Republican China from 1911 until the formation of the PRC in 1949, with the Nanjing Library designated as the national library.
- Anhui Province: Considered a central province, although it appears to be well east of center, Anhui is a center of agriculture. It is often cited as the grassroots origin of market experimentation by farmers. It has a large population of poor, rural residents and few large cities, and has the reputation of supplying a-yi (housemaids) and fuwuyuan (waitresses and hotel maids) for major coastal cities. Its capital, Hefei, is not its historical capital, but has a long history as a major market city.
- Shaanxi Province: Shaanxi is the terminus of the Silk Road and was home to China's original imperial capitol, Chang'an, which became Xian, the current capital of the province. A western province, its physical isolation provided a site (along with Sichuan, its next door neighbor) for Mao's military industrial complex (Naughton 1988). Hence it continues to be home to considerable machine tooling and aerospace expertise, which it is currently trying to convert to contemporary precision market-based manufacturing capacity.
- Gansu Province: A far western province, this is one of China's poorest, least developed provinces. With relatively large Tibetan and Uigyar populations, it is also the most ethnically diverse province that I visited.

[25]The Nanjing Library serves as the Jiangsu Provincial Library.

Table 2 shows some basic demographic statistics for each of provinces whose libraries I visited. The table also includes Beijing (as the province[26] with the highest individual income levels), Tianjin and Guangdong (provinces that contain two of the original four SEZs), Jiangxi (as one of the poorer eastern provinces) and Tibet (which sits at the bottom of many wealth indicators). It should be noted that the provinces whose libraries I visited offer wide variance along these metrics while avoiding the extremities. Other combinations of provinces might have had severe outliers—both in their underlying demographics and in their libraries. For example: the manufacturing centers of Guangdong Province are so tightly integrated with the economy of Hong Kong, and its Gross Regional Product is so much higher than other provinces that it would not make a fair comparison. Province-level municipalities, like Beijing and Shanghai, create the same problem. They are cultural, political, and economic powerhouses. Shanghai, in particular, has a library with twice the holdings of the largest provincial library (see table 3). Less obvious, but at least as important, the municipalities lack the vast countrysides that typical provinces are obliged to provide with social services and development assistance, thereby allowing them to spend surplus revenues on spectacular development projects such as stadia, universities, museums, and libraries.

[26]Beijing is a provincial level municipality. China actually has 22 provinces, 5 autonomous regions, and 4 provincial level municipalities (metropolitan areas that are administratively treated as provinces). These are Beijing, Tianjin (which both have been removed from Hebei Province), Chongqing (removed from Sichuan), and Shanghai (removed from Jiangsu). Hong Kong and Macau are generally not included in comparative statistics.

Table 2. Comparing provincial level entities

	Per Capita GRP (RMB)	GRP per capita rank*	Average earnings (RMB)	Average earnings rank*	PC per household	PC per household rank*	Persons employed in ICT industries	ICT worker rank[a]
Beijing	50467	2	39684	1	95.7	1	57792	2
Tianjin	41163	3	27628	4	59.2	7	14158	26
Zhejiang	31874	4	27570	5	64.83	5	41466	9
Jiangsu	**28814**	**5**	**23657**	**7**	**52.48**	**9**	**50086**	**4**
Guangdong	28332	6	26400	6	74.45	3	94211	1
Shaanxi	**12138**	**20**	**16646**	**24**	**34.88**	**19**	**22524**	**21**
Jiangxi	10798	24	15370	31	37.33	15	24877	19
Tibet	10430	26	29119	3	9.54	31	2904	31
Anhui	**10055**	**28**	**17610**	**19**	**33.89**	**21**	**27293**	**17**
Gansu	**8757**	**30**	**16991**	**22**	**28.68**	**27**	**15011**	**25**

Source: National Bureau of Statistics 2007.

Provinces whose libraries were visited for this thesis are highlighted.

[a]'Rank' is out of 31 provincial level entities for which China offers comparative statistics.

Table 3. Comparing libraries and their cities

Province	Capital city Population	Holdings	Staff	GRP[a]
Guangdong	3,117,400	3,700,000	220	22,366
Shandong	5,974,400	3,950,000	151	18,516
Jiangsu	**5,958,000**	**6,755,995**	**322**	**18,305**
Zhejiang	6,400,000	3,800,000	146	13,437
Hebei	9,273,000	877,000	133	10,096
Shanghai	13,602,600	8,248,000	582	9,154
Anhui	**4,557,000**	**2,060,000**	**125**	**5,375**
Shanxi	**7,417,300**	**2,417,200**	**147**	**3,675**
Gansu	**3,117,400**	**2,330,000**	**193**	**1,933**
Tibet	257,000	590,000	40	251

Sources: National Bureau of Statistics 2007, Gong and Gorman 2000.

Provinces whose libraries were visited for this thesis are highlighted.

[a]millions RMB.

4.3 Observations

4.3.1 Structure of the Provincial Library System. The provincial libraries are administratively under each province's Department of Culture. The National Library of China, itself a part of the national Ministry of Culture, provides some coordination of activities (as described for the NDCNC), but I encountered conflicting accounts of its oversight activities. For example: one of the librarians in the poorer half of my sample commented that projects are not often generated within the library. Instead

Beijing 'tells us what to do and we do it.' Another librarian speculated that the ability of any individual provincial library to successfully fund digital projects is linked to the clout of that province's Culture Department within the provincial government. This is indicative of the tiao kuai system in which vertical bureaucracies (PRC ministries, 部 bù) coexist with the horizontal authority of the provincial administrative structure (provincial departments, 厅 tīng) (Zheng 2007). This also leads to some confusion regarding responses, specifically when inquired about the role of the National Library. Regardless of these vagaries, each provincial library sits in an identical position within the PRC administrative hierarchy: they are part of their respective provinces' department of culture (文化厅 wénhuà tīng).[27]

Each library is in the capital city of its province. Many of these cities also have municipal libraries. I had the opportunity to visit one, and there was no obvious functional difference between it and the provincial library. Both offered a similar variety of public reading rooms dedicated to different genres and user groups: self-study rooms, children's rooms, Hong Kong and Taiwan reading rooms. There are even examples of staff members moving back and forth between institutions over the course of their careers, indicating that neither type of library requires extraordinarily specialized skills, and also lending credence to the observation of one librarian that 'provincial libraries are typical public libraries.'

[27]It is possible that the libraries of the municipalities or autonomous regions might function differently. For example: I still have not found a website for two of the autonomous regions' libraries, even though I know that there are central libraries in both.

One feature that varies between the libraries is their province-wide outreach activities. Multiple librarians told me that smaller towns and villages mostly lack libraries. In some provinces, the provincial library might be the only one to offer services in many localities. The two western provinces, Gansu and Shaanxi, were able to articulate this function most clearly: in towns too small for a library, it is the local Culture Station (文化站 wénhuà zhàn), also administratively under the Department of Culture, that is the home of the person responsible for library services. In villages too small for a Culture Station, this responsibility might fall onto a primary school teacher. Regardless of where the office is located, someone in every village in China has the responsibility of working for the Department of Culture.

Gansu Province Library reported that many of these Culture Stations have books donated from nearby cities or second-hand books from libraries. On the other hand, the Nanjing Library, functioning as the Jiangsu Province Library, has two branches and seventeen "communication sites" (流动点 liúdòng diǎn)[28] that receive materials from the Nanjing Library. Anhui province made no mention of services to local communities, providing my first evidence that something is unique to Anhui's situation.

While my original goal was to examine the NDCNC's role at the local level, my conversations actually uncovered strong relationships among library services, China's transitional economy, and rural human development efforts. Zhang Hui described a 1980s bookmobile service of the Nanjing Library, which he would use to

[28]A colleague has suggested that a better translation might be *drop-in centers* or *sub-branches*, and that the name infers a location with no fixed hours.

travel to towns outside of Nanjing with, among other things, Western fashion magazines. In these smaller towns, workers would line up waiting to take their turn sketching patterns for reproduction in local garment factories. While this is likely a function that has been replaced by access to domestic fashion publications, cable and satellite television, the Internet, and other information resources associated with globalized ICTs, it shows that the provincial libraries have a history of providing services outside of metropolitan centers that are oriented towards economic growth.

Services to rural communities were most strongly stressed at the Gansu Province Library, and relate to China's efforts to modernize its agricultural practices. Librarians at the two western provincial libraries told me that all provincial libraries have a strong mission to serve peasants in the countryside; indeed, a primary focus of the entire NDCNC is on getting agricultural information to farmers in video format. In essence, the provincial library is attempting to use its existing administrative structure—which has a distinct spatial hierarchy that reaches all the way down to the village level--to disseminate agricultural research to illiterate farmers. When I explained the role of the Land Grant colleges' Cooperative Extension Service in the United States, the librarians reported that even though the local university is a leader in agricultural research, it lacked any mechanism to disseminate information to local farmers.

These two observations provide strong evidence that the overall character of libraries reflects patterns of uneven development. Gansu Province remains primarily rural, and its library boasts of its efforts to improve the countryside. Jiangsu Province

has been moving towards a manufacturing and service economy for quite some time, and its library has supported that transition. Moreover, the librarians at the Nanjing Library did not mention services to rural communities at all until prompted, and even then, they seemed a little confused that I raised the issue.

There are a remarkable number of other differences between the libraries that speak to differing development statuses of the different provinces. One simple example is the number of staff that libraries reported devoting to digitizing projects (see table 4). Jiangsu Province brings considerable resources to bear on creating digital collections. Twenty full-time (although not all permanent) staff work on digitizing projects at the Nanjing Library, and they are dedicated to these tasks. At the Anhui Province Library, digital projects appear mostly to be among the collateral duties of librarians. For example, a single reference librarian works on their 'Folk Architecture of Anhui Province' project, personally travelling around the province taking photographs. Anhui also has an extensive calligraphy collection, and a suite of analog services built around it. Calligraphic samples are microfiched for preservation, and fine-art reprints of the work of famous calligraphers are published, distributed to other libraries, and sold. However, the staff in this department is just beginning to experiment with preservation scanning, and at the time of my visit the scans were not yet available online. Gansu Province Library lies in the middle of these two extremes, reporting having ten people, all in the library's Information Technology Department, who worked at least part time on digitizing projects.

Gansu and Anhui Provinces offer another interesting contrast. Both rank near

Table 4. A summary of digital projects discussed with host librarians.

	Project	Staff	
Anhui	Geneology		
	Local Architecture	1 non-dedicated staff	
	Calligraphy	1 dedicated, at least 2 non-dedicated	Mostly analog. Beginning to experiment with digital
	Local art		Images primarily from books.
Shaanxi	Digitizing local materials	Dedicated workers hired specifically to develop NDCNC collections.	Little interaction with librarian staff.
	Culture Station computer labs		
Gansu	Local dramas	10 full and part time. Plus local workers	
	Arid lands farming		
	Culture Station computer labs		
	Sci-tech bibliographic index	< 10 dedicated staff	Joint project with provincial Science & Technology office.
Nanjing	Republican Era historical figures	20 dedicated staff working on all digital collections.	Little interaction with librarian staff.
	Republican Era books		
	Republican-era historical events		
	Sports (planned)		

the bottom of GRP per capita (28th and 30th respectively, out of 32. See table 3), yet Gansu is devoting considerably more resources to the NDCNC and to other technology projects. This could be the result of WDS-type subsidies. One librarian reported that, for many national projects, the eastern provinces (like Jiangsu and Anhui)

are responsible for their own funding, while the central provinces are asked to split the costs. The central government provides the bulk of funds for projects in western provinces like Gansu. This leaves Anhui Province at a significant disadvantage: too poor to develop its own projects, its provincial library appears to be falling behind in overall CHCi capacity. Meanwhile, Gansu Province boasts of creating its own literature index, and can afford to license a major software product from Tsinghua University.

4.3.2 Creating Digital Collections. Digital collections form the heart of the contemporary library and serve a number of functions, including providing access to rare materials that would otherwise be locked in a vault. Their presence online also increases the probability that they will be discovered by scholars and other people with an interest in the materials. For example, the re-mix culture that is part of both neo-bohemia and the NIE includes visual artists who use existing materials in collage and other derivative works. Digital library collections are now part of the raw material of this culture and the repeated use of Chairman Mao-era propaganda imagery (see figure 4) and conceptual art pieces that use archival materials (see figure 5)

Chinese artists are as active in this realm as any. The quality and extent of these digital collections, as well as their methods of production, are indicators of an institution's CHCi. Because provincial libraries are rooted within their local contexts, the digital collections are an indicator of a province's CHCi.

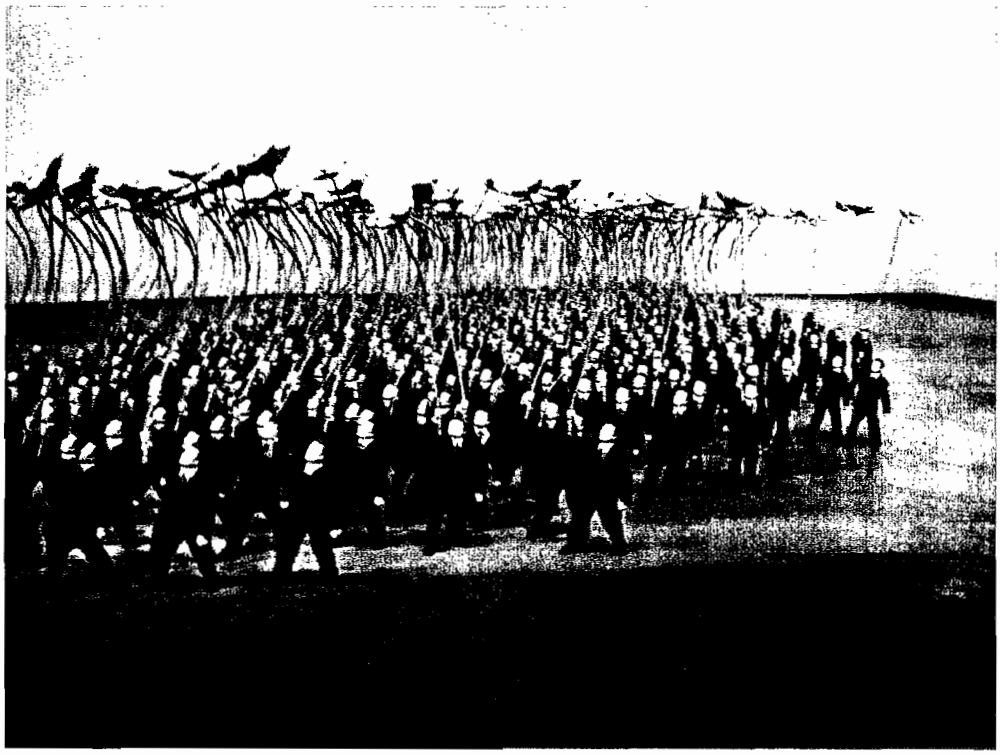

Figure 4. Ji Wenyu and Zhu Weibin's *Men Holding Flowers*. The work references the 1950's Hundred Flowers Campaign (photo by the author).

Creating digital collections is one of the main activities of the NDCNC, but the provincial libraries are also working on other digital projects—not all of which include digitizing existing materials. The basic aspects of building digital collections, however, remain the same regardless of the source material: collect, acquire, organize, distribute. Below I compare the differing approaches of the four provincial libraries.

Collect. The main task of collecting is to determine the scope of what one wants to collect and then to select specific specimens. For the NDCNC projects, one particular type of content that the libraries are collecting are local dramas—traditional and modern theater productions, often musical, staged in *ad hoc* theaters in villages

across China. Librarians in both Gansu and Shaanxi stated that collecting these performances is a major part of their NDCNC efforts. Likewise, as of autumn 2008 one of the most visible links on the national NDCNC site is a curated collection of 'local Peking opera.' that includes audio, video, and still images of theater productions and outdoor stagings from each province. Conversely, Anhui Province Library said that it is capturing local dramas only when asked, and the Nanjing Library made no mention of them (although they did list them among materials that are delivered to remote sites from the central library). Zhang Hui describes these types of efforts as capturing disappearing rural lifestyles, and pointed in particular to interviews with older artists, some of which I have found on the national website.

A notable collecting strategy in the western provinces of Shaanxi and Gansu is that local Culture Station workers ask villagers what they want to share with the rest of the country, and what they want, in turn, to see from other rural areas. Librarians told me that the most requested items are these local dramas. In this way, the digital collections are grassroots efforts, with selection decisions being made at the lowest level of the scale hierarchy. Shaanxi Province Library considers this collecting process to be part of its rural outreach efforts. Although I was never able to find written guidelines from the National Library, I received the distinct impression from several librarians that this grassroots selection approach was part of the directive of the NDCNC.

Neither Anhui Province Library nor the Nanjing Library reported following this directive. The Nanjing Library appears to be putting most of its efforts into

digitizing existing library materials, including documentary materials about famous figures from the Republican Era. Anhui is also building digital collections from existing materials (in particular the aforementioned calligraphy collection). I have since also discovered a collection of traditional medicine texts), but it is also building a folk architecture collection that includes work by a librarian sent out to photograph buildings around the province that are considered endangered. It was unclear whether these projects are part of the NDCNC efforts. This split between the eastern and western provinces is repeated in several of my observations, but here it was most striking.

Gansu and Shaanxi Province Libraries also describe projects that depend on the curatorial expertise of librarians (as would typically be the case in the United States) rather than the grassroots collecting approach of the NDCNC. However, because the NDCNC projects are a national effort, they are the most directly comparable efforts between the libraries that I visited. Also, they have a strong publicly stated function: they are described as efforts "to accelerate dissemination and innovation of Chinese remarkable culture" through the "digital creation of 1 million items" and "to integrate social cultural resources that are close to people's life and common scientific knowledge" (Wan 2003 under "Gestation and Objectives of Digital Resources Creation"). On the other hand: only Zhang Hui and the Anhui Province Library talked about the importance of these digital collecting projects for preserving cultural practices and artifacts. As described by the Gansu and Shaanxi Province Libraries, the most important aspects of the NDCNC projects are in building a rural outreach

network that seeks to improve the quality of life in rural China. In other words in western China, building an access and services network is much more important than building collections.

Acquire Acquiring materials for library collections can be as simple as buying a book, but when libraries are creating digital collections from physical artifacts and performances, acquisition is a much more complicated process. Here I concentrate on the actual act of digitizing materials rather than the mechanisms used to store the collections, which I cover under 'Organize' below.

Again, it is the western libraries that stand out in this part of digital collection building. For the NDCNC local drama projects, Gansu and Shaanxi Province Libraries both report that the local Culture Station workers have been trained to operate the video equipment and record the dramas as they are performed. A librarian at Shaanxi commented that it is the local staff that best knows the local cultures, but their technical and curatorial skills ('information transfer skills' was the phrase we settled on during our conversation) were lacking at the beginning of the project. My host described how the Department of Culture's institutional infrastructure has reached down to the lowest level of the spatial hierarchy in China to make these projects succeed: the NLC formed a 'national expert committee' that developed detailed instructions for the provincial libraries; the provincial libraries in turn train local library and Culture Station workers, how to operate recording equipment;[29] the local workers then record local dramas as they are performed. The Gansu Province

[29]As is seen in section 4.3.3: they must also have received training on supporting the equipment in the computer labs of the local culture stations.

Library noted that sometimes training takes place in the capital city of Lanzhou, and at other times, library staff goes to smaller towns in order to conduct training.

While none of these distributed training programs or local outreach efforts were in evidence in Anhui or Jiangsu, there is enough information about their digitizing programs to make comparisons among the four provinces. Zhang Hui notes that the Nanjing Library, located in the richest province that I visited, has been involved with digitizing efforts for quite a while. Indeed, some of its projects contain low-resolution images of the type commonly found in the late 1990s, when storage was expensive enough to visibly limit the size of images. He also noted that the Nanjing Library developed a traditional to simplified character converter and optical character recognition software using in-house programmers: two advanced technologies that in the United States would have been developed either by a university research program or a commercial enterprise. The second richest province, Shaanxi, is the only province that uses color targets and monitor calibration software—a question I asked at each location. These techniques help to ensure consistent color quality when scanning images. In Anhui, ranked 28th out of 30 provinces in GRP, librarians are building a database of the works of local artists, mostly by scanning images from books and magazines. The resulting online images show artifacts of the print-originals—artifacts that could be minimized through post-processing the images or eliminated by using film slides or by photographing the original works. Both of these alternatives would vastly increase the cost of the project. The Gansu Province Library, the poorest of the provinces that I visited, did not discuss

digitizing efforts other than the recording of local dramas. However, in noting how these recordings are processed, the librarian I talked with revealed how Gansu's physical ruggedness and remoteness affect cyberinfrastructure. After records are made by the local Culture Station, the media is sent to the provincial library for conversion to a disk-based format and loading into the province's database. Because the Gansu's Internet access is asynchronous (upload speeds are slower than download speeds) a subset of these materials are then placed on portable hard drives and physically shipped to Beijing for inclusion in the central, national database. This system is also used for moving materials back down the scale hierarchy: hard disks are also shipped to remote villages' Culture Stations for use in their faux-net cafes (see section 4.3.3).

When observing the methods that the provincial libraries use to acquire their digital collections, there is an exact economic match rather than the east-west split that showed up in how they select materials. The well-off provinces started earlier (Nanjing), and have the technical skills required to consistently create high quality files (Shaanxi). The poorer provinces are forced to use *ad hoc* scanning procedures and source materials (Anhui), and are hampered by a network infrastructure incapable of moving large datasets over a long-haul network.

Organize. At its most basic, to organize a digital collection is to describe each item. It is analogous to cataloging books, but even that process is shrouded in standards, tradition, and practice. Moreover, the question of how to organize a digital collection is also one of system design, which is a complicated process that cannot be covered in any great detail in this thesis. To complicate things further, this stage of

building digital collections overlaps with selection and distribution. For example, the formats chosen for digital objects affects what storage systems can be used and how end-users will interact with the collections. There is also the question of discovery: how an item is described dictates how it might be found.

Unfortunately, cataloging and description practices were among the most difficult topics of discussion during my visits. The vocabulary of these work processes is highly specialized even in one language, and not all librarians are especially well versed in these topics. Neither the English-student in Gansu nor the administrative assistant in Shaanxi helping to translate were able to carry the conversations forward when I asked about metadata standards. However, I am able to draw some observations based on descriptions of the systems being used to store the various digital collections.

Digital collection management systems come in a variety of shapes and sizes. Choosing appropriately and implementing successfully are a challenge for any library. To greatly simplify, it is largely a matter of choosing the right tool for the job: one would not want to license an expensive database system that requires a large amount of custom programming to store and deliver a collection of 500 still photographs. On the other extreme, there are few systems that can accommodate a collection of more than 500,000 archival scans of photographs, their lower-quality display versions, and associated metadata.

Each of the libraries that I visited appears to be implementing multiple systems on multiple platforms. For example, one of the digital projects in Anhui is simply a

collection of static web pages and digital images, while another is using a content management system (CMS) that was developed by the NLC. The Nanjing Library is using at least two different CMSs for its digital projects. In addition to NDCNC efforts to digitize local dramas, the Gansu Province Library is building a homegrown bibliographic index of electronic books, journal article, theses, and dissertations that contains science and technology information relevant to local enterprises. The librarians note that the platform, vended by Tsinghua University, is expensive but that this is a joint venture with the province's science and technology office and has been a major priority since 2005. The librarians told me that many provincial libraries are working on similar projects, but the Gansu Province Library was the only one that described such a project to me. At the Shaanxi Province Library, we did not discuss the platforms for their projects, but I have no reason to doubt that they are in a similar position. Therefore, I believe that I can safely conclude that all of these libraries have access to a variety of digital collection management technologies.

Unfortunately, because I am not intimate with the inner-workings of any of the systems described, I cannot draw direct comparisons between the four libraries that I visited. What I can compare is the ability of librarians to discuss the details of their systems, a factor that I found to be important in my pilot study. If my observations about mid-level managers at American research libraries are accurate, then the Gansu Province Library becomes an outlier not just in how its digital collections are organized, but for its ability to explain technology infrastructure generally. Based on the economic conditions of the province, these librarians should have been *least* able

to explain how their digital projects are put together. Instead, in their description of their local bibliographic index, they offered me the most complete explanation of any project that I encountered in my fieldwork. Not only did they describe the TPI platform, but also the origins of the project, how the project team fits within the library administrative structure, content acquisition, access restrictions, and the search mechanisms of the user interface. This is more information than any other single project that was described to me in any of the four libraries that I visited. Moreover, I cannot place this solely on the quality of this particular translator (because just as many parts of the Gansu conversations were garbled as they were in other libraries) nor the competence of the individual staff person offering the explanation (because this wasn't the only place that I spoke to an 'on the ground' implementer of a project, nor was it the only place that I got to ask specific implementation questions—these were simple the best answers). Instead, I conclude that the Gansu Province Library has a more advanced CHCi as a result of the Western Development Strategy. (I discuss this conclusion at length in section 5.1.)

Distribute. Distributing digital collections is often a matter of mediating access—ensuring that those who have legitimate access rights to content can get to it and making sure that those who do not are excluded. In the digital realm, an additional important aspect of access is to make sure that materials are easy to find and use. This requires knowing something about a library's intended audience. For some of the NDCNC digital collections, it is obvious that rural farmers are not the only intended audience. The China Local Opera site (shown as figure 1) contains an

English language logo, hinting that this is a showcase project intended for a global audience. However, the text is fully in Chinese and none of the video controls are bilingual, indicating that the primary audience remains Chinese. The site is a highly curated collection of photographs and video recordings showing not just a wide regional range of materials, but also a wide range of stagings: contemporary and historic, formal and informal. Still: who is the audience? And what is the intended use?

Over the course of this study, I have developed two conflicting narratives in answer to these questions. The first is that the NDCNC digital collections, and other provincial library projects, are intended as showcases of modernization: the digital equivalents of model villages, whose successes are inherently impossible to replicate on a large scale; or, more accurately, the literary equivalent of the spectacular development of Olympic sports arenas and the National Theater. The second, more grounded in the empirical results of my visits, is that the provincial libraries are public libraries in the nineteenth-century mode of public self improvement: they deliver carefully selected content to a constituency that would otherwise not have access to the types of materials being provided by the libraries.

The showcase library is on display in Nanjing: a huge new building in the central business district, little evidence of having rural outreach efforts, digital projects that highlight important figures through history. These projects add up to the equivalent of a traditional fine art museum: a place to highlight the accomplishments of China's high culture. On the surface, many of the other province's efforts are

similar: Anhui province's special collections department is based around one prominent person's collection, and their calligraphy projects celebrate one of China's traditional art forms. These libraries certainly still perform important public service functions, and the new Nanjing Library most definitely has more publicly accessible computer terminals than the old one, but it is difficult escape the feeling that spreading literacy and providing free Internet access are secondary to highlighting the province's ability to afford fine architecture.

This showcase extends online. The Nanjing Library's digital collections are highlights from its physical collections. At the national level, the NDCNC's goal is for "the splendid resources from libraries" to be "preserved in digital form so as to accelerate dissemination and innovation of Chinese remarkable culture" (Wan 2003). On the other hand, in the poorer provinces we have the Shannxi Library lamenting an overall lack of economic development, bottom-up collection development efforts in Anhui, and the Gansu Library creating a local database in cooperation with the province's science and technology department. In this way there is again a spectrum from richest to poorest province: the poorer the province, the more that splendid resources and remarkable culture take a back seat to economic development efforts.

The second access narrative is about the public self-improvement functions of these very public libraries. This is the access function that I was completely unaware of before visiting the provincial libraries. While my initial expectation was to find digitizing projects that were preserving and sharing endangered cultural objects and practices, the western provinces' librarians emphasized that the NDCNC's mission

was to "serve the people" through improving the standard of living in rural areas. They did not mean this in the sense of edifying personal enrichment through access to *the great books,*[30] but rather they meant it in a very practical sense: the provincial libraries are attempting to improve the productivity of individual farmers through the dissemination of agricultural and other public interest instructional videos. While I was surprised to hear the Maoist slogan "Serve the people" still in use, I was more surprised to discover that the main reason, in the eyes of the librarians with whom I spoke, that provincial libraries have been tasked with creating computer labs in small towns that lack Internet access is to train farmers.

4.3.3 Creation of Rural Access Points. Only the two western provinces, Shaanxi and Gansu, discussed this part of the NDCNC, and I have failed to find detailed online documentation. However, the two descriptions of providing access to training videos were so complementary that both provinces are obviously engaged in very similar efforts. In section 4.3.1, I described how these rural outreach efforts resemble agricultural extension in the United States, and that the librarians talked about academic institutions that do agricultural research have no means to disseminate their results directly to farmers. The provincial libraries are using their connections to the administrative structure of the culture stations to create a mechanism to distribute this information.

[30]There was a debate in the early twentieth century, around the time of the Carnegie library movement, about whether popular works should be included in library collections, or if collections should be restricted to nonfiction and canonical works of literature. Occasional controversies about removing inappropriate books from libraries can be seen to be the descendants of this debate.

Part of this mechanism includes delivering services to areas that completely lack Internet connectivity, either because the locations are too remote or too rugged to install high speed connections. In these cases, just as the Gansu Province Library ships hard drives to the NLC because it lacks broadband upload capabilities, the provincial libraries have built computer labs in which the individual machines share information with each other and a local server, but lack connectivity to the outside world. This enables people to play games with each other and to view content on local video servers. These servers contain large, removable hard drives. Occasionally these hard drives are swapped out for ones containing new content. This is a creative solution to the lack of Internet access, effectively simulating the Internet experience without actually incurring the expense of running fiber optic cables or point-to-point microwave towers to these small villages.[31]

Whether actually connected to the Internet or not, the culture stations become, in effect, public net cafes. While they offer basic computer training, the intent seems to be to attract the farmers' attention with entertainment content which is interspersed with agricultural and public health instructional videos. One librarian explained that video is used because local residents are not able to read and only speak local dialects—a striking comment in a country that officially has a ninety-nine percent youth literacy rate (World Bank 2007) and has worked for decades to introduce standard Mandarin Chinese across the country. Moreover, even though Lanzhou

[31]While creative, it is not absolutely unique. Greenstone Digital Library Software, a joint project of UNESCO and the University of Waikato, is designed to run digital collections off of CD-ROM (in the absence of Internet connections) and has an emphasis on enabling locally developed content (Witten and others 2002).

University, located within walking distance of the Gansu Province Library, has a prominent research program in arid lands agriculture, the information is useless for the peasants because it is locked up in scholarly journals, pictures, and text. So while the university and the province's Science and Technology Office (another institution mentioned during my visit) might assist with the production of information, it is ultimately because of the library's access to the Culture Departments' network of culture stations that the libraries are being charged with disseminating the information to local residents.

4.4 Major Themes that Emerge

One of my main questions can now be answered affirmatively: Are national and regional economic trends visible in provincial libraries? Yes: these trends are highly visible, and the libraries turned out to be rich with information about these trends. The homogenous provincial administrative structures helped to strengthen direct comparisons between the libraries. The state, economy, and society are so highly visible in the libraries and their work that these observations are likely possible in other countries with similarly homogenous systems. From this main question three major themes about contemporary China emerge.

First, libraries are significant actors in Chinese life, and are assuming a large role in provincial activities, both urban and rural. The rural outreach programs of the provincial libraries, and the explicit role the NDCNC is taking in improving life for rural residents and urban migrant workers was completely unexpected. In the western

provinces, these functions show a social-services orientation that reinforces the idea that these are very much public libraries. In Jiangsu, the prominent placement and architectural grandeur of the new Nanjing Library reveals that the library is not only an important civic landmark, but that Nanjing itself is striving to participate in the global city system.

Second, as expected, economy is reflected in CHCi. Cultural heritage cyberinfrastructure efforts are intimately tied to China's transitioning economy. The differences among the provincial libraries' efforts to digitize local cultural heritage materials are acute and show different priorities based on two factors: location and wealth. The western provinces are engaged in participatory efforts to identify materials that local peoples find valuable, while the eastern provinces are more engaged with digitizing materials selected by library staff. How wealth affects digitizing efforts is less distinct: the wealthiest province's library is almost completely internally focused and has devoted significant staff resources to its digitizing efforts, whereas the poorer eastern province is going outside of its collections to create original content, but is depending on its own staff to select materials. Libraries in poorer provinces are able to devote fewer staff members to digital collections, and are more likely to be responsive to the directives of national level actors such as the National Library of China, even though there is not a direct line of oversight between the two.

Finally, location matters. China's transition has been purposely regionalized for the reasons outlined in section 2.2, and China remains a country with very distinct

regions that have economic and cultural differences that are emphasized by historical and spatial factors. While the case study reveals no simple correlation between economic development and CHCi, the east to west and urban to rural differences between the provincial libraries' efforts help explain the complex interaction between economy and the state in China. The central government is using provincial libraries to mitigate disparities between urban and rural residents, assist migrant workers, and bring Internet access (or a simulation thereof) to underdeveloped regions show that the Chinese state is acutely aware that moving to a market economy by itself will not modernize the entire country.

CHAPTER V

CONCLUSIONS

Provincial libraries in China, through their efforts to digitize cultural heritage materials, are constructing Cultural Heritage Cyberinfrastructure, which is subject to a complex set of interactions between the state, economy, and society within China. Through these digitizing efforts, and other projects associated with the NDCNC, provincial libraries are part of an ongoing legitimization project of the Chinese party-state. Two of the most visible aspects of this project within the libraries are rural outreach efforts that are seeking to improve rural quality of life and an effort to revive and preserve traditional Chinese cultural practices that help to reinforce the power of the central government.

The NDCNC includes projects that seek to bring Internet access to rural areas (or simulate it in areas too remote to wire). Along with access, the provincial libraries are providing training in basic computer skills and online content that is appropriate to each area. Besides entertainment content, libraries are creating and distributing public health, legal, and farming information in an effort to improve standards of living in the countryside. The National Library of China is also distributing information relevant to urban migrant workers. In this respect, CHCi development in China is part of China's larger modernization project.

The cultural heritage materials that are being digitized are an effort to reinforce a Chinese national identity. Traditional calligraphy, Buddhist and Confucian texts, and other pre-PRC heritage materials that were once suppressed are now being mobilized in support of the state. Provincial library websites present almost exclusively Han Chinese materials—even in provinces like Shaanxi that attract tourists to Hui, Uyghur and Tibetan sites. Even Republican Era materials that highlight the role of the Kuomintang, the traditional rival of the CCP, are being digitized and disseminated.

The end goal of all of these projects should be seen as matching the CCPs larger efforts to promote continued economic growth and social stability.

5.1 Lessons from the Case Study

Several specific conclusions can be drawn that support the general statements above. Each of them draws from the three broad themes that emerged from the case study: that provincial libraries' actor networks extend from local villages to the national level; that CHCi is intertwined with China's economy, reflecting national trends and mitigating uneven growth; and finally that regional differences in CHCi interact with wealth, urbanization, and east-to-west regionalization processes.

5.1.1 Development Policies are Highly Visible in Libraries. Section 4.1.2 showed that many of the people I encountered in China have an acute sense that the country as a whole lags behind the 'developed' world of Europe and North America. This

awareness was often expressed as apologies for a lack of amenities and a desire to learn from western academics. Librarians often used the word *development*, but they rarely talked about China's market transition.

Librarians therefore should be seen as very much engaged in activities that are affected by the market. As pointed out in section 3.3, librarians are very aware of larger economic issues that affect their institutions, including wage pressure created by private industry and the costs of commercial software—even if vended by a state-owned enterprise like a university. Provincial libraries in China, by the nature of their place in the administrative hierarchy, are operating as state entities inside a market economy. Moreover, the skills that library workers develop and use have market value, as does the content and other cyberinfrastructure that they create. While they might not produce revenue for the libraries, value gets transferred to other parts of the economy in exactly the same way that improved agricultural productivity will for the peasants watching NDCNC training videos. These are excellent examples of NIE-type activities: creating free web content; building computer labs in rural villages; working with software platforms common to the library industry. This CHCi development supports a wide range of other types of development: overall ICT development, human development, rural development, and support for urbanization.

The difference between how eastern and western provincial libraries are building their collections highlights a contradiction in China's development strategies. On the one hand, the state is encouraging local entities to experiment and create innovation on their own; on the other, it is strengthening the party-state as it maintains

tight control over the economy and undertakes state-building exercises like the NDCNC and WDS. This contradiction strengthens whenever a successful local experiment is replicated across a wider area. This is indicative of the *de facto* federalism, which was discussed in detail in section 2.2.1 and that I return to in section 5.1.4.

Economic development policies on a larger scale are most apparent in the western provinces, where the Western Development Strategy is providing extra help to Gansu and Shaanxi provinces, although I found no evidence that the NDCNC is part of the WDS. The labor devoted to digitization projects (see again Table 4) is out of step with what one would expect given their overall economic status. The lack of staff devoted to digitizing projects in poor Anhui Province indicates that its CHCi might be stunted, as it gets lost in the wake of its richer provincial neighbors such as Jiangsu and Zhejiang. Moreover, although eastern China generally enjoys better overall Internet connectivity and benefits from spatial proximity to the professional and educational resources of Shanghai and Beijing, the librarians in the two western provinces show a better grasp of the range and scope of their institutions' digital projects. They also happen to be younger, and were likely educated after universities rebuilt after the Cultural Revolution. While I have no way of knowing if this is a representative demographic gap, it does suggest that China still suffers from a lack of senior level managerial expertise. (Note that this would help to explain an early observation form Zhang Hui that information architecture skills are lacking even while software programming skills are profligate.) If Jiangsu and Anhui are more 'important'

provinces with more senior staff managing their libraries, they might be suffering from managers who lack technical training simply because of their age.[32]

5.1.2 Connections to Economic Growth Policies. Closely related to development policy issues is the central government's mandate that economic expansion must continue. The most obvious connection between the provincial libraries' efforts and economic growth is the western province's NDCNC rural outreach efforts aimed at improving agricultural productivity and public health. In one sense, the farmers who remain have to increase their productivity, as the rural population has remained stagnant while the number of people living in cities has increased—therefore the remaining farmers simply have more mouths to feed.

Increasing access to technology also increases the number of people with basic computer skills, which are increasingly seen as necessary for many jobs. Hence, the rural outreach programs and the NLC's dissemination of content targeted at migrants workers' job skills is helping to train the nation's workforce. These efforts might also help to increase demand for personal electronics, which would further fuel China's emerging consumer class.

Again, the fact that the only two western provinces I visited are engaged in these rural outreach activities, including the participatory collection development scheme, is an anomaly. Why is this directive of the NLC being ignored by the Nanjing Library, one of the premier research libraries in the provincial system? One

[32]This is not meant to be a value judgment. There was no indication that the young managers of Shaanxi and Gansu could marshal the resources necessary to build a landmark building like the Nanjing Library.

explanation might be that Jiangsu might already be developed to the point where the provincial hierarchy decided that further economic growth does not need the assistance of the provincial government via its library. Jiangsu does have by far the highest per capita income in my sample (3.5 times that of Gansu Province), and a computer ownership rate of more than fifty percent. There was a time, however, when local industry welcomed the help of the Nanjing Library: twenty years ago when Zhang Hui was driving copies of Western fashion magazines around to local libraries.

5.1.3 State-Building Efforts. Chapter 2 opened with an often quoted phrase from Lucian Pye to the effect that China is a civilization pretending to be a nation-state. The author's point is that China has been struggling to form a modern state since the overthrow of the final dynastic government at the turn of the twentieth century. This final chapter opened by noting that China's state-building efforts are going so far as to highlight the accomplishments of the Kuomintang by re-publishing Republican Era newspapers as part of the NDCNC digitization projects. If the People's Republic is still seeking a master narrative for the excesses of the Cultural Revolution (Weigelin-Schwiedrzik 2006), it is well on its way to building one for the period immediately before its founding.[33]

There are other aspects of Chinese culture included in digitizing projects that reinforce the notion of the unitary Chinese state. I have repeatedly turned to one of the

[33]I was also told while touring Nanjing that KMT flags at the tomb of Sun Yatsen had long been covered and that tour guides would point out bullet holes from the Japanese invasion while ignoring damage to the monument by the Red Guard during the Cultural Revolution. The flags were uncovered and the tour script changed as Nanjing's tourist industry, heavily Taiwanese, grew.

most prominent collections on the central NDCNC website: the local opera database. Although this dramatic form comes from the Qing Dynasty court, and its origins are distinctly from central China, the genre has become a national symbol. Every province, including Taiwan, Hong Kong, Macau, and the autonomous regions, is represented in the database.

While national museums put ethnic minorities in the forefront and Beijing is home to minority research centers and the Minzu University of China (中央民族大学 Zhōngyāng Mínzú Dàxúe, literally: Central Ethnic University), the NDCNC and other provincial library websites are overwhelmingly Han affairs. This typifies the socially conservative nature of official culture, and reinforces the notion that western provinces have been intentionally Hanified since the founding of the PRC in an effort to integrate the western territories into the Chinese state.[34]

The combination of the emphasis on high Han culture, grassroots collection development efforts, self-improvement videos for migrant workers, and computer training for farmers paints a very positive image of the central government. When looked at as an integrated program, the provincial libraries' CHCi efforts cannot help but be viewed as an effort to strengthen the position of the state. After all, the main project examined in this thesis is the *National* Digital Culture Network, not the Provincial Culture Networks. The NDCNC is branded as an effort of the *National* Library—even though the provincial libraries and their Departments of Culture are

[34]A notion well illustrated by the Xinjiang Production and Construction Corps, an SOE that owns one-third of the arable land in the Xinjiang Uyghur Autonomous Region and employs some 2.5 million workers, 80% of whom are ethnic Han People's Liberation Army veterans (Becquelin 2004).

financing the bulk of the work and the provincial culture stations are building the network. The credit goes to the state.

5.1.4 Decentralized Decision Making. One of the socio-political changes accompanying the transition to a market economy is the devolution of economic decision making to the provincial and city level. The NDCNC digitizing program is also a devolution of power. In the case of the participatory collection development efforts, it is a devolution all the way down to the village level.

The Nanjing and Anhui Libraries' decision to concentrate more on digitizing materials from their own collections is another indicator of the constantly renegotiated consensus process that *de facto* federalism forces the central government to engage in with the provinces. Jiangsu and its Nanjing Library appear to have negotiated themselves some level of freedom—at least in its embracing of its KMT and republican heritage. This should not be viewed as the library acting on its own, but rather as a manifestation of a larger trend for the wealthy city of Nanjing.

A librarian in Anhui reinforced the idea of some provinces being more equal than others when he hinted that, even though every province's library is ostensibly at the same position in the administrative hierarchy, not every library has equal power and political influence. This comment matches a statement from Shaanxi that centralized provincial control over the library is beneficial because only that level of government can muster the skills and equipment needed to create the local net cafes. The same librarian presented one of the clearest statements of the *tiao kuai* vertical

and horizontal lines of power through the government apparatus when he made it clear that the central government was not paying for the NDCNC project, that he felt fortunate to have access to funding and labor from the provincial government, but that nonetheless 'Beijing tells us what to do, and we do it.'

Again, the Anhui Province Library seems to be stuck in the middle: it lacks the CHCi to forge its own path like the Nanjing Library and it is not rich enough to hire dedicated programmers and system integrators to build digital repositories. Therefore its librarians are creating digital collections as collateral duties. A more politic view might be to say that *tiao kuai* and *defacto* federalism allow the less technically advanced provincial libraries to take guidance and advice from national experts in order to improve their CHCi. But still, if the local workers cannot implement that advice, what use is devolved decision making authority?

5.2 New Directions for Internet Geography?

Section 2.4 laid out four separate propositions for a new type of Internet geography that is necessary in order to study China today. I called on this new geography to examine:

- how the Internet affects people's lives
- development in a way that does not make assumptions about the various paths of capitalism
- the social processes of firms that construct cyberinfrastructures
- gaps left by quantitive measures of costs and profits

This thesis is an attempt to apply this new sort of geography. In this section I review how each individual proposition was treated by the case study, and summarize the efficacy of the concept of Cultural Heritage Cyberinfrastructure.

5.2.1 The Four Needs of a New Internet Geography. The first proposition is that, in many countries, Internet access is no longer a novelty. In a world where Internet access is becoming increasingly ubiquitous, I called for a geography that looks at how the Internet affects people's lives—specifically how it affects their use of space and sense of place. This thesis has looked at the Internet not as a new, novel communication medium, but rather as one actant within complicated actor networks in China that are part of a larger development project. I have shown how one set of institutions, provincial libraries, is leveraging its education, entertainment, and technical functions into what I call Cultural Heritage Cyberinfrastructure. The emphasis has been on what this cyberinfrastructure is hoping to achieve (improved rural quality of life, improved access to preserved cultural materials, social stability) and on the factors that affect the success of its construction (regional economy, provincial political structures, lingering damage from the Cultural Revolution). The Internet is just one of many factors that are coming together to change Chinese society—it cannot be said to cause change on its own. However, cyberinfrastructures are indelibly linked to daily life, and this thesis has shown how they affect, and are affected by, the Chinese state, economy, and culture.

The second proposition argued that, in a world with an increasing number of alternate capitalisms, we need a geography that explores development in a way that does not assume that economic development will follow the same free market path in all countries. China especially shows a unique post-socialist narrative, and there is nothing inevitable or pre-ordained about how the Chinese state and economy will continue to interact in the future. This thesis has explored how provincial libraries, as state-sponsored organizations with no mandate to produce revenue, are operating within a transitional economy and how the state is directing them to assist with this transition. I found that the provincial libraries, like libraries everywhere, are struggling to retain workers with technical skills who can command higher wages in private industry and are competing for resources from their parent institutions. Each of the Chinese libraries are operating within different sociopolitical and economic contexts, therefore each of their paths is a slightly different reflection of larger forces within society and economy.

Chapter 2 argued against making predictions about what form of government China will have in the future. This thesis has discussed a number of very traditional Developmentalist projects, and even the NDCNC can be seen as a continuation of agricultural extension. But when taken as a whole, the rural development efforts are being undertaken very much on China's own terms because it can afford to do so.[35] This trickles down to the regional level, where some of China's more prosperous areas

[35]While it might be assumed that the current global recession will slow these efforts, Lin (2000) notes that China weathered the 1997 Asian currency crisis because of its central bank's willingness to mobilize currency reserves. China's current stimulus efforts may spare it serious economic damage even as unemployment in the export sector is reaching high levels.

are also writing their own narrative. In retrospect, I can see why so many writers fall into the trap of advocating for or against the inevitability of political change in China. There are real injustices and abuses of power--but these are not unique to China.

After acknowledging that there are multiple capitalisms, the third proposition seeks a further admission that the Internet needs to be studied not just for how it enables the production of revenue, but also for how it has changed the social processes of work. Specifically: if cyberinfrastructure is essential to a modern economy, how do firms go about constructing cyberinfrastructures?

The different paths that the provincial libraries have taken suggest that there is no one way to successfully implement digital collections. The Anhui Library is using existing staff to produce content from around the province, as well as from within its existing collections. The Nanjing Library, large and wealthy, has dedicated staff reaching into its deep collections and digitizing content that is unique to Nanjing's past as a national capital. Neither Anhui nor Nanjing has taken up the charge to extend Internet access to rural areas within their provinces. Whether they are ignoring that charge or that charge is not necessary in these smaller, more densely populated, and ostensibly more developed provinces is unclear. What is clear is that the western libraries, both well-off and poor, are building a physical (net cafes in village culture stations) and intellectual (technical and teaching skills for the local workers, who in turn pass on basic computer skills to local residents) infrastructure to accompany the content that they are producing. The differences in the tasks that each library chose to

share with me are striking, and I have endeavored to explain why these differences exist.

The actor networks that perform these tasks are Cultural Heritage Cyberinfrastructure. By naming the actors and examining their work, and by exploring the ways that they differ among provinces, this thesis offeres a useful concept that moves beyond measuring economic growth by measuring revenue. Instead, development is tied to a complex interplay between the state's efforts to assert and maintain political control and the cultural impact of a newly built consumer society.

Finally, I called for a methodological framework that would paint a richer picture of the Internet. Quantitative measures of how the Internet affects economy paint only a limited picture, and in a rapidly changing environment, often an untimely one. We need a geography that supports the use of a narrative case study to fill the voids that purely monetary measures miss.

While income levels and gross regional product were used to explain some of the demographic differences between provinces, the bulk of the analysis in the preceding pages has been narrative. The idea of the information have-less (Cartier, Castells, Qiu 2005) is a look at the technologies of individuals' lives rather than the corporate use of technology. Whereas the information have-less live at the intersection of technology, the masses, and the market, CHCi lives at the intersection of technology, the state, and the market.

5.2.2 CHCi as a Proxy of Regional IT Capacity. One of the motivations behind constructing the idea of Cultural Heritage Cyberinfrastructure was to see if it could stand as a measure of overall technology development for a province. This thesis has shown that CHCi tied to overall economic situation in a given province, but other factors complicate the relationship between information technology and economy. These factors lead to one important conclusion: Because the evidence shows that, in important ways, the rural, western provinces are exceeding the capacity of wealthy, developed Jiangsu province, it seems clear that the CHCi exhibited by the western libraries is actually an indication of *emerging* regional IT capacity.

In Shaanxi and Gansu Provinces, both in western China, the evidence of strong state support and supervision of the NDCNC projects, as well as their connections to larger human development efforts, helps to explain the relative overcapacity of the provincial libraries as compared to the Nanjing and Anhui Libraries. In the absence of a dominant market apparatus, the state apparatus is taking the lead in cyberinfrastructure development using the institutions it has available to it.

The observations that support this conclusion carry with them an anomaly that must be examined. By arguing that both western provinces exceed the capacity of the eastern provinces, I am intimating strongly that CHCi in the Gansu Province Library exceeds that of the Nanjing Library. At face value, it is difficult to argue that the capacity of anything in Gansu exceeds that of Nanjing. Jiangsu and Gansu provinces are simply too different—almost at opposite ends of China's economic spectrum. I offer two explanations for this seeming anomaly. First, if the two western libraries

have a greater ability to take on projects outside of their immediate institution *and* are engaging in digitizing projects that require the same sorts of technical expertise, then it would seem that the Western Development Strategy is having beneficial effects for Gansu and Shaanxi provinces. This supports the idea that CHCi is actually measuring *emerging* capacity. Second, there is a possibility that the success of the market transition is actually stunting CHCi in the advanced parts of the country. If, as speculated in section 5.1.4, Jiangsu's economic success is allowing it greater freedom to make its own decisions, then someone is choosing to concentrate on making a big beautiful library in Nanjing rather than on providing actual library services. In the long run this could develop into a problem for the Nanjing Library. Moreover, this situation presents a problem for provinces such as Anhui. If the WDS is in fact taking hold, then the cultural institutions of poor eastern provinces will be left behind, their cultural institutions left in a ghetto space between Shanghai's and Beijing's huge CHCi capacities that spring from their prominent global positions, and the heavily subsidized CHCi created by the central government's subsidizing of western provinces. My visit to the crumbling Hebei Province Library provides evidence in support of this.

5.2.3 CHCi as a Different Type of Development. Assuming that the anomalies I encountered are not simply due to taking too small a sample or being able to communicate effectively, this thesis offers a foundation for a qualitative metric of technology development. The overall information technology infrastructure of a city, region, or country cannot be measured simply by counting the number of computers

per household or miles of fiber optic cable; nor can one judge an economy based simply on Gross Domestic Product, nor the overall level of human development on the World Development Indicators. These are useful metrics, but they are incomplete.

The popular business literature suggests that some combination of capital investment, management expertise, and successful business models produce successful economic development. Taking a cue from this observation, in my research I tried to assess how well the librarians were able to articulate the overall process of building CHCi. This strategy was particularly effective in light of Zhang Hui's warning that Chinese libraries lack information architects: those workers who can steer a digital collections project from concept through to execution. In the end, despite librarians' lamentations that their situation is dire because they are poor, it was clear that the poorest province that I visited, Gansu, is successfully implementing CHCi projects. And in Shaanxi, with half the population, less than half the average income, and twice the territory of Jiangsu, the library displayed an ability to create and disseminate digital information equal to that observed in that rich, coastal province—it is just choosing a different type of content.

This type of qualitative evaluation of technology development avoids over-equating size with quality. Throughout this investigation I could hear how the libraries' actor networks produced and disseminated agricultural information. And through careful observation I could see poor quality images and missing metadata, even if I could not read the details. And I could see Cultural Heritage Cyberinfrastructure perhaps being stunted by an overemphasis on grand physical

spaces and lack of outreach activities. This is not to condemn the management of the Nanjing Library. Those in charge are making a choice as to where to place the library's priorities, and in a very real way the library has already completed its task of assisting with the economic transition in Jiangsu. It may not be building CHCi because it feels it need not.

This particular form of development can be validly measured through the careful observation of technical and organizational capacity. Not only is this possible, but it leaves room to explain some of the anomalies that are encountered when using other measures. For example, the unusually strong CHCi encounetered in Gansu is evidence that the central government's attempt to mitigate uneven economic growth is succeeding. It is possible that smaller organizations might more successfully adapt to technological change, especially given the post-Cultural Revolution management gaps that developed.

5.3 Implications

This thesis has offered specific observations about the economic transition in China and the important role cyberinfrastructure plays in the Chinese state and economy. Cyberinfrastructure is often cited in the global network city literature for its role in enabling more efficient capital flows and post-Fordist industrial supply chains, but I have argued that this view is limited, and ignores important actors both in China and in the global city system. These conclusion have implications for the wider practice of geography, both in China and beyond.

First, Internet geography is not just urban and economic geography. The emphasis that this thesis placed on rural issues was not preplanned. Instead, rural issues were presented as important by the librarians whom I visited in China. While the overwhelming majority of the Internet literature deals with its use in urban (or often suburban) settings, the emphasis that the Chinese are placing on the Internet in rural areas is likely not unique. While I went looking for cultural preservation leadership centered in large provincial capitals, I was pointed down the spatial hierarchy to agricultural education in small rural villages.

The actor networks that I observed are social and cultural phenomena, affected by institutional structures as well as by individual human actors' guanxi (connections), power, and personalities. All of these factors in China are colored by the strong influence exerted by the idea and the physical reality of *the countryside*. Where peasant and subaltern scholars might condemn the lack of access to technology in these rural settings, I failed to find any of them studying how cyberinfrastructure is currently affecting the countryside. This is a gap that this thesis barely addresses, and would be fertile ground for additional study.

Second, Actor-Network Theory was found to be a useful theoretical and methodological stance to adopt when observing cyberinfrastructure. Lin (2002) observes that until recently China geography has not been as theoretically engaged as the rest of the discipline. He notes that on-the-ground studies are becoming more common as the country opens itself to foreign researchers and rebuilds the academic infrastructure that is still suffering the effects of the Cultural Revolution. This new

openness, and the access to librarians and academics that it presents, allowed me to complete a comparative, multi-province study in a sector where quantitative measurements remain either undependable or unavailable and in locations where I had little access to detailed textual information.

One remaining open question is whether or not the analytical trope of Cultural Heritage Cyberinfrastructure constructed with this framework can be used to validate larger economic development observations. While this study uncovered enough anomalies between the levels of CHCi development and the relative economic status of the observed provinces to lead me to posit that CHCi is in fact a complementary description of development trends, exactly how it might be useful in other contexts is open to debate.

Using ANT allowed me to develop a case study that begins to show the complexity of regional variation. One of the more surprising observations was the relatively strong east-west divide encountered, which ran against the expected differences along economic prosperity lines. Shaanxi and Gansu Provinces, ranking twentieth and thirtieth in GRP, respectively, had much more in common with each other than either did with Anhui (twenty-eighth) and Jiangsu (fifth). Yet the Anhui Province Library and the Nanjing Library (again, serving as the Jiangsu provincial library) shared only a lack of rural outreach as a common trait.

All this said, it is possible to compare the relative CHCi development successes between provinces in China; like economic and human development, success is uneven. However, because of interventions by the strong central state, this

unevenness manifests itself differently. CHCi is stronger in the west because of heavy state subsidies that are parts of the larger Western Development Strategy. Moreover, there is some evidence that the emphasis placed on western provinces is creating a situation where poor eastern provinces are lagging behind, not just in economic growth, but also in CHCi development. This would suggest that investment in public sector CHCi shows results ahead of investment in market infrastructure.

Finally, this thesis shows that, in economic geography, the nonmarket, nongoverning sector is sometimes neglected. Section 2.2.2 observed that China geographers are focused on measuring the impact of China's commercial activities and speculating on the future of its one party political system. Emphasizing the economy is understandable because of the massive social and spatial changes that have accompanied the truly incredible economic growth over the past thirty years. As discussed, the political speculation is sometimes read as unnecessary interference (especially by Chinese nationalists), but scholars more often criticize such speculation as assuming that liberal democracies are the inevitable outcome of economic prosperity.

These assumptions help to explain why nongoverning institutions in China are neglected actors in China geography. Those who would argue democracy in China is inevitable would likely also are that if all state-sponsored institutions are tools of an unjust political system that is in its final days, then these institutions can only be targets of criticism, not objects of study. However, even with their intellectual freedom restrictions, Chinese libraries are a fertile ground for research in a China with

burgeoning social, cultural, and political strength. In private conversations, librarians and other people that I encountered acknowledged political difficulties, but were quick to point out that direct interference in personal affairs were a concern for their parents' generation, not theirs. A few people revealed that restrictions on Internet content are easily subverted. The only real ideological issue I encountered was a concern over a lack of accurate portrayals of the excesses of the Cultural Revolution.

These issues aside, the provincial libraries of China are a set of government institutions that interact with the economy, even though they are not directly involved in governing or revenue production. China is constructing a development narrative unique among emerging nations. Its great wealth might preclude inclusion in the category of emerging nations, but uneven development persists in China in the form of a vast income and standard of living divide separating various segments of Chinese society: rural and urban, east and west, literate and lettered. As long as the state apparatus' main goal is to maintain stability through economic growth, it will to mobilize every tool at its disposal, market based or not, to achieve that goal.

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