

The Dragon's Tail: Utilizing Chengdu and Chongqing Technology Development Zones to Anchor West China Economic Advancement

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Abstract:

This research examines the role of post-1999 'Develop the West' policies in promoting accelerated economic development in Chengdu and Chongqing, the two largest, spatially proximate metropolitan centers of western China. Differences between these two cities test theories regarding utilization of characteristics that flow from a place's location, history, political-economy, and cultural resources. Chengdu serves as the traditional capital of Sichuan province. The mountainous setting of Chongqing relegated it to a military-industrial complex dominated by state-owned enterprises. Its new autonomous status and completion of the Three Gorges Dam will solidify the city as the western edge of the Yangtze. It is argued that geographically reinforced historical cultural patterns form the basis of systemic problems. A key difference between the two cities lies in their different utilization of university research, a proxy for openness to information fueling change. Statistics and interviews accumulated in both cities flesh out this comparative examination of two major geographical bases for economic dynamism in west China.

Key Words: Technology, development zones, western China, geography

JEL Classifications: R12, R58

Article:

Introduction

China's rapid economic development following new policies promulgated in 1978 led to a rise in internal regional disparity that risks incurring domestic instability, especially along a rural-urban and coastal-inland divide (OECD, 2001). Proclamation of the central government's 'Great Western Development' (GWD) policy (Xibu Da Kaifa) in June 1999 signaled a major escalation in resources and attention focused on decreasing the development gap between the east coast powerhouse metropolitan regions and the 12 provinces of the increasingly lagging western region.¹ Comparing the economic performance of east coast and western provinces based on gross domestic product (GDP) generated from 1980–2000 (Table 1) finds the ratio gap increased steadily from 2.98% to 4.33% – a clear indication of the yawning disparity divide (Yeung & Shen, 2004). Although the GDP 2002 figures in Table 1 show that Shanghai appears five times as prosperous as either of the virtually identical west China cities, and is still almost double the figures for Beijing since 1980, the rate of increase for Chengdu and Chongqing – at over 200% – shows the effect of central government investment over the situation in 1990 when Shanghai was seven times more prosperous than these cities.

Table 1. Change in per capita GDP in selected coastal and interior cities

City	GDP 1980/Rank	GDP 1990/Rank	Change
Shanghai	2,738/1	30,805/1	28,067
Beijing	1,582/2	19,803/2	18,221
Guangdong	473/8	11,739/5	11,266
Chongqing		4,852/20	
Sichuan	315/24	4,356/24	4,041
Guizhou	219/30	2,463/31	2,244

The critical question remains as to whether preferential policies will prove sufficient to transform major urban growth areas in west China by utilizing strategies developed elsewhere. Tax and other fiscal incentives may prove less than needed to offset distance costs for inputs and export shipment to major markets. Constructing development zones to attract foreign and domestic relatively high technology industries forms a key part of China's national and internal regional economic advancement plans. This approach concentrates scarce human and fiscal resources into nurtured locations where they are most likely to grow and spread economic benefits (Wang, 2002). Encouraging technological development as an integral part of China's development began in March 1986 with the '863' plan to facilitate technology transfer from universities. The 'Torch' program, launched in August 1988, encouraged small and medium size businesses. That year also saw the first high tech zone established in Beijing. The '973' plan (March 1997) singled out six 'key pillar' technology areas for development funding support. Xi'an's Jiaotong University-connected high tech park, established in 1987, was the first in western China. The geography that historically isolated China's western interior region presents challenges in an era where connectivity brings economic prosperity. Linking major urban economic development centers in west China through policies focused on promoting elevated technology clusters constitutes an attempt by the government to configure special spaces for regional advantage in an especially difficult place.² The two cities profiled faced similar Western region location challenges and benefited from similar government incentives. The different outcomes flow from consequences of human choices in relation to promotion of idea flows, as illustrated by the role of technology transfer from universities or other sources.

Numerous studies of urban economic development based on clusters of technologically advanced companies demonstrate that the crucial factor for success lies in learning enhanced by information flow, which is promoted by spatial propinquity among participants in the value chain.³ External factors include relatively inexpensive land, financial and physical infrastructure, decreased red tape, and the ability for companies to obtain specialized labor. Internal factors – those elements necessary to promote easy transmission of tacit information within circumscribed space – rely on readily available and welcoming places for information accumulation and exchange. These spaces of flows enhance learning and thereby innovative improvements in products that in turn attract companies and employees to that location (Audretsch & Stephan, 1996). The setting crucially advances vital adventitious tacit knowledge transfers and underlying trust-building opportunities.

This examination focuses on science and technology industrial parks contained within western China's two largest cities. Created in March 1997 as a national-level municipality, Chongqing contains the largest area and population of any city region in China. On Chongqing's western border, Chengdu serves as the historic capital of Sichuan province. At the turn of the 21st century, these two cities ranked first and second in GDP (Gu et al., 2004). Although national policy is directed to 'The West' as a region, the municipal level is the most appropriate scale for assessing likely outcomes of this policy, since resources were directed into designated projects (poverty alleviation, minority mitigation, economic infrastructure building) rather than away from the east as a whole (Goodman, 2004). Given the similarity in national policies and the shared west China regional location, differences between the two cities must reflect their particular physical and/or human framework. This study points to human relationships as being decisive.

Crucial differences exist between the two metropolises as well as from the demonstrably successful east coast urban innovation areas such as Beijing, Shanghai, and Shenzhen.⁴ Five major models, all based on east coast areas, characterize post-1979 contemporary Chinese development patterns. The Sunan model, from southern Jiangsu province, benefited from township and village enterprise collectives. The Gengche model, based in northern Jiangsu, profited from strong village organizations. The Pearl River Delta model, from areas around Guangzhou in Guangdong province, features small- and medium-size enterprises flourishing from investments by overseas Chinese with familial ties to the area and its convenient location close to dynamic Hong Kong. The Yangtze River Delta model, epitomized by the Shanghai area experience, relies on large firms with foreign direct investments and government contacts. The Wenzhou model, from Zhejiang province, serves as the most capitalistic example of small and medium enterprises financed by pooled household funds. While the delta models are essentially export oriented, the others cater to a largely domestic market. Success relies on outward

orientation in each instance. This study assesses the transferability of these models to another internal Chinese location.

Due to the newness of the policy and the time needed to assess implementation outcomes at this early stage, few research studies of west China development currently exist. In the present era of renewed interest in West China development,⁵ the obvious development gap with the east coast led policy makers to propose an urban technopole focus to funding efforts. This enabled more efficient concentration of scarce resources in spatially defined areas such as technology parks, a popular strategy in developing countries with limited resources (OECD, 1987; Castells & Hall, 1994; Fan et al., 2001). East coast areas benefited from spatial designations around their ports, promoting ease of transit whether importing parts used in manufacturing in tax-free zones or export efficiencies due to coastal connections to major shipping facilities. Western region cities needed extra efforts to overcome their distance disadvantage and isolation from other major urban areas to which trained workers were migrating. Technopole targeting sought to stem this tide by creating local growth engines that would nourish the surrounding areas supplying material and labor inputs. The cities of Xi'an, Chengdu, and its suburb of Mianyang remain the most advanced research bases for products with high technology infusions (Gu et al., 2004; Walcott, 2003b). A key factor, as in the east coast areas, lies in their connection with local universities generating commodifiable ideas and external promoters.

Places need to assemble an attractive package of amenities to entice and hold people who produce these ideas and connections. This study accentuates a critical problem absent in much of the literature and policy rationales discussing western China's development policies and prospects: quality of life considerations. Policy makers and critiques concentrate on neoclassical economic fiscal incentives such as cheap land and reduced taxes. Analyses of why it is difficult to retain highly educated and skilled labor, on the other hand, invariably cite the lure of large eastern cities with more comfortable living conditions. Other issues heavily impacting foreign investment and settlement are also absent in the literature, from international schools and intellectual property protection to sanitary conditions, water and air quality, and cultural entertainment. China's policy for developing the western regions includes infrastructure construction, tourism and natural resource utilization pieces. For the portion tailored to increasing high technology intensity, this wide web of support amenities is vital to compete with other location choices such as east coast cities, all trying to lure scarce highly skilled labor.

This paper assesses whether a network of types of labor, companies (including multinational companies as a critical learning factor in China), universities (whose productivity value can be measured by factors such as patents generated, national rank of faculty, and number of science and engineering graduates), production inputs, distribution links, and other vital factors exist to create positive synergies for prosperous and innovative development. Park & Markusen's (1995) study of Asian adaptations to developed world business park models provides a similar set of benchmarks for measuring the maturity of Chengdu and Chongqing in a relatively lagging region within China's vast interior. This study also considers how urban boundaries are changing under the impact of development park clusters, the nature of relational networks in place, impacts of cultural components, and localization economies at work such as absorptive capacity (Stephan et al., 2004).

Primary methodological tools, beyond surveying the literature, included a series of interviews in each city, following the general format of a bilingual survey that was also distributed in Chongqing. Development park and university personnel were contacted and requested to introduce the author to several businesses with which they are connected. This yielded interviews with five individuals at Sichuan University, three officials at Mianyang 'Science City', three pharmaceutical company executives, two IT company officials, six technology park officials, and one US Trade Office official. Fourteen involved Chengdu connections, with the remaining six in Chongqing. Work in these cities took place during the summer of 2004 over a period of several weeks. Interviews followed up on the questions asked in the survey instrument, seeking to establish the connectivity between sources of research, funding, market orientation, and between companies in each location.

This first introductory section outlined major characteristics important for enhancing technology-based economic growth. The next section begins the empirical piece by outlining salient characteristics in the cities of

Chengdu and Chongqing. The analytical section then emphasizes the comparison between these two major west China urban centers. A key contention of this research, and an area for future investigative monitoring, asserts that significant place-based distinctions exist and need to be recognized for tailored development potential. The conclusion highlights the two metropolitan areas' comparative strengths, weaknesses, and lessons for other regions seeking to develop rapidly by utilizing technology and clusters of companies in special zones to fuel their growth.

So Close, and Yet so Far Away ...

Emphasis on the west of China kicked into high gear with the 1999 proclamation of a 'Great Western Development Strategy', implemented the next year with the creation of an Office of the Leading Group for Western Region Development under the umbrella of the State Council. January 1, 2001, marked the launch of the 'Decade of Western Development', with the national government wielding the principal tools of infrastructure and tax policy assistance. Development continues to be a major challenge however, especially for nurturing a technology base as practiced by other rapidly developing regions. Western China is ranked low in key areas such as low education attainment, poor institutional reform, restrictive conservative thinking, insufficient internal and linkage infrastructure, an economic base strongly reliant on state-owned enterprises, and insufficient attention to designing policy tailored for local and regional differences. The following subsections provide a more detailed picture for each municipal region featured.

Chongqing

With a population of 31 million (4.8 million in the urban core) and a declared political area of 82,000 sq. km. in 2003, Chongqing remains primarily a manufacturing town with a focus on producing automobiles, natural gas, chemicals, weapons, instruments, and agricultural products. Building on its base as a 'Third Front' military-industrial site, Chongqing's industries now produce 'dual use' products such as motor vehicles and electronics (Naughton, 1988; Frankenstein, 1997). The national government signaled a major policy change in the city's profile in 1997 when it raised Chongqing to the level of a provincial municipality (like Beijing and Shanghai). Separated from Sichuan province and made its own special municipality, and extended to contain the world's largest damming project on the Yangtze River, Greater Chongqing comprises the largest urban region in western China. Ambitious urban development projects within Chongqing's Economic Urban Region include the Economic Technology Development Zone on the southern edge of the city, the High and New Technology Development Zone to the west, and a massive high technology corridor to the north (Gelb & Chen, 2004; Chengdu, 2004). In the year 2002, the most recent year for which figures are available, the scientific research and services sector employed 47,300 individuals. Gross industrial output value of electronic and telecommunication equipment (in 100 million yuan) was only 10.79, compared with ten times that for Shaanxi province (basically Xi'an), 591 for Beijing and 839 (also in 100 million yuan) for Shanghai (National Bureau of Statistics, 2002). Major electronic information projects in Chongqing involved building government and infrastructure capacity, from e-government and network operations, distance-education, digital library, and harbor projects (Chongqing Science & Technology Commission, 2004).

A survey of resident businesses conducted for the author by the Chongqing Hi-Tech Industry Development Zone office yielded a summary of responses from IT and pharmaceutical companies representing the major types of businesses in the Zone. Major foreign companies present in Chongqing in this category include Ericsson Communications and Nokia, along with Phillips, British Petroleum, Ford and Honda. They are greatly outnumbered by Chinese companies, particularly large state-owned enterprises. Ten companies responded to the survey administered by the administrative office. Reportedly, the primary considerations for companies to be in the development zone came from government incentive policies and government-funded infrastructure provisions, including roads and Internet links. Leadership in the Zone came from the administration, with no internal companies providing alternative organizational linkages. This pattern seems to be quite prevalent in China, reflecting both the government structure and the newness of capitalist companies. In contrast, the situation in developed countries such as the United States and among multinational companies in China includes industry associations among all in the same sector, such as biopharmaceutical companies, or accountants as an occupational category (Walcott, 2003a). For the pharmaceutical survey, local business links

came almost entirely from companies involved in packaging (cardboard material), transportation, and product distribution. The survey form, in both Chinese and English with a bilingual explanatory covering letter, was designed by the author and distributed by the Chongqing technology park management.

Chengdu

With a core city population of 3.4 million (metropolitan population 10 million) in 2003, Chengdu continues to be the historic, cultural, and economic capital of Sichuan province. The city complements the Yangtze Basin-oriented role of Chongqing by orienting itself toward other regions in southern and further western China (Han & Wang, 2001; Webster et al., 2003). Chengdu successfully attracted major transnational corporations specializing in high technology projects, such as Microsoft, Intel, and Motorola. These companies see Chengdu as the urban hub of a province with 43 universities, 184 government-connected research institutions, 1.2 million scientists and engineers, and the home of Sichuan University with 60,000 students. Set up in 1991, the High-Tech Industry Development Zone covers 67 square kilometers. Corporations including Alcatel, Intel, D-Link, Ericsson, Mitsui & Company, Motorola, Siemens, Fuji Heavy Industries of Japan, and more than 200 other firms have set up facilities in the area's special technology districts. Chengdu capitalizes on its location close to areas rich in traditional medical plants, with the University of Chinese Medicine serving as an important center for development of this rival to 'chemical' pharmacopeias from more developed countries (Liu & Shiu, 2004; Chengdu, 2003).

With a focus on electronics, IT and pharmaceuticals, similar to Chongqing's declared high technology industrial emphasis, the zone also features an 'incubator' (since 1996) and 'startup parks' for highly educated college graduates and returned students (since 1998).⁶ The incubator holds 289 hopeful companies, whose 313 overseas returned students had a combined total of 100 new companies initially started by the turn of the century.⁷ Relatively few projects have matured to graduated commercial ventures however, with lack of business expertise and maturity a major factor. Little research was independently conducted, and work appeared to be of an assembly nature. According to a university technology transfer official, research work is also undertaken on behalf of non-local companies on the east coast. Shanghai in particular sees a sister city-type relationship – encouraged by the national government – with upriver inner China businesses and labor seeking to utilize their lower cost but high quality skills. The medicine base consists of both traditional/herbal and developed nation/chemical preparations, but again features basically assembly functions and local ingredients. Sanitary conditions are less stringent than those observed in either foreign multinational companies or top Indian biopharmaceutical companies, indicating lax standards and a local market. These companies, however, were hugely successful and highly profitable (personal observation and interview communications). Infrastructure linking the industrial park constructed around these featured companies is linked by good highways to larger cities in the area, making possible a supply of needed parts and labor.

Related parks and designated zones include an export processing zone (1991), an 'Across-straits Science and Technology Industrial Park' (Taiwan-linked) in suburban Wenjiang, a Singapore Industrial Park (1994), and a 'Southern Railway Processing and Trade Zone'. The southern side of Chengdu includes a New Deputy City Center (similar in function to Chongqing's northern extension), acknowledging its role as a center for 'R&D, education, culture, and the hi-tech endeavors' (Chengdu, 2004). In response to the province's drive to secure companies in its two top target areas of electronics in information technology (IT) and biomedical engineering, Chengdu ranks third in China's technology-related sales revenue from its parks, after Beijing and Guangdong (CSB, 2003).

Comparative Analysis

Both cities feature similar types of economic development parks. Chongqing's Northern New District and ETDZ, built on state reclaimed land that was leveled for construction of a vast second city, dwarfs projects elsewhere. Older portions of the Mountain City resemble Hong Kong's tightly packed dense verticality. The Northern New District's purpose is to house a modern, dispersed metropolis for high technology, high income, and international functions. Adamantly persisting attitudes color the picture. Despite the listing of six university parks in Chongqing, the dubiousness of the contribution of academics expressed by economic development

officials limits the utility of this potentially innovative source. It also contrasts sharply with the entrepreneurial involvement of Sichuan University in incubators and lab-to-bench technology transfers in Chengdu, some of whose products have become nationally prominent, such as 360⁰ airport navigation simulators.

Figures 1 and 2 compare the technology productivity of major east coast and western interior cities to each other. The number of scientists and engineers in the three national-level cities of Shanghai, Beijing and Chongqing roughly reflect their different population size, and the draw of prominent universities in the first two locations. Sichuan dwarfs Chongqing due to the prominence of universities in greater Chengdu. Shaanxi, a poor interior province, outperforms all the other areas in its wealth of scientists and engineers due the Third Front importance of Xi'an's numerous technical institutes (Walcott, 2003b). The same three outstanding locations of Shaanxi, Sichuan, and Shanghai show up when technological innovativeness is measured by the number of patent applications granted from 1997–2002. If science and technology are proposed as the drivers of west China development, Chengdu and Xi'an are the rocket engines. Their universities are the most prominent and prolific producers in the western region of graduates majoring in science and engineering, turning out patents, and fueling economically-linked innovations.

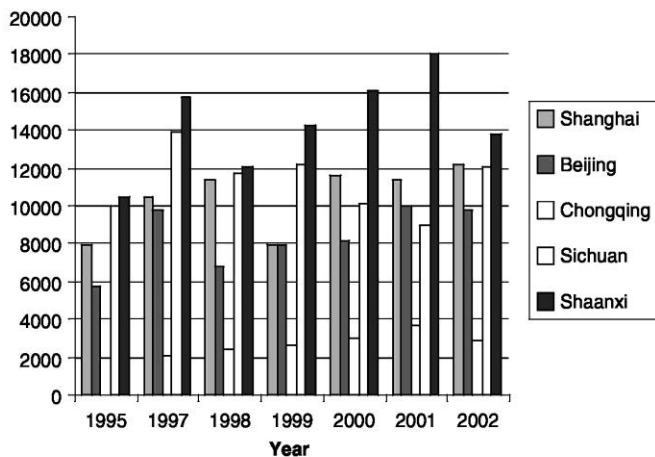


Figure 1. Scientists and engineers in comparative areas
Source: China Statistical Yearbook, selected years.

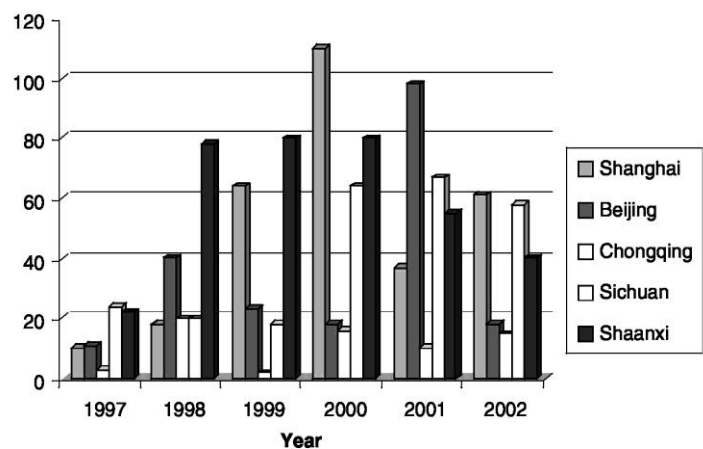


Figure 2. Patent applications granted
Source: China Statistical Yearbook, selected years.

Although some observers noted the paucity of an international presence in Chengdu (Schneider et al., 2003), it exceeds that apparent in Chongqing and is only lacking relative to large east coast centers such as Beijing, Shanghai and Shenzhen. Chengdu, rather than the larger Chongqing, hosts three international schools and the US consulate (among other diplomatic representations), in addition to more foreign representative offices than its neighbor national city-province. Figure 3 charts the flow of global capital – an important source of development funds in east coast cities – from 1997–2000 into the metropolitan area of Chongqing, Sichuan (largely represented by Chengdu) and Shaanxi (largely represented by Xi'an) provinces. By 2000 foreign direct investment (FDI) in Chongqing had fallen to the initial level of Sichuan (Chengdu), which had risen steadily to surpass the other two cities by 1999.

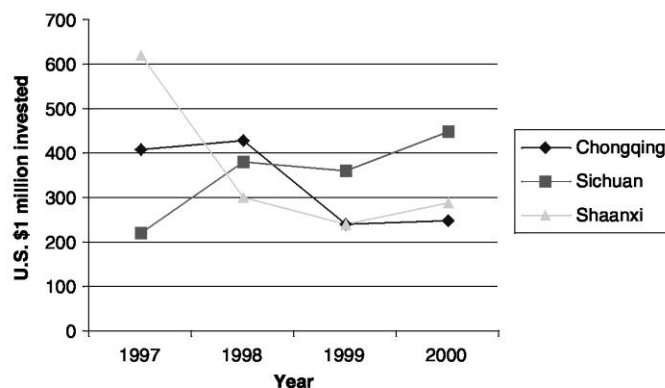


Figure 3. Foreign Direct Investment (US \$1 million)
Source: China Statistical Yearbook, selected years.

Ironically, in the city whose wartime boom in population came in response to Japan's invasion and occupation of the north and east coastal areas of China, Chongqing now happily hosts three major Japanese automobile manufacturers. The vertical city also produces three of the top five best-selling Chinese motorcycles, even though China's globally dominant bicycles are too difficult to use in Chongqing's mountainous terrain. The city's military past tilts it to heavy manufacturing, as well as military industrial goods from sturdy vehicles to digital display technology. In medical supplies, Chongqing's research output comes from the large Military Medical Hospital #3, whereas Chengdu's comes from Sichuan University's famous hospital facilities and the Chengdu University of Traditional Chinese Medicine.

The following section contrasts the two proximate municipalities in several explicit areas. New urban boundaries containing technology districts extend old developed areas in different sections of each city (Deng, 2003). Chongqing's 'Northern New District' forms the most striking extension, given the paucity of flat land and the intensity of agricultural development in its vicinity. Although planners declared that the land was empty, and flattened by machinery, other studies belie this assertion. Expansion of urban land use in Chengdu from the late 1970s through the early 2000s indicated acceleration in every direction, but principally to the west and along major highway arteries. This pattern indicates Chengdu's primary orientation and service area to populations in the more remote southwest, rather than increasing integration with its neighboring metropolitan Chongqing. Challenging topography between the two cities, and lack of smooth or speedy transportation access, contributed heavily to this skewed direction.⁸ It also signals lack of coordination between city leaders in the two giants, western China competition rather than cooperation, and is indicative of Chongqing's continuing isolation.

Economic zones border on pre-existing satellite towns, and drive their economic growth. New leisure activity centers featuring restaurants and fountains styled in the form of classic architecture are designed to attract the anticipated new wealth. The city of Chengdu itself is famous for its restaurants, tea shops, and proliferating places for leisure service establishments. The broad pedestrian mall in the new deputy center includes eateries, movie houses, bowling alley, major department stores, and coffee and tea shops with international names. A large restaurant complex adjacent to the technology center on the south side, its towers of new apartments and latest (third) extension of Sichuan University, also attest to the new prosperity fed by technology-related growth. Chengdu's boundary bulge occurs on its southern border, with a mixture of companies linked to innovative developments at Sichuan University and service and leisure establishments linked to the income generated by such positions. Rows of rapidly sprouting upscale apartments fill in the blocks behind multinational businesses and domestic high tech or leisure companies such as cars and computers.

Plans for both nearby cities include greatly improving transportation links between them (a train now takes 12 hours to wind through intervening mountains) so that they can complement each other by linking to air, water, and surface transportation routes. At present, the most time-efficient connections are by air and a freeway. Internally each city (and particularly the previously less well-developed Chongqing) is designated for upgrades in their logistics infrastructure, public services, and roads. Areas along the transportation roadways are also designated for expanded medical and health provision.

Although research institutions in Chongqing recently opened several small industrial development parks, municipal development officials disparage their output and express doubt as to the ability and transferability of contributions by academics. Traditionally, universities in China were either academic (theoretically oriented) or funded by entities of the State for solving very specific problems. Policies promoting younger, more innovative and entrepreneurial people to leadership positions in major universities such as Sichuan University in Chengdu and Beijing's Tsinghua and Peking University – producers of major national Chinese politicians – led to much more applied research and company spin-offs. The huge size of state-owned enterprises in Chongqing also does not bode well for change and innovativeness. When the 'people's money' is at stake, decisions tend to be cautiously conservative, according to interviews. Reflecting its importance as a Third Front site, Chongqing remains a place with a high degree of military influence. Companies currently producing automobiles for the domestic market got their start making military vehicles. The major hospital connected with medical device and

biopharmaceutical products is also managed by the military. Despite its large size preponderance, Chongqing contains only slightly more multinational companies than does Chengdu (122 to 98), is burdened with twice the number of often borderline insolvent state-owned enterprises (2054 to 1318), has only slightly more universities (29 to 22), and far fewer college students.⁹ Comparing North American companies in the two cities (Table 2), Chengdu contains 88 listed US companies in a wide variety of areas, while only nine reside in Chongqing. IT companies show the greatest difference, with 21 (the largest category) in Chengdu and none from the US in Chongqing.

Table 2. Major sectors for North American* Businesses in Chengdu and Chongqing

Type of Business	# in Chengdu	# in Chongqing
Infrastructure	3, C	C
Telecommunications	4, C	C
IT	21, C	C
Energy related	6, C	1, C
Mining & metals	2, C	C
Law	2	
Finance, Insurance, Real Estate	4	2
Agribusiness	C	
Forestry & paper	2, C	1
Environment	2, C	C
Hydroelectricity		C
Pharmaceutical	6	C
Security	1	
Medical equipment, services	4	
Freight, shipping	1	
Fixtures	2	
Aviation	5	
Cosmetics, personal care	4	
Construction	5	
Food & beverage	8	1
Photo	1	
Supermarket	3	
Automotive	1	3
Hotel	2	2
TOTAL	88	9

*Identified by Canadians as major area for businesses in China.

Source: US Trade Representative Office, Chengdu; Canadian Trade Rep publication.

Revealing an important indication of Chongqing's bureaucratic attitude toward innovation, development zone representatives in Chongqing expressed doubt as to the feasibility of university science and technology parks. They saw instead an impractical connection between academic research, traditionally focused on theory development and teaching, and the practical demands of innovative market-oriented production. Some local entrepreneurs and planners felt that a zero-sum competition scenario existed wherein if some people gained access to resources, others necessarily lost by being differentially disenfranchised. Sichuan University's leadership in Chengdu, and the demonstrated success of several professor-led discoveries to commercial ventures, shows that, as in the West, such technology transfer bench-to-market moves are possible. Attempts to influence Chongqing's political leadership reflect the central government's concern with opening 'the mountain city' up to more fast-paced and globally integrated ways of operating. A recent deputy mayor was transferred from Shanghai specifically to bring a model of more innovative and broader scale ideas into municipal governance and economic development. Many beneficial changes are attributed to his leadership influence, but it takes time for the development of an entrepreneurial attitude. Chongqing's ties to Beijing's beneficence form both its historic strength and possible future weakness. Saddled with hemorrhaging SOEs, a high number of low income agriculturalists, a sense of claustrophobic isolation and consequently low FDI, Chongqing's ties to the central government's purse strings remain its main opportunity to transcend a historic disadvantage relative to the provincial capital of Chengdu (Hong, 2004).

Chengdu remains the more outward-oriented, intellectual and foreign investment capitol, outranking Chongqing by having more than double the amount of foreign direct investment from 1999–2001 and multinational

companies overall (Figure 3; State Statistical Bureau, 2000–2002). Chongqing is favorably tied to its geographical edge as a river shipping port linked now to the east through the tamed Yangtze and as a military-industrial base with transferable technology, similar to Xi'an. This unique link may end up defining Chongqing's position, however, while Chengdu's entrepreneurial intellectual edge fits as an aspect most relevant to the base of a new economy. The quality and quantity of information flows within high tech zones as new container districts constitute a critical factor for assessing their sustainable success in creating profitable products. Interviews with both company and development zone representatives in both Chengdu and Chongqing did not seem to place heavy emphasis on information sharing, seeing other firms as rivals and meetings as ways to disseminate information from a knowledgeable source to the corporate receivers. Receptivity of bureaucrats to outside inquiries varies markedly between the two cities, in the experience of several recent researchers.¹⁰ This point underscores a critical attitudinal distinction at the root of differences between east and west coast, as well as the two major cities in this research. The vibrancy of officially encouraged technology transfers from university research spin-offs in Chengdu contrasts markedly with the continuing reliance on SOE and non-university research transfers in Chongqing, as shown by the types of companies in each place.

Conclusion

Circumstances in western interior China, represented in this study by the major metropolitan areas of Chengdu and Chongqing, and the economic, historical, and cultural conditions prevailing in the more prosperous east coast cities, dictate different approaches to development. Sensitive policy adjustments need to reflect development potential differences between neighboring Chengdu and Chongqing. As hypothesized earlier, embedded locational, historical, and cultural resources differentially affect outcomes in similar types of ventures such as the establishment of the same sort of development park. Although Chengdu is further west, hence locationally more removed from the east coast power centers, it remains the core location in bustling Sichuan. Chongqing's mountain-rimmed fastness continues to hold it in a more isolated state of mind and infrastructural remove, with its Yangtze River lifeline to Shanghai still underdeveloped. Mental attitudes of leadership exert formidable influence on development policies and need adjusting to overcome systemic problems – a larger challenge than remediation of physical infrastructure through facility construction.

As pointed out in their study of west China development strategies, Sims & Schiff¹¹ emphasized that 'changing the way people think is crucial to the success of China's latest drive to develop its west.' Policies promulgated by the central government – from Premier Zhu Rongji in March 2000 at the national People's Congress to the Director General of the Department of Foreign Investment in May 2004 – focus on structural economic policy such as tax rates, foreign investment targets, SOE reform, and infrastructure upgrades. Interviews with foreign business managers and business development personnel in foreign consulates repeatedly point out that China's greatest challenge, exacerbated in the western region, lies with 'software development': human attitudes. Tax breaks are less potent than training people and providing support services.

Several structural challenges to attraction, retention, productivity and application of relevant research by university personnel in that region include a concentration of major national universities in the east, which removed issues relevant to west China from their view. The lower standard of living in the west compared to the east coast also worked against top university researchers locating away from more comfortable conditions. Many of these structural conditions could be changed by funding from the central government, providing countervailing incentives such as increased salaries, well equipped laboratories, and other amenities around the university-high tech park district. Funding should be redirected to building human rather than physical infrastructure in western China, increasing incentives for human migration to, and development of, research on issues of particular relevance to this region, rather than more highways and railroads lines, for example.

The need to modify strategies developed elsewhere to fit western conditions is reflected in newly adapted slogans, which nonetheless belie continuing underlying problems. 'Self-propelled internally oriented development' raises the question of how such development can be propelled by an inadequate, undercapitalized, underpopulated, and ill-educated market focused on domestic Chinese consumers. 'Market-oriented exploitation' raises the consideration of where the market lies – globally, or in more populous, prosperous

eastern China? The proclaimed aim of ‘sustainable development’ follows decades of draining western China’s forest and mineral resources, with infrastructure being developed to ship out the remaining reserves. Truly sustainable development would be built by educating the local populace better, thus building human capital for long term pay offs, a step not yet on the horizon (Shi et al., 2004).

To summarize, the initial hypothesis proposed that place-based distinctions between the two major cities in the western region were critical factors for comparing the role of technology zones in accelerating regional development. Government policies actively seek to upgrade the physical infrastructure of this area. Belying political attempts to remedy economic differences rooted in geography and history, human attitudinal frameworks and intellectual infrastructure remain the most critical differences between the cities and the more successful coastal metropolitan areas. Every proxy measure examined in the figures, tables, and text indicated Chengdu’s historical development edge, marking it for continued success as the innovation leader over neighboring Chongqing. Neither city has been able to capitalize on the export orientation of the delta models, nor the social networks of the Guangdong and Wenzhou models. Utilization of marketable university research spillovers that characterize both Beijing and Xi’an remained another option. The critical underlying and predictive factor, also earmarking economic advancement based on technology in east coast cities and Xi’an, is the degree of university involvement in the local political economy and openness to change from this source. Future research examining development attempts in urban regions outside the east coast models might well consider the role played by structural elements, such as a path dependent process, or individual cultural roots or local leaders in each location, such as illustrated in this examination.

Notes

¹ This category encompasses Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Inner Mongolia, and Guangxi.

² An especially thoughtful assessment can be found in Lai (2003).

³ Notable works in this genre include Castells & Hall (1994), Audretsch & Feldman (1996), and Malecki and Oinas (1999).

⁴ Numerous studies discuss these models, summarized in Walcott Chinese Science and Technology Industrial Parks (Ashford, UK: Ashgate, 2003).

⁵ Of particular note is the June 2004 The China Quarterly Special Issue: China’s campaign to ‘Open up the West’: National, Provincial and Local Perspectives.

⁶ Based on personal observation and interviews, as well as reports by the author.

⁷ See note 6 above.

⁸ As observed in remotely sensed images analyzed in Liu & Shiu (2004).

⁹ Webster et al. (2003). Also Goodman (2004) who notes in his introduction to the Special Issue The China Quarterly, that in Chongqing major restructuring has all been due to the efforts of the central government, rather than rising from local enterprising political, intellectual or economic leadership.

¹⁰ See notes 5 and 6.

¹¹ www.chinabusinessreview.com/members/0011/print/sims.html, accessed 29 February 2004.

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