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Chinese Science and Technology Industrial Parks

Susan M. Walcott

CHINESE SCIENCE AND TECHNOLOGY INDUSTRIAL PARKS

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Contents

List of Figures		*vi*
List of Tables		*vii*
Acknowledgments		*viii*
List of Abbreviations		*ix*
1	Chinese Economic Development Zones: An Overview	1
2	New Industrial Districts: Theories and Models	25
3	Chinese Policy Background	44
4	Multinational Development Zone: Shenzhen	71
5	Multinational Development Zone: Dongguan	85
6	Multinational Development Zone: Suzhou	99
7	Multinational Learning Zone: Shanghai	111
8	Local Innovation Learning Zone: Beijing	157
9	Local Innovation Learning Zone: Shenzhen	176
10	Local Innovation Learning Zone: Xi'an	187
11	A Chinese Best Practice Model	200
Index		*219*

List of Figures

1.1	Chinese cities with featured industrial parks	2
1.2	Chinese science and technology industrial parks	2
1.3	Foreign direct investment by source country, 1998	5
1.4	Foreign direct investment absorbed by the end of 1999, Shanghai	9
1.5	Actually used foreign direct investment, China 1997	9
1.6	Regional distribution of technology-related revenue and exports, 2000	15
1.7	Regional distribution of domestic patents granted	15
1.8	Location and amount of foreign direct investment	17
2.1	A Chinese typology of new industrial districts	32
3.1	Technology import contractual value by country	63
3.2	R&D expenditure and share in GDP	64
4.1	Map of Shenzhen's development zones	72
4.2	Shenzhen High Tech industrial park	75
4.3	Container cargo leaving on the overland loop	76
5.1	Dongguan's location within the Pearl River delta	86
5.2	Female factory workers	90
6.1	Map of Suzhou relative to Shanghai	100
6.2	CSSIP setting	106
7.1	Shanghai science and technology industrial parks	116
7.2	Foreign High Tech company clusters in Shanghai	118
7.3	New Shanghai, Pudong across from the Bund	132
7.4	Shanghai Zhangjiang Hi Tech Park investment	139
7.5	Source of foreign direct investment, 1998	146
8.1	Beijing Universities and High Tech park zones	158
8.2	Sources of Beijing's science and technology funds	172
8.3	Sources of science and technology funds nationwide	173
9.1	Shenzhen Hi Tech Park 'Virtual University'	178
9.2	Incubating low-cost local hopefuls	184
10.1	Map of Xi'an	190
10.2	Innovation Center	192
10.3	Number of scientists and engineers in major regions	194
10.4	Number of enterprises graduated from Xi'an Business Incubation Center, 1994-1999	196

List of Tables

1.1	U.S. foreign direct investment in China	12
1.2	Foreign capital actually used	14
1.3	Development of high technology industrial zones	22
1.4	Worker technology productivity, 2000	22
3.1	Chinese high technology incubators, 1994-2000	53
3.2	Hi Tech parks by technology-related sales revenue	54
3.3	Large and medium size high technology enterprises, 1991-2000	57
3.4	Increase in STIP output, 1991-2000	59
3.5	Exports by types of zones, 2000-2001	60
3.6	Exports of high technology products, 1996-2000	66
3.7	Timeline of STIP related policy developments	67
4.1	Measures of Shenzhen's high technology production	77
5.1	Dongguan in relation to Guangdong Province and China	89
5.2	Development of High Tech in Dongguan	91
7.1	Industry sectors in major metropolitan areas	115
7.2	Comparison of metropolitan Shanghai STIPs	117
7.3	Major Shanghai technology industry sectors	120
7.4	Location and features of Shanghai High Tech companies	123
7.5	Land and building prices in Shanghai zones	124
7.6	Minhang index of technology development	125
7.7	Caohejing index of technology development	127
7.8	Zhangjiang High Tech Park, 1997	136
7.9	Lujiazui Finance and Trade Zone, 1997	136
7.10	Jinqiao Export Processing Zone	137
7.11	Waigaoqiao Free Trade Zone	138
7.12	Zhangjiang employees by education	139
7.13	Inflow of foreign direct investment to Shanghai	145
7.14	Shanghai profile	147
7.15	Manufacturing location oscillation of global sites	148
8.1	Beijing high technology development	161
8.2	Beijing Zhongguancun science park	164
8.3	High Tech expansion project plans, 2001-2005	167
8.4	Beijing area incubators	169
9.1	Pre-tax profit of Shenzhen High Tech enterprises	179

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List of Abbreviations

ATP	Advanced Technology Products
BDA	Beijing Development Area
BEZ	Beijing Experimental Zone for the Development of New Technology Industries
CAS	Chinese Academy of Sciences
CSSIP	China-Singapore Suzhou Industrial Park
ETDZ	Economic Technology Development Zone
FDI	Foreign Direct Investment
HTP	High Tech Park (*gau keji yuan*)
IT	Information Technology
LDC	Less Developed Country
MDC	Most Developed Country
MNC	Multinational Corporation
MNE	Multinational Enterprise
MOFTEC	Ministry of Finance, Technology, Economic Cooperation
NID	New Industrial District
OECD	Organization of European Cooperative Development
PKU	Peking (Beijing) University (retaining the old name in the Wade-Giles romanization prevailing in the pre-1949 days of its founding)
PLA	People's Liberation Army
PRC	People's Republic of China
QU	Qinghua University, also known as Tsinghua University (retaining the old name in the Wade-Giles romanization prevailing in the pre-1949 days of its founding)
R&D	Research and Development
RMB	Renminbi, Chinese currency
SHIP	Shenzhen Hi Tech Industrial Park
SMETDZ	Shanghai Minhang Economic and Technological Development Zone
SOE	State Owned Enterprise
STC	Science and Technology Commission
STIP	Science and Technology Industrial Park
TNC	Transnational Corporation

TVE	Township-Village Enterprise
UAE	University-Affiliated Entity
WFOE	Wholly Foreign Owned Enterprise

Chapter 1

Chinese Economic Development Zones: An Overview

Introduction

China functions as the linchpin for Asia's future development. Issues of geography provide a crucial lens for examining economic prospects in specific places within this varied country roughly the size of the contiguous United States. The central concern of this book lies with the role of proximity among companies for promoting learning, enabling adaptation to new conditions. This includes challenges faced by both Chinese firms seeking to upgrade product and production techniques, and by foreign firms seeking a foothold in China's domestic market as well as competitive advantage for export production. A major finding of many place-based studies of successful businesses is the key importance of frequent interactions, creating 'learning districts' based on information exchange, which in turn enable companies to be more flexible and innovative. Chinese business parks featuring companies classified as possessing relatively advanced technology serve as spatially distinct areas set aside within large urban areas for the promotion of technology development through transfers from nearby foreign companies and domestic research centers. Comparing how this strategy works in six different locations from the north to southeast coast and inner China (Figure 1.1) demonstrates important variations that reflect location specific attributes within a global hierarchy of production sites. A total of 53 national-level science and technology industry parks have been established at different locations throughout China (Figure 1.2). Division of the cities between parks featuring predominantly multinational companies and those promoting local innovation emphasizes the two-track nature of development. This study concludes with suggested features of a best practice model suitable for China's circumstances.

Figure 1.1 Chinese cities with featured industrial parks

Figure 1.2 Chinese science and technology industrial parks

Repositioning for New Growth: High Tech as Economic High Hope

The first chapter following this overview deals with general theoretical issues within economic geography that frame the investigation. Key questions posed by this examination consider whether the current state of China's science parks falls into previously proposed models, presents a developing world modification, or constitutes a type of its own. Use of High Tech parks as a growth engine reflects a global economy that particularly rewards knowledge-based inputs.

A global hierarchy structures a network of cities wherein regions closest to innovation sites garner the greatest profit, down to regions of routine, low-cost labor who at least are part of a high technology-infused commodity production chain. Local industrial districts are set within geographically expanding global corporate and urban networks. Particular cities serve as major capital accumulation and transaction points. Municipalities and their regions are not immune from the influences of the nation-state, particularly in a country as centrally controlled as China. The success of the so-called Asian Tigers demonstrates that national government policy plays a significant role in shaping the outcome of local development attempts. The role of each participant is thus considered at a variety of geographic scales.

Regions

The economic condition and power of regions rise and decline in succeeding waves. Successful businesses, and the individuals who work in them, consequently are attached less to a place than to a habitat of corporate culture, which reflects characteristics that are both local and transferable. In order to obtain the growth and economic dynamism emanating from international links created by successful businesses, countries and cities harboring such inhabitants compete by replicating a cocoon of familiar internationally interchangeable settings. Economic islands are unsustainable. Highly successful but small scale city states such as Singapore must extend their economy, becoming major sources of assistance to near neighbor China. A network of city-regions, inhabiting but less subordinated to nation-states than in the preceding century, increasingly asserts a new hierarchy of connections in a global production chain, which can be either producer driven or market driven,

with power in both cases residing with the more developed country (Gereffi, et al., 1994).

Firms

Corporate mergers occur across country borders, submerging cultures into a new logo identity, while city-regions increasingly scramble to attract lucrative relocated headquarters. Although there is some debate as to the degree of control, consensus prevails as to the relative power of China's central government to decide what areas of the country will receive powerful development incentive priority (Fan, 1997; Lin, 2000). Under current conditions of loosened centralized control, gray areas exist leaving regions to find their own way to economic success. If the outcome achieves the desired ends, the path must have been correct (Cooke, et al., 1998; interviews).

Transnational corporations (TNCs) function to spread an internal corporate culture and organization across geographic space, in a transfer of knowledge enhancing local dynamism. Clustering firms in a district draws on advantages that come in general from being in an urban area (improved infrastructure, larger and more diverse labor base, financial instruments, and information access) and advantages from being in proximity to firms with similar production or distribution affinities. Three criteria, now relaxed since their original promulgation, generally guide Chinese acceptance of foreign direct investments (FDI). Companies seeking to enter China should be technologically advanced, possess the potential to generate foreign currency, and combine both urgent need and the inability of China to produce the product domestically. Recognizing that every investment decision has a spatial component, the goal is for the area's pool of China's highest skilled labor, improved infrastructure and service sector to produce agglomerated economies of scale that will attract foreign direct investment. A 'virtuous cycle' might then occur with labor and capital attracted to a good investment site. Indeed, the value (both contracted and fulfilled) of projects attracting foreign investments has climbed steadily since the rise of market liberalizing advocates in 1976, especially in the 1990s with economically booming times in the West.

Countries investing in China do indeed represent the most developed nations, such as the 'Triad' of the United States, Europe, and Japan. Regional leaders Korea (ROK), Taiwan, and various source-shielding capital havens in the Caribbean (Virgin Islands, Bermuda, Cayman Islands) also represent significant sources of foreign direct investment (Figure 1.3).

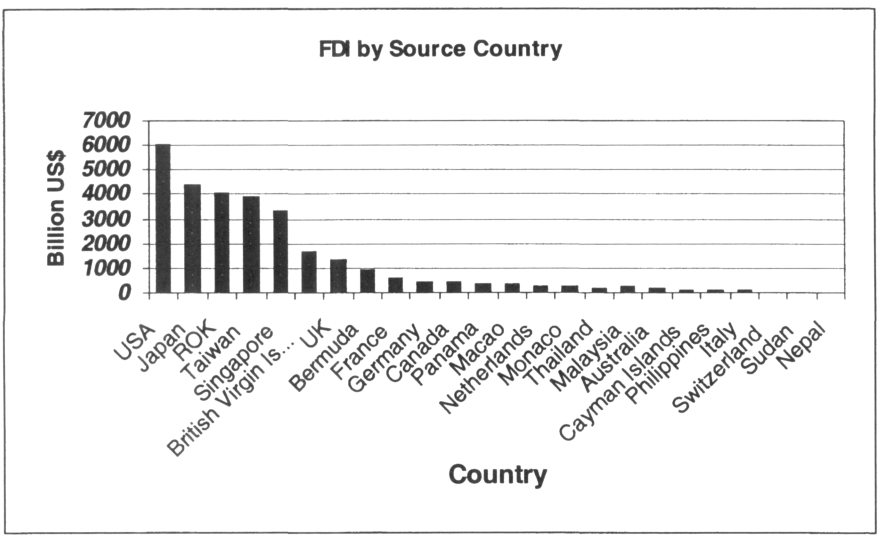

Figure 1.3 Foreign direct investment by source country, 1998

Districts

The term 'technopole' applies to planned developments assisted by local universities, research institutes, land developers, and governments at all scales (Castells and Hall 1994). Technopole enterprises utilize locally created information and scientific labor, though the manufactured commodification of that knowledge may occur elsewhere. Since new ideas generated from research in technopoles draw upon research centers located within or close to parks with companies developing their products (Southern Growth Policies Board, 2002). The land development piece can originate from the private sector, universities, government entities at various scales, or combinations of these. At their core parks are places where research ideas are developed into products for the market. The parks are spatially distinct economic ventures supported by

political and educational bodies in recognition of their profound potential for contributing corporate profits to reshape their region.

The ways in which science and technology industry parks (STIP) in emerging economies vary in components and functions from their spatial counterparts in developed countries forms a key focus of this investigation of Chinese parks. In countries with developed economies, places where individuals network pre-existing institutions, from universities to financiers and manufacturers, can be enough over time to create an industrial cluster. In developing countries such as China, much more is needed in the form of government support and development of underlying institutions to support activities in economically privileged spaces. Examples include enforcement of intellectual property protection laws, an effective and solvent financial system, and amenities to entice expatriate native skilled labor to return.

Questions arise as to whether foreign firms keep technopole functions overseas while utilizing China for low cost labor, or use China's scientists for breakthrough ideas but then obtain a substantial share of the profits through partnership arrangements in return for capital needed to keep the local company afloat. China's STIPs test the hypothesis that spatial clustering is an especially effective strategy in developing countries and other regions where barriers to access exist, despite the demonstrated fact that information exchange constitutes a key production element. One measure of the different nature of these parks is to compare the proportional mix of capital from government sources, private domestic pools, multinational companies, and Chinese multinationals. Looking at the types and extent of supplier-labor-market linkages can assess embeddedness. China's technopoles function as a national variant of the model, with distinct characteristics due to China's centrally controlled political economy and early stage of transition development.

Examinations of science parks in various global locations display a wide variety of conclusions as to their usefulness in promoting either business or regional development success. The most negative views see these land set-asides as principally a scheme of real estate developers to enhance tax revenues (Massey, et al., 1992). Other studies, along this continuum, found that park occupants justified the premium rents based on the benefits from spatial agglomeration fostered by the prestige location as well as frequently theorized clustering benefits from enhanced infrastructure to information exchange interactions (Staudt, et al., 1994; Sternberg, 1996).

Studies by the OECD (1987) asserted, and the International Technology Research Institute (Boulton and Kelly, 1999) confirmed, that

> Where extending advanced infrastructures across an entire economy is too costly and complex to accomplish in the short term, science and technology 'parks' have allowed countries to rapidly build state-of-the-art mini-economies within a geographically restricted area...[giving] Asia's high-tech industrial parks an advantage in attracting or keeping global competitors (pp. 60-61).

Networks

Networks knit together the constituent parts of a production chain within and across geographic areas. The nature of these networks falls into two basic schools of thought. One stresses transaction flows, whether of material or information (Storper, 1997; Cooke and Morgan, 1998, Boulton and Kelly, 1999). The other emphasizes the relations of participants who construct, operate and function within networks (Thrift, 1996; Yeung, 2000a). Networks examined in this study are particularly complex, consisting of transnational businesses operating according to procedures set out by their company, within the occasionally clashing cultural norms of their home setting and their host foreign setting. Science and industrial technology park zones combine elements of both worlds by encompassing a variety of interacting geographic scales: the global political-economic macroscale, the nation-province-city mesoscale, and the corporate microscale (Lin, 2000).

Networks for information exchange were objects of persistent inquiry in the interview process. Lack of interfirm connectivity could be a major impediment hampering the blossoming of China's hi-tech parks into something more than zones for extraction of profit for transnational companies. Network factors missing included mediating actors and institutions, rules of engagement, more tech transfer mechanisms, and informal interaction spaces. Other major concerns cited were shortage of venture capital (and capital for investment in general, as well as mechanisms for doing so) and over-extensive bureaucratic restrictions. This section on individual Parks examine to what extent each served some of these needs; it should be noted that certain shortcomings derive from remediable institutional deficiencies during transition from a controlled economy, while others are apparent in some Western districts as well.

Formerly prosperous regions can be regenerated through connection to a global network, particularly as the region draws on high growth, high profit technology-intensive industries utilizing local factors such as labor with suitable cost, sufficient numbers, skills, and/or work ethic attributes (Scott and Storper, 1987). The Rustbelt Midwest's 'Auto Alley' revs new economic engines thanks to Japanese and German mini-steel mills and car manufacturing facilities. Deep South states have turned from textiles to telecommunications. Southern California cities weaned from government defense grants grow biotech upstarts. And across the Pacific, China has overcome a century of civil strife to sprout construction cranes for instant cities from former agricultural fields as in Shenzhen and Pudong, on the outskirts of Hong Kong and Shanghai, respectively. The combination of embedded and created characteristics leads to a politics of place competition between locations and firms illustrated by the case studies in this research, wherein local advantages furnish the competitive features utilized by the wise metropolis and intelligent firm seeking the best location match (Stopford and Strange, 1991).

The contrast in FDI absorption and type can be illustrated by a proportional comparison of the municipality of Shanghai and China as a whole (Figures 1.4, 1.5). In the highly urban setting of that east coast commercial giant, by the end of 1999 the tertiary sector represented 46 per cent of total foreign direct investment, with real estate comprising 54 per cent of that piece. Secondary investments were overwhelmingly in industry, reflecting Shanghai's traditional strength. Primary sector interest was only .2 per cent of the total FDI in the city. For China as a whole, 63 per cent of foreign direct investment was in manufacturing, four per cent in the primary sector, twelve per cent in real estate and six per cent in electronics and telecommunications. Revealingly, only .02 per cent of FDI fell into the category of scientific research. For the purposes of this examination, these figures indicate the interest of foreign investors lies far less in actual innovative R&D using China's intellectual labor but rather in manufacturing supplied by low cost labor.

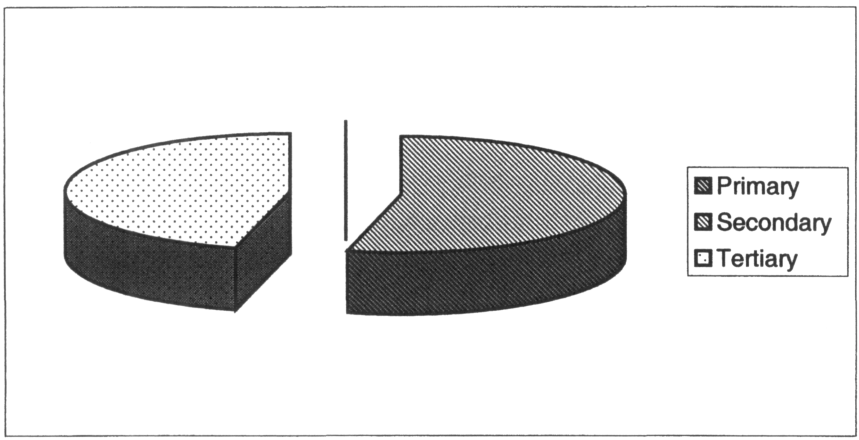

Figure 1.4 **Foreign direct investment absorbed by the end of 1999, Shanghai**

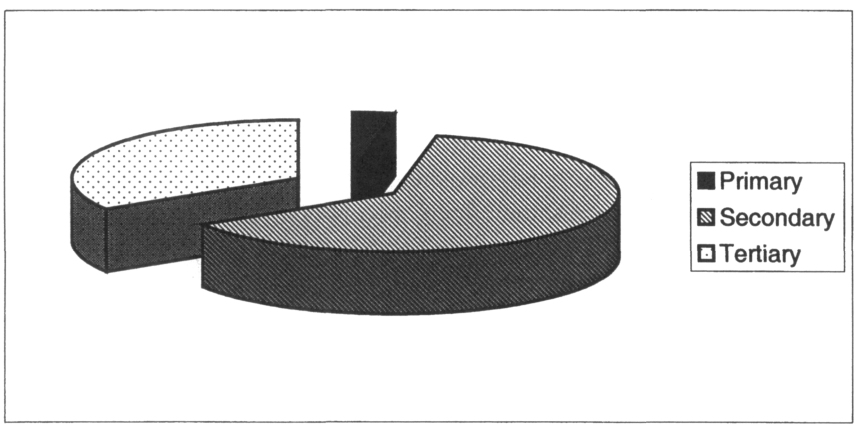

Figure 1.5 **Actually used foreign direct investment, China 1997**

Globalization

Within the global flow of capital, products, processes, individuals, and ideas, places with particular characteristics are more attractive sites of accumulation than others (Park, 1996; Markusen, 1997; Porter, 2000). The basic underlying competitive factor for high technology companies is rapid access to the best information. This can come through obtaining the most innovative and task-suitable employees, associating with other innovative companies through business, social, or site arrangements, or connecting to locations convenient to cutting edge insights from nearby research centers. The most highly sought economic salvation comes in the lab coat of research and development. Restless capitalism looks for the newest breakthroughs to generate surging market demand and profitable paybacks, with enormous margins that more than cover the costs of past and future product discovery and development. The United States' pre-eminence in technology, and in particular the role played by companies on the West Coast, inspires numerous attempts by other nations to create their own technopoles. Any lack of success to date indicates that essential, identifiable ingredients must be missing. This is less a problem of place, since technological business success is not culture-bound, than a problem of an incomplete understanding of the process. Given the cyclical nature of economic and political change, dynamism is clearly geographically mobile. With microwave communication enabling almost instantaneous transfers bounced off satellite dishes, business is a global proposition.

China's economic relationship with the U.S. greatly assisted that country's meteoric economic development in the past two decades, during which China's international goods trade zoomed from US$28 billion in to US$510 billion in 2001; U.S. trade with China alone grew for US$1 billion in 1978 when 'Reform and Opening' was initiated to US$119.5 billion in 2000. At the turn of the 21st century, the trade deficit with China represented 19 per cent of the U.S.s total trade deficit. While exports to the U.S. constituted over 41 per cent of China's total, the U.S. exported only two per cent of its total global exports to China.

The decade of the 1990s marked a particularly significant change in the nature as well as the volume of the bi-lateral trade relationship between the two countries. Not only did the trade deficit soar from US$11.5 billion to US$83 billion, the proportion of high technology exports shifted from roughly non-existent in 1990 to US$13.3 billion by the year 2001, encompassing over two-thirds of all items on the U.S. 'advanced technology products' (ATP) list. This shift began in 1995, with the ATP trade deficit between the two countries widening from US$1 billion to over US$8 billion by mid-2002. Globalization's influence enhancing the trend for foreign subcontracting enhances China's attraction as an 'export platform' for companies headquartered in more advanced (high cost) countries. In 2000, China was #7 in exports (US$249.3 billion), #8 in imports (US$225.1 billion), and #1 in FDI (US$46.8). Almost all of the ATP trade with China falls into four categories: mechanical equipment including computers (46 per cent), electrical machinery (35 per cent, aircraft and spacecraft (12 per cent), and optical-photographic and measuring equipment (almost 7 per cent) (U.S.-C.S.R.C., 2002). Areas of major U.S. foreign direct investment in China by 2000 are detailed in Table 1.1. Areas of major expansion in China's ATP manufacturing strength include telecommunication equipment and silicon wafers (largely due to cross-Straits re-location by Taiwanese firms). Clearly, China is a major economic player in global trade and investment, meriting further examination of past trends and future potential (Lin, 2000).

Studies set out in this book turn agglomeration theory around. In a free market, companies choose to congregate in order to maximize their utilization of local advantages, thus realizing 'localization economies'. In China's centrally controlled economy, location choices are constrained and highly influenced by government directives encouraging companies to locate in designated areas. This research assesses the outcome of such compelled proximity. Two tracks exist for businesses in Chinese economic development zones: one is for transnational companies (TNCs), while the other is for native Chinese companies. Separate sections treat areas that tend toward each of these types. A model emerges of economic development more suitable to developing countries that usually exhibit a stronger government rather than market directive role.

Table 1.1 U.S. foreign direct investment in China

Sector	Investment (US$billion)	%Total	% Increase (1994-2000)
Electrical equipment Manufacturing	3.2	33.5	1,787
Petroleum	1.8	19.3	106
Financial services	1.1	11.6	179
Machinery manuf.	.93	9.7	NA
Chemical manuf.	.24	2.6	11
Metals manuf.	.18	1.9	76
Food manuf.	.18	1.8	38
NEC manuf.	.77	8.0	252
Wholesale trade	.36	3.8	168
Other	.59	6.2	357
TOTAL	9.57	100	275

Source: U.S.-CSRC, 2002, based on US Bureau of Economic Analysis

Chinese Science and Technology Industry Park Policy

Moving from macro scale issues of theory to the particulars of China's setting, the third chapter discusses how Deng Xiaoping's economic reforms opening China since 1978 to more capitalist ways signaled the beginning of a major shift permitting closer integration of the domestic economy with the global economy. Subsequent development plans targeted particular sectors for investment and attraction of foreign companies. In 1988, the launching of the national 'Torch Program' provided carrots (incentives) and sticks (regulations) for luring foreign investments to 54 'economic and technology zones' and 27 science and industrial parks concentrated largely in coastal China. These sites represented, in the judgment of the central government, the areas most likely to be able to attract, absorb, and thrive from infusions of foreign capital in the form of corporations and managers. By 1997, foreign funded enterprises represented significant investments in these zones throughout China, particularly along the eastern coast. The large concentrations of companies in Beijing, Shanghai, and Shenzhen-Guangdong development areas were especially successful in securing High Techincome, though 'technopoles' operate in large cities with major research institutes throughout China (Wang, et al., 1998).

Comparison Models: Multinational Development Zones

Various new types of districts dot the economic landscape of developing countries such as China, posing variants on technology park and corporate configurations due to their transnational nature bridging developed and transitioning economies (Park, 1996). This study looks at several zones in geographically diverse regions of China, noting differences due to the type of activity contained and the type of company profiled. The comparative approach combines a manufacturing zone framework within a regional analysis (Johnston, 1999), arguing that similarities within zone type can still be usefully contrasted by regionally influenced factors.

The first set of three multinational development zones considers the role of transnational companies as economic development growth engines for China's leapfrog into the 21st century network of global capitalism. China's post-1978 modernizers see this as the fastest way to gain access to transferable Western technology, while financing the development of local companies through foreign trade profit. Since the initial proclamation of an 'Opening and Reform' movement in 1978, the number and value of projects involving foreign investment has increased at a steeply accelerating rate (Table 1.2). The slowdown from 1989-91 reflects both the general global recession and the chilling effect of the Tiananmen suppression on foreign investment. Consequently, the huge increases of the next two years demonstrate not only recovery in the American economy, but the sense that China was again secure for investment and eager to catch up quickly with delayed opportunities.

China's economy also benefits by an increase in jobs in the foreign-invested sector while China's bloated state-owned enterprises (SOE) dismiss workers as part of an unprecedented restructuring. The types of economic investments made by foreign companies reflect a specialization in areas most affected by modernization infrastructure needs, and most neglected in the preceding decades: real estate services, electric, gas, and water infrastructure, electronics and telecommunication facilities. Foreign companies often come to China to gain a foothold in what is perceived as a potentially vast 1.2 billion market, presently providing a large, inexpensive labor pool for simple assembly operations. Chinese workers come to foreign enterprises for the better pay and generally better working conditions, which varies widely depending on the country of ownership.