The Impact of Clustering of DFI on Urban Economic Development in China: The Case of Qingdao Development Zones

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Abstract

With the dramatic increase in direct foreign investment (DFI) in China over the past two decades, understanding the role of DFI in her economic development has become essential. This thesis focuses on the impact of the clustering of DFI on urban economic development through a case study of the Economic and Technological Development Zone (ETDZ) and High-tech Industrial Park (HTIP) in Qingdao, Shandong Province.

The concept of 'cluster' has become an object of desire for many cities and regions, resting on the widely accepted assumption that increased specialisation and external economies in clusters may contribute to urban and regional economic development. Little research has been conducted, however, as to the underlying role of DFI in fostering industrial clusters. This thesis attempts to fill this gap by examining the supplier-buyer linkages between foreign invested firms and local firms within the electrical and electronic sectors in development zones built by the Chinese government, hence investigating the mechanisms of how such a linkage may increase productivity and promote local economic development.

The present research utilises 21 detailed firm case studies and describes the process and mechanisms of urban economic development through the interaction between foreign invested firms and local firms in development zones. In addition, with the help of quantitative methods, including regression, shift-share and location quotient (LQ) analyses, the thesis quantifies the macroeconomic impact of the clustering of DFI on local economic development.

This thesis concludes that large domestic firms have played a pivotal role in forming the local industrial cluster, whereas foreign invested firms have played a supporting role. However, the foreign invested firms act as a bridge between large Chinese firms and their local suppliers by being both a main supplier (first-tier supplier) for large Chinese firms and a main buyer of raw materials and components for local suppliers (second-tier and third-tier suppliers). Through such a relationship, foreign invested firms, as innovators, enhance quality control management in local industries and facilitate the technology transfer for local suppliers. Thus, local suppliers and foreign invested firms provide the stable quality parts and components for the main domestic firms who play the leading role in forming clusters.

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Acronyms

AT: Advanced Technology
BA: Budgetary Allocation
CJV: Contractual Joint Venture
COE: Collective Owned Enterprise
CPT: Colour Picture Tube
CPU: Central Processing Unit
CRT: Cathode-ray Tube
DFI: Direct Foreign Investment
DMS: Domestic Market Seeking
DY: Display Yoke
DZ: Development Zone
EJV: Equity Joint Venture
ETDZ: Economic and Technological Development Zone
EPZ: Export Processing Zone
EXO: Export Oriented
Eview: Econometric View
FAI: Fixed Asset Investment
FBT: Fly Back Transformer
FDD: Floppy Disk Driver
FIE: Foreign Invested Enterprise
FIZ: Free Industrial Zone
FTZ: Free Trade Zone
GDP: Gross Domestic Production
GIOV: Gross Industrial Output Value
GRP: Gross Regional Production
HDD: Hard Disk Driver
HTIP: Hi-tech Industrial Park
HT: High Technology
IC: Integrated Circuit
ID: Industrial District
IT: Information Technology
IPZ: Investment Promotion Zone
ISIC: International Standard Industrial Classification
ISO: International Standardisation Organisation

JIT: Just-in-time

JV: Joint Venture

LCD: Liquid Crystal Display

LTSE: Limited Stock-hold Enterprise

LQ: Location Quotient

MNE: Multinational Enterprise

N/A: Not Available

OCC: Open Coastal City

OEZ: Open Economic Zone

OECD: Organisation for Economic Cooperation and Development

OER: Official Exchange Rate

PACEC: PA Cambridge Economic Consultant

P&A: Processing and Assembly

PCB: Printed Circuit Board

PDP: Programmed Data Processor

R&D: Research and Development

RMB: Ren-min-bi (unit of Chinese currency)

S&T: Science and Technology

SEZ: Special Economic Zone

SIP: Science based Industrial Park

SME: Small and Medium Enterprise

SOE: State Owned Enterprise

SRF: Self-raised Fund

SPSS: Statistical Package of Social Science

SSB: State Statistical Bureau

TFP: Total Factor Productivity

TNC: Transnational Corporation

TVE: Township and Village Enterprise

UNCTAD: United Nation Conference of Trade and Development

USD: United States Dollars

VA: Value Added

WFO: Wholly Foreign Owned Enterprise

Chapter One Introduction

1.1 Inflows of DFI and Economic Growth in China

Until the late 1970s, China had been largely a closed and centrally planned economy. In 1975, state-owned enterprises accounted for 97 percent of fixed assets, 63 percent of employment and 86 percent of gross output in industry (Zhang, 1994, p. 45). It was in 1979 that China turned to the 'reform and open door' policy, which emphasizes the role of the external sector in national economic development. In addition to encouraging the expansion of trade, a central component of that policy has been to open the country to DFI on an incremental basis.

In 1980, the Chinese government established four Special Economic Zones (SEZs) along the coast, which offered substantial tax holidays, low tax rates and relatively flexible administrative procedures to foreign investors. In addition, there are two types of development zones. One is the Economic and Technological Development Zone (ETDZ) implemented by the State Council and by the Offices of the Development Zones. The other is the Hi-tech Industrial Park (HTIP) promoted by the Science and Technology Commissions of the different levels (Wang J.C and Wang M, 2002). Into these zones which occupy 0.01 percent of Chinese territory, more than 15 percent of total DFI are attracted, and are actually utilised. This fact indicates that the inflow of DFI is highly concentrated on the development zones in China, implying that government policy for attracting DFI is quite successful. As a result, China has emerged as the largest recipient of DFI among developing countries since 1992. In 2002, China, attracting the amount of 52.7 billion USD, is the biggest host country of DFI in the world. As of 2002, GIVO by FIE represents 33.8 percent of total gross industrial output value (GIOV), which has remarkably increased from only 5.3 percent in 1991 (see Table 1-1).

Table 1-1 Contributions of DFI to China's Economy, 1991-2002

Item	1991	1997	1998	1999	2000	2001	2002
Actual value of DFI inflows ($ billion)	4.4	45.3	45.5	40.3	40.7	43.9	52.7
FIEs' exports ($ billion)	12.0	74.9	80.9	88.6	119.4	133.2	169.9
FIE exports/national exports (%)	16.8	41.0	44.1	45.5	47.9	50.1	52.2
FIE output/national output (%)	5.3	18.6	24.7	26.1	27.4	33.03	33.8
FIE value added/national value (%)	--	--	20.9	22.5	24.0	25.2	26.0
FIEs' share of State tax revenue (%)	4.3	13.2	14.4	16.0	17.5	19.0	20.5

Source: China Statistical Yearbook (2003) and Jiang (2004)

The key characteristic of DFI inflow in China is that most DFI concentrates on manufacturing industries that are explicitly export-orientated; the inflow of DFI contributes significantly to the increase in export growth in China. Hence, FIEs have played a major role in encouraging export growth (Kueh and Ash, 1996, p. 176). As is shown in Table 1-1, about 17 percent of exports in 1991 were produced by FIEs (including Hong Kong, Macao, and Taiwan). This figure had risen to 41 percent in 1997 and to 52.2 percent by 2002 (China Statistical Yearbook, 2003). In terms of export amount by FIEs, it has been expanding more than fourteen times during the period between 1991 and 2002.

The importance of DFI in Chinese industrial development is also observed by investigating the share of FIEs in the total value of output of various manufacturing industries. In 2000, 27.4 percent of the total value of output of the manufacturing sector was produced by FIEs. In electronic industry, FIEs have become the dominant producers, producing 72 percent of the total output (see Table 1-2).

Table 1-2 FIE's Role in the Manufacturing Industries of China in 2000

	Gross Industrial Output Value			Value Added		
Industries	Total	FIEs	%	Total	FIEs	%
Food and Beverage	5917.59	1938.55	32.8	1870.00	519.60	27.8
Textiles	5149.30	1094.13	21.2	1272.84	263.80	20.7
Garment and Fibre	2291.16	1112.06	48.5	592.02	289.07	48.8
Leather and Furs	1345.17	759.40	56.5	323.62	176.77	54.6
Paper and Printing	1590.36	502.23	31.6	412.62	118.71	28.8
Chemical product	5749.02	1183.87	20.6	1415.81	305.00	21.5
Medical and Pharmaceutical	1781.37	403.73	22.7	633.88	155.71	24.6
Chemical Fibre	1243.07	436.46	35.1	295.78	116.17	39.3
Plastic product	1899.70	828.86	43.6	464.43	205.84	44.3
Metal product	2539.76	964.98	38.0	609.46	212.24	34.8
Machinery	3046.95	652.68	21.4	840.75	186.46	22.2
Transport equipment	5364.83	1624.85	30.3	1323.61	408.25	30.8
Electrical equipment	4834.68	1603.06	33.2	1231.50	421.69	34.2
Electronic equipment	7549.58	5403.41	71.6	1824.31	1192.97	65.4
Electric power, Steam	4611.39	714.13	15.5	2328.62	359.88	15.5
Total	85673.66	23464.55	27.4	25394.80	6090.35	24.0

Source: China Statistical Yearbook 2001 Unit: 100 million RMB

This evidence indicates that FIEs have made an active contribution to China's electronic sectors. Another important indicator, that of value added data, also shows the significance of FIEs to the Chinese manufacturing sector. In 2000, for instance, FIEs produced 65.4 percent of the total value added in the electronic industry (see Table 1-2).

1.2 The Role of Development Zones

Development zones in China have played an important role in accelerating coastal development, experimenting with an impressive number of managerial, financial and technological reforms, and acting as a bridge between the advanced capitalist countries and the Chinese economy (Bahl, 1996). The leadership of Deng Xiaoping initiated a systematic approach to greater integration with the international economy and treated foreign investment and trade as main 'engines' for China's development. This development strategy required the richer coastal regions to be transformed into major centre of foreign investment that were partially integrated with the international economy (Reardon, 1996). According to this strategy, foreign technology, capital and managerial skills would be absorbed by development zones in coastal areas and then gradually disseminated into other regions or provinces. The Chinese leadership recognised this because the coastal cities possessed:

'A relatively favourable geographical position enjoys a good economic base as well as good economic management and technological expertise; they are bound to be the first to progress forward. While taking advantage of foreign capital, technology and market, these coastal cities must first carry out technical transformation of older industries.' (Reardon, 1996, p. 296)

Hence, the main policy aim of development zones is to attract inflow of DFI to transform local industry development, by which local economy establishes capital intensive and technology oriented industries, increases the industrial output, and boosts exports. More importantly, development zones are used as windows to receive new technology and managerial skills for Chinese domestic company from foreign firms; conversely, foreign firms enjoy tax benefits and infrastructure, and obtain local information for developing potential new markets. In this regard, ETDZ and HTIP are the main functional and institutional frameworks for both domestic and foreign firms to have an impact on local economic development. They are sponsored by China's national policy, but both are actually established at the initiative of city government, with investment and administration provided by local authorities.

1.3 Research Purposes

The massive inflows of DFI have been geographically concentrated in costal area development zones. The concentration of DFI is especially seen in manufacturing industries, which is coherent to Chinese explicit policies to encourage export growth in manufacturing sectors. However, the most important consequence of utilising DFI in China is to foster local embeddedness of foreign firms. This refers to the network of relationships between foreign firms and their competitors, customers, suppliers, local business and public organisations in geographical area in which they operate (Yeung and Li, 2000). This is to reduce protection of the domestic market, forcing domestic firms to face competition and co-ordination from the foreign firms, resulting in significant pressures for improving productivity and product quality. Finally and most importantly, while attracting DFI, the different types of development zones have become more specialised in industrial clustering within city economies. From these zones, indigenous local firms and city's overall industrial base enable the participating foreign firms to draw upon a common infrastructure and a specialised pool of labour.

The statistical significance of DFI, as seen from Table 1-1 and 1-2, illustrates that DFI plays an important role for economic development and growth of manufacturing industries in China. The mere feature of statistics, however, does not explain the underlying impact of DFI on the local economy. In order to look into the full effect of DFI on local economic development, this research uses the concept of 'clustering of DFI' as analytical lens for investigation of the purpose of the study. The definition of clustering of DFI is "a group of geographically concentrated both local and foreign invested firms specialising along the lines between similar and complementary activities and developing grater skills and productive knowledge." Specifically, this thesis refers the clustering of DFI to groups of local and foreign invested firms in which intensity of local purchase and supply linkages, managerial and technology transfer exist.

Qingdao city governments (municipal and district) have provided initiatives to attract foreign investment into their administration boundary. In Qingdao, there are 3,965 foreign-invested enterprises (Qingdao Statistical Yearbook, 2001). Surprisingly, more than 40 percent of Qingdao city's total gross industrial output value (GIOV) contributed by electronic foreign and local firms is concentrated in two development zones, namely HTIP and ETDZ (Qingdao Statistical Yearbook, 2003). This result comes from Qingdao city's effort that city governments facilitate any request or service in order to attract the foreign invested firms and build industrial concentration in development zones.

Successful attraction of DFI inflows into specific industrial location, namely, development zones and rapid economic development in Qingdao city, motivates this research. The main purpose of this research, therefore, is to explore the impact of clustering of DFI on urban economic development in the context of China's local level analysis. The primary research questions are as following: how foreign invested firms in development zones are interacting with local firms, how relationships between local and foreign invested firms affect local economic development, and what the underlying mechanisms of such relationships are.

1.4 Structure of this thesis

This thesis comprises eight chapters. Each chapter is linked to the others, and brings essential information to this research. Chapter 1 identifies the main issues and the purpose of this research, as derived from a relevant literature review on inflows of direct foreign investment in the context of China.

Chapter 2 looks into the characteristics of inflows DFI and the Chinese development zones. More specifically, the role of development zones and key policy framework regarding DFI are discussed. The contribution of development zones to the Chinese economy is evaluated through statistical indicators. Finally, the chapter presents the limitation of statistical indicators to explain the mechanism of how FIEs contributes to urban economic development.

Chapter 3 establishes the main theoretical framework regarding clustering of DFI based on the concept of spatial organisation in urban economic development. Urban economic development will be measured by key variables, namely, innovation, productivity growth and structural transformation. Related key concepts regarding spatial organisation are examined, which include the development pole, the innovative milieu, and industrial districts. Special focus is given to the hub and spoke model in industrial districts

Chapter 4 constructs an analytical framework and research design in order to explore the answers to research questions. Both quantitative and qualitative methods are utilised for this purpose. More specifically, the impact of the clustering on local economic development is evaluated by quantitative methods such as regression, location quotient and Shift-share analyses. For qualitative methods, an in-depth interview is carried out which provides detailed information regarding mechanism of supplier-buyer linkages.

Chapter 5 provides an overview of the area where the case study takes place, namely the development zones, Economic and Technological Development Zone (ETDZ) and Hi-tech Industrial Park (HTIP) in Qingdao city. The discussion covers various aspects of the zones, including overall and industrial growth patterns; changing economic structure; and economic performance of foreign invested firms and Chinese local firms. The background information regarding inter-firm linkages between local and foreign firms is provided, and general findings in this chapter serve as a foundation for further investigation of the impact of clustering of DFI on urban economic development.

Chapter 6 presents empirical findings relating to the main impact of clustering of DFI on urban economic development. The impact is measured in terms of 1) productivity growth 2) innovation 3) structural transformation, and evaluated and analysed by both quantitative and qualitative methods. For quantitative analysis, the productivity growth has been investigated based upon value added information; innovation is explained by information on R&D expenses, technology transfer and information sharing; and Shift-share and Location Quotient are used in order to explain the structural transformation. The qualitative analysis is conducted by in-depth interview, which provides the detailed explanation for inter firm linkage that play a crucial factor in the process of clustering. In addition, the role of the Chinese government is discussed, focusing on its ETDZ and HTIP policy.

Chapter 7 explores the mechanism of inter-firm linkages and the specific nature of supply networks in HTIP and ETDZ with particular focus on collaboration and competition between domestic and foreign invested firms. The contents of this chapter are based on final field research which combines a questionnaire survey with face-to-face interview. Four types of inter-firm linkages are identified: global subcontract supply network; global strategic alliance and joint ventures dynamic local collaboration and supply linkages; intra-firm linkages between FIEs. These types of linkages are synthesised in the light of hub and spoke model, and the role of government is briefly discussed as well.

Chapter 8 brings together the arguments and evidence presented throughout the research. The main findings of the clustering of DFI and its impact on urban economic development and underlying mechanism are summarised. The limitations of this research are presented. Finally, theoretical and practical implications are presented, which provide some suggestions for future development zone policy.

Chapter Two: DFI Inflows and Development Zones in China

2.1 Introduction

This chapter presents the characteristics of DFI inflows and the Chinese development zones. As already observed in the previous chapter, the inflow of DFI is highly concentrated within the development zones in China, implying that government policy to attract DFI in the specific regions is relatively successful. In the process of attracting DFI, however, an important issue is raised: how to efficiently utilise the DFI for local economic development. More specifically, what is the underlying mechanism of utilizing DFI and how does this mechanism affect urban economic development in China?

Before investigating the above question, this chapter examines the role of development zones in attracting DFI, including the key policy framework regarding various types of development zones. Section 2 describes the characteristics of DFI inflow in China. The rationale of development zones and related DFI policy are presented in Section 3. Section 4 analyzes a statistical assessment of development zones for Chinese regional economic development. The final section discusses the limitation of statistical features to explain the FIEs' role in local economy, thus addressing an issue for further study.

2.2 The Characteristics of DFI inflows in China

This section describes the spatial feature of DFI inflow in China. Table 2-1 shows the recent trend of inflow of DFI by location. An important characteristic of DFI in China is its concentration on the coastal region. In 2002, for instance, about 85 percent of total DFI inflow is located in coastal regions. The reason for this concentration is due to not only better economic, social and physical infrastructure than other regions but also government preferential policy such as tax incentives for foreign firms in coastal regions. Among the coastal regions, Guangdong was the largest recipient province of DFI; in 2002, it accounted for more than 20 percent of the total actual value of DFI in China. In Jiangsu, the second recipient province, the inflow of DFI has doubled from 1996 to 2002. Shandong was in third position, accounting for 9 percent, followed by Shanghai (8 percent) and Fujian (7.2 percent)

Table 2-1 Actually Used DFI in China by Location (in millions of dollars)

Rank	Coastal regions	1996	1997	1998	1999	2000	2001	2002
1	Guangdong	11,754	11,711	12,020	11,658	11,281	11,932	11,334
2	Jiangsu	5,210	5,435	6,632	6,078	6,426	6,914	10,189
3	Shandong	2,634	2,493	2,203	2,259	2,971	3,521	4,734
4	Shanghai	3,941	4,225	3,602	2,837	3,160	4,292	4,272
5	Fujian	4,085	4,197	4,212	4,024	3,432	3,918	3,838
6	Liaoning	1,738	2,205	2,190	1,062	2,045	2,516	3,412
7	Zhejiang	1,521	1,503	1,318	1,233	1,613	2,212	3,076
8	Beijing	1,553	1,593	2,168	1,975	1,684	1,768	1,725
9	Tianjin	2,153	2,511	2,114	1,764	1,166	2,133	1,581
15	Hainan	789	706	717	485	431	467	512
DFI in costal region		35,378	36,579	37,176	33,375	34,209	39,673	44,673
Share to total DFI (%)		84%	81%	82%	83%	84%	85%	85%
Rank	Other regions	1996	1997	1998	1999	2000	2001	2002
10	Hubei	681	790	973	915	944	1,189	1,426
11	Jiangxi	301	478	465	321	227	396	1,082
12	Hunan	745	917	818	654	678	810	900
13	Hebei	830	1,101	1,429	1,042	679	670	783
14	Sichuan	441	635	373	341	435	582	556
16	Guangxi	663	880	886	635	525	384	417
17	Henan	524	692	617	521	564	457	405
18	Anhui	507	434	277	261	319	367	384
19	Shaanxi	326	628	300	242	288	352	360
20	Heilongjiang	567	735	526	318	301	341	355
21	Jilin	452	402	409	301	337	338	245
22	Shanxi	138	266	245	391	225	234	212
23	Inner Mongolia	72	73	91	65	106	107	177
24	Yunnan	65	166	146	154	128	65	112
25	Gansu	90	41	39	41	62	74	61
26	Qinghai	1	2	0	5	0	36	47
27	Guizhou	31	50	45	41	25	28	38
28	Ningxia	6	7	19	51	17	17	22
29	Xinjiang	64	25	22	24	19	20	19
30	Tibet	0	0	0	0	0	0	0
Total DFI Inflow		42,135	45,257	45,463	40,319	40,715	46,878	52,743

Source: China Statistical Yearbook 1998, 2000, and 2001, 2003

As for the regional distribution of value-added industrial activities, FIEs are also largely concentrated in the coastal area, where they contribute dramatically to the regional industrial output growth. Table 2-2 presents the contribution of FIEs to China's value added of industry and gross industrial output value in 2002 by region. The share of FIE's total value added was 25.9 percent in China. In some coastal province, FIEs were the dominant industrial producer; for instance, in Guangdong and Fujian provinces, FIEs produced 58.4 percent and 58.9 percent respectively of the total provincial value added in 2002.

Table 2-2 Contribution of FIEs to China's Value Added and GIOV of Industry in 2002

	Value-Added			Gross Industrial Output Value (GIOV)		
Region	Total	FIEs	Share (%)	Total	FIEs	Share (%)
Total	32994.75	8573.10	25.9	110776.48	32459.28	29.3
Guangdong	4361.14	2544.80	58.4	16378.60	10055.46	61.4
Shanghai	2131.94	1136.56	53.3	7740.56	4572.64	59.1
Jiangsu	3546.72	1066.81	30.1	13865.86	4128.85	29.8
Fujian	1177.59	694.74	58.9	3676.37	2308.69	62.8
Shandong	3500.54	523.37	14.9	11497.53	1770.79	15.4
Beijing	840.43	283.13	33.7	3173.48	1258.08	39.6
Zhejiang	2403.85	472.21	19.6	9779.04	1921.93	19.6
Tianjin	843.38	389.23	46.2	3323.12	1601.29	48.2
Liaoning	1377.73	280.53	20.4	4888.02	1072.07	21.9

Source: China Statistical Yearbook 2003 Unit: million yuan

Another indicator of FIE's contribution to China's economic development is seen in the gross industrial output value (GIOV). As indicated in Table 2-2, FIEs produce 3,245 billion yuan of GIOV in 2002, contributing to 29.3 percent in the value of total industrial output. In Guangdong and Fujian province, FIEs produced 61.4 percent and 62.8 percent respectively of the total industrial output.

FIEs in Tianjin produced 48.2 percent of the total industrial output. It should be noted here that the contribution of FIEs in the Shandong region is relatively low value-added and GIOV, being 14.9 percent and 15.4 percent respectively. The main reason is that most FIEs in Shandong province are suppliers of domestic firms, thus their activities are not directly shown by these two economic indicators, namely value-added and GIOV. Overall, the FIEs contribute to China's economic growth and DFI plays an important role of underpinning Chinese economic development in terms of industrial growth.

2.3 China's Development Zones: Rationales and Policies

The history of Chinese Development Zones goes back to the 1980s after the China's State Council approved the setting up of four special economic zones (SEZs) in the cities of Shantou, Shenzhen, Zhuhai in Guangdong province and the city of Xiamen in Fujian province. The SEZ policy is to use a Zone as a laboratory of experiment to ensure the smooth transition of the Chinese economy from a centrally controlled economy to market economy by initiating the

transition in selected territorial pockets. Hence, the zone policy reduces the risk of failure for the whole Chinese economy (Gupta S.P, 1996). Benefiting from the preferential economic development policies, all these growth centres (Shantou, Shenzhen, Zhuhai, and Xiamen) were used as windows and contact points for the rest of world; as prior to the reform the Chinese economy was almost closed. For this purpose in choosing initial locations, proximity to advanced and fast developing countries and availability of ports and other linkages were made with the prime consideration. More importantly, Deng Xiaoping's idea of permitting some localities and people to '*xian fu lun*' (get rich first) was the cornerstone of zone approach.

At the beginning of 1984, to further open to the outside of the world, the Chinese government decided to establish economic and technological development zones (ETDZ) along coastal areas by using the successful experiences of special economic zones (SEZ) in the previous period. From 1984 to 1988, 14 ETDZs including Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai Minhang, Hongqiao, Caohejing, Ningbo, Fuzhou, Zhanjiang and Guangzhou are the first that had been established after the approval of the Chinese State Council. In 1992 and 1993, the State Council designated other 18 ETDZs. In 2004, there were 54 State-level ETDZs, among which eastern coastal regions and 33 and Middle West regions 21 (http://www.china.org/english/SPORT-c/76751.htm accessed in 8/6/2004).

This section provides some background as to the Development Zone policies such as ETDZ and HTIP in China. The discussion is composed of three parts. The first provides the objectives and rationale for development zones in China. The second part identifies policy framework regarding DFI. In the final part, different types of FIEs and development zones in China are discussed.

2.3.1 Rationale of Development Zones in China

The purpose of establishing ETDZs in the Open Coastal Cities (OCCs) can be explained on the basis of several factors. First, drawing on the experience of the first four SEZs, the ETDZs built infrastructure and provided energy, communications, and other basic public facilities necessary for production and new technological development. Second, by offering standard investment incentives in the ETDZ along the coastline from north to south, foreign investors were provided with more opportunities to locate their ventures where the transaction cost was the lowest. Third, by expressly designating the goals of the ETDZ, the Chinese government made it clear that the primary objective of ETDZ was to establish more technology intensive industries and related projects by attracting an inflow of DFI; thus government policy is to foster specialization of high-tech industry in development zones (source: www.adelaide.edu.au/ceru/wrkpprs/97_15.pdf accessed in 15/09/02).

Hi-tech Industrial Parks (HTIPs) were established under the domestic-oriented policy. In March 1986, renowned Chinese scientists suggested the State Council that China should join the international race for high-technology development. Following this, the State Council called for 124 senior scientists to draft China's strategic high-technology plan, with 863 specifications. The plan was to monitor high technology research in the world and, more importantly, to develop and commercialise technologies produced by Chinese scientists. To implement the 863 specifications, the State Science and Technology (S&T) Commission designed the Torch Programme. The aim of programme is to tap the potential research findings of Chinese S&T workers, to promote innovation in state-owned enterprises, and to encourage state-owned research institutes, universities and enterprises to set up research-intensive enterprises. The plan selected seven areas of industries as priorities – biotechnology, space technology, information technology, laser technology, automation, advanced energy and material technology (Wang JC and Wang M, 2002).

2.3.2 Policies of Development Zones in China

During the early 1990s, Chinese officials sought to designate several development belts aiming at developing high-tech industries. Five such belts are envisaged, and are interconnected through existing transport and communication networks:

1) Yangtze River delta in Jiangsu: Suzhou, Wuzi, Changzhou, Yangzhou, Zhenjiang and Nanjing;
2) Pearl River delta in Guangdong: Guangzhou, Shenzhen, Zhuhai, Foshan and Huizhou;
3) The QiLu belt in Shandong: Jinan, Zibo, Weifang, Qingdao and Yantai;
4) The ShenDa belt in Liaoning: Shenyang, Anshan, Yingkou, Haicheng and Dalian;
5) The JingJin belt: Beijing and Tianjin.

In these areas, Zhong (China) and Wai (Foreign) are associated, such that inter firms relations between foreign and domestic firms are intended to grow. The Qingdao region is a part of the belts where active engagement by foreign firms takes place (Wang et al., 2002, p. 179).

In this sense, China's ETDZ has emerged as the most prominent symbol of China's state-oriented policy to achieve technological development through DFI. According to Reardon (1996, p. 294),

'...**must have technological cooperation** includes production technology, production instructions, technology secrets, and the dispatch of skilled technician to provide instruction as well as provide advanced equipment. There must be a logical division of sales between the

foreign and **domestic** market.'

The government, on the other hand, generates some dynamism into the system by letting some forms of commercial activities act as incentives to technical development and spill-over. This sort of entrepreneurial and innovative approach reflects a belief in market forces as the prime regulators of advanced technical change. Hence, this governmental policy is implemented on the basis of the six principles of non-interference, which means that Chinese new-technology enterprises may choose partners by themselves (*ziyoujiehe*), finance for themselves (*zichouzijin*), operate by themselves (*zizhujingying*), and responsible for all losses caused by the venture (*zifuyingkui*), master themselves (*ziwoyueshu*), develop themselves (*ziwofazhan*) (Wang et al., 2002).

Preferential policies in Development Zones are attached in appendix 2-2, 2-3, 2-4 and 2-5. It varies from productive enterprise and non-productive enterprise. Also, it depends on what sorts of production are produced from the enterprise. Basically, knowledge-based, export-oriented, infrastructure related enterprise and technology intensive enterprise receive an income tax refund. Productive and high-tech enterprises with more than 10 years of operation terms have been exempted from income tax in the first and second profit making years. Thereafter, this tax is reduced by half in the subsequent three years. These policies are also applied for infrastructure related enterprises. In addition to exemption and reduction of various taxes, the rates of local taxes which vary from zone to zone, are often being regulated by local government (see appendix 2-5).

2.3.3. Types of Foreign Invested Firms

This section presents ownership structure of foreign invested firms in China. According to recent Chinese official guide (http://www.cadz.org.cn/en/tzzg/part2_1.asp, accessed in 23/01/05), the categorisation and definition of foreign invested firm is as follows: Chinese-Foreign Equity Joint Ventures, China-Foreign Contractual Joint Ventures, Wholly Foreign-Owned Enterprise. These are the three main forms of Foreign Direct Investment in China for absorbing foreign capital. Other investment forms include Share Company with Foreign Investment, and Foreign Invested Holding Company.

Chinese-Foreign Equity Joint Ventures are also called as Share Company with Foreign Investment. An equity joint venture shall be invested and operated jointly by both foreign and Chinese investors, who share the profits and losses, as well as risks, in proportion to their respective shares in the registered capital. Chinese-Foreign Equity Joint Ventures are Limited Liability Company, possessing the status of Chinese legal person. In such an enterprise, the

proportion of the investment contributed by the foreign party should in general be more than 25% of the total. The partner could offer cash or other kinds of things instead such as building, factory, machinery, industrial property right, special technique, and field utilization right. The profits and other legal interests that foreign investors have shared can be remitted out or reinvested in China.

Chinese-Foreign Contractual Joint Ventures are enterprises jointly established within Chinese territories by foreign companies, other economic entities or individuals, or Chinese companies, depending on their cooperative conditions. The parties to a contractual joint venture should prescribe in the contract their respective conditions, rights, obligations, incomes distribution, responsibilities for risks and debts, the company management and negotiations on the property transaction at the expiration. When establishing China-Foreign Contractual Joint Ventures, the foreign party usually provides all or major part of capital, while the Chinese party provides land, factory buildings, certain usable machines and facilities, and in some cases a certain amount of capital as well.

Wholly Foreign-Owned Enterprise is invested entirely by foreign companies, enterprises, other economic entities or individuals within Chinese territory in accordance with the related Chinese laws. Wholly Foreign-Owned Enterprise usually takes the form of limited liability companies, and does not include the Chinese Branch of foreign company or other economic organization.

Foreign Invested Holding Companies is within Chinese territory that deals with direct investment, usually in the form of limited liability companies. Foreign investors who apply to establish a Foreign Invested Holding Company must possess good reputations and great assets with more than 30 million USD. Upon the approval of the Chinese government, Foreign Invested Holding Company could enjoy a broader field of managing than other ordinary companies, in an attempt to encourage overseas large companies to carry out their series of investment plans. At present, the Foreign Invested Holding Company is permitted to invest in the fields of agriculture, infrastructure and energy industries.

2.3.4 Different Types of Development Zones in China

According to Gao and Long (1996, pp. 152-154) and Bahl (1996, pp. 78-80), state-level ETDZ can be divided into 6 different types, as follows:

(1) ETDZs, with financial and trade activities as the main focus. Typical of these are Hongqiao ETDZ in Shanghai and Lujiazui Financial, Commercial and Trade Zone in the Shanghai Pudong New Area. The former is located in the Hongqiao District in southeast Shanghai, occupying an area of 16.82 square kilometres (Ge, 1999c, p. 143).

(2) ETDZs with industrial development as the main focus. Shanghai Minhang ETDZ is one of them accepting foreign investment in industrial productive projects. Relying on its existing industrial advantage, Minhang was constructed in 1983 and was approved as a state level development zone by the State Council in 1986. Minhang ETDZ was exclusively devoted to the industrial sector, and added emphasis on advanced technology and exports (Bahl, 1996)

(3) ETDZs with exporting processing. There are also some EPZs in China, which are exclusively devoted to export processing. Jinqiao Export Processing Zone in Pudong New Area of Shanghai is a classic example. This zone was established in September 1990, and is the first development zone under the nomenclature of "Export Processing Zone" in China (Bahl, 1996). Such ETDZs give priority to processing industries, which turn out products for export (Ge, 1999a,b).

(4) ETDZs with Free Trade Zone (FTZ). "*Baoshuiqu* which means 'Boned area' seems to be Chinese variant of what is known as 'Free Trade Zone'. The Chinese central authorities consider the task of creating *Boashuiqu* presently in an exploratory and experimental stage, wherein they must learn from the successful experience Free Trade Zone of foreign countries, but they must not mechanically ape them and instead build 'Free Trade Zones with Chinese characteristics' keeping in a view the concrete situation obtaining in China" (Bahl, 1996, p. 79). The Chinese FTZ is a comprehensive enclosed type area that is open to outside world. The typical example is Shanghai Waigaoqiao Free Trade Zone. This zone, located in the northeast of Pudong, with a planned area of 10 square kilometres, is comprehensive free-trade zone in China (Ge, 1999c). They are however, different from those abroad, in that much land is used for other purposes such as financial, trade and residential buildings in addition to industrial development.

(5) Hi-tech Industrial Park (HTIP). It was established in the most convenient location of the region in terms of abundant intelligence resources and preferential infrastructure policies. HTIP has made a great contribution to develop high and new technological products. For instance, Caohejing Economic and Technological Development Zone located in the southeast Shanghai has attracted 62 science development and operations projects and 227 foreign-funded enterprises, which form two backbone industries:

micro-electronics and computer software (Gao and Long, 1996). These zones also nurture native enterprises by promoting geographical proximity to advanced foreign multinational company production facilities (Walcott, 2002). Firms in China's 53 nationally recognized high-technology zones reportedly increased their revenue by 35.7 percent from 1999 and 2000, contributing USD 10.6 billion to the national treasury (Li N, 2000). Different types of examples (Walcott, 2002) such as university-business ties occur in Zhangjiang Hi-tech Park, in Shanghai-Pudong and in Shenzhen Hi-Tech Industrial Park. Research institutions provide the essential bridging component between the initial stages of production, dominated by advanced offshore companies. In the Harbin High and New Technology Industrial Development Zones (HNTIDZ) – a national level zone – the provincial and municipal governments have promoted close linkages between the Harbin University of Industries (a first-class science and technology university) and the emerging hi-tech industries. This zone represents China's effort to emulate and replicate the Silicon Valley model of hi-tech development (Chen X, 1995).

(6) ETDZs with multi-functions. Such development zones are generally far from cities, occupying a large area and are to a large extent independent, providing comprehensive conditions and services for production, living and entertainment. Qingdao, Ningbo, Dalian and Tianjin ETDZ fall into such a type. This category concentrates on industries, particularly the manufacturing sector and gives utmost importance to high technology as also to exports (Bahl, 1996).

2.4 An initial assessment: Development Zone's Impact on Chinese Regional Economy

This section presents an initial assessment of development zones and its impact on Chinese regional economy. The evaluation is measured by following economic indicators: export, gross industrial output value, sales profit, fixed asset investment, and direct foreign investment.

According to Chinese official data (www.fdi.gov.cn; www.cadg.org.cn), in 2001, the proportion of export by ETDZ accounted for approximately 10 percent of total Chinese exports. The total amount of export by ETDZs over a period of 7 years (June 1985-1992) was about USD 3.3 billions, with an average of USD 236 million each (see Table 2-3). It is noteworthy that the export continued to climb dramatically in almost all ETDZs in China. In 1993, the amount of export in Qingdao and Tianjin ETDZs was only 233.52 and 14.86 million USD. By 2002, these areas achieved quite significant export amounts of 57.06 and 7.69 billion USD respectively. The ETDZ in Shanghai Caohejing is the most noticeable case. This zone was constructed in the early 1990. In 1993, the performance of export was less than a million dollars. By 2002, the export amount reached more than 13.3 billion.

Table 2-3 Export by ETDZ (Unit: million USD)

	*June 1985-1992	1993	Jan-June 1994	1998	2000	2001	2002
Tianjin	376	**233.52**	151.292	2261.40	3266.92	4035	**5706**
Dalian	720	566.03	309.472	1341.05	2366.20	2696	3244
Guangzhou	713	122.78	55.003	584.63	897.30	977	1876
Qingdao	110	**14.86**	11.510	541.42	644.75	734	**769**
Ningbo	200	48.77	33.250	378.00	860.21	967	1004
Fuzhou	122.42	29.58	3.703	565.144	450.13	460	510
Yantai	110	29.71	23.640	201.72	311.08	380	477
Nantong	88.85	87.88	49.963	296.22	348.44	356	463
Zhanjiang	189	44.44	36.218	83.60	109.05	115	151
Qinhuangdao	12.25	20.34	13.994	130.12	156.13	165	204
Lianyungang	21.51	14.61	3.285	128.14	57.56	76	109
Minhang	410	10.07	13.246	296.00	377.96	365	404
Hongqiao	-	-	-	388.025	274	246	187
Caohejing	230	**0.01**	40.956	665.623	957.60	1141	**1330**

Source: 1985- 1994: Bahl, 1996, p. 115-17; 1998: Ren, 2000, p. 372; 2000: Qingdao ETDZ authority; 2001-2002: www.fdi.gov.cn/state accessed in 10/8/04
Note: *June 1985-1992 is cumulative value

The data in Table 2-4 shows export and import in the level of province, city and development zone. First of all, four provinces (Guangdong, Jiangsu, Shanghai and Shandong province) occupied around a 65 percent share of China's total export and import. Guangdong province has predominant position in China. In 1999, Guangdong accounted for about 40 percent share of export and import in China. As Open Coastal City (OCC), Qingdao has the highest share of export and import in the province. In 1999, Qingdao contributed almost 40 percent of total value of export and import in Shandong province. Nanjing and Suzhou accounted approximately 20 percent in province.

While the zone's export and import as a share of country's total export and import are generally low, their share of the city's export and import is much higher. For instance, the Shanghai Pudong development zone accounted for 42.3 percent in share of Shanghai city. In case of Suzhou and Lianyungang ETDZ, the share was 25.4 percent and 23.7 percent respectively.

Table 2-4 Import and Export Value of Commodities by Places of Destination or Origin in China by Region, 1999

Places of Destination or Origin	Total Value of Import and Export			
	Amount (USD 1000)	Share of China (%)	* Share of Province (%)	* Share of City (%)
National Total	360,629,975	100		
Guangdong	143,391,046	**39.7**	100	
Guangzhou City	18,204,730	5.0	12.7	100
Guangzhou ETDZ	1,456,063	0.4	1.0	8.0
Guangzhou HTDZ	54,684	0.0	0.0	0.0
Guangzhou FTZ	329,625	0.0	0.0	0.2
Shenzhen City	49,289,794	13.6	34.4	100
Shenzhen SEZ	19,644,418	5.4	13.7	40
Shenzhen HTIP	1,067,207	0.2	0.0	2.2
Shenzhen FTZ	3,353,136	0.9	2.3	6.8
Zhuhai City	5,480,452	1.5	3.8	100
Zhuhai SEZ	4,524,488	1.2	3.2	82.6
Shantou City	5,268,974	1.4	3.7	100
Shantou SEZ	2,423,887	0.6	1.7	46
Zhenjiang City	854,781	0.2	0.0	100
Zhenjiang ETDZ	113,901	0.0	0.0	13.3

Zhungshan City	5,184,364	1.4	3.6	100
Zhungshan ETDZ	6,348	0.0	0.0	0.0
Shanghai City	38,052,787	**10.5**		100
Caohejing ETDZ	1,154,765	0.3		3.0
Shanghai ETDZ	99,474	0.0		0.0
Shanghai Pudong	16,109,770	4.4		42.3
Shanghai FTZ	4,797,406	1.3		12.6
Jiangsu	32,859,534	**9.1**	100	
Nanjing City	6,314,103	1.7	19.2	100
Nanjing ETDZ	584,873	0.1	1.8	9.2
Suzhou City	6,131,253	1.7	18.7	100
Suzhou ETDZ	1,556,489	0.4	4.7	25.4
Nantong City	2,590,395	0.7	7.9	100
Nantong ETDZ	488,063	0.1	1.5	18.8
Lianyungang City	432,416	0.1	1.3	100
Lianyungang ETDZ	102,687	0.0	0.0	23.7
Shandong	20,797,875	**5.7**	100	
Jinan City	1,328,216	0.3	6.4	100
Jinan ETDZ	5,746	0.0	0.0	0.4
Qingdao City	8,126,268	2.2	39.1	100
***Qingdao ETDZ**	937,290	0.3	4.5	11.5
Yantai City	2,820,817	0.7	13.6	100
Yantai ETDZ	478,403	0.1	2.3	17
Weihai City	1,157,841	0.3	5.6	100
Weihai ETDZ	44	0.0	0.0	0.0

Source: Chinese Custom Statistical Yearbook 1999

*Author calculates the share of province and city level. The data of Qingdao ETDZ is from ETDZ Economic Bureau (Huangdao ETDZ Statistical Yearbook, 2000)

As is shown Table 2-5 and 2-6, FIEs have played a significant role in most ETDZs in China. As indicated in both tables, FIEs have, crucially, contributed to local economy in terms of both gross industrial output value (GIOV) and sales value in ETDZs. In the example of Tianjin, Dalian, Guangzhou, Minhang, Jinqiao and Qinhuangdao, more than 95 percent of GIVO and sales value were achieved by FIEs activity.

Table 2-5 Economic Indicators of China's ETDZs in 1998 (Unit: 100 million RMB)

	Total GIVO	FIE's share (%)	Total Sales value	FIE's share (%)
Tianjin	540.22	96.3	533.74	96.3
Dalian	243.00	91.2	231.00	90.9
Guangzhou	231.02	97.7	230.94	97.7
Qingdao	101.00	53.2	91.00	N/A
Ningbo	149.97	40.0	130.60	43.6
Fuzhou	129.30	68.9	88.33	62.7
Hongqiao (SH)	0.00	0.00	0.00	0.00
Caohejing (SH)	N/A	N/A	125.61	63.7
Minhang (SH)	152.48	100	152.61	99.9
Jinqiao (SH)	241.31	97.9	237.00	97.8
Yantai	70.20	87.7	58.30	87.8
Qinhuangdao	32.40	89.2	32.10	90.0
Lianyungang	53.20	60.0	45.10	53.2
Nantong	52.00	79.3	49.80	46.0
Zhenjiang	60.75	59.7	34.05	38.9

Source: Huangdao ETDZ Statistical Yearbook (2001)

In the case of Qingdao ETDZ, the share of FIE's GIOV is relatively low, at 53.2 percent and 44.8 percent in 1998 and 2000, respectively; hence FIE's share in Qingdao ETDZ does not seem to be very significant in comparison with its counterparts elsewhere. This may be due to Qingdao's industrial characteristics that the city has a strong industrial capacity led by local based collective owned firms and state owned firms. For example, the electrical and electronic industry, Qingdao's main industry, has been strengthened by large Chinese firms settled in ETDZ. However, as indicated in Table 2-6, FIE's share of FAI in Qingdao ETDZ is 66.5 percent, which is not only higher than the share of GIOV during the same period, but is also above average when compared to other counterparts regions. This mixed feature may suggest that, with statistical data alone, it does not provide an exact feature of how FIE's contribute to local economy in China. In order to understand FIE's true contribution to the local economy, it might be necessary to have more analytical assessment both qualitatively and quantitatively.

Table 2-6 The Economic Indicator of China's ETDZs in 2000 (Unit: 100 million RMB)

	GIVO	FIE's share (%)	FAI	FIE's investment (%)
Tianjin	731.8248	96.9	50.4624	22.0
Dalian	360.1240	90.9	24.3935	55.1
Guangzhou	338.9045	N/A	N/A	N/A
Qingdao	180.6811	44.8	36.8862	66.5
Ningbo	222.1300	62.8	35.2955	88.3
Fuzhou	164.6311	73.4	18.2661	N/A
Yantai	100.5076	86.1	9.5175	77.3
Nantong	54.2437	70.6	5.6453	24.9
Zhenzhang	61.4287	42.3	1.1270	16.6
Qinhuangdao	45.7065	29.1	9.0660	78.8
Lianyungang	62.6294	52.0	5.0108	N/A
Minhang (SH)	161.7475	N/A	N/A	N/A
Hongqiao (SH)	N/A	N/A	N/A	N/A
Caohejing (SH)	136.6780	N/A	N/A	N/A

Huangdao ETDZ Statistical Yearbook (2001)

Table 2-7 shows that the contractual and actual value of DFI in ETDZ across China. As is shown in the table, the performance of attracting actual value of DFI varies across regions in China. Tianjin ETDZ has performed best in attracting DFI in terms of number of projects, contracted value and actual amount. Actual value in Tianjin has doubled between 2000 and 2002 while the contracted value is maintained around 2,300 million USD. In case of Qingdao, both contracted value and actual value have significantly grown from 289 million USD to 473 million USD and 486 million USD to 1238 million USD, respectively. As that contracted value became three times greater during the period, the actual value of DFI has the potential to increase more rapidly in the future. The inflow of DFI in Guangzhou also shows a similar pattern to Qingdao.

Table 2-7. Contractual and Actual value of DFI in ETDZ, 2000-2002: unit: 100 million USD

	Contractual DFI			Actually utilised DFI		
Coastal Area	2002	2001	2000	2002	2001	2000
Qingdao	**12.38**	**9.23**	**4.86**	**4.73**	**4.65**	**2.89**
Yantai	3.44	2.11	0.90	1.31	0.81	0.65
Weihai	2.07	0.94	1.06	0.57	0.85	0.55
Nantong	1.03	2.10	1.28	0.81	0.61	0.52
Lianyungang	1.25	0.64	0.75	0.60	0.50	0.25
Shanghai Minhang	0.59	0.70	0.57	0.26	0.68	0.39
Hongqiao	0.91	0.38	0.73	0.71	0.21	0.73
Caohejing	2.30	1.32	2.60	1.80	1.20	0.96
Ningbo	11.21	8.01	4.00	4.00	3.01	1.99
Nanjing	5.19	1.06	N/A	2.50	1.01	N/A
Fuzhou	3.04	1.88	1.51	2.16	1.49	1.38
Guangzhou	**21.48**	**12.96**	**8.95**	**5.60**	**5.00**	**4.85**
Nansha	0.90	1.76	0.59	0.39	0.52	0.34
Dayawan	3.18	1.37	1.19	1.72	1.06	1.04
Zhanjiang	0.42	0.57	0.57	0.27	0.48	0.45
Wenzhou	0.42	0.27	0.07	0.16	0.11	0.07
Kunshan	8.80	13.38	12.40	5.65	3.75	3.85
Yingkou	1.12	0.63	1.24	0.51	0.44	0.32
Hangzhou	5.86	4.01	2.49	2.06	1.62	1.20
Dalian	8.07	6.00	4.52	3.75	3.10	2.22
Qinhuangdao	1.12	1.13	1.10	0.81	0.71	0.78
Tianjin	**24.11**	**22.00**	**26.40**	**20.0**	**18.01**	**10.10**
Beijing	3.32	2.93	1.50	2.00	1.72	0.70
Xian	2.24	1.84	1.55	0.71	0.58	0.51
Taiyuan	0.46	0.10	N/A	0.16	0.10	0.10
Wuhu	0.83	0.88	0.62	0.39	0.25	0.19
Xining	0.06	0.04	N/A	0.03	0.01	N/A
Huhhot	0.43	0.71	0.99	0.24	0.13	0.07
Shihezhi	0.31	0.04	0.06	0.23	0.00	0.007
Nanchang	1.71	0.35	0.06	1.00	0.10	0.06
Nanning	0.19	0.11	N/A	0.006	0.07	N/A
Yinchuan	0.47	0.30	0.67	0.03	0.01	N/A
Changchun	4.19	2.52	1.87	2.51	2.02	1.12
Harbin	1.80	1.28	0.93	1.01	0.74	0.69
Shenyang	6.93	5.24	4.14	1.90	1.49	1.76
Chongqing	0.57	0.70	0.30	0.38	0.60	0.15
Wuhan	1.75	1.01	1.45	1.22	0.78	1.39
Chengdu	0.25	0.16	0.64	0.09	0.04	0.07
Dongshan	0.53	0.52	0.87	0.21	0.52	0.42
Fuqing Rongqiao	0.73	0.43	0.50	0.41	0.23	0.50
Zhengzhou	0.34	0.65	0.25	0.19	0.09	0.08
Guiyang	0.33	0.38	0.08	0.02	0.05	0.04
Changsha	1.38	0.78	1.55	1.14	0.47	0.81
Kunming	0.22	0.06	0.04	0.04	0.06	0.03
Urmuqi	0.10	0.26	0.28	0.00	0.16	0.17
Hefei	0.78	0.63	0.07	0.51	0.31	0.07
Total	**148.81**	**114.37**	**96.20**	**74.79**	**60.35**	**44.467**

Source: Author based on raw data from www.fdi.gov.cn/state accessed in 10/8/04

Table 2-8 represents the DFI's share of ETDZ in China. The total space of ETDZ occupied in China accounted for only 0.01% of whole Chinese territory (see Appendix 2-1), but its DFI share to total DFI is around 14% to 17% in 2002 which explicitly shows that DFI inflows is mainly concentrated in development zones.

Table 2-8 DFI's Share of ETDZ in China

	Contractual DFI			Actually utilised DFI		
	China	ETDZ	Share (%)	China	ETDZ	Share (%)
2000	623.80	94.92	15.2	407.15	45.747	11.2
2001	691.95	112.82	16.3	468.78	61.9	13.2
2002	827.68	147.166	17.8	527.43	76.44	14.5

Source: China Statistical Yearbook 2003 and www.fdi.gov.cn/state (accessed in 10/8/04)

So far, this section has investigated the role of development zones and DFI within the Chinese economy which is explicitly shown in the statistical features. The statistical data indicates that development zones are an important part of Chinese economy and inflows of DFI are highly concentrated in development zones. However, it is evident that the role of DFI in the local economy varies, probably due to varied interaction with the local environment. This raises a number of questions: how foreign invested firms (FIEs) are engaged in domestic economy in China; and more specifically, through what kinds of channels and economic activities, FIEs interact with local firms in China.

2.5 Conclusions

The chapter has examined the inward DFI and the role of ETDZ in the Chinese regional economy. The inflow of DFI, which is concentrated in costal regions, especially, development zones, makes a significant contribution to Chinese economy in terms of export, GIOV growth and value added. However, it is also noticed that the share of contribution to GIOV by FIEs varies, depending on local economic environment. Hence, statistical indicator is not sufficient to investigate FIE's impact on local economy since it does not explain the underlying mechanism of how FIEs affect local economic development. Similarly, geographical concentration and development zone policy do not provide enough explanation of how FIE's interact effectively with local firms or the local economic environment.

In this regard, an important issue is raised, namely what is the underlying mechanism of

utilising DFI, which cannot be found directly from statistical data alone. This needs further in-depth analysis in terms of FIE's interaction with local firms in development zones. Regarding this issue, related ideas and research questions will be addressed in the following chapter 3.

Appendix 2-1 The Main Features of China's ETDZ

ETDZ	*Year (a)	Area (km2)	*GRP (b)	*Industrial Output (c)	Priority industry of Encouraging DFI projects
Qingdao	1984	220	169.20	353.06	Electronic and electrical components, machinery, chemical and new materials
Yantai	1984	16	102.59	208.39	Electronic, Machinery, Medical product, Refined chemistry
Weihai	1993	72	32.22	61.00	New building materials, port warehouse, textile, food processing
Nantong	1984	5.02	35.61	90.42	New building materials, Ship building, electric power, food processing, New synthetic fibre
Lianyungang	1984	76	38.06	94.00	Chemical and Pharmaceutical, machinery, Electronic, Building materials, textile
Shanghai Minhang	1986	3.5	59.49	198.29	Electrical equipment, pharmaceutical, R&D related centres
Hongqiao	1986	0.65	51.30	N/A	IT, electrical goods, new material (Nokia, Ericsson, LG, GE, 3M)
Caohejing	1988	6	103.65	272.76	IT, software, bioengineering, new material
Ningbo	1984	29.6	105.35	325.40	Electronic, Chemical (Samsung, DOW, EXXON)
Daxie	1993	5.92	30.0	N/A	Port warehouse, Petroleum product, Oil refining, Ship building
Nanjing	2001	13.37	46.86	186.98	IT, Bio-pharmacy, New materials, Logistics, Refined chemistry (Sharp, Fujitsu, Phillips, Ericsson, LG)
Haicheng	1989	31.8	41.9	111.00	Petrochemical, Electronic, Machinery, building materials, Bio-pharmaceutical
Fuzhou	1985	10.1	85.36	179.78	Multimedia appliance, Electronic, Semiconductor, Household electronic (LG, Hitachi, Epson, Ricoh)
Guangzhou	1984	17.67	244.16	560.54	Electronic information, Bio-pharmaceutical, Chemical, Automobile
Nansha	1993	54	39.99	63.02	Plastic, Chemical, Electronic, Food processing and Ship building (GE, BASF)
Dayawan	1993	6.98	18.53	24.06	Infrastructure (port, railway, LNG), Automobile, Chemical (Dongfeng Automobile, Shell, CNNOC)
Zhanjiang	1984	6	23.67	62.53	IT, Household electronic and components, Biotechnology
Wenzhou	1992	6.85	43.30	101.25	Machinery and electronic, Chemical and Real Estate
Kunshan	1992	30	180.39	535.03	Software, telecommunication, automobile, semiconductor, Biotechnology, Agricultural products
Yangpu	1992	30	3.26	15.2	Electric, bio-engineering, Real Estate and Tourism

Yingkou	1992	24	32.22	61.00	Agricultural projects, infrastructure construction, electronic and machinery, chemicals
Hangzhou	1993	18	71.63	252.21	Infrastructure, Motor parts and accessories, Hotels and resorts Entertainment, logistics, Hypermarket
Suzhou	1994	8	180.15	375.02	Electronic and Pharmaceutical, new materials (Nokia, Hitachi, Samsung, Phillips, Alcatel, Bosch)
Dalian	1984	28	242.63	490.53	IT, new materials, energy-saving recycling goods, infrastructure
Qinhuangdao	1984	8	35.03	85.45	IT, Bioengineering, Refined chemical (Itochu, LG)
Tianjin	1984	27	380.09	1031.24	IT and Pharmaceutical (GlaxoSmithKline and Novo Nordisk, Samsung, Motorola, Panasonic)
Beijing	1994	13	75	410	IT and Pharmaceutical (GE, ABB, Nokia, Bayer, Unilever, Phillips)
Xian	2000	4.9	39.52	100.07	Automobile, Electronics, Machinery (GM, Benz, Rolls &Royce, Volvo, ABB, Mitsubishi)
Taiyuan	2001	0.66	1.93	4.33	Clean fuels, coal based electric chemicals
Wuhu	1993	10	54.80	139.40	Automobile and automobile parts, Electronic and electrical components, new materials, Bio-medical
Xining	2000	12.79	4.77	3.77	Chemicals based on salt lake resources, nonferrous metal, natural gas and petroleum, food processing
Huhhot	2000	9.1	27.86	68.48	Green food processing (Diary production), valuable metal refining and Jewellery processing
Shihuzhi	2000	5.3	7.05	18.37	Agricultural products and new materials
Nanchang	2000	5.5	28.70	50.30	Automobile, Electronic, Medicine, Chemical
Naning	2001	7.68	7.00	19.76	Automobiles, car parts and machinery, electronics, paper making, Tourism, Logistics
Yinchuan	2001	2.26	8.96	11.48	IT, pharmaceutical and Petrochemicals
Changchun	1993	14.38	125.00	310.03	Automotive parts, photo-electronic information, food processing, new building materials
Harbin	1993	5.6	53.46	208.00	Pharmaceutical, IT, Automobile and car components, food processing, textile
Shenyang	1993	13.18	100.65	280.35	Automobile, machinery, electronic, pharmaceutical, infrastructure, new building materials
Chongqing	1993	24	50.84	112.24	IT, environment engineering, Bio medicine
Wuhan	1993	18	88.10	200.24	Automotive, Electric appliance, Bioengineering, Hypermarkets, Finance and real estate
Chengdu	2000	10.25	39.10	35.81	Machinery, Automobile, IT electronic, Bio-medicine, Aviation and space industry, Refine chemistry
Dongshan	1993	3.5	9.50	19.01	IT, new building materials, Port warehousing, textile, food processing, Medicine
Fuqing	1992	10	41.78	184.42	High quality synthetic fibre, Automotive parts, HDTV, electronic components

Rongqiao					
Zhengzhou	2000	7	16.10	21.78	Specialised in IT Electronic industry (LG-Phillips has been invited)
Guiyang	2000	6.5	15.27	22.50	Bio-engineering, IT, Medicine, Green food, Machinery
Changsha	2000	12.33	50.84	85.26	IT Electronic, New material, Chemical, infrastructure related
Kunming	2000	6	17.27	30.15	Optical electric-machinery, bio-food and bio-pharmaceutical
Urmuchi	1994	4.34	12.20	23.04	IT, Bio-engineering and New energy and materials
Hefei	2000	24	53.71	152.40	Household electronic (Haier Hefei branch, Hitachi) Chemical, Automotive
Total		984.73	3326.05	8249.35	

Source: Author based on raw data from: www.fdi.gov.cn/state , www.fdi.gov.cn/common and www.cadz.org.cn/ Accessed in 10/08/04 and 12/08/04

Note: * (a) Year of Establishment; (b) GDP and (c) Industrial Output in unit price is 100 million RMB in year of 2002

China's total area of territory: 9,600,000 km2 hence, ETDZs occupy only 0.01%.

Appendix 2-2 China's national preferential policies I

Enterprise Income Tax rate	State regulation	SEZ	ETDZ	HTIP	FTZ	The Border Economic Cooperative Ares	Open Cities and areas
Productive enterprise	30%	15%	15%	15%	15%	15%	24%
Non-productive enterprise	30%	15%	30%	30%	30%	30%	30%
①Knowledge intensive and technology intensive projects and Technology Development Centre; Projects with a long investment period	30%	15%	15%	15%	15%	*(15%)	15% (Including those industrial projects encouraged by the government in middle western areas)
②Export-oriented enterprises with its export value of the year equals or exceeds 70% of its output value of the same year after the exemption-reduction period is over	15%	10%	10%	10%	10%	12%	12%
③Financial institutions with foreign operation capital above 10 million US$ and an operation period of 10 years or more	30%	15%	15% (Approved by the State Council; including Shanghai Pudong)				
④projects concerning energy, transportation, port or projections engorged by the governments	15% (including those enterprises engaging in infrastructure construction in Shanghai Pudong)						

Source: http://www.cadz.org.cn/en/zgkfq/yhzc.asp (accessed in 10/8/04)

Appendix 2-3 China's national preferential policies II

***The exemption-reduction period of the Enterprise Income Tax Policy**	State regulation	SEZ	ETDZ	HTIP	FTZ	The Economic Cooperative Ares	Border	Open Cities and areas
1. Productive enterprise, high-tech enterprises or technology development centre	An exemption for the first and second year and a reduction by half from the third to fifth year							
2. Technology advanced enterprises	Granted a reduction by half for 3 more years as long as it remains advanced-technology-oriented after the exemption-reduction period is over.							
Refund of Tax for reinvestment Policy	① The foreign investor of the enterprise with foreign investment that makes a direct reinvestment in their enterprise or in other enterprises scheduled to operate for a period of more than 5 years with foreign investment using profits obtained form their enterprises in return shall enjoy a refund of 40% of the paid income tax for the reinvestment. ② If the reinvestment is made in an export or technology advanced enterprises; the investor shall enjoy the entire refund of the said income tax for the part of reinvestment.							

Source: http://www.cadz.org.cn/en/zgkfq/yhzc.asp (accessed in 10/8/04)

*Note: (The operation period is over ten years, commencing from the year in which the enterprises make profits)

Appendix 2-4 China's national preferential policies III

Custom Duties	State regulation SEZ ETDZ HTIP FTZ The Border Economic Cooperative Ares Open Cities and areas
1.Imported Equipment	① The productive, constructive and managerial equipment, supplies and transferred goods in Free Trade Zones and Export Processing Zones are granted an exemption from customs duties and value-added tax; ② For the foreign investment projects of encouraged type and limited type B which conform to "Guiding Catalogue for Foreign Investment Industries" and transfer their technology, the imported non-utility equipments(including the technology, Kit piece and spare parts imported with the equipments according to the contracts)within the total amount of investment will be exempted from duty and value-added tax except goods listed in "Non-duty-free Imported Goods Catalogue for Foreign Investment Projects"
2.Exported product	Exempted from export duties with the exception of those under state restriction; those products with its values increase by over 20% due to substantial processing may be exempted from export duties by the Customs as long as they are documented by the competent authorities concerned. The enterprises and managerial departments will enjoy an entire refund for the productive equipments, original material, spare and accessories parts, constructive supplies and office equipment purchased with Chinese territory
Valued-added Tax	① three types of rate at 17%,13%, 6% respectively according to different products categories; granted exemption or reduction according to the national tax laws ② exempted for the products sold in Special Economic Zones; common tax payer is levied at rate of 6% ③ exempted for the products made and sold in Free Trade Zones and Export Processing Zones
Investment adjusting tax of fixed assets	Exemption for investment of foreign-funded and foreign enterprises in Chinese territory
Urban House Tax	Exempted
Cultivated land use	Exemption for productive projects of foreign invested enterprises

Source: http://www.cadz.org.cn/en/zgkfq/yhzc.asp (accessed in 10/8/04)

Appendix 2-5 Qingdao ETDZ's Preferential Policies

	State regulation SEZ ETDZ HTIP FTZ The Border Economic Cooperative Ares Open Cities and areas
1.General guideline of State Government	Levied at 10% according to the state regulations. It can have a reduction or exemption made by the government of province, autonomous regions or cities directly under the jurisdiction of the central government according to the specific circumstance.
Qingdao ETDZ	If the profit deriving from the foreign invested enterprise is reinvested into the enterprise, added to the registered capital, or invested in another foreign invested enterprise under a business license of 5 years or upwards, a 40% rebate will be given to the foreign investor on the business income tax of the reinvestment
	If the foreign investors use the profit deriving from a foreign invested enterprise either to set up or extend an enterprise whose products are to be exported or establish an enterprise using advanced production techniques, the business income tax levied on his reinvestment will be rebated in full according to State Council's relevant regulations. **However, 60% of the rebate must be handed back if the newly built or extended enterprise fails reached the export requirements within three years from the month when production commences, or if they fail to prove the advanced nature of the techniques used in production.**
	Those foreign invested enterprises with advanced production techniques that proved to be successful maintaining their leading technical role, a 50% reduction in the business income tax for the following three years according to tax laws will apply, **when the preferential policy of two-years exemption and three-years' half become inapplicable.**

Source: Qingdao ETDZ Guide to Investment (2002) and http://www.cadz.org.cn/en/zgkfq/yhzc.asp (accessed in 10/8/04)

Chapter Three: Theoretical Framework

3.1 Introduction

In the previous chapter, the characteristics of DFI inflows and role of development zones were examined. This chapter reviews some of the theoretical perspectives relevant to this study of the impact of clustering of direct foreign investment (DFI) on the host country's urban economic development. The 'cluster' has become a popular concept, resting on the assumption that increased specialisation and external economies in clusters contribute urban and regional economic development and industrial growth (Porter, 1998; Cumber and MacKinnon, 2004). The idea of cluster stems from spatial organisation in urban economic development, which in turn refers to the relationship between firms and their environment, encompassing all the institutions competing and collaborating (Alchian, 1950).

The spatial organisation of firms creates positive externality through interactions among firms. This research focuses on firms' spatial network and linkages within certain geographical boundaries. In this regard, the utilisation of DFI inflows in development zones will be explained by networks among local and foreign invested firms. The networks interacted between local and foreign invested firms will create dynamic features in development zones.

In the light of this introduction, the remainder of this chapter is structured as follows: Section 2 explores the relationship between DFI inflows and its impact on urban economic development. Urban economic development will be measured by key variables, namely, innovation, productivity growth and structural transformation. A critical literature review is presented in Section 3; in this section, the idea of clustering based on spatial organisation will be introduced by addressing existing sets of theories, namely, development pole, industrial district, and innovative milieu. In particular, a hub and spoke model in industrial district is discussed in detail. The final section summarises the existing literature and states the research propositions.

3.2 DFI and Urban Economic Development

3.2.1 Impact of DFI on Urban Economic Development

The impact of direct foreign investment (DFI) on national or regional economies has been a long standing concern of researchers from a number of disciplines. It is, however, generally agreed that DFI has induced the host country's economic development and introduced advanced operation and management experiences, especially advanced and applied technologies, as well as speeded up the renovation of old enterprises.

One of the most important ways in which DFI may impact upon the host region is through the formation of industrial linkages with local firms. Manufacturing plants purchase a variety of different inputs including raw materials and components, services, machinery and equipment, utilities, and labour. If these inputs are purchased from within the host region, this will provide a boost to the regional and urban economy by stimulating increases in output and employment among the local supply industries (Hirschman, 1958). Thus, from the perspective of the host region, it is desirable that a high proportion of input is purchased from local suppliers (Crone, 2002, p. 131).

Similarly, inter-firm linkages are one of the most important channels to technology transfer. As part of an international network, the external linkages foreign affiliates are supplemented by internal ties within MNEs (parents firms). Thus, foreign affiliates are linked with two dynamics – those internal to the MNEs, and those operating within the locality under consideration. As Blomstrom and Kokko (1996, p. 1) have pointed out, in cases where firms are inter-linked, "local firms may be able to improve their productivity as a result of forward or backward linkages with MNE affiliates, by intimating MNE's technologies (quoted in Gorg and Ruane, 1998, p. 5)." Markusen and Venables (1996) also observed that the inflow of DFI changes supplies and demands in a number of related industries. Hence, it will be beneficial to firms in other sectors, for example, through price reductions and 'forward linkages' to customer firms. Also, DFI may create demands for local output, and these 'backward linkages' may strengthen supply industries, in turn feeding (via forward linkages) to other local firms.

Positive externality is another important feature in explaining the DFI and its impact on urban economic development. A particularly significant channel for spill-over is through the linkages between the foreign firms and its local suppliers and customers. Lall (1980) identifies the following MNE and suppliers interactions that can help increase the productivity and efficiency

of local firms: (1) helping prospective suppliers set up production facilities; (2) demanding from suppliers reliable, high quality products that are delivered on time, while also providing the suppliers with technical assistance or information to help improve the products or facilitate innovations; (3) providing training and helping management and organisation; and (4) assisting suppliers to find additional customers including their sister affiliates in order countries. Such suppliers may then start to export to the sister affiliates as well as to other independent external purchase.

So far, this subsection has explained the general impact of DFI on urban economic development. The concept of urban economic development needs to be further clarified. The next subsection will define urban economic development and discuss the main indicators as to measuring it.

3.2.2 The Concept of Urban Economic Development

What is the urban economic development as defined in this thesis? Understanding the meaning of economic development will be the starting point for this question. The most persuasive meaning of economic development is that it is the *process* whereby the *real per capita income* of a country increases over a *long period of time* – subject to the stipulations that the number of people below an "absolute poverty line" dose not increase, and that the distribution of income does not become more unequal (Meier, 1996).[1] To interpret development in terms of a process involving a form of progressive action, such economic development involves something more than economic growth.

Meier (1996, p. 7.) explains that "development is taken to mean *growth plus change*." There are essential qualitative dimensions in the development process that extend beyond the growth or expansion of an economy through a simple widening process. This qualitative difference is likely to appear in the improved performance of the factors of production and improved techniques of production. It also appears in the development of institutions and change in attitudes and values. Economic development is, thus, much more than the simple acquisition of industries (Meier, 1996). In this sense, development should be perceived as a ***multidimensional process*** involving major changes in economic structures, as well as the acceleration of economic growth, and the creation of more job opportunities.

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[1] Meier (1996, p. 7.) stresses that the primary goal rises in per capita income rather than simply an increase in the economy's real national income, uncorrected for population change. Also, he emphasizes a long period of time because what is significant from the standpoint of development is a sustained increase in real income – not simply a short period rise occurs during upswing of the business cycle.

The economic development process in the city economy is well presented in a recent study by Zhang (2003). Zhang (2003, pp. 1550-1552) pointed out three key perspectives (growth theory, neoclassical, and sturcturist) on the economic development of cities and the role of state. According to her research, in 'growth theory perspective', the central role of the state is to support both physical and human capital formation. In terms of 'neo-classical perspective', the key role of the state would be to ensure the operation of a competitive market in which resources can freely flow to the most efficient users. Finally, the structuralist perspective stresses state-led structural transformation through selective policy intervention. After constructing this theoretical framework, she identifies key factors and applies them to case study in Shanghai, in order to clarify the process of Shanghai's economic development, and to examine the links between this development and government policies (Zhang, 2003).

The 'strategic positioning' of Shanghai city reshapes the city's spatial structure by concentrating tertiary industries in the city centre and moving other manufacturing industries to the suburbs. It also stipulates the target number of branch organisations and headquarters of transnational corporations (TNCs) that city was to attract. Meeting the TNC's common objective to penetrate the Chinese market, Shanghai's policy of encouraging import-substituting industries has resulted in the attraction of particular large collection of TNCs to Shanghai. This selective policy is well expressed in Shanghai's designation of six pillar industries (steel, automobile, electronics, household appliance, power equipment, and chemical), targeting mostly the growing domestic market (Zhang, 2003). In the process of selecting pillar industry, city government is concerned about industrial growth, specialisation, and linkages. Hence this process might be on a basis of formation of industrial clusters.

In the light of Zhang's (2003) findings, this research also examines Steiner's viewpoint (1998, pp. 1-4 quoted from Cumber and MacKinnon, 2004, p. 956), namely that "clusters have become an object of desire for many cities and regions, resting on the widely accepted assumption that increased specialisation will lead to increased levels of productivity, growth and employment. Cluster-based policies have been adopted by a various range of organisations operating at different geographical scale." In this respect, the author defines urban economic development as a process of specialisation and sustaining economic growth through innovation and urban productivity growth as well as institutional and structural transformation (industrial and sectoral) in urban area. With this definition, this thesis focuses on the impact of the clustering of DFI on urban economic development. Innovation, productivity and structural transformation are used as key indicators in urban economic development. The meaning of these key indicators is explained in the following subsection.

Innovation

The term 'innovate/innovation' and identical or similar phrasings in other European languages – *erneuern, inovacion, inovacao, innovazione, innove, innovez* – all derive from Latin *novus* (which itself derives from the Greek *neos*) meaning 'new'. An indication of the universality of this conceptualisation is how, in non-Western languages as well, the notion of innovation appears with almost identical connotations. In Chinese, the equivalent term is *'ge-xin'* which literally means 'to peel away the old to create the new.' The same phrasing also appears (identically written but differently pronounced) in Korean and Japanese as *'hyokshin'* and *'kakusheen'*, respectively (Koepp, 2002, p. 213).

What is important about so basic and widespread a concept as innovation is that the practice of innovation can vary in significant ways for economic development. One of the most distinguished economists, Joseph Alois Schumpeter, identified economic development in terms of three key words. The first is *innovation*, the main cause of economic development. Innovation covers the introduction of **new** goods, introduction of a **new** method of production, the opening of **new** sources of supply and **new** market, and the reorganisation of an existing industry (Schumpeter, 1961). Innovation destroys old things and creates new ones and is thus called creative destruction. It is exactly same connotation of Chinese term **'ge-xin'**. It also can be interpreted as the creation of new varieties in a process of trial and error.

The second key aspect is *entrepreneur*, the subject of economic development or the agent of innovation. Schumpeter's entrepreneur is not a business manager himself. In contrast to a manager, who depends on existing method of production, the entrepreneur carries out new and creative projects. This creation of new ideas and products is determined by the interplay between entrepreneurial competencies and innovative atmospheres.

The third is *capital*, the means by which the entrepreneur accomplishes innovation. The entrepreneur acquires new credit from capitalists or banks and by means of the newly created purchasing power, pays higher prices than before for required resources. During the implementation of new combinations – defined by innovation (cause), entrepreneur (subject), and capital (means) – proceeds, a series of changes including those in the business cycle will occur in the economic process (Shionoya, 1997).

The process of innovation is considered to be the driving forces for economic development.

Innovation is related to the dynamics of the economy, which means the performance of the national economy formed by firms and the industrial structure (Lopez, 2003). A crucial factor of interactive innovation process is the importance of relations in the process and the definition of the key variables in the process. Within this context, the characteristics of innovation namely learning and improvement can be understood by adopting the indicators such as patent creation, ISO 9000 or 14000 (output of innovation), terms of training unskilled and semi-skilled labour forces in local in-house training centre or overseas headquarter and labour training by firms (input of innovation).

Productivity Growth

Productivity in general can be defined as the relationship between gross industrial output value and one or more of associated input used in the production process (Haynes, Dinc and Paelinck, 2003, p. 80). The heart of the process of urban economic development is the establishment of mechanisms for a continuing rise in the productivity of the factors of production. The total factor productivity (TFP) of a firm, industry or group of industries is defined as the real output produced by the firm or industry over a period of time divided by the real input used by same set of production units over the same period of time. However, it turns out to be difficult to provide a meaningful definition of real output or real input due to the heterogeneity of outputs produced and inputs utilised by a typical production unit (Diewert, 2000, p. 45). Harris (1991) also argues that the differences in productivity between sectors and sub-sectors of national output are key factors in producing or enhancing territorial and geographical differentiation. The sectoral difference is potential for scale economies in generating and sustaining different size of settlement.

In order to measure the total factor productivity (TFP) of a firm or an aggregate of firms, it is necessary to have accurate price and quantity data on all of the outputs produced by the set of production units for the two time periods under consideration as well as accurate price and quantity information on all of the inputs utilised. In reality, it is extremely difficult to obtain accurate data for TFP.

Given the problems of gathering data for TFP measurement, Bergman and Goldstein (1986)'s study provides helpful guidance. They found that the measuring indicators of productivity growth are value-added per worker, capital expenditures per worker, utility costs and shipment per worker. Among these indicators, this thesis focuses on value-added per worker to measure productivity growth.

Structural Transformation

Structural transformation is an important element to illustrate the economic development of a city. According to Adam Smith's view, structural changes are a consequence of the division of labour, a fundamental principle of production. It is evident that without some specialisation among the productive forces of an economy there could hardly be any classification of sectors by different produces. Negishi (2000) identifies two aspects of Adam Smith's division of labour namely intra-firm and inter-firm division of labour. The intra-firm division of labour is explained by his famous example of pin-making. The process of production within a firm is subdivided and each of these sub-processes is performed by highly specialised worker.

On the other hand, the inter-firm division of labour occurs not within a single firm, but within whole industry, where different firms perform different parts or components of one manufacturing process. The second important characteristic of inter-firm division of labour is specialisation. It is generally accepted that when the unskilled labour is concentrated on a single activity he might be able to perform this activity more productively than an experienced craftsman. In this sense, specialisation leads to an upgrading of the skills of employed workers and their productivity. These sorts of improvement can also affect the production process, quality control and operational management. Such activities are sometimes called 'on the job training' or 'learning by doing'. In contemporary economics and management studies, a case of division of labour between different firms is called 'outsourcing', for instance, the firm concentrating on some core competences and purchasing the remaining services from other firms via markets (Zakarias et al. 2001). The formation of clusters is based on the specialisation of 'division of labour'.

As Zhang (2003, p. 1552) explains, growth theory and neoclassical perspective have informed policy actions that concentrate on the attraction of inward investment and economic competitiveness in international trade, while structuralist views stresses sustaining structural upgrading of the city economy in response to changes in both the technologies of production and market demands. Harris (1991) also suggests that when market mechanism encounters a bottleneck, local authorities need to facilitate economic change and exploit opportunities, and continually seek to change the structure of the city's output in order to upgrade the long-term productivity of the city.

3.3 Critical Review of Literatures

So far, this chapter has examined the relationship between DFI and urban economic growth, explaining the definition of urban economic development and its key variables. From the previous section, it is generally assumed that there is a positive relationship between DFI inflows and urban economic development. This section introduces theories and concepts of spatial organisation, inter-firm linkages and urban economic development, and the role of foreign invested firms. The first part of this section will establish the key concepts regarding the clustering of DFI by examining the spatial organisation of firms. The notion of spatial organisation will be conceptualised by addressing a development pole, industrial district (ID) and innovative milieu. With the special focus given to the hub and spoke model of industrial district, inter-firm linkages and urban economic development will be investigated. Furthermore, the role of FIEs in inter-firm linkages will be highlighted.

3.3.1. Spatial Organisation of Firms: Development pole, Innovative milieu, ID

The basic arguments underpinning spatial organisation stem from several different streams of literature. These span the range from simple models of firm location to much wider debates on industrial organisation and spatial clustering (Bapista, 1998). Within the geography and planning literature, the interest in so-called new industrial districts arose primarily from the observation of spatial organisation of production in several key industries, such as the electronic industry in California and the clothing industry in northern Italy. Within these studies, much of the interest in the modern form of spatial clustering is motivated by the re-awakening to the possibilities for a renewed public policy role in local economic development issues. Important though this attempt is, the policy context has not always encouraged analytical clarity. In particularly, there have been frequently used terms such as 'agglomeration', 'clustering', 'industrial districts', and 'innovative milieu', 'embeddedness' which have been used more or less interchangeably, with little concern for questions of operational characteristics, which are actually far from straightforward, and should be different for each other term (Gordon and McCann, 2000).

The spatial organisation of firms is characterised by the dynamic process of geographical concentration. As one competitive firm grows, it generates demand for other related industries. The concentration of spatial economic activity becomes more complicated when a propulsive industry is established at a development pole. The development pole led by regional economic policy will enable the region (relatively lagging region or city) to attract firms which are related

to this particular industry in terms of backward and forward linkages (Parr, 1999, 2002). However, in many of these regions, there were few of structural linkages between new investments (assembly branch plants) to the regions. The lack of linkages causes a reduction in the number of branch plants, or closures down. In 1980, an appeal for endogenous local and regional initiatives for economic development was made. Some localities identified from Western Europe, North America and Japan and collectively termed industrial districts have experienced remarkable growth. An industrial district stresses the innovative capacity of local SMEs belonging to the same industry in local economy. In many ways the concept of industrial district comes quite close to the concept of innovative milieu. The commonality of the industrial district and innovative milieu approaches rests on the role of inter-firm co-operation and collaboration in the local economy. The following subsection gives more details of the relevant concepts of spatial organisation in order to offer a theoretical base to explain inter-firm linkages in the clustering of DFI; these are the development pole, the innovative milieu, and the industrial district.

Development Pole

"Growth does not appear everywhere at the same time; it appears at point or *poles of growth* with varying intensity; it spreads along various channels and with differing overall effects on the whole economy." (Perroux, 1955, p. 309 quoted in Parr 1999, p. 1197)

Perroux's growth pole theory hypothesises that growth is stimulated by leading industries, firms or other actors who are dominant in their regions (Blakely and Bradshaw, 2002). Hence, a critical aspect of the development pole theory is how and where economic growth does, or should take place in a region. More specifically, the key questions are asking about the formation and spread of poles in geographical space, the structural characteristic of pole and the development process and the spill over of development impulses among regions.

The definition of a development pole is a large group of industries, strongly related through their input-output linkages around a leading industry and clustered geographically (Lasuen, 1972, p. 24). As Hermansen (1972, p. 161) explains Perroux's conception of development is "essentially polarized in the sense that forces inherent in the development process worked toward clustering activities and growth and toward imbalance between industries and geographical area."

The applications of development pole theory has been concentrated mainly on problems of inter- and intra regional development. Typically, geographical and territorial aspects of

development emphasize the tendency towards the clustering of economic development in certain areas or centres as inherent in the economic forces at play, and concomitant with economic development. Hirschman's theory of development is the recognition of interdependence linkages (input-output) achieved by fostering backward and forward inter-firm linkages. These linkages not only become an important part of Hirschman's unbalanced growth strategy for economic development, but also play a major role in the Perroux's development pole theory.

Perroux draws heavily on Schumpeter's theories of role of innovation. Schumpeter (1961, pp. 100-101.) stressed that the innovations which induce dynamics tend to cluster both temporally and sectorally (Kirat and Sierra, 1998). The theory of polarized development is based on a detailed vision of the leading enterprise and industry. The leading enterprises exerts, over those industries within its circle of relationships, certain 'propulsive effects', meaning a set of asymmetric and irreversible actions over a specific period. The leading industry's action thus generates, at the next highest level of aggregation, the 'domination effect', the asymmetric and irreversible influence that the 'dynamic entrepreneur' exerts over his environment, wherein innovation is placed in opposition to routine (Kirat *et al.*).

The major limitation of the development pole concept is that it fails to explain how the poles are generated and how development impulses are spread among such poles. It is also an extremely abstract concept in terms of 'economic space' and fails to measure the spread effect of development in 'economic space'.

In this thesis, it is crucial to identify the inter-firm linkage between firms which is core component of formation of poles and process of urban economic development. Close inter-firm linkages are important for initiating and diffusing structural transformation in economic development, since firms share information and technology by interactions through linkages. When one strong and leading industry or enterprise has a number of inter-firm linkages with small and medium sized enterprises (SMEs) it may stimulate SMEs' productivity and leads structural transformation.

Innovative Milieu

The innovative milieu is characterised by geographical proximity, informal relationships between firms and a collective learning process. Geographical proximity facilitates information and knowledge exchange, as well as enabling social cohesion to develop. It contributes to

generating synergetic and collective learning processes within the milieu (Lisa, 2001).

Peter Hall (1999) systematically analysed the concept of innovative milieu. He pointed out Keeble and Aydalot's (1988) arguments that, in order to understand innovation, the key need was to study the firm in its local and regional context, and thus to identify the external conditions that helped both the creation of new firms and adoption of innovations by existing ones. These local milieus were 'the incubators of innovative firms', particularly important for nourishing small and young firms in close proximity (Hall, 1999). These forms of local milieu especially appear to facilitate the emergence and development of clusters of technologically-based activity (Camagni and Capello, 1997).

The formation of a 'local milieu' with a particular propensity stimulates creative innovations (Maillat, 1991; Hall, 1999). Such 'innovative milieus' are characterised by a certain coherence based on 'technical culture'- a distinctive way to develop, store and disseminate knowledge and technical 'know-how', norms and values – that is linked to a certain type of economic activity (Coffey and Bailly, 1996, pp. 31-35). The interaction taking place between firms is *embedded* in a complex web of relations that link them to suppliers and customers, organisations and local authorities (Grabher, 1993). The elaboration of a supply-chain can be characterized in terms of inter-firm relationship in certain location (Cook and Morgan, 1998). This peculiar specializing location may thus attract direct foreign investment seeking such linkages, thereby strengthening the clustering (Grabher, 1993).

This framework is particularly propitious to the development of specific resources and to the emergence of innovation networks. In general, innovation is a complex, non-linear process, which implies the participation of several actors or partners. Because it offers not only physical but also above all institutional and cultural proximity, the context of innovating milieu favours the creation, development and the vitality of innovation networks. In this context, it helps to find reliable partners and to facilitate communication (Maillat, 2001).

However, a major weakness of the innovative milieu model is that it dose not clearly explain spread effect in terms of an internalised transaction process in certain location. The following questions need to be answered, namely what the foundation of inter-firm linkages is, what the main reasons of generating spill-over through inter-firm relations are, and what exactly the mechanism of collective learning in particular location is.

A recent critical survey concerning the territorial innovation model (Moulaert and Sekia, 2003)

stresses 'apprenticeship', meaning that innovative activities of different members of the milieu depend on the capacity of learning. Learning enables them to perceive changes in their environment and to help them to adapt their behaviour accordingly. The dynamic apprenticeship and inter-firm linkages constitute the core of the innovative milieu. 'Apprenticeship' can be interpreted as an input of innovation due to its emphasis on the importance of the learning process in order to achieve innovation. Innovation, as Schumpeter (1961) notes, refers to the introduction of a new method of production technique, and a new means of organising production. The learning process is, hence, most crucial part to acquire innovation. The author regards such learning activities as input of innovation.

Industrial Districts

The conceptual background of spatial clustering can be traced back to Alfred Marshall's observation of industrial districts in the UK (Marshall, 1920). According to Marshall's concept, the advantages of agglomeration are rooted in the reduced costs that arise from the operation of three sets of 'localisation economy': (1) the growth of various intermediate and subsidiary industries which provide specialised local input; (2) the development of pool of skilled labour; (3) the establishment of a dedicated infrastructure and resources (Cumbers and MacKinnon, 2004).

The key linkages which affect the extent and nature of clustering of DFI include local inputs, notably labour market linkages with suppliers and sources of other intermediate inputs; interaction with customers; networking, collaboration and competition with firms and organisations other than customers and suppliers; and collective learning and creativity (Keeble and Nachum, 2001). Through collective learning processes which promote new knowledge creation and transfer, local linkages are particularly emphasised in terms of the theorisation of clusters as *industrial districts* (Marshall, 1920; Scott, 1988a,b, 1992, 1998, 1999; Becattini, 1990; Martin, 1999a,b). An industrial district is characterised by high level of inter-firm networking and collaboration.

Inter-firms relationships can be observed between large and small firms, among large firms and among small firms. These relationships include supplier-customer relations; subcontracting relationships; strategic alliances; and other kinds of collaborative activities. Through these interactions or networks, different types of industrial districts can be developed. According to Markusen (1996), there are four distinctive industrial district types: (1) Marshallian industrial district where the business structure is comprised of small, locally owned firms and cooperation

with firms outside the district are assumed to be minimal; (2) the hub and spoke model, where regional structure revolves around one or several major corporations in one or a few industries (3) the satellite platform model, comprised chiefly of branch plants of absent multinational corporation; (4) the state anchored industrial model, a more eclectic category, a special case where much of the stimulus to the region comes from one or several large government institutions, such as military base, research laboratories, universities or from proximity to state or national capitals. In each type of industrial districts, the intensity of inter-firm linkages is the decisive factor of industrial district.

In general, industrial district models – when they are successful – are creative, display originality, are often able to discover new markets, and continuously introduce incremental innovations, some of which may prove important, whilst enhancing social mobility and worker participation. However, as Brusco (1992, p. 196) argues, they are "slow to adopt new technologies, lack expertise in financial management and technology, and are unable to produce epoch-making innovations."

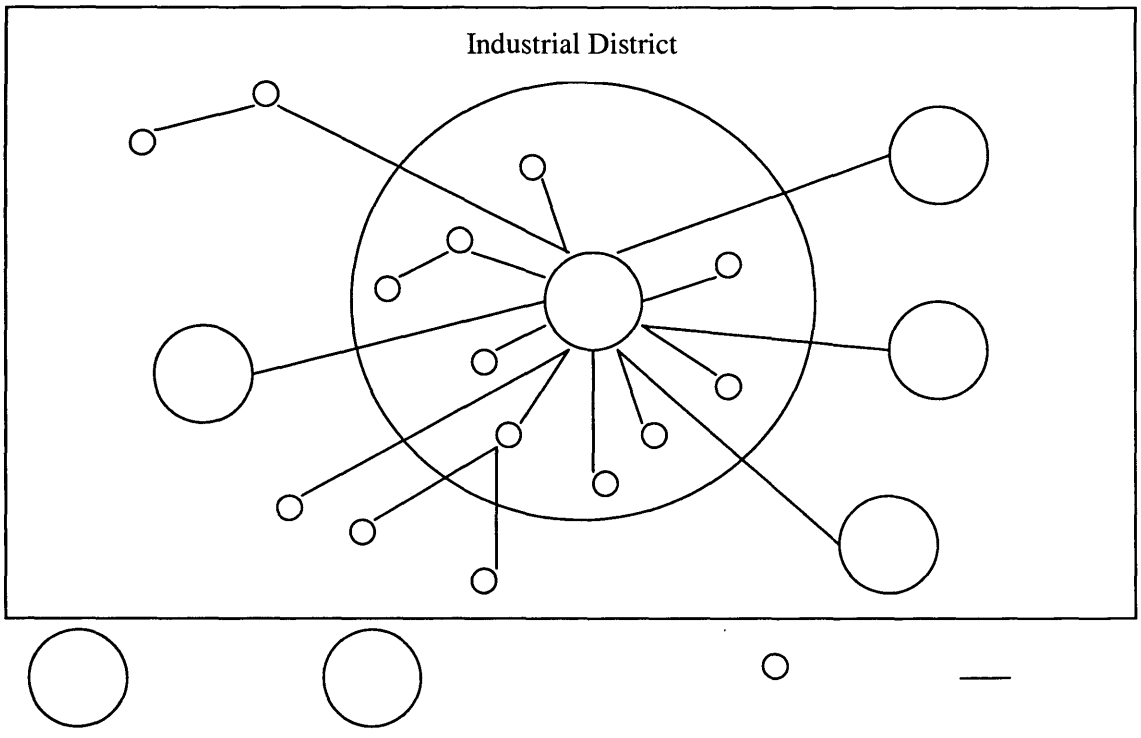
Hence, "the district has to be viewed not only as a unit of analysis but also as a unit of initiative: as a fully-fledged and organically unified organisation, whose development is slowed down or impeded by bottlenecks that public action must turn into opportunities" (Brusco, 1992, p. 195). This debate fundamentally turns on analysts' interpretation of how or whether strong institutions allow territorial networks of small firms to compete successfully with larger, more highly capitalised multinational companies. However, the most crucial issues lie in questions about the past adequacy of a district's regulatory and service institutions in overcoming the market failure, and more importantly, what further innovations are required given a series of changes in regional economy.

Among numerous theories of spatial organisation, this thesis adopts Best's (1990, p. 233) definition of an industrial district as a main conceptual idea of 'clustering' of DFI, which states "a group of geographically concentrated firms specialising along the lines between similar and complementary activities and developing greater skills and productive knowledge (Best, 1990, p. 233)." More specifically, the concept of industrial district for this study takes key features from the hub and spoke model (Markusen, 1996). Details of the hub and spoke model in the context of inter-firm linkages are examined in next section.

3.3.2. Inter-Firm Linkages and Urban Economic Development

In order to build the concept on clustering of DFI, the hub and spoke model from industrial district provides key theoretical intuition. The hub and spoke model is presented in regions where a number of key firms act as anchors or hubs to the city or regional economy, with suppliers and related activities spread out around them like spokes of a wheel. Examples are Seattle, USA and Toyota City, Japan. As shown in figure 3-1, a single large firm (e.g. Boeing in Seattle or Toyota in Toyota City) buys from both local and external suppliers and sells chiefly to external customers, who may be large, and masses of individual customers. Thus, the hub and spoke of industrial districts are dominated by one or several large, vertically integrated firms, in one or more sectors, surrounded by smaller and less powerful suppliers (Markusen, 1996). The 'hub' and 'spoke' configuration typifies the dominant role played by large producers within a region in managing their needs for production capacity. The dynamism of the hub and spoke model is associated with the position of these hubs' organisation and their national and international markets. Other small and medium local firms tend to have a subordinate relationship to them. Thus, the largest returns for local trade tend to be tied up as retaining earnings in the major hub firms who are efficiently utilising their global strategic linkages.

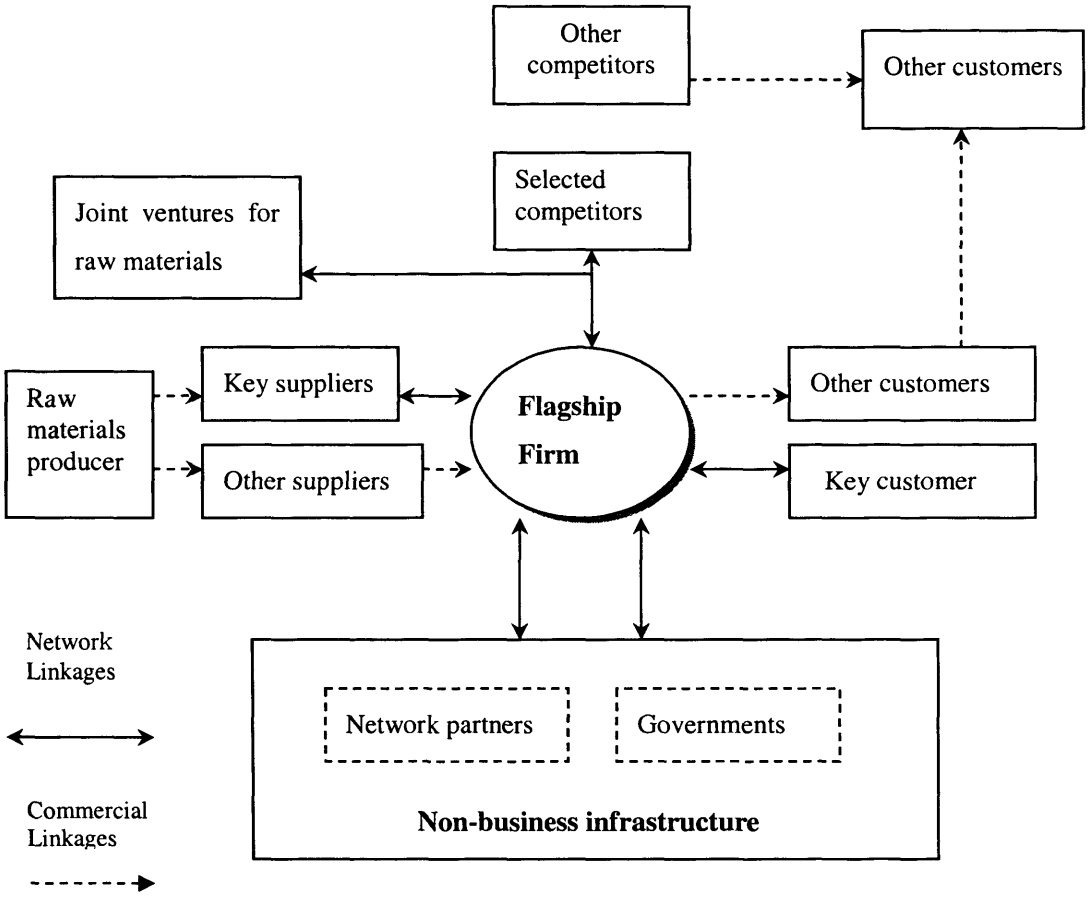
Figure 3-1 Hub and Spoke model



Source: Markusen (1996, p. 297)

The strategic application of the hub and spoke model is found in the model of 'flagship and five partners' by Rugman and D'Cruz (2000). 'Flagship and five partners' model provides leadership to a vertically integrated chain of business with which it has established key relationships. Rugman and D'Cruz (2000) confine the definition 'flagship firms' to Multinational Enterprises (MNEs) or Transnational Corporations (TNCs). This model, however, is different from industrial districts in that it focuses merely on the internal firm network of MNE, neither considering inter-firm linkage with local firms nor stressing host country's local economic development. The five partners consist of a flagship firm, key suppliers, key customers, competitors, and non-business infrastructure. The last partner refers to the non-traded service sectors, the government, social service and education. As shown in Figure 3-2, flagship firms lie at the hub of the business network. It is the flagship firm that provides strategic direction and purpose to the network by orchestrating the relationship among the partners. Key suppliers differ from other suppliers in that they enter into a close network relationship with the flagship firm, sharing strategies, information, resources and responsibility for the success of the network. Key customers also develop network relationships with flagship firm that entail close co-operation and sharing of resources and information (Rugman and D'Cruz, 2000). A set of vendors is nestled around a large core firm, either providing inputs to the firm or distributing its inputs. The 'dynamic network' is a network in which a 'lead firm' identifies and assembles assets owned largely by other firms (Ritter and Gemunden, 2003).

Figure 3-2 The flagship firm and the five partners business system



Source: Rugman and D'Cruz (2000), p. 31

Leading firms typically rely on core skills such as manufacturing, research and development (R&D) capacity, design and assembly, or sometimes, pure brokering (Giroud, 2003). According to Jarillo, the MNE has a bundle of competitive advantages that are often unavailable to local indigenous firms. This dynamic network is also 'strategic', since the 'hub firm' sets up network, and takes a proactive attitude in the care of it (Jarillo, 1995).

Whatever the type of network, the central idea resides in the existence of 'node' and 'links' created by the interaction of firms. The inter-firm network is largely governed by economic interests in terms of buyer-supplier subcontracting and joint venture. It is also related to concepts such as social network and embeddedness (Yeung, 1998, 2000; Yeung and Li, 2000). "Embeddedness refers to the fact that economic development is affected by actor's dyadic relations and by the structure of overall network of relations." (Grabher, 1993, p. 4 quoted from Yeung and Li, 2000, p. 625)

3.3.3 Global Value Chain and Clusters

In the recent debate on global value chains (Gereffi 1999; Humphery and Schmitz, 1998) networking refers to the activity of creating and maintaining organisational exchange and focuses on buyer-supplier relations between economic agents. In this regard, global value chains have been paid attention as a suitable approach to explain dynamics and structure of global-local linkages (Bair and Gereffi, 2001). One of the key hypotheses of the global value chain literatures is that the leading firms which govern and feature a commodity chain are driving forces of industrial development in the location where the chain lies down (Gereffi, 1999).

Lowe and Kenney (1999) investigated why inflows of DFI in Mexican consumer electronic industry led to decline of industry. They argue that weak linkages between local and foreign invested firms are the main reasons. This view highlights the role of 'core' or 'leading firm', often multinationals but sometimes domestic large firms, in governing the supply chain. Okada (2004, p. 1268) quoted Asanuma's view (1997, p. 158) that "the way a 'core' firm develops inter-firm linkages with its suppliers determines the networks' performance and thereby the core firm's competitiveness, which in turn determines the growth of the network itself. Hence, for a product to become competitive, the core firm must achieve a high level of productivity and product development capability, and also ensure high network performance." Therefore, the formal contractual relationships (subcontracting, joint venture or strategic alliance) between suppliers should entail some institutional engagements that can motivate the network to improve its performance (Okada, 2004).

More specifically, Giuliani, Pietrobelli and Rabellotti (2005) examined the difference across sectoral groups namely, complex products and specialised suppliers, raise questions on the role of global buyers in fostering the upgrading in different clusters. According to Table 3-1, Complex products are defined as "high cost, engineering-intensive products, subsystems, or constructs supplied by a unit of production" where the local network is normally anchored to one 'assembler', which operates as a learning firm characterized by high design and technological capabilities. Scale-intensive firms typically lead complex product sectors where the process of technical change is realised within an architectural set and it is often incremental and modular. Specialised suppliers are promising sector for developing countries' SMEs, due to the low cost of transportation and high information intensity of the sector. Moreover, the proximity of the market and of clients may crucially improve the development of design capabilities and thereby foster product process upgrading (Giuliani, et al).

Table 3-1 Global Value Chains: Patterns and operation of learning in Electronics Industries

Groups	Industries	Learning patterns	Description
Complex products	Consumer electronics	Scale intensive firms	-Technological accumulation is generated by the design, building and operation of complex production systems or products -In-house R&D is critical for innovation -Process and product technologies develop incrementally -In consumer electronics, technological accumulation emerges mainly from firm's R&D laboratories and university collaboration
Specialised suppliers	IT and software	Specialised suppliers	-Important user-producer interactions -Low barriers to entry -High in-house R&D for development of edge technology

Source: Adopted from Giuliani et al. (2005), p. 555

Learning through inter-firm linkages may take various forms, such as product innovation, R&D activities, process innovation, sharing knowledge and skills among networked firms. This means that the mechanisms for development of skill should be integrated within the firm as well as within the supply network in inter-regional boundary (Scott, 1998). The extent to which the networked firms can absorb technological innovation depends on the level of skills that the network as a whole has acquired (Okada, 2004). Hence, the core or leading firm plays a crucial role in developing a system to foster skill formation and development industrial cluster. The next section discusses the role of foreign invested firms in the context of the inter-firm networks and its impact on urban economic development.

3.3.4 The Role of Foreign Invested Firms

Innovative Activities through Linkages

The mechanisms of innovation identified by suppliers is through the informal sharing of knowledge and information, the value of purchases from the inward investors, increased awareness of better practices, and contractual arrangements on product specification and technical aspects of production. As inward investors, suppliers identify key impacts on

competitive advantage including product quality, speed of service and price, although suppliers also placed emphasis on their responsiveness to client needs and reputation in the market. Suppliers and inward investors both recognise gains in sales, employment, profitability, productivity and investment. However, suppliers place more emphasis on the value of purchases in terms of transmitting the impact and were more neutral in terms of their links with inward investors and their willingness to adopt their practices and working methods (PACEC, 1995, p. 71-75)

Recent articles (Yeung and Li, 2000; Wang and Tong, 2002) suggest that the local supply of materials and parts, local participation in management and technology development are major sources of local economic development. Yeung and Li (2000) have argued that supplier relationships are the most important single indicator of local embeddedness. In fact, the local involvement in terms of local participation of management is China's main target in attracting DFI. The level of managerial localisation is defined by the ratio of local managers to the total number of managers of an FIE.

Thompson (2002) studied FIEs' technology transfer to local firms by investigating Hong Kong garment firms in China. In his research, technology transfer to local firms by geographically concentrated FIEs was compared with that of geographically dispersed FIEs. He concluded that FIEs enhance technological development of local firms; more specifically geographically concentrated FIEs is better than dispersed FIEs at transferring technology and managerial skills via training and spill-over to Chinese firms.

As industry moves into more complex products with technology development, specific types of higher technical and other skills becoming essential to efficient operation. Individual learning occurs through a process by which workers gain new knowledge, insight, and skills and thereby modify their actions. Workers' skill development mostly takes place in the workplace, however, through informal on-the-job training, or through formal training programmes, provided by either linked firms or external training institutions. Thus, the way in which a firm designs on-the-job training and formal training programme affects how quickly knowledge and skills are diffused within it (Giroud, 2003). Hence, the issues of how firms create mechanisms to accelerate such an individual as well as organisational learning become a critical factor in creating innovation.

Productivity growth through linkages

Crone and Roper (2001) have examined the local learning from multinational plants in the case

of Northern Ireland. They provide new empirical evidence that multinational enterprises (MNEs) can play a particularly significant role in fostering 'local learning' and promoting regional growth and competitiveness. More specifically, direct foreign investment can stimulate urban and regional growth through technology transfers that may improve the competitiveness of local firms. The supply chain is the important channel for this type of learning process.

The similar study by PA Cambridge Economic Consultant (PACEC) (1995) examined the impact of manufacturing inward DFI on the UK economy, focusing especially on the impact on management and operational practices, using a survey of 30 large foreign-owned plants. The PACEC study (1995) confirmed the theoretical assertion that, because of the competitive strengths of the inward investors, there was substantial potential for knowledge transfers from MNE plants to local suppliers. It also found that most inward investor adopted a positive stance on the transmission of knowledge to their suppliers.

As a result, foreign invested firms contributed to local firms' business performance by their product development activities and quality assurance system. Also, foreign invested firms in inter-firm linkages enhance quality of labour (enhanced skills), quantity of labour and business support services. In addition, Gorg and Ruane (1998) proved that inter-firm linkages can have positive effects on the creation of indirect employment generated in supplier firms.

Structural Transformation through Linkages

Wang and Blomstorm (1992) pointed to the importance of the learning efforts of host-country firms in increasing the rate at which foreign firms transfer technology. Through the learning process of technologies, skills and know-how, it will increase industrial productivity (upgrading the competitive assets from low technology, low productivity, low value-added and labour-intensive industry to higher-technology, higher-productivity, higher value-added and knowledge-based industry) in the host country. This process includes the generation and efficient allocation of capital and labour, the application of technology and the creation of skills and knowledge. The crucial factor is the extent to which the technology is made available to potential users outside the firm either directly, through **linkages** with indigenous firms, or indirectly via the *demonstration* effects[2] (Dicken, 1998, p. 248-9).

[2] The review of DFI and technology transfer described in "UNCTAD (1995), World Investment Report 1995: Transnational Corporation and Competitiveness, Chapter three, pp. 137-190". This report composed of three sections mainly clarifies that (1) Innovation and the transfer of technology and skills within transnational system. (2) Linkages with and spillovers to firms and institutions outside the TNC system. (3) Implications for the economic performance of countries. The most critical implication is that

Table 3-2 Dependent and development linkage structure

	Dependent structure	Development structure
Form of local linkages	Unequal trading relationships. Conventional subcontracting. Emphasis on cost-saving	Collaborative, mutual learning. Basis in technology and trust. Emphasis on value added
Duration and nature of local linkages	Short-term contracts	Long-term partnerships
Degree of local embeddedness of inward investors	Weakly embedded. Branch plants restricted to final assembly operation	Deeply embedded. High level of investment in decentralised Multi-functional operations
Benefit of local firms	Markets for local firms to make standard, low-technology components. Subcontracting restricts independent growth	Markets for local firms to develop and produce their own products. Transfer of technology and expertise from inward investor strengthens local firms
Prospects for the local economy	Vulnerable to external forces and 'distant' corporate decision-making	Self-sustaining growth through cumulative expansion of linked firms
Quality of job created	Predominantly low-skilled, low-paid. May be high level of temporary and causal employment	Diverse, including high-skilled, high-income employment

Turok (1993, p. 402)

Apart from the extent of linkages created by foreign firms in host country, greater emphasis is given to the quality and dynamic nature of linkages, together with the longer term implications for structure of local linkage development. Turok (1993) identified the two different types of structure: development structure and dependency structure depending on the degree of inter and intra linkage between DFI and local firms (see Table 3-2). As shown in Table 3-2, in dependence structure, the main purpose of DFI is to minimise the production cost. FIEs make the profit by employing the cheap local labour forces. Thus, the relationship with local firms is not horizontal but vertical. And most existing research on DFI in developing country belongs to this type.

In development structure, foreign invested firms share the information and technology with local firms, strengthening the sustainable partnership. Thus, this type focuses on local economic

the ability of inward DFI to contribute to technology capacity building in host countries' own technology capabilities. Where these capabilities are well developed, and indigenous enterprises are well equipped to "learn, train, adapt and compete", access to technology through inward DFI to speed up technological progress.

development by means of extensive investment and significant transfer of know-how. Following case study shows an example of how FIEs in China are engaged in local firms in technology development and local participation of management.

Clustering in Electronics: Comparative Case Studies of Taiwanese and Foreign Invested Firms in Dongguan and Qingdao

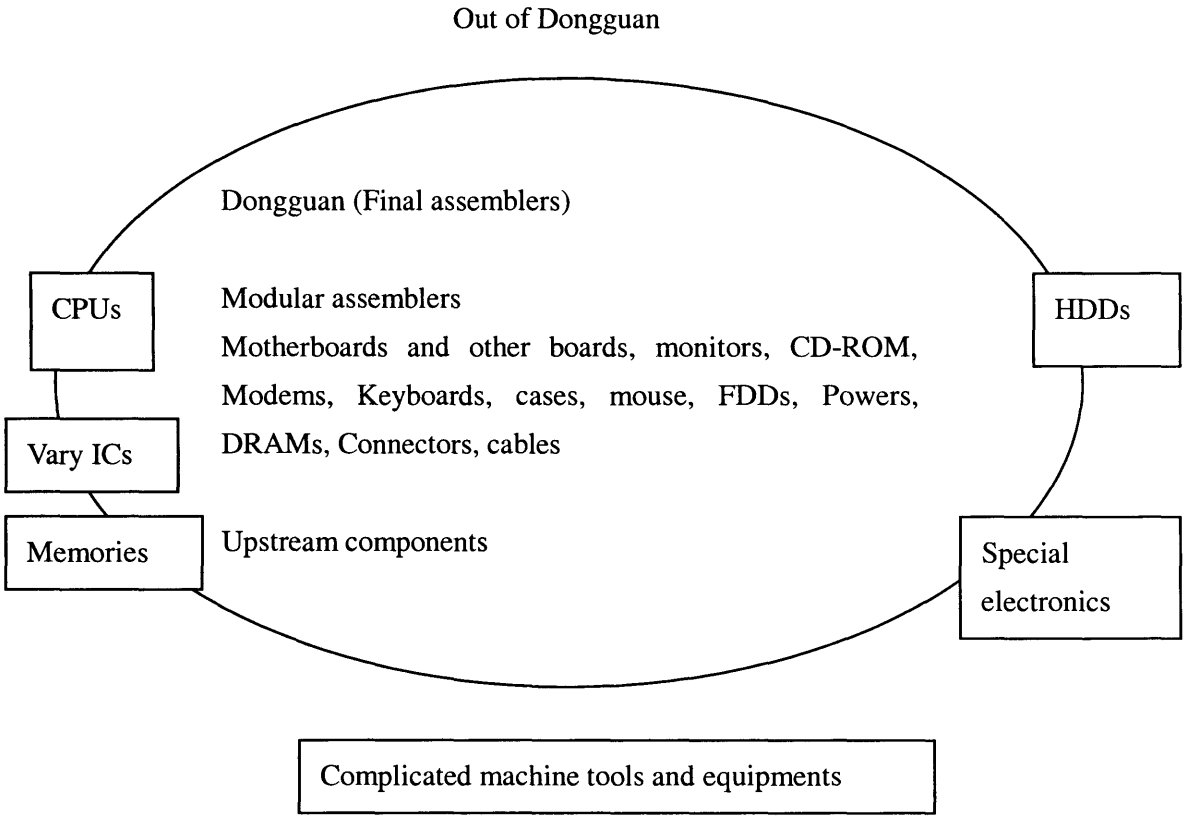
This section briefly illustrates the role of FIE clustering and interaction between local and foreign invested firms. Inward DFI played an important catalytic role during the development of Taiwan's electronic industry. It also contributed to the development of local suppliers for domestic market-oriented production. These DFI-related linkages enabled extraordinary developmental leverage: these arrangements include subcontracting, consignment assembly and various forms of OEM (Original Equipment Manufacturing) contracts. Since the early 1990s, the Taiwanese OEM suppliers have shifted a growing share of their production to low-cost production sites in Southeast Asia and China. Since then, Taiwan's PC industry has experienced an extremely rapid expansion of overseas production (Ernst, 2000). Most of the overseas production of Taiwanese computer companies is concentrated in neighbouring regions in China especially Dongguan, Guangdong province.

Dongguan, a city of Chinese young export-oriented personal computer (PC) manufacturing, initiated her industrialisation mostly by exploiting lower costs of land and labour. This foreign investment-driven district, with its export-oriented manufacture, experienced a fast growing industrialisation process with the characteristic of inter-districts mobility of labour, non-local linkages and non-local embeddedness. The local linkages between the plants were weak, while most producers kept strong linkages with global market through Hong Kong.

However, the major driving forces of local PC manufacturing network were constructed by the following two factors. One came from the following change to the region that most PC companies in Taiwan moved production and manufacturing offshore due to the increasing labour and land cost. The other factor was found in the booming of the Chinese PC market. Qingxi, located in the southwest of Dongguan, was mainly a rural area until 1994, but the booming of PC industry in this remote town was undergone after a few large companies from Taiwan came to establish a plant here, and then it received the title 'Computer Town'. Figure 3-3 shows the local PC-related production chain in Dongguan (Tong and Wang, 2000).

The establishment of Taiwan invested firms has attracted a more massive inflow of foreign investment. With Taiwanese enterprises taking the lead, electronic enterprises from Hong Kong and other countries' firms have found their business opportunities in Dongguan. In 2000, FIEs in electronic sector accounted for 32.5% of all the foreign capital in Dongguan (Jiang, 2004). Taiwanese firms have also developed a capacity to provide a package of services and parts across a wide range of global value chain activities, sustaining their position as preferred OEM suppliers to the industry. In this regard, Dongguan is the strategic location of Taiwanese investment of PC industry.

Figure 3-3 Local PC-related hardware processing activities and products in Dongguan

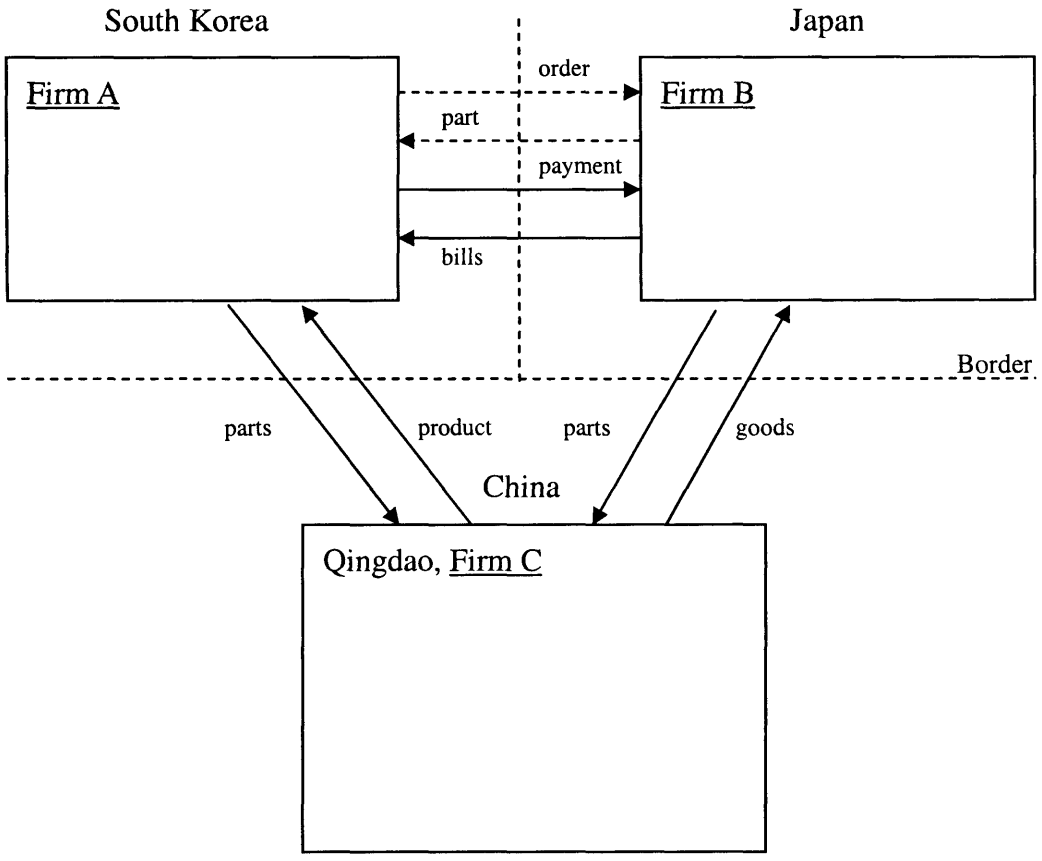


Source: Tong and Wang, (2000), p. 8.

The advantage of FIE clustering is that the upstream modular assembling plants for the final assemblers were quite complete. Dongguan city is able to supply 95% of all the component parts needed to assemble a computer. The city is the purchasing centre for the global TNCs including IBM, Compaq, and Hewlett Packard. TNCs find their local suppliers among the competitive foreign or local firms and purchased components from them such as computer

magnetic heads, motherboards, monitors, scanners, drivers, keyboard and connector (Jiang, 2004). Local firms have also tried to keep up with the fast change of technology in this industry and sharpened their low cost advantage in manufacturing processes, through local interactions with TNCs and close linkages with global market. Subcontracting activities are extensive in local PC production. Many local suppliers felt the pressure to improve the quality and speed of reaction while cooperating with big buyers. In this regard, the quality management department of buyers play an important role in the technological transfer between suppliers and customers. This interaction could lead to further networking of local production (Wang and Tong, 2002).

Figure 3-4 Global Value Chain of Inter-firm Networks in Qingdao Electronic Industry



Source: Prof. Howe and Dr. Thoburn's Comments (2005)

The deepening of an international production network increases number of stages of the value chain in shifting to overseas. While the case in city level analysis (Dongguan city) is illustrated in Figure 3-3, interactions among wider regional picture are described in Figure 3-4. Figure 3-4 shows inter-firm network in Qingdao city with neighbouring nations (South Korea and Japan).

As pressure on cost competition becomes more severe, the firm's overriding concern is to generate, across national borders, faster and most cost-effective interaction between different stages of global value chain. Since the 1990s, foreign electronic firms have rapidly expanded their production in coastal China (Ernst and Ravenhill, 2000). The significance of intra Asian direct investment (by countries other than Japan) lies in the search for production with lower labour and land cost than those available domestically in South Korea and Japan (Howe, 1996). This fact, Japan and South Korea's comparative advantages in capital and technology intensive goods, explains why global value chain should consider the wide regional boundary including South Korea and Japan.

3.4 Conclusion: Synthesis of Conceptual Framework

This chapter has established the main theoretical framework regarding the clustering of DFI, based on the concept of spatial organisation in urban economic development. This chapter focused on firms' spatial linkages and networks, and presented the set of theories on industrial district, development pole, and innovative milieu. Each theory has helped to understand inter-firm linkages and the role of FIEs in providing the useful insights to develop an integrative approach of which features are derived from existing literatures. The limitation and gaps of the existing theories are also assessed. Based on the evaluation of existing literatures, this chapter develops a theoretically integrative view – clustering of DFI – through which role of inter-firm linkages between local and FIEs can be better understood in the process of urban economic development.

Table 3-3 summarises the assessment of existing theories and introduces how different theories are integrated in order to explain the impact of clustering of DFI on urban economic development. Three theories commonly stress the importance of the geographically concentration of firms' activity by which innovations are created. However, the way to create innovation is different: development pole emphasizes that the innovation is created from input-output (backward and forward) linkage; in innovative milieu, innovation results from social network and collective learning process; industrial district focus on inter-firm linkages to explain the innovation. Each theory has its own theoretical limitations. The development pole cannot explain the procedure of how the poles are generated. Similarly, the mechanism of the collective learning process is not clear in an innovative milieu. The industrial district overemphasizes the local firms' spin-off mainly based on social network. More specifically, view of hub and spoke model in industrial district does focus on local firms' business activity, but has little emphasis on the role of inter-firm linkages between local and foreign invested

firms in the process of spatial clustering in local economy.

Table 3-3 Assessment of Theoretical Framework: Integrative Approach

	Development Pole	Innovative Milieu	Industrial District (Hub and Spoke model)	Integrative Approach: Clustering of DFI
Key concepts for analysis of Linkages	Poles as large groups of industries of leading firms are strongly related through their *input-output (or backward and forward) linkages* around leading industries or firms, and are clustered geographically (Lasuen, 1972).	Innovative milieu is characterised by geographical proximity, and *informal relationships* between firms and a collective learning process (Lisa, 2001)	Industrial district is defined as a group of geographically concentrated firms specialising along the *lines between similar and complementary activities* (Best, 1990)	Clustering of DFI features both spatially concentrated and industrially specialised group of firms. It is facilitated by the linkage between local firms and FIEs.
Key concepts for analysis of UED	**Innovation** is created by geographic polarization development	**Innovation** is generated by social network and collective learning process	**Specialisation, Innovation, Productivity growth** and **Common labour markets** are created by inter-firm linkage	**Innovation, Specialisation** and **Productivity Growth** are fostered by supply network between local large firms and FIEs
Limitations	Lack of explanation of how the poles are generated and how the development impulses and spreads.	No clear explanation of mechanism of collective learning process	Overemphasis on local firms' spin-off based on social network. Hub and spoke model little consider role of foreign invested firms (FIEs)	Indigenous local capacity in terms of industrial base being required

This research seeks to contribute to overcoming the limitations, by integrating existing approaches (development pole, innovative milieu, and industrial districts) into the concept of DFI clustering and its impact on urban economic development. Hub and spoke model, with special focus, offers key intuition in constructing the theoretical framework for examining the impact of clustering of DFI on urban economic development. The main difference of clustering

of DFI from existing studies lies in the view that it emphasizes the supplier and buyer linkage between local and foreign invested firms. This approach views clustering of DFI as being formed by way of attracting DFI to development zones. The existence of interaction between firms may generate positive externality to the local economy, in the form of technological transfer and knowledge exchanges. If such interaction between firms is understood as inter-firm linkage and assumed to exist in the zones, the inflow of DFI and role of development zones can be re-investigated more dynamically. Moreover, an area where such interaction actively takes place will offer the basic concept of clustering of DFI. In order to verify theoretical issue of clustering of DFI and its impact on urban economic development, following research proposition is constructed:

Research Propositions

1. The inward direct foreign investment (DFI), geographically concentrated in development zones, creates buyer-supplier linkages and facilitates the local industrial cluster.

2. The buyer-supplier linkages between local large firms and foreign invested firms become a channel to transfer technology and managerial skills into local small and medium firms. Interactions between local and foreign invested firms enhance productivity and innovation in development zones.

3. The buyer-supplier linkages in the Qingdao city case studies are explained by a hub and spoke model of industrial district: domestic large firms play as hub firms and foreign invested firms as spoke firms.

In the light of the research propositions, the procedure of innovation, productivity growth, and specialisation which are key indicators of urban economic development will be empirically investigated. Detailed methodology which measures the empirical significance of the clustering of DFI, is introduced in Chapter 4.

Chapter Four Research Methodology

4.1 Introduction

The key research objective in the present thesis is to investigate the impact of DFI clustering on urban economic development with a case study of Qingdao city, China. In order to achieve this objective, the research aims to explore the following key questions: 1) How does inflow of DFI foster local industrial clusters in Qingdao? 2) What is the impact of the clustering on local economic development? 3) What are the main mechanism underlying this impact?

This author hypothesises that inflow of DFI facilitates local industrial cluster through buyer-supplier relationships between local and foreign invested firms in development zones in Qingdao, China; that buyer-supplier relationships in development zones provide the channels whereby active learning and technological transfer are carried out in the process of clustering of DFI; and that clustering of DFI contributes to urban economic development in the sense of innovation, productivity growth and structural transformation.

Given the research objective and hypotheses as stated above, this chapter establishes the efficient research methods and designs in exploring the answer to the research questions. For this purpose, the methodology adopted in this study is based on a combination of quantitative and qualitative methods. More specifically, the impact of clustering on local economic development is evaluated by quantitative methods such as regression, location quotient (LQ) and Shift-share analyses. However, quantitative methods alone cannot explain the specific nature and mechanism underlying the impact of clustering of DFI on urban economic development. Qualitative method based on in-depth interview is essential. Through in-depth interviews, the detailed mechanism of how clustering of DFI influenced on urban economic development will be investigated.

The chapter consists of four sections. Section 2 addresses the analytical framework specifying the research technique focusing on Shift-share and location quotient analysis. Section 3 presents the research design which includes questionnaire survey, in-depth interview, and sampling. This section also reports the result of preliminary field work and raises the further issues explored in final field work research. Concluding remarks are presented in Section 4.

4.2 Analytical Framework

The research questions of this thesis need both quantitative and qualitative analytical methods. For quantitative analysis, a questionnaire survey is utilised; from the information of the survey, data are extracted which will be used in the regression analysis. In-depth interviews are also carried out at the same time as the questionnaire survey.

In general, the regression analysis is most widely used in quantitative research technique in social sciences, using statistical software package such as EXCEL, SPSS and E-VIEWS. Data for regression analysis in this thesis is collected from the questionnaire survey, while Shift-share and location quotient (LQ) analysis use official statistical data.

Shift-share and LQ analyses are also popular analytical tools in the field of regional and urban economics. These techniques use secondary data, namely, data from official statistical yearbooks. The rationale of Shift-share and LQ analyses are explained in the following subsection.

4.2.1 Shift-share Analysis

The Shift-share model examines economic change (e.g. growth or decline) in a region by breaking it down three components: national growth, industrial mix, and local competitiveness. The variable may be employment, income, gross industrial output, value-added, population or a variety of other economic factors that are imbedded in different hierarchical levels. This method helps to understand and select key leading industries in the region.

The simple formula[3] of Shift-share analysis as follow:

1) $TS \equiv RS + IS + DS$

2) $TS \equiv \sum E_{ir}^{t} g_{n} + \sum E_{ir}^{t} (g_{in} - g_{n}) + \sum E_{ir}^{t} (g_{ir} - g_{in})$

With the same logic, Shift-share analysis can measure impact of direct foreign investment clustering on urban economic development in terms of (industrial) structural transformation.

[3] This simple formula and notation are drawn from Haynes and Dinc (1997)

* $TS_{dfi} \equiv RS_{dfi} + IS_{dfi} + DS_{dfi}$

$$TS_{dfi} \equiv \sum E^t_{ird} g_{nd} + \sum E^t_{ird} \left(\frac{E^{t+1}_{ind} - E^t_{ind}}{E^t_{ind}} - g_{nd} \right) + \sum E^t_{ird} \left(\frac{E^{t+1}_{ird} - E^t_{ird}}{E^t_{ird}} - \frac{E^{t+1}_{ind} - E^t_{ind}}{E^t_{ind}} \right)$$

Notation

TS is the total shift share; *RS* is the reference economy share; *IS* is the industrial share or proportional share; *DS* is the differential shift or competitive advantages[4]

E^t_{ir} is the employment or output growth in sector i of region r at the beginning of a time interval extending from t (initial year) to t+1(final year)

g_n is the rate of growth of all industries combined in the reference area, n

$g_{in} = \frac{E^{t+1}_{in} - E^t_{in}}{E^t_{in}}$ is the rate of growth of employment or growth output in industry i in the reference area, n.

$g_{ir} = \frac{E^{t+1}_{ir} - E^t_{ir}}{E^t_{ir}}$ is the rate of growth over the same time interval in employment or growth output in industry i of region r

TS_{dfi} is exactly the same as of previous formula and notations, but using different data set (foreign invested firms' constant value added data). This Shift-share research technique uses computer software such as Excel. The followings are definitions of each acronym used in Shift-share formula.

1. *RS* (reference economy share or national effect): economic growth in a local area's benefits or suffers from the changes in overall national, state, regional and even city economy. No matter what industry it is, the overall growth or decline has an impact on the locality, and part of change in employment or growth output of a local industry has to do with what is happening in the broader economy.

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[4] Blakely and Bradshaw (2002, p. 128) called competitive advantage.

2. *IS* (industrial mix or proportional shift) is the relative change of an industry to the total of all industries. It simply measures the relative advantage or disadvantage that an industry has relative to overall economic growth.

3. *DS* (differential shift or local competitiveness effect) is the difference in the rate of growth or decline in the local industry relative to the rate of growth or decline in the same industry on the reference economy (national, provincial, or city). Hence, it helps to determine whether local industries are more or less competitive than the reference economy in the same area.

Shift-share analysis has been heavily criticised as being simplistic and inadequate as a policy-making tool. One of the most vehement critics is Richardson (1978, p. 202), who refers to Shift-share technique as "a harmless pastime for small boys with pocket calculators." In his view, it is "the most overvalued tool of analysis in regional economics and it tells us nothing about the capacity of a region to retain growing industries or how to attract them in the first place" (Davila, 1999, p. 209). Richardson concludes that "this primitive technique should be abandoned, since ease of operation provides insufficient justification for preserving with such a biased and inconclusive method of analysis" (Armstrong and Taylor, 1993, p. 144). These warnings, however, have not been heeded. Shift-share analysis continues to be used as an aid to analysing regional industry and employment research.

Davila (1999, p. 209) critically pointed out that although many of the criticisms (regarding the adequate use of the tool) were raised by many scholars including Richardson, "there would seem to be some degree of agreement as its usefulness in describing industrial change in a region, and attempting to disentangle some of the effects that different factors would have upon on such growth. The Shift-share is a standardisation technique which, like experimental controls in the physical sciences, are an important step in understanding the world. Thus, as first step to describe growth in its different components, Shift-share has much to offer, especially if it is seen as a starting point from where the researcher may begin to test hypotheses in a meaningful way."

4.2.2 Location Quotient (LQ) Analysis

Location quotient (LQ) analysis is also often used in measuring competitiveness of region's

industry. It quantifies a ratio of industry's concentration in a specific city or region. To be more sophisticated, the same type of ratio, like gross output and value added, can be calculated. In this research, constant value added data is used for analyzing DFI location quotient. A measure of relative concentration and is defined as

$$1)\ LQ = \frac{E_{ij} / E_j}{E_{ir} / E_r}$$

Where E_{ij} is the value added in industry i in area j, E_j is the total value added in area j, E_{ir} is reference area's value added in industry i and E_r is total reference value added. As a same logic, LQ can also measure clustering of direct foreign investment.

$$2)\ *LQ_{dfi} = \frac{E_{ijd} / E_{jd}}{E_{ird} / E_{rd}}$$

Where E_{ijd} is the value added by DFI (foreign invested firms) in industry i in area j, E_{jd} is total value added by DFI in area j, E_{ird} is reference area's value added by DFI in industry i and E_{rd} is total reference value added by DFI.

In this way, LQ provides a measure of the specialisation index in each industry in the region or city (Glaeser et al, 1992). For instance, if the calculation of the location quotient for an industry produces a result greater than one, the industry's share of total local employment or value added exceeds the same industry's share of total employment or value added in the reference area. This suggests that the industry's contribution to the local economy surpasses the same industry's contribution to the economy of the reference area. If the LQ results in less than one, the industry's share of total local value added falls short of the same industry's share of total value added in the reference area. The implication in this case is that the industry's contribution to the local economy lags the same industry's contribution to the economy of the reference area (Carvalho, 2001, p. 73).

4.2.3 Data collection

The purpose of collecting statistical data is to analyse the impact of clustering of DFI on urban economic development in terms of structural transformation assisted by the Shift-share and LQ analyses. The following is a list of the secondary data for location quotient and Shift share technique needed to complete the analysis.

* GIOV (constant value base year 1990) for the Qingdao and China (1985-2002);
* GIOV (constant value base year 1990) by foreign invested firms for the ETDZ, Qingdao and China (1995-2002);
* Value added (constant value base year 1990) by industry for the ETDZ, Qingdao, China (1995-2002);
* Value added (constant value base year 1990) by industry by foreign invested firms for the ETDZ, Qingdao, China (1995-2002).

In addition, secondary data was collected through government files and documents, local newspapers and magazines and academic reports. More specifically, a range of secondary data – published and unpublished statistics, urban plans and planning documents, maps, newspapers, academic literature – has been collected in the course of this study. Much of this data is available only in China, and mostly in Chinese. The important secondary sources to obtain data on foreign firms and DFI across China were the China Statistical Yearbook, China Urban Statistical Yearbook (1985, 1986, and 1998) and Shandong Statistical Yearbook (1990, 1999 and 2000). Basic data on foreign firms, DFI distribution and other aspects of Shandong's spatial economy was provided by various published sources, especially in Shandong Statistical Yearbook 1990, 1999, 2000. In addition, Qingdao Yearbook 2000, 2001, 2002, 2003; Qingdao Statistical Yearbook, 2001, 2002 and 2003; Huangdao ETDZ Statistical Yearbook, 1996, 1998, 2001, 2002 and 2003 are confidential resources, but were utilised for this study as important references.

Throughout the research, a number of libraries and information centres in several related locations have been consulted; these are listed in Appendix 4-1 of this chapter. The documents consulted include published books and articles, research reports, working papers, Ph.D. theses, and unpublished official documents. The research procedure also involved consulting with a

number of people including policy-makers, civil servants in national, provincial, city and district governments, academics, as well as the managers of the firms included in the sample survey.

4.3 Research Design

4.3.1 Questionnaire Survey and In-depth Interview

The over-arching objective of the questionnaire and survey and in-depth interview in this research is to verify the existence of clustering of DFI, to acquire the data to measure the impact of this clustering on urban economic development, and to explore the main mechanism underlying this impact.

The questionnaire survey can be understood as a form of planned collection of data for the purposes of describing and predicting the relationship between social phenomena. This is particularly important for quantitative analysis. However, some of the questions in questionnaire are qualitative in nature; especially questionnaires made with form of 'open-ended' question can provide the important qualitative information which author does not originally intend to acquire

For the design of questionnaire for this research, 'closed-ended' questions were mostly constructed. Some of crucial questions, however, were 'open-ended' when asking the sensitive information, for instance, detailed procedure and mechanism of supplier-buyer network. Questionnaire survey was carried out by 'face-to-face interview,' of which method is known for high response rate. With 'face-to-face interview,' it was possible to gain in-depth information when 'open-ended' questions were actively interacted between an interviewee and an interviewer. Thus, the questionnaire survey in this research often involves in-depth interviews, making it possible to acquire both quantitative and qualitative information.

In constructing the questionnaire, the main questions were formulated to identify the key characteristics of inter-firm relationships between local firms and foreign invested firms in development zones. Additional questions were accordingly made to obtain a fuller picture of the relationship between local and foreign invested firms. A detailed questionnaire is attached in the end of the present thesis.

4.3.2 Sampling Design

Primary data was collected by two field works: preliminary field work and final field work. Preliminary fieldwork involved 33 firms from various industrial sectors in ETDZ and HTIP while final field work investigated 34 firms only from electronic sector. Data acquired from preliminary fieldwork was to identify whether clustering activity exists and which industry is dominant in the development zoned. Given the information from preliminary field work, the final fieldwork could be more sophisticatedly designed.

The main source of primary data was by face-to-face interview, questionnaire survey, and in-depth interview within a sample of foreign and domestic firms. A key theme in the final fieldwork was how the performance of local suppliers, customers and competitors' productivity has changed in Qingdao city. In order to measure productivity growth, this research used value added per worker as Bergman and Goldstein (1986)'s study suggested[5]. Hence it needed both micro-level and macro-level data collection. Basically, both micro and macro-level data are available in Qingdao Statistical Yearbook (2003). But what I needed to collect from interviews was the raw data which was not available in statistical yearbook, for instance, process of technology improvement (source of technology: domestic, foreign or both together), number of patent per employees (technician), index of standardisation technology (ISO 14000), percentage of local sourcing such as inflow of raw materials, components, goods, technologies, services and personnel information. In order to investigate buyer-supplier linkages between local and foreign invested firms, it was essential to conduct in-depth interview in field research. Through this field research, the author could gain key indicators for measuring impact of DFI clustering on host country's local economic development in terms of innovation and productivity growth.

For this purpose, the questionnaire survey from final fieldwork involved 34 electronic and electrical related firms in both ETDZ and HTIP. Based on the data from these firms, regression analysis could be carried out. Among 34 firms surveyed, 21 firms offered in-depth interview opportunities (about 2 hours), from which detailed information regarding mechanism of supplier-buyer network was gained. This information from 21 firms in ETDZ and HTIP is utilised in Chapter 7 as 21 firms' case studies.

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[5] For details, see section 3.2.2 in theoretical chapter 3.

Preliminary Sampling

The first step arising from preliminary sampling was to identify the whole firm population from all industrial sectors in ETDZ and HITP. According to Huangdao Statistical Yearbook 2001, the total number of firms in Huangdao ETDZ was estimated at roughly as 793[6]. In Qingdao Hi-Tech Industrial Park (HTIP), the number of firms were identified as 1072, as specified in Qingdao HTIP authority's investment guidebook (2001). Thus a total number of firms were 1,865 firms from all sectors in ETDZ and HTIP.

Given the total population of firms, the next step was to narrow down the number of firms in the sample frame. In this regard, the author tried to categorise firms by size; and their contribution of GIOV was examined accordingly. Table 4-1 shows the result of this trial. This thesis only considers large and medium sized firms. According to the Qingdao official data, these are defined as firms whose minimum annual sales value exceeds 5,000,000 RMB. Large and medium firms mostly contributed to the GIOV by 90.2 percent and 97.0 percent in ETDZ and HTIP, respectively. Since large and medium firms share the majority of gross industrial output value in both ETDZ and HTIP, the focus of preliminary field research was narrowed down to large and medium firms in ETDZ and HTIP. Firms belonging to this category were 269, summated by 187 firms in ETDZ and 82 firms from HTIP.

However, it should be noted here that there are limitations of GIOV data in China. According to Field, Lardy and Emerson (1975)'s study of Chinese Methodology for compiling gross industrial output value (GIOV), they pointed out the problems of GIOV data as following:

"Since 1950, the Chinese have used the 'factory reporting method' to compile GIOV data. Under this system, each enterprise accounting unit makes periodic reports on the gross value of its output in constant prices, net of intra-enterprise transfers. No deductions are made for the costs of raw materials or semi-finished inputs purchased by individual enterprises, or for capital depreciation. The GIOV for the country as a whole is simply the sum of the output value of all industrial enterprises. The use of 'factory reporting method' to calculate GIOV affects both the level of output and the rate of growth shown in Chinese statistics. Because the costs of purchased raw materials and semi-finished inputs are included in the GIOV of an enterprise, **a substantial amount of double counting is contained in the officially reported gross value data** (Field, Lardy and Emerson, 1975, p. 2)."

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[6] Only the number of firms in Huangdao ETDZ Statistical Yearbook 2001 is stated

Despite this limitation, GIOV data had to be used extensively since there was no alternative especially in local level data, i.e. in Qingdao ETDZ.

Table 4-1 Contribution of GIOV by size of firms in ETDZ and HTIP Unit: 10000 RMB

Size of firms	ETDZ	Share of ETDZ	HTIP	Share of HTIP
Large	1058713	**82.2%**	3260118	**95.2%**
Medium	103435	**8.0%**	62053	**1.8%**
Small	125205	9.7%	101913	3.0%
Total	1287353	100%	3424084	100%

Source: Qingdao Statistical Yearbook 2001

From the 269 large and medium firms in ETDZ and HTIP, 33 firms were randomly selected from both development zones and were visited to identify the existence of clustering activities in terms of buyer-supplier linkage. Table 4-2 summarises the number of sampled firms in preliminary field research, indicating that 33 firms were widely selected from ETDZ and HTIP.

Table 4-2 Preliminary Sample selection (out of total population)

City regions	Types of Industry	Ownership structure	Number of firms
Huangdao ETDZ	Manufacturing	Indigenous Chinese firms and Foreign Invested	**22 (187)**
Qingdao HTIP	High and New Technology	Indigenous Chinese firms and Foreign Invested	**11 (82)**
		TOTAL NUMBER	**33 (269)**

Source: Preliminary field work (2001)

The preliminary surveyed companies in Huangdao ETDZ mainly dealt with electronic, machinery, chemical and textile products (see Appendix 4-5). In Qingdao HTIP, they are geared more toward higher technology oriented products specialising in electronic firms (see Appendix 4-6). Overall, the sample has wide coverage in terms of diversity of business scope and is in line with the general industrial structure of these two zones. In the preliminary field research, the author also conducted a series of interview with local authority officers and experts and then found out the city planner's expectation regarding the impact of clustering of direct foreign

investment on urban economic development in terms of local labour market supply, services, facilities, premises and infrastructure construction. Interviews took place with 14 government officers, 4 local academic experts and 3 Chinese urban development affair specialists (see Appendix 4-7).

Final Sampling

From the preliminary field work, it was found that large and medium firms mostly contributed to GIOV in ETDZ and HTIP (See Table 4-1). Considering this information, the sampling for the final fieldwork was reconstructed. First of all, the performance of large and medium firms in two development zoned were examined by industrial sectors. Table 4-3 describes the contribution of each industry sector to the local economy by gross industrial output value. In ETDZ, two sectors such as electrical and electronic sectors, denoted as D31 and D32, were predominant; they shared 75.3 percent of total gross industrial output value in ETDZ. In HTIP, electrical sector contributed to most GIOV with its share of 95 percent of total GIOV in its local economy.

Table 4-3 Contribution of Each Industry's GIOV to Local Economy Unit: 10,000 RMB

	Qingdao City Total	Share of City total	ETDZ	Share of ETDZ	HTIP	Share of HTIP
D15	334247	3.1%	16964	1.4%	7192	0.2%
	111108	1.0%	11455	0.9%	6084	0.2%
	151663	1.4%	2180	0.2%	54238	1.6%
D16	199700	1.9%	0	0.0%	0	0.0%
D17	392746	3.7%	35082	2.9%	4176	0.1%
D18	178359	1.7%	3673	0.3%	19383	0.6%
D19	128361	1.2%	8490	0.7%	2575	0.1%
D20	15753	0.1%	2408	0.2%	2130	0.1%
D21	101007	0.9%	3748	0.3%	24676	0.7%
D22	68605	0.6%	0	0.0%	0	0.0%
D23	151328	1.4%	434	0.0%	0	0.0%
D24	89986	0.8%	1727	0.1%	8025	0.2%
	173679	1.6%	115074	9.5%	0	0.0%
D25	320608	3.0%	15254	1.3%	1008	0.0%
	182264	1.7%	16876	1.4%	19010	0.6%
D26	99671	0.9%	22890	1.9%	10230	0.3%
D27	222906	2.1%	3013	0.2%	4768	0.1%
D28	176377	1.6%	0	0.0%	0	0.0%
	1400	0.0%	0	0.0%	0	0.0%
D29	77293	0.7%	3164	0.3%	1995	0.1%
	205891	1.9%	5748	0.5%	14768	0.4%
D30	51512	0.5%	3581	0.3%	565	0.0%
D31	**3942609**	**36.7%**	506864	**42.0%**	3180217	**94.6%**
D32	**2662195**	**24.8%**	401842	**33.3%**	1498	0.0%
D34	709007	6.6%	27309	2.3%	542	0.0%
Total	**10748276**	100.0%	1207776	100.0%	3363080	100.0%

Source: Qingdao Statistical Yearbook 2001

In addition, Table 4-4 shows the contribution of each industrial sector to the city economy by gross industrial output in the whole Qingdao city economy. ETDZ and HTIP's total share of GIOV is more than 40 percent of Qingdao city economy. In HTIP, the electrical sector alone shares almost 30 percent of total GIOV of Qingdao city. These statistical features from Table 4-3 and 4-4 provide a basis to select industrial sectors for the final field work. The final field work focuses on electrical and electronic related industries in ETDZ and HTIP. The statistics,

however, should be interpreted cautiously because of double counting problem in calculating GIOV data in China (Field, Lardy and Emerson, 1975, p. 2)

Table 4-4 ETDZ and HTIP Contribution of Each GIOV to Qingdao City Economy

	Qingdao City	Share	ETDZ	Share	HTIP	Share
D15	334247	3.1%	16964	0.16%	7192	0.07%
	111108	1.0%	11455	0.11%	6084	0.06%
	151663	1.4%	2180	0.02%	54238	0.50%
D16	199700	1.9%	0	0.00%	0	0.00%
D17	392746	3.7%	35082	0.33%	4176	0.04%
D18	178359	1.7%	3673	0.03%	19383	0.18%
D19	128361	1.2%	8490	0.08%	2575	0.02%
D20	15753	0.1%	2408	0.02%	2130	0.02%
D21	101007	0.9%	3748	0.03%	24676	0.23%
D22	68605	0.6%	0	0.00%	0	0.00%
D23	151328	1.4%	434	0.00%	0	0.00%
D24	89986	0.8%	1727	0.02%	8025	0.07%
	173679	1.6%	115074	1.07%	0	0.00%
D25	320608	3.0%	15254	0.14%	1008	0.01%
	182264	1.7%	16876	0.16%	19010	0.18%
D26	99671	0.9%	22890	0.21%	10230	0.10%
D27	222906	2.1%	3013	0.03%	4768	0.04%
D28	176377	1.6%	0	0.00%	0	0.00%
	1400	0.0%	0	0.00%	0	0.00%
D29	77293	0.7%	3164	0.03%	1995	0.02%
	205891	1.9%	5748	0.05%	14768	0.14%
D30	51512	0.5%	3581	0.03%	565	0.01%
D31	**3942609**	**36.7%**	506864	**4.72%**	3180217	**29.59%**
D32	**2662195**	**24.8%**	401842	**3.74%**	1498	0.01%
D34	709007	6.6%	27309	0.25%	542	0.01%
Total	**10748276**	100.0%	1207776	**11.24%**	3363080	**31.29%**

Source: Qingdao Statistical Yearbook 2001 (Unit: 10000 RMB)

The number of large and medium sized firms from electrical and electronic sectors of zones was identified as 49 and 59 in ETDZ and HITP, respectively; thus, the total number was 108. Given this information, effort was made to select a number of sampling firms. More importantly, the fieldwork suffered from the difficulties of obtaining a *truly* random sample from 108 big and

medium firms from electrical and electronic sectors in ETDZ and HTIP. The researcher randomly selected and telephoned 55 firms as potential interviewees. Among 55 firms, 34 firms agreed to respond to a questionnaire survey, which became the final sampled firms.

Table 4-5 presents an overview of 34 sample firms in ETDZ and HITP. Categorised by ISIC, the number of sample firms in ETDZ are 21 out of 49 population and those in HTIP are 13 from 59 population. The detailed information of firms was acquired after the visit, and is presented in Table 4-6.

Table 4-5 Final sample selection in ETDZ and HTIP (out of total population)

ISIC	Number of FIE and local firms[7] in ETDZ	Number of FIE and local firms in HTIP
31	**12 (21)**	**13 (59)**
32	**9 (28)**	
Total	**34 (108)**	

Source: Huangdao ETDZ Statistical Yearbook (2003), Qingdao Statistical Yearbook (2003), Qingdao government document from Bureau of Foreign Trade and Economic Co-operation Qingdao Municipal People's Government

Table 4-6 List of Final Sampled Firms in ETDZ and HTIP

Firms	Location	Country of Origin	Main Product
1	ETDZ	China	Commercial Air-conditioner
2	ETDZ	China	Microwave
3	ETDZ	China	Bottle cooler (refrigerator)
4	ETDZ	China	Special Refrigerator
5	ETDZ	China	Household refrigerator
6	ETDZ	Korea	Electronic capacitors, condenser for PCB and PWB 1st tier supplier of no.1, 4, 5 firm
7	ETDZ	Hong Kong	Special silk screen, Plastic and steel hardware mould for refrigerator and air-conditioner 1st tier supplier of no. 1, 4, 5
8	ETDZ	Japan	Compressor 1st tier supplier of no. 4, 5
9	ETDZ	Japan	Tactile sheet, Safety unit for battery, Antenna, Encoder, Light touch switch, micro stick, remote control unit, transparent touch panel 1st tier supplier of no 1
10	ETDZ	China	Switch (1st tier of Hisense)
11	ETDZ	Taiwan	Electric wire, cable, connector, PCB components for household electronic goods

[7] In this research, we confine scale of firms (local firms and Foreign invested firms) in annual sales value over 5 million RMB because of data availability.

			1st tier supplier of no.1, 4, 5
12	ETDZ	Korea	Electronic production Logo, Aluminium panel, TV components, Nickel coating 2nd tier supplier of no. 1, 2, 3, 4, 5
13	ETDZ	UK	PDP TV module components, PCB, IC, Flip circuit, SMT line, COB 1st tier supplier of Haier and Hisense
14	ETDZ	China Hong Kong	Plastic frame 2nd tier supplier of Haier
15	ETDZ	Japan	Optical glass for camera phone, semiconductor, LCD photo-mask, panel
16	ETDZ	Japan	Soft ware, REC, Coil AMM, Head, FDD
17	ETDZ	China	Electromagnetism four-way reversing valve 2nd tier suppliers of no 1
18	ETDZ	Japan	Electronic micro injection moulding, precision dies 2nd tier supplier of no. 8, 9, 16
19	ETDZ	China	Commercial Air conditioner, PC, TV mobile phone
20	ETDZ	Korea	Mobile phone components such as super thin micro speaker, dynamic receiver 1st tier supplier of no. 19
21	ETDZ	Korea	Silicon zener diode SMD zener & switching Silicon Rectifiers for TV, PC, monitor
22	HTIP	America	Motor for household electronic goods 1st tier supplier of no. 1, 3, 4, 5
23	HTIP	Australia	Control unit with VFD for refrigerator, washing machine, air conditioner and dishwasher, remote control 1st tier supplier of no 1, 2, 4,5
24	HTIP	China-Korea Joint-Venture	Wire, Plug, Power supply cord, SMD inductor and transformer, Sensor for air conditioner, line filter 1st tier supplier of no. 1, 2, 3, 4, 5
25	HTIP	Korea	Micro-switch, transistor, Relay, thermostat, cordless motor for mobile phone, Desktop charger, Hand-free kit, Key pad assembly, headphone, DVD Rom, Dech Assembly, MP3 player 1st tier supplier of Haier and Hisense
26	HTIP	Sweden	EMIP (Ericsson M2M Intelligent Platform) IT networking for PDA mobile phone, ATM, POS, Logistic Haier group (27) is main customer
27	HTIP	China	Haier-PDM (Product digital management system)
28	HTIP	China	Control unit, PCB, remote control, PDM Haier's branch firm
29	HTIP	China	Soft-ware, IT networking 'Haier' – headquarter firm's networking*
30	HTIP	China	Washing machine
31	HTIP	America	Connector, 2nd tier supplier of Haier
32	HTIP	America	PCB, IC, Control parts for all household electronic goods 2nd tier supplier of Haier, Hisense, Aucma
33	HTIP	China	Electronic Cash register *Spin-off from Hisense computer co. Ltd
34	HTIP	UK	Control, Thermostats, Timer, Valve for washing machines, air conditioner, dishwasher, refrigerators 1st tier supplier of Haier, Hisense, Aucma

Source: Final field work (2004)

4.3.3 Preliminary Field work

From November 2001 to January 2002, preliminary field research was conducted in Qingdao HTIP and ETDZ. The work mainly consisted of two surveys: the survey of FIEs and Chinese firms and interviews with local officials at different government levels and localities. The purpose of the preliminary field work was to examine the operational characteristics in ETDZ and HTIP, thus to look into how firms in general are linked with suppliers and buyers.

As described in the previous section, 33 preliminary surveyed firms were randomly selected from big sized firms from all industries in ETDZ and HTIP. With 33 sampled firms, the initial stage of the research involved conversations and completion of pilot interview questions about the existence of inter-firm linkages or buyer-supplier network. More specifically, 33 sampled firms were asked what the motivation to be located in development zones is, and whether there exist benefits by locating in the zones such as collaboration with other firms and information sharing, and whether firms have business partners and suppliers. These questions were responded through interviews.

In addition, interviews were carried out with local officials regarding the role of local government regarding development zones and DFI inflows. From the interviews, local officials stressed an important role of FIEs in ETDZ and HTIP to local economy. They were very concerned whether DFI was successfully attracted and actively utilised in their region.

From this information by 33 firms and local officials, the preliminary fieldwork confirmed that there exists clustering activities in development zones, especially between foreign investment firms and local firms as buyer and supplier relationship. In addition, it seemed that most industries in Qingdao city were led by big and medium domestic firms.

This preliminary finding, however, needed further investigation and a more sophisticated approach. Although the finding in preliminary fieldwork tried to reflect overall operational characteristics in Qingdao city, an individual industrial sector was not classified by ISIC. Therefore, the preliminary result could not provide detailed industrial structure in Qingdao, but depict general picture of operational characteristics in ETDZ and HTIP.

4.3.4 Final Field work

In the final field research, the researcher started by drawing a random sample categorised by ISIC and the size of firm by gross industrial output value. After finding electrical and electronic sectors were predominant in ETDZ and HTIP, the sample firms were chosen, and where roughly proportional to the overall structure of the firm population in electrical and electronic industries. Thus, final field work involved 34 structured interviews carried out from Dec. 2003 to Apr. 2004.

With the questionnaire survey and in-depth interviews conducted with these final sample firms, key issue were stated as follows: information on the company's buyer-supplier linkages between local and foreign invested firms in development zones; mechanism how such linkage is related with innovation and productivity growth. More specifically, the questions based upon the key issues were to ask the detailed procedure of local procurement of raw materials and components within the zones, to examine the kinds of collaboration, if any, between different level of firms including domestic and foreign invested firms. Moreover, the questions were to explore the existence of technology and managerial skill transfer among firms, and to verify how innovative activities (input of innovation) are fostered in terms of technical assistance, training assistance and information sharing.

4.4 Conclusion

With key research questions and hypotheses, the main concern in this chapter is how to construct an analytical framework and research design in order to explore the answers to research questions. Both quantitative and qualitative methods were utilised in this regard. For quantitative analysis, regression, Shift-share location quotient (LQ) analyses were conducted. Shift-share and location quotient analyses, based on statistical data from Statistical Yearbooks, were calculated. However, statistical data alone does not tell the whole story nor present the deeper picture and the underlying dynamics of inter-firm linkage. Hence, a regression analysis, based on questionnaire survey, was conducted. The questionnaire survey involved the 34 electronic and electrical related firms in both ETDZ and HTIP. For qualitative analysis, in-depth interviews were carried out. Among 34 firms surveyed, 21 firms offered more detailed in-depth interview opportunities, from which detailed information regarding mechanism of supplier-buyer network was gained.

In order to gather the relevant information and data for the research, preliminary and final field works were carried out. The aim of the preliminary field work was to identify whether clustering activities exist in development zone in Qingdao. Through the preliminary field work of 33 surveyed firms from various industrial sectors (see Appendix 4-5), the author confirmed that the DFI clustering exists in a way of buyer-supplier relationship between local and foreign invested firm. Then, the final field work, focusing on 34 firms in electrical and electronic sectors, scrutinized how buyer-supplier linkages in development zones foster clustering of DFI and how such linkages enhance innovative activity and productivity growth.

Given the result of field research, the next Chapter 5 will provide the background information of operational characteristics in ETDZ and HTIP. The main research findings of final field work will be presented in Chapter 6 and 7.

Appendix 4-1 Libraries and Documentation Centres Consulted

1. Qingdao

Qingdao City Bureau of Statistics
Qingdao Academy of Social Science
Qingdao City Library
Qingdao University Library
Chinese National Ocean University Libraries
Qingdao Association of Foreign Invested Firms
Haier University Document Centre
Qingdao Haier Economic and Trade College information centre in Chinese National Ocean University
Qingdao City Office of Electronic Industry
Bureau of Foreign Investment in Qingdao
National Bureau of Patent Qingdao branch
Huangdao ETDZ Policy research institutes
Huangdao ETDZ Bureau of Statistics
Qingdao HTIP Foreign Investment Service Centre

2. United Kingdom

The British Library
University College London
School of Oriental and African Studies, University of London
London Business School
Senate House, University of London
University Library, University of Cambridge
Marshall Library of Economics, University of Cambridge
Judge Institutes of Management Studies, University of Cambridge
Land Economy Library, University of Cambridge
Geography Department Library, University of Cambridge
Social and Political Science, University of Cambridge
Pembroke College Library, University of Cambridge
Queen's College Library, University of Cambridge
University of Warwick
Bradford University

3. Korea

Central Library, Seoul National University
Graduate School of Environment Studies Library, Seoul National University
Korea Development Institute (KDI)

Appendix 4-2 The Specific Research Questions for Final field work

Inter-firm networks (interview questions)

	Questions	Operating feature
Local Government	Does government encourage FIE to linkage with local firms?	Regulatory framework: Labour, taxation, licensing Transparent proceedings of public administration
	How can government encourage FIE to input-output linkage with local markets?	Facilitating raw materials, components, services, machinery equipment and utilities linkages with local market
	Does local authority support small and medium size firms (SME)?	Involve groups of SME and their associations in formulation of local development strategy Subsidizing network initiatives to cover transaction cost Establish technology incubator
Business Association	How does organisational structure of clustering influence degree of innovation? What are the transmission mechanisms of technology learning? What is the role of incubators in domestic high-tech firms?	Training courses for SME group Support to firms: education and technology Dissemination of technology information Training course for group of suppliers
Large COE, SOE, local firms	How are innovative structures or networks implemented?	Degree of improvement of production process and feature Degree of innovative activity (patent)
FIEs	Do they concern supplier development? What is the nature of relationship or cooperative structure? What kind of channels did large firms inter-linkage with local SME or FIE?	Individual assistance to suppliers Training course for group of suppliers

Additional Questions for Final Field Research

The inward investors and subcontractors

1. Type of flow
   - Typical inter-firm linkages in terms of raw materials and services exchange
   - Technology transfer

- Managerial and marketing skills
- Information exchange (sharing information)

2. Significance
   - Ratio of raw materials, technology and services exchange
   - Sales Proportion of customers
3. Principal motivation
   - New business opportunities with local suppliers and customers
     (creating new markets and customer)
   - Long-term supply agreement (single-sourcing relationship)
   - Quality of geographical location and cost of premises, services and resources
   - Government incentives (tax return, quality labour supply, export tax incentives)

Domestic Large Firms and local suppliers

1. Type of flow
   - Typical inter-firm linkages in terms of raw material, parts and goods transaction
   - Formal and informal information sharing
2. Significance
   - Ratio of local raw materials from suppliers
   - Sales proportion of customers
   - Length of inter-firm relationship with inward investors or other local firms
3. Principal motivation
   - New business opportunities with local suppliers and customers
     (creating new markets and customer)
   - Potential development for technology and managerial skills
   - Long-term stable relationship

Appendix 4-3 Name of Interviewees in Government Organisation, Respondent Status

Government Organisation	Respondent's Position	Respondent's Name
Bureau of Foreign Trade & Economic Cooperation Qingdao Municipal People's Government	Deputy Division Chief	Zhang, Jianjun
Development Zone Affairs Coordination Division		
Economic Development Bureau of	Director	Sun, Minggang
Qingdao Development Area, Qingdao, PRC	Vice Chief	Qu, jie
	Staff	Guo Baoxing
Economic Development Bureau of	President & Lawyer	Ling, Song
Qingdao Development Area, Qingdao, PRC		
Policy Research Office		
Economic Development Bureau of	Vice President	Sun, Dingli
Qingdao Development Area, Qingdao, PRC		
Political Association		
Administrative Committee of Qingdao Hi-Tech	Project Manger	Liu, Chunwang
Industrial Park Investment Promotion Bureau		
Administrative Committee of Qingdao Hi-Tech	Staff	Zhang,
Industrial Park Investment & Cooperation Dept.		Yuanyuan
Qingdao Research Institute of Urban Planning	Researcher	Zhang,
		guozhong
Chinese Academy of Social Science in Qingdao	Researcher	Ren, inmu
	Researcher	
Qingdao Association of Enterprise with Foreign	Chief Secretary	Zheng, Bingtai
Investment Korea Branch		
China Qingdao International Economic &	Assistant Director	Yang, Kelly
Technical Cooperation Corporation	Vice President	Chui, shunran
Qingdao Foreign Economic Relations & Trade	Staff	Li, Hong
Information Centre		
Institute of Korean Research, Department of	Assistant Professor	Park, Yeunghee
International Relation, Qingdao University		
Historical Periodic Department,	Director	Duan, Ziyong
Qingdao City Government		

Preliminary field work (2001)

Chapter Five: The Case Study: ETDZ and HTIP

5.1 Introduction

The chapter presents the overall picture of the operational characteristics in ETDZ and HTIP of Qingdao, China. The description of this chapter is largely based on the preliminary field work during Nov. 2001 – Jan. 2002, providing the background information regarding inter-firm linkages between local and foreign firms in the development zones. Some of findings from final field work (Dec. 2003 – Apr. 2004) are discussed in this chapter as well as in order to identify formation of clustering of DFI in Qingdao city.

The chapter consists of five sections. Section 2 provides an overview of the main features of ETDZ and HTIP. The section also observes inflows of DFI and their contribution to the local economy. Section 3, based on the findings from preliminary field work, presents general operational characteristics of ETDZ and HTIP and identifies whether inter-firm linkage exists in development zones or not. Section 4 specifies electrical and electronic sectors for further investigation, and explains how clustering of DFI is formed in these sectors with an example of buyer-supplier network in TV industry. Then conclusion ends the chapter in Section 5.

5.2 Overview of Huangdao ETDZ and Qingdao HTIP

Qingdao city is located in the southwest of the Shandong Province on the Yellow Sea coast. Qingdao has well-developed port trade, light industry, chemical production, financial services, holiday facilities and marine science research institutions. It is a State-designated national economic central city, Open Coastal City (OCC), self-planning city and Vice-provincial-level City. Qingdao port is one of the China's five major ports particularly, supported by investment from overseas. Also, the Qianwan Port has two container docks, cargo dock, ore dock and oil dock. Qingdao covers a total area of 10,654 square kilometres, has a population of 7.06 million, and administers five satellite towns and seven urban districts.

Historically, Qingdao city has been industrialised early, being an international open city in China. Recently, Qingdao has been one of China's fastest growing cities, more than doubling its GDP from 64.2 billion *yuan* in 1995 to 151.8 billion in 2002 (Qingdao Statistical Yearbook, 2003). In 2002, fixed asset investment (FAI) in Qingdao was 478.25 hundred million RMB. The

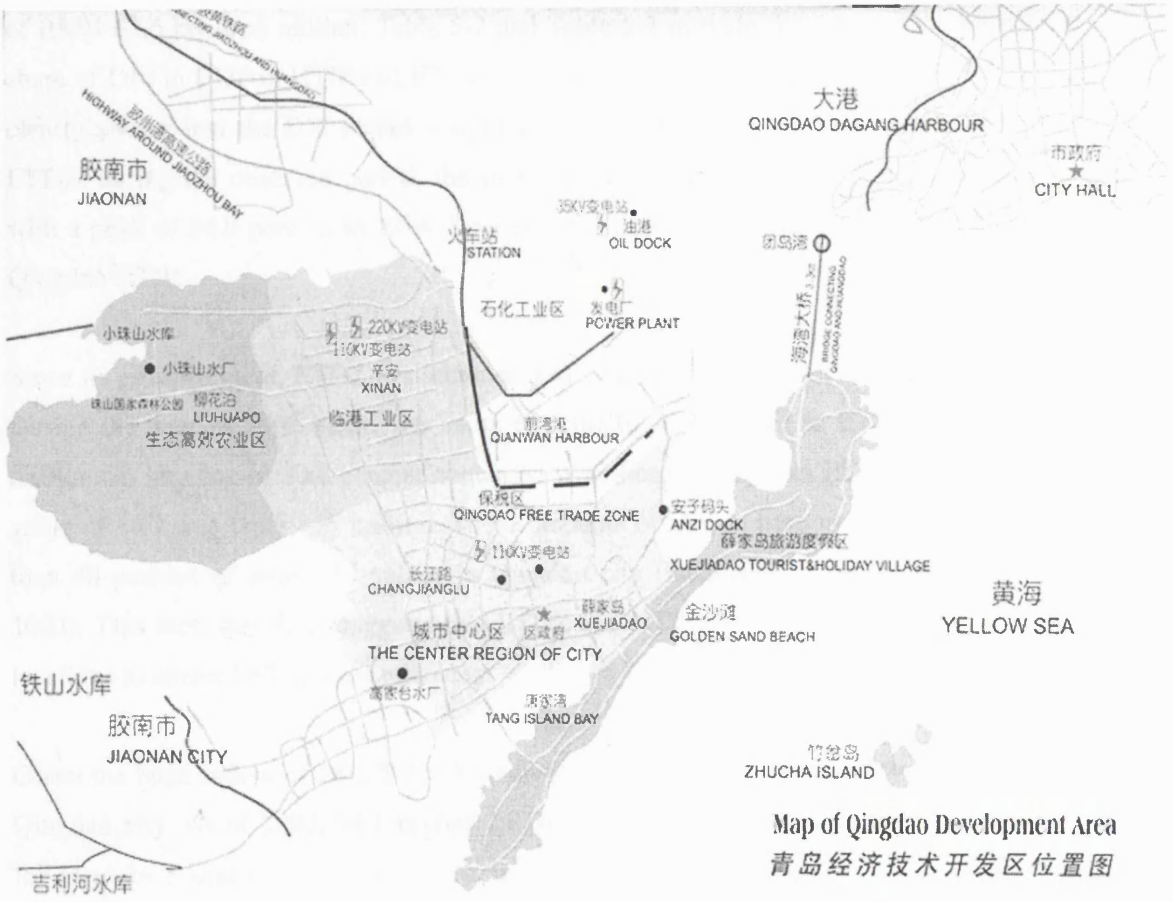
source of fixed asset investment in Qingdao city during the 1990s is presented in Table 5-1. From 1990 to 2002, Qingdao gained a cumulative amount of 20 billion USD. This huge amount of investment is due to four major financing sources; budgetary allocation (BA), bank loan, DFI, and self-raised funds (SRF) and others. The portion of FAI by BA is relatively small, with an average share of 3.5 percent during the period between 1990 and 2002. The percentage of bank loans in FAI has gradually decreased from 32.3 percent in 1990 to 17.8 percent in 2002. The percentage of DFI has notably fluctuated during the observed period. Starting with 8.3 percent in 1990, the contribution by DFI peaked in 1997 by 22.6 percent, just before the Asian financial crisis; then followed a sharp drop to 8.9 percent and 6.6 percent in 1998 and 1999. Since then, the percentage of DFI has gradually recovered; in 2002, DFI constituted 10.2 percent of FAI in Qingdao city.

The State Council approved Qingdao Economic and Technological Development Zones (ETDZs) in October 1984, and 28th March 1985 saw the official laying of the foundation stone, occupying the area of 15 square kilometres. Since then, Qingdao's key development zones have benefited from a series of government preferential policies for OCC. In 1992, ETDZ and the Huangdao District of Qingdao were combined into one administrative body, expanding to an area of up to 220 square kilometres and 250,000 people (hereafter Huangdao ETDZ). Qingdao Free Trade Zone (*Bao-shui-qu*) and Xuejiadao *tourist and holiday village* have been established within the ETDZ. Located on the western coast of Jiaozhou Bay and facing Qingdao city proper across the sea, ETDZs is only 2.26 nautical miles from Qingdao City at the nearest points (see Map 5-1, 5-2).

Qingdao HTIP, located in the Laoshan district, was founded in May, 1992, and is an advanced industry development zone of national quality and hi-tech industry. Since 1992, HTIP has become a main base of hi-tech industrialisation and new growth engine of Qingdao city economy (see Map 5-3). HTIP has an industrial region whose area is 16.7 square kilometres where the headquarters of Haier, the largest consumer electronic company in China, is located. Big foreign firms such as Lucent Technologies, Ericsson, Emerson, Invensys, and Mitsubishi are also located in this region.

Map 5-1 Geographical Location of Qingdao

Map 5-2 Huangdao Economic and Technological Development Zone (ETDZ)



Map 5-3 Qingdao Hi-tech Industrial Park

In 2002, ETDZs' GDP reached 169.2 hundred millions RMB, with an annual fixed investment of RMB 67.6 hundred million. Table 5-2 and Table 5-3 provide the information on percentage share of DFI in GDP in HTIP and ETDZ, respectively. From the last column of the Tables, it is clearly shown that the DFI makes a significant contribution to GDP in these two regions. In ETDZ, during the observed period, the share of DFI in GDP is about 36 percent, on average, with a peak of 54.9 percent in 1994. Similarly, the ratio of DFI has been around 20 percent in Qingdao HTIP.

Since its establishment, ETDZ has attracted a large amount of foreign investment and projects. During the year of 2002 alone, the value of actually utilised DFI in ETDZ was USD 473.23 million, an increase of 30.8 percent compared with those of 2001. In HTIP, the actually utilised value of DFI was USD 305 million. These amounts of DFI in both zones accounted for more than 40 percent of total DFI values in Qingdao city (Huangdao ETDZ Statistical Yearbook, 2003). This fact, therefore, suggests that ETDZ and HTIP are important strategic geographical locations to attract DFI into Qingdao city.

Given the huge inflow of DFI, Table 5-4 categorizes its actual utilization by industrial sector in Qingdao city. As of 2002, 78.1 percent of DFI was concentrated in the manufacturing sector, followed by social service and real estate. The high percentage of DFI in the manufacturing industry implies that Qingdao city has the advantage of locality to attract and facilitate manufacturing-related DFI. The nationality of DFI is presented in Table 5-5. While DFI from Hong Kong has decreased from 24.9 percent to 13.7 percent in 2000 and 2002, respectively, both Japan and USA have sustainable investment in this region. The highest amount of DFI has come from Korea during this period. The investment by Korea comprises more than one third of total utilized DFI, and both absolute amount and percentage shares of DFI by Korea has steadily increased in Qingdao. Hence, the geographical advantage as OCC and city's industrial capacity has enabled Qingdao HTIP and Huangdao ETDZ to successfully attract the substantial amount of DFI.

Table 5-1 Growth and sources of fixed assets investment (FAI) in Qingdao City, 1990-2002

Year	FAI (100 million RMB)	OER (RMB/USD)	FAI (100 million USD)	Sources			
				BA	Loan	**DFI[1]**	SRF & Others
1990	29.80	4.78	6.2	8.7%	32.3%	**8.3%**	50.7%
1995	214.00	8.35	25.6	1.6%	23.0%	**19.9%**	55.5%
1996	210.00	8.31	25.3	2.2%	27.6%	**19.3%**	50.9%
1997	210.20	8.29	25.4	1.7%	18.4%	**22.6%**	57.3%
1998	242.30	8.30	29.2	3.5%	25.8%	**8.9%**	61.8%
1999	278.94	8.28	33.7	5.8%	26.5%	**6.6%**	61.1%
2000	321.13	8.28	38.8	3.1%	20.2%	**6.8%**	74.4%
2001	384.41	8.28	46.4	3.0%	20.1%	**7.0%**	69.9%
2002	478.25	8.27	57.8	1.9%	17.8%	**10.2%**	74.1%
1998-2002	1705.03		205.9				
1995-1997				1.8%	23.0%	**20.6%**	54.6%
1990-2002				3.5%	23.5%	**12.1%**	60.9%

Source: Qingdao Statistical Yearbook 2003; OER (Official exchange rate) period between 1990 and 2000 from Zhang (2003, p 1555)

Note: DFI[1] specifies the value of actually utilised DFI to FAI, not total value of utilised DFI in Qingdao city.

Table 5-2 Ratio of DFI in GDP in Huangdao ETDZ

Year	GDP (100 mil. RMB)	IFA (100 mil. RMB)	OER (RMB/USD)	GDP (100 mil. UDS)	DFI (100 mil. USD)	Share of DFI in GDP (%) DFI/GDP
1990	3.0	1.4	4.78	0.627615		
1991	3.2	1.9	5.32	0.601504		
1992	6.8	5.7	5.51	1.23412		
1993	10.85	11.3	5.76	1.883681	0.48	25.5%
1994	15.9	10.7	8.61	1.84669	1.0	54.2%
1995	22.8	13.6	8.35	2.730539	1.5	54.9%
1996	30.3	15.9	8.31	3.646209	1.7	46.6%
1997	40.2	16.7	8.29	4.849216	2.0	41.2%
1998	50.3	32.1	8.30	6.060241	2.10	34.7%
1999	65	25.7	8.28	7.850242	2.20	28.0%
2000	85.7	36.9	8.28	10.35024	2.89	27.9%
2001	130	48.7	8.28	15.70048	4.64	29.6%
2002	169.2	67.6	8.27	20.45949	4.73	23.1%

Source: Huangdao ETDZ Statistical Yearbook (2003); OER (Official exchange rate) period between 1990 and 2000 from Zhang (2003, p 1555)

Table 5-3 Ratio of DFI in GDP in Qingdao HTIP

Year	GDP (100 million RMB)	FAI (100 million RMB)	OER (RMB/USD)	GDP (100 mil. UDS)	DFI (100 mil. USD)	Share of DFI in GDP (%) DFI/GDP
1994	20.3	19.1	8.61	2.36	0.97	41.1%
1995	28.6	15.3	8.35	3.43	1.14	33.2%
1996	37.8	18.4	8.31	4.55	0.91	20.0%
1997	49.2	23.8	8.29	5.93	1.4	23.6%
1998	59.2	24.5	8.30	7.13	1.45	20.3%
1999	69.1	26.2	8.28	8.35	1.7	20.4%
2000	83.2	27.2	8.28	10.05	2.5	24.9%
2001	103.5	32.6	8.28	12.5	2.61	20.9%
2002	126.3	38.55	8.27	15.27	3.05	20.0%

Source: Qingdao Laoshanqu Commerce Investment Guidebook by HTIP Officials (2001, 2003); OER (Official exchange rate) period between 1994 and 2000 from Zhang (2003, p 1555); www.e532.org/web/gaoxinqu/summary/introduction.htm accessed in 10/01/03

Table 5-4 Actually utilised DFI by Industrial sector in Qingdao (unit: 10,000 USD)

	Current Year Value			Share (%)			Cumulative Value			Share (%)		
Categories	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
Farming, Forestry, and Fishery	3863	5720	6082	3.1%	3.6%	2.6%	9044	14764	20846	1.3%	1.8%	1.9%
Mining, Quarrying	733	245	171	0.6%	0.2%	0.1%	773	1018	1189	0.1%	0.1%	0.1%
Manufacturing	87158	124069	180619	69.1%	78.5%	78.1%	492834	616903	797522	73.1%	74.1%	74.5%
Supply of Electric Power	365	58	2518	0.3%	0.0%	1.1%	1215	1273	3791	0.2%	0.2%	0.4%
Construction	3198	2094	684	2.5%	1.3%	0.3%	9790	11884	12568	1.5%	1.4%	1.2%
Transport & telecommunications	5928	844	7725	4.7%	0.5%	3.3%	14831	15675	23400	2.2%	1.9%	2.2%
Wholesale, retail and catering	3035	6972	16608	2.4%	4.4%	7.2%	29003	35975	52583	4.3%	4.3%	4.9%
Banking and insurance	N/A	N/A	2434	0.0%	0.0%	1.1%	4460	4460	6894	0.7%	0.5%	0.6%
Real estate	1934	13372	7870	1.5%	8.5%	3.4%	61842	75214	83084	9.2%	9.0%	7.8%
Social services	17940	4660	5021	14.2%	2.9%	2.2%	40792	45452	50473	6.1%	5.5%	4.7%
Health, education, and culture	188	11	132	0.1%	0.0%	0.1%	3376	3387	3519	0.5%	0.4%	0.3%
Scientific research and services	990	N/A	1350	0.8%	0.0%	0.6%	1139	1139	2489	0.2%	0.1%	0.2%
Others	800	N/A	N/A	0.6%	0.0%	0.0%	913	913	913	0.1%	0.1%	0.1%
Total	126132	158094	237820	100%	100%	100%	674012	832106	1069926	100%	100%	100%

Source: Qingdao Statistical Yearbook 2001, 2002, 2003

Table 5-5 Actually utilised DFI by Country or Region in Qingdao (unit: 10,000 USD)

	Current Year Value			Share (%)			Cumulative Value			Share (%)		
Country (Region)	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
Hong Kong	31440	22513	32570	24.9%	14.2%	13.7%	166347	188860	221430	24.7%	22.7%	20.7%
Taiwan	9145	12604	17891	7.3%	8.0%	7.5%	49208	61812	79703	7.3%	7.4%	7.4%
Japan	10055	16271	21858	8.0%	10.3%	9.2%	67505	83776	105634	10.0%	10.1%	9.9%
Singapore	2067	2750	2941	1.6%	1.7%	1.2%	26965	29715	32656	4.0%	3.6%	3.1%
USA	12776	12635	30577	10.1%	8.0%	12.9%	49417	62052	92629	7.3%	7.5%	8.7%
Korea	38700	59269	93178	30.7%	37.5%	39.2%	204159	263428	356606	30.3%	31.7%	33.3%
German	3414	1602	743	2.7%	1.0%	0.3%	9469	11071	11814	1.4%	1.3%	1.1%
Others	18535	30450	38062	14.7%	19.3%	16.0%	100942	131392	169454	15.0%	15.8%	15.8%

Source: Qingdao Statistical Yearbook 2001, 2002, 2003

5.3 General Findings of Operational characteristics in ETDZ and HTIP

Between November 2001 and January 2002, preliminary field work was conducted in HTIP and ETDZ. The main purpose of the preliminary field work was to establish whether DFI clustering exists in ETDZ and HTIP or not. This section describes the details of the preliminary field research findings.

33 companies surveyed during the preliminary field work in ETDZ and HTIP mainly dealt with electronic, machinery, chemical and textile products (see Table 5-6). Overall, the sample has wide coverage in terms of the diversity of business scope of these two zones. In this survey, the author categorised four kinds of FIEs and domestic local firms: 1) Advanced Technology (AT) oriented, 2) High Technology (HT) oriented, 3) Export (EXO) oriented, 4) Domestic Market seeking (DMS) oriented.

There are some biases in the sample. As shown in Table 6-6, sampled firms from ETDZ include 10 Wholly Foreign Owned (WFOs), 8 Equity Joint Venture (EJVs) and no Co-operative Joint Venture (CJVs). This does not reflect the overall distribution, since the recent trend of DFI in Qingdao has a dramatic increase in the number of WFO types. Secondly, the sample slightly over-represents high technology and advanced technology oriented FIEs and domestic local firms: they are less than 30 percent in reality, while they account for 45 percent in the sample. The difference seems to be very small in relation to the size of the sample, and therefore should not have a significant effect on the sample results. Finally, the general performance of FIEs in the sample seems to be better than average, and this may explain why they agreed to be interviewed. For instance, No. 12 company, an equity joint enterprise from America, is the largest piston ring maker in the world. The high-tech industrial enterprise (No. 16) is fully acknowledged by Qingdao City government. No. 17 enterprise, a wholly foreign owned Korean company, has been chosen as the best performed foreign owned company by Qingdao City government and acquired AAA credit rating from China Construction Bank. No. 19 company, originating from France, is one of the largest joint venture companies in Shandong Province.

Table 5-6 Profile of Preliminary Surveyed Firms in ETDZ and HTIP

No.	Type	Firm Size (Labour)	Main business activities	Salient feature
1	LTSE	6000	TV, Computer, Air-conditioner, Mobile Phone	AT + DMS
2	LTSE	90	Vending machine, Electronic ice box	AT + DMS
3	SOE	800	Military goods (Artificial Satellite, Missile, Rocket, Artillery); Telecommunication, Electronic mediator, Remote control unit	HT + DMS
4	EJV	1000	Light touch switch, TTP (Transparent Touch Panel), Compact Thermal Printer Unit, Circuit Panel, Tactile Sheet, Remote control unit	EXO
5	WFO	6500	HEAD, FDD, SWITCH, REC, COIL, AMM	EXO
6	WFO	1370	Switch, Potentiometers	EXO
7	WFO	1000	Plugs, Plug Adapter, D-Sub Connectors, Din Connectors, Mini Din Plugs, Mini Din Sockets, 8-Pin Mini Connectors and Sockets VCRs	EXO
8	EJV	50	Screen and Silk Printing Machine	DMS
9	WFO	30	Design Central Heating and Air conditioning, Electronic system and instrument	DMS
10	EJV	503	Car manufacturing (UK Rover series; QE 1020, QE 6400, B-level commercial and family car, touring)	DMS
11	EJV	400	Motor cycle, engine, QM 125-11 (125cc, 100cc, 50cc)	DMS
12	EJV	70	Piston, Ring and Pin, Cylinder liner, engine, bearing, camshaft and valve train (most of the car components)	HT + DMS
13	WFO	50	Original group in Korea is focusing military based industry (Tank, Rocket, Missile, Artillery) In Qingdao, just focusing on Machine for car components (machine, electronic)	EXO
14	WFO	35	Chemical, T-60 Tabular Alumina, T-60 Chemical-resistant material.	HT + DMS
15	WFO	22	Chemical products, Carbon sheet, fibre, Carbon casting material	AT + DMS
16	EJV	143	Material for Nylon, Spandex-covered yarn	HT + DMS
17	WFO	670	Polyester, PET Polycondensation, Textile	AT + DMS
18	WFO	400	Textile	DMS
19	EJV	500	Sophisticated Spinning Lines, Polymerization, Covering yarn, Dried Semi-dull PA6 Chips, FDY, POY, DTY, Torque yarn	AT + DMS
20	SOE	310	Printing and Packing, Shoe, Textile	DMS
21	WFO	15	Storage, Inventory Management, Logistic Processing, Transport, Information Network	DMS
22	EJV	350	Food, Processed sea food product	EXO
23	COE	3001	TV, Computer, Air-conditioner, Mobile Phone, Refrigerator	HT+DMS
24	EJV	1000	CDMA Telecommunication system, OS, GSM, DSL Voice, ISP, RAS, ISDN Modem, Network Management, QIP	HT + DMS
25	WFO	400	Switching transformer for TV, Computer Modem transformer, Rotary transformer, Coil, Inductor, EMI Bead Filter	EXO
26	WFO	200	Transformer, PCB, Switching Transition Coil, All Power Transition	EXO
27	WFO	583	Transformer, Switching Driver, Coil	EXO

28	WFO	70	BGA Mould Cavity, Semiconductor Mould Components	HT+ DMS
29	EJV	500	Car components, Steering System, Breaking System, Air conditioning	AT + EXO
30	EJV	160	Pharmaceutical Products, Sodium Chloride Injection, Non-PVC	HT+ DMS
31	WFO	503	Food (Noodle)	AT + DMS
32	EJV	1100	Material for Textile	AT + DMS
33	WFO	400	Basketball, Football, Volleyball, Sporting Goods and Clothes	AT + DMS

Source: Preliminary field work (2001)
Note: Firms' number 1-22 in (ETDZ); 23-33 in (HTIP)

In HTIP, there are also similar biases. First, the sample over-represents export-oriented FIEs, although there are only three of them in the sample. This, however, will not have a serious effect on the overall pattern of inter-firm linkages, since these companies have subsequently shifted the marketing line and the supply of local sourcing. Second, the sample has bias towards high technology and advanced technology oriented FIEs and domestic local firms: they share around 60 percent in reality, while they account for 75 percent in the sample. However, this should not have significant effect on the sample result because the difference seems to be very small in relation to the size of the sample. In addition, the overall performance of firms in the sample is better than average. For instance, No 23 firm is the largest consumer electronic companies in China. No. 24 company is the biggest technological firm in Shandong Province. No. 31 enterprise is top ranked in Instant Noodle market in China and the market share is approximately 40-45 percent. Despite the limitation of sample firms of preliminary field work, it provides important information of foreign firms and Chinese firm's business activities in ETDZ and HTIP.

Table 5-7 shows that the index of R&D activity in Qingdao period between 1990 and 2002. During this period, average R&D expenses per person have sharply increased from 1.25 million RMB to 14.85 million RMB. The notably increased average expenditure implies that Qingdao hi-tech firms put a great emphasis on research and development. In fact, the existence of strong local based R&D activity is a crucial factor in achieving innovation. For example, large firms like Haier have a business capacity to realise R&D investment so that they are able to introduce radical and incremental innovation. They also have scientific and technical competencies that not only help to produce technical advances, but also contribute to understanding and adopting innovations produced elsewhere, and embedded in new technologies and new products.

Table 5-7 Domestic Enterprise R&D Index in Qingdao 1990-2002

	Unit	1990	1995	1998	1999	2000	2001	2002
Share of R&D employees in total employees	%	2.3	2.6	5.96	5.6	5.7	5.7	5.6
Share of Scientist in R&D employees	%	32.4	39.0	50.86	51.2	62.3	68.6	69.3
Share of Scientist in R&D institutes	%	37.1	48.1	76.32	72.5	77.6	51.9	65.6
Share of new product value in total product value	%	8.2	N/A	35.08	33.7	35.5	35.7	38.2
Share of new product sales in total sales	%	8.0	12.2	37.55	33.5	32.7	37.4	37.9
Share of income tax in new product sales value	%	7.4	18.7	26.71	31.1	30.6	N/A	N/A
Average R&D expenses per person	10,000 RMB	125.0	114.5	651.4	548.7	812.0	1226	1485.4
Average R&D funding per person	10,000 RMB	144.0	118.2	720.2	585.2	873.0	1310.2	1498.7

Source: Qingdao Statistical Yearbook (2003)

The statistical data shown in Table 5-8 describes the labour productivity of state owned enterprises (SOE), collective owned enterprises (COE) and foreign invested enterprises (FIE) in terms of per capita GIOV in industrial sectors. It is noted that the most hi-tech oriented manufacturing industries such as electrical machinery (D31), electronics (D32) in SOE and COE are better performing than FIEs. This fact implies that these kinds of industries have strong fundamentals in Qingdao city.

Table 5-8 Sectoral Labour Productivity in Qingdao City (Per capita GIOV; unit: RMB)

ISIC D	State Own Enterprise (SOE)	Collective Owned Enterprise (COE, local large-size firms)	Foreign Invested Enterprise (FIE)
15	115,211	72,874	54,936
17	11,307	22,445	35,815
18	9,152	14,895	26,467
19	4,933	-1,598	28,346
20	3,318	37,367	49,287
21	17,667	22,851	50,935
22	6,775	24,872	50,571
23	146,613	380,664	120,556
24	20,550	46,627	37,819
26	26,052	33,559	42,133
27	11,288	29,289	59,785
29	9,776	23,982	50,660
30	14,135	20,395	50,623
31	43,020	223,520	54,061
32	264,827	18,431	40,736
33	16,104	140,437	62,149
34	50,811	46,729	36,096

Source: Qingdao Statistical Yearbook (2001)

Note: Possible limitations using GIOV data are explained in previous chapter p. 74.

Table 5-9 shows the foreign investor's motivation to locate their firms in ETDZ or HTIP. The information is based on the survey from preliminary field work. In ETDZ, the most important factor to choose DFI location by FIEs is that of local government incentives. FIEs in HTIP emphasize the convenient transportation system and availability of the skilled labour forces as a major motivation; all respondents agreed on the importance of transportation system and 80 percent of managers in FIEs pointed out the availability of skilled labour forces as a key factor. More than 50 percent of FIEs in ETDZ chose this location to co-operate business within zones, while those in HTIP totalled 40 percent. This evidence indicates that a co-operative business partnership was not the main initial motivation of FIEs to choose ETDZ and HTIP.

Table 5-9 Motivation of Selecting DFI Location

'Which factors were important in the decision to locate on this development zone?'

	Huangdao ETDZ (18)	Qingdao HTIP (10)
Local government incentives	15 (83%)	7 (70%)
Convenient transportation system	13 (72%)	10 (100%)
Enterprise assistance available	13 (72%)	4 (40%)
Suitable premises were available	11 (61%)	7 (70%)
Available skilled labour forces	12 (67%)	8 (80%)
To co-operative with business nearby	10 (56%)	4 (40%)

Source: Preliminary field work (2001)

Note: Results relate to the six most important (out of 14) motivations in terms of the number of FIEs rating the 4 or 5 only, on a scale from 1 indicating completely unimportant to 5 indicating extremely important.

Inter-Firm Linkages within City Economy

Many of the SOEs and COEs in Qingdao have established all or part of their manufacturing unit in ETDZ. These domestic enterprises have been clustered, along with the FIEs in the Zone, thereby creating another linkage between domestic enterprises and FIEs. One of the car components P Company in ETDZ has advanced equipment, skilled labour force and existing intricate sub-contracting relationships with TVEs in Qingdao city and Shandong province. In 1998, this company signed a joint venture with the world's biggest car component enterprise (USA). P Company benefits most advance technology transfer. P is now embarking on a Quality Assessment (QA), engineering and production skill transfer project with an aid of one Korean joint venture company. P Company has been clustered along with more and more FIEs in the Zones and out of Zones (Preliminary field work, 2001). There is another example. One of the biggest chemical fibre companies in Korea concerns inter-firm linkage with long-term local procurement of raw materials and components (Preliminary field work, 2001). Actually, this firm has supply linkages with several Chinese and foreign invested firms in ETDZ.

On account of questionnaire survey, the firms' actual benefits obtained from two different zones have an interesting feature (see Table 5-10). Over 90 percent respondents reported that inter-firm linkages either within zones or cities are very useful for their firm's development. Through an interview with the president of biggest electronic component FIEs in HTIP, the author found that Qingdao has strong electronic industry based on Chinese large companies such as Haier,

Hisense and Aucma. These companies have strong supplier network within ETDZ and HTIP.

Table 5-10 Actual Benefits of Firm's Growth in Development Zones

'Which of the following have been of benefit to your company's growth in this zone?'

	Huangdao ETDZ (22)	Qingdao HTIP (11)
Co-operation/collaboration with other businesses in the area	**17 (77%)**	**10 (91%)**
Purchase from other firms in the area	12 (55%)	9 (82%)
Sales to other firms in the area	12 (55%)	8 (73%)
Expansion into related industries	19 (86%)	8 (73%)
Excellent quality of infrastructure	18 (82%)	8 (73%)
Business institutional support	15 (68%)	7 (64%)
Share knowledge and information with other companies in the area	14 (64%)	7 (64%)

Source: Preliminary field work (2001)

Note: Results relate to the six most important (out of 14) advantages in terms of the number of FIEs and Chinese domestic firms rating the advantage 4 or 5 only, on a scale from 1 indicating completely unimportant to 5 indicating extremely important.

The survey result also revealed that more than 80 percent of respondents expressed that sales products and raw material purchase were also important benefits from HTIP (see Table 5-10). More specifically, the author's field research saw some evidence of active inter-firm linkages in Qingdao HTIP. One of the most notable cases was a WFO sports and leisure Product Company. The author conducted an in-depth interview with the executive manager of this company. The company has very sophisticated inter-firm linkages with more than three hundred Chinese local firms all over China for marketing channel linkages with most open coastal cities. In terms of raw material and semi-processed material linkages, this company has gained from TVEs in Qingdao city and Shandong province (Preliminary field work, 2001).

Table 5-11. Existence of Partnership in Development Zones

'Do you either have any joint venture partner or obtain subcontractors from firms located in your Development zones'

	Huangdao ETDZ	Qingdao HTIP
Joint venture partners in DZ	13 (59%)	10 (83%)
Obtain subcontractors (suppliers) in DZ	14 (64%)	10 (83%)
No joint venture partners in DZ	7 (32%)	2 (17%)
No obtain subcontractors in DZ	6 (27%)	2 (17%)
No responses	2 (9%)	0 (0%)
Total responses	22	12

Source: Preliminary field work (2001)

It should be emphasized here that this result reflects the facts that close inter-firm relationships between clients and suppliers (e.g. network relations between specialized firms that collaborate within one product field supported by the existence of a local qualified and specialized production system) are very important in this zone. As is shown in Table 5-11, in HTIP, most firms (more than 80 percent) have joint venture partners and subcontractors.

Table 5-12 and 5-13 indicate that the wider inter-firm networks are important as an essential means of access to information. Interviews with FIE and Chinese local firms suggested that there is a significant interchange of useful information and knowledge with their competitors. The channels of information sharing were mainly from joint venture partners and subcontracting firms. The detailed mechanism was not revealed in this preliminary field work, since the main purpose was to identify the existence of inter-firm linkage and information sharing in development zones.

Table 5-12. Informal meeting with competitors

Informal meeting with Competitors in Development Zones	Huangdao ETDZ	Qingdao HTIP
Yes	6 (43%)	6 (75%)
No	8 (57%)	2 (25%)
Total responses	14 (100%)	8 (100%)

Source: Preliminary field work (2001)

Basically, both ETDZ and HTIP were found to share information and knowledge. The question in the interview was that "what sorts of information do you share with other companies?" In ETDZ, they were sharing information such as local government tax scheme, the cost of using infrastructure fees and Chinese business and commercial law; thus firms shared relatively general information. On the contrary, firms in HTIP shared more information on technology and market related knowledge. For instance, it includes information about the labour market (some electronic component firms sharing same labour pool), employee's benefits and salary, business connections, local marketing channel and general market trends, as well as government regulations. Informal contacts and meetings with similar industries of firms are also frequent in HTIP.

Table 5-13 Sharing knowledge and information in Development Zones

Do you share general or specific business information with competitors?	Huangdao ETDZ	Qingdao HTIP
Yes	5 (83%)	6 (100%)
No	0 (0%)	0 (0%)
No response	1 (17%)	
Total responses	6 (100%)	6 (100%)

Source: Preliminary field work (2001)

5.4 Identifying a Clustering of DFI in Qingdao: Electrical and Electronic Sector

The company survey evidence during preliminary field work suggests that inter-firm relationships, sharing information and labour pool are crucial factors for both ETDZ and HTIP. In addition, Qingdao and Huangdao city government officials play an important role in providing effective institutional services and enhancing the operation of FIEs and Chinese local firms in their development zones. Also, the local authorities sometimes make an effort to introduce local firms to foreign investors, to engage joint venture partners in Qingdao.

Qingdao city has invested in education and improved potential workers' professional and vocational skills in order to produce highly skilled and specialized labour forces. This serves as an infrastructure to support globally competitive firms and develop stronger entrepreneurial and technological capacity among small and medium sized local firms in Qingdao. In particular, the educational system in ETDZ is successful in meeting those purposes. In 1994, the number of

vocational schools within electrical and electronic sectors totalled 3-4. The schools were closely linked with electrical and electronic firms in ETDZ. As the electrical industry grew, so the demand for skilled workers in these sectors also increased. The government in Qingdao responded quickly and efficiently to the labour required; more specifically, the government officials in Qingdao categorised the required skilled worker into three types, highly-skilled, semi-skilled, and basic-skilled workers; then they established different vocational schools depending on target of degree of skill required by local and foreign invested firms. In 2003, the number of such of schools increased to more than 50. Most graduates become the important human resources in this region as 80 percent of employee in ETDZ graduated from these schools. In addition, Shandong Science and Technical College moved to ETDZ, thus providing higher quality work through this institution. (Final field work, 2004)

5.4.1 Historical Background of Electronic Industry in Qingdao

The history of the electronic components industry in Qingdao started in 1939 with products of recorder, electric indicator, and voltmeter. At that time, most of electronic firms were operated by Japanese ownership. Since its independence from Japanese occupation, the electrical and electronic component industry has flourished. Following the establishment of Qingdao Electrical and Electronic Company (Qingdao Micro Electronic Plant) in 1953, more than 110 electronic components plants were built. China's first '2CZ50A silicon instrument' was developed in Qingdao city, which led to the establishment of the biggest silicon plant across China. With this success in silicon development, the electronic components industry grew rapidly; for example, the Qingdao Nanhua components plant, the 1st electronic component plant, and the 4th component plant started to produce cordless diversion equipment and micro connectors. During 1966 to 1969, the agglomeration of plants such as the 2nd component plant, the semiconductor component plant, the silicon lab, optics measurement institution, Qingdao magnetic iron ore plant, electronic counter plant and brown-tube plant were founded in Qingdao city, which eventually served as a solid foundation for the formation of electrical and electronic clustering.

From 1980 to 1985, 101 new products for electronic components were invented in Qingdao, of which sales value accounted for 60 percent of GIOV in the city. The city also imported and utilised 28 technological items from foreign countries. During this period, the main products were colour TV, tape recorder components, radar, camera, air conditioner, TV tube, integrated

circuit and turner. In January 1985, Qingdao's deputy mayor made historic contract with the Sanyo company regarding air conditioner technology, thus starting to receive core technology and equipment in turn-key base procedure. This was followed by the establishment of a comprehensive air conditioner assembly line. Since then, the technological skill has progressed impressively, resulting in the localisation of major electronic components for final goods: in the case of the colour TV, 80 percent of components were produced by local technology; 91.6 percent of components were localised in camera. As a result of the thorough indigestion of foreign technology, the electronic industry in Qingdao city has expanded both qualitatively and quantitatively. Productivity in Qingdao was enhanced with the settlement of Haier, Hisense, and Aucma, thus, being a solid base for formation of clustering. As of 2004, Haier leads the Chinese electronic market with a market share in refrigerators (23%), washing machines (24%), vacuum cleaners (18%), and air conditioners (21%), while Hisense occupies third place in the TV market share, and Aucma first in special refrigerators in China.

5.4.2 Formation of Clustering of DFI in Qingdao Development Zones (HTIP and ETDZ)

Qingdao city has planned to build the ETDZ in Huangdao as "an electrical and electronic industrial base in China." In ETDZ, there are three big companies (Haier, Hisense and Aucma), and other large foreign invested enterprises (FIEs) including Panasonic electronic components, Mitumi Electronic, Nanya Electronic. The collaboration between three big local firms and FIEs works as a vital factor for establishing the clustering of electrical and electronic industry in ETDZ. In HTIP, Haier plays the predominant role that is a hub firm of electronic industry with its major suppliers and related firms. Those enterprises located in the zone enjoy more flexible regulation and tax incentives from the district government. Moreover, Haier has built a convenient transportation system and communication infrastructure, thus facilitating Just-in-time (JIT) inventory and production process.

According to a HTIP official document entitled 'Planning for the National Economy and Social Development,' the development goal during 2001-2005 is to change HTIP into a knowledge-based industrial park by fostering hi-tech firms, industries, high quality human resources. The city plans to build a one-stop system in HTIP that involves IT related R&D, manufacturing, sales and services. First of all, hi-tech projects such as information technology like GSM, computer related model, and mobile phone technology are targeted. For this reason, renowned professionals are invited to HTIP, and by means of electronic commerce college, the city tries to

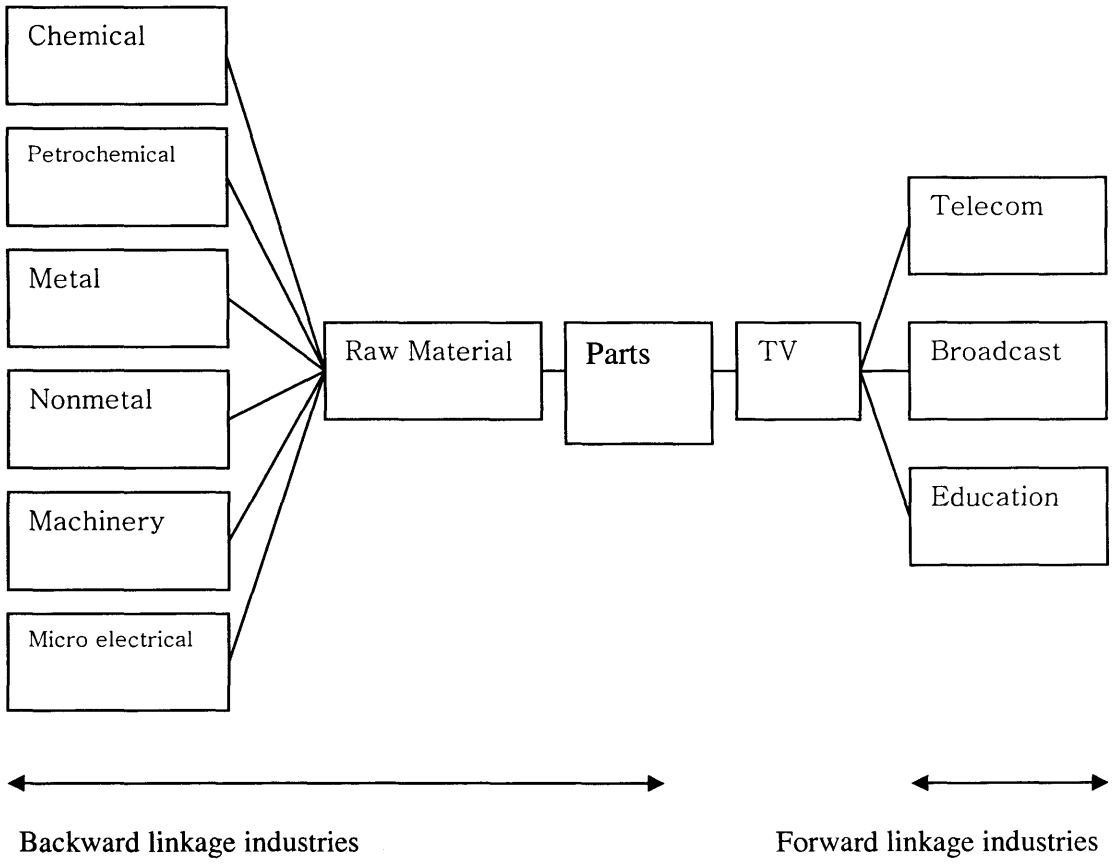
rear talented individuals. Moreover, Invensys, global electronic components company, located in HTIP, is close to Haier industrial park. Invensys provides Haier with the core components for refrigerator, washing machine, and air conditioner.

When the author conducted an interview with the director of Policy research centre in ETDZ, he emphasised importance of FIE-local firm collaboration and industrial clustering. According to the director, ETDZ benchmarks Shanghai Pudong Development Zone as the model, sending researchers to Shanghai since 2001. This trial is consistent with the city government's effort to transform the development zone into the most successful clustering for electronic industry in China. Thus, Qingdao city government has tried its best to develop the electrical and electronic cluster and to attract more DFI, which has turned out to be successful. In particular, near Hisense IT industrial Park and Haier Industrial Park, the related components' suppliers are located. Since the refrigerator plant of Haier has moved to ETDZ, its component suppliers have also gathered around ETDZ. Due to Haier groups' JIT (just in time) zero distance policy, the suppliers not only deliver the components, but also build solid collaboration with Haier regarding new technology and business administration, being assisted by E-commerce as well as a face to face meeting. All this activity is coordinated by Haier Logistics Ltd, thus accelerating the form of household electronic clustering made up with foreign invested enterprises (FIE).

Large local firms' research institutes also play an important role in fostering the local industrial cluster. For example Haier's central research centre at HTIP has built a network with 60 global, regional, and local research institutes around the world. Hisense R&D centre plays a leading role in Chinese electronic industrial development. The company has 11 research institutes for household appliances, mobile phone, information network technology, intelligent control and optical communication, where more than 1,500 professionals and experts are working. By cooperating with Qingdao Semiconductor Research institutes and other Chinese research centres and universities such as Qinghua University and Harbin University, Hisense has developed advanced high technologies related with State 863 plan (National hi-tech research project) which include the optical communication and PDP module for digital TV. Qingdao Semiconductor Research Institutes was at first named the Qingdao Semiconductor Experimental Lab when established in June 1965, and changed to its current name in 1980. In the early days, the institute started with 125 researchers including 20 technicians. Now the human resources have more than quadrupled and they often co-work with R&D centre of Hisense group for the development HDTV, PDP TV.

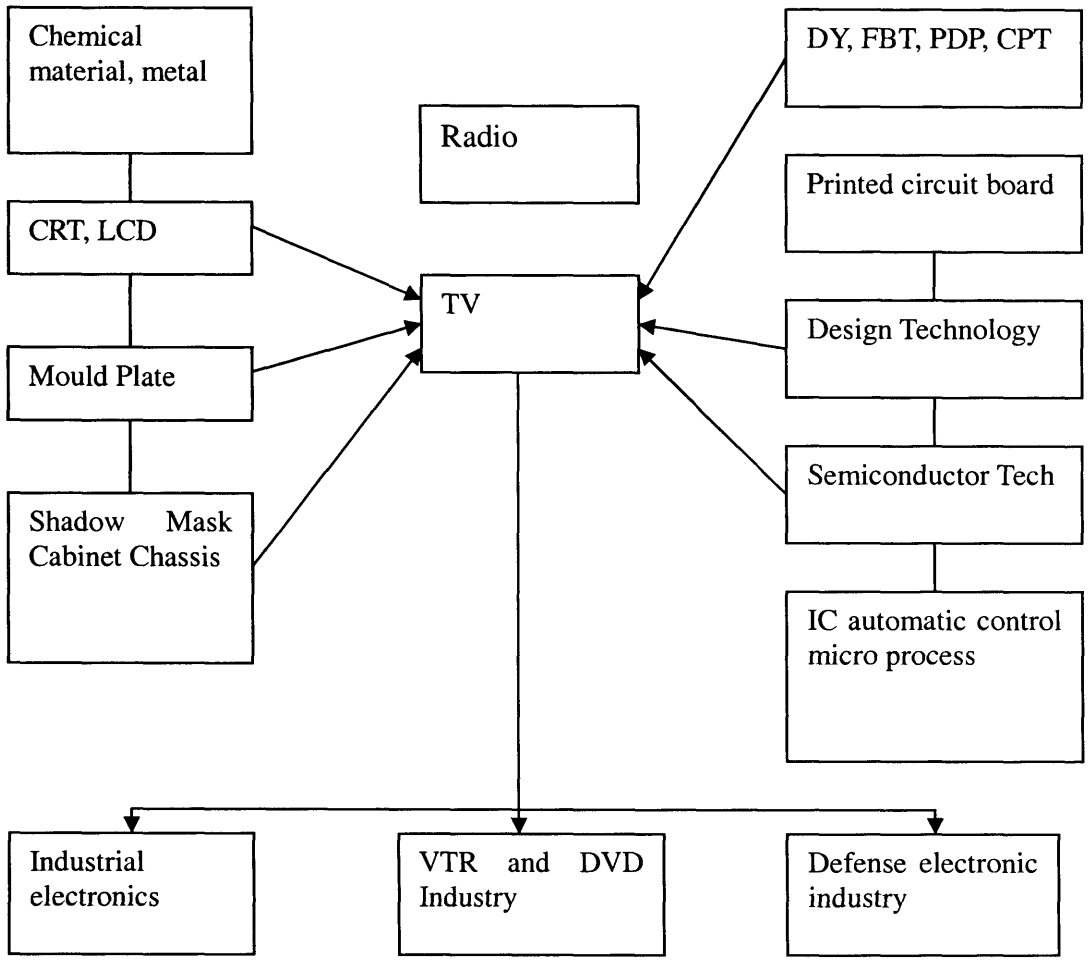
The TV industry has a positive economic impact on related industry such as electronic components, metal processing, petrochemical, and precision machinery because it generates indirect employment in the related industry, not to mention direct employment opportunity. As shown in Figure 5-1, manufacturing TV has strong forward and backward linkages with other sectors. Forward linkage industries include information technology, communication, and broadcast; backward linkage industries chemicals, electronic component, precision machinery, and machinery, petrochemical, metal and non metal industry.

Figure 5-1 Backward and forward linkages in TV industry



Source: Final field work (2004)

Figure 5-2 Technological linkages of TV industry



Source: Final field work (2004)

Note: Acronyms are presented in page 9.

The number of TV models and other products such as computer components and monitors has increased rapidly in Qingdao. Hisense, the 3rd TV and computer monitor manufacturer in China, has 10 different sizes and more than 100 models with key components (ie. Capacitor, Filter, Power module, DVD Loader) that are produced by local and foreign invested firms in Qingdao (see Table 5-14). Obviously, the main buyer of these TV components is Hisense group. When the author interviewed with the director of strategic purchasing and management department in the Hisense group, the director kindly offered the broad picture of TV industrial clustering in Qingdao. According to him, the total number of subcontractor of Hisense is more than 10,000 in China and whole world. Basically, the main suppliers of key components are from Qingdao,

Guangdong, Zhejiang and Shanghai.

Table 5-14. TV industrial clustering in Qingdao

Buyer's in Qingdao	Main Supplier		Other suppliers	
TV components	FIE	Local firm	FIE	Local firms
Colour picture tube (CPT)		V		
Capacitor	V			V
Window screen	V			V
Filter		V		
Speaker	V			V
Cathode-ray tube (CRT)		V		
Display yoke (DY)		V		
Cabinet assembly		V		
Lens	V			
Channel Tuner		V		V
Remote controller	V			V
Transistor	V			V
WVT set				
Fly back transformer (FBT)	V			
Back cover assembly				
Tube		V		
Micro switch	V			V
Connector	V			V
Wire		V		
LCD	V		V	
Printed Circuit Board	V			
PDP module (DTV)	V			
Digital IC (DTV)	V			
Diode	V			
Power module (DTV)	V			
DVD Loader (DTV)	V			

Bold character is core technology and high value-added components.

Source: Final field work (2004)

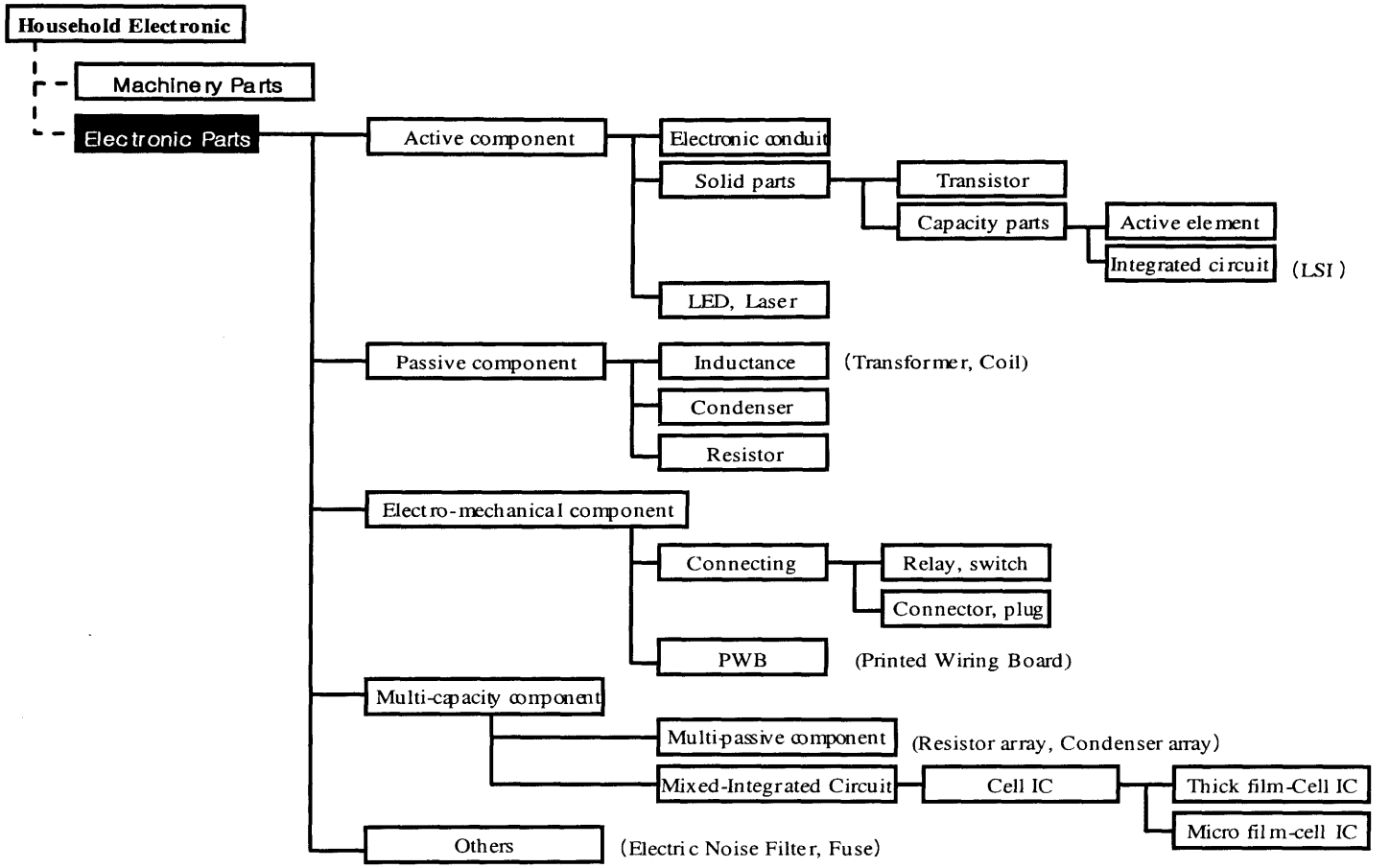
5.5 Conclusions

This chapter has sought to examine general findings and background information concerning ETDZ and HTIP, mainly from preliminary field work though some of findings were from final field work. The discussion has covered various aspects of zones, including overall and industrial growth patterns; changing economic structure; and economic performance of foreign invested firms and Chinese local firms. From the statistical data, it was confirmed that inflows of DFI make a positive contribution to the local economy in ETDZ and HTIP. The chapter also sketched the overall picture of operational characteristics in ETDZ and HTIP and found inter-firm linkages between local and foreign invested firms in various sectors such as machinery, textile, electronic and chemical sectors.

These general findings were further researched in final field work focusing on electrical and electronic industries in ETDZ and HTIP. From the final field work, the researcher has found evidence that large domestic firms in electronic sector have strong supply linkages in ETDZ and HTIP. Considering that electronic sectors emphasise forward and backward linkages, the strong supply linkages can be expected in these sectors. In Qingdao case, however, it is surprising that the main supply linkages are found between large domestic firms and foreign invested firms. These buyer-supplier networks are an important foundation of the clustering of DFI in ETDZ and HTIP.

The detailed processes and mechanisms of clustering of DFI and its impact on urban economic development in Qingdao city will be investigated in next two chapters. Hence, chapter 6 and 7 present detailed research findings based on final field research, evaluated by both quantitative (cross sectional regression analysis, Shift-share and location quotient analysis) and qualitative (21 case studies) analysis.

Appendix 5-1 Classification of Electronic Components



Appendix 5-2 TV Manufacturing process

1. Preparation process Cabinet – Assembled Screen filter – Fix Screen filter
2. Assembly process Module assembly – Sub board assembly – power board assembly – VSC board assembly – Arrange the connector wire – PDP set up
3. Function test process First function inspection
4. Adjustment process Voltage module – White balance adjustment
5. Function test process Performance inspection
6. Assembling process Fixing the back cover 1 – Fixing the back cover 2
7. Function test process Hi-pot inspection – General inspection – Appearance inspection
8. Packing process Appearance inspection – pack the inside & outside of the set – Out packing

Source: Field research 2004

Appendix 5-3 List of Final Sampled Firms

Key Firms	Location (Nationality of Firm))	Main Product	Components from local firms	Components from foreign firms (DFI)
1	ETDZ (China)	Commercial Air-conditioner	Tube, Valve, Package assembly, Install part assembly, Panel, Resin, Base, Fan, Steel	Compressor, IC, Control box assembly, Remote control, PWB assembly, Condenser, Switch, Motor
2	ETDZ (China)	Microwave	Resin, Motor, Plate, Panel, Out case, Oven, Box, Steel	Control, PWB, Cable, Transformer, Magnetron, IC
3	ETDZ (China)	Bottle cooler (refrigerator)	Resin, steel, Evaporate assembly	Compressor, Polyurethane assembly, Cover assembly Door foam assembly, motor
4	ETDZ (China)	Special Refrigerator	Cable, switch	Compressor, Control, Cover assembly, Plastic hardware, Thermostat, Four-way reserving valve, Programme timer, water valve, Motor
5	ETDZ	Household refrigerator	Plastic, Electric cable	Compressor, Control,

	(China)			timer, Motor
6	ETDZ (Korea)	Electronic capacitors, condenser for PCB and PWB 1st tier supplier of no.1, 4, 5 firm	Rubber pad, Can, Aluminium foil and case, paper box	Chemical materials
7	ETDZ (HK)	Special silk screen, Plastic and steel hardware mould for refrigerator and air-conditioner 1st tier supplier of no. 1, 4, 5	Steel (Shanghai Bao-steel)	Steel (Posco) Plastic (BASF)
8	ETDZ (Japan)	Compressor 1st tier supplier of no. 4, 5	Spray, punch	Steel (Posco, Nippon Steel), motor, micro fan, injection mould
9	ETDZ (Japan)	Tactile sheet, Safety unit for battery, Antenna, Encoder, Light touch switch, micro stick, remote control unit, transparent touch panel 1st tier supplier of no 1	Packing product, sub-raw materials (plastic)	Stein-less steel, Steel, PVD, micro chip
10	ETDZ (China)	Switch (1st tier of Hisense)	Plastic button, steel	N/A
11	ETDZ (Taiwan)	Electric wire, cable, connector, PCB components for household electronic goods 1st tier supplier of no.1, 4, 5	Tube, plastic, wire	N/A
12	ETDZ (Korea)	Electronic production Logo, Aluminium panel, TV components, Nickel coating 2nd tier supplier of no. 1, 2, 3, 4, 5	Switch, Bearing, paper packing box, rubber	Nickel, Aluminium, iron mould, Tape
13	ETDZ (UK)	PDP TV module components, PCB, IC, Flip circuit, SMT line, COB 1st tier supplier of Haier and Hisense	N/A	IC components, SMT procurement, LCD
14	ETDZ (HK)	Plastic frame 2nd tier supplier of Haier	N/A	Raw plastic material, core plant from BASF and DOWE
15	ETDZ (Japan)	Optical glass for camera phone, semiconductor, LCD photo-mask, panel	No local suppliers	All materials imported from Japan
16	ETDZ (Japan)	Soft ware, REC, Coil AMM, Head, FDD	Spring,	Switch, micro injection moulding, precision dies
17	ETDZ (China)	Electromagnetism four-way reversing	Iron steel	N/A

		valve 2nd tier suppliers of no 1		
18	ETDZ (Japan)	Electronic micro injection moulding, precision dies 2nd tier supplier of no. 8, 9, 16	N/A	Iron steel, Machinery plant from Japan's mother company
19	ETDZ (China)	Commercial Air conditioner, PC, TV mobile phone	Deflection Yoke, Fly back transformer (FBT), Cabinet assembly, Tube, Valve	Switch, IC, PCB, PDP module, LCD, Capacitor, Control box, Fan, Compressor, Panel assembly, micro speaker, dynamic receiver
20	ETDZ (Korea)	Mobile phone components such as super thin micro speaker, dynamic receiver 1st tier supplier of no. 19	Coil (wire), plastic frame	PCB, film, grill
21	ETDZ (Korea)	Silicon zener diode SMD zener & switching Silicon Rectifiers for TV, PC, monitor	Box	Raw materials for chip, glass (from Japan)
22	HTIP (America)	Motor for household electronic goods 1st tier supplier of no. 1, 3, 4, 5	Lamination, copper wire, end-shield, electronic goods	Core components of motor is from USA, Japan
23	HTIP (Australia)	Control unit with VFD for refrigerator, washing machine, air conditioner and dishwasher, remote control 1st tier supplier of no 1, 2, 4,5	IC part, electric condenser, connector	Semi-conductor chip, PCB, Transformer
24	HTIP (China-Korea JV)	Wire, Plug, Power supply cord, SMD inductor and transformer, Sensor for air conditioner, line filter 1st tier supplier of no. 1, 2, 3, 4, 5	PVC, raw material for wire, cord	Hosing, Terminal plate
25	HTIP (Korea)	Micro-switch, transistor, Relay, thermostat, cordless motor for mobile phone, Desktop charger, Hand-free kit, Key pad assembly, headphone, DVD Rom, Dech Assembly, MP3 player	Packing box	Integrated circuit, circuit controller, injection moulding, heat sink assembly

		1st tier supplier of Haier and Hisense		
26	HTIP (Sweden)	EMIP (Ericsson M2M Intelligent Platform) IT networking for PDA mobile phone, ATM, POS, Logistic Haier group (27) is main customer	No local supplier	All systems from Sweden headquarter
27	HTIP (China)	Haier-PDM (Product digital management system)	Qingdao University Xin-sing, National Ocean University, Beijing University, Qinghua University Haier Central Research Institutes	N/A
28	HTIP (China)	Control unit, PCB, remote control, PDM Haier's branch firm	LED, Plastic	Semiconductor chip, condenser, switch
*29	HTIP (China)	Soft-ware, IT networking 'Haier' – headquarter firm's networking*	Qinghua University IT networking system	Cisco system, Intel
30	HTIP (China)	Washing machine	Housing, Shaft, Tube, Bearing, Pump	Motor assembly, PWB assembly, IC, Panel assembly, Cover assembly, Valve, Steel
31	HTIP (America)	Connector 2nd tier supplier of Haier	N/A	Plastic, Metal
32	HTIP (America)	PCB, IC, Control parts for all household electronic goods 2nd tier supplier of Haier, Hisense, Aucma	N/A	Integrated circuit chip
*33	HTIP (China)	Electronic Cash register *Spin-off from Hisense computer co. Ltd	Power supply, Capacitor, adaptor, monitor, Cable	IC, LCD, PCB, DVD Rom, FDD, Connector, PWB assembly, inductor, Diode, Heat sink assembly, transistor Hardware, CPU
34	HTIP (UK)	Control, Thermostats, Timer, Valve for washing machines, air conditioner, dishwasher, refrigerators 1st tier supplier of Haier, Hisense, Aucma	Spring, Metal, Packing box, plastic	Capillary tube, special metal parts from Italy

Source: Final field work (2004)

Chapter Six: Main Research Findings I: Quantitative analysis

6.1 Introduction

This chapter analyzes the impact of the clustering of DFI on urban economic development in terms of innovation, productivity growth and structural transformation. It is generally accepted that the process of innovation is the driving force for local competitiveness. Local competitiveness in this thesis is defined as a relatively higher growth rate of gross industrial output and value-added in relation to the reference economy. Innovation involves the development of new ideas and their economic application as new products or processes. Innovation provides opportunities for productivity growth through the development of more valuable products, services or the development of new processes that increase efficiency. Innovation is mainly produced from the learning process, through formal buyer-supplier linkages, sharing information, and informal collaboration and competition. The learning process is regarded as the input of innovation, since it causes actual output of innovation.

Innovation is mainly created by the dynamic learning process through inter-firm linkages. Hence this study observes the innovation of firms by using input of innovation (learning process) as a proxy. The input of innovation is explained by information sharing, technical and training assistance by inter-firm linkages; thus innovators in this analysis are local large firms and foreign invested firms. Especially, foreign invested firms are the main suppliers of major domestic firms, being a bridge between domestic small and medium firms (second and third tier suppliers) and large domestic firms (main buyers); the productivity growth is investigated as based upon value added information. These two variables are the main indicators of urban economic growth. In using them, the relationship between clustering of DFI and urban economic development is measured by cross sectional regression analysis. In order to clarify the structural transformation, Shift-share and location quotient analysis are used.

6.2 Innovation and Productivity

ETDZ and HTIP in Qingdao are the industrial base where three leading electronic firms (Haier, Hisense, Aucma) are located. The strong industrial bases in Qingdao successfully attract DFI from the globally leading firms supplying electrically and electronic components. Local SMEs can increase the productivity and enhance the quality of human capital by frequent contacts with

foreign invested firms. Some well-trained employees from foreign firms establish their own company. Through this spin-off effect, they maintain and extend technological knowledge in this region. This process is a crucial factor of the clustering of DFI, which facilitates 'input of innovation' contributing to output of innovation in the sense of (1) the introduction of a new method of production (2) the introduction of a new source of supply (3) the development of a new form of industrial structure. These are the rationale of Schumpeter's term 'innovation'. This thesis adopts Schumpeter's (1961) definition of innovation. To achieve innovation following innovative activities (input of innovation) is essential: (see table 6-1)

1) Technological assistance;
the specification of standard materials or components, method of operational specification, assistance in establishing a production plant, assistance by supplying machinery, assistance in the supplier technical management, assistance in input procurement of suppliers, assistance in quality control: ISO standard level

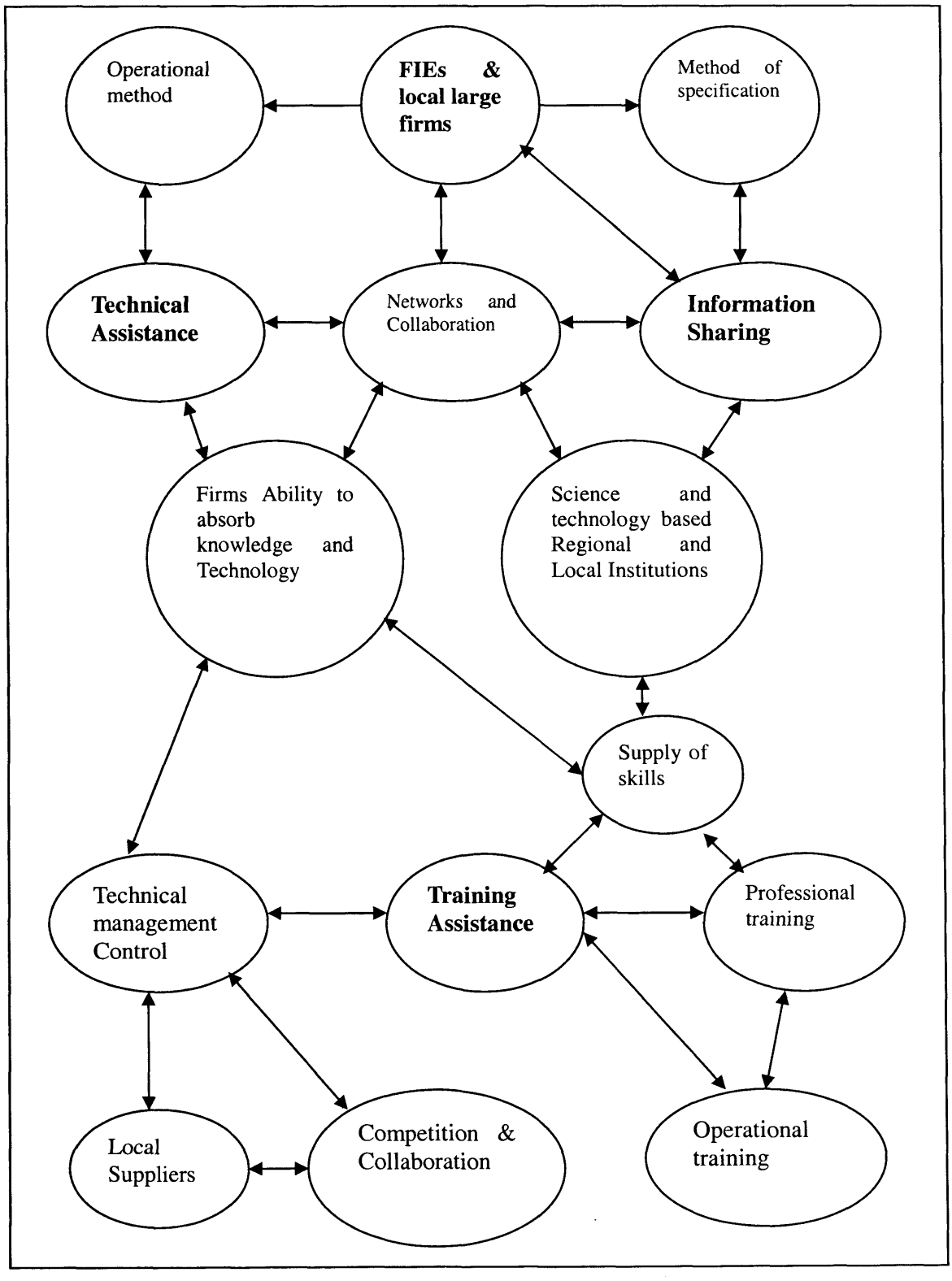
2) Training assistance;
professional training for suppliers' manager, operational training to machines and equipment

3) Informational sharing;
providing production management know-how, marketing channels, market information, information regarding tax policies in destination.

These activities are perceived as inputs of innovation. Using inputs of innovation (innovative activities) as proxies for innovation, the section measures the impact of clustering of DFI on innovation and productivity growth which are key indicators of urban economic development.

The input of innovation (innovative activities) in Qingdao is described in figure 6-1. According to Figure 6-1, innovative activities are led by **local large firms and foreign invested firms**, and the main components of input of innovation are by 1) technology assistance 2) training assistance 3) information sharing. These factors are inter-related with a number of other factors such as knowledge absorptive capacity and competition and collaboration.

Figure 6-1 Key factors determining input of innovation in Qingdao



Source: Final field work (2004)

The detailed explanation of Figure 6-1 is as follows. First of all, technological assistance to local suppliers facilitates the capacity to absorb and utilise knowledge and technology. The maximum effect of technology assistance depends on networks and collaboration. Most firms rarely innovate alone, but rely on a variety of organisations such as other firms, universities and educational bodies, government research institutes. Training assistance, being an important indicator of measuring input of innovation in firms, affects the firm's innovation. Training assistance is related to professional training by learning skills such as the specification of standard materials or components, method of operational specification and technological management, which are indirectly connected with technological assistance. Lastly, information sharing has an important role in strengthening a firm's innovative activities. Gaining production method and specification from well qualified first-tier supplier, second and third-tier suppliers can share the know-how of production.

Data and Variable Construction

Regression analysis, in this section, has the purpose of verifying the relationship between the clustering of DFI and urban economic growth. Two kinds of regressions are specified for this purpose. The first regression investigates the relationship between local supply linkage and the input of innovation. Local supply linkage is a part of the clustering process and input of innovation is closely related to innovation. The second regression is constructed to see how the clustering of DFI, the input of innovation, and R&D expenses have an impact on the urban economic development. The data, based on the questionnaire survey (face-to-face in-depth interview), is collected from individual interviews with 34 electronics firms from ETDZ and HTIP in Qingdao city which were conducted during December 2003 through April 2004.

Firstly, the regression analysis is conducted on following model:

$$\textit{Input of Innovation} = \alpha_1 + \alpha_2\, \textit{Local supply linkage} + \alpha_3\, \textit{duration of contract}$$

(α_1 is constant; α_2 and α_3 are coefficient of local supply linkage and duration of contract, respectively)

In order to measure the input of innovation, as previously explained, technological assistance, training assistance and information sharing are investigated and the average weekly hours spent for three variables are summarised. For example, if firm X spends 10 hours weekly on

technological assistance, 4 hours for training assistance, and 3 hours for information sharing, the input of innovation is calculated as 17. This information is solely acquired by structured interview with the person in charge. Explanatory variables include local supply linkages and the duration of supply contract. Local supply linkage plays a significant role in facilitating information sharing and collaboration between firms, and to foster the formation of clustering. The duration of the supply contract indicates how constantly such supply linkage is maintained. The indication of local supply linkage is measured by the value of local outsourcing, from either local firms or foreign invested firms. The value of local outsourcing is defined as the ratio of local raw materials or the components' purchase value against total purchase value. The degree of proportion is judged by the purchasing manager's evaluation (confidential information) ranging from 1 to 10. For example, 1 means that the percentage of local outsourcing is less than 10 % while 10 indicates that the local purchase value against total purchase value is more than 90%. Thus, the more components are purchase from local supplier, the higher the evaluation number. The duration of supply-contract is a dummy variable (=1 if contract is short-term contract less than 1 year).

The regression analysis is further constructed in second model:

$$Productivity = \beta_1 + \beta_2\ input\ of\ innovation + \beta_3\ clustering\ of\ DFI + \beta_4\ R\&D\ expenses$$

Productivity is usually measured by total factor productivity (TFP). The author, however, has had difficulty in acquiring accurate information to measure TFP[8]. Instead, this study measures productivity using value added per worker, as suggested by Bergman and Goldstein (1986). In this regression analysis, value added per worker is logged since the logged value is conveniently interpreted as being a percentage change of the dependent variable. The input of innovation, R&D expenses and clustering of DFI, are explanatory variables. In particular, clustering of DFI is a key variable to investigate the impact on productivity growth. The key variable is *clustering of DFI* which is a dummy variable depending on the existence of 1) local and global supply or purchase linkage and 2) managerial or technology transfer: if 1) and 2) exist, the dummy variable becomes 1; zero, if otherwise. This information is also acquired from in-depth interviews during the final field work. When local firms have strongly linked with foreign

[8] In order to measure TFP growth, it is necessary to have accurate price and quantity of information on all of the outputs produced by the set of production units for the two time periods under consideration as well as accurate price and quantity information on all of the inputs utilized (Diewert, 2000, p. 46).

invested firms such as joint venture subcontracting, these firms can be part of the clustering of DFI. Further details of variables, with their indicators, are presented in the below Table 6-1.

Table 6-1 Description of Variables and Their Indicators

Variable	Indicator
Input of Innovations (Innovative Activities)	Hours per week spent in the following activities: **Technological Assistance** Specification of standard materials or components. Method of operational specification Assistance in establishing a production plant Assistance by supplying machinery Assistance in the supplier technical management Assistance in input procurement of suppliers Assistance in quality control: ISO standard level **Training Assistance** Professional training for suppliers' manager Operational training to machines and equipment **Information Sharing** Provide production management know-how Provide marketing channel and market information Provide information about tax policies in destination
Local Supply Linkages	Degree of below criteria {from 1(low) to 10 (high)}: Value of local outsourcing defined as the ratio of local outsourcing against total purchase value.
Duration of Supply Contract	=1 if the contract is short term contract (less than one year) =0 otherwise
Productivity	Logged value-added per worker
R&D Expenses	Amount of R&D spending, RMB 1000
Clustering of DFI	=1 if only all following conditions exist: local or global supply linkage, managerial or technology transfer* =0 otherwise.

*the result is based on in-depth interview and questionnaire survey during final field work.

Empirical Results

Two different regressions of ordinary least squares (OLS) analysis are shown in Table 6-2. The first regression shows the relationship between the input of innovation and local supply linkage; the second regression indicates how clustering of DFI as well as input of innovation, R&D expenses affects productivity. First of all, Analysis I regresses the input of innovation variable on constant, local supply linkage (inter-firm networking) and dummy variable, depending on long term or short term subcontracting duration. As shown in the result, there is a strong relationship between the input of innovation and local supply linkage. One unit of increase in local supply linkage is estimated to raise input of innovation by 6.724 units on average. The minus coefficient result of Duration variable, which is a dummy, implies that the short term contract is expected to grow by 2.852 unit of input of innovation less than an otherwise equivalent long term contract. But the t-statistics of duration, which is -0.361, is low with insignificant probability value. Thus, in this data analysis, duration variable has little impact for the input of innovation of firms while the supply network system shows a significant effect. R-squared, which is 0.3616, is not very high. As Wooldridge (2000, p. 40) mentions, however, "it is worth emphasising here that a seemingly low R-squared does not necessarily mean that OLS regression is useless." More importantly, all diagnostic tests, including Durbin Watson statistics, report that OLS estimators in this regression are unbiased and efficient.

Based upon the positive impact of local supply linkage on the input of innovation, Analysis II regresses the logged value added on constant, input of innovation, clustering of DFI and R&D expenses. The result of regression reports that all three explanatory variables have a significant and positive impact on productivity growth. For example, one more hour spent on innovation is expected to increase productivity by 2.5% on average. One unit (1000 RMBs) increase in R&D expenses is associated with a 0.3% increase in productivity on average. The most significant impact is seen in the clustering of DFI, dummy variable such that the clustering of DFI is expected to raise the productivity by 304% more than an otherwise equivalent firms. The t-statistics, 4.380 is also high enough to be significant at 5% level. This result supports the substantial impact of DFI on local economic growth. The statistical significance of all three explanatory variables is approved at 5% (Although the p-value of input of innovation is 0.052, it can be interpreted as significant at 5% since the value is very close to 0.05). The diagnostic tests are conducted to see the validity of OLS estimators; the insignificant result of normality, heteroscedasticity, and Ramsey reset tests show the efficient and unbiased estimators of this

regression.

Table 6-2 Results of Cross Sectional Regression

Analysis I (Ordinary Least Squares)

Dependent Variable: Input of Innovation			
Variable	Coefficient	t-statistics	Probability value
Constant	37.196**	3.146	0.0036
Local Supply Linkages	6.724**	4.138	0.0002
Duration (Dummy)	-2.852	-0.361	0.7198
R-squared: 0.3616	Durbin-Watson Statistics: 2.585		
Diagnostic Test:			
Normality: 5.274 (0.071) Heteroscedasticity: 0.217 (0.883) Ramsey Reset Test: 0.991 (0.383)			

Note: **indicates significant at 5% level of which t-statistics is 1.96, * indicates at 10% level with t-statistics of 1.65. Diagnostic means test of residual. Diagnostic test is calculated as F statistics. ( ) parentheses are p-value Normality statistics is based upon F value of Jarque-Bera test. Heterscedasticity is white heteroscedasticity with no cross term. Ramsey Reset test includes the two fitted term in the original regression.

Analysis II (Ordinary Least Squares)

Dependent Variable: Productivity (Log (Value-Added))			
Variable	Coefficient	t-statistics	Probability value
Constant	5.742**	5.214	0.0000
Input of Innovation	0.025*	2.021	0.052
Clustering of DFI (Dummy)	3.044**	4.380	0.0001
R&D Expenses	0.003**	2.336	0.0264
R-squared: 0.609	Durbin-Watson Statistics: 1.843		
Diagnostic Test Statistics:			
Normality: 0.076 (0.962) Heteroscedasticity: 0.465 (0.798) Ramsey Reset Test: 1.275 (0.295)			

Note: **indicates significant at 5% level, * indicates at 10% level. ( ) parentheses of diagnostic test are p-value. Normality statistics is based upon F value of Jarque-Bera test. Heterscedasticity is white heteroscedasticity with no cross term. Ramsey Reset test includes the two fitted term in the original regression.

According to this result, the input of innovation and clustering of DFI have a substantially positive impact on economic development. With this quantitative result, the detailed mechanism of inter-firm linkage and clustering of DFI is explored in Chapter 7 with a qualitative approach.

6.3 Structural transformation

One speaks of structural change if the different gross output value or value added within the industry change their relative composition. Shift-share analysis examines economic change (e.g. growth or decline) in a region by breaking it down into three components: national share, industrial mix, and regional share. Shift-share analysis is one way to measure the competitiveness of a region's industries. It provides a picture of how well the region's current mix of industries is performing and how well individual industries are doing. The analysis examines three components of regional growth: national growth, industry mix, and local competitiveness. Shift-share analysis can measure separately the impact of direct foreign investment clustering on urban economic development in terms of (industrial) structural transformation. A simple formula is as follow, which is exactly same way of notation and general formula as explained in Chapter 4.

1) $TS_{dfi} \equiv RS_{dfi} + IS_{dfi} + DS_{dfi}$

2) $TS_{dfi} \equiv \sum E^t_{ird} g_{nd} + \sum E^t_{ird} \left(\frac{E^{t+1}_{ind} - E^t_{ind}}{E^t_{ind}} - g_{nd} \right) + \sum E^t_{ird} \left(\frac{E^{t+1}_{ird} - E^t_{ird}}{E^t_{ird}} - \frac{E^{t+1}_{ind} - E^t_{ind}}{E^t_{ind}} \right)$

Notation

TS_{dfi} is total shift share; RS_{dfi} is reference economy share; IS_{dfi} is industrial share or proportional share; DS_{dfi} is differential shift or competitive advantages[9]

$E^t_{ir\,d}$ is employment or growth output in sector i of region r at the beginning of a time interval extending from t (initial year) to t+1(final year)

$g_{n\,d}$ is rate of growth of all industries combined in the reference area, n

To construct a better understanding of local competitiveness, the location quotient (LQ) analysis is also often used in measuring the competitiveness of a region's industry. It is the ratio of industry's concentration on a specific city or region. This research uses constant value added data to analyzing DFI location quotient. Since the detailed description of LQ methodology is presented in Chapter 4, this chapter, without further explanation of LQ, shows the formula which measures the clustering of direct foreign investment in LQ.

[9] Blakely and Bradshaw (2002, p. 128) called competitive advantage.

$$3) * LQ_{dfi} = \frac{E_{ijd} / E_{jd}}{E_{ird} / E_{rd}}$$

Where E_{ijd} is value added by DFI (foreign invested firms) in industry i in area j, E_{jd} is total value added by DFI in area j, E_{ird} is reference area's value added by DFI in industry i and E_{rd} is total reference value added by DFI.

The LQ has been widely used in different studies (regional and urban economics, urban planning), but it has rarely been used to measure DFI clustering in local-level analysis. In this research, the LQ technique measures the local specialisation of DFI in each industry, given the overall economic importance of the area. The LQ is most often calculated with employment data but in this research, constant value added data[10] is used for calculation. By using constant value added data, the calculation is not affected by price level and inflation. In shift-share analysis, this research uses constant gross industrial output value (base year 1990) due to the availability of long period of data (1985-2002).

Findings of Shift-share and LQ analysis

Table 6-3 summarises the results of the application of a shift-share analysis to a set of manufacturing constant (base year 1990) gross industrial output value (GIOV) data for Qingdao city, in the period between 1985 and 2002. Most of the information used in this section comes from confidential data from Huangdao ETDZ, and official data from China Statistical Yearbook and Qingdao Statistical Yearbook. The analysis period I is categorised by three time spectrums: 1985-1990; 1990-1995; 1995-2002. Each categorisation is characterized by economic transition during the entire period, these being initiation (1985-1990), expansion (1990-1995), and maturity period (1995-2002). Initially ETDZ was approved by state council in October 1984, and March 1985 saw the official laying of the foundation stone in Huangdao district, designating an area of only 15 square kilometres. Since then, Qingdao's key development zones have benefited from a series of government preferential policies for Open Coastal Cities. In the expansion period (1990-1995), ETDZ and the whole Huangdao district in Qingdao combined into one administrative body, expanding an area up to 220 square kilometres. In 1992, at the same year of expansion in ETDZ, Qingdao HTIP (16.7 square kilometres) was also designated by the State government. From 1995, the inflows of actually utilised DFI became notably active

[10] To be more sophisticated, the same type of ratios can be calculated if the analysis has data on the industrial output, value added, payroll or any other related data series.

in ETDZ and Qingdao city; in 2000, ETDZs' GDP reached RMB 8.57 billion, four times higher than base year 1995, and local financial revenue of RMB 600 million, six times higher than base year 1995.

During the initiation period of 1985 to 1990, the result of industry mix was favourable towards industry output growth, while the local effect was strongly against it. In fact, Qingdao in 1985 was a small port city and the local competitive of Qingdao was quite low during this period. Since then, Qingdao has been transformed into a modern industrialised city. During the expansion period of 1990 to 1995, the industry structure held back growth, but the local competitiveness became surprisingly enhanced to -19.8% from a previous -112.6 %. Following this, the city continued to increase industrial output growth. During 1995 to 2002, local effect has highly positive value with amounts of 7,572,171 new industrial gross output. Hence Qingdao city has generated a greater output growth rate than national average.

Analysis (2) shows the shift share result after each period in analysis (1) is reorganised. The overall result is similar. During the expansion and maturity period (1990-2002) an amount of 7,330,454 of new gross output was attributable to its competitive locality. The positive local effect since 1990 outweighed the negative effect during initial period. Therefore, during the entire period of 1985 to 2002, local competitiveness of Qingdao city turned out stronger than the national level.

Table 6-4 and 6-5 describe the result of shift-share components in electrical machinery and apparatus (D31) and television, radio and communication equipment (D32), respectively. The categorization of period is same as Table 1. From the table, local effect on D31 and D32 shows the positive initial conditions. In case of D32 industry, importance of local effects has grown up during the three periods while the pattern of D31 indicates the relatively small local impact during the expansion period of 1990 to 1995 compared to other two periods before and after. The local effect for entire observed years (1985-2002) is presented in analysis (2) in each table from which local competitiveness for D31 and D32 explain 93% and 70.8% of the change, respectively. Huge impact of local competitiveness is in fact consistent with the expansion of Haier group in Qingdao city. Table 6-6 described the chronological history of Haier group's expansion during 1984 through 2002. Starting the establishment of Qingdao refrigerator plant in 1984, the Haier group has grown fast by taking over the existing firms during the first half of the 1990s. Since the second half of the 1990s and onwards, the Haier group has more actively

established new firms and cooperation with foreign invested firms has also became strengthened.

From Table 6-3, 6-4, 6-5, it is found that the importance of local effect is highest during the maturity period of 1995 to 2002 when the inflows of DFI became notably significant in Qingdao city. In Qingdao City, the actually utilised DFI in 1990 was 0.07 billion USD. Since then it has increased to 0.86 billion USD in 1995, and has risen up to 2.38 billion USD in 2002. This period (1995-2002) also represents the years when supplier linkage between local firms and foreign invested firms was motivated by an alliance of technology transfer. As shown in Table 6-6, in the year of 1999, Haier collaborated with Lucent Technology, Microsoft, and Toshiba.

On the other hand, measuring the DFI clustering, the DFI location quotient relative to national level and Qingdao level is calculated as presented in Table 6-7. The calculation is based upon the constant value added from 1995 to 2002. The first column lists ISIC number of each industry, and the relative concentration of DFI is highlighted in D31 and D32 industry. For example, DFI LQ for D31 industry with reference to China and Qingdao city and China and Huangdao is 5.04 and 8.36, respectively, implying that the clustering of DFI for electrical machinery and apparatus in ETDZ, relative to national level and Qingdao city, is highly concentrated. Similarly, LQ for D32 also presents 1.11 and 2.12, respectively. The feature of the strong concentration of these two industries is consistent with the result of their local competitiveness component in 8^{th} and 9^{th} column of the table which reports the substantial positive local condition in ETDZ.

Table 6-3 Shift-share components of change of total manufacturing GIOV in Qingdao, 1985-2002

	National Effects		Industry-Mix Effect		Local Competitiveness Effect		Total Change	
Period of Analysis (1)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
85-90	1397919	148	610774	64.6	-1063939.3	-112.6	944753	100
90-95	3344807	122.7	-78548	-2.9	-539511	-19.8	2726748	100
95-2002	4821438	36.4	841815	6.4	7572171	57.2	13235425	100
Period of Analysis (2)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
90-2002	8789245	55.1	-157527	-1	7330454	45.9	15962173	100
85-95	5479796	149.3	96814.9	2.6	-1905110	-51.9	3671501	100
85-2002	12123984	71.7	-660979.17	3.9	5443921.37	32.2	16906926	100

Source: Author's own calculation

Calculation based on constant Gross Industrial Output Value (base year 1990) unit: 10,000 RMB

Table 6-4 Shift-share components of change of Electrical machinery and apparatus (D31) GIOV in Qingdao, 1985-2002

	National Effects		Industry-Mix Effect		Local Competitiveness Effect		Total Change	
Period of Analysis (1)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
85-90	32908	26%	-5156.9	-4%	99272.3	78%	127023	100
90-95	249167	47%	65362.6	13%	210836.4	40%	525366	100
95-2002	683983	15.2%	243945	5.4%	3569343.9	79.4%	4497272	100
Period of Analysis (2)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
90-2002	654743	13%	299396	6%	4068499	81%	5022638	100
85-95	128996.9	20%	9461.7	1%	513930.4	79%	652389	100
85-2002	285404.2	5.5%	78183.7	1.5%	4786073.1	93%	5149661	100

Source: Author's own calculation
Calculation based on constant Gross Industrial Output Value (base year 1990) unit: 10,000 RMB

Table 6-5 Shift-share components of change of Television, radio and communication equipment (D32) GIOV in Qingdao, 1985-2002

	National Effects		Industry-Mix Effect		Local Competitiveness Effect		Total Change	
Period of Analysis (1)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
85-90	38893	70%	-2522.86	-5%	19211.7	35%	55582	100
90-95	140711	28.3%	169912.3	34.2%	186304.7	37.5%	496928	100
95-2002	588103.7	14.5%	1431221.05	35.3%	2037198.3	50.2%	4056523	100
Period of Analysis (2)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)	Amount	Share (%)
90-2002	369750	8%	1315385	29%	2868316	63%	4553451	100
85-95	152459.9	27.6%	125553.6	22.7%	274496.5	49.7%	552510	100
85-2002	337315.6	7.3%	1009971.9	21.9%	3261745.45	70.8%	4609033	100

Source: Author's own calculation
Calculation based on constant Gross Industrial Output Value (base year 1990) unit: 10,000 RMB

Table 6-6 Haier Group's Expansion

Year	Expansion of Haier	Location	Important Notes
1984	Establishment of Qingdao Refrigerator plant	**Qingdao city**	**Designate ETDZ**
1988	Take-over of Qingdao Electroplating plant	**Qingdao city**	N/A
1991	**Establishment of Qingdao Haier group** Take-over of Qingdao AC plant & Ice-Box plant	**Qingdao city**	N/A
1992	Take-over of Qingdao Condenser Plant renamed as Haier group	**Qingdao city**	**Designate HTIP** **Extend ETDZ (15-220 km2)**
1995	**Establishment of Haier Industrial Park** Take-over Red Star Electrical Appliance Plant Purchase of Wuhan Refrigerator Plant	**Qingdao HTIP** **Qingdao city** Wuhan city	N/A
1997	Shunde Haier Electrical Appliance Co. Ltd Take-over Qingdao 3rd Pharmaceutical plant Haier-LKG (Philippines) Co. Ltd; Haier (Asean) Co. Ltd Laiyang Haier Electrical Appliance Co. Ltd Hefei Haier Electrical Appliance Co. Ltd	Shunde, Guangdong The Philippines Malaysia Laiyang, Shandong Hefei, Anhui	Call centre
1998	Take-over Zhangqiu Electrical Machinery plant Joint R&D Centre with Chinese Academy of Science (CAS) Strategic Alliance with Philips Haier Digital Technology Development Co. Ltd Joint software Co. Ltd with Beijing Aerospace University **Haier IT industrial Park in Qingdao** **Haier Central Research Institute**	Zhangqiu, Shandong Beijing (R&D) Shanghai (R&D) Beijing (R&D) Beijing (R&D) **Qingdao HTIP** **Qingdao HTIP**	Website upgrading; Office automation; Internal service & manufacturing system; Reengineering of AC dept. (ERP)
1999	**Cooperate with Lucent (GSM mobile phone)** **Cooperate with Microsoft (Venus plan)** Haier (US) Trade company Haier (US) Industrial Park C3P Joint Lab with Shanghai transport Univ. **Cooperate with Toshiba (AC manufacturing)** **New Industrial Park in Qingdao ETDZ**	**Qingdao HTIP** **Qingdao HTIP** New York, US South Carolina Shanghai (R&D) **Qingdao HTIP** **Qingdao ETDZ**	Internal information infrastructure development Reengineering of business flow (ERP)
2000	Haier E-Commerce Co. Ltd	**Qingdao HTIP**	Total E-Commerce solution
2001	Haier International Logistic Centre Haier (Pakistan) Industrial Park Cooperate with Ericsson (network appliance)	**Qingdao ETDZ** Pakistan **Qingdao HTIP**	Reengineering and integration of outsourcing, production and marketing based on e-commerce
2002	**Cooperate with Sanyo Electrical Machinery**	**Qingdao ETDZ**	**JIT and zero stock policy**

Source: Author's field research: Data from Haier Group (2004)

Table 6-7 Results from Clustering of DFI Analysis for Qingdao ETDZ

ISIC	ALL INDUSTRIES	Share of Value added 2002	Change in value added 1995-2002	DFI L.Q(1)[1] based on value added 2002*	DFI L.Q(2)[2] based on value added 2002*	Change in L.Q 1995-2002	Competitiveness Component (1)[1] 1995-2002	Competitiveness Component (2)[2] 1995-2002	Industry mix component (1)[1] 1995-2002	Industry mix component (2)[2] 1995-2002
	TOTAL MANUF.	100%					339043.8	133839.8	69157.685	147776.82
D15	Food and beverage Products	15.4%	45.4%	1.40	1.65	150.2%	74103.7	77126.0	-6207.11	-27171.84
D17	Textiles	0.8%	-26.2%	0.15	0.08	-6.0%	-8789.1	-34184.9	-10531.03	6760.4498
D18	Apparel; dressing and dyeing of fur	0.5%	48.3%	0.10	0.11	8.0%	-214.7	-5873.0	-3021.728	223.43269
D19	Tanning and dressing of leather	1.4%	72.0%	0.23	0.17	53.0%	11145.1	8453.0	-194.6892	2271.9818
D20	Wood and of products of wood and cork, except furniture	0.1%	82.7%	0.09	0.21	18.0%	757.1	770.9	-10.55043	-34.63707
D21	Paper and Allied Products	0.1%	8.3%	0.09	0.05	1.6%	-2623.1	-1581.1	1372.0293	-414.6118
D22	Printing, Publishing, and Allied Industries Chemicals and Allied Products	0.3%	20.1%	0.08	0.25	13.6%	-749.8	-371.1	782.31879	-252.2113
D23	Coke, refined petroleum products and nuclear fuel	3.3%	3.8%	1.96	11.82	158.8%	-4313.7	22420.3	26802.707	-1138.886
D24	Chemicals and chemical products	2.3%	32.6%	0.34	0.33	30.7%	5283.8	-8868.5	683.18036	10869.492
D25	Rubber and plastics products	0.9%	-86.6%	0.15	0.07	-40.3%	-90931.1	-148630.0	15633.797	47279.962
D26	Other non-metallic mineral products	1.1%	40.7%	0.20	0.33	21.7%	-42.8	3824.6	-2808.207	-10285.12
D27	Primary Metal Industries	0.4%	17.7%	0.10	0.08	4.5%	-3379.5	-573.0	-34.39952	-5032.402
D28	Fabricated metal products, except machinery and equipment	0.6%	77.1%	0.20	0.13	28.3%	4121.8	3282.6	-180.4536	474.29641
D29	Machinery and equipment	0.6%	48.4%	0.15	0.08	17.1%	4068.3	3874.1	-134.8902	-346.7694
D31	Electrical machinery and apparatus	41.5%	31.6%	**5.04**	**8.36**	**496.0%**	**193261.0**	**202112.0**	**21154.836**	**-25962.88**
D32	Radio, television and communication equipment and apparatus	29.8%	25.4%	**1.11**	**2.12**	**106.8%**	**154438.4**	**32617.1**	**26017.906**	**128648.79**
D33	Medical, precision and optical instruments, watches and clocks	0.7%	41.3%	0.24	0.44	23.8%	2502.4	-21497.7	-365.4894	22420.128
D36	Furniture and Fixtures	0.2%	25.8%	0.15	0.22	13.2%	406.1	938.5	199.45464	-532.3538

Source: Author's own calculation based on constant Value added (base year 1990) unit: 10,000 RMB
Note: [1] and [2] indicates calculation result relative to national level and Qingdao city level, respectively.

6.4 Conclusions

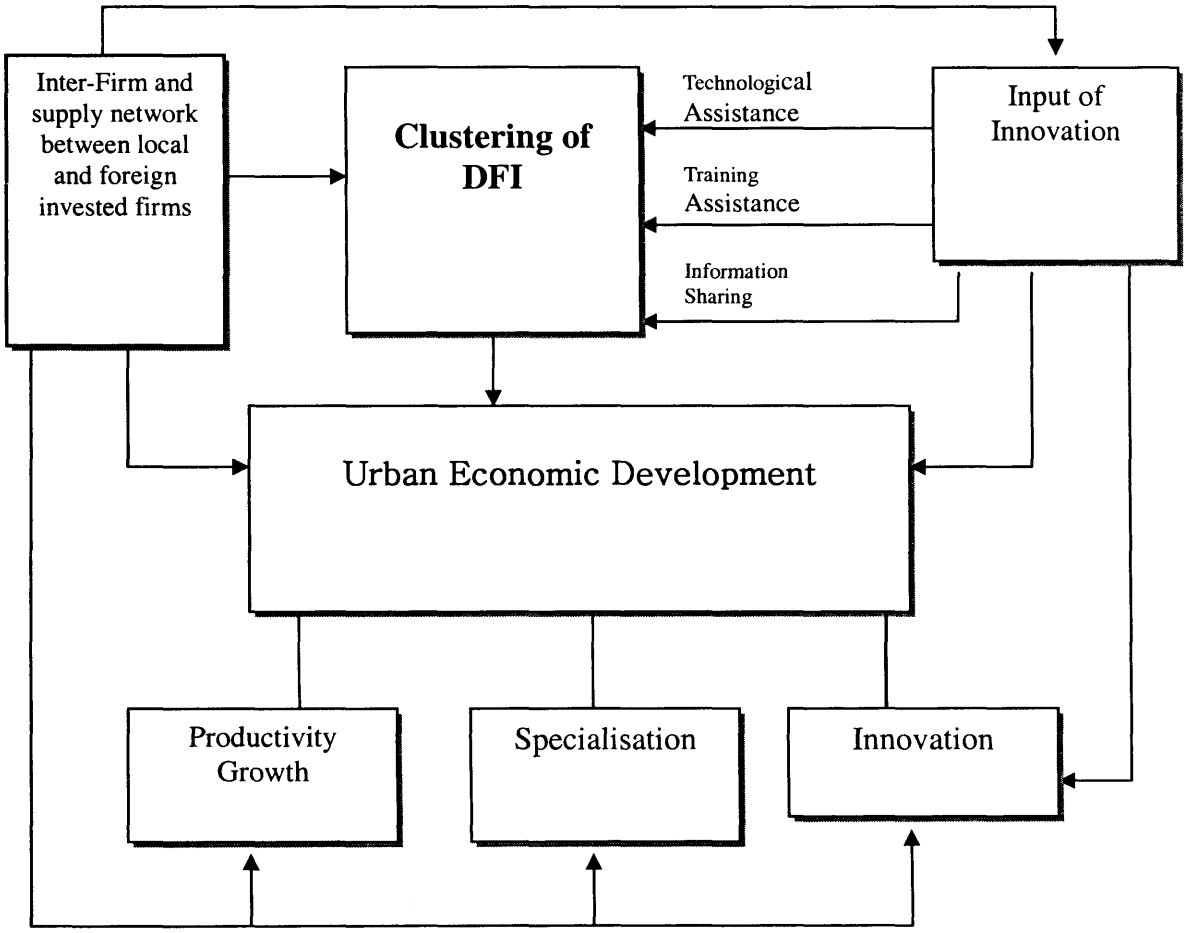
This chapter has analysed the empirical evidence based on the relationship between the clustering of DFI and urban economic development in Qingdao city in the sense of innovation, productivity growth and local competitiveness. The meaning of local competitiveness, as previously evaluated by Shift-share analysis, is the difference in the rate of growth or decline in output or value-added to the rate of growth or decline in that same output or value-added nationally (Blakely and Bradshaw, 2002, p. 128). For this purpose, quantitative data are collected from secondary data (official statistics) and primary data from questionnaire survey. These data are processed with OLS regression estimation, Shift share analysis (local competitiveness index) and location quotient (specialisation index) in order to verify the factors influencing urban economic development. From the regression result, the input of innovation created by technological training assistance and information sharing takes place more actively where the local supply linkage is strong. The result also shows that productivity became positively associated with clustering of DFI and input of innovation; especially, being a clustering of DFI considerably enhances productivity growth.

Before generalising these results as the implication of the urban economic development, local competitiveness of this particular place, Qingdao city is also examined. From the Shift-share analysis, it is found that Qingdao city has a strong local capacity for electronic industry. In addition, high location quotient index of DFI in ETDZ, notably for electronic industry, indicates that utilisation of DFI inflows has been most specialised and concentrated in the electronic industry of Qingdao city. These findings imply that if the particular industry in a certain region has higher growth rates than other regions, the inflows of related DFI is utilised to form industrial specialisation. In other words, based upon the local competitiveness, the interaction between the specialisation of industry and inflows of DFI fosters the clustering of DFI. In the course of interaction, supply network is systemised, and input of innovation is facilitated, which finally makes the substantial influence on the urban economic development.

The quantitative analysis in this field work provides evidence of a positive relationship between clustering of DFI and urban economic growth. This positive result is mainly gained from the innovative activities based upon local competitiveness in particular industry. The particular findings in Qingdao city can be generalised in designing and planning the urban economic development. The mechanism is described in Figure 6-2. In order to connect the DFI with urban

economic development, input of innovation utilised by inter-firm linkages is crucial. Inter-firm linkage has various modes such as joint ventures, strategic alliance and subcontract linkage between local large firms and foreign invested firms. With such linkage, technological assistance, training assistance, and information sharing are facilitated; moreover, by establishing inter-firm linkages with innovative activities, clustering of DFI is fostered and strengthened. Clustering of DFI, with interactions between domestic and foreign firms, contributes to urban economic development in terms of productivity growth, specialisation, and innovation.

Figure 6-2 Mechanism of Urban Economic Development in Qingdao City



Chapter Seven Main Research Findings II: Case Analysis

7.1 Introduction

This chapter presents in-depth information about the specific nature of supply networks in development zones (HTIP and ETDZ) in Qingdao, as based on the analysis of a series of interviews. The results provide a comprehensive picture of what happens in inter-firm networks between local firms and FIEs, looking at particular types of firms with their strategy and linkages. This chapter also explores how the linkages between foreign and local firms have acted as a catalyst for the development of clusters and subsequently as driving forces in the ongoing development of a cluster.

The contents of this chapter are based on final field work, which combined a questionnaire survey with face-to-face interview. The face-to-face interview allowed the researcher to obtain a full description of the real nature of business in terms of purchase and supply networks. This chapter focuses on each firm's supply networks created by either foreign or local firms through innovative learning activities, thus exploring the mechanisms that underlie the positive impact of clustering of DFI on local economic development. The number of firms originally surveyed was 34 firms. Among them, 21 firms provided further information regarding the detailed mechanism of what happens between a foreign invested firm and local firms, looking at particular types inter-firm network.

In order to explore the inter-firm supply linkage between domestic and foreign firms, 21 firms' case studies are utilised and divided into four types depending on the network characteristics. The 21 firms' case study are categorised into four types based on the characteristics of inter-firm linkages, as presented in Section 2. These four types of inter-firm linkages are as follows: global supply network; strategic inter-firm network; dynamic local collaboration; intra-firm linkages between FIEs. Section 3 synthesises the case studies findings. The findings in the Qingdao case might be better explained by means of the 'hub and spoke' model of industrial district. In this case, however, there are some differences from conventional wisdom of the hub and spoke model. The role of the government is briefly discussed as well. Finally, Section 4 discusses the main conclusions of this chapter.

7.2 Types of Supply Networks and Strategies

From the final field work, the author conducted in-depth interviews with 21 firms in ETDZ and HTIP, by which a full description of inter-firm linkages has been acquired. Each case study firm has its own characteristics and strategies in industrial linkages. Nonetheless, the author also found there are some common features of inter-firm networks in 21 firms. The common features are identified and categorised as four types of inter-firm linkages; global supply network, strategic inter-firm network, dynamic local collaboration, intra-firm linkages between FIEs. The categorisation of four types of supply network and strategies are made by the author's own efforts. The detailed description of each type is presented as follow.

7.2.1 Global Supply Networks

It is generally accepted that a firm's growth is rarely achieved by itself. It could be accomplished through a form of clusters as groups of related firms with buyer-supplier linkages, sharing information within the atmosphere of co-operation and competition. What, then, is the most important factor of clustering development? Two main factors are very important: (1) the presence of functioning networks and partnerships; (2) a strong innovation base, with institutional support activities. Sharing knowledge through global networks and partnerships can be achieved through close linkages between local large firms and foreign suppliers. These procedures help to upgrade local suppliers through fierce competition.

Schumpeter has consistently defined innovation in a broad sense to mean 'the carrying out of new combinations', a definition which embraced much more than just technological innovation because it included *the introduction of a new good; the introduction of a new method of production; the opening of the new market; the conquest of a new source of supply; and the development of a new form of industrial organisation* (Schumpeter, 1961). From this perspective, innovation is fundamentally a learning process. Such learning – by 'doing', 'using' and sharing with others – depends upon the accumulation and development of relevant knowledge (Dicken, 1998). The following case studies show the specific mechanism of innovation process by global supply networks.

Case 1 Haier Intelligent Electronics Company (HIEC): The firm, established in July 1999, is the subsidiary of Haier group whose main product is control parts for the Haier group. HIEC's

main business focuses on advanced intelligence controlling technology applied to appliance and communication, manufacturing of micro-computer controlled electronic modules as well. HIEC has made various types of electronic modules such as intelligent washing machines with fuzzy controlling systems, inverter controlling systems, PWB assemblies, control systems for refrigerators and air-conditioners. The control system is one of the most important parts of electronic products.

R&D networks

HIEC has engaged in R&D networks with global firms such as Matsushita, Toshiba and Sanyo. In order to exchange technology and understand the specification of product components, they send engineers to HIEC. Researchers in HIEC also make regular meeting with Haier group and central research centre. More specifically, Haier group's central research centre (HCRC) has closely connected with HIEC, in which the active exchange of information is possible. Furthermore, they also keep their active relationship with local and global subcontractors (second and third tier companies). According to the interview with the team officer of Haier, the Haier group tries to keep close relationship with suppliers so that Haier is willing to give any practical advice whenever suppliers face difficulties. In addition, supplies are registered in Haier groups' supply network, taking advantage of E-commerce by which they receive purchasing order and deliver the goods. Since there are fierce open competitions to be the Haier groups' suppliers, even the registered suppliers make the effort to upgrade their quality and productivity to keep their status being suppliers.

Supply networks

Core components and raw materials are imported from Korea and Japan. Semiconductors are supplied from global firms such as Samsung, NEC, Matsushita (Panasonic); micro-transistor, condenser, capacitor are from FIE and local supplier including Yunlu electronics and Samyoung electronics in Qingdao. The company spends 45 percent of its whole purchases on firms in development zone and Qingdao city, 25 percent from abroad, and 30 percent from the rest of China.

This firm is actively involved in technology transfer and quality control management for local suppliers. From the interview, it is found that there is the specified division in Haier intelligent

electronics (HIE) which is responsible for consulting technology with local suppliers. Thus, local suppliers send the officers to the division for any problem they might confront. Since JIT management (Haier Logistic) is run with computerised purchasing order (P/O) system, the firm offers educational training for suppliers, which results in enhancement of supply network.

Case 2 Haier Logistics: the firm was established in 1999. Haier Logistics Promoting Division works as an independent logistics company, which has integrated the functions of purchase, storage and delivery of raw materials, storage and delivery of end products from 23 product departments of Haier Group. In 2001, the company had a turnover of 19.3 billion RMB.

Supply Chain Management

Domestic integrated supply chain management makes it possible to reduce an ordering cycle of more than 7 days to less than one hour. Besides, indicator board-watching management enables the materials to be delivered to working points in 4 hours. In the case of international, the supply chain management system extends to every supplier, allowing the responding time of 36 days for an order to be reduced to 10 days or less.

Table 7-1 Haier Group's Project Planning and Evaluation in Supply Chain Management

No	This Week's Planning					Actual accomplishment	
	Project	Weekly Objective	Working Standard	Supervisor	Working Deadline	Achievement	Analysis of Good & bad

Source: Haier group's confidential document

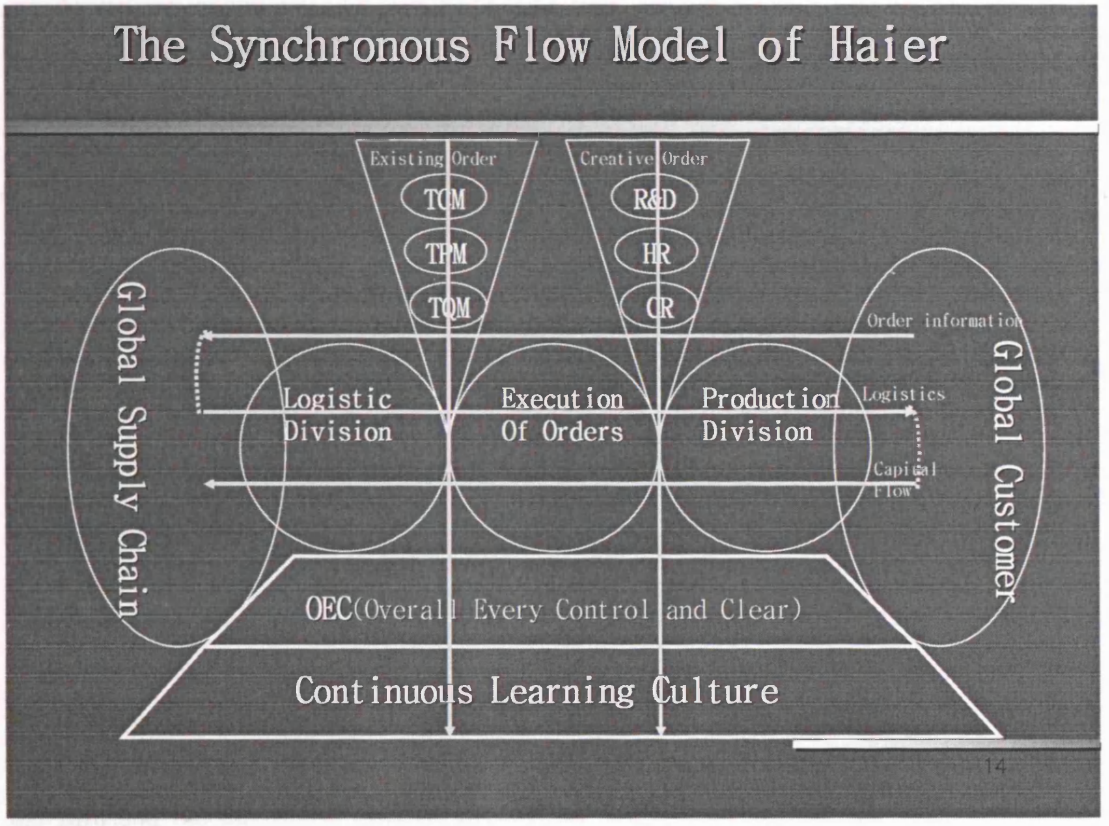
Table 7-1 is the weekly planning table of market supply chain management in Haier group. Once the weekly strategy is set up with target and deadline, the procedure is supervised by SBU (Strategic Business Unit) until the target is completed. Then the performance is analysed and evaluated by the upper division according to which rewards or penalty are enumerated. As each SBU evaluated by individual unit has motivation to be competitive, their efforts have a positive spill-over to whole group, bringing a synergy effect. These procedures are based on Haier's culture and Overall Every Control and Clear (OEC), from which Haier is able to focus on its order information and realise the 'three zeros' (zero stock, zero distance, zero delay) goal.

More importantly, the fundamental aspect of Haier's culture lies in innovation and continuous learning. If you go to the 'Daily Improving Veranda' located in the heart of Haier's human resource training centre, the so called Haier University, you can find the Haier groups' motto "***ju ri xin, ri ri xin, you ri xin***" meaning that "one must absorb new ideas everyday to improve oneself" This word is from "Great Learning" in "the book of Rite" written by Lao Zi. Hence, innovation is fundamental to Haier's spirit and OEC is the platform of business process reengineering which is unique to Haier. In Figure 7-1, the 3Rs (**R**&D, Human **R**esource, Customer **R**elationship) stands for innovations in purchasing order support flow, and the 3Ts (**T**otal Capital Management, **T**otal Production Management, **T**otal Quality Management) are assurances in purchasing order fulfilment support flow. The 3Rs and 3Ts are based on the corporate culture and functional centres (logistics centre, production centre, R&D centre etc.), sustaining the flow of Haier's market chain.

Synchronous Flow of "One Flow and Three Networks" Makes an Enterprise Highly Competitive

"One Flow" focuses on the information flow of orders and "Three Networks" means Global Supply Chain Network, Global Delivery Network and Computer Network (see Figure 7-1). "Three Networks" work together to support the processing of order information, and the order information moves all business activities. Through its advanced supply chain management system, Haier has realised integrated control of the entire production process, from the purchase of raw material through the manufacturing, inspection, delivery and shipment of products.

Figure 7-1 Haier groups' market chain management model



Source: Haier group

Global Supply Chain Network

Haier has set up a huge global supply chain network by which more than 2,200 suppliers in 2000 are decreased to 721 (based on March, 2004), while the proportion of international suppliers among them have risen to 82.5 percent. Due to the dramatic improvement of the supply network system, competition among the enterprises has changed into competition among the supply chains. Haier Logistics has attracted 36 international suppliers including Invensys and Sanyo Compressor to Qingdao for investment in setting up factories and forming all-round supply-demand relation that meets the requirements for quality, cost and delivery period. At present, one fifth of the top 500 global companies have become Haier's partners. Furthermore, Haier also introduces Emerson motor and other international suppliers into its industrial park for investment in setting up factories, with a total investment amount of 60 million USD as of 2003. The reconstruction of the global supply chain network enables Haier to have the capacity to meet customer's requirement more quickly than ever. Moreover, with the reconstruction of the global supply chain network, the excellent suppliers have been invited to establish business.

Haier has constructed a huge information data base of suppliers, which contains information about 10,000 suppliers and over throughout different industries.

Global Delivery Network

With the global delivery network reconstructed, the network has extended from city to countryside, from coast to inland and from home to overseas. Haier now has close co-operation with more than 300 transport firms. Haier has 42 delivery centres throughout the country in which every day, 50,000 products in more than 100 categories are delivered to 1,550 super stores and over 9,000 sales agencies.

Computer Network

The information highway built within the enterprise, together with the Enterprise Resource Planning (ERP) information system, transforms the information of customers into the internal information of the enterprise synchronously, which allows information as a substitute for the stock and zero capital usage. Outside the firm, a communicating bridge has been set up between the firm and the customers, and between the firm and the suppliers by means of Customer Relationship Management (CRM) and Business Benchmarking Process (BBP) platform. All suppliers can receive orders from the network, enquiring about plans or stock on the network. Currently, Haier integrates supply chain management systems for transport, warehouse sand orders, and thus quickens the tempo of response and delivery to customers.

Case 3 Arrow: This firm, the largest electronic component distributor in the world, has more than 600 suppliers. The Arrow Electronics China's headquarter is located in Shanghai with 12 branches in big cities like Qingdao. Table 7-2 presents that Arrow in China has strongly connected cutting-edge semiconductor suppliers (except Maxim/Dallas) in the world. Though not seen in Table 7-2, Sanyo Semiconductor, and Samsung Electronics supply semiconductors via different distributors.

Table 7-2 Regional Line Card Arrow Asia Pacific

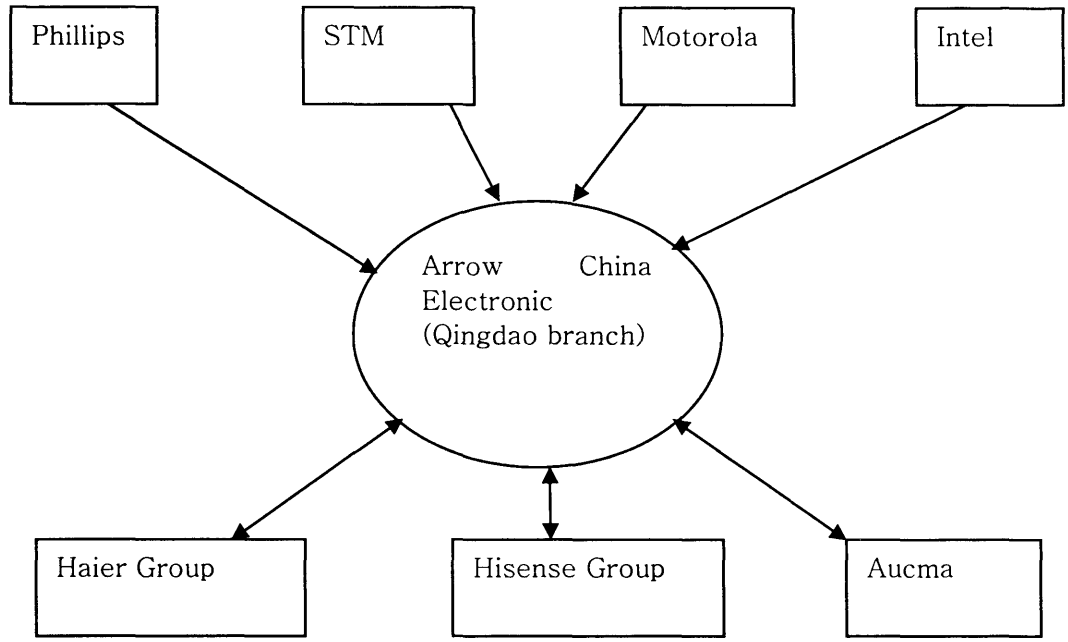
Semiconductor	China	Australia	Taiwan	Singapore	Korea
ADI	Y		Y		Y
Agilent Technologies	Y	Y	Y	Y	Y
Altera	Y				
AMD	Y	Y	Y	Y	Y
Authen Tech	Y	Y	Y	Y	Y
Broadcom	Y		Y	Y	
Cypress Semiconductor	Y	Y	Y	Y	Y
Fairchild Semiconductor	Y	Y	Y	Y	
Intel Semiconductor	Y				
International Rectifier	Y	Y	Y	Y	Y
ISSI	Y	Y	Y	Y	Y
Intersil	Y	Y	Y	Y	Y
Maxim/Dallas		Y			Y
Microchip	Y	Y			
Micron	Y	Y	Y	Y	Y
Motorola Semiconductor	Y	Y	Y	Y	Y
National Semiconductor	Y	Y	Y	Y	Y
ON Semiconductor	Y	Y	Y	Y	Y
Phillips Semiconductor	Y	Y	Y	Y	Y
Solomon Systech	Y	Y	Y	Y	Y
ST Microelectronics	Y	Y	Y	Y	
Texas instruments	Y	Y	Y	Y	Y
Toshiba	Y	Y		Y	Y
Vishay Intertechnology	Y	Y	Y	Y	Y

Source: Final field work (2004)

(Y means yes)

As seen in Figure 7-2, many global semiconductor suppliers of Arrow China Electronic in the Qingdao branch supply semiconductors to big companies such as Haier, Hisense and Acuma in Qingdao. Since the price of semiconductor is volatile to the external market environment, it is safer to purchase goods via distributors.

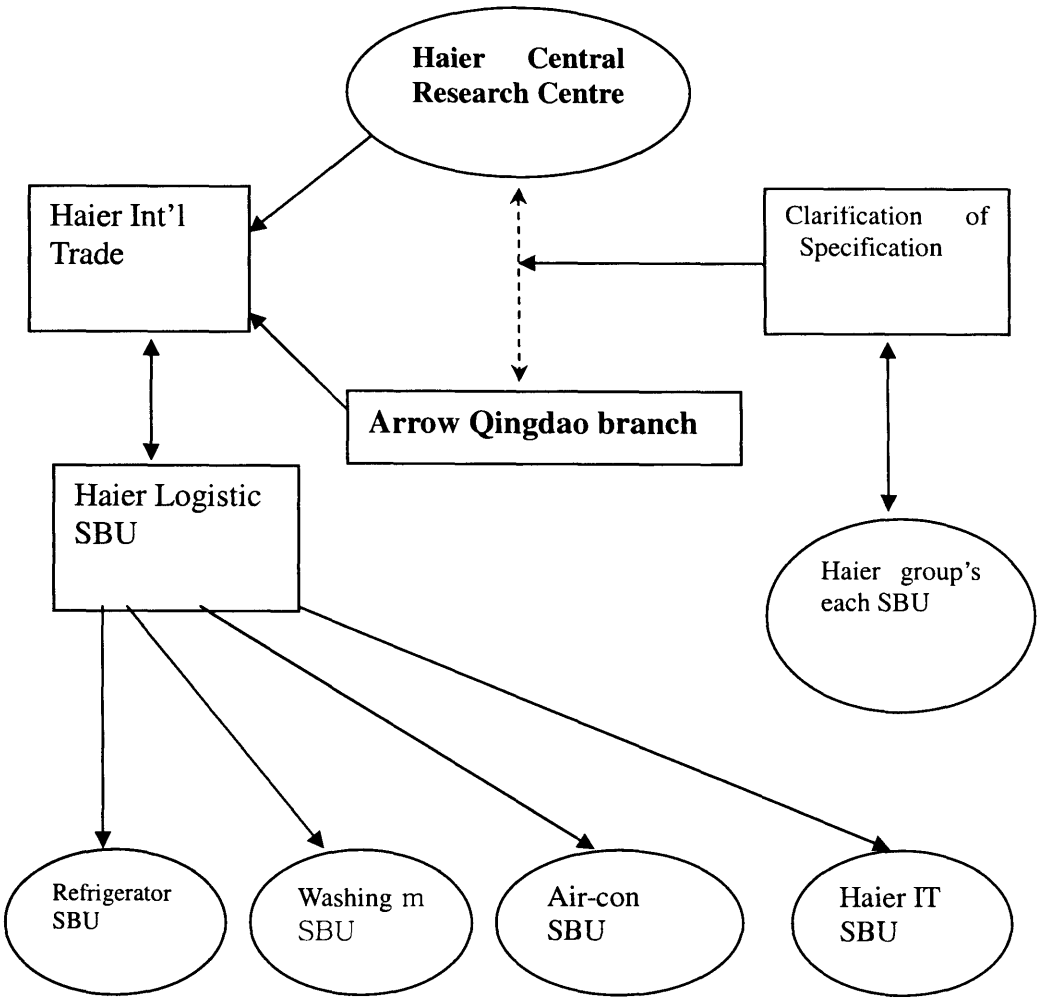
Figure 7-2 Arrow's basic structure of supply linkage



Source: Final field work (2004)

For instance, with Haier group's JIT management of zero stock policy, a purchasing order is processed monthly order in case of international transaction or 7-10 days (domestic transaction) order term, thus it is convenient to use distributors. The Arrow Qingdao branch supplies semiconductor to all electronic companies in Qingdao including Haier, Hisense, and Aucma. The supply by Arrow accounts for 90 percent of whole amount in Qingdao. Of course, there are 30 small distributors in Qingdao, but the only competing distributor is Future Electronics, based in Canada, but its market share is not substantial. The field interview with the persons in charge from Haier and Arrow can be summarised in the following Figure 7-3.

Figure 7-3 Supply Linkage with Haier group



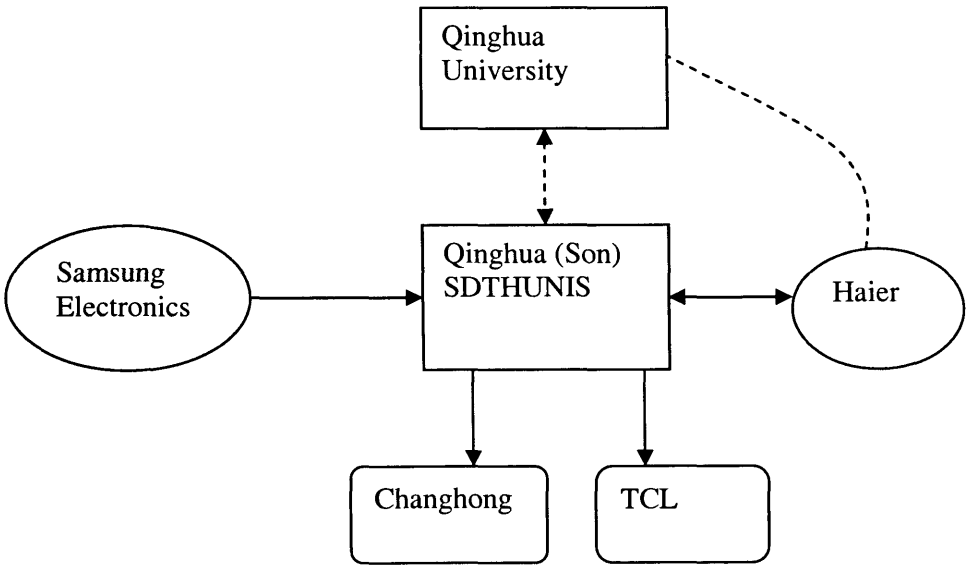
Source: Final field work (2004)

As seen in Figure 7-3, Arrow discusses the specification of components with Haier central research centre by sending off engineers in each division. After finishing the first meeting with engineers from Haier, the final meeting is held with senior researcher from Haier central research institute. Following this, the purchasing order is received from Haier International Trade, and components are distributed through Haier Logistic. In this way, Haier Logistic is responsible for the purchasing part of the supply linkage, while technology and specification are operated by a central research institute in Haier. Each division, though appearing separate, is connected each other with efficient collaboration, hence the divisions grasp the exact amount of

purchasing order and purchase needed goods at the optimum price, and receive goods at the most appropriate time.

Case 4 Qinghua Zhiguang (SDTHUNIS) Qingdao: In the case, Samsung Electronic supplies the semi-conductor components to Haier as well as Changhong, TCL, via the Qinghua Zhiguang SDTHUNIS (role of agency) which is an affiliated company of Legend group. As shown in figure 7-4, Qinghua Zhiguang is the spin off company from Qinghua University, renowned for high technology and advanced research on science. This company hence possesses cutting edge research facilities, leading the technology of applied semiconductors in China. Haier is also engaged with Qinghua University Electronic Research Lab and Joint R&D Centre with Chinese Academy of Science, thus having an indirect relationship with Qinghua Zhiguang.

Figure 7-4 Inter-firm linkages in terms of knowledge and technology transfer



Source: Final field work (2004)

In maintaining a close relationship with Qinghua Zhiguang (SDTHUNIS), Samsung has a guaranteed long-term supply contract of the semiconductor. Because of the indirect linkage between Haier and SDTHUNIS, the specification of the semiconductor is tailored by the SDTHUNIS in order to meet requirements from Haier or other producers. In particular, Haier is actively involved in the business with Samsung and SDTHUNIS by exchanging professional engineers with Haier's central research centre, thus having the opportunity to secure knowledge

transfer; Changhong and TCL in turn, take advantage of stable supply of components or parts.

Based on the interview with project manager in charge of the semiconductor division of Haier central research centre, much of Haier's research is conducted under cooperation with Qinghua University. SDTHUNIS in Qingdao is located in 5 minutes walking distance from Haier headquarter and is one the spin off companies from Qinghua University. SDTHUNIS is located in H typed venture building where 30-40 hi-tech related firms are settled in as well, and HTIP district government is close to the building, providing the convenient one-stop service.

Case 5 Invensys (First-tier supplier of Haier): The Company's (Invensys Group) headquarters in London UK is a global leading firm in the automation and control components for household electronic goods. It is one of the Fortune listed 500 companies, with operations in more than 80 countries, and an annual revenue over 15.5 billion USD. It has four focused divisions – software systems, automation systems, power systems and control systems. With more than 100,000 employees, the company's products and services range from advanced control systems and networks for automating industrial plants and controlling the environments of buildings, to electronic devices and controls found in residential building and light commercial applications, plus complete power systems for the telecommunications and information technology industries. This firm has 19 subsidiary companies, producing 'control parts' of the home and household electronic appliances.

Qingdao branch established in 1997 is a take-over of an existing firm (Qingdao electronic factory-USA Cibi Joint venture) which previously manufactured same types of goods. The type of this firm is wholly foreign owned company from UK. In 2003, sales value was 0.2 billion RMB. A large part of the current equipment is replaced by imported from UK. The core components are also imported from Italy. Most raw materials and simple components such as spring, material, Capillary tube, and plastic are from local market. The Proportion of product sales is 60-70 percent in Qingdao city or zone, and other domestic market shares the 30-40 percent of whole sales. As a subcontracting company, the majority of the parts and components are supposed to be purchased from the vendor list provided by the major customers such as Haier. However, this company can free to choose any firm not in the list but qualified 2nd tier local suppliers. Total number of suppliers is 40. Among these, the number of local suppliers is 12.

Supply network

It is a wholly owned subsidiary of Invensys Group, specialising in the production and sales of thermostats and defrost timers for refrigerators, freezers, washing machines and air-conditioners. Meanwhile, this firm is also engaged in developing electronic control products. The company possesses advanced technology and equipment from Europe and USA, adopts latest MRP II manufacturing system, and has ISO 9002 certified, offering its customers with competitive quality products which all have UL, VDE, CSA, and CCEE approvals.

The main customers in China are **Haier, Aucma**, Siemens, Electrolux, RDS, Xinfei, Meiling. About 60 percent of products are supplied to Qingdao HTIP, ETDZ and the remains go to other domestic markets. Thus purpose of investment in Qingdao is to meet local demand, being a strategic location. An interview was held with Chen Wentao, sales department manager, scouted from Tienjin Electroux Electronic component. According to him, the market share of home electronic industry is categorised into three regions: Guangdong (Kerong, Meidia, Geli), Shanghai (Meiling, Chunlan, Xinyi), Qingdao (Haier, Hisense, Aucma). The radius of supplier network in this industry where the intense competition takes place is about 500Km. Within the network, global electronic firms such as Hitachi, Mitsubishi, Samsung, LG, Electroux, GE, Toshiba, and Sanyo as well as global electronic components firms are located.

Table 7-3 Main components of washing machine assembly line

1. **Tube assembly**	10. Panel assembly
2. Top cover assembly	11. Hose assembly
3. Motor assembly	12. Shaft
4. PWB assembly	13. Bearing
5. Steels	14. Pump assembly
6. Resin	15. Cable and Electric wire
7. Cover assembly	16. **Valve assembly**
8. **IC (control part)**	17. Base assembly
9. Stator assembly	18. Cover
	19. Package assembly

Source: Final field work (2004)

Note: Bold character means this firm's product

As a first-tier supplier, the firm produces a control part for washing machine (see Table 7-3) and refrigerators; 60 percent of products are supplied to Haier, and the remaining are for Hisense, Aucma. Raw materials and components such as spring, metal plastic is purchased from local suppliers located in development zone or Qingdao city, but capillary tubes, a core component, are imported from Italy, since the local supplier cannot have the international standard (ISO 9000) in this product. In purchasing the raw materials, it does not need approval from the headquarter in England, though they can utilize the headquarters' supplier network called Asian sourcing supply chain. Once suppliers are selected, the firm continuously takes care of the management and quality control for suppliers. According to the interview with Li (purchasing manager), the firm has price pressure from Haier because other competitive suppliers suggest a better price with similar quality. In order to survive as a first tier supplier, Invensys makes an effort to lower the price through efficient technology, cooperating with second and third tier suppliers. These efforts enable to build the solid business and technological partnership among suppliers.

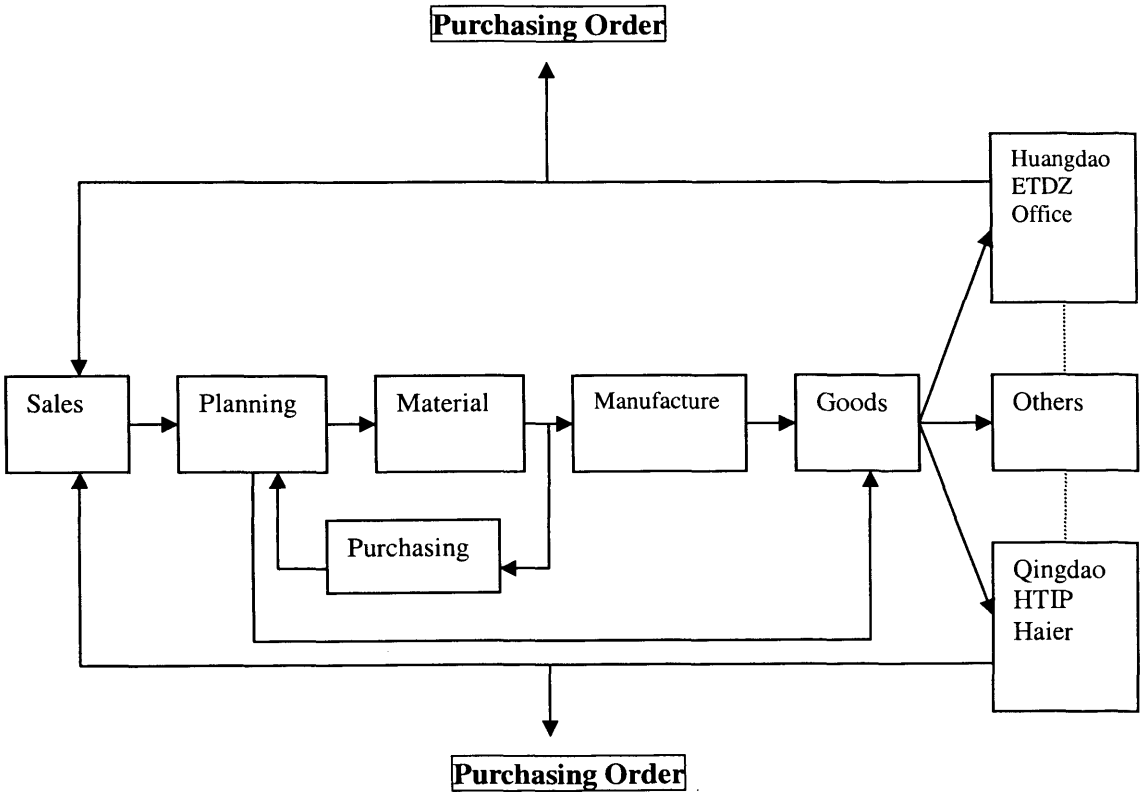
Case 6 Emerson (First tier supplier of Haier, Hisense): The main products are motors for air conditioners, refrigerators, dish washers and washing machines. The purpose of investing Qingdao is to meet local demand. Having a supply linkage with Haier, the increasing transaction induces the firm to establish Qingdao branch in HTIP near Haier headquarter. Being one of the biggest electronic components companies, Emerson also has supply linkage with LG, Samsung, Electroux, and GE.

Inter-firm linkages are the most important channels through which technology change is transmitted. Emerson has backward linkage with 50-60 local suppliers; among them 6 firms are located in HTIP. From local suppliers, the firm purchases lamination, copper wire, end-shields and electronic goods which are ordered by own network and e-commerce. By placing order with local suppliers for materials or components that must meet stringent specifications, technical expertise is raised. The experience gained in new technologies by local big firms and FIEs enables them to compete more effectively in broader markets. The sourcing of materials locally may lead to the emergence of new domestic firms to meet the demand created. Emerson's headquarters do not control the purchasing raw materials from local supplier. However, local suppliers should have the international standard in technology and quality control.

The firm collaborates with Chinese Universities and research institutes which include Technology Development division in Harbin University, HVAC engineering & development laboratory in Hong Kong, Shanghai Jiao Tong University material characteristic centre, Astec's China engineering centre in Shenzhen. However, there is no relationship with Qingdao's local universities due to the fact that the technology exchange is controlled by parent firm, which likes to build the global research network not geographically limited.

Case 7 Sanyuan Electronic: The firm located near Haier group's headquarter is a local stock-hold company. The main products are the following: electric wires, plugs, sensors for household electronic goods (Refrigerator, air conditioner, washing machine). The purchasing activity is centralised in two branch offices which are located in both HTIP and ETDZ. The whole process of purchasing activity has very systematic way as presented in Figure 7-5.

Figure 7-5 Process of P/O (purchasing order)



Source: Final field work (2004)

Figure 7-5 describes the procedure from purchasing order to sales. A purchasing order is

received from sales department, which sets up the required amount of raw material or components before the order is sent to product planning department. Any problem regarding raw materials is claimed through the purchasing department. In case of Haier, the late penalty is charged to the supplier, and thus, suppliers try to secure raw materials from the reliable global firms who also make a contract with Haier.

The firm, for example, purchases crucial raw materials from suppliers with global supply networks such as Ampeon, Molex, JST (All three firms are global leading firms). In the case of foreign invested firms such as Sanyo-Haier, it is possible to choose one of three (Ampeon, Molex, Zst). But some other foreign invested firms' customers, who prefer to carry out the pre-selection themselves, provide the companies with manufacturing parts and components for particular supplier (e.g. Molex) and they strongly recommend using this particular supplier's goods. On the other hand, some accessory raw materials are purchased from local suppliers, but the firm has a strict quality control management with the local supplier by sending engineers for supervision, which would minimise any possibility of paying a heavy fine[11]. In addition, the firm enforces its own effort to develop PVC plastic materials with the collaboration of local universities. (University of Chemical Technology in Qingdao)

Case 8 Qingdao Hi-Link Electric Cable & Wire Co., LTD: The firm, established in 2001, is a green field investment in Huangdao ETDZ. The firm type is 100 percent ownership from Taiwan, and the total amount of investment is five million USD. The descriptions of the main products are as follows: Connector, Cable, PCB Compound, Tube, Electric wire for Air conditioner, Washing machine, Refrigerators, Dish washer, etc. (consumer electronic goods). The Proportion of product sales is totally for Haier in ETDZ and HTIP.

Characteristic of Supplier network

Approximately 90-95 percent of raw materials are provided from global supply networks, which are AMPEON in USA, JST in Japan and Molex in Korea branch via their agencies in Qingdao. Hence, most local suppliers work in the form of agency; numbers of agencies are 12 in Qingdao and Huangdao in addition to 34 agencies across China. These suppliers produce the global standard components, and make a business relationship with Haier, delivering goods to Haier in real time. Since Haier has zero-stock policy, suppliers try to minimise the lead-time, not to

[11] In Haier group, the policy of local supplier is very strict. If the supplier provides unqualified parts or components, the supplier should pay huge fine.

exceed 2 days delivery in domestic market. Most suppliers meet the condition of delivery and many of them establish their branch office in Huangdao Haier industrial parks where one of the world standard logistic centres is located.

The Monumental Change in Haier Group's Supplier Network

From 2000 to 2001, there have been significant changes in Haier suppliers' network in terms of the transaction billing system. Before 2001, suppliers of Haier had difficulty because of insecure billing transaction. One supplier, for example, hardly received the money, or at best with a 12-18 month delay. In spite of unstable transactions, it is still competitive to be chosen as Haier's supplier because of the huge demand of parts or components. Since 2000, the billing system has improved in parallel with the substantial transformation of existing suppliers. According to an interview with president, Danny Hong, a number of suppliers were displaced during the period between 2000 and 2001, and then Haier established the Haier Logistics to be responsible for managing supply networks. As a result, systematic billing system satisfies suppliers.

Inter-firm Relationships between Haier and 2nd and 3rd tier-Suppliers

In order to be chosen as Haier's supplier, the potential supplier should pass the quality test. Having passed the test, the company is registered as a qualified brand, and then given the opportunity to participate in open bidding for supply. Open bidding takes place on the internet, from which a successful candidate is chosen among 3-4 competitors. It seems like fair competition. However, there is a story behind Haier and 2nd and 3rd tier suppliers. In general with the open bidding system, the candidate who offers the lowest price is chosen, assuming equal quality products. For example, there are three bidders, A, B, C. If C offers the lowest price, Haier informs A and B of the bidding price of C, then lets them bid again until the price satisfies Haier. Though selected as a supplier, the contract is based upon a short term contract relationship for 6 month to 1 year then can be renewed by another bidding competition. This policy is applied to firms specialising in labour intensive goods. In the case of high technology-oriented foreign invested suppliers, such a bidding system is not applicable (see the case of Sanyo and Panasonic).

There is no financial assistant for small and medium sized suppliers. The initial contract is based upon a short term contract. In technology, Haier sends off the engineers to suppliers in order to

give specification of technology with relevant training. Since suppliers should pass the quality test, Haier finds it easier to control the quality management. Suppliers also make every effort to enhance the technology and efficiency for the purpose of surviving from renewal bidding competition

Case 9 Jomyong Electronics (2nd tier supplier of Haier and Hisense): Established in November 1996, Qingdao Jomyong Electronics is a Korean invested company specially producing various aluminium, electroform, crystal (polyurethane), PVC badge and aluminium squeezing; managing Korea 3M 3-dimensional designation brand of the household appliances. Through the continuous developing, the firm has gained the recognition from the global electronic companies such as Samsung, LG, Daewoo Electronic, Electroux, Sharp, Panasonic, Sanyo, Hitachi, Philips, Haier and Hisense and set up the long-term subcontract cooperation.

Supply network

The company is the supplier of 50 electronic firms across China, especially, the main supplier of Haier, Hisense, and Panasonic in Qingdao. The main marketing channel is the e-commerce by Chinese electronic component networking. This firm purchases the raw materials and components from 45 local firms. The key components are switch, bearing, belt, control box, bolt, and wire. Nickel and aluminium is imported from Korea and decision of local outsourcing does not require the approval from headquarter in Korea.

Competition is a driving force

The business transaction with Haier was initiated in 1997 though public bidding competition among 2nd tier suppliers. For each component, Haier has contracts with three to four, at most five to six suppliers, and each year, invites other competing suppliers in order to select the firms having the best quality at a low price. The initial short term contract (normally six months to one year) can be renewed by competition with other firms. Thus, there is fierce competition among firms producing similar components. The competition enhances the productivity in which supply-linkages upgrade each firm's technology. In this sense, Clustering may develop where the presence of key customers stimulates the development of competitive advantages amongst suppliers. Competition can inspire, motivate and stimulate a culture of innovation within successful clusters. In areas of intense competition, rapid product development, new

start-up firms and spin-off technologies can flourish and support the development of dynamic local clusters.

Jomyong Electronics has also developed global competitiveness in technology and made a contract with Hitachi, Sharp, Sanyo, Toshiba, LG, Electroux, Samsung, Sony, Hisense, and Aucma. This achievement, based upon more than 20 years of know-how, is acknowledged by ISO 9000.

Once registered as Haier's supplier, the relevant quality control management, equipment, facility and technology are regularly supervised by Haier. If necessary, Haier provides the blueprint for specification and relevant training, thus supporting the suppliers in order to maintain qualified technology for Haier.

7.2.2 Creation of Strategic Inter-firm Network

Strategic alliances and joint ventures are formal agreements between firms to pursue a specific strategic objective, and to enable firms to achieve a specific goal that they believe cannot be achieved on their own. The linkages create a synergy effect that enhances or reshapes the competitiveness of firms bonded by such an alliance. There are various forms of strategic linkages, and DFI is one of them. The purpose of strategic linkages, through DFI, is to tap into strategic resources in foreign firms. The following cases are example of strategic alliance or joint venture between Chinese big firms and global firms. The motivations of collaboration are technology-oriented and market-oriented. More specifically, Chinese firms want to gain new product development, whereas foreign firms are facilitating entry into the Chinese market.

Case 10 HappyLine Electronic – Haier Refrigerator: HappyLine in Qingdao is a subsidiary of Happyline Electronic which produces special refrigerators such as *Kimchi* refrigerators and Wine cellars in Korea. The company has collaborated with Haier special refrigerators in producing high value added refrigerator by transferring technology of kimchi refrigerator to Haier in addition to supplying the design and specification of refrigerating know-how. Due to technology transfer from Happyline electronics, Haier, based on low wage advantages, makes it possible to produce the price competitive and high value refrigerator. Hence, Happyline electronics takes advantage of using Haier's product assembly line, marketing channel and supply networks in China. Happyline adopts an favourable stance for cultivating a potentially

huge market in China. In addition, there is Happyline & Haier refrigerator research institute in both Qingdao and Bundang in Korea, where the development of technology is activated for more professional refrigerators for the specification for meat, cheese, wine, and kimchi.

Being in a superior technological position, Happyline leads the R&D partnerships, subcontracting with Haier special refrigerators. The term of contract is renewed each year. As each division in Haier has individual negotiation power, called SBU (Strategic Business Unit), one supplier can negotiate multiple divisions in Haier. For instance, the refrigerator division one, two, three, etc. in Haier can produce a different design and style of refrigerator and then select the best produced. This way, each division in Haier competes and collaborates to enhance the efficiency. The central research institute in Haier plays the role of the brain and Happyline electronics develops the Chinese tailored refrigerator through alliance with the central institute of Haier. As of 2004, Haier has occupied more than 30% of Chinese home electronics and is top ranked in brand power. Haier also has the most comprehensive sale and distribution networks among Chinese electronics firms

Besides Happyline electronics, Haier Home Appliance has exchanged technology with several companies: for built-in furniture, contract was also made with Hanpae Company which specialises in built-in furniture, wine cellar, and home-bar; with Bumyang and Woongjin, the contract is in form of OEM for producing air-conditioning and water purifier. In this way, Haier enjoys the horizontal integration in home appliances.

Case 11 Haier Commercial Air-conditioner: Established at ETDZ in 1999, it has produced air-conditioners. Technological innovation is a key to maintaining a firm's competitiveness. Currently, Haier develops on average 2.2 new products and applies for 3.4 patents daily, and is top ranked as a whole among Chinese electronic firms (Final field work, 2004). Nevertheless, along with other Chinese consumer electronic manufacturer, it has remained highly dependent on foreign key components and technology. These include high-performance electronic motors, micro controllers, compressors and electronic sensors, magnetrons, semi-conductors and micro switches. Haier has been aware of this weakness and has taken strategies to remedy them: the increasing R&D investment (see table 7-4); establishment of a research and design centre; forming international technological alliance with major foreign firms and then outsourcing of core components.

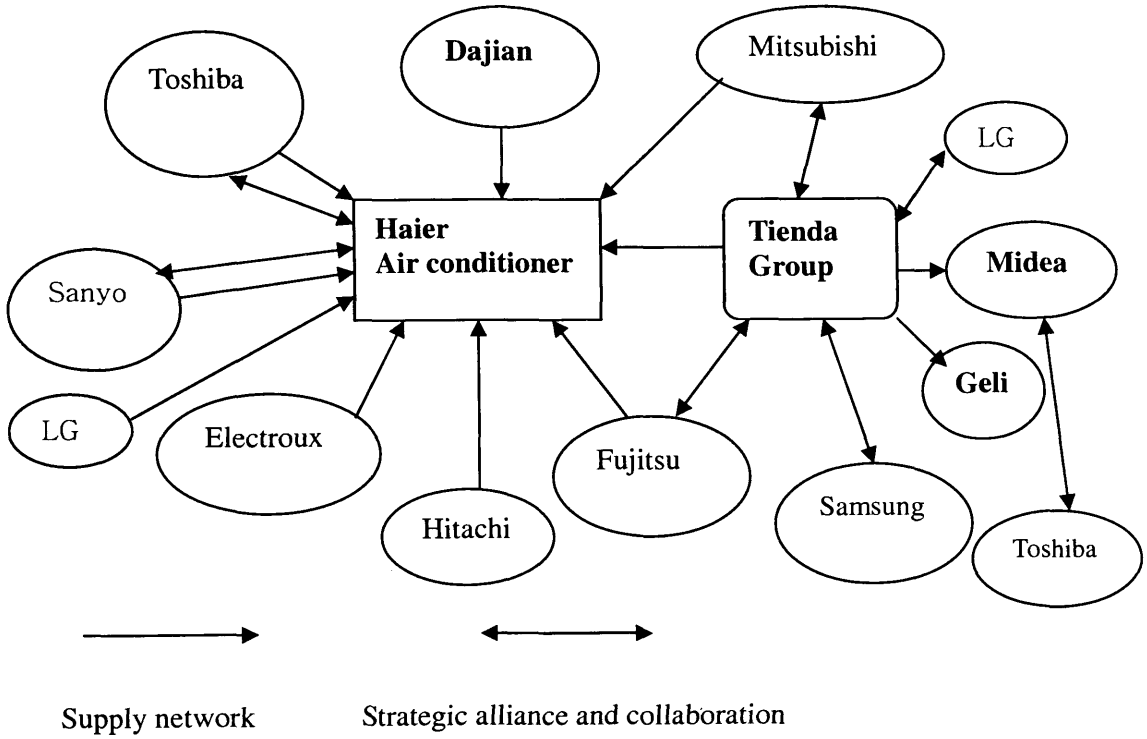
Table 7-4 Haier's Investment in R&D (1997-2000)

	1997	1998	1999	2000
Investments in R&D (million RMB)	480	780	1030	1949
Share of sales (%)	4	4.6	4.8	4.8

Source: Liu et al. (2002, p. 704)

The main suppliers of compressor are the following: Shanghai Dajin, Huangdao ETDZ Sanyo, Shanghai Toshiba, Dalian Sanyo, HTIP Mitsubishi Heavy-Haier, Shanghai Electroux, Suzhou Samsung, Fujitsu, Ningbo Huikang, and Shunde Likair. Among the suppliers, a strategic alliance relationship has been made with Sanyo, Mitsubishi Heavy-Haier, located in the Huangdao Haier industrial park and the Haier headquarters, respectively. These key alliances comprise 60 percent of total outsourcing; the remaining 40 percent being received from foreign invested firms located in the Shanghai, Guangdong, Zhejiang provinces.

Figure 7-6 Supply network and strategic alliance collaboration in Haier Air-conditioner



Source: Final field work (2004)

Note: Bold character is domestic firms

The electromagnetism four-way reversing valve, another core component of air-conditioning, is supplied by the **Tienda group** (headquarter is in Anhui province but branch plant in Qingdao). This group has owned assets worth 1000 million RMB, and has 1,800 employees. The production layout of the assembly line is same as Toshiba, Mitsubishi and Kraussmaffei (German). Tienda group conducts the research on 'four way valve, plastic mould', cooperating with Chinese Science and Technology University, Shanghai Jiaotong University, institute of solid state physics in Chinese Academy of Science. According to Figure 8-6, the group involves the active partnership with Hitachi, Panasonic, Sharp, LG, Samsung, Haier, Chunlan, Kongka, Midea, and Geli for strategic alliance and cooperation. With the global inter-firm networking by Tienda, domestic electronic firms such as Haier receive benefits. The Tienda group has established its branches in strategically geographically important regions: Qingdao, Tienjin, Guangdong, and Hefei. In particular, the main responsibility of the branch in Qingdao is to facilitate the supply of main components to Haier.

Furthermore, Haier maximises the efficiency of group activity by means of just-in-time (JIT) management and zero stock policy. During the period between 2001 and 2003, Haier transformed the supply network of strategic alliances by selecting and merging 2200 second and third tier suppliers into 721 key partners for all products. This transformation was partly influenced by changing the corporate governance of Haier group. According to Table 7-5, Haier's key businesses such as washing machines (Haier-Melloni), refrigerators (Haier-Carrier special refrigerator), and commercial air conditioners (Mitsubishi Heavy industry Haier) are produced by forms of joint venture. In case of air-conditioning, Haier has benefited from Mitsubishi's global supply networks, including Toshiba, Hitachi, LG, Sanyo, Electroux, Panasonic, and Fujitsu. Table 7-6 represents more than 20 foreign invested firms in Haier industrial park which have strong links with Haier.

Table 7-5 Corporate Governance of Haier Group

	Location	Type of ownership
Haier group (Mother company)	**HTIP**	**Collective owned**
Haier refrigerator	HTIP	Joint venture
Haier international refrigerator	ETDZ	Joint venture
Haier Intelligent Electronic	HTIP	Limited stock-hold
Haier special refrigerator	ETDZ	Joint venture
Haier dishwasher Ltd	ETDZ	Limited stock-hold
Haier Melloni washing machine	HTIP	Joint venture
Mitsubishi Heavy industry Haier	HTIP	Joint venture
Haier-Carrier special refrigerator	HTIP	Joint venture
Haier Health Household Electronic	HTIP	Limited stock-hold
Haier Logistic	HTIP	Limited stock-hold

Source: Special report for Board of the Governing Body in Haier group (2002)

Table 7-6 Foreign invested firms in Haier Group's Industrial Park (ETDZ, HTIP)

Haier Melloni Washing machine	Haier-Baihui
Mitsubishi Heavy Industry Haier (Commercial Air-conditioner)	Haishimao
	Haier-Weicheng
Haier-Happyline Kimchi Refrigerator	Qingdao Meier Plastic
Haier-Carrier Commercial Refrigerator	Haier Special Steel (Posco)
Haire CCT (Telecommunicatuin)	Haier-Haiyongli
Sanyo Electronic Components (Compressor)	Haier special refrigerator
Sanyo Electronic Machinery (household electronic)	TDK
	Haier-Ericsson
Haier Hong-ji	Haier home electronic appliance
SKD	Haier commercial air conditioner
Haier Dish washer	Haier C-MRV

Source: Final field work (2004)

Strategic Relationship between Sanyo and Haier

For efficient technology transfer, host country's local capacity is very important. Japan's Sanyo Electric component and China's Haier Group (Haier) have signed a wide-ranging business co-operation agreement. According to the agreement, Sanyo's products are sold in China through Haier's strong sales network with Sanyo and Haier brand names, while sales of Haier's products in Japan are promoted by a joint venture set up by the two companies (Field research, 2004).

In April, 2002 the Sanyo-Haier joint venture was established with a capital of 500 million RMB

(3.78 million USD). Sanyo owned 60 percent and Haier 40 percent ownership. The two companies built a compressor factory based on Sanyo's core technologies next to Haier refrigerator factory in ETDZ. Haier executives say the two companies will also cooperate in the production and supply of parts, as well as technological cooperation and personnel exchange. Sanyo is one of the key suppliers of Haier. Sanyo's proportion of sales to the Haier group is 34 percent (36.2 billion Japanese yen) of the total sales value. Sanyo provides core technology layout to Haier. Therefore, Haier gets the technology and a stable supply network and sale network in Japan. Sanyo gains the biggest potential marketing channel in the world (Final field work, 2004). In February, 2002, Haier also signed a strategic alliance contract with Taiwan's biggest household electronic company 'Sampo', regarding Agency cooperation, OEM, core components exchange.

Case 12 Qingdao Hisense Co., LTD: Hisense has a 30 years of history; initiated with Qingdao No.2 Radio Factory, Qingdao TV Factory and Hisense Electric Company, Hisense Group has now become one of the largest electronic enterprises in China, specialising in household electronic, IT communication, and trade development. Currently, Hisense has established 30 subsidiaries within China and abroad. The description of main products are as follows: PDP (Plasma Display Panel) TV, LCD Projection TV, TFT TV, LCD TVs, POS (point of sell) machines, laptops and desktop computers, software, mobile phones, air conditioners, (consumer electronic goods), and internet equipment. The sales value in 2002 was 19.3 billion RMB, ranked as 5th position in China. It has maintained its ranking in the list of the 500 largest and most profitable Chinese enterprises for 12 consecutive years. Hisense has a global level R&D centre and has been playing a leading role in Chinese electronic industry, stimulating its efficient technology innovation mechanism. The group has also served as an industrialisation base for China's '863 plan'. Currently, the group is under development for DTVs (Digital TV) and PDP TVs cooperating with the Qingdao Semiconductor research institute (Final field work, 2004).

As is shown in Table 7-7, the strategic alliance has made with Intel, IBM, Sharp, LG, Siemens, Toshiba, Electroux, Oracle, Sanyo, Sony, Samsung, ST, HP, National/Panasonic, GM, Hitachi, Phillips, Gfk, Lucent technology for the technology development. Especially, Toshiba, Intel, Phillips, ST are the core strategic partner for Hisense. These global firms supply core components of DTV such as integrated circuit, ARM chips and PCB to Hisense group (see Table 7-8). Hisense ranked as first in DTV manufacturing in Chinese domestic firms, becoming

a specialised information technology firm.

Table 7-7 Hisense group's co-operative partners

IBM	Siemens
Toshiba	Sony
Lucent technology – Hisense (Joint Venture)	Electroux
Hisense – Hitachi (Joint Venture)	HP
Sharp	**National Panasonic**
LG	Philips
Samsung	Gfk
	GM

Source: Final field work (2004) Note: Bold character means DFI in Qingdao

What is noteworthy is that most firms with a strategic alliance with Hisense invested in China; ST, Toshiba, Phillips, Intel has the branch office in Qingdao and Sanyo, Lucent technology and Panasonic have made DFI in HTIP and ETDZ. These firms also have a close partnership with Haier for supplying components and technology transfer. This fact is unusual case of DFI pattern in developing countries. Most DFI in developing countries show weak local linkage in terms of limited inter-firm linkages with local firms, resulting in only a limited impact on local economic development. By this field study, however, it is found that even in developing countries, strong cooperation with MNE is possible under a supportive local capacity, which leads to the formation of clusters along with considerable development for the urban and local economy.

Table 7-8 D-TV Components

Display: Projection, CRT, PDP	**PCB**
IC	Connector
A/V switch	FBT
NTSC Decoder	Deflection Controller
U-Com	SMPS Module
Video Chromatic IC	Tuner
Video Amp	Speaker
A/D, MUX	Antenna
ARM, LG-4chip	SMD

Source: Final field work (2004) Note: Bold character means supplied from global firms

Case 13 Qingdao Aucma-Carrier Refrigeration Equipment Ltd: Aucma group is the top manufacturer of special ice fridges in China. The firm is a joint venture of Aucma group and Carrier. Carrier constructs whole production assembly line of compressor (core component of ice fridge) and Aucma takes responsibility for sales and distribution. The main product is bottle coolers v260, v268, v400, c265 CR, v412 series. Aucma-Carrier joint venture firm has been certified with ISO 9000 and 14000.

Table 7-9 New Production Process of Compressor in Aucma (the most core part of refrigerate)

Rotor
Components assembling parts input – Internal Broaching – External Cutting – Washing – Heat treatment – Final washing – To assembly group
Stator
Roll material assembling – slitting – Stator and Rotor – Internal sizing – Annealing – To assembly group
Case
Roll material input – Drawing – Washing – Comp base welding – Lower stopper welding – Spring support welding – Terminal welding – Stopper –A welding – Terminal box welding – Pipe brazing – Final assemble
V/Plate
Part input – Lapping – Final washing – Caulking – Leak investigation – To assembly group
Piston
Con Rod parts input / Input Piston Metal – Washing /External cutting – Projection welding / Heat treat – Ring Honing – Final washing – caulking – To assembly group
Shaft
Part input – Body cutting – Thrust Burnishing – Crank cutting – Parkerizing – polishing and oil pump injection – Final washing – To assembly group
Cylinder
Part input – internal examining – Valve Deburning – Washing – Parkerizing – internal polishing – Final washing – To assembly group
Frame
Part input – Internal Honing – Thrust Lapping – Washing – Final washing – To assembly group

Source: Final field work (2004) (The full layout of production process is confidential for the company so that the author describes only part of some crucial process)

Aucma, being a number one special fridge manufacturer, has constructed 119 supplier service points across China, and runs 1600 toll-free hotline operation part centres. The firm actively learns the technology of compressor as well as supply chain management from Carrier. The main procedure of manufacturing compressor is in Table 7-9. The actual assembly line is from Carrier (USA) and operated by technician from Singapore branch. The whole manufacturing assembly line is supervised by a unified system of quality control management in Carrier. Through the advanced management skill from Carrier, Aucma provides the management skill to the local suppliers to enhance their quality and technology, which results in generating global and local supplier network among different firms.

The 'frame' and 'case cover' parts of refrigerators can be purchased by locally. Three local suppliers in Acuma provide the frame assembly items. Although many items (see table 7-10) are purchased from local suppliers, the manager cannot provide sensitive information such as core components of products.

Table 7-10 Main components of refrigerator

Compressor	Comp Base Assembly
Evaporator Assembly	**Cover Assembly**
PWB Assembly (PBA)	Handle Assembly
Tray Assembly	Door Foam Assembly
Diphenyl Methane	Box
Shelf Assembly	Barrier Assembly
Poly-urethane Assembly	Pipe Assembly
Heater	Steel, Resin
Motor Assembly	Sheet
	Frame Assembly

Source: Final field work (2004)

Table 7-11 Local suppliers' performance (ratio of failure components) in 2003

Month	Jan	Feb	Mar	Apr	May	June
Quantity	294183	484065	1784002	1448752	298737	153505
Fail	30	26	60	44	43	33
%	0.01	0.0054	0.0034	0.0030	0.014	0.021
Month	July	Aug	Sept	Oct	Nov	Dec
Quantity	16005	141054	129270	66147	135120	N/A
Fail	3	7	11	12	9	N/A
%	0.019	0.005	0.0085	0.018	0.0067	N/A

Source: Final field work (2004) (This data is from Aucma-Carrier President office)

Table 7-11 is the confidential data from the Acuma group showing the failure rate in quality control. It shows that the firm reduced the failure rate dramatically after a joint venture with Carrier in 2003. Although the data is confidential and also controlled by Aucma group office, the manager can provide current trend data of failure rate. From the interview, the author has perceived the approximate failure rate at around 1-2 percent before the joint venture with Carrier. Therefore, this is very important evidence of improving quality control by the Aucma-Carrier joint venture.

Case 14 Qingdao Matsushita Electronic components (first tier supplier of Hisense, Haier): In 1993, Matsushita established a joint venture with Qingdao electronic components sixth factory (hereafter 6th factory). At the time of establishment, 6th factor needed Matsushita's technology, and Matsushita in return required the 6th factory's market channel (huge market potential in China). The motivation of both firms was well matched when the 6th factory developed a light touch switch for household electronic goods. Matsushita, through the joint venture, could develop the potential Chinese market. The main products are as follows: light touch switch, TTP (Transparent Touch Panel), and compact thermal printer unit, circuit panel, tactile sheet (mobile phone), and remote control unit. These products are used as components for mobile phone, air-conditioners, TVs and audio equipment.

When the firm was established in 1993, the local demand increased due to the rapid growth in Haier, Hisense, and Aucma. Since 6th Factory had a business relation with Hisense, Matsushita without any special effort, became the suppliers of Hisense; such a supply linkage was developed by long-term relationship with Haier. Currently, Matsushita has made supply linkage

with local firms in HTIP and ETDZ in addition to multinational firms such as JVC, Toshiba, Sony, Sanyo, LG-Phillips, Samsung, and Hitachi in China. Although the mother company in Japan controls the decision-making of local outsourcing in Qingdao, it is possible to outsource raw material from local markets. Through the joint venture with Matsushita, the 6th Factory achieved technological development and an efficient management system since Matsushita provides the 6th Factory with the Japanese managerial skills and quality control. The quality of goods is assured, since the company uses the same raw materials as Matsushita in Japan. Although Matsushita purchases high price raw materials imported from Japan, the quality assurance is the most important matter for this firm.

7.2.3 The Dynamic Local Collaborations

The growth of dynamic local collaboration may influence technological change and innovation. This section analyses of each firm's local supply networks and strategy of learning process. Understanding the detailed procedure of each firm's strategy and management style can explain the mechanism of urban economic development in terms of innovation and productivity growth. In this section, the author identifies important types of linkages between FIEs and local small and medium enterprise (SME).

The linkages between FIEs and local SMEs can be facilitated by a specific policy considering the characteristics of industry. Described as 'a deeply embedded' local economy by Turok (1993) and Yeung and Li (2000), inter-firm linkages between foreign firms and local firms may provide a solid foundation for the development of the local economy. The intention of the transplant strategy is generally to increase the overall stock of business or to fill an identified weakness in the current configuration (for instance a structural gap within the supply chain through the relocation of a major player). The following case analysis shows the types of dynamic local collaborations.

Case 15 Haier Management Consulting: The firm is located in a Hi-tech incubator, the heart of HTIP where 30 high tech firms are settled in. The firm is a subsidiary of Haier group and develops logistic software used in strategic business unit (SBU) in Haier. This software called Haier-PIMS (Product Information Management System) provides 30 different divisions of the group. In addition, the firm provides services to more than 30 firms, universities and organisations (see table 7-12). Software has been developed through collaboration with Haida

Xinsing, which is a spin-off firm from the department of computer science in National Ocean University, and technology collaboration with Ericsson, which is located in the Hi-tech incubator. Research partnership is also developed with Qingdao University software development centre and information technology (IT) business unit in the Haier central research centre.

Table 7-12 Main customers of Haier Management Consulting

Haier group planning centre	China Ocean University
Haier Mould Ltd.	Etsong group
Haier Air-conditioner	Qingdao King-king (Jinwang) group
Haier Washing Machine	Qingdao Hongling group
Haier Refrigerator	Qingdao Double Star group
Haier Microwave	Qingdao Iron Steel group
Haier computer	Qingdao Petroleum group
Haier Logistics	Weifang Bohai University
Haier Tourist	Shandong Zhuli group
Haier Household Equipment	Qingdao city South District Officials and 20 more firms

Source: Final field work (2004)

The interview with Mr. Fang, Vice President, found that in order to be a supplier of Haier, the firm, in spite of being affiliated to the Haier group, had to participate in bidding competition procedure. In 2002, the firm failed to win a bidding competition against SAP, a global software firm, but in 2003, it won by consortium form with SAP-Haier. This fact shows that competition and collaboration co-exist in Qingdao city and the momentum to compete with global software firm like SAP can be achieved by full support from local government and universities.

More specifically, in terms of the development of technology in local high-tech firms, Qingdao HTIP government hosts the conference for technology development, inviting renowned professors around the world and conducts the joint research with the Department of Technology in Qingdao City Council. This effort is shown in Qingdao city's software industry research report. According to the report, Chinese government seeks "to encourage software industry and integrate circuit policy" in 2000. Cited by Zhu, Rong Ji, prime minister of central government, China plans to be number one in the software industry by 2015, and Qingdao as one of the most advanced software cities in China. In parallel with this national plan, Qingdao city has already

constructed the Software Industrial Park and develops software development institute in Qingdao University. In addition, National Ocean University is moving its the 2nd campus to a place near Qingdao University in order to construct research collaboration. Therefore, two universities (Qingdao University, National Ocean University) are actively engaged with the research consortium organised by Qingdao HTIP, Hi-tech business incubator, overseas venture centre, and the Haier group. Haier also cooperates with the computer science department from Beijing University, Qinghua University, and Harbin University by running a post-doctorate research centre.

Case 16 DAESUNG Electronics: The company has mainly produced various types of electronic components, such as switches, relays and thermostats for industry, household electronics and automobile, micro motors for mobile phone and power amplifier for cars, DVD-Rom, Dech assembly, desktop charger, MP3 player components. Many types of products have attained UL, CSA, VDE and GREAT WALL certificate. More than ninety percent of the products have been exported to Japan, U.S.A, Korea, and Holland.

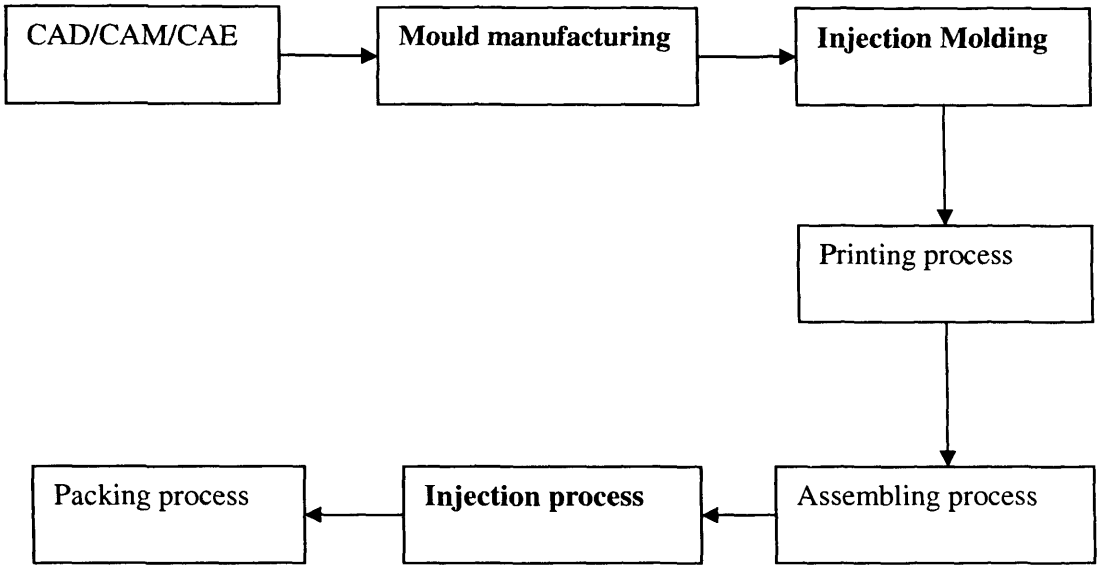
In China, the firm also has supply linkage with many global firms and large Chinese firms, such as LG, Daewoo, Samsung, **Haier, Hisense**, Amoisonic, Kongka, JAC, Matsushita, Niles, Delphi (GM), Pantech & Quritel and so on. This firm has established a collaborative relationship with Sony, Alpine, Panasonic and so on. Daesung electronics were awarded the ISO 9001 and QS 9000 certificate in November 1997, received the ISO14001 environment certificate in July 2002 and attained the TS16949 system certificate in December 2003.

The whole assembly line in Qingdao factory is constructed by parent firms in Korea. Since systems such as computer-aid-design (CAD), computer-aid-manufacturing (CAM), computer-aid-engineering (CAE) are internationally standardised, these systems do not need modification. More than 35 percent of all products are sold on the local market (development zone or city); 25 percent are exported to Korea; the remaining 40 percent to US, Japan and Europe.

The company has actively involved Qingdao local markets. Among the total suppliers (30) of Desung, more than 80 percent (24-25) are local suppliers. Thus most raw materials and components are provided from the local market. These items are heat sinks, heater covers and aluminium goods. These materials are mainly used in injection moulding, assembling process and injection processes (see figure 7-7). A few materials such as injection moulds and printed

circuit boards are imported from Korea and Japan via a supply network from the headquarters in Korea.

Figure 7-7 Production process in Daesung Electronics



Source: Final field work (2004)

In case of local outsourcing, Daesung has a localised network in Qingdao, minimising the control from the headquarter in Korea. In the process of localisation, this firm also sends the local labours to Korea in order to acquire R&D design and assists the quality control and technology development whenever required. With, ISO 9000, 14000, QS 900 system, TS 1693 standardisation, Daesung teaches the standard technology to local supplier in return to receive the qualified components.

Case 17 Qingdao HongJiye Refrigeration Technology Co., Ltd,

This firm, established in 1999, is located in the centre of ETDZ. The ownership type is a stock-hold firm and it received a provincial important hi-tech firm award from local government. This firm specialises in high quality components for air-conditioning and refrigerating appliance. As shown in Table 7-13, the main product is electromagnetism four-way reversing valve, adopting electronic welding of program PLC to produce and control. Meanwhile, the company produces other components for air-conditioning and refrigerating appliance such as electromagnetism

frost thawing valves, connecting tubes for air-conditioning, air-conditioning total tube assemblies, check valves, refrigerating filters, and cupper tube assemblies. All products are in accordance with the global standards. In particular, the quality of the four-way reversing valve is a global standard and has obtained ISO 9000.

Table 7-13 Main components of Air-conditioner

Compressor	Aluminium
Control Box Assembly	Steel
Tube	Resin
Motor (Mechanic) Assembly	Install part Assembly
Compressor Assembly	**Panel Assembly**
Grille Assembly	**Valve**
Tube Assembly	Package Assembly
Remote Controller Assembly	Base Assembly
IC	Fan Assembly
PWB Assembly (PBA)	Box

Source: Final field work (2004)

Note: Bold character means this company's product

Supply network

Main customers include Aucma-Carrier Air-conditioning and Haier Air-conditioning. Since the Vice President of this firm has worked for Haier, Hisense, Aucma as factory manager and CEO, the company well understands the needs of these customers (Haier, Hisense and Aucma) by upgrading the supply network and quality of goods. In particular, competitive technology is highly emphasised in this firm because the key for successful subcontract depends on high quality and low price in the public bidding competition through internet based E-commerce. Only with advanced technology with price competitiveness, will it become a successful supplier.

Case 18 Wintec Technology Co., LTD

This firm is a *spin-off* company, established by two former vice presidents of the Hisense group (the 5th largest electronic firm in China). The firms has a high R&D proportion (10 percent of sales revenue) while average competitive firms spend 2-3 percent in R&D. Main product is

electronic cash register (Point of Service): Win3000, Win1000, Win100, 450, 650 series.

Supply linkages

The total number of suppliers is 80. Local suppliers are only about 8-9 and other suppliers are located in Guangdong (Shenzhen) and Beijing; the ratio in terms of price value of purchasing amount is 60 percent and 30 percent respectively. The ratio in Qingdao is about 10 percent. The main marketing channel is the President's own network in the previous company which the president was worked (Hisense computer) and E-commerce. Raw material is mostly supplied from Shenzhen, Shanghai, and Ningbo and then delivered to Qingdao assembling. In the case of computer monitor related components, 15-20 percent is received from Zhejiang while 40-50 percent is from Guangdong, Japan, and Taiwan.

The transaction contract is based upon a long-term relationship under quality assurance. The firm prefers 2-3 suppliers in each component, since multiple suppliers compete the quality and price by themselves. In reality, the middle sized firm has a difficulty in assuring the multiple suppliers, but the president is formerly from the Hisense group, and could contact former Hisense's suppliers. However, these relationships depend on the capacity of suppliers. Of course, all supplier of Hisense should provide goods for Hisense first.

Research network

The company conducts active research network with the National Marine University in Qingdao HTIP, Shandong Science and Technology University in Huangdao ETDZ, and Chemical Engineering College, yet not in stage of producing goods.

7.2.4 Intra-Firm Linkages between FIEs

Intra-firm linkages between FIEs might have typical feature of DFI in developing countries, which are characterised by weak linkages with local suppliers. This type is similar to the 'dependent' type of direct foreign investment in most developing country as mentioned by Turok (1993, p. 402), who stated that the nature of 'Dependent' linkages tend to weakly embedded local suppliers, low-tech components, price-cutting and restriction of branch plant's independent growth capacity. The following cases provide a detailed description of exclusive

intra-firm linkages between FIEs.

Case 19 Samyoung Electronics

Established at December, 1994, Samyoung electronics started to produce goods in 1995, specialising in electronic capacitors. The firm constructed supplier linkages with Tienjin Samsung Electronics, Shenyang LG Electronic TV monitor, Weihai Daewoo Electronic monitor, CRT, Qingdao Haier, Hisense, Nanjing TV monitor, Shanghai Samsung DVD, VCD player, Shenzhen monitor, audio. The proportion of product sales in Qingdao is only 1-2 percent; 40 percent of products are for domestic Chinese market; exports to Korea and Japan consist of 40 percent and 10 percent, respectively. Thus, the company increasingly emphasises the product sales in domestic markets in the whole of China and exports to Korea rather than local sales in Qingdao. This fact is related to the original supplier linkages in Samyoung; the firm came to Qingdao to follow major customers which are the Korean large firms such as Samsung Electronic, LG Electronic and Daewoo Electronics, investing in China. Now the company tries to encompass its sales network; as a result, it receives a small amount of purchasing order from Haier and Hisense.

Raw materials and parts are supplied from local sources, with partial imports from Korea and Japan. For example, local sourced materials are aluminium foil, slippers, cans, aluminium case, and rubber pads. Total number of local suppliers are ten among which 3 firms are located within zones.

The principal channel for finding a supplier is through a parent firm's network and own network in Qingdao. The decision in favour of local outsourcing can be made without the approval of headquarter in Korea. By subcontracting supply linkage with Chinese local firms, the local suppliers may enhance the production system and quality control management. Core technology is also transferable under the contract or special joint venture scheme.

Case 20 Ogasawara Electronic component

Established in 1995, this firm has endeavoured to develop moulding technology and it has introduced the latest technology regarding punching, injection mould and injection process into China. Its main products or services are the manufacture of punched product, finished products

and precision dies.

Table 7-14 Main customers of Ogasawara Electronic Component

Qingdao Mitsumi Electronic	Qingdao Tyco Electronic Ampeon
Qingdao Matsushita Electronic	Sansei Electronic
Qingdao Sanyo Electronic	

Source: Final field work (2004)

This firm is a joint venture in which Seiho, Ogasawara, Qingdao Electronic component 6th factory provide 42 percent, 37 percent and 21 percent of initial investment. At first, Seiho and Ogasawara are affiliated companies in Japan, supplying components to Matsushita, Sanyo and Mitsumi (see Table 7-14). When these customers initiated their business in Qingdao, Seiho and Ogasawara decide to build in Qingdao branch plant. In case of Matsushita, 80 percent of components are supplied by Seiho and Ogasawara, with more than a 20 year long term subcontract relationship.

Most raw materials for this firm are imported from Japan, following direction from headquarters, which is different from most foreign firms who have independent decision-making for purchasing raw materials. For example, Matsushita choose specific third tier supplier for Ogasawara, then Ogasawara contacts the specified supplier via the headquarters in Japan. DFI from Japan maintain a close relationship with their own headquarters via inter-firm network, thus, supplier network is also constructed based on long-term relationships with headquarters in Japan. In this way, the supplier network from Japanese firms in Qingdao is very exclusive in, not giving the opportunity to local suppliers. This case can be an example of a typical resource-seeking (e.g. cheap labour) DFI, which has only limited impact to host a city's economy.

Case 21 Hoya (Currently no linkages with local firms)

Hoya, specialising in information technology, is a Japanese wholly foreign owned company. In this field, the company manufactures and markets mask blanks and photo-masks, that are essential to semiconductor manufacturing, large-scale masks used to manufacture liquid crystal display (LCD) panels, glass disks for the hard disk drives (HDDs) used mainly in computers and other equipment, as well as optical glass products for digital cameras and other devices.

Currently, Hoya supplies optical glass for digital cameras and digital camera mobile phones to Samsung electronics. This company has not yet established supply linkages with large local firms such as Haier and Hisense, but it can be a potential supplier since Haier and Hisense is under developing the digital camera. The Hoya company is named as a Hi-tech firm by Qingdao and Shandong province on account of its key technology in micro-optic glass. Thus, more vivid contact with IT mobile phone division in Haier and Hisense will create in future partnerships.

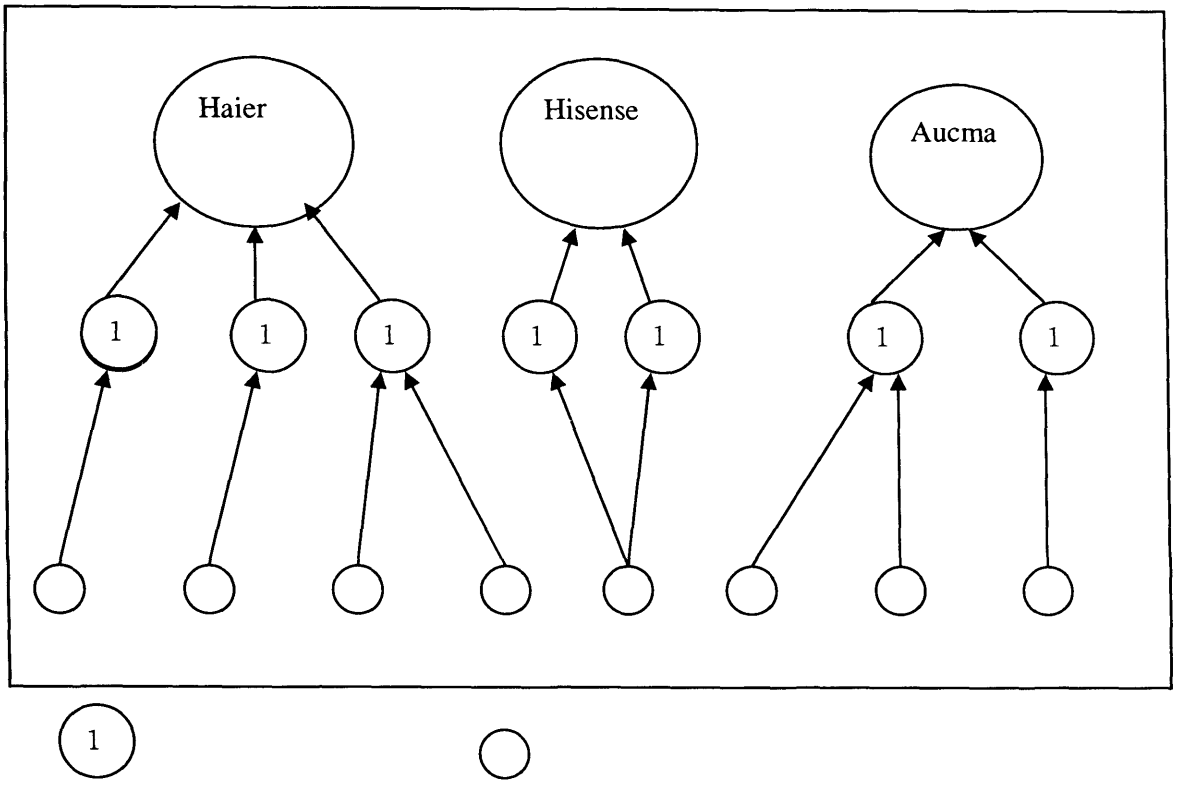
7.3 Synthesis of Case Studies' Findings

7.3.1 'Hub-and-Spoke' model of Industrial Districts

An industrial district 'hub and spoke' model can be applied, as a theoretical framework, to the qualitative 21 firm case study. The conventional wisdom of European industrial district literature, mainly based on Italian case studies, suggest that 'none of the industrial districts are the results of planned action of a local or regional industrial strategy. They all developed spontaneously.' It emphasizes inter-firm linkages between local small and medium firms. Such models, which offer most potential for endogenous industrial upgrading, are extremely rare in developing countries. Reasons include the lack of technological innovative capabilities and resources (Becattini, 1990; Brusco, 1990). Alternatively, a hub and spoke model is dominated by one or several large, vertically integrated firms, in one or more sectors, surrounded by smaller and less powerful suppliers. This model emphasizes local firms as key firms building both hubs and spokes to the regional economy, with suppliers and related activities spread out around them like spokes of a wheel (Markusen, 1996). Moreover, the 'Flagship and five partners' model provides a detailed and sophisticated explanation of inter-firm linkages. This model however confined 'flagship firm' to MNE.

When a hub and spoke model is applied to Qingdao case, this research found some differences. As with to the conventional view of hub and spoke model, supply network was constructed around one or several major firms. The hub firms are local large firms in the Qingdao case. A noticeable difference, however, is found in the important role of foreign invested firms in this case. Foreign invested firms act as spoke firms. More specifically, foreign invested firms play a bridging role between local SMEs and large domestic firms in the form of buyer-supplier linkages. The detailed explanations are illustrated in following Figure 7-8 and 7-9.

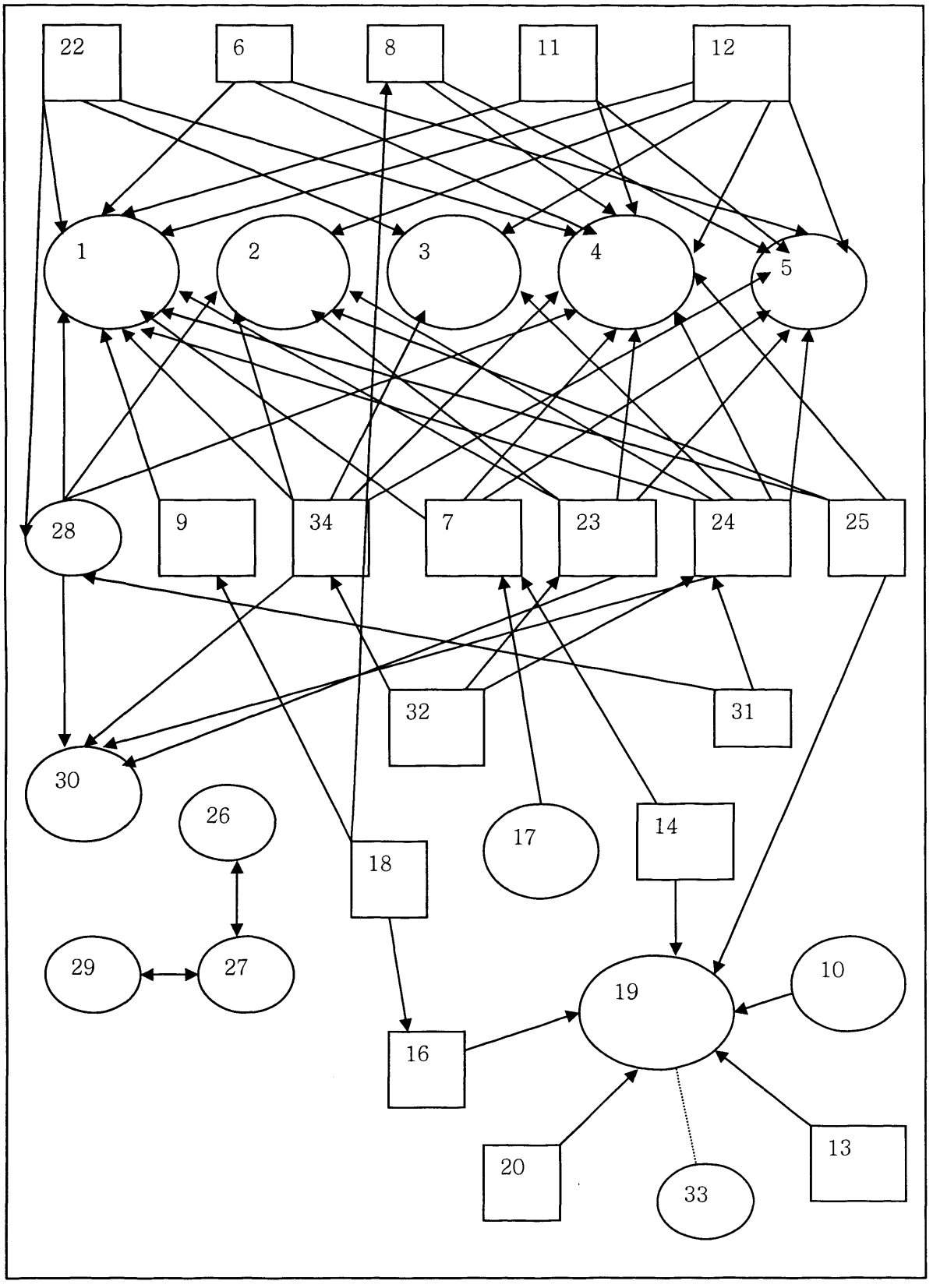
Figure 7-8 The structure of supply network in Qingdao during 1990s



Source: Interview results from final field work (2004)

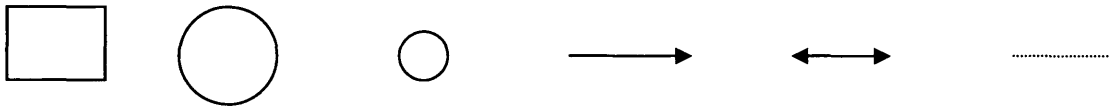
Figure 7-8 presents the structure of the supply network in Qingdao city during 1990s when the supply network was incompletely constructed. At that time, the inter-firm networks were built among local firms; their structure was similar to the conventional hub and spoke model where local large firms are hub and local SMEs are spokes. As illustrated in Figure 7-8, around these large firms, the first, second, and third tier suppliers built the network as a buyer and supplier relationship. During this period, however, firms were not actively interlinked. Though vertical collaboration existed between each hub and spoke firms, it was rarely seen to interact among hub firms. The intense competition among three large companies did not share the suppliers; for example, Haier prohibited its suppliers to have another contract with Hisense and Aucma. But inflow of DFI has transformed the structure of inter-firm linkage, forming sophisticated supply networks.

Figure 7-9 Inter-firm linkages in Qingdao HTIP and Huangdao ETDZ (Interview results)



Source: Final field work (2004)

Firm number 1-21 (located in ETDZ) 22-34 (located in HTIP)



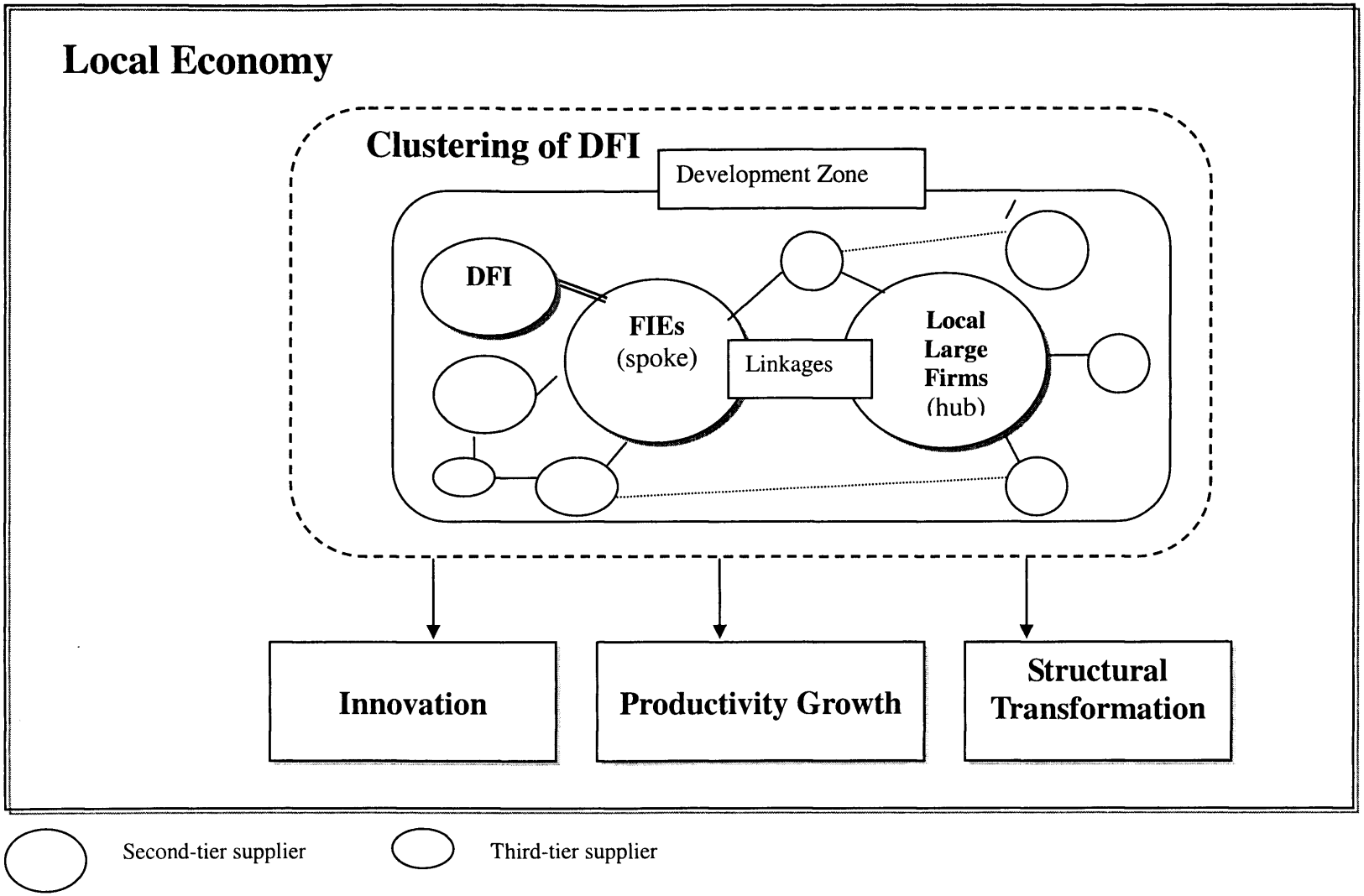
As Figure 7-9 demonstrates, a conventional hub and spoke model becomes more sophisticated with inflows of DFI. Most DFI came to Qingdao city as forms of wholly foreign owned or joint ventured firms and their main purpose is to provide key components and parts to local large firms. When they supply the parts and components, foreign suppliers (foreign invested firms) can make the contract with multiple big firms. For example, a number 34 firm in Figure 7-9 supplies goods to six different large firms which are numbered as 1, 2, 3, 4, 5, 30; a number 25 firm is a supplier for four large firms of which number are 1, 2, 4, 19. Hence, large firms numbered as 1, 2, 4 share the foreign subcontractors for their final products. One interesting thing is that the contract between them is led by local large firms when local large firms and foreign invested firms make a contract.

Sharing suppliers are not limited to large local firms, foreign suppliers also share second and third tier suppliers. During the transaction activity between local large firms and foreign invested firms, numerous second and third-tier suppliers are engaged in as well, forming further intricate networks among suppliers. Such transactions among different firms provide the opportunity to cooperate and collaboration which becomes networked and finally linked with formation of DFI clustering. From this networking activity, local firms, both large and small, have enhanced their technology by receiving the competitive components from foreign invested firms (first tier suppliers); interaction between DFI and local firms can be described as a win-win partnership. In this way, foreign invested firms play a vital role in building supplier networks, not only being a supplier to local large firms, but also being a nexus between large firms and SME firms, whereby knowledge sharing and technology transfer take place. Hence, the hub and spoke model is modified and collaborated in Qingdao case, emphasizing the role of foreign invested firms.

Figure 7-10 shows the mechanism of hub and spoke model to explain the urban economic development in Qingdao city. With inflow of DFI, the inter-firm linkages are mainly engaged between FIEs and local large firms and further networked with local small and medium sized firms. Through the inter-firm networks, firms exchange managerial skills and technologies. The

linkages are first established in development zones, and can be spread to firms beyond the zones. The bulk of linkages based on learning and interaction form the clustering of DFI. Such activities in DFI clustering, most importantly, may increase innovation and specialisation by structural transformation and productivity growth.

Figure 7-10 Mechanism of Hub and Spoke Model in Qingdao City



7.3.2 Role of Local Government

In February 2004, ETDZ Policy Research Centre promulgated a 'clustering policy' which designated leading industries as electronic, chemical oil, machinery, automobile components, new materials, and biochemistry. These industries were encouraged to form industrial clustering. In particular, ETDZ tries to attract more electronic related DFI projects by tax-incentive programme for the foreign investment projects, with an amount of more than 50million RMB. For example, ZhangJie, head of district government pays several visits to Haier to provide government support and service. According to Ling Song, who is director of Policy research institute in Huangdao ETDZ, **"As policy intervention should be minimal and only to maintain the foster and growth of the cluster, the market is the driving force. Government should play a role of servant for enterprise development."** In fact, supply-chain development cannot be built in a day even if government is actively involved with. It should be led by key local firms supported and co-operated by foreign invested firms and local suppliers.

The incubator system in HTIP can be used to illustrate government policy of building favourable businesses environment. Incubators simplify the experience of running a business for new start-ups, offering a sheltered environment in which to grow. The following four steps are required to develop incubators in Qingdao HTIP.

1. The development of ideas: Minimising physical and organisational barriers and allowing entrepreneurs the freedom to innovate;
2. Nurturing the idea: Supporting the innovator by providing time and resources to develop idea;
3. Formalising the development: Creating a business unit;
4. Creation of the new company: Defining company structures, producing a business plan and budget. Supporting and assisting the new business with investment, finance, marketing and sales, law, recruitment, ICT and facilities.

In fact, the purpose of incubators is to assist the safe settlement of new industry rather than to pursue profit-seeking. In the case of high-technology related firms, what is most needed is to have a research facility, and this can be supported by the government. This view is suggested by Brusco, emphasising 'the district has to be viewed not only as a unit of analysis but also as a

unit of initiative: as a fully-fledged and organically unified organisation, whose development is slowed down or impeded by bottlenecks (e.g. market inefficiency) that public action must turn into opportunities' to resolve problems the private sector would be unable to solve alone (Brusco, 1992, p. 195).

Incubators are also directly related to assisting in development of particular clusters. In Qingdao HTIP, there are Science & Technology incubator, Bio-marine technology incubator, Laoshan District and Qingdao hi-tech management incubator, Software industrial park, University Science Park. These incubators play a pivotal role in formation of hi-tech clustering in HTIP. Especially, Science & Technology incubators and Qingdao hi-tech management incubators offer wide-raging business, technical and scientific mentor to create a supportive environment. They play a significant supporting role in the early stages of a new hi-tech firm. Under the cooperation and collaboration by means of inter-firm linkage, given the supportive policy by local authority, Qingdao HTIP, in spite of its short history of 10 years, is regarded as one of most successful development zones among more than 50 similar zones across China.

7.4 Conclusions

Thus far, the author has explored the type of inter-firm linkages and detailed description of company's strategies. Among the 34 firms responding to questionnaire survey, 21 provided further detailed information about mechanisms and processes of inter-firm linkages by in-depth interview. This in-depth interview was utilised as the basis for the 21 firm case study in this chapter.

Table 7-15 summarises the main findings in 21 firm case study. Four types of inter-firm linkages are evaluated in terms of promoting R&D, product quality control, local supply linkages, and supporting access to technology. First, global supply network has a very strong propensity for product quality control and access to technology; firms in this type stress the collaboration of technology development and knowledge sharing. In the case of the creation of strategic inter-firm network, firms are mainly concerned about promoting R&D and quality control. Firms in a type of dynamic local collaboration emphasize product quality control and strength of local supply linkages. Finally, FIEs in intra-firm linkage have little effect on local linkages since this type of firm is governed by parent firms.

Table 7-15 General Framework of case analysis in inter-firm linkages

Type of Inter-Firm linkage	Promoting R&D	Product quality control	Strengthening local supply linkages	Supporting access to technology
Global Supply network	+	+ +	+	+ +
Creation of strategic inter-firm network	+ +	+ +	+	+
Dynamic local collaboration	+	+ +	+ +	+
Intra-firm linkages between FIEs		+		

Source: the content of table is based on in-depth interview in final field work (2004)

Note: +, ++ denotes 'positive effect' and 'strong positive effect' respectively

The first three types in Table 7-15 are related to the hub and spoke model in industrial district theory. In these types, large local firms act as hub firms and foreign invested firms as spoke firms. Basically, interactions between local and foreign invested firms have a strong positive effect on R&D promotion, product quality, supply linkages and technology, thus make contribution to local economic development. The last type is not a hub and spoke model, making little impact on local economy. Firms from Intra-firm linkages between FIEs focus on processing and assembly (P&A) for exporting, thus they came to Qingdao city in order to take advantage of low labour cost, not to seek and engage in Chinese domestic market. The other three types tend to be associated with closer local embeddedness because they are actively involved with the local economy through buyer-supplier linkages not only as first tier suppliers to large domestic firms but also as buyers of raw materials for domestic SMEs.

From the case study, it is known that both local firms and foreign invested firms work together in supplier-buyer linkages. Table 7-16 describes the local linkage of each case study firm, characterised by 7 indicators: Promoting R&D, local universities' linkages, global supply linkages, local supply linkages, managerial support to local suppliers, training education support to local supplier. 21 firms in case study is categorised by three ownership types: 7 stock-hold enterprises (local firm), 5 joint venture enterprises, 9 wholly foreign owned enterprises. As shown in Table 1, most Chinese stock-hold firms and joint venture firms are actively engaged in promoting R&D, global-local supply linkages, technology and managerial skills transfer to their local subcontractors.

Table 7-16 Analysis of Case Study Firms

Case study	Ownership type	Promoter R&D	Links local Univ.	Global supply links	Local supply linkages	Managerial support	Training education support
1	**Stock-hold**	Yes	No	Yes	Yes	Yes	Yes
2	**Stock-hold**	Limited	No	Yes	Yes	Yes	Yes
3	WFO	Limited	No	Yes	Yes	No	Yes
4	**Stock-hold**	Yes	No	Yes	Yes	Yes	Yes
5	WFO	Limited	No	Yes	Yes	Yes	Yes
6	WFO	Yes	No	Yes	Yes	No	Yes
7	**Stock-hold**	Limited	Yes	Yes	Yes	No	Yes
8	WFO	Limited	No	Yes	Limited	No	No
9	WFO	Limited	No	Yes	Yes	No	No
10	JV	Yes	No	No	Yes	No	Yes
11	JV	Yes	No	Yes	Yes	Yes	Yes
12	JV	Yes	No	Yes	Yes	Yes	Yes
13	JV	Yes	No	Yes	Yes	Yes	Yes
14	JV	Yes	No	Yes	Limited	Yes	Yes
15	**Stock-hold**	Yes	Yes	No	Yes	No	Yes
16	WFO	Yes	No	limited	Yes	No	Yes
17	**Stock-hold**	Yes	No	No	Limited	No	Yes
18	**Stock-hold**	Yes	Yes	No	Limited	No	No
19	WFO	Limited	No	limited	Limited	No	No
20	WFO	Limited	No	No	Limited	No	No
21	WFO	Limited	No	Yes	N/A	N/A	N/A

Source: Final field work (2004)

*Stock-hold firms are all Chinese local firms

For instance, all joint ventures participate in R&D promotion, while 5 out of 7 stock-hold firms involve such activity. Local universities' linkages, which indicate close local engagement, only exist in stock hold firms. 4 out of 5 joint ventures and 4 out of 7 stock-hold firms have the global linkage which shows the firms relationship with global external suppliers. Most joint ventures and stock-hold firms have local supply linkages. For managerial support and training

education support, except 1 firm for managerial support, all joint ventures are concerned with such supporting activities. Three out of five Stock-hold firms also take part in managerial support and 6 out of 7 in training education support. Therefore, the overall result of Table 7-16 supports the fact that strong local engagement exists in stock-hold firms and joint venture firms. On the other hand, wholly foreign owned (WFO) companies do not have active local engagement in terms of local supply network. None of the WFO has a local university link, and only 2 out of 9 promote R&D activity. Global linkages and local linkages exist in 6 and 5 WFO respectively. In case of managerial support, only one WFO assists the local suppliers. The joint venture and stock-hold firms play an important role in forming local linkages. Taking into account the importance of stock-hold firms in local and global supply networks, they become the main structure of forming the clustering of DFI. Based upon this structure, inflows of DFI in the form of joint venture and WFO from related industries can foster the clustering, and interaction among local firms, joint venture firms and wholly foreign owned firms spread the positive spill-over in terms of 'innovation' to local economy. This result is also consistent with the quantitative analysis described in chapter 6.

Chapter Eight Conclusion

8.1 Introduction

This thesis has aimed to examine the impact of clustering of DFI on urban economic development. The empirical field work in Qingdao HTIP and Huangdao ETDZ as a case study, was utilised in order to investigate the detailed mechanism of how clustering of DFI affects local industries and urban economic development. In order to achieve this objective, inflows of DFI and Chinese development zones were examined in Chapter 2. A review of the relevant literature was presented in Chapter 3, highlighting the hub and spoke model in industrial districts to explain role of inter-firm linkages in urban economic development. The research hypothesis and questions were examined in the methodology Chapter 4. In Chapter 4, both quantitative and qualitative methods were examined. The results, mainly obtained from preliminary field works, were presented in Chapter 5. In Chapter 6, the data from the questionnaire survey and the statistical data from local government authorities were computed for quantitative analysis. The qualitative analysis of the result obtained from 21 in-depth interviews appeared in Chapter 7. In this way, the purpose of all preceding chapters was to answer the following research questions of this thesis.

1) How does inflow of DFI foster local industrial clusters in Qingdao?

2) What is the impact of the clustering of DFI on local economic development?

3) What are the main mechanism underlying this impact?

In this concluding chapter, the author summarises the main findings regarding the clustering of DFI, its impact on urban economic development and its underlying mechanism. In addition, the limitations of the thesis are discussed, and the theoretical and practical implications follow.

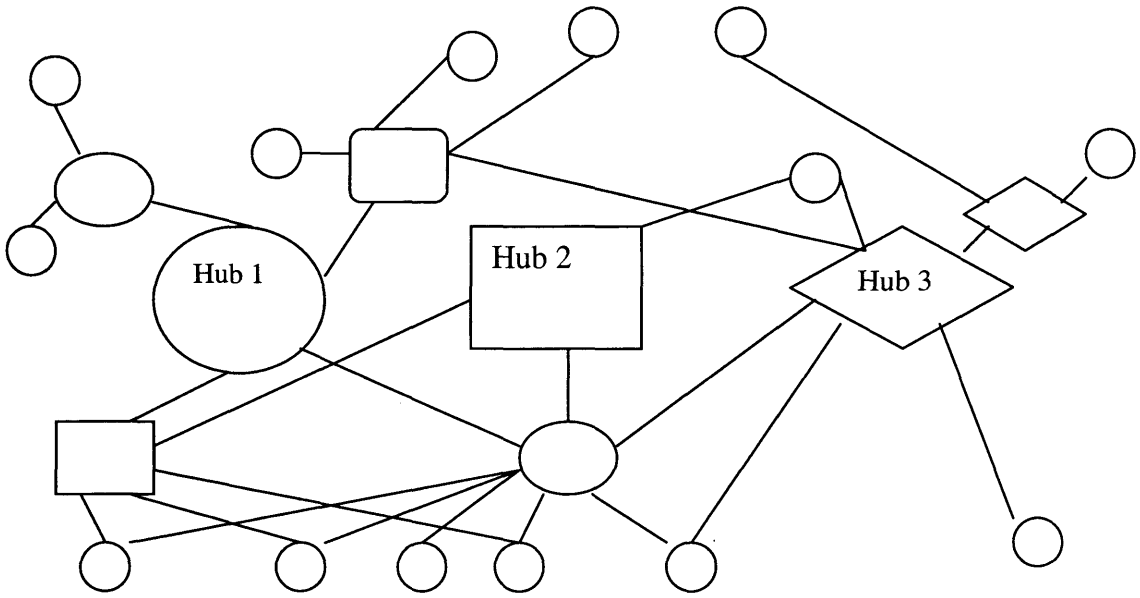
8.2 Key Research Findings

Formation of DFI Clustering in Qingdao Development Zones

Huangdao ETDZ and Qingdao HTIP are the location of Haier, Hisense, and Aucma's headquarter (1st, 5th, 15th largest electronic firms in China). Is it appropriate to be called a 'cluster' when one has a group of three big companies in this location? The nature of cluster requires more than co-existence of several competitive companies. So, on what theoretical or empirical basis can this thesis "The impact of clustering of direct foreign investment on urban economics development in China: case of Qingdao HTIP and ETDZ" be written?

In the real business world, most Chinese firms are very reluctant to share any information with their competitors. The Chinese proverb, '*Jing shui bu fan he shui*' means that 'Well water does not intrude into river water,' implying that each one must go about one's own business. But the inflows of direct foreign investment have transformed the nature of business in China, especially in Qingdao city. This transformation has been attained with collaboration and competition among firms, which make an essential contribution not only to the pillar industry (electrical and electronic sector) but also to urban economic development of Qingdao City.

Figure 8-1 Characteristics of Inter-Firm linkages in Qingdao electronic industry



: key supplier ○: second or third tier supplier —— : supplier linkages
Source: Final field research (2004)

The electronic industry, in particular, has been strengthened by a number of competitive partner companies who supply the core parts of final goods. In other words, the partner firms play a significant role in the development of electronic industry. Industrial capacity becomes strong by cooperation between local large firms and foreign invested firms. Such cooperation can be perceived in the hub and spoke model, where key firms act as anchors or hubs to the regional economy, with suppliers spread out around them like spokes of a wheel. Figure 8-1 illustrates this linkage. There are three hub firms and around them revolve key suppliers and second or third suppliers.

As is shown in Figure 8-1, the electronic industry in Qingdao is dominated by Haier, Hisense, and Aucma, which act as hub firms; foreign invested firms play the role of spoke firms. For instance, Haier chooses Mitsubishi as its strategic alliance partner, while Hisense takes Hitachi and Aucma for Carrier. All of these strategic alliances have supplied compressors which are the core part of air-conditioner for their partners by establishing the joint venture company in ETDZ and HTIP. Especially, Haier receives the important technology from Mitsubishi and operates the own assembly line. Thus in Haier industrial Park, there are two firms: one is Haier Air conditioner; the other is Haier-Mitsubishi limited. Both are separate companies, but the quality of their product is same since they share the same technology. Hitachi-Hisense and Carrier-Aucma also are supplied the core parts of electronic goods by means of joint venture. At the same time, these firms share the technology with their 2^{nd} and 3^{rd} tier supplier networking by foreign subcontractors or joint venture firms.

Hence, inter-firm linkages between large domestic firms and foreign invested firms in Qingdao generate more opportunity for Chinese local small and medium firms to learn new technology, not only among the large domestic firms, but also between second tier and third tier suppliers. In the process of inter-firm linkages between local and foreign invested firms, the clustering of DFI has been gradually formed in development zones.

Clustering of DFI and Local Economic Development

The impact of clustering of DFI on urban economic development is measured in terms of innovation, productivity growth and structural transformation (local competitiveness). These are evaluated and analysed by a quantitative method. From quantitative analysis, the regression results indicate that the input of innovation created by technological, training assistance and information sharing, more actively takes place where the local supply linkage is strong. The results also show that productivity becomes positively associated with clustering of DFI and input of innovation. When Shift-share analysis examines the local competitiveness of this particular place, Qingdao city, it is found that Qingdao city has a strong local capacity for electronic industry. In addition, high location quotient index of DFI in ETDZ, notably for electronic industry, indicates that massive inflow of DFI has been most specialised and concentrated in the electronics industry of Qingdao city. Hence the quantitative analysis in this field work provides evidence of a positive relationship between the clustering of DFI and urban economic growth. In sum, the positive result is acquired with the innovative activities based upon local competitiveness in particular industry.

The qualitative analysis of the 21 firm case study investigates detailed features of inter-firm linkages in development zones. 21 firms are classified as four types of linter-firm linkages: global supply linkages, strategic inter-firm network, dynamic local collaboration, and intra-firm linkages between FIEs. Among the four types categorised, three types of linkages such as global supply linkages, strategic inter-firm network, and dynamic local collaboration play a vital role in building the clustering of DFI, since these types of linkages emphasize the collaboration of technology development, knowledge sharing, and the promotion of R&D activities. In the course of interaction between local and foreign invested firms, supply network is systemised, the input of innovation is facilitated, and the clustering of DFI is formed, which has makes a substantial influence on the urban economic development.

One interesting finding is noted in the process of inter-firm linkages and forming the local industrial cluster: local large firms have played a leading role, whereas foreign invested firms have played a supporting role. This finding is different from conventional knowledge (Thompson, 2002) that foreign firms, in most cases, act as hub firms in developing countries. This may be due to local industrial capacity and domestic firms' relative advantage in having access to domestic market. More specifically, Qingdao city has competitive local capacity in

electrical and electronic industries, as indicated by LQ analysis, and large domestic firms in these industries have been established before massive inflow of DFI. The advantage in Chinese market entry also explains why domestic firms play a leading role in the local industrial cluster. For example, although core technologies and managerial skills are assisted by foreign invested firms in production processes, final goods (refrigerator, TV, and air-conditioner) are produced by large local firms in targeting the domestic market. Since large local firms have a dominant position in the marketing channel, they have competitive advantages in accessing huge Chinese market. In addition, this research found that foreign invested firms play a bridging role between large Chinese firms and their local firms of second and third tier suppliers by being both a main supplier (first tier supplier) for Chinese large firms and a main buyer of raw materials and components for local suppliers (second and third tier suppliers). This finding is reflected in Figure 1, which describes the inter-firm linkages in the context of the hub and spoke model.

Both quantitative and qualitative findings discussed are comprehensively listed in Table 8-1. First of all, the local industrial capacity is very competitive in Qingdao city, which serve as a strong base to attract the related DFI. Under the condition of the fully prepared or advantageous infrastructure for specific industry, the massive inflows of related DFI are successively localised in Qingdao city so that knowledge and technology transfer to local firms take place. The education and training facility in Qingdao also has a strong linkage with industry in order to provide the qualified labour to local and foreign firms. In building the business relationship between DFI and local companies, innovative activities and structural transformation become essential by-products, generating a positive and significant economic impact in Qingdao city.

Table 8-1 Characteristics of inter-firm linkage in ETDZ and HTIP

Contribution to existing literatures	Most existing studies[12]	New findings from Qingdao
Nature of local industrial capacity	Fragile infrastructure and lack of competitiveness	Very competitive local industry
Type of local firm linkages	Very low local linkages and strong dependence with mother company.	The solid partnership with local firms in which the information and technology is exchanged.
Duration of local firm linkages	Short-term sub contract relationship (specialising in product for simple components or parts)	Short-term contract but firm selected by bidding procedure. (they produce the core component and acquire the necessary technology from the contractor)
Degree of localisation of DFI clustering	Low degree of localisation. Little transfer of technology with lack of collaboration. Most decision ordered by mother company	High degree of localisation with substantial transfer of technology. (collaboration may due to the growing importance of Chinese market), Autonomous decision by DFI (Most managers are local people)
Linkages through Education & training	Insignificant	Significant
Role of local government	Consistency with tax policy proposed by central government.	Entrepreneur government (Tax benefit are proposed autonomously by local government)
Effect on local economy	Little evidence of economic impact due to lack of technology transfer and poor networking system	Significant impact on local economy via technology transfer by DFI (Through technical education, knowledge is transferred to suppliers)
Entry to domestic markets	FIEs focus on processing and assembly (P&A) for export, Little concern about domestic market	FIEs seek domestic market

Source: Final field work (2004)

[12] Most existing studies are in developing country's cases (Humphrey, 1995; Humphrey and Schmitz, 1996, 1998; Jansen, 1995; Kaplinsky, 1993; Lall, 1979, 1980; Lee, 1999, 2001; Schmitz, 1995).

8.3 Limitations of the research

This section discusses the limitation of this thesis and, where applicable, offers some recommendations for further research. This research has investigated the buyer-supplier linkages between local and foreign invested firms in electrical and electronic sectors. Hence the sampling process, inevitably, should focus on these sectors. Although 34 sample firms in the final field research were chosen randomly, they may not represent a truly random sample since survey mainly examined firms in electrical and electronic sectors. Hence, the main research findings and conclusions are limited to this sector of activities. Generally speaking, the electrical and electronic sectors have a higher degree of inter-firm relationship than other sectors.

Another limitation is related to particular data under consideration, since both official and confidential companies' data are collected from surveys of electrical and electronic firms[13] with annual sales value of 5,000,000 RMB or more. This may cause a possible sampling bias. However, considering that the proportion of this scale of firm comprises 90 percent of whole study population in Qingdao, this may not cause serious problem.

Since the field work survey was carried out at a particular time period, (final field work, Dec 2003 – Apr 2004). The regression analysis should focus on cross-sectional analysis rather than dynamic time series analysis. This questionnaire survey, as distinct from longitudinal approaches, does not provide dynamic features of research site. Related to time limitation, China has dramatically changed since the 1990s. The industrial capacity and technology development has rapidly grown day by day. Although this research tries to capture the current feature of inter-firm linkages in development zones in China, it might have slight different picture at the time this thesis is completed.

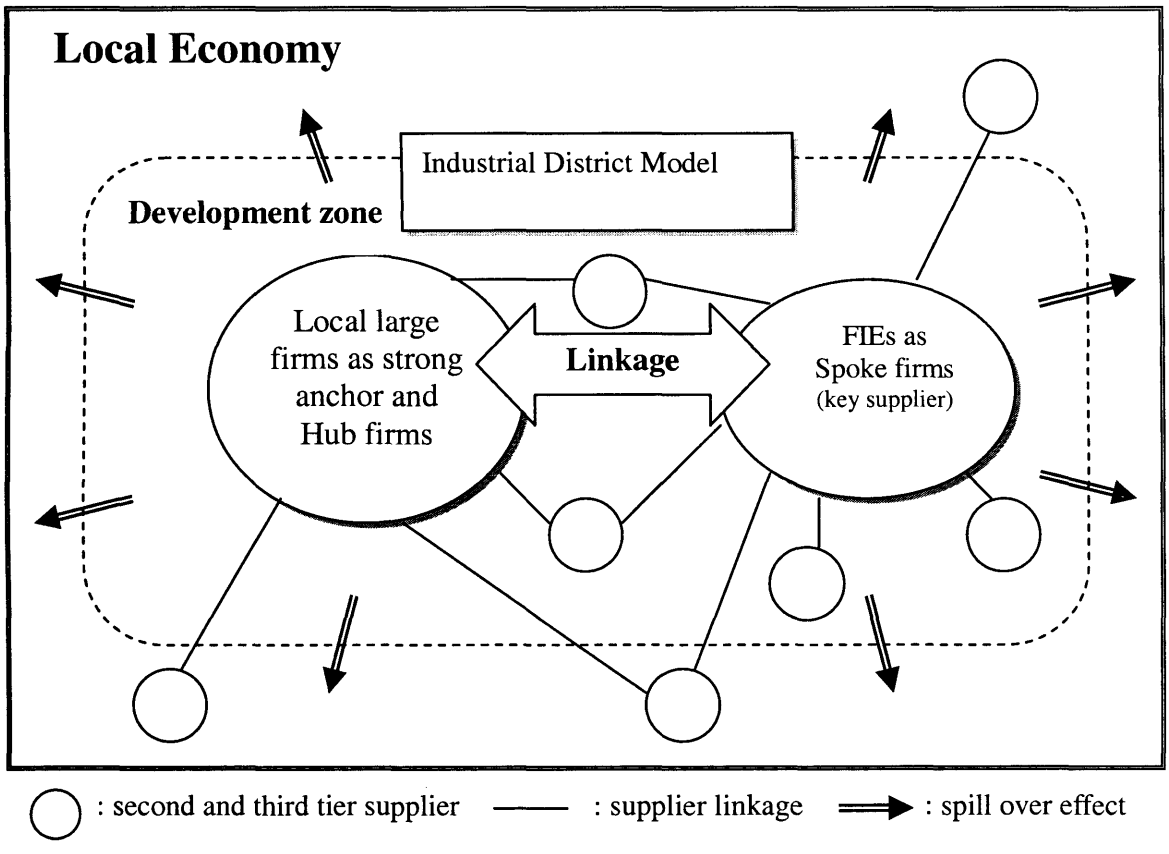
The field work research also suffered from financial budget constraints in addition to time limitation; the sample size has been restricted for this reason. Longitudinal studies at regular intervals, for instance, five or ten years of whole time framework with field work conducted each year, will give richer information and findings, reflecting dynamic changes of development within the Chinese city economy.

[13] In this thesis, author unified the term 'firm' as a unit of research so that exclude the term 'establishments' and 'plants'.

8.4 Theoretical and Practical Implications

This research is based on theoretical concepts developed by more than one theory, which include hub-and-spoke model in the concept of industrial districts and 'flagship firm and five partners' model from strategic management theory. First of all, the hub-and-spoke model of industrial districts theory emphasizes the inter-firm relationships between local large firms and local small and medium sized firm for local economy. The conventional hub-and-spoke model, however, does not consider the role of FIEs when explaining spoke firms. 'Flagship firm and five partners' model focuses on inter-firm linkages led by FIEs' own network, but does not take into account host country's local economic development. When these theories are applied to explain Qingdao case study, several theoretical implications are addressed as follows.

Figure 8-2 Qingdao Model of Local Economic Development



Source: Final field research (2004)

First of all, the field research from Qingdao case study bridges the theoretical streams of existing models in that this research finds the importance of role of foreign invested firms

(FIEs) as spoke firms and role of local government to encourage the inflows of DFI in development zones. In existing models, positive perspectives on FIEs in local economy emphasize the role of FIEs as hub firms or leading firms for the development of certain industry, whereas negative perspectives (dependency school) regard FIEs as exploiters of the local economy. In the Qingdao case, however, FIEs are found to be a spoke firm, especially being a mediator between local large firms and local small and medium sized firms. Figure 8-2 describes such role of FIEs; FIEs can be formally inter-linked with local large firms in forms of joint ventures, strategic alliance, and subcontracting. Based upon the strong link between local large and foreign invested firms, second and third tier suppliers are both directly and indirectly connected to local large firms which are main buyers, and such linkages are expanded to local economy.

The bridging role of FIEs in local economy sheds new light on the dynamics of inter-firm linkages. Inter-firm linkages in Qingdao case study act not only as supplier and buyer relationship, but also as a main channel where the technological and managerial skills are interacted among firms since R&D activities and technology transfer take place in forms of inter-firm linkages. In addition, local firms are allowed to utilise the global network which is brought by FIEs. Hence, by FIE's involvement as spoke firms in inter-firm linkages, relationships between hub firms and local small and medium sized firms become dynamically engaged, especially through component specification[14] and local procurement of components.

In this respect, the finding of this study differentiates the concept of clustering of DFI from existing studies. Thomson's study (2002, p. 877) defined clustering of DFI as a geographical concentration of FIEs. This thesis, however, places much more emphasis on the existence of inter-firm linkages between local large firms and FIEs in order to define clustering of DFI. More specifically, according to this thesis, FIEs geographical concentration in certain industries are not a sufficient condition to be called clustering of DFI; only when FIEs are engaged in buyer-supply linkages with local firms, can this be called as clustering of DFI. Hence, the clustering of DFI is a place where dynamic interactions between FIEs and local firms are taking place.

Related to dynamic features of inter-firm linkages by involvement of FIEs, buyer-supplier

[14] For instance, when local second or third tier suppliers receive the purchasing order from FIEs, they are also provided component specification which contains detailed information of component. Manufacturing the component allows second and third tier suppliers to achieve the technology which is finally utilised for final product by local large firms.

linkages are perceived as a main route for innovation activities, which become a crucial factor for urban economic development. In the process of buyer-supplier linkages, innovations are generated through information, technology, raw material and managerial linkages. Table 8-2 lists the relationship between different flows of linkages and their impact on innovation. Technological linkage, for instance, has a strongly positive effect on a new product process and improvement of instruments. Linkage, like raw material procurement, makes a significant effect on substitution to cheaper material in the production process. Managerial linkage has a positive impact on the reorganisation of production and internal function. Such beneficial spill-over effects would occur only if the FIEs do become linked with local firms.

Table 8-2 Innovation and Inter-firm Linkages

Linkage / Criteria of Innovation	Informational linkage	Technological linkage	Raw material procurement	Managerial linkage
A new product process		++		+
Substitution to cheaper material in the production process	+		++	
The reorganisation of production, internal functions, or distribution arrangements	+	+	+	++
An improvement in instruments or methods		++		

Source: Final field research (2004)

Note: +, ++ denote 'positive' and 'strongly positive,' respectively.

Qingdao's case study also addresses practical implications for urban economic development especially from the 'industrial policy' aspect. Depending on cities and regions, specific features of local economic environment and institutional setting are different. The local government should set up comprehensive industrial policy, based on the insightful knowledge as to local industrial competitiveness, thus identify the right pillar industry on which the related DFI and local suppliers are encouraged to interact, build the inter-firm network, and finally be extended to the clustering of DFI. Hence, an industrial cluster approach which considers the potential role of FIEs to transform the local industrial structure, must be an efficient tool in designing local economic development.

In addition, development zone policies should be planned with a prior design of potential nature of inter-firm relations and their expected impact on local economic development. From the Table 8-2, for example, it explains how innovation activities are closely connected with different kinds of inter-firm linkages. Different types of firms may require various degrees of support

from the government, since innovation activities should vary among firms. It is noted that the local economic development can be boosted by inter-firm collaborations between local and foreign invested firms in development zones, which also become the key determinant factor for forming local industrial clusters. In order to maximize the effect of inter-firm linkages on urban economic development, DFI related industrial policy should be integrated into development policy, being interconnected among them. By integrating these two policies, local authority can efficiently exercise institutional and administrative support tailored to individual specific demand.

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Survey Questionnaire: Inter-firm linkages in Development Zones

Method: face-to-face interview

Structured and Semi-structured interview: Closed questions and open-ended questions

The Structure of the Questionnaire

A. Company details

Details about input-output procurement of firms

B. Characteristics of inter-firm relationships in Development Zones

Information on the company's linkages, via sales and purchases, with companies located on the Development Zone and elsewhere, together with the location of the company's suppliers.

-The detailed local procurement of foreign subsidiaries and local firms

-The collaboration between local big firms or foreign subsidiaries and to local suppliers

Financial engagement

Technical and training engagement: product and process technology

Export assistance

A. Information about Company

1. Your company's name:

2. Company address:

3. Telephone number:

4. Name of respondent:

5. Position of respondent:

6. Please give a detailed description of your company's main products and services

7. What is the ownership structure in your company? (Please tick appropriate box)

Foreign Invested	
Sino-Foreign Joint venture Enterprise	
Sino-Foreign Contractual Joint venture Enterprise	
Foreign Wholly-Owned Enterprise	
Hong Kong, Macao, Taiwan Invested	
Joint venture Enterprise	
Contractual Joint venture Enterprise	
Wholly-Owned Enterprise	
Domestic Invested	
Stock Company with Limited Liability Enterprise	
State-owned by Central Administrated Enterprise	
State-owned by Local Administrated Enterprise	
Collective owned Enterprise	
Joint-Owned Enterprise	
Private-Owned Enterprise	
Other (Please specify below)	

8. What is the proportion of stock ownership?

Chinese	%
Hong Kong, Macao, Taiwan Invested	%
Foreign (exclude HK, Macao, Taiwan)	%

If your firm is subsidiary of a foreign firm, please go to 8-1

8-1. Please state the country of origin of the firm ( )

9. In what year was the company established in this zone? ( )

Total investment amounts ( ) RMB until 2003

Year	1997	1998	1999	2000	2001	2002	2003
Investment							

10. In what year did the company start operating in this area? ( )

11. At the time of establishment, was your investment

(a) Totally new production unit, or ( )

(b) Takeover of an existing firms ( ) If takeover an existing firms, please go to 11-1

11-1. Why is this new type of ownership desired?

(Please answer on a scale of 1 to 5, where 1 is of no importance and 5 of great importance)

(1) Lack of financial resources	
(2) Introduce more advanced technologies	
(3) To obtain more advanced managerial skills	
(4) Take advantages of government tax incentives	
(5) Take advantage of Strategic location	
Others: please specify	

11-2. Please tell me more about previous company.

What was the previous ownership?	
What were the main products?	
What were the main technologies?	
What were the main marketing channels?	
What were the main markets?	

More comments:

12. What are the proportions of expenditures on R&D or training to turnover in this year?

In the year of 1997	RMB
In the year of 2003	RMB

13. What is the proportion of product sales?

Qingdao city or zones	%
Domestic market in China	%
Export to Hong Kong, Macao and Taiwan	%
Export to Korea	%
Export to Abroad (except Korea)	%

Others: please specify

14. Would you give me detailed explanation about your marketing channel?

15. Which factors were important in the decision to locate here rather than elsewhere? (Please answer on a scale of 1 to 5, where 1 is of no importance and 5 of great importance)

Local resources available		Strategic location available	
Available skilled labour forces		Convenient transportation system	
Suitable premises were available		Previous relations with local suppliers	
Rents were affordable		Prior contacts with local firms	
Land was available for development		Close to your firm's existing investment	
Attractive physical environment		Establishment of supporting industries	
Huge domestic market potential		Investor-friendly milieu	
To meet the local demand		Convenient investor service available	
Easy to access domestic market		To be close to competitors	
Availability of suppliers		Access to financial services	
Hub of global marketing channel		Favourable government tax policies	

If there were any other factors, which encouraged the company to locate in this Development Zone rather than elsewhere, can you please specify here?

16. How many employees (including directors) are there in your company in year 2003?

17. How many employees (including directors) and sales value did the company employ in the last 7 years of the company?

Year	1997	1998	1999	2000	2001	2002	2003
Employees							
Sales value							

18. What is the breakdown of presence educational level by the following categories? (Please state percentage)

	Primary school level	Middle school to High school level	College and University	Graduate school
Managers				
Professional/Technologists				
Administrative/Clerical				
Skilled manual/Technical				
Semi-skilled manual				
Unskilled				

19. What is the breakdown of present employment by the following categories?

	Male	Female	Total	%of City	%of out of City
Mangers					
Professionals/Technologists					
Administrative/Clerical					
Skilled manual/Technical					
Semi-skilled manual					
Unskilled					

20. Could you estimate the proportion of those recruited locally who were unemployed or agrarian previously to recruitment? (Please state percentage)

21. Does you company recruit employees by local government agencies?

Yes	
No	

If yes, please go to 21-1

If no, please go to 21-2

21-1 What is your opinion about the quality of labour?

21-2 How do you recruit employees?

22. Where do the following categories recruit through government agency? (Please state proportions to add to 100%)

	Within Zone or City	Within Province	Elsewhere	Total
Managers				100%
Professional/Technologists				100%
Administrative/Clerical				100%
Skilled manual/Technical				100%
Semi-skilled manual				100%
Unskilled				100%

If you select 'Elsewhere', please specify

23. Does your company provide formal training to any of its employees either in-house or by external agencies (including headquarters)? (Please tick appropriate box)

	In-house	Headquarter	Elsewhere
Managers			
Professional/Technologists			
Administrative/Clerical			
Skilled manual/Technical			
Semi-skilled manual			
Unskilled			

If you select 'Elsewhere', please specify

B. The characteristic of inter-firm relationships in Development Zones

1. Is your firm

Independent firm	
Subsidiary of	( ) firm

If your firm is subsidiary, please go to 1-1

1.1 What is the position of your product range compared to that of your parent firm?

(1) No difference, production of more or less same goods	
(2) Extension of the range of your parent firm's product	
(3) Components or parts required for parent firm's production	
(4) Independent range of products	
(5) Parent firm's components or parts used in the subsidiary	
(6) Other, please specify	

2. Do you have local suppliers15?

Yes	
No	

If yes, go to 2.1

2.1 Could you tell me how many suppliers in your company?

Overall number of suppliers	
Number of local suppliers (within zone or city)	

2.2 Would you please tell me more about your suppliers?

Name	Location	Products or services from suppliers

[15] In here, local means geographically confined Qingdao city included two zones such as Qingdao HTIP and Huangdao ETDZ.

2.3 What are the principal channels of finding your suppliers?

Introduced by local government	
Your parent firms' network	
E-commerce (world wide web)	
Local specialised supply market	
Local trade affair association	
Your partner (JV) firms' network	
Your own network	

Could you tell me more about your own network?

3. If the firm uses imported raw materials, please indicate the approximate percentage of imported raw materials, parts or intermediate materials?

Name of raw materials	% of quantity
(1)	
(2)	
(3)	
(4)	
(5)	

Others: please specify

4. If the firm uses zone or city's raw materials, please indicate the percentage of its raw materials and intermediate goods?

Name of raw materials	% of quantity
(1)	
(2)	
(3)	
(4)	
(5)	

Others: please specify

5. What proportion of your raw materials, parts and components by cost are made within the following areas? (Note: In this question rough proportions will be sufficient)

	Purchasing from suppliers % of total sales value
Within the DZ	
Within rest of the City	
Within the Province	
Elsewhere in China	
Korea	
Abroad (except Korea)	
Total	100%

6. Could you tell me the list by ownership structure of your local suppliers?

	Number of firm	Full list of suppliers
Chinese Firms		
State owned		
Local government owned		
Privately owned		
Foreign invested Firms		
Joint venture with majority locally owned		
Joint venture with majority foreign owned		
Wholly foreign owned		
Total number		

7. Does your company receive advice from its parent firm, current foreign partner or any other institutions about purchasing source?

Yes	
No	

If yes, please go to 7.1

7.1 How independent is your company's decision making in its main purchase of major input?

(1) Company completely dependent in its main purchase	
(2) Company mostly dependent in its main purchase	
(3) Company mostly independent in its main purchase	
(4) Company completely independent in its main purchase	

8. Can you break down your company's suppliers by origin?

Input purchased within your parent firm or other subsidiaries	%
Input purchased from other firms	%
Total inputs purchased by your firm	100%

9. Has your firm provided its local suppliers technological skills for improving product process development?

Yes	
No	

If yes, please go to 9.1

9.1 Would you tell me what ratio of technologies are being used in your production?

Name of technology	Main sources (%)		% of contribution total product value
	Domestic firms	Foreign invested firms	

10. Has your company provided its local suppliers managerial skills for developing efficiency of organisation structure?

Yes	
No	

If yes, please go to 10.1

10.1 Would you tell me what ratio of managerial skills are being adopted in your organisation?

Managerial skills	Main sources (%)	
	Domestic firms	Foreign invested firms

10.2 Would you give me more detailed explanation about how can these managerial skills improve your firms' organisation structure?

11. Could you evaluate the ability of your local suppliers to fulfil the following requirement?

	Very poor		Fair		Excellent
Product control	1	2	3	4	5
Quality of product					
Cost of supplies					
Regularity of supplies					
Technical and managerial competence					
Capacity to improve quality level					
Supplier management attitude					
Supply linkages					
Flexibility to new orders					
Punctuality of supply (JIT)					
Transaction stability					
Delivery before payment					
Others (please specify below)					

(

12. What type of contractual agreements does your firm maintain with your suppliers?

(1) Subcontracting agreements	%
(2) Joint venture agreements	%
(3) Informal agreement	%
(4) Others	%
Total	100%

Please specify other agreements:

13. Could you tell me how long do the overall supplying agreements with your suppliers last for?

(1) Long-term relationship (explain reasons)

(2) Short-term relationship (explain reasons)

14. What are the usual supplying patterns per range of product?

(1) Single supplier (explain reason)

(2) Various suppliers (explain reason)

15. What sorts of assistance has your firm provided to its zone or city's suppliers?

Activities	Often (5-10)	Rarely (1-4)	Never (0)
Technical Assistance			
Specification of standard materials or components			
Method of operational specification			
Assistance in establishing a production plant			
Assistance by supplying machinery			
Assistance in the supplier technical management			
Assistance in input procurement of suppliers			
Quality control: ISO standard certificate			
Other: please specify			
Training Assistance			
Professional training for suppliers' managers			
Operational training to machines and equipment			
Other: please specify			
Information Sharing			
Provide production management know-how			
Provide marketing channel and market information			
Provide information about tax policies in destination			
Other: please specify			

*** Numbers in parenthesis indicate the hours per week spent in the listed activity.**

16. Has your firm received any service and advice from following organisations?

	Yes	No
Domestic research institutes (including business incubators)		
Universities		
Qingdao city government		
Development zones officials		
Chamber of Industry		
Association of foreign investors		
Other (please specify)		

If yes any item, please go to 17

17. How often does your firm use input from following organisations to help generate innovative new ideas and technologies?

	Never ← → Frequently				
	1	2	3	4	5
Qingdao university					
Qingdao Haier management college					
National Ocean university					
Qingdao Hi-tech incubator					
Association of foreign investors					
Development zone authority					
Chamber of Industry					
Others (please specify)					

18. How often does your company use input from following organisations to help actually develop and commercialise new products?

	Never ← → Frequently				
	1	2	3	4	5
Qingdao university					
Qingdao Haier management college					
National Ocean university					
Qingdao Hi-tech incubator					
Association of foreign investors					
Development zones authority					
Chamber of Industry					
Others (please specify)					

19. If you select any item 3, 4 or 5, (often or frequent) could you tell me more about their activities and procedures?