# Industrial Clusters and Regional Economic Development in China: the case of Heilongjiang Province

Jialiang Wang

A Thesis Submitted

In Partial Fulfilment of the Requirements of

Edinburgh Napier University, for

The Award of Doctor of Philosophy

March 2013

# ABSTRACT

The concept of the 'industrial cluster was first discussed in the early works of Alfred Marshall. In the 1990's the term became part of mainstream economic thinking largely due to the work of Krugman in the area of New Economic Geography. There have been numerous studies into the theoretical and empirical nature of industrial clusters in the past twenty years as well as numerous examples of industrial cluster policy implementation. In China the concept was also adopted in policy in a number of Provinces. One of these, Heilongjiang, began to implement industrial cluster policies for the green food and pharmaceutical industries in 2003. This study investigates the resulting outcomes of these policies. In particular it examines the concept of the industrial cluster, how this is defined in both Western and Chinese academic studies and the specific implementation plans used for both industries in Heilongjiang. The research methods employed include interviews with key participants and official data from both national Government sources and Provincial sources. The central argument of the Thesis is that there exists key elements that must be present for an industrial cluster to exist (or to be developing) and that most of these are measurable. A set of theoretical propositions are presented and examined via a number of techniques including location quotient calculations, shift-share analysis, correlation analysis, regression analysis and careful analysis of descriptive data. The Thesis concludes that there is no doubt the green food industry in the Province is a strong but developing cluster and policy has positively encouraged this. However the same cannot be concluded in the case of the pharmaceutical industry. It is also suggested that cluster theory (Western and Chinese) continues to be rather vague in a number of fundamentals and requires some rethinking to more explicitly incorporate the role of *business culture* and of *policy* itself in our understanding of the formation of industrial clusters.

# ACKNOWLEDGEMENTS

Working as a Ph.D. student in the UK was a magnificent as well as a challenging experience to me. Throughout these years, many people were instrumental directly or indirectly in shaping my academic career.

My first and most earnest acknowledgment is dedicated to my supervisors, Prof. John Adams and Dr. Linda Juleff, for introducing me to the world of regional economic research. Only because of their valuable guidance, cheerful enthusiasm and ever-friendly nature, I was able to complete my research work in a respectable manner. They were instrumental in ensuring my academic, professional, financial, and moral wellbeing during my research studies.

I am appreciative to my external supervisor Prof. George Malcotsis who had a great role in the success of my several visits to Switzerland and for improving my research skills. I am also indebted to Heilongjiang Green Food Development Office, Heilongjiang Development and Reform Commission, and Limin Economic and Technological Development District of Harbin where many of the interviews for this study were completed with their support.

My final and most heartfelt acknowledgment goes to my wonderful parents for always being there when I needed them the most in any aspect. Providing my overseas tuition fees for many years, never once complaining about how infrequently I visited, they deserve far more credit than I can ever give them.

# DECLARATION

I, Jialiang Wang, hereby declare that this thesis is my original work and that it has not been submitted previously for the award of any other qualification or other work undertaken by me. The work has been completed under the supervision of Prof. John Adams, Dr. Linda Juleff and Prof. George Malcotsis. Parts of the text have been presented in conferences in related fields which are listed below:

Parts of Chapters 1, 3 and 6 were presented at the CAMOT International Conference in Beijing, China, 2008 (China Association for Management Technology). The paper won the Emerald Best Paper Award, and is published in the 'Journal of Chinese Entrepreneurship', Vol.1 No.3, 2009.

Parts of Chapters 6 and 7 were presented at the Regional Science Association International British and Irish Section, 38th Annual Conference, Limerick, Ireland, 2008, and published in the conference proceedings.

Parts of Chapters 1 and 6 were presented at the Scottish Economic Society 2009 Conference, Perth, Scotland and published in the conference proceedings.

Parts of Chapter 6 were presented at the 4th International Seminar on Regional Innovation Policies, Edinburgh, Scotland, 2009, and published in the proceedings.



Signature

# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF CHARTS



# LIST OF APPENDICES



[1] This Appendix is provided for readers who require a wider context of agricultural development in China in order to better appreciate the specific policies applied in the green food and pharmaceutical (Chines herbal medicines mainly) industries.

# Chapter One: Introduction

## 1.1 Background

By 1999, many European countries and American states had introduced the concept of industrial cluster initiatives (CI) (Wang, J.C. 2005). In 2003, a major study, '*The Cluster Initiative Greenbook*' (Orjan et. al, 2003), was published; it was based on 250 CI's in Europe and America. This study was also published by the International Organization for Knowledge Economy and Enterprise Development (Andersson et. al, 2004). Furthermore, international organizations such as UNCTAD, UNIDO, OECD, and the World Bank investigated and advocated the industrial cluster policy, and subsequently implemented intensive research into its potential in developing countries (Wang, op.cit). However this research work, according to Wang, has shown that the cluster 'strategy' in developing countries is still dominated by low technology and low-cost-based industries.

According to the report published by the UNCTAD, '*World Investment Report 2001*', Industrial Clusters (IC) have been pivotal in global investment. In the '*Report of Global Competitiveness 2001-2002'*, the IC received special attention and was identified as the key factor for influencing industrial innovation. Of the 49 countries and regions included in the appraisal, China was ranked 31$^{st}$ in overall competitiveness but in terms of technology competitiveness it was

ranked number 25. In the '*Report of Global Competitiveness 2002*' which included 75 countries and regions, China ranked 43rd whereas Brazil was ranked at number 33 and India number 38 in terms of innovation. Both Brazil and India are often compared to China in terms of their GDP growth rate, investment and competitiveness. Consequently several researchers paid more attention to the role of innovation and creativity in cluster development (Caves, 2000, Asheim and Vang, 2005, Florida, 2002).

The two official reports mentioned above and the increasing interest by academics indicate that IC's are very important to the regional economy in developing countries. The term 'industrial cluster' appears in various kinds of media in China and is found in many government reports and official documents of the National Development and Reform Commission. The opportunities with the reform and opening-up policy since 1978 and the growing entrepreneurship in the country has given a boosting effect to Chinese industrial clusters; spatially these have mostly developed in Guangdong, Zhejiang and Jiangsu provinces which are often recognized as the Chinese economy's 'development engines' (Wang, *op cit*). This latter point is emphasised by Chen and Wu (2005) who show that between 1988 and 1998, regional growth disparities increased significantly across China primarily due to differential distributions in foreign

direct investment (FDI) which has generally been attracted to ‘clustered’ areas of specific types of industry.

The performance of Chinese industrial clusters, especially in these three provinces also attracted media attention. As early as 2004 an article about the introduction of the Chinese textile industrial clusters was published in the New York Times for example. However, the term ‘industrial cluster’ does not represent a strict and uniform concept. Porter (1990) attempted to use the term to cover all kinds of clusters even though their origin, structure, impetus and development paths are all quite different. Basically a ‘cluster’ is an industrial agglomeration phenomenon. If clusters are used as a basis for regional and national planning, there must be an objective procedure developed to identify and define them. It is, however clear that the ‘industrial cluster’ is an economic geography phenomenon and therefore should be treated as a type of industrial spatial organization. This spatial dimension easily lends itself to the application of the concept of regional economic development and as a development tool which treats the regional economy as the natural ‘spatial’ unit for the geographic convergence of interdependent enterprises and institutions. It is in this context that the use (or apparent use) of the industrial cluster concept in Heilongjiang Province, North-East China, with respect to the green food industry and pharmaceutical industry is investigated. An obvious question in this respect is

why these two sectors and why this particular Province? There are a number of reasons. First, Heilongjiang Province is one of the oldest industrial parts of China and until the early 2000's was declining in terms of jobs and job creation. The old heavy industries of steel, coal and petroleum were in decline for many years and the Province became the subject of no less than three regional development plans within the past nine years (2003, 2007, and 2009).

Second, five sectors were to be prioritised, including green food and pharmaceuticals as 'cluster initiatives'. The other three sectors given a priority status are energy, petrochemicals and equipment manufacturing. Because green food and pharmaceuticals have been targeted as potential 'clusters' of industrial development this provides a very useful opportunity to examine the efficacy of such an approach (supported by many international organisations as explained above) and the extent to which the theorised advantages of clusters can be realised in the Chinese context.

And third, the combination of three regional development plans and cluster initiatives in a single Province enables a more spatially focused study to be undertaken.

In respect of the 'Green Food'[2] industry this refers to agricultural products that are produced using organic methods of agriculture. Green Food production is based on a sustainable system of farming that recognizes a healthy, vibrant and live soil and ecosystem significantly benefits crops. Green Food is grown according to organic principles and is free of exposure to many harmful herbicides and pesticides which involve promoting the health of the soil and the ecosystem in which the crops are raised. From a marketing perspective green food has been described as *'one of the most successful eco-labelling programs in the world'* (Giovannucci, 2005, p.12).

Some countries, such as the United States, Germany, Denmark, Switzerland, Austria and the United Kingdom have already formed a relatively complete market for green food. The expenditure on organic food reached US$40 billion globally for the first time in 2007 (China Green Food Industry Report, 2008). In 2006, China's total value of organic food production reached $2.1 billion; a mere six per cent of the global total for that year. According to the statistics from the

[2] 'While 'Organic' is still poorly understood in the Chinese domestic market, 'Green Food' is well known and readily available. Green Food is a Chinese innovation and dates from 1990...The China Green Food Development Centre was founded in 1992 to oversee the implementation of this food production innovation. Certification for Green Food production involves the regulation of inputs, with the objective of reduced use of pesticides, the oversight of production, and the residue testing of the produce. This Green Food strategy has been used as a 'half-way house' between chemical food and organic food production. In 1995 Green Food certification was split into Grade A and Grade AA. It is this bifurcation of Green Food standards that laid the groundwork for the rapid articulation from Green Food certification to organic certification, and thus enabled the reported dramatic ten-fold increase in organic hectares in China in 2006 –and thereby placed China second in the world in terms of hectares under organic management, after only Australia. Paul, J. (2008), ''The Greening of China's Food-Green Food, Organic Food, and Eco-labelling', Sustainable consumption and alternative agro-food systems conference Liege University, Arlon, Belgium, 27-30 May 2008.

China Green Food Development Centre, China's annual output of green food reached 15 million tons in 2006. However, China's production level is still quite low, only taking up 3% of the market share in food commodities. The development strategy for the green food industry is to assure the quality of the products and focus on the development of key products. The North Eastern province of Heilongjiang is particularly known for its rich and unpolluted soil and has for several years been the focus of the country's green food production. The most recent five year plans (the tenth and the eleventh: 2001-2005, 2006-2010) have identified green food (organic food) as a key industrial cluster within the national economy and is focused in Heilongjiang Province. The new five year plan (the twelfth between 2011 and 2015) has set to strengthen the economic development in the northeast of China especially in respect of its regional industrial clusters. Hence, although a relatively recent initiative (2003) the *regional* policy of developing the green food cluster in the Province is continuing to be supported in *national* planning. .

The second cluster initiative developed from the 2003 'revitalisation' policy is the Pharmaceutical Industry. As early as 1998, the Heilongjiang Provincial government identified the pharmaceutical industry as an emerging major sector. The 2003 national initiative for the industry and Province boosted the local government strategy further. After 2000 the industry rapidly accelerated as will be seen in the following Chapter. In summary both the green food and

pharmaceutical industries in the Province have been ‘targeted’ strongly as industrial cluster initiatives in recent economic planning and both continue to be treated as such in the current national plan to 2015. Promoting regional and national economies as well as advanced industries, through developing regional industrial clusters, has become a new economic growth strategy in recent years. From the perspective of international backgrounds, economic globalization has increased the pressure on national and regional industries in China in terms of international competition. This will require further development of the ‘green food’ industry in Heilongjiang Province to adapt to new requirements in the global market if it is to become more competitive. Furthermore, from the macro perspective, according to central and provincial government documents (see Chapter Two); the ‘green food’ industrial cluster and pharmaceutical industrial cluster are both pillar industries which have already made an outstanding contribution to regional economic development in Heilongjiang.

It is not sufficient to delineate a whole industry as a cluster without relating each of its key components in the supply chain. Indeed it is the supply chain which effectively delineates an ‘industry’ in terms of a cluster which is integrated according to three levels – the main supply chain of the industry, forward and backward industries, and the relevant and supporting industries. According to Chart 1.1 the ‘Green Food’ industrial cluster can be understood in terms of three

levels – the Base/Farmer, Manufacturing and Distribution enterprises are the main sectors in the supply chain whereas seed, manure, raw materials and processing machinery and logistics, packaging, advertising and marketing are the forward and backward components of the industry. On another level (Government organization and green food development centres) and (Education, research, finance and agency organization) are the relevant supporting industries for the 'Green Food' industry.

**Chart 1.1 The 'Green food' industrial cluster on three levels**

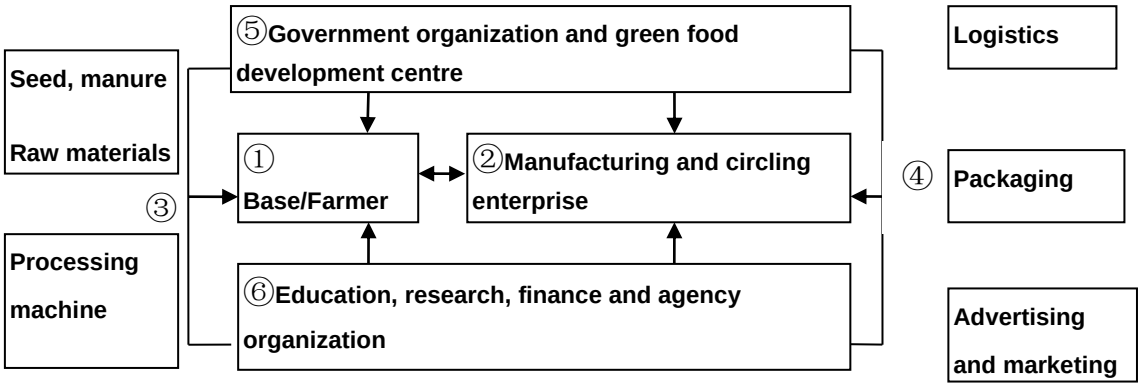
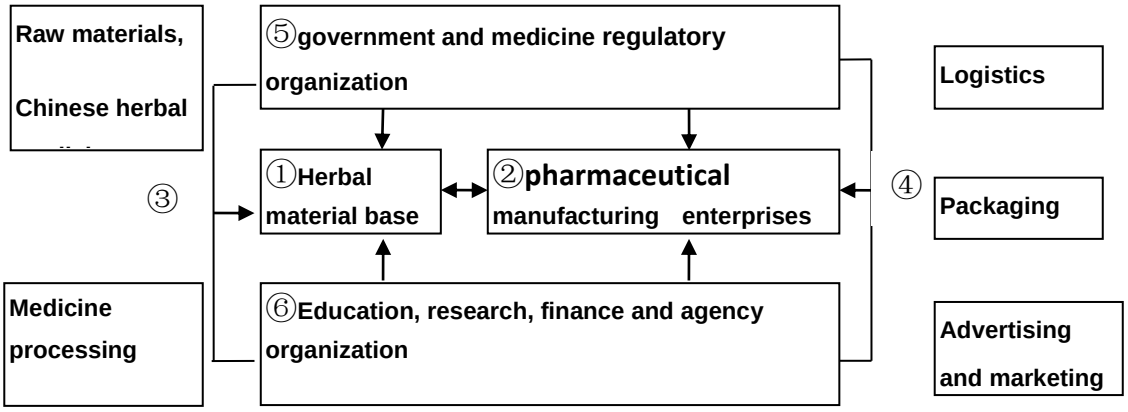



Chart 1.2 offers a similar representation of the pharmaceutical cluster again on three distinct levels. The herbal material base and pharmaceutical manufacturing enterprises are the core sectors of the industry; raw materials, Chinese herbal medicine planting and medicine processing and logistics, packaging, advertising and marketing are the backward and forward industries of the supply chain respectively.

**Chart 1.2 The Pharmaceutical industrial cluster on three levels**




Due to the nature of the pharmaceutical industry, it is much related to the 'green food' industry at the 'planting' level to obtain the raw material for traditional Chinese medicine. It is also closely related to the education, research, finance and government sections of the supporting industries of both clusters. This is a key reason why national planning has particularly identified these two industries for cluster development in Heilongjiang Province and further helps to achieve the hoped for 'cluster' advantages. After a dozen years of development the 'green food' industry in Heilongjiang Province has formed a significant scale and brand advantage which has played an important role in the adjustment of the Province's agricultural structure as well as increases in rural incomes and the promotion of agricultural products for export. Similarly the pharmaceutical industry has developed strongly in the Province over this time period. The extent to which these positive developments can be linked directly or indirectly with the cluster 'policy' or cluster 'theory' is however a key question for this research. In

addition, the extent to which this policy ‘matches’ the underlying theoretical arguments of the proponents of cluster policy is another important question. This leads naturally to a clear

statement of the objectives of this research study.

### 1.2 Objectives of the Study

This study will critically examine relevant theories (for example, the ‘new economic geography’, industrial cluster theory and related theories) to test to what extent they provide a useful explanation for the developments in the Province in the past ten years. Another objective is to examine the extent to which these two industrial clusters in Heilongjiang Province have been successful in terms of the criteria often used to measure the success of a cluster policy. Finally the study will examine the current problems of both industrial clusters and suggest possible future policy directions.

### 1.3 The significance of the Study

This study has significance from a number of perspectives. First, this is the first detailed analysis of available empirical data on industrial clusters focusing on a regional perspective within China. Although there are many studies of ‘clusters’ they tend to be industry focused but this does not shed any light on the important regional dimension behind the very concept of industrial cluster policy. Second, the economic ‘system’ in China is very different from that of Western economies

– the importance of national planning cannot be overestimated and therefore the active promotion of cluster policy, within a specific Province, ought to reveal definite outcomes that can indeed be compared to the theoretical propositions we find in 'cluster theory'. The latter is the primary theoretical premise of this Thesis. Finally the study provides an opportunity to further develop the 'theory' of industrial clusters within a Chinese perspective since there are significant differences between the latter and Western approaches to policy design.

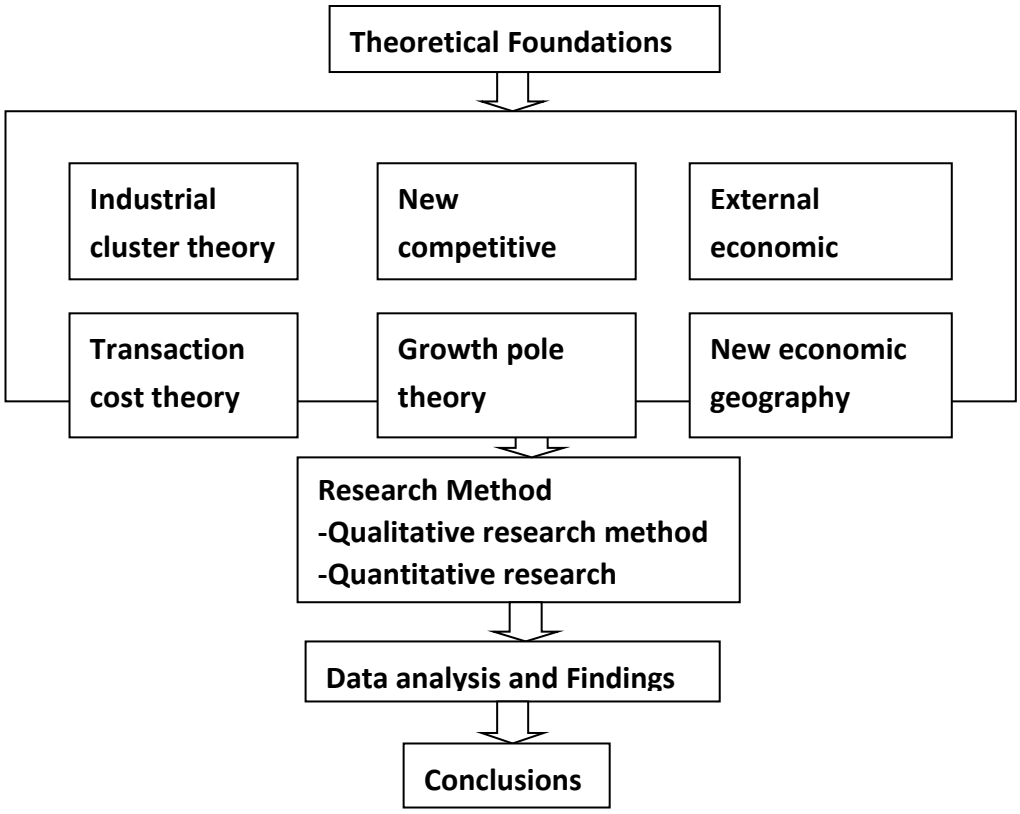
### 1.4 Research methods

The study combines qualitative analysis of in-depth interviews with key officials in order to examine the performance, existing problems and explain the possible reasons for these problems in both clusters with empirical data drawn from various sources. Details are provided in a later Chapter.

### 1.5 Structure of the Thesis

There are nine chapters as follows: The current chapter provides the background, objective and significance of the study. Chapter Two presents a recent economic history of Heilongjiang Province in order to set out the context for further Chapters including a summary of the regional policies adopted in China since the 1960's. Chapter Three provides a close examination of relevant literature from which a set of testable hypotheses can be generated which focus on the theoretical propositions to be found in industrial 'cluster

theory'. The latter are closely examined in Chapter Four where the various theoretical models relevant to clustering and agglomeration are analysed in detail. Chapter Five describes the research methods employed in this study, the data collection process and the surveys undertaken. Chapter Six presents the qualitative data analysis and Chapter Seven presents the analysis of the quantitative data. Chapter Eight provides a discursive assessment of the evidence and finally Chapter Nine presents the conclusions from the research along with suggestions for further research that is required in this particular field. Specific components of the study are summarised below:



The following Chapter sets out a recent economic history of the Province in order to provide a relevant context for the rest of the Thesis.

# Chapter Two: The Recent Economic History of Heilongjiang Province

## 2.1 Introduction

The Province is located in China's North-East region and since 1949 developed an industrial structure mainly based on heavy industries in addition to its large agricultural sector. The Northeast covers the areas of Liaoning Province, Jilin Province and Heilongjiang Province, as well as the eastern part of Inner Mongolia. These areas are home to 120 million people and occupy 1.45 million square kilometres.

The production of iron, steel, heavy equipment, oil and petrochemicals dominated the Province until the late 1990's. The opening up of China to the global market in 1978 saw the development of light manufacturing clusters mainly in the southern Provinces and mainly driven by FDI. However this process did not benefit Heilongjiang Province. The latter continued after 1978 with heavy industry but this was already slowing considerably in terms of jobs. Total employment in the Province's traditional heavy industry sectors only increased by 1 percent between 2000 and 2007, total agricultural employment actually fell by 0.34 percent while employment in green food related production increased by 18 percent (China Statistical Yearbook (CSY), various years).

Over 30 years since 1979, under the reform and opening-up strategy, the Chinese Government introduced a series of principles and policies for setting up special economic zones, using foreign investment and developing foreign trade. These zones were first introduced in the south of the country then extended to individual coastal cities and most recently to the largely undeveloped western Provinces. The 11$^{th}$ Five Year Plan explicitly addressed the issue of regional development although specific Provinces had been the subject of Government attention, including Heilongjiang.

The focusing of investment, especially FDI, in the coastal and southern areas of the country since 1978 led to a rapid increase in regional inequality in China. For example Kanbur and Zhang (2005) show the regional inequality (using per capita income) increasing as decentralization increased during the economy's transition from a planned to a market economy. It is particularly interesting in the latter study that in the post-reform period, the coefficient of heavy industry becomes insignificant while the coefficients of decentralization and trade are both positive and significant. This is consistent with Heilongjiang's continued reliance on heavy industry while coastal and southern Provinces were absorbing the majority of FDI and becoming more competitive in globally tradable goods. Hence the need for a regional policy in the North East of the country to attempt to revitalise the ailing traditional heavy industry (energy, petrochemicals and equipment) and also promote the development of two industrial clusters in green food and pharmaceuticals. The latter are particularly appropriate to the Province because of its vast areas of rich arable land and also because China joined the WTO in 2001. Both these sectors' outputs are globally tradable (organic foodstuffs and Chinese medicines, especially herbal medicines) thus enabling the Province to potentially join others in China's rapidly expanding export sector.

Thus regional economic development strategy in China has gradually moved from low technology manufacturing (light consumer goods) to a more sophisticated approach to the product mix. Heilongjiang's contribution to this

was to be through green food and pharmaceuticals, both expanding as industrial clusters. This is also a policy that could also address the regional income gap between the Province and those in the coastal areas. In order to better understand the specific regional policies implemented in the Province it is first useful to provide some contextual background on China's approach to regional policy. This is presented below.

## 2.2 China's Regional Economic Development Policy Since 1978

Regional economic development is a priority for China in the second decade of the 21st century and this has been reinforced through the most recent 5 year plans. However regional economic policy in China is not a recent 'invention' – in fact the 6th, 7th, 8th and 9th five year plans[3] all made regional economic policy (REP) a significant part of national development strategy. Indeed the third five year plan (1966-70) was famed for the introduction of the tier concept[4] which later became applied (for a different purpose) to urban areas in terms of population density and economic importance. The development of REP in China since 1978 can best be understood in terms of the classification and repeated re-classification of the country's regions as in the Table below.

[3] The 6th Plan was from 1981-1985 – the first full Plan after the introduction of the 'opening policy' in 1978.

[4] This was based upon first, second and third tier (larger) regions where the over-riding criteria applied was internal security and national defence.

**Table 2.1 Classifications of Regions in China since 1978**

| PLAN | PERIOD | DELINEATION |
|---|---|---|
| Sixth | 1980-85 | Coastal and Inland |
| Seventh & Eighth | 1986-95 | Eastern, Central & Western |
| Ninth | 1996-2000 | Seven Economic Zones |
| Tenth, Eleventh & Twelfth | 2001-2015 | Coastal, North Eastern, Central & Western |

These classifications are geographic but in the detail of regional policy in China since 2001 they are further categorised into smaller ‘zones’ according to ‘special’ development zones, ‘optimal’ development zones, ‘restricted’ development zones and ‘non’ development zones. All of China’s ‘regional’ delineations throughout the past sixty years have contained several Provinces and have always been geographically defined (see map over-page). This in turn has led to a degree of specialisation in terms of the regional policy focus where the coastal Provinces became the export and FDI centres, the North East became the focus for revitalising older industrial sectors and creating modern ‘clusters’ from them and central and western Provinces for resource extraction and infrastructure development. The latter is of course a broad generalisation however it succinctly describes the primary direction that regional policy has taken in China since 1978. As we will see later the distinction between these regional policy directions started to become blurred in the more recent past especially with all ‘regions’ being opened up to FDI.

## Development of Special Economic Zones in China (1980 – Present)


**Source: World Bank (2009) World Development Report 2009: Reshaping Economic Geography.**

The border city and capital of Heilongjiang finally became a special economic zone in 1992 (highlighted in the map above). As we will see later in this Chapter this development soon led to the introduction of three specific plans for the whole region with an emphasis on cluster development in Heilongjiang Province. Before we examine this specific regional policy in detail it is useful to return to the more general discussion. There is no doubt that the principle vehicle for the implementation of REP in China since 1978 has been the introduction of the special economic zones the purpose and function of which can be summarized as: (1) expand the country's foreign trade; (2) introduce more foreign capital, technology and management experience; (3) increase employment opportunities and expand social employment; and (4) accelerate economic development in specific regions.

## The Implementation of Special Economic Zones

Over 30 years since 1979, under Deng Xiaoping's reform and opening-up policy, the Chinese Government has set up a series of principles and policies for special economic zones, based primarily on foreign investment and developing foreign trade. The 'opening-up' process that began in 1979 eventually spread from the coastal areas of China to the whole country. This process can be described (briefly) in terms of four main phases that cover the six five year plans outlined in Table 2.1 above.

### Phase 1: Launch of the Opening-up strategy (1979-1983):

In July 1979, the Chinese Government first decided to implement special policies and incentives for Guangdong and Fujian provinces for their foreign economic activities. In May 1980, the central government decided to set up special economic zones in the cities of Shenzhen, Zhuhai, Shantou and Xiamen (see map above). The establishment of these four special economic zones included the creation of modern port and logistic facilities, port to population centre infrastructure development, special tax and other financial incentives to foreign firms, a more streamlined component import licencing system and export procedures were much more simplified. Within a few years these four SEZ's were generating a significant proportion of China's trade surplus and the concept of the SEZ was further applied to other areas as explained below.

**Phase 2: Coastal Area to the Mainland of China (1984-1991):**

In the middle of the 1980s to the early 1990s, the scope of the 'opening-up' policy began to be gradually spread from the coastal 'economic zones' to other regions, coincident with major rivers but close to sea lanes. This included Qinhuangdao, Dalian, Tianjin, Yantai, Qingdao, Lianyungang, Jiangsu Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai. These new SEZ's had a particular focus through the setting up of technological development districts. From February 1985 onwards, the policy it successively developed economic zones along the Yangtze River Delta, the Pearl River Delta, southeast of Fujian and the Bohai region.

In April 1988, the central government took a major decision to define the island of Hainan as a new Province and granted the whole island the status of special economic zone, by far the largest in China. Two years later the Pudong district in Shanghai was made into a SEZ.

In 1991, four Northern ports were 'opened' up - Manzhouli, Dandong, Suifenhe and Hunchun. In the same year, the Government successively approved the setup of bonded areas in important coastal ports such as Waigaoqiao (in Shanghai), Fujian and Shatoujiao (in Shenzhen) and Tianjin Port. These had the specific focus of establishing bonded warehouses, bonded processing and re-export operations almost entirely based on FDI.

**Phase 3: Accelerating the policy (1992-2000):**

In 1992, after the famous ‘South Tour Speech’ from Deng Xiaoping, a new turning point emerged in the regional policy ‘opening-up’ process.

First of all, following the ‘Pudong’ district in Shanghai, five river cities were opened up (Wuhu, Jiujiang, Wuhan, Chongqing and Yueyang) but with the same conditions regarding SEZ’s. At this same time, the central Government also turned its attention to north eastern regions and the SEZ policy was instituted in Harbin (Heilongjiang), Changchun, Hohhot and Shijiazhuang – four border capital cities. Soon after this a further 13 border cities were granted SEZ status to encourage the development of border trade and economic cooperation with neighbouring countries. By 2000, accompanied the ‘opening-up’ had expanded to the Western region.

In the 21 years since 1979 China’s regional policy was closely integrated with the central strategy of opening the economy to trade. By 2000, geographically, most of China had been redefined on a regional policy basis with many categorised as SEZ’s although many were ‘formed’ with a particular economic focus. In 2001 another major step in regional policy was taken with the entry of China into the World Trade Organisation (WTO).

**Phase 4: A new era (2001-present):**

Prior to 2001 all of the SEZ’s in China were manufacturing or raw material based. After joining the WTO in December 2001 the ‘opening-up’ entered a new

phase with a shift (in several SEZ's) towards trade in services.[5] In terms of the development of regional policy itself there is no doubt that China's approach has been rapid, even drastic in terms of successive reformulations but above all it has been a very clear example of the close connection between a national overall strategy (trade expansion) and the requirements of that strategy in terms of different regional capacities and specialisations. However this approach to regional policy in China was not simply driven by the national goal of trade expansion – but also by a clear need to reduce the regional disparities that were already present in 1979 but growing rapidly in the early 1980's as indicated earlier in this Chapter. We turn now to the specific case of Heilongjiang Province.

Heilongjiang Province boasts a considerable amount of natural resources and ranks first in the country in terms of total arable land and woodland areas. It is also the largest base for commercial grain and timber production in China. Its annual mineral production value is the second highest in the country (CSY, various years). The province also enjoys a wealth of flora, fauna and tourism resources with distinctive characteristics. Furthermore, education and technology have been well developed in the Province. There are 65 higher education institutions, 605 institutes of research and development with more than 100,000 people engaged in scientific research. Northeast China was once

[5] In particular finance, logistics and software.

dubbed ‘the industrial cradle of new China (since 1949)’. Major industrial projects in iron and steel, energy, heavy machinery, vehicle and aeroplane manufacturing, ship-building and weapons sectors were the foundation of China’s industrialisation. These advantages are not possessed by the coastal areas in the southeast. However the source of the Northeast’s problems can be traced back to more than two decades. In the early 1990s, the protracted sluggish economy of the region was diagnosed as the “northeast syndrome”. The region found it very hard to adapt to structural reforms and the country’s economic transition due to the imbalanced industrial structure. Facing foreign competition in an ever-integrated international market, low competitiveness and the high cost of the region’s agricultural products became evident. In Heilongjiang, agricultural output’s share in Provincial total output decreased from 16.35% to 11.6%. The percentage of agriculture in the Northeast’s total GDP decreased from 17.21% in 1998 to 12.80% in 2002 which was almost 1.5 times higher the national average. In 1998 Heilongjiang’s share in *national* agricultural output decreased from 3.11% to 2.77%. This change is out of proportion with the rich agricultural resources that the Province enjoys, (CSY, 2003). Furthermore, employment itself was falling in the whole region and in Heilongjiang Province. From 1993 to 2002 the number of employees in China increased from 602.2 million to 737.40 million. But in the Northeast region the number of employees decreased from 46.74 million to 45.64 million and the percentage of the

workforce to the total population decreased from 45.66% to 42.59%. The population increased from 102.37 million to 107.15 million in the Northeast in the same period indicating that there were an additional 3.62 million people unemployed in 2002. This combination of economic data over a significant period finally led to the realisation that the whole Northeast required greater attention from central Government. The response was the production of no less than three 'plans' for the whole region over the next eight years plus the introduction of the current regional plan.

### 2.3 The 2003 Northeast Plan

In October 2003, the Central Government formally issued '*The Guidelines of the CPC Central Committee and the State Council on Implementing the Strategy of Revitalizing Northeast China and Other Old Industrial Bases'* (State Council Document No.11). This document was a clear sign of the official launch of the policy of revitalising the Northeast old industrial base. Furthermore, in December 2003, the State Council officially set up a leading group in charge of the Northeast revitalization. The document of 2003 indicated that the main problems confronted by the Northeast, since 1949, was the low level of market efficiency, lack of economic development vitality and the relatively high proportion of State-owned enterprises. Problems also included slow industrial restructuring and ageing of enterprise equipment and technology. A key element in the 2003 Plan for the region was:

*'To vigorously develop modern agriculture, increase efforts on supporting food production; to develop a quality, ecologically safe and modern agriculture, to build up a* ***green*** *and superior industry zone for the agricultural products under professional standards, on a large-scale and to increase the expansion of agricultural product exports.'.* (State Council Document 11, p3)

The provincial targets included keeping the registered urban unemployment rate within 5%, curbing the tendency towards a worsening eco-environment, and increasing the annual industrial output value by 10% or increasing the GDP by more than 9%. However there was little in this Plan to specifically address how the issue of environmental sustainability could be tackled and this is particularly important to the brand 'image' of green food – especially in the international market. Nevertheless, the 2003 Plan gave, for the first time, a clear lead to the Province to prioritise the green food industry and capitalise on the natural advantages held by the area's rich land resources. As can be seen shortly the 2003 plan did indeed boost the output of green food in the Province and it also led to the reduction in the number of smaller enterprises involved in this type of agriculture through the creation of larger firms to take advantage of the potential scale economies. However more needed to be done in this area and this was recognised in the second Plan produced in 2007.

## 2.4 The 2007 Northeast Plan

In 2007, in order to consolidate and promote the revitalisation, the office of the leading group promulgated another document called ‘The Plan of Revitalizing Northeast China’. It aimed to accelerate the pace of revitalizing Northeast China, and promote coordinated regional economic development. This Plan was formulated in line with 2003 Plan but with the clear purpose of speeding up the process of revitalising the Northeast region. In 2006 China introduced its 5th Five Year national Plan with a strong emphasis on regional development and the focus on the Northeast fitted well with this. In fact this was a departure in many ways in national planning since up to that point (the 5th National Plan) most of the emphasis had been focused upon the coastal regions and the south of the country.

In the plan of 2007, it firstly confirmed the significant progress that had been made in technological innovation and structural readjustment which was highlighted in the 2003 Plan as being essential to revitalising the whole area. However, the 2007 Plan repeatedly stressed the importance of dealing with the pronounced problem in the revitalization process of institutional obstacles which need to be removed. For example, the underdeveloped non-public economic sector and market still needed to play a bigger role in the economy. In addition, the small proportion of high-tech and equipment manufacturing firms needed to

produce more compatible products and improve their ability to coordinate more effectively. Here the 2007 Plan was making a clear reference to one of the 'benefits' of industrial clusters – the geographical advantage of enabling adjacent (or very close) companies to learn and adapt from each other (see Chapter 3) but the 2003 Plan had clearly not been successful in this respect. In order to effectively address these problems, the 2007 Plan clearly set out the guiding principles and major measures which should be undertaken in the revitalisation process in the Northeast – in particular there were three objectives in the latter that are specifically relevant to the subject of this Thesis:

These were;

*1. 'The pace of reform and opening-up will be accelerated. We must deepen institutional reforms by establishing a modern enterprise system and ownership structure, promoting strategic restructuring of the state-owned sector, and cultivate the non-public economy. We must increase development vitality by opening up more in both domestic and foreign markets'.*

*2. 'Efforts should be enhanced in restructuring and upgrading of industries and must enhance independent innovation capability ... and*

*3. Efforts should be made to establish regional coordination and interactive mechanisms to remove administrative barriers and promote the fast flow of resources and factors of production ... in order to boost more employment'*

*[2007 Northeast Plan, p2).*

These three particular statements in the 2007 Plan fit well with the specific purpose of industrial clusters – to raise inter-firm cooperation, to raise the level of innovation and to raise both productivity and employment. As we shall see in the next Chapter these (and other benefits) are often postulated as the *raison d'etre* for the industrial cluster strategy adopted in many countries and, as pointed out in Chapter One, often the rationale behind the promulgation of the strategy by UN agencies.

In order to sustain and enhance the effectiveness of the central strategy of revitalising Northeast China, the plan of revitalising in 2007 was aiming to achieve a comprehensive rejuvenation of the Northeast in the following 10 to 15 years. The plan aimed to develop the northeast into 'four bases and one strategic area' of the country, namely 'an internationally competitive equipment manufacturing base for new materials and energy supply, a key state base of grain commodities and agricultural and animal husbandry production'. It also aimed for 'a key state of technological development and innovation, as well as a strategic area for national ecological safety'. In addition, it emphasised that these objectives must be attained in Northeast China during the 11th Five-Year Plan (2006-2010). However this appears to contradict the overall target of 'rejuvenation' in the next 10 to 15 years (2017-2022) since the Plan was

announced in 2007! In fact the achievement of the objectives by the end of the 2006-10 Plan was simply reference to the laying of the foundations for rejuvenation which had actually started from the introduction of the regional plan of 2003.

Driven by the strategy, Northeast China has accelerated its reform and development. Its economic growth has overtaken the average level of China. Between 2004 and 2006, the average annual GDP growth of the three provinces in the Northeast was 12.6%, higher than the average of 10% in the three years before the implementation of the strategy. (Xinhuanet Report, 2007).

Over the strategy implementation period, major progress was made in the reform of the ‘old’ and ‘big’ state-owned industrial enterprises which has been one of the key achievements in the revitalisation of the Northeast region. Heilongjiang, particularly, enhanced the development of its three traditional industries which are machinery, petrochemicals and food cultivating and processing. Heilongjiang’s three other major sectors energy, medicine and pharmaceuticals and timber processing. In 2006, they accounted for 95% of the total production value of industrial enterprises and in 2010 this had risen to 97% of total production value (CSY, 2006 and 2011).

By 2008, the total GDP of Northeast China was 2, 820 billion Yuan ((23,500 per capita) which is more than two times that of 2003, growing at an annual rate of 13.05%; furthermore, by 2010, the total GDP of Northeast China increased to 3,709 billion Yuan (31,000 per capita), with an annual growth rate of 18.5% from the 2003 level.

The data above suggests significant overall economic achievements across the Northeast region since the 2003 Plan was implemented however the extent to which these had anything to do with the introduction of a 'cluster' strategy requires to be investigated. This is particularly so in the case of the green food and pharmaceutical sectors since these were highlighted since 2003 as sectors (or industries) that could mutually benefit from such an approach (see Chapter One). Nevertheless despite two plans (2003 and 2007) yet another was introduced in 2009 regarding the region of the Northeast.

### 2.5 The 2009 Northeast Plan

After 6 years since the 2003 Plan the central government officially issued a document in September 2009 called '*Opinions of the State Council on Further Implementing the Strategy of Revitalizing the Old Industrial Bases Including Northeast China'* (State council document No. 33). This document aimed at enriching the revitalisation strategy and formulating new policies and measures. The document summarised the progress between 2003 and 2009, but also

pointing out that *'... if deep-rooted problems on aspects of system and structure in the old industrial bases are to be solved, the achieved results have to be reinforced and the potential for accelerated development needs to be exerted*' (p 1).

To this end, some of the measures proposed to address the problems included speeding up the merger of smaller firms into large corporations that could be internationally competitive (this strongly applied to the green food industry), improve both operational and management level effectiveness, improve both innovation and cooperation in SME's and emphasise the development of human resources. These were measures that were included in the two previous plans but the 2009 plan had re-emphasised them. But the latter went further than the two previous plans. For example there is explicit reference to the creation of clusters:

*'... enterprises are encouraged to establish cooperation relationships with larger enterprises to form industrial chains and develop to be professional, unique and competitive' (p1, paragraph 2).*

The green food industry was particularly emphasised in the 2007 Plan and this was to continue in the 2009 Plan however the latter did also emphasise the

development of the pharmaceutical industry in relation to the production of traditional medicines:

*'The advantage of abundant Chinese medical plant resources shall be given full play to develop modern Chinese medicines'.* (p1, section 1, paragraph 4).

The 2009 Plan is a document that essentially reinforces the original strategy for the Northeast region but with special emphasis on the creation of clusters, greater innovation, investment in research and the development of scientific human capital. In many respects this Plan can be seen as an attempt to re-invigorate the strategy which clearly was not progressing as fast as expected in the two previous plans. However it could be argued the first plan of the revitalising strategy in 2003 was experimental in nature while the next plans in 2007 and 2009 were more a deterministic guideline and approach to revitalisation and development. However decades of intensive traditional industrial development did affect the resource and environmental carrying capacity of Heilongjjang Province – for example some minerals are near exhaustion in parts of the Province, while water and land capacity hardly meets the economic and social requirements. These issues were recognised in the 2009 Plan but taking all three plans together not enough emphasis has been placed on resource and environmental constraints. Even though the latest plan warns that the current approach is not sustainable enough and industry

transformation has to parallel with eco-environmental improvements over the longer term. However there has been a clear emphasis for the Northeast and especially Heilongjiang Province in terms of moving towards establishing clusters of industries in a number of product ranges. In the Province this was heavily bent towards the green food and pharmaceutical industries.

So, in the period from 2003, after three plans, what has actually happened and how can we determine if such clusters have actually been developed? This will be analysed closely in Chapter Five of the Thesis – first an assessment of the impact of the plans on both industries in terms of employment, number of enterprises and various other economic data is made in the next section. It must be emphasised here however that most of this relates to the green food industry. The data availability on the pharmaceutical industry in China is not good although the author did manage to collect some along with very informative qualitative information. The reasons behind this are set out in Chapter Four. The impact of the three plans on green food in Heilongjiang is presented and discussed in terms of other Provinces in order that the developments in the former can be put into context.

### 2.6 The Development of the Green Food industry in Heilongjiang Province

Heilongjiang Province was the first which followed the central government appeal to develop the green food industry and up to the present, the green food

industry has experienced around 19 years of its development process. However it is important to identify key indicators for the industry that can be clearly and unambiguously interpreted in terms of the concept of a cluster. In order to do this first we must identify the key elements that constitute an industrial cluster (from relevant literature) and then to match these against relevant data. This enables an assessment of the true extent to which the Province really is 'prioritising' the industry as a cluster.

The discussion in this Chapter is therefore mainly of a descriptive nature – tracking if there really has been any significant development in the industry in Heilongjiang over the relevant period. Whether this constitutes the development of a cluster is left to later Chapters where we analyse and compare and contrast detailed quantitative and qualitative data with the *a priori* expectations of a 'cluster' drawn from the theoretical literature. The latter is examined in detail in the next Chapter where we can identify a number of theoretical propositions that can be tested.

The nature of any such tests, if possible at all, will depend very much on the time series available and the reliability of the data itself. However in the meantime we return to the real purpose of this Chapter – the extent to which either of these 'targeted' industries (green food and pharmaceuticals) have demonstrated any

significant developments under the three plans. The main indicators which will be used for this purpose are (over time):

- The number of employees
- The number of enterprises
- The number of product varieties
- Sales volumes/output value

This will enable a determination of the extent to which the green food industry occupies within the economy of the Province over time and to determine if the industry has demonstrated a growing trend in both quality and quantity. The collected data which will be analysed in this research is drawn mainly from between 1999 and 2010. This period is selected since it is the implementation period of China's ninth five-year plan is 1996-2000, tenth five-year plan is 2001-2005, and the eleventh five-year plan is 2006-2010 which also coincide with the three Northeast regional plans discussed above.

Where possible and appropriate, data from more recent years has been added to the primary time period above however, as alluded to earlier, there are data issues particularly in relation to the pharmaceutical industry.

**Table 2.2: 1999-20010 Heilongjiang Green Food, Agriculture Gross Output value and GDP (100 million Yuan)**

| Year | **Green food Gross output value (100 million Yuan)** | **Agriculture Gross output value (100 million Yuan)** | **Green food share of agriculture%** | **Total GDP of Heilongjiang (100 million Yuan)** |
|---|---|---|---|---|
| **1999** | 26.0 | 660.5 | 3.9 | 2,866.3 |
| **2000** | 72.3 | 625.1 | 11.6 | 3,151.4 |
| **2001** | 127.0 | 711.0 | 17.9 | 3,390.1 |
| **2002** | 150.0 | 776.7 | 19.3 | 3,637.2 |
| **2003** | 190.0 | 903.3 | 21.0 | 4,057.4 |
| **2004** | 327.0 | 1,136.6 | 28.8 | 4,750.6 |
| **2005** | 400.0 | 1,294.4 | 30.9 | 5,511.5 |
| **2006** | 476.0 | 1,391.1 | 34.2 | 6,201.4 |
| **2007** | 581.4 | 1,700.6 | 34.2 | 7,065.0 |
| **2008** | 684.2 | 1,983.4 | 34.5 | 8,178.5 |
| **2009** | 817.9 | 2,336.8 | 35.0 | 9,234.8 |
| **2010** | 929.2 | 2,639.7 | 35.2 | 10,256.4 |

*Source: Collected and organized from China Green Food website: http://www.greenfood.org.cn/sites/MainSite/

Table 2.2 illustrates Heilongjiang's green food industry's gross output value between 1999 and 2010. Prior to the first Plan the industry expanded its output value by over 150 percent per year to the year 2002 (from a very low base). Between 2003 and 2007 (the start of the second Plan) it expanded by over 200 percent and one year into the third Plan (2010) output value grew again by 60 percent (from a much higher base). Of particular significance is the share of the green food output value in total agricultural output value – between 1999 and 2010 this increased from a mere 3.9 percent to just over 35 percent.

Clearly the green food industry developed very fast during the three plan periods and this can only be interpreted as a success (in terms of the plans). However, whether it is primarily due to the development of the industry as a cluster is a very different question. We will be considering this key issue in Chapter Five. Other indicators listed above also reveal a very substantial development of the industry in terms of the number of enterprises and the number of green food varieties being developed and produced. In particular the number of varieties is consistent with the second two plans where innovation and product development were highlighted. The absolute number of different varieties of green food produced in the Province has risen from only 98 in 1999 to nearly 1200 in 2010. This would tend to suggest a major effort has been undertaken in research, development and scientific manpower in this industry – driven primarily by central and provincial government. The number of technicians and senior technicians in the industry increased from just under 7,000 in 2001 to over 20,000 by 2010. The majority of these staff are diploma and degree graduates (Heilongjiang Yearbook, various years). This degree of innovation and product diversification is certainly consistent with what we would expect from an industrial cluster in a competitive environment. On the other hand, as mentioned below, the same result could well be achieved by consolidation of existing enterprises into very large operations. The data on the number of enterprises and varieties is given in Table 2.3 below.

**Table 2.3: 1999-20010 Heilongjiang Green Food Enterprises, Product Varieties and Gross output Value (100 million Yuan)**

| Heilongjiang | | | | |
|---|---|---|---|---|
| | **Number of enterprises** | **Number of Product varieties** | **Yield of product （10,000 tons）** | **Output value (100 million Yuan)** |
| **1999** | 93.0 | 128.0 | 106.0 | 26.0 |
| **2000** | 195.0 | 165.0 | 280.0 | 72.3 |
| **2001** | 197.0 | 281.0 | 508.0 | 127.0 |
| **2002** | 221.0 | 470.0 | 600.0 | 150.0 |
| **2003** | 295.0 | 585.0 | 710.0 | 190.0 |
| **2004** | 329.0 | 712.0 | 1,100.0 | 327.0 |
| **2005** | 344.0 | 797.0 | 1,500.0 | 400.0 |
| **2006** | 398.0 | 1,028.0 | 1,836.0 | 476.0 |
| **2007** | 462.0 | 1,065.0 | 2,121.8 | 581.4 |
| **2008** | 488.0 | 1097.0 | 2,188.7 | 684.2 |
| **2009** | 493.0 | 1121.0 | 2,236.3 | 817.9 |
| **2010** | 512.0 | 1178.0 | 2,346.4 | 929.2 |

*Source: http://www.greenfood.org.cn/sites/MainSite/

These are very impressive statistics by any measure. However it is noticeable that the number of green food enterprises (in terms of growth) has slowed down considerably. This is because most of these are not strictly independent enterprises. Part of the 2007 and certainly the 2009 plans was to consolidate these into larger enterprises. In fact the majority are really production/processing units belonging to the three very large enterprises that dominate the green food industry in the Province. This was a deliberate strategy in the plans in order 'force' knowledge sharing and benefit from scale economies. However it is not, as we shall see, necessarily an expected outcome from the creation of a cluster. Nevertheless, in terms of raw growth there is no doubt this industry has expanded at a tremendous rate – especially in terms of the number of varieties.

There has also been a very impressive development in terms of green food employment in the Province as we can see in the Table below:

**Table 2.4: 2003-2010 Heilongjiang Employment by Green Food related industries (10,000 people)**

| Industry Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Total Change % |
|---|---|---|---|---|---|---|---|---|---|
| Agriculture | 827.7 | 812.1 | 804.4 | 806.1 | 789.7 | 781.2 | 779.8 | 778.2 | -5.98 |
| Manufacturing | 181.7 | 191.2 | 189.4 | 189 | 199.3 | 202.6 | 209.3 | 211.1 | 16.18 |
| Green Food Manufacturing | 5.1 | 6.2 | 6.6 | 7 | 10.5 | 12.4 | 14.7 | 16.8 | 229.4 |

*Source: Collected and organized from CSY (various years) and Heilongjiang Yearbook (various years).

There has been a fairly significant decline in agricultural employment in general in the Province between 2003 and 2010 while general manufacturing has increased jobs by just over 16 percent in these 8 years. However, the growth in employment in green food has been spectacular! From 51,000 people in 2003 to nearly 170,000 by the year 2010. This is clear evidence that the industry has indeed developed, not only in terms of output value and 'enterprise' numbers but also in terms of jobs – the latter being one of the major objectives in all three plans. Hence, in terms of employees, product varieties, output value and the number of enterprises the Province has certainly seen an acceleration in the development of the green food industry.

## 2.7 The Pharmaceutical Industry in Heilongjiang Province

As indicated earlier in this Chapter the available statistical data on this industry is not as nearly comprehensive as for the green food industry. Although the pharmaceutical industry is the 'other' industrial cluster development for the Province it is in fact more focused on the production of traditional medicines – many of which depend on the agricultural sector overall and the green food industry in particular (see Chapter One).

This and the difficulty in realising more comprehensive data is why the Thesis focuses more on the green food industry. However, it will be very clear from the data below that the development of the pharmaceutical industry over the same period has not been as successful. The reasons for this are analysed in Chapter Five. For the moment a few descriptive statistics demonstrates the lesser performance of this industry in the Province compared with the green food industry.

**Table 2.5: Sales and Output Value of Heilongjiang Pharmaceutical industry (100 million Yuan)**

| **Indicators Year** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **Total Change (%)** |
|---|---|---|---|---|---|---|---|---|---|
| **Sales revenue** | 106.8 | 110.7 | 135.4 | 165.6 | 192.5 | 205.6 | 220.7 | 236.8 | 121.7 |
| **Output value** | 99.6 | 103.5 | 120.1 | 123 | 129 | 134.4 | 141.2 | 148.8 | 49.4 |

Source: Year 2003-2010 Local Statistics Communiqué of the National Economic and Social Development Council

The first point to note is that the total output value is just under one-sixth that of the green food industry (see Table 2.3). Whereas the gross output value of the green food industry expanded five-fold between 2003 and 2010 the same indicator shows only an increase of just under fifty percent in the pharmaceutical industry. Another major contrast between the two is the employment data. Table 2.6 below shows that the pharmaceutical industry added very little in the way of jobs between 2003 and 2010. The green food industry expanded jobs by over 200 percent in the same period. Unfortunately no data could be realised concerning the number of scientific (technical) manpower added to the pharmaceutical industry in the same period. As we shall see in a later Chapter there are several reasons for such contrasts between these two industries in the Province and these may shed some light on the relevance of industrial cluster theory to these industries, particularly within the Chinese context.

**Table 2.6: Employment in the Heilongjiang pharmaceutical industry**

| **Year→** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **Total Change (%)** |
|---|---|---|---|---|---|---|---|---|---|
| Employment | 45580 | 46420 | 46480 | 46630 | 46440 | 46987 | 47105 | 48650 | 3.6 |

*Source: Collected and organized from Heilongjiang Yearbook (various years).

Nevertheless with an increase in employment of only 3.6 percent the industry has managed to increase output value by nearly fifty percent! This would tend to

suggest that productivity has been the major focus in the pharmaceutical industry rather than expansion *per se*.

However in terms of value added per employee this may not be the whole story – the figure in 2010 for the pharmaceutical industry is 102,000 Yuan but for the green food industry it is 273,000 Yuan (CSY, 2011). Therefore, even with a very large increase in jobs the green food industry has still managed to outperform the pharmaceutical industry in a very substantial manner. Again, the reasons for this will be discussed in later Chapters but for the moment these descriptive data do not suggest that industrial clusters (as theorised) are really the basis of these developments in the Province. As we will also see the qualitative data analysis also suggests a very different explanation.

### 2.8 Summary

Due to the regional revitalisation policy adopted by the central government in various plans since 2003 industrial re-organization in the Northeast was certainly stimulated, particularly in the green food industry. However, the extent to which this success in the green food industry or the pharmaceutical industry was due to the formation and encouragement of an 'industrial cluster' remains the key question of this Thesis. In order to make sense of the developments we need to critically examine relevant economic theories from which their propositions can be matched with the data. And, if possible, to test any sensible hypotheses that

can be derived from these propositions. The next Chapter will examine the relevant literature on industrial cluster theory and include an assessment of how relevant these may be to the particular case of Heilongjiang Province and the more general case of China.

# Chapter Three: Literature Review

## 3.1 Introduction

“Industrial clusters” has been a major research field in Economic Geography, Spatial Economics and Regional Economics since the 1990s. This topic has been an attractive one although the economic phenomenon described as ‘agglomeration’ or ‘convergence’ already existed 100 years ago.

Scholars have undertaken a lot of research on the theory and practice of industrial clusters and many related literatures have emerged. However, as the term ‘industrial cluster’ has been applied across several areas of economics and has also been used in interdisciplinary studies it does not represent a strict and uniform concept. Porter (1990) attempted to use the term to cover all kinds of clusters even though their origin, structure, impetus and development paths are all different from each other. It is however clear that the term ‘industrial cluster’ is primarily based in studies that can be classified as economic geography and as such represents a spatial phenomenon. This spatial dimension easily lends itself to the application of policies in regional economic development and as a development tool which treats the regional economy as the natural ‘spatial’ unit for the geographic convergence of (supposedly) interdependent corporations and institutions.

Whether this convergence is a ‘natural’ or policy induced effect is still a matter of debate but it is very clear that many Government’s have used the concept (or variants of it) as a regional development tool. This is also the case in China and particularly in Heilongjiang Province where several industries were ‘targeted’ as potential clusters of development. As we saw in Chapter Two the green food industry in the Province has developed (along several dimensions) very rapidly since it was prioritised as a cluster whereas the pharmaceutical industry appears to have lagged behind. But, as also indicated in Chapter Two, these outcomes may or may not be the result of cluster effects and even if they are we have to understand the nature of them. To do this we need to be informed of the basic theoretical premises of industrial cluster ‘theory’ and from these derive testable hypotheses (if possible) or at least theoretical propositions that can be measured against empirical data.

As is sometimes the case in economics a ‘theory’ does not have clearly identifiable precepts or even origins and it can be difficult to categorically streamline its propositions. Industrial cluster theory is certainly in this mould. As stated above it is generally seen as an economic geography ‘product’ but in fact it has roots in many strands of economic theory. This current Chapter therefore has three objectives:

1. To examine the various strands of economic literature that either focus on clusters as a concept or at least clearly have utilised the idea (even without using the term itself).

2. To draw out from these strands of literature their key theoretical 'predictions', hypotheses or propositions that can be tested (or measured, if testing is not possible) and,

3. To then derive from these a theoretical 'model' or, if more feasible, a set of propositions that *may* apply to the case of the two 'clusters' being examined in Heilongjiang Province in China.

The reason that it is not possible to be absolutely definite about the possibilities above is, as discussed in Chapter Two, because data availability especially for one of the industries, is not very good. While the data time frame has been considerably shorter than expected when the research began. As indicated earlier these particular data problems will be discussed in the Research Methods chapter.

### 3.2 Industrial Cluster 'Theory'

As said above cluster 'theory' has its roots in several economic concepts but the main lines of inquiry have essentially come from ideas that originated in the late nineteenth century and early, mid and late twentieth century. In particular from Marshall (1920), Weber (1909), Coase (1937), Perroux (1950), Krugman (1990)

and Porter (1990). In the Chinese literature on the subject (which has been much more recent) the key research has been undertaken by Wang (2004), Qiu (2008), Chen (2009), Yue (2009) and Liu (2010). The focus of the three objectives set out above for this Chapter is on these works in addition to other studies that are centrally relevant to the concept, practice and policy behind industrial clusters.

Another very important element of the literature is exactly what an industrial cluster is – because, as is often the case in economics, there is no precise definition of what would appear to be a relatively simple concept. The literature review will also critically assess the various definitions of the concept (from various authors) and how these can help in identifying a clear definition of the term as it applies in the case of China (or specifically Heilongjiang Province) since the focus of the Thesis is an examination of the development of such clusters in that Province. A key feature in the Western literature is the importance of geography – this relates to location specific advantages which enable firms to come together in a spatially concentrated focus which in turn enables knowledge sharing, labour pooling, interaction with education and research institutions and the development of innovative and 'learning' organisations. All of these elements and others are key arguments behind the formation of industrial clusters much of these being found in the so-called New

Economic Geography literature. However as we shall see in this Chapter much of this is not that new in the sense that regional economic theory has contained many of these ideas (but perhaps not so explicit) throughout the past century.

Therefore we begin with a critical review of the relevant literature in which the concept of industrial clusters is clearly present. This will examine not only theoretical precepts but also empirical studies of the phenomenon. The latter are taken from many authors which focus on specific cluster policies in specific countries, including China, and therefore we can also compare the results with the theoretical precepts drawn from the earlier twentieth century literature. The fundamental concept of the industrial cluster is often attributed to the original work of Alfred Weber therefore it is logical to begin from this point.

Alfred Marshall (1920) was the first to systemically study the industrial cluster phenomenon (but did not use the term itself), showing that enterprises were centralized in order to seek significant economies of scale. He classified the above economic phenomenon into two types: industrial development which is relative to regional concentration as well as organisation and management efficiency within enterprises. He entitled the first as an external scale economy and the second as an internal scale economy. Marshall recognized the close relationship between external scale economies and industrial clusters. He also argued that the industrial cluster is a direct result of the external scale

economies. He claimed that a high level of efficiency cannot be accomplished by the corporation which is not part of an industrial cluster. This high efficiency forms the external scale economy and therefore, accelerates a corporation's tendency to move into industrial clusters. Marshall named such areas of specialization as 'industrial districts.' He identified three advantages for the 'districts' such as: 'labour force pooling' which Combes and Duranton (2006) further demonstrated, 'information exchange' and 'technology spillover'. In the literature that appeared much later (20th and 21st centuries) all three are repeatedly identified as key outcomes of industrial clusters. The argument is that information exchange and technology spillover leads to innovation. However this argument is posited on the basis that firms 'cooperate' as opposed to compete. As we will see in a later Chapter the assumption of cooperation cannot be sustained in the case of Heilongjiang Province. Given the three 'plans' for the Province we would expect all three features of Marshall's 'industrial districts' to be relatively easily identified in both the green food and pharmaceutical industrial clusters. Labour costs and quality have been examined as crucial factors in the agglomeration of firms (Florida, 2002, Toulemonde, 2006). A key feature of 'clusters' that Marshall did not consider is the social dimension. For example Hu and Weng (2007) found that firms often tend to cluster in countries and regions that have pleasing social and economic environments to live in.

Alfred Weber first used the process of agglomerative factors for analysing the distribution of single industrial districts of the Marshallian type. In *'The Theory of the Location of Industries'* (Weber, 1909), he argued that industrial convergence could be classified into two phases. The first phase is simple scale expansion, which is the base stage of industry convergence. The second phase mainly depends on the centralizing tendency of large enterprises. Weber breaks down the development of industrial 'clusters' into four aspects. The first is the development of technical equipment which is specialized for different purposes. Many firms will share a mutual dependence on this equipment which will encourage regional centralization. The second factor is the development of a labour pool, as in the Marshall case. Weber argued that a sufficiently developed, integrated, labour pool in terms of skills and experience is essential as it accelerates industry convergence.

The third aspect is marketisation. Weber argued that it is the most important factor. Industrial clusters increase the scale of bulk purchase and sales, gain lower cost credit, and eliminate the 'middle man'. The last aspect is the ability of firms in industrial clusters to reduce common costs such as gas, water and so on. However, Weber's cluster theory was divorced from the wider social and economic environment and only made sense in terms of its simplistic distance, resource and energy sources angle. Both Florence (1948) and Losch (1954)

further explained the importance of agglomeration economies but also very much in terms of distance.

None of these authors gave any particular role to policy – yet in China's case the development of clusters cannot be done in the absence of explicit policy design. Weber's model was much more focused on firms' production function. Firms which mainly aim at cost minimizing have to consider the relationship between fixed input and output. The quantity of inputs required and output produced together with transportation costs became the major issues for cost minimizing firms (McCann and Sheppard, 2003). Rosenthal and Strange (2004), based on the Silicon Valley case, suggested that the high presence of computer-based businesses reflects regional specialization and is consistent with the localisation of economies. Lindqvist (2009) divided agglomeration into two separate components. The first component is 'agglomerations' which are high spatial densities of economic activities. The second is 'proximity effects' that affect economic activities in a way that depends upon spatial distance. He emphasized that although both are separate, agglomeration and proximity effects mutually re-enforce each other, reflecting the early work of Myrdal (1957) and more recently O'Hara (2008). This theory in terms of the 'industrial district' and its features may apply to the pharmaceutical industrial cluster of Heilongjiang province as a series of pharmaceutical enterprises are locating in the Limin

Economic and Technological Development District of Harbin which is promoted by Government.

The term ‘transaction cost theory’ was first officially mentioned in Ronald Coase’s article ‘*The Nature of the Firm’* (1937). He pointed that there are a number of transaction costs for using the market. For instance, the cost of obtaining a good or service via the market is actually higher than the price of the good. Other costs include searching for information costs, bargaining costs, keeping trade secrets, and policing and enforcement costs. These costs can potentially add to the cost of procuring something with a firm. This suggests that firms will arise when they can arrange producing what they need internally and somehow avoid these costs. In this article, he noticed that when other things are kept equal, a firm will tend to be larger because:

1. The lower the costs of organizing and the slower they increase with a rise in the number of transactions organized.

2. The less likely the entrepreneur is to make mistakes and the smaller the increase in mistakes with an increase in the transactions organized.

3. The smaller the increase in the cost of factors of production to firms of larger size.

The first two costs will increase with the spatial distribution of the transactions organized and the dissimilarity in transactions. This explains why firms tend to either be in different geographic locations or perform different functions. Additionally, technology changes that mitigate the cost of organizing transactions across space will cause firms to be larger. For example, the advent of the telephone and cheap air travel would, expectedly, increase the size of firms. Coase argued the large number of agglomerating firms would increase the trading frequency and reduce the location cost. Thus, the scope and object of transactions will be relatively stabilised and firms' transaction cost will be reduced. Meanwhile, the nearby geography will minimise information asymmetry, overcome opportunistic behaviour in transactions and save time and cost for enterprises while searching for market information, to significantly reduce the transaction costs. According to William and Yang (1995), the industrial cluster is one of the intermediate organization forms existing between markets and enterprises. William and Yang argue that the enterprises within the industrial clusters would reduce transaction costs depending on the geographical advantage and the linkage of their production. This reduction would take place through their collaboration, division of labour and relevant supporting upstream and downstream enterprises. This particular 'angle' potentially should apply to the green food and pharmaceutical industrial clusters in Heilongjiang Province as the geographical concentration advantage

in terms of either the enterprises within both industries and inter-related industries or being physically near to the natural materials related to both industrial clusters definitely reduces transaction costs.

The use of ‘growth pole’ and ‘development pole’ theories for analysing and planning the development of underdeveloped and stagnating regions has been rapidly expanding. The widespread use of the concept in regional planning is reflected in the number of publications on this topic. In the regional development plans, the main idea is to foster development (growth, employment and industrialization) in backward areas. Development would occur by implanting new industries in focal points or devoting efforts such as investment in certain areas, from which the development is supposed to diffuse to the regional at large. Most modern theories of the growth pole and development pole can be traced back to the French political economist Francois Perroux and his early work ‘*dominance*’ in 1950. The concept of growth in Perroux’s work denotes an individual plant (firm) though one which occupies an abstract economic space rather than a specific geographical space. In 1950, he described the growth pole as a firm or an industry or group of firms or industries. It is characterised by its large size, high degree of interaction with other firms, high degree of dominance and high level of innovations. These firms tend to grow at a faster rate than other related industries. According to Perroux, the aspect of dominance is important

for growth poles. A large firm or industry that is highly interactive with others and dominant in interactions is said to be propulsive. The process of development of a propulsive firm or industry is called polarization. He based the concept on the notions of external economies, agglomeration and linkages, essentially using the ideas of Marshall and Weber. An external economy exits if a change in the output of a firm or industry affects costs of other firms. External economies of scale may be negative, as in the case of pollution costs. Moreover, they may be positive, as in the case of the development of integrated circuit technology in the electronics industry (Silicon Valley for example).. Linkage is a concept developed in regional economics that could be forward or backward. If production growth in an industry stimulates production in the supplying industries then that industry has backward linkages. Furthermore, Albert Hirschman (1958) used the term “polarization” to refer to the negative impact of a growth pole on surrounding regions. ‘Trickling down’ was the term he used for the positive impact of a growth pole or growth centre on adjacent regions. The ideas behind the growth pole concept are very consistent with those examined by Marshall, Weber and Coase and all four ‘cluster’ theories tend to agree on the expected outcome – greater cooperation between firms, increasing size of firms, greater innovation, pooling a ‘skilled’ labour force and increasing competitive ability. However none of the above actually say much at all about real regions – they are highly abstract in their view of economic ‘space’ and all fail to recognise the

possibility that a region could in fact be developed through direct policy. In the 1990's the so-called New Economic Geography (NEG) literature essentially adopted many of these conceptual ideas but added the essential element of defining the 'region' in a more systematic way. The author most associated with the NEG is Paul Krugman and we now turn to this strand of cluster theory.

Krugman (1991) combined trade theory and location theory and emphasised the roles of 'self-organizing theory', centripetal and centrifugal forces and of low transit cost and concluded that high manufacturing proportions and scale within a spatially defined region are critical to forming regional convergence. This approach significantly offset Marshall and Weber's theoretical deficiencies. Yet, Krugman also emphasized the role of the internal growth of large enterprises and the market affiliation between them which could be quantified. Moreover, he admittedly neglected affiliations that result from corporate activity which is far more difficult to quantify. These affiliations include information asymmetry and technology development and diffusion. After the 1980's, there was an increasing interest in local industrial agglomeration and specialization (Martin and Sunley, 2003). Indeed, economic activities are not spread on average; rather they display strong concentrations in some locations and relative scarcity in others (Krugman, 1991a, 1991b; Porter, 1990; Rosenthal and Strange, 2004), raising questions about why and what factors lead to the concentration of industry. The

geographical literature explained the agglomeration as the geographic concentration of firms and establishments (Leahy et al, 2009).

A number of variables that can help explain the location behaviour of enterprises were identified. These variables include input costs, raw materials, infrastructure, tax levels, incentives and even weather (Arauzo-Carod and Viladecans-Marsal, 2009). Thus, economic localization arises from the benefits of intra-industry agglomeration, while economic urbanization creates benefits through inter-industry concentration (Knoben, 2009). According to the NEG literature pioneered by Krugman (1991), agglomeration economies are the centripetal force inducing the clustering of firms which results in an unequal distribution of economic activity across space. Krugman's (1991) core-periphery model which is based on labour mobility, Krugman and Venables' (1996) model is based on inter-industry linkages and Martin and Ottaviano's (1998) model is based on the R&D sector.

Other important contributions to the NEG literature were made by .Puga (1999), Ottaviano and Puga (1997) and Fujita and Mori (2005) provide useful analytical reviews of the various New Economic Geography models. The essential features of these are the degree of economies of scale, the share of consumer spending on manufactured goods, transport costs, innovation, cooperation and product diversification. All of these elements are considered to be the result of

successful industrial clusters or even successful regions. Some authors however have stressed the primary importance of innovation as an output of clustering.

Martin and Ottaviano (1998) for example construct a model in which growth and agglomeration are mutually self-reinforcing processes. The source of growth in the model is the invention of new product varieties. This is centrally important in a cluster based upon green food since it is product variety that enables the final consumer market to expand. Growth through innovation accelerates agglomeration which in turn lowers the cost of innovation leading to even more agglomeration and more growth.

Agglomeration is stronger the lower is the cost of R&D, the lower are transaction costs (a la Coase, see above), the larger is the share of manufacturing in consumer expenditures and the larger are the economies of scale in production. The model is very relevant in explaining “Silicon Valley” types of agglomerations[6]. The extent to which it is so relevant to the case of green food and pharmaceuticals in Heilongjiang is not so clear however. This will be examined later in the Thesis. Porter (1990) popularized the concept of industrial clusters. Porter developed the “Diamond of Advantage” which consists

[6] Silicon Valley is one of the largest agglomerations of high-tech industries in the world. The term comes from the region's large number of silicon chip innovators and manufacturers. Silicon Valley is located in North Carolina, the United States.

of four factors that create a competitive advantage for firms. The four corners of the diamond include factor conditions, demand conditions, industry strategy/rivalry, and related and supporting industries. Porter used this diamond to determine which firms and industries had competitive advantages. His emphasis on the importance of related and supporting industries encouraged interest in clusters.

Even though his original thesis was applied to nations as a whole, Porter recognized that the majority of economic activity takes place at the regional level. This research classified different modes of cooperation among enterprises into: cluster, network and associated stratagems. It also examined the ability of corporation's to compete. Martin and Sunley (2003) argued that Porter's cluster concept is rather intuitive. They also added that it does not add new insights to cluster identification methods, although Porter focused on the innovative aspect of competition rather than the traditional aspects such as cost minimizing.

This diamond model has been widely used by enterprises, government at all different level worldwide to investigate the organizational, national or regional competitiveness. Porter (1998) provided a general definition for two types of clusters: vertical clusters and horizontal clusters. Vertical clusters are made up of industries that are linked through buyer-seller relationships. Horizontal

clusters include industries which might share a common market for the end products, use a common technology or labour force skills, or require similar natural resources, all of which was identified by Weber in 1909. Indeed it could be argued that Porter's 'model' actually contains very little that is new to either regional economics or the NEG.

Other authors have provided a far more detailed examination of cluster types. Markusen (1996) and Knorringa and Stamer (1998) for example classified industrial clusters into three types in their research focused on developing countries. These are summarised in the Table overpage.

**Table 3.1: Three types of industrial clusters and their characteristics**

| | **Italianate** | **Satellite** | **Hub-and -spoke** |
|---|---|---|---|
| Main features | Mainly SMES<br>Strong specialization<br>Strong local rivalry and networking(competition)<br>Trust-based relationships | Mainly SMEs, dependent on external firms often based on cheap labour | Large local firms and local SMEs clear hierarchy |
| Main strength | Flexible specialization<br>High product quality<br>Innovative potential | Cost advantage<br>Skills/tacit knowledge | Cost advantage<br>Flexibility<br>Weight of large firms |

| | | | |
|---|---|---|---|
| Main weakness /vulnerability | Path dependence, slow adoption to radical change in economic environment or technology | Dependency on external actors for sales, inputs, and know-how limited scope for local activities to create competitive advantage | Whole cluster depends on the performance of few large firms |
| Typical trajectory | Stagnation/decline<br>Changing internal division of labour, outsourcing of certain activities to other locations<br>Emergency of hub-and-spoke structure | Stagnation<br>Upgrading, integration of backward/forward steps, offering complete package to external clients | Stagnation/decline(if large firms stagnate/decline)<br>Upgrading, changing internal division of labour (large firms outsource activities locally ) |
| Promising policy interventions | Collective action to shape locational advantages, public-private partnership | Typical instruments of SMEs upgrading (training at all levels, technology extension) | Partnership between large firms/business associations and public SME support agencies to strengthen SMEs |

*source: http://www.meyer-stamer.de/1999/atas.pdf

The main aspect of the above table is just how different the three ‘types’ of cluster are according to these authors. This is largely due to the fact, and explained earlier, that cluster ‘theory’ is drawn from so many different parts of economics as well as parts of geography (and other social sciences). This in turn makes it even more difficult to be unambiguous in the determination of sound theoretical predictions (or propositions) and therefore testable hypotheses in this subject area.

All of the above ‘theories’ of clusters however do identify key elements, as mentioned above, that should be looked for in the identification of a cluster – such as labour pooling, innovation, product variety, economies of scale and knowledge sharing between firms. However if we turn to some of the empirical literature on this subject we again find a great deal of ambiguity. Mytelka and Farinelli (2000) classified industrial clusters into three types based on the inherent relation within the clusters using specific examples from Ghana, Nigeria, Pakistan, Denmark and Italy. Their findings are rather disappointing in the sense that there is no clear pattern which emerges that can easily be linked to their classification, or that of Markusen (op cit) or Knorringa and Stamer (op cit) or even that of Porter (op cit). Mytelka and Farinelli utilise a wide range of ‘indicators’ to determine the type of cluster and then to determine if it is actually performing as a cluster as per the expectations to be found in most of the theoretical literature discussed above. Roelandt (1999), Jay-Mitra (2003) and Andersson (2004) also offer varied expositions of industrial cluster classification, function and but these are easily subsumed within the classifications given in the Table above. The empirical findings regarding classification and performance of clusters however are rather contradictory as can be seen in Table 3.2 below.

**Table 3.2: Type of clusters and their performance**

| Types | Spontaneous clusters | | |
|---|---|---|---|
| | Informal clusters | Organized clusters | Innovative clusters |

| Examples | Suame Magazine (Kumasi, Ghana) | Nnewi (Nigeria) Sialkot(Pakistan) | Jutland (Denmark) Belluno (Italy) |
|---|---|---|---|
| Critical factors | Low | Low to medium | High |
| Size of firms | Micro and small | SMEs | SMES and Large |
| Innovation | little | High | Continuous |
| Trust | little | High | High |
| Skills | Low | Low - Medium | High |
| Technology | Low | Low - Medium | Medium |
| Linkages | Some | Some | Extensive |
| Cooperation | Little | Not sustained | High |
| Competition | High | High | Medium to High |
| Product change | Little or none | Some | Continuous |
| Exports | Little or none | Medium to high | High |

***Source**:http://scholar.google.com/scholar?q=lynn+mytelka+and+fulvia+farinelli+2000&hl=zh-CN&lr=&um=1&oi=scholarte

Centrally important elements such as cooperation, product variety and linkages vary tremendously between the types of clusters. In particular the 'organised' clusters (by policy) show that the firms tend to be SME's which are not well known for benefiting from significant economies of scale (see above), although innovation is high but cooperation is not long lasting. There is only 'some' development of products and both the application of skills and technology is low to medium. If these features are typical of policy induced clusters then we should observe them in the Heilongjiang green food and pharmaceutical industries if these clusters follow the same pattern.

Some scholars believe that the concept of industrial clusters is very complex and confusing, even though they have conducted detailed comparative studies (for example Martin and Sunley, op cit.). Within those definitions various studies (Henderson, 1986; Van der Panne and Van Beers, 2006; Boshuizen et al., 2009) attempted to identify whether the Marshallian or Jacobian effect is stronger. However, the results were often inconclusive (Beaudry and Schiffauerova, 2009). UNIDO (1995) believed that industrial clusters were a geographical concentration of the enterprises which have a series of identical or similar products within an industry.

The OECD (1999) described clusters as the network based on the value of a product chain which links together the enterprise, knowledge institutions, intermediary agents and customers. Enright (1996) pointed out that regional agglomeration and industrial clusters were close to each other in location. Swann and Preveze (1996, 1998), first, defined industrial clusters as an enterprise group of an industry within a specific geographic area and thereafter, expanded the definition into enterprise groups of relevant industries. Furthermore, Rosenfeld (1997) emphasized that the geographical closeness and interdependence of enterprises would create synergistic effects on their own.

Feser (1998) pointed out it would make it more competitive under the social relation with interrelated and mutually supportive industries. Roelandt and den Hertog (1999) emphasized that industrial clusters were based on the value chain linked through production networks. Leahy et al (2009) explained that they are a part of a production chain which also forms groups of interrelated companies. Rosenthal and Strange (2004) provided a large body of empirical evidence on agglomeration economies offering a more categorical description of agglomeration dependent upon dimension and scope, including industrial, geographic and temporal activities.

Porter (1998) stressed on the commonness and complementarily of enterprises of a specific industry with geographical proximity. He also defined and classified industrial clusters in his article (2000) in terms of competition and cooperation of enterprises as well as improvement of regional and national competitiveness. Simmie and Sennett (1999) introduced the concept of ‘innovation clusters’.

They claimed they were a series of related industries and service enterprises with high collaboration under the same market environment which is linked by the product chain. Van den Berg et. al (2002) believed that industrial clusters are professional organisations and local networks for goods, services and

knowledge exchanging. Crouch and Farrell (2001) pointed out the concept of ‘industrial clusters’ had been expanding, which means it is not restricted to a specific area as long as the location of similar businesses is close to each other. Although the definition of ‘industrial cluster’ has not been clarified, the ‘cluster’ characteristics of spatial agglomeration, enterprise interaction, infrastructure sharing, specialised division of labour, labour ‘pooling’, innovation, product diversification, ‘learning’, cooperation and specialization and local networks have been widely recognized and accepted. In the China context characteristics such as ‘cultural embedding of social behaviour’ have been stressed by Song and Liu (2006). This is particularly relevant since, in all of the above ‘western’ literature it is rare that social norms or culture are discussed. This is rather surprising given that so many of the authors put a lot of stress on firm cooperation, knowledge sharing and trust. If the ‘culture’ does not support these elements then a cluster is unlikely to either develop or be successful.

The classification of industrial clusters has been very complicated because scholars have different views and focus. Based on previous research, Liu Qingshan (2009) summarised and classified the types of industrial clusters. He also pointed out that industrial clusters have been mainly categorised by approaches. For instance, Markusen’s theory (1996) which was discussed in the previous section classified them by Italianate, Satellite and Hub-and – spoke.

According to the transaction cost view, they are classified by pure agglomeration, industry complex and social networks. Furthermore, the structure of a cluster has been classified by market-based, vertebral and complex network industrial clusters. Based on the industrial related degree of location advantage, they should be classified by vertical, horizontal and location directed industrial clusters.

In addition, classifications by industrial type, degree of FDI involvement, the causes of cluster formation and the nature of industrial clusters have been introduced in Liu's study. The recognition of industrial clusters includes identifying, classifying, and determining their boundaries. Jianhua and Shujing (2009) believe that the division of labour (specialization) and linkages are fundamental to recognize industrial clusters. This recognition will be shown in terms of identification of standards, agglomeration and cooperation levels, innovation capability and performance evaluation.

Wang and Hou (2008) on the other hand utilised what they claim to be the main measurement tool for identifying the agglomeration level of industrial clusters which is the 'Location Quotient (LQ)'. They also used it to carry out an empirical study on the auto industry in China. The use of the LQ to identify a cluster is problematic in that it tends to be a very blunt tool – on the other hand, given the

range of ‘indicators’ of clustering identified from the above literature, if the data on the latter is simply not available (and it is often not available, especially in developing countries), then the LQ is at least telling us that ‘related’ firms are spatially concentrating or they are not. As we shall see in the next Chapter this is precisely the case in China – even the qualitative data generated for this study was incapable of providing much useful information on these indicators. And the quantitative data, in many cases of these indicators simply does not exist.

Puga (1996) points out that international trade and FDI have created industrial clusters in some developing countries. For instance, it created the information technology (IT) industrial cluster in Dongguan (Guangdong Province) of China. In the Chinese literature on the subject this formation of industrial clusters has been described as ‘external power-driven’ and has also drawn attention from several Chinese scholars (Wang Jici, 2001; Zhu Huasheng 2006; Liu and Chen 2009). Chen and Wu (2005) showed that, primarily due to regional clustering, between 1988 and 1998 regional growth disparities increased significantly across China – although they do not actually classify them as per Table 3.1 above or any other classification.

Some researchers argue that the nature of industrial clusters is a ‘bundle’ of knowledge collection which agglomerated during an industry’s development

process (Lu 2009). Others tend to explain industrial clusters from the ‘innovation network’ and ‘knowledge spill over’ perspectives (Belussi, 2006). Beers (2006) showed that localised economies favour innovativeness in the Netherlands. Due to the growing complexity of the innovative activities, diffusing of tacit knowledge has been restricted by distance. Thus, geographic proximity has become the key motivation which forms agglomeration (Baptista and Swann, 1998). Hence, ‘agglomeration’ has become the new special area for collective learning and innovating (Capello, 1999).

It is argued, in Western and Chinese literature that industrial clusters enhance the overall regional economic competitiveness. Studies by (Porter, 1998, Maskell, 1995, Shen, 2008, Wu, 2009) investigated the important role of industrial clusters for improving regional economic development from aspects of regional competitiveness, knowledge spill over, increasing return to scale and the coupling effect of industrial cluster and regional economic development. Arauzo-Carod and Viladecans-Marsal (2009) reported that localization economies have positive effects on new firms in all industries while urbanization economies (as per Marshall) only have positive effects on new enterprises in technology industries.

Secondly, industrial clusters improve the regional brand (Chen, 2006; Tu, 2008; Zhang and Yang 2010). Therefore, regional competitiveness and regional brand effects arising from industrial clusters become an important external pull that attracts firms to clusters. Liu and Lin (2008) focus on the internal mechanisms that should be expected to be found within firms that are part of clusters. They classified these into: complementary mechanisms of specialization; culture mechanisms and cooperation and competition based on trust, transaction costs, technology spill over, knowledge sharing and innovation. In an earlier paper Liu (2007) pointed out that the cooperation between enterprises of clusters can be presented as synergistic competition and described this as ‘co-opetition’. Dai and He (2008) constructed a mathematical model of relations of competition and mutual benefit between enterprises, based on a biological population theory. They emphasized that members of industrial clusters which have competitive relationships must keep a certain level of difference.

However, members who have mutual beneficial relationships to each other must maintain keen competition. Thus, in their research they largely agree with the views of Liu and Liu and Lin (op cit). A significant number of other studies (both Western and Chinese) have emphasised that interactions between enterprises that are part of a cluster need to be based on mutual trust (see Granovetter, 1985; Banks, 2000; Lorenzen, 2002 and Becerra, 2003). Wei et. al (2008)

however put much greater emphasis (in the Chinese context) on what they term the 'learning process' and classified learning mechanisms that *should* exist into three different levels: the first level is the interactive learning process between core members of industrial clusters (human resources flowing between member enterprises; cooperative interaction between enterprises; and informal communication, normally culturally determined). Most of the literature on learning in the local environment has highlighted the mobility of qualified labour as an important mechanism of knowledge transfer (see Saxenian 1991; Keeble et al. 1999; Capello 1999; Feldman 2000; Capello & Faggian 2005) and Wei et al strongly argue this is very important within Chinese industrial clusters as well as those in Western economies. The second level is the knowledge flowing process from an assisting (or support) network to the core network of industrial clusters (public services and agents offering technical knowledge and information support to member enterprises of the clusters). We know that this was given particular emphasis in the Third Plan for industrial clusters in Heilongjiang Province (see Chapter Two). The third level is another knowledge flowing process but directly linked to the training and education base generally within a cluster's 'catchment' area. Here again this was given a lot of emphasis in all of the three plans for Heilongjiang Province. It is very clear that both the Western and the Chinese literature on industrial clusters is in broad agreement of the key elements one should expect to be demonstrated by industrial clusters. It is also

very clear that the plans developed specifically for Heilongjiang Province have indeed explicitly recognised these. Another aspect of ‘cluster enterprise—government’ interaction is the ‘innovation environment and innovation system’ within which a cluster’s firms are operating. The GREMI research group (Groupe de Recherche sur les Milieux Innovateurs), a European Research Group on Innovation Management, argues that one of the fundamental requirements of a regional innovation environment is promoting enterprise agglomeration. This has also been explicitly recognised in all three of the Provincial plans of Heilongjiang principally with the objective of improving efficiency by addressing market failures such as monopoly, unfair competition, low efficiency of resource allocation and non-cooperative business strategies. However as (Liu et, al, 2010) point out while government may take the initiative to establish the industrial clusters if ‘plans’ are only passively implemented then all of the above elements we should expect to see are very unlikely to materialise.

This is supported in the work of Adylot (1985), Dodgson (1993) and Freeman (1991). Both Canagni (1991) and Lawson (1999) further argue that the ‘collective learning’ process essential to successful clusters must involve government agencies, universities, research institutions as well as cooperative enterprises. But they argue that this requires government to design a set of

effective systems and mechanisms for cultivating and strengthening the innovation environment through the 'collective learning' process. Gai (2008) adds that in addition to these 'soft' systems it is also a requirement for successful clusters that government establishes effective regulations and efficient infrastructure to enable the cluster to develop. A key function of industrial clusters is to improve regional economic growth and in particular increase employment within the clusters which have been targeted for development. We are now in a position to summarise the key elements that the various theories tell us should be evident in industrial clusters. From these we are able to derive specific hypotheses and specific theoretical propositions which may be amenable to testing depending on data availability[7]. This is presented in the next Chapter.

[7] As indicated in Chapter Two for a number of reasons the expected data availability for some of the research questions has turned out to be rather disappointing.

# Chapter Four: Theoretical Perspectives

## 4.1 Introduction

The previous Chapter examined the focus of the key literature on industrial clusters from the work of Marshall to Weber and on to the 'modern' approach of the new economic geography arguments (NEG). In this Chapter the focus moves specifically to the detail of those theories that emphasise the importance of spatial agglomeration in the regional development process. This is important since the very basis of cluster 'theory' is derived from the fundamental concept of agglomeration economies.

It is also important because regional development policy in China or anywhere else for that matter must be informed by an understanding of the agglomeration and, just as important, by an understanding of what a 'region' actually is. This Chapter therefore lays the basis for the development of a set of hypotheses and propositions that can be reasonably applied to the regional policy initiatives that have championed the idea of industrial clusters in Heilongjiang Province as discussed in Chapter Two. Although the Province itself is defined in

geographical space we first need to establish the meaning of a region from a variety of perspectives.

### 4.2 Defining a Region

A region may defined in terms of a set of unique geographical, ecological, cultural and economic characteristics that make it ‘different’ from other parts of the world, other parts of a continent or other parts of an individual country. For example Sub-Saharan region of Africa is often identified as unique in terms of its slow pace of economic development compared with many parts of the world. The region of South East Asia is often separated from Asia as a whole in terms of its economic growth performance (the so-called Asian ‘tiger’ economies’) and within countries we often refer to the ‘North-East’ in England, the Basque ‘region’ in Spain and the ‘Western region’ in China in terms of being palpably ‘poorer’ than other parts of these countries. Regions may also be identified in terms of language or local cultural norms that are somewhat different from the country they are part of. They are most commonly defined however in terms of administrative ‘space’ (see Vanhove, 1999). This ‘space’ may or may not follow geographic contours but generally will not deviate too much from them. A useful definition of a ‘region’ is given by Perloff, it is:

> *'… a group of geographically contiguous areas which have certain common or complementary characteristics or which are tied by extensive inter-areal activity flows '.*
>
> [Vanhove, 1999, p. 133]

The key idea here is that of 'inter-areal' activity flows between contiguous areas. In other words, a collection of localities that interact to generate economic exchange and activities that in totality define an economic 'space'. [8]

Hence it will often be the case that a geographical definition will rarely match the economic concept of a region. There are several definitions that are primarily geographical but may not be an economic region in the sense of Perloff – these include administrative systems such as at the level of the State or Province, the county, and cross border 'regions' such as the EU, ASEAN or NAFTA. A region can also be defined as functional (operational) as well as administrative (political). Functional regions are regions that are homogeneous relative to a specific characteristic such as a coal region, a diamond region or a tourism region.

[8] This economic 'space' may cover several thousand square kms but will not necessarily conform to the administrative 'region' in which it takes place.

The key point, however a region is defined, is that it is usually understood in terms of the common activities that take place and primarily this is in terms of economic activities. In other words a region can also be viewed as a physical area, whether administrative or not, where the common and complementary economic activities are so obviously evident that it represents a physical space where agglomeration processes have already taken place or are in the process of taking place. That is where industries, businesses and labour have concentrated such that it can be called a 'cluster' in the sense discussed in Chapter Three. The fundamental theoretical question then is how does this agglomeration process happen and at what scale can we claim that a cluster has actually emerged?

### 4.3 Spatial Agglomeration

As discussed in Chapter Two the implementation of regional development policy is often driven by a number of motivations – economic, political, security and social considerations. However Williamson (1965) argues that regions within nations do not possess equal capacity for growth and hence 'policy' may not in itself be capable of achieving what a regional economy cannot achieve itself. The Williamson argument is relatively simple: when growth first appears in one region 'the north' for example, due to a random event (eg discovery of oil) the absolute differential between this region and the 'south' increases. Even if both

regions grow at the same rate after the event the regional differential will persist and may even increase leading to greater regional divergence. This will inevitably lead to disequilibrium, particularly in labour markets since labour will begin to migrate to the improving north region. This in itself is not an issue if the south already contains surplus labour however such migration according to Williamson will tend to be highly focused on skilled workers, the better educated and even firms and entrepreneurs – in other words human capital stock improves in the north but is depleted in the south. In turn capital itself will move north where investment opportunities are being created and hence differential returns to capital between the south and the north become even greater. The agglomeration processes involving firms, labour and finance capital are also very likely to induce Government to divert more resources to the north for infrastructure development- roads, rail, telecommunications, education and health care – since these will be a key requirement for the north to continue to 'boom'. The Williamson 'model' of regional inequality arising from agglomeration effects is very much in accord with the classic Myrdal theory of cumulative causation in which unequal initial endowments will inevitably lead to agglomeration in certain regions while other will lag behind, perhaps permanently.

However, where Williamson differs from Myrdal is in the long term outcome. The former argues that since the poorer region (the south) is also growing though not as fast, as the development process proceeds, counter effects will develop to reduce the gap between the regions. Wage differentials between skilled and unskilled labour in the north will decline with a tighter labour market as unskilled wages rise. This will encourage unskilled labour from the south to migrate since the costs no longer outweigh the benefits. At the same time scarcity of skilled labour in the south will raise the wage premium for such workers and fewer will be tempted to migrate north. In addition it is also very likely that those skilled workers who already have relocated to the north may find their home (the south) now more attractive and migrate back again. Williamson also argues that this process is likely to be mirrored by firms and finance capital as they begin to see the location specific advantages of the north diminishing relative to the south. This in turn could lead to infrastructure now being targeted in the south. The result of this agglomeration process over time is the theoretical existence of an inverted U shaped curve in terms of regional development in the case of a two region framework.

The Williamson framework therefore postulates regional convergence over time where lagging regions will ‘catch up’ with regions that have gained an initial advantage. Lessmann (2011) using one of the widest data sets used in

cross-country studies on regional differentials supports Williamson's (1965) hypothesis that regional divergence follows an inverted U-shaped pattern implying a significant degree of convergence.

The 2009 World Development Report also supports the Williamson hypothesis by arguing that the evidence suggests that infrastructure investment reduces the economic 'distance' between production and markets. The argument here is that distance is not measured in kms but in accessibility to labour, consumers, capital, other firms and information. As the 'economic' distance falls labour mobility is enhanced and agglomeration economies of scale and scope can develop without negatively affecting weaker regions significantly. This shorter 'distance to density' effect also enables faster communications, technology spillover and the formation of industrial clusters. Spatial agglomeration therefore occurs as a result of initial conditions that are very different between regions (or even within a region) but will lead economic convergence (eventually). This process will in turn generate the development of specialized clusters which drive forward the competitiveness of each region and therefore the national economy. The Williamson argument however has some serious weaknesses. The 'model' does not fully explain exactly what type of 'event' or positive 'shock' is required to propel the 'north' forward. It is not clear that any such event will necessarily be positive anyway. For example such an event may prove to be a resource 'curse'

leading to currency appreciation for the country which in turn produces the classic 'dutch disease' phenomenon (see Collier, P. 2008). This means even if the 'north' benefits there is no guarantee that the 'south' will actually keep growing if it is already export dependent or import dependent. Hence 'catching up' will be a far longer process. In addition it cannot be assumed that the initial conditions in two regions (or more) will be close enough to enable catching up after one of them gains an advantage. This leads us to require other explanations for agglomeration which are less rooted in standard development economics or regional economics as exemplified by Myrdal and others.[9] In the early 1990's some economists began to turn their attention to issue of globalization and within this context developed the so-called New Economic Geography. Initially the theories developed here were intended to explain the globalisation process but in fact soon became recognised as providing new insights into the process of agglomeration itself. These provide theoretical perspectives where geography itself becomes the core vehicle for understanding agglomeration processes at the global, national and even the locality level.

## Natural Resources and Factor Endowments

[9] The Williamson model is quite typical of a group of theories on this subject that are highly similar – for example Todaro's migration model (1971), Myrdal's cumulative causation (1957) and Lewis' economic dualism (1954) although these do not suggest convergence in the long run.

In economic geography and neoclassical economics the 'concentration' forces leading to agglomeration result directly from initial differences in natural resource endowments and in capital and labour endowments respectively.[10] These enable a better endowed 'region' to gain a comparative advantage than less well-endowed regions within the same national economy. Natural resources in this context do not simply mean oil, coal etc but also climate – for example a harsh climate is not conducive to economic development unless huge capital investments can be made to offset the climatic and living conditions. The comparative advantage gained then leads to higher income levels and higher employment opportunities in the endowed region.

This is commonly described in the literature as 'first nature geography' where a key determinant of agglomeration is the physical availability and ease of access to useful natural resources. However this in itself is not sufficient to explain agglomeration since there is little explanation of how and where differential labour and capital endowments come from in the first place. Indeed there is no obvious reason why we should expect economic activity to closely match the distribution of natural resources across regions or across countries and

[10] However both of these may be restricted by policy itself. The Hukko system in China enforced since 1953 and partially relaxed since 2001 is an example of man-made barriers to labour mobility. Through linking the place of residence with access to consumer goods, employment opportunities and social protection, it is one of the main factors perpetuating China's regional disparities.

continents. For example Silicon Valley is not there because of silicon! It is there because other factors are far more important in driving the agglomeration process and producing industrial clusters. This is the argument put forward by Krugman (1991) and others and is now referred to as 'second nature geography'. In Chapter Three a number of key authors were cited in reference to the concept of industrial clusters and we now turn to the theoretical framework put forward by these authors in some detail. There is much similarity between this and the work of Williamson, Lewis and others.

### 4.4 New Economic Geography Models

According to the NEG literature pioneered by Krugman (1991), agglomeration economies represent a centripetal force that *causes* the clustering of firms. This is what generates the unequal distribution of economic activity across space even where regions have very similar natural characteristics. Therefore 'first geography' explanations are not necessary. Krugman also argues that regions which can be defined to have identical natural as well as technological characteristics are likely to become very different in terms of outcomes as measured by income. There are many NEG 'models' however those that encapsulate the key features of this theoretical perspective are Krugman's (1991) core-periphery model (based on labour mobility), Krugman and Venables' (1995) model and Venables' (1996) model both of which are based on

inter-industry linkages. A further contribution to the NEG approach is that taken in the Martin and Ottaviano (1998) model which is based on the role of the R&D sector.[11]

**Krugman's Core-Periphery Model**

The processes that underlie the development of agglomeration and thus the development of industrial clusters according to Krugman (1991) are threefold: transport costs, economies of scale and the share of manufactured goods in consumer expenditure. Krugman develops a 2-region model in which the two-region country becomes differentiated into an industrialized 'core' and an agricultural 'periphery'. There are 2 types of goods produced by each region, agricultural goods and manufactured goods. Agricultural goods are assumed to be homogeneous, produced under constant returns to scale, are sold in perfectly competitive markets and transported costlessly. Manufactured goods are differentiated, produced under increasing returns to scale, sold in a monopolistically competitive market and are expensive to transport.

[11] Other useful contributions to the NEG literature are Baldwin and Rikard (1997), Puga (1999) and Fujita and Mori (2005).

Krugman further assumes that in agriculture labour is the only input, peasants are immobile since agriculture is tied to land while manufacturing workers can move freely since manufacturing production can be located in either region. And because agricultural goods can be transported costlessly the price of agricultural output and hence the earnings of peasants will be the same in both regions. Three 'drivers' determine the agglomeration process in this model: manufacturing transport costs, the degree of economies of scale in manufacturing and the share of consumer spending on manufactured goods. Combinations of these drivers will determine whether regional divergence takes place. Although the Krugman model is mathematically detailed the fundamental theoretical predictions can be simplified as follows:

1. Weak economies of scale combined with low consumer spending on manufactured goods and high transport costs will cause manufacturing firms to be dispersed, not to agglomerate.

2. Strong economies of scale but high transport costs will lead to equal distribution between the two regions (assuming their natural endowments are the same).

3. If the share of spending on manufactured goods rises in one region and transport costs are high and economies of scale become stronger then population will begin to concentrate (migrate) and then the regions will diverge.

In the case of (3) above higher concentrations of manufacturing firms will bid up the wages of workers and thus attract workers to this region and this in turn creates a larger 'home' market in this region. This then gives location specific advantage and more firms will be attracted – hence the agglomeration process becomes self reinforcing. The region where manufacturing and workers are concentrated becomes an industrial core while the other region becomes a "periphery" that supplies the industrial core with its agricultural requirements. The key prediction of the Krugman model is that there is a critical level of transport costs above which dispersed production is the stable equilibrium (high transport costs discourage agglomeration) and below which dispersed production becomes the norm and the stable equilibrium.

This approach to explaining agglomeration and eventual clustering can be criticised on a number of fronts. First, it is not particularly new in the sense that it contains most of the arguments of Williamson's 1965 theory as well as the key concept of circular (and cumulative) causation from Myrdal (1957). Although a

‘stylised’ model it nevertheless contains very untenable assumptions such as the total immobility of agricultural labour – this has never been materially true of any economy. In addition the focus on transport costs ignores the role of the State in reducing these through infrastructure investment. The model also ignores positive externalities that are very difficult to ‘model’ such as cultural and social norms that may be very powerful in restraining non-agricultural labour mobility as well as political constraints (such as the Hukko system in China). The role of knowledge and technology spillover effects is completely missing from the Krugman model yet both of these are strongly evident in the theoretical literature in Chapter Three. Also, they are widely accepted as key drivers of economic growth (see Romer, 1986). Finally the model has nothing to say about the location decisions of specific industries (this is true of all NEG models) and therefore is less informing than some of the less well known theoretical arguments discussed in the previous Chapter.

The key elements of the 1991 model are applied by Krugman and Venables (1995) and Venables (2001) to show how globalization/inter-regional trade affects inequality between nations and regions. In these models the focus is on inter-industry demand and cost linkages as the forces behind agglomeration. Again the critical factor constraining agglomeration is argued to be high transport costs and immobility of labour. In fact both of these models suffer from the same

problems as those of the 1991 model. They also make the same prediction as Williamson – that the 'core' region will eventually lose to the periphery region as labour costs are driven up in the core. As we shall see later in the thesis there is no evidence of this process in China – in fact the opposite continues to be the case. This raises another very important criticism of NEG models: they do not provide any indication of time scales for the agglomeration and 'de-agglomeration' processes they attempt to explain. This suggests that a national or even global economy will either be in a 'dispersed equilibrium' in terms of the spatial distribution of production or in an 'undispersed equilibrium'. It says nothing at all about the inter-temporal equilibrium distribution of production and this is a major weakness of NEG theory.

Martin and Ottaviano (1998) construct a model in which growth and agglomeration are mutually self-reinforcing processes. Unlike the above models the source of growth in the model is the invention of new product varieties. Growth through innovation spurs agglomeration of economic activity which in turn lowers the cost of innovation leading to more agglomeration and more growth. The driver of innovation and growth is the R&D sector and the mechanism through which agglomeration occurs is a circular causation process similar to that of Krugman and Venables. The central argument by Martin and Ottaviano is that firms in the R&D sector use differentiated goods from

imperfectly competitive industries as their only inputs to the creation of new product varieties thus if R&D firms were to agglomerate, the industries which already have the incentive to concentrate because of increasing returns to scale would be drawn towards the location of the concentrated R&D firms. They do this to take advantage of the presence of a large market, this in turn lowers the cost of R&D because transaction costs would be reduced leading to more agglomeration of R&D activity followed by more agglomeration of industrial activity.

Martin and Ottaviano begin with an initial condition in which two locations are identical and assume no inter-locational labour mobility and no intra-industry vertical linkages. According to this model of agglomeration as long as the economy is growing (which takes place if the return to R&D is high enough), the only stable equilibrium is one in which all innovation activity and most of the industrial production is concentrated in 1 location[12]. Agglomeration is stronger the lower is the cost of R&D, the lower are transaction costs, the larger is the share of manufacturing in consumer expenditures and the larger are the economies of scale in manufacturing production. As in Krugman's (1991) model, agglomeration generates spatial divergence in income levels, thus economies grow richer but more spatially uneven as innovation takes place. The model is

[12] The authors exclude the core-periphery cases of full agglomeration of industrial production due to the presence of centrifugal forces in the form of inter-locational price differential of immobile factors. Less than full agglomeration is closer to reality where full agglomeration is rarely observed.

very relevant in explaining “Silicon Valley” types of agglomerations[13]. The Martin and Ottaviano model also suffers from similar criticisms to that of Krugman and Venables but with the added complication that they are not able to explain why innovation should initially take place in any given location. This is a serious problem since as most authors who have examined industrial clusters and agglomeration have shown the role of innovation is fundamental (see Chapter Three). Why it should occur somewhere specific or within certain industries is simply not addressed in the NEG models.

### 4.5 Urbanization as an Alternative Explanation

The process of agglomeration of industry leading to industrial clustering is clearly a complex one and still not well understood. The NEG models, the original work of Marshall and others have so far failed to set up completely unambiguous predictions that can be tested easily. However an alternative approach to the agglomeration process is that provided by Jacobs (1969). He argues that it is not regions per se that we see agglomeration processes but in fact it is much more clearly understood as a result of urbanization – not a cause of concentration of populations. The Jacobs argument postulates that knowledge and technology spillovers, knowledge sharing and all the other elements to be found in the later studies of clustering actually come from

[13] Silicon Valley is one of the largest agglomerations of high-tech industries in the world. The term comes from the region's large number of silicon chip innovators and manufacturers. Silicon Valley is located in North Carolina, the United States.

diversity and not from specialization. These spillovers are external to industries, not internal and they generate firm and economic growth through learning *between* different industries. The fundamental idea is that very different industries and products can give rise to innovation in a whole range of other industries simply through already being diversified but existing within the spatial context of the city, not the region. Jacobs therefore concludes that diversity of knowledge is greatest in cities which are more amenable (due to size) to creating interactions and driving new ideas. It could also be argued that the same idea lies behind Romer's notion of the 'flow of knowledge' increasing as communications improve so much that the very notion that 'distance' or distance related costs are important is no longer valid. Firms that are thousands of miles away from each other can still benefit hugely from this flow of knowledge. Returning to Marshall he argued that agglomeration of industry is a function of industrial concentration forces (localisation, leading to specialisation, see Chapter Three) whereas Jacobs rejects this by arguing the real cause of agglomeration is actually urban centres that have diverse types of industry.

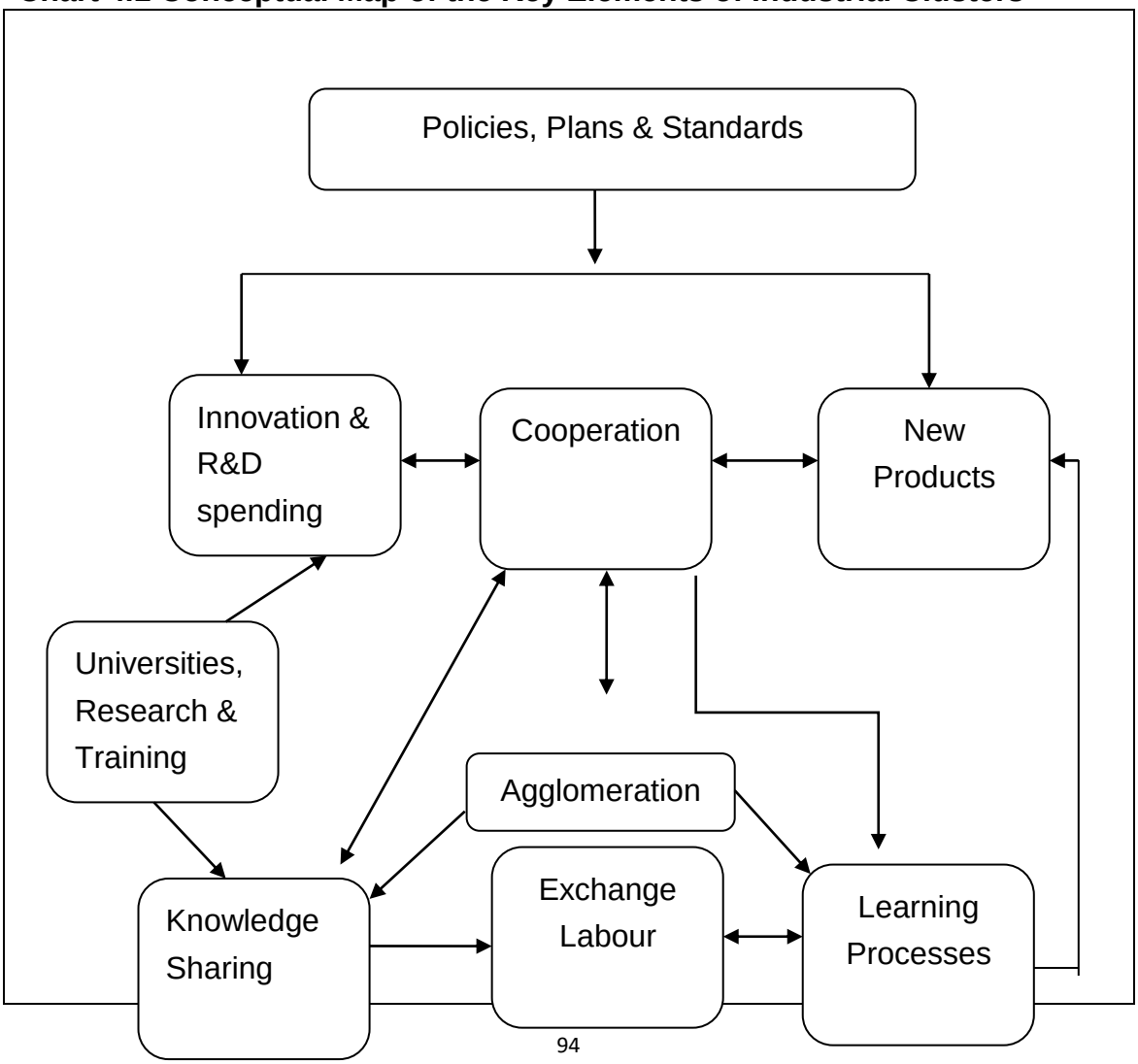
This 'debate' is highlighted in the work of Knoben (2009) in which he shows that both 'approaches' lead to very different types of agglomeration. On the one hand for Marshal Localisation economies arise out of the perceived benefits of intra-industry agglomeration while for Jacobs urbanization economies arise out of inter-industry agglomeration. Both of these theoretical positions, the Myrdal

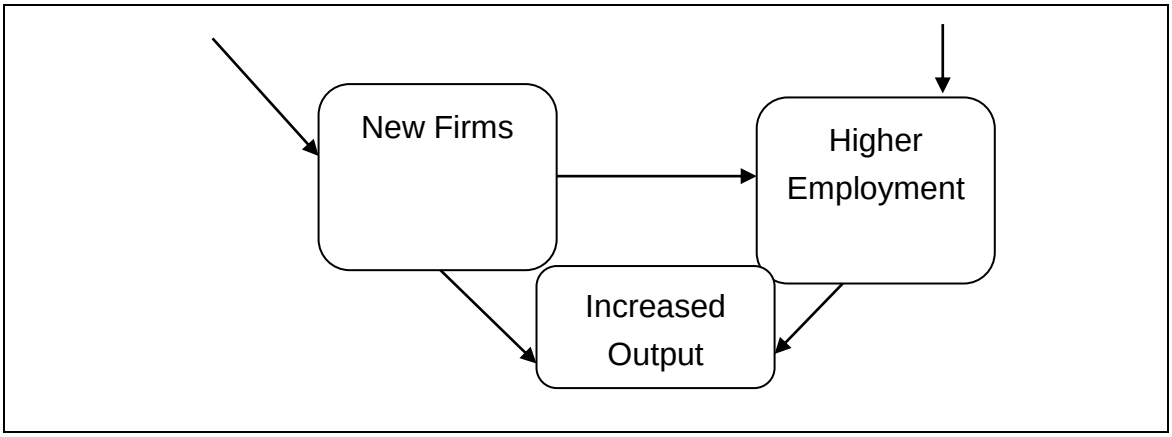
framework and the work of Williamson were developed well before the advent of the NEG models. The latter have provided some insights to the agglomeration process but not to the extent that they have revolutionised the subject by any means. Where does this leave our understanding of industrial clusters which are a highly focused type of agglomeration? We can identify from cluster theory (Chapter Three) and from the predictions of the above models a definite number of theoretical propositions that can be examined. This is done in the next section.

### 4.6 Key Elements of Cluster Theory

From the examination of the literature in Chapter Three (both Western and Chinese) and the discussion above a number of points can be drawn out from which it ought to be possible to derive several hypotheses or propositions that can be considered in later Chapters. This requires first a careful exposition of the theoretical framework from which the hypotheses can be derived. This is done using a conceptual 'map' (below) which highlights all of the key elements the literature and NEG models repeatedly emphasise and which are generally agreed whether from Western or Chinese sources. The conceptual map enables the application of a reasonable logic in order to extract potential hypotheses or propositions. Consider the elements represented in Chart 4.1 over-page.

**Chart 4.1 Conceptual Map of the Key Elements of Industrial Clusters**






From Chapter Two we know that the various plans for Heilongjiang Province most certainly emphasised the implementation of specific cluster plans, local policies and the importance of achieving quality standards in both green food and pharmaceuticals production. As several authors have emphasised such a framework is essential for the future of clusters. But within the clusters themselves both Western and Chinese literature have identified a large number of 'variables', 'elements' or 'outputs'[14] that we should expect to observe in successful clusters. The literature analysis above has repeatedly shown that the most commonly cited 'elements' are those presented in the conceptual map in Chart 4.1. – there are ten of these that repeatedly appear in both the theoretical and the empirical literature. The connectors shown in the 'map' are to some extent arbitrary since not all the theoretical or even empirical studies agree on the direction of the relationships between them. It is also clear that some elements are *more* connected than others.

[14] In the literature these three words are used inter-changeably.

For example the element ‘cooperation’ is much more connected than innovation while other key elements of a cluster, knowledge sharing, exchanging labour and ‘learning’ are clearly dependent on cooperation. From the ‘map’ (derived from the theoretical literature) it would seem fairly clear that cooperation (often called co-opetition in the literature) is very central to the successful operation of industrial clusters.

There are also elements in the map that equally apply to firms that may not be part of an industrial cluster – for example R&D is undertaken by many firms (large and small), many firms continually strive to generate new products and to raise output as well as liaise with the educational sector. Therefore the cluster literature has not identified exclusive elements of firm or industry behaviour which can only be observed within clusters. However, what the literature does emphasise is rather straightforward – the presence of most, if not all, of these ten ‘outputs’ should be observable in an industry that is organised (*de facto* or by policy) as a cluster. And these are measurable. Elements such as knowledge sharing, cooperation, learning and exchanging labour [15] are not directly measurable.

[15] Labour mobility between firms is of course directly measurable if the data has been collected. Unfortunately this is rarely the case in China since many labour exchanges between firms go unrecorded and in any case are often the result of personal relationships between senior people in the firms. Therefore this can only be ‘measured’ through a qualitative approach – this will be discussed in the next Chapter.

The bottom three elements of the 'map' plus new products represent the *real* outputs we should expect to see in the context of the Heilongjiang green food and pharmaceutical clusters. New products can also be considered as a proxy measure for innovation (only in terms of outputs, not processes) but R&D spending ought to be directly measurable. The 'framework' for the industrial cluster to operate in is essentially provided by the policies, plans and standards set out at National and Provincial level and the training, education and research support provided by State agencies and Universities.

Taking these three groups of 'outputs' it is logical to categorise them in terms of their amenability to measurement, type of measurement and therefore to determine the possibility that any propositions or hypotheses from them can actually be tested. This is done below in Table 4.1.

**Table 4.1 Grouping the Elements in the 'Map' and Type of Measurement**

| **Cluster Element Group →** | **Framework** | **'Inputs'** | **Real Outputs** |
|---|---|---|---|
| **Measurement →** | **Qualitative** | **Qualitative** | **Quantitative** |
| | Policies & Plans | Knowledge Sharing | New Products |
| | Quality Standards | Cooperation | R&D Spending |
| | Education & Research Support | Learning & Exchanging Labour | Higher Employment+ |
| | _ | _ | Increased |

| | | | |
|---|---|---|---|
| | | | Output |
| | - | - | Agglomeration |
| **Testable?** | **Yes*** | **Yes*** | **Yes** |
| **Evidence base** | **Interviews & Surveys** | **Interviews & Surveys** | **Official Statistics** |

*Note: Only in relation to the respondent comments but not directly statistically.

+Note: In total and in terms of skilled/educated manpower.

The framework grouping has been discussed in some detail in Chapter Two, the various Provincial Plans, raising quality standards and the bringing together of education and research institutes to be more industry focused). These will be discussed again in the data analysis Chapter. The required 'inputs' for cluster success cannot be directly measured except through interviews and surveys of relevant participants in the cluster and Provincial government. The real outputs can be quantified from official statistics but any relationship we can theorise between these and the 'qualitative' elements cannot be tested directly since we would be mixing data types.

Even so, we should still be able to numerically demonstrate if these quantitative outputs are actually evidenced from the data. Given the above analysis of the theoretical and empirical literature, the derivation of the 'cluster elements map' and the method by which these can be evidenced we can hypothesise, in the case of both the green food and pharmaceutical clusters within Heilongjiang, that *after the introduction of the various Plans:*

1. New Products (or varieties) have increased.

2. R&D spending, output and employment have increased significantly.

3. Firms have engaged *more* in cooperation and knowledge sharing.

4. Firms have exchanged labour *more* and learn *more* from each other than before.

5. Quality standards of the products have increased.

6. Firms benefit *more* from research and University support.

7. Both industries exhibit high Location Quotients (agglomeration).

All of the above have been directly derived from the literature analysis in Chapter Three and the NEG models in this Chapter and represent the most logical approach[16] to the empirical analysis of the various 'relationships' proposed in the literature. How these will be 'verified' is presented and discussed in the next Chapter.

We can also examine each of the above (where data is available) in comparative terms with Provinces that have a green food and/or pharmaceutical industry but were *not specifically* earmarked for cluster development in one or both of these.

[16] Given the nature of many of the cluster elements themselves and the mixed data types this is the *only* approach left available to the researcher.

In the next Chapter a discussion and explanation of the research methods, data sources and analysis techniques are presented and explained.

# Chapter Five: Research Methods

This Chapter sets out the selected research method, describes the various stages of the research, and evaluates each of the research instruments in sequence. It includes a discussion of the processes involved in designing the primary research stages of the study that correspond to the research objectives stated in the Introduction Chapter. In order to better understand the approach taken it is useful to restate the hypotheses/propositions that have arisen from analysis of the literature in the previous Chapter.

## 5.1 Restatement of the Theoretical Framework

The literature analysis above has repeatedly shown that the most commonly cited 'elements' are those presented in the conceptual map in Chart 41. – there are ten of these that repeatedly appear in both the theoretical and the empirical literature. These are summarised in Table 5.1 below:

**Table 5.1 Elements Associated with Cluster Presence**

| | | |
|---|---|---|
| Policies & Plans | Knowledge Sharing | New Products |
| Quality Standards | Cooperation | R&D Spending |
| Education & | Learning & | Higher |

| Research Support | Exchanging Labour | Employment |
|---|---|---|
| _ | _ | Increased Output |

We know from Chapter Three that the measurement of these is not straightforward and that several can only be measured qualitatively. In fact only the final column lends itself to direct numerical measurement. This in itself significantly determines the type of research methods that can be employed to test any hypotheses or judge any proposition that arises from them. However also from Chapter Three we can specify what these hypotheses are:

***After the introduction of the various Plans in Heilongjiang the following outcomes are hypothesised to have occurred:***

1. New Products (or varieties) have increased.

2. R&D spending, output and employment have increased significantly.

3. Firms have engaged *more* in cooperation and knowledge sharing.

4. Firms have exchanged labour *more* and learn *more* from each other than before.

5. Quality standards of the products have increased.

6. Firms benefit *more* from research and University support.

*And additionally;*

7. In the case of both clusters, the Heilongjiang ‘results’ are superior to other Provinces that were never earmarked for similar policies or plans.

As argued in Chapter One the importance of national planning in the China context cannot be overestimated and therefore the active promotion of cluster policy, within a specific Province, ought to reveal ***definite*** outcomes that can be compared to the theoretical propositions we find in ‘cluster theory’. The latter is the primary theoretical premise of this Thesis. The specific theoretical propositions are those given above.

The purpose of the present Chapter is to set out clearly how these propositions might be tested or judged to be approximately correct along with the type of data required to do this. This is presented below. First in terms of the qualitative data generation method and second in terms of the quantitative data collection process.

**5.2 Qualitative Data Generation**

As made clear above much of the data required for this study is of a qualitative nature primarily due to the fact that many of the theoretical ‘predictions’ or propositions of cluster theory are themselves of a qualitative nature. The Table below specifies which of the ‘measures’ of clustering are qualitative.

**Table 5.2 Qualitative Indicators of Clustering**

| **Framework** | **'Inputs'** |
|---|---|
| **Qualitative** | **Qualitative** |
| Policies & Plans | Knowledge Sharing |
| Quality Standards | Cooperation |
| Education & Research Support | Learning & Exchanging Labour |

We have already specified the policies and plans set out for the Province in three detailed Government Plans and they are very clear – to enhance not just output but also quality, cooperation, firm 'learning' to support the firms via education and R&D support and for firms to be encouraged to share technically qualified labour. All of these objectives are part of most if not all of the three Plans. As pointed out in Chapter Three they are also clear predicted 'outcomes' from the clustering process. These outcomes are generally agreed in both the Western and the Chinese literature on industrial clusters. However the very nature of these require an interview approach to data collection – there is simply no other way of acquiring this type of data. A survey is a possible alternative except in China survey response rates are notoriously low – typically below five per cent.

Hence the in-depth interview using a structured but also open interview format had to be adopted.

### 5.3 Identifying Interviewees

The approach to planning in China means that it is essential to interview key people who actually implement and monitor plans laid down at either the national or provincial level. In this study this means a number of people needed to be interviewed who have a central role in the cluster implementation policy. These are local government senior officials and senior officials at the provincial level institutions responsible for both the green food and pharmaceutical sectors and the enterprise managers in both industrial clusters.

All interviews were carried out between June 2007 and December 2007. The interviews were conducted with three government[17] policy makers and 17 enterprise managers, which included 5 green food[18] leading enterprises and 12 pharmaceutical enterprises[19]. Thus, in total, 20 interviews were conducted; each

[17] Twelve officials/policy makers were contacted but only 3 agreed to an interview (2 from Green Food and 1 from the Limin Economic & Technology Development District (Pharmaceuticals).

[18] As pointed out in Chapter Two in fact many of these enterprises were merged under the earlier 'plans' to provide a 'critical mass' for a cluster. The assumption of the researcher that most were small outfits proved to be rather naïve. The result was that the green food industry in the Province is actually made up of only a few very large organisations. On the other hand the pharmaceutical sector remains more diverse.

[19] A total of 20 were contacted but only 12 felt able to take part in the research. Only a few gave an explanation for this.

lasting between 60 to 90 minutes. To ensure that the interviewees had no difficulty in going through this process, the interviews took place in a peaceful environment such as a private room located in the enterprise or government office building.

Also, it is important to make sure the physical environment is comfortable. The questionnaire used for each interview session was given a reference number. The interviews contained standard interview questions which are common to all informants (see Miller 1970; Zeller and Carmines 1980 and Phillips and Pugh 1994). These questions elicit primary data required to validate (or not) some of the hypotheses identified in Chapter Three. The interview questions were designed to cover the necessary issues which were framed in an open-ended manner. This offered the interviewees sufficient latitude for introspection and open reporting of their own perspectives (see for example Beed and Stimson 1985; Converse & Presser, 1986; Foddy 1992; and De Vaus 1996) on the importance of this point in the design of interviews). As a result, interviewees were free to pursue those matters that they considered important. A single open semi-structured questionnaire was developed for both sets of officials. The design, layout and format for answering were intentionally kept brief and few

instructions were necessary since this is very important to the efficient operation of the interview process.[20]

However, it was necessary to emphasise the importance of responding to each of the questions and offering strong support through their participation. This latter point is emphasised by Marshall and Rossman (1995). It was also vital to stress on the confidentiality with which the data and information would be handled, highlighting that the information would be used only for the purpose of the research (see Fowler (2008). The questionnaires were designed for senior officials of Heilongjiang Province local government and relevant official bodies connected to the green food and pharmaceutical industries and pharmaceutical and green food enterprise managers[21].

### 5.4 Questionnaire Design

Following the considerations as above, an open-ended questionnaire design is very necessary to carry out a structured face to face interview. The design of the questionnaire is of particular importance to the result of the interview. The first step of the process was to prepare the questionnaire that would assess the

[20] This point is emphasised strongly by several authors as critically important in ensuring that neither the questions, structure or interview 'purpose' can be easily misunderstood by interviewees and hence raises the quality of the responses – see Sudman and Bradburn, 1982; Babbie (1983) and Ghauri et al. (1995).

[21] It also needs to be pointed out that in the context of China getting access to managers or officials depends mainly on personal contacts. Hence, using these at Harbin University of Commerce the researcher was able to find the 20 (12) pharmaceutical and 5 green food respondents. The notion that the sample could have been structured in any other way is simply not realistic in the context of China.

contribution of the industrial clusters to the regional economy in Heilongjiang. As shown in Appendix two sets of questionnaires were designed for local government /relevant institution policy makers and enterprise managers of the relevant industry respectively. The questions are all open-ended where respondents had to express their views and respond to a set of questions aimed at generating relevant data and information. This information would assist in understanding the development of industrial clusters and the effect on the local economy in the regional context.

The questionnaires are anonymous in that they bear a reference number that only the researcher is able to trace back. This helped to calm the fears of the enterprise managers that the information given may be disclosed to someone else (see Belous and Hartley (1990). Layout and printing are two key issues that were considered to ensure that editing and coding could proceed smoothly upon compilation.

The questionnaire for government policy makers comprised of 11 open-ended questions. These questions were designed to obtain information from the government perspective regarding the importance of local industrial clusters and the extent to which the government has pushed their development (see Chapter Two regarding the three ‘plans’). The questionnaire for the enterprise managers

comprised of 22 questions designed to establish the relevant enterprises' operating mechanisms in terms of historical development, economic data and management systems. Both questionnaires were deliberately kept in general terms to be easily understood. The purpose of the specific questions is detailed below:

***Interviews with Government Officials (Appendix 1)***

- Question 1 identifies industrial clusters from the local government perspective and the actual industrial clusters in Heilongjiang for the purpose of this research.

- Question 2 deals with the intensity of support for industrial clusters from government at different levels for analysing the relationship between government and industrial cluster development.

- Question 3 collects information regarding the most developed and targeted local industries in the officials' opinion.

- Question 4 identifies which industries the government pays attention to the most.

- Question 5 tackles the way the government targets industries to push regional economic development.

- Question 6 evaluates the relevant and supporting industries of the main

industries recognized by local government in Heilongjiang in order to demonstrate the multiplier effect that arises by industrial clusters on regional economic growth.

- Question 7 obtains further information regarding how much attention the government devotes to the supporting industries and how it encourages them to strengthen the cluster chain (see Chapter One).

- Question 8 examines the extent to which the government recognizes the problem of industrial cluster development; in terms of its significance for regional economic growth.

- Question 9 indicates the main obstacles encountered in the economic development process.

- Question 10 examines how much the government eliminated the barriers during economic development. It also analyses the aspects that the government focuses on to influence the regional economy.

- Question 11 focuses on the officials' 'forecasts' of the development of the 'pillar' industries (the two clusters) in Heilongjiang.

***Interviews with Enterprise Managers (Appendix 1)***

This questionnaire below is designed for the enterprise managers and aims to obtain enterprise information in terms of their historical development, economic data and management systems as follows:

- Part 1: Historical development (Questions 1 to 15)

Questions 1 to 9 are designed to obtain basic information about the company in terms of scale and initial investments (capital and resources). As pointed out in Chapter Three the demand conditions, factor conditions, firm strategy and related and supporting industries are the basic elements for a region or a nation to obtain a competitive advantage especially via cluster development. Thus, identifying the basic histories of the enterprises is an important part in the analysis of those factors facilitating the industrial cluster formation. For instance, the source of equipment would reveal how much the enterprises depend on local related and supporting industries. These connection levels between enterprises and their local sources show whether the cluster and the clustering level of the industries is high or low and is a key element in cluster theory.

Questions 10-14 were designed to obtain information about employment in Heilongjiang in order to examine the relationship between the local industrial

cluster development and possible employment shift[22]. Finally Question 15 was designed to identify the product range and variety in each enterprise. This is vital to examine the product linkage between each enterprise in order to demonstrate the cluster concept (see Tables 3.1, 5.1 and 5.2).

- Part 2: Economic data (Questions 16 to 18)

Questions 16 to 18 were designed to identify the operating linkages of the product chain. They examine how much the enterprises depend on local resources and interact with each other (see the cluster 'map' in Chapter Four).

- Part 3: Management system (Questions 19 to 22)

Questions 19 to 22 aim to analyse the local industrial cluster mechanism from the management and logistics perspective. A change in market share or an increase in production efficiency or a rise in the number of varieties/products or in investment and employment would all reveal the benefit of industrial clusters as so often 'predicted' in the literature (see Chapter Three). The analysis of the qualitative data generated by these interviews is presented in Chapter Six.

[22] As we will see in the next section this 'shift' of employment towards the clusters is a critical indicator of cluster development. In addition, as highlighted in Chapter Two, calculating this was the only practical approach left open for quantitative purposes due to a real paucity of time series data in the Province.

Before presenting the quantitative data generation method it is useful first to discuss the problems inherent in the approach adopted for the qualitative data collection process.

### 5.5 Problems in Qualitative Data Collection

As indicated above there were a number of such problems. First, it took several months simply to identify the names of enterprises in both industries from available company listings. Even when this was done many had been ‘absorbed’ into larger enterprises (mainly the green food companies) making identification even more difficult. Once this particular problem was ‘solved’ it became very clear that access to the enterprises could only be done through personal contacts. This proved to be a very difficult process and the researcher only managed to gain access to five green food enterprises. On the plus side these proved to be amongst the largest in the Province. Nevertheless it does mean that the standard notion of representativeness could simply not be applied in this case.

The fact that the five are amongst the largest reduces this ‘bias’ to a significant degree but does not eliminate it completely. Getting access to the five was only possible through many meetings (some failed) and many calls, emails and finally

introductions. This degree of difficulty was not expected to be *so* high but it did require much perseverance.[23]

For the pharmaceutical firms the process was considerably easier primarily because they are reasonably small in size, more approachable and less inclined to direct a researcher to a Government office. Even so, getting access still depended on personal introductions that took a very long time to finalise. As for the representativeness of these twenty firms the researcher has no obvious reason to believe they are any different from any other twenty firms that may have been approached. However a degree of bias must exist since all were the result of 'who knows who' rather than of a logical and scientific sample selection process. Despite these difficulties the data collected is extremely useful in examining the hypotheses presented in this Chapter and it is also the first set of such data ever collected for these two industries to the researcher's knowledge. However as we will see in Chapter Five even these 'willing' respondents very often became less willing during the actual interviews. And of course due to the nature of qualitative data and the manner in which it is often collected it is criticised for being subjective and difficult to replicate and generalize (Bryman, 2004).

[23] As a new researcher this in itself provided a learning experience. Collecting data often throws up problems that are never anticipated and leads to a collection process that can be two or three times longer than planned. It also involves a degree of frustration not experienced until this work was carried out!

However this is a criticism that neglects the fact that very often there is simply no other way in which any data can be collected and it also neglects the fact that such data is actually enriched when it can be 'matched' in some way to objectively generated numerical information. Now we turn to the question of the quantitative data collection process.

### 5.6 Quantitative Data Generation

Official documents, articles and data reports (secondary sources) have asserted that industrial clusters in Heilongjiang have made an outstanding contribution to the local economy since their development had been emphasized in the early 2000's. These have largely comprised the three development plans and various reports already discussed in Chapter Two[24]. The other main secondary source for quantitative data for this research is held in the Annual Statistical Yearbooks of China and of the Province itself. Indeed these are the *only* sources of such data for almost any economic data. It has been a very long tradition in China to produce statistical yearbooks and these essentially represent the country's only long term archive of social and economic information. They are depended upon by social science researchers in China and across the world since there is very little alternative[25]. Hence the researcher utilised relevant yearbooks as much as

[24] In terms of both planning to achieve specific outcomes and later criticism where these were not achieved.

[25] In fact much of the economic data to be found in U.N. statistics sources on China actually comes from these yearbooks.

possible and discounted specific entries where there appeared to be unlikely ‘spikes’ in the data given that no plausible explanation (in that year) could be found for such spikes. However these particular ‘events’ were very few and the consistency of the data appeared both reasonable and reliable.

Although China’s yearbooks represent a long tradition this does not help where the subject under investigation is relatively recent. In the case of the two clusters in the Province the policy itself did not begin until 2003. This means that prior to that year the collection of data for the yearbooks regarding green food and many elements of the pharmaceutical industry did not classify all sub-sectors in the same way over time. This only began in the late 1990’s. Hence the expected time series (by the researcher) simply does not exist.

This is a similar problem to that of the qualitative data collection process – the barriers were much more significant than expected. Similarly the lack of clearly defined data categories for both industries meant that applying standard time series applications would be futile given the low frequency of the data (only annual) and the length of the series itself. This point was alluded to in both Chapters Two and Three above.

However it is in the very nature of clusters themselves and strongly argued in the 'cluster' literature that *agglomeration* processes are a key feature of cluster development. This allows us to apply another type of standard quantitative analysis from economics (specifically regional economics) and that is both the location quotient concept and the concept of shift-share analysis. Both of these give non-parametric results but they do give numerical results that that are mathematically reliable and clearly indicate if any such agglomeration process has occurred. Therefore, in Chapter Seven we will examine the quantitative evidence for the development of the two clusters in the Province using both the location quotient and shift-share analysis. The results of these can also be compared with the 'opinions' of the respondents from the qualitative analysis to come in Chapter Six.

With the permission of the national library in China and a number of university libraries in Heilongjiang, a mass of secondary data was collected from China and Heilongjiang year books of most of the last two decades. Furthermore, some specific data relating to the green food industry and pharmaceutical industry was obtained from a series of local ministry statistics yearbooks.

This facilitated examining the two industrial clusters using Shift-Share Analysis and the Location Quotient. It also assisted in comparing economic indices which

are relevant to industrial clusters between Heilongjiang Province and other provinces where cluster ‘plans’ were not in force.

### 5.7 Problems in Quantitative Data Collection

China remains very much a developing economy, not least in many of its western and northern provinces. Like so many developing countries it will be a very long time before statistical data and databases such as those that are taken for granted in highly developed countries become available. Therefore finding reliable secondary data on many economic issues within China is itself a difficult and frustrating process.

In particular there is a definite shortage of long term time series data and this makes application of econometric models either very difficult or, in the extreme, pointless. In this research study no such time series exists therefore the choice of ‘model’ does not arise. We have what we have, in terms of numerical data, and hence must apply the most appropriate analysis methods to what we have. At the same time it is extremely important to recognise that this in itself limits economic interpretation, especially in relation to the hypotheses presented above.

But it does not prevent sensible interpretations of the results such that the stated hypotheses and/or propositions found in cluster theory cannot be ‘tested’ at all.

Rather it means that these can be considered as being supported or not supported given the *weight* of the numerical results alongside the strength or otherwise of the qualitative results. Then we will be in a position to make informed and educated conclusions regarding the cluster policy in the Province, the relevance of cluster theory to the Heilongjiang experience and usefulness of the literature in informing research in this subject within the context of China. Additionally the concept of both the location quotient and shift-share analysis will be applied to determine if clusters have developed.[26] The results of these can also be compared with the 'opinions' of the respondents from the qualitative analysis to come in the following Chapter.

# Chapter Six: Analysis of the Qualitative Data

## 6.1 Questions and Responses

In this Chapter the responses of both officials and enterprise managers are analysed in terms of the rationale for the questions explained in the previous Chapter. The analysis is presented systematically in terms of the order of the

[26] This official data relates specifically to employment growth, higher skilled manpower, output growth, product differentiation and innovation (varieties, technology etc) and comparison with Provinces where there has not been a cluster policy.

questions given to the respondents. We begin with the responses of the officials working in the Green Food and Pharmaceutical administrations. The most common response is given in italics.[27]

1. Which industries do you think are clusters? Why do you think so?

   *Green food and pharmaceuticals; because the government has identified potential of those industries in Heilongjiang and has promoted them a lot.*

2. Is there any policy now for supporting local industries?

   *Yes, there have been several policies promoted and supported by the national and provincial government.*

3. If yes, how many of them are from the central government? How many of them are from local government?

   *All policies are from central government and implemented locally.*

4. Which industries do you think are the strongest in Heilongjiang Province now? Why do you think so?

   *Green Food and pharmaceuticals, the green food is performing well and contributing a lot to local GDP, the government has a lot of confidence in*

[27] Common is possibly not the best description given that only 3 officials actually took part in the interview process. Nevertheless they all were very clear on the policies that were being pushed for both these industries.

*pharmaceuticals and has invested a lot of money to construct the industrial district.*

5. Which industries do you pay more attention to? Why? How do you support them?

   *Priority industries in the regional plans of 2003 and 2007. That's the policy we have to implement . By giving reduced taxes and investment to them.*

6. Is there any potential advantage of the other industries? If yes, which ones? And why do you think so? If not, why?

   None of the officials were able to identify any other industries. Indeed all three focused on the policies and plans as laid down by central government.

7. Do you plan to use the policy tools (tax and investment incentives/directives) to support them? If yes, how will you do that? If not, why?

   All three commented on the fact that these 'tools' are set out in the implementation plans and therefore would and do get used when it is necessary.

8. What do you think are the main problems of the industrial clusters in Heilongjiang Province now? Why do you think so?

   *Still relatively young industries and still a lot to learn about quality production methods*

9. What do you think are the main barriers to the economic growth of these clusters? Why do you think so?

*Finance, logistics and not talking to each other especially in pharmaceuticals.*

10. Do you have any strategy for that? If yes, what is that? And why do you think it is the appropriate one?

    None of the officials commented on this except to point to the policies and plans already laid down.

11. What industrial clusters do you think will be the main ones in the province over the next ten years? Why do you think so?

*Green food and pharmaceuticals. If they can solve their problems.*

The responses from Government officials in both 'departments' were not particularly forthcoming. As can be seen above the tendency was very much to focus on official (central) policy while at the same time refer very little to what the

problems actually are in both industries. However there are two particularly strong messages (even from this limited information). First, the policies laid down in 2003, 2007 and later in 2009 are specifically those of central Government. It is seen as the job of the Provincial Government to implement these. Even the 'tools' to be used are prescribed by central government.

This is not the policy approach used in the West (see Chapters Two and Three) where a significant degree of local autonomy is given to local policy design. However in the context of the central planning philosophy applied in China since 1949 this is hardly a surprise. But it does shed some doubt on the efficacy of the cluster literature which emphasises the important role of local government and local agencies. The second message which came out of these three interviews is perhaps more of a concern. It was emphasised by one of the Green Food officials and certainly by the Pharmaceutical official that a lot of the problems could be solved if the people involved would 'talk to each other'. This suggests a central problem in the cluster initiative in the Province – we know from Chapters Three and Four that knowledge sharing, exchange of labour and 'coopetition' are considered vital to the development of any industrial cluster and all three ought to be associated with high degrees of agglomeration. Yet, these elements are very weak in the case of pharmaceuticals in the Province and relatively weak in the case of Green Food. Indeed if we go back to the cluster 'elements map'

presented in Chapter Four, these represent the central spine of the map – and yet they appear to be either missing or at the very least weakly applied.

Again the literature on this is inconclusive – the fact that many of the enterprises do not engage in ‘sharing’ is definitely a matter of culture. In China the specific culture of ‘guanxi’ ensures that such activities take a very long time to establish and depend wholly on trust. The latter requires a slow build up to facilitate the exchange of very often ‘commercially confidential’ information and is likely to take even longer than the period of a plan.

It may well be that trust and ‘guanxi’ will operate in both industries eventually but clearly this is not the case yet. How this can be speeded up was implied in Question 10 but the responses were not encouraging. Again this may be to do with the fact that local policy or local initiatives are not encouraged and so the local officials will continue to rely on central direction to deal with the problem of sharing information within each of the clusters.

Of course with only three officials taking part in the interviews it is not possible to be definitive about such a conclusion. However, given the administrative culture and the primacy of central plans it is difficult to imagine that these responses

would have been any different with three different officials or even thirty three officials![28]

A clear positive message from these three interviews however is that the 'departments' concerned are very aware that both these industries have been designated as industrial clusters. This means that the local government system is following central plans and is attempting to encourage cluster development.

As we will see in Chapter Seven this is certainly more obvious in the case of Green Food than in the case of Pharmaceuticals. Possibly because the former was already a developing industry in the Province prior to the policies while the latter was relatively young (as one official said) and relatively small. Although the results of these three interviews are mixed in terms of how the responses relate to what we might have expected given the literature another positive implication from all three interviews is that both industries have a healthy future if they can resolve their problems, which will depend very much on more cooperation within each industry.

How does the above compare to the responses of the enterprise managers in both industries? As explained in Chapter Five (and Chapter Two) the Green

[28] As explained in Chapters 2, 3 and 5 obtaining access to officials in China is extremely difficult. Obtaining answers after this often proves even more difficult.

Food industry actually contains large organisations due to the consolidation of many smaller enterprises in the early stages of the plans. The Pharmaceutical industry contains many smaller enterprises. Five managers in the Green Food industry agreed to interview and twelve in the Pharmaceutical industry agreed to interview. An analysis of these responses is given below.

**Some Basic Data**

The average size in terms of employment of the five GF enterprises is 3,900 with the largest around 4,500 employees.[29] This contrasts with the twelve in the pharmaceutical industry where the largest employed just over 600 staff and the smallest around 160 staff, the average is around 250 employees.[30] For the GF firms the oldest began operations in 1965 while the oldest amongst the twelve pharmaceutical firms began in 1995.

### 6.2 Analysis of Responses

None of the enterprise managers were able to recollect the initial capital invested mainly because they were either new or replacement staff for earlier managers. Others were simply unsure and reticent to guess. As to equipment being used only one pharmaceutical enterprise indicated that *one* piece of equipment had been imported from abroad. All the GF and the other pharmaceutical firms sourced all of their equipment from the rest of China.

[29] As explained in earlier Chapters the many 'small' GF enterprises were brought together as part of the cluster policy leading to the creation of very large corporations.

[30] The pharmaceutical industry was not 'combined' into larger units because many were and are specialised in specific drugs and Chinese medicines.

This is somewhat surprising given the nature of these industries. As pointed out in Chapter Three a key element of an industrial cluster is innovation and technology application – although innovation has been relatively high in GF (see next Chapter) the development and/or application of the latest technologies in both industries has been very slow. Several managers commented that this is largely due to lack of foreign exchange but that it does slow down the development of productivity.

In response to whether there has been a change in the policy of sourcing equipment only from China all enterprise managers indicated that there has not been. Therefore, even as far into the cluster policies as 2006/7 the ability or desire to import new technology remains very weak. This has implications for both quality and export potential as we will see in the next Chapter. In terms of labour sourcing however all 17 firms indicated that either all of their employees came from Heilongjiang Province or as many as 95 percent. Very few came from outside the Province. But a clear indication of the efforts of the local educational and training institutions is given in the response to the qualification levels of the employees: in the GF enterprises up to 60 per cent are qualified to technician level while in some of the pharmaceutical enterprises this rises to 85 per cent

with as many as 10 per cent being at post graduate level.[31] In all cases the managers indicated that these employees have been educated locally.

The Governor from Heilongjiang Development and Reform Commission gave some examples such as Harbin Institute of Technology, Harbin Engineering University, Northeast Agricultural University, Heilongjiang Bayi Agricultural University, Northeast Forestry University, Harbin University of Commerce, Heilongjiang Provincial Academy of Social Science and Heilongjiang Academy of Agricultural Science. He added that these institutions possess many senior faculty and researchers. This has proved very important in the production of qualified manpower for the industry in terms of scientific technology and education. This does suggest that at least the education institutions have been meeting their 'obligations' in terms of producing the right number and right level of qualified labour under the cluster policies.

For all enterprises 100 per cent of all raw materials are imported from other Provinces or sourced locally (mainly the latter). There is no importation of raw materials from abroad. Again this is somewhat surprising given that, for example, the organic food industry of the UK and several other countries is highly integrated into the global sourcing network. Yet the equivalent enterprises

[31] It is not surprising that this industry would have a higher proportion of graduates given the nature of the work which is heavily focused on R&D and medicine improvements.

in Heilongjiang are not. This of course is largely due to the fact that the Province has been a long term source of raw materials for both industries – but even so, the almost complete lack of connection to the rest of the world in both is unlikely to help in the development of new products or in the development of export markets. Yet a key 'plan' for both industries was to achieve competitiveness at international level and to increase exports.[32]

In terms of prices obtainable for the products there was no response from the managers due to commercial confidentiality. In addition some even indicated that the pricing was not the responsibility of the enterprise – rather it is part of the local administrative system of price setting. This conforms with the responses of the Government officials where it became very clear that local autonomy is highly restricted. This is largely due to the highly regulated nature of both the green food and the pharmaceutical industries. These, like other sectors, are subject to strict control in terms of prices, inputs, FDI, imports and technology as set out in the detailed industry plans derived from the national and Provincial five year plans. This is quite different from the regulations we often see in Western countries that are more focused on safety and health. It is much more of a hand's on approach in China. There are of course strict regulations regarding quality and safety standards as well as in environmental standards. However all

[32] Both do export but as we will see in the next Chapter this has been very variable.

of this regulatory framework does not leave a great deal of room for enterprise managers to be innovative or to take business risks. This is an aspect of the cluster policy that is much more important than is normally recognised in Western literature.

In response to the questions regarding changes to the operation system the majority of managers in both industries pointed to the problem of finance – this was also indicated by one of the officials. Given that both industries have been and continue to be under specific plans the requirement to invest and the ability to invest is a function of the plans rather than a function of need or future output plans. This again points to a reduced autonomy for all of the enterprises.

On the other hand most of the GF managers argued that despite technology and financing issues the industry and their enterprises have managed to increase the number of GF varieties by a very large amount in just 8 to 10 years. This is a claim that is confirmed in the data analysis in Chapter Seven. The issue of 'talking to others in the industry' was raised in the manager interviews. In the GF enterprises most of the five managers agreed that they do exchange ideas with their counterparts in other firms and this largely because these firms tend to have been around for quite a long time.[33]

[33] As noted in the discussion of the officials' responses the role 'guanxi' in business in China is paramount and it tends to operate best where individuals have known each other or their predecessors for a long time.

This often leads to new ideas for the enterprises. However in the pharmaceutical industry very few of the twelve managers conceded that they talk to or even need to talk to their counterparts. Mainly because they tended to specialise in different medicines and so could not gain much from the exchange of ideas. However it is also probably due to the fact that most of these enterprises are no more than 10 years old and so the social networks have not had time to develop good ‘guanxi’ amongst the managers.

This suggests that the cluster ‘literature’ is not complete in the sense that the role of culture, especially business culture, in the development of a cluster has not been adequately studies. Some of the Chinese literature does suggest this (see Chapter Three) but even then its importance seems to have been under-estimated.

In addition it suggests that central planning itself will not and cannot overcome the importance of such business culture (even in a State system) and needs to design policies (or incentives) that will encourage the exchange of not just ideas but also labour and knowledge. The notion of a ‘learning industry’ or a ‘learning enterprise’ that we find in the Western cluster literature is not strongly evident in

the Chinese case. Therefore more effort needs to be focused on this particular issue.

There is no doubt that all managers in the survey are aware that their industry is part of a long term cluster policy. All were keenly aware of the policies and plans. However there is also no doubt that some of the key elements required for an industrial cluster such as knowledge sharing, labour sharing, technology investment and 'pooling' of ideas are not present at all or are only weakly present (in the case of GF). Across the 17 enterprise managers there was very little variation in their responses whether based on enterprise size, age or industry. Indeed all were keenly aware of the plans and policies for their industry and there was little difference in the way they saw the future in terms of barriers or potential.

Nevertheless the GF enterprise managers do emphasise the fact that their organisations have been innovating, employing well qualified staff and increasing production and sales substantially. Although their impact on quality standards (in terms of double A products) is not as strong as it could have been. Similarly the impact of the cluster policy on GF exports has been very slow and is highly variable (see next Chapter). In pharmaceuticals there is a strong tendency to see each enterprise as an 'island' specialising in particular

medicines and therefore little attempt is made to ‘learn’ from other enterprises. In addition the question of financing and technology remains a significant one and this impacts on both productivity and the ability to export. Overall the impact of the policies within the Province has been significant in terms of qualified manpower, education and production levels although these have been more pronounced in the GF industry than in pharmaceuticals.

The responses of the officials are largely in tune with those of the enterprise managers in that both are aware of the achievements and both are similarly aware of the existing barriers to further development in both clusters. How do these responses compare to the quantitative data? Is it the case that GF appears to be more of a cluster than pharmaceuticals? Do these 17 enterprises reflect what has happened across both clusters in terms of innovation in products, product quality, employment and qualified manpower and the level of exports? These issues are analysed in the next Chapter using official data sources.

# Chapter Seven: Analysis of the Quantitative Data

## 7.1 Introduction

As explained from the analysis of the qualitative data there is no doubt that the green food industry in the Province is very much seen by those connected to it as an industrial cluster in the sense we would expect on the basis of the cluster

theory (Chapters Three and Four) and the resulting hypotheses/propositions detailed in Chapter Four. This is despite the fact that the same respondents reported many weaknesses in the cluster which could shed some doubt on the extent to which it is a cluster in the true sense of the cluster theory.

However it is also clear from the respondents connected to the pharmaceutical sector that this industry could be a cluster in the real sense but in Heilongjiang Province it has a very long way to go to satisfy most of the tenets of cluster theory (whether in western or Chinese literature). So, there is very clear difference in the qualitative results between the green food and pharmaceutical industries.

The present Chapter will examine if these results are also reflected in the quantitative data for the two industries specifically via a detailed examination of employment growth, higher skilled manpower inputs, output growth and product differentiation and innovation. All of the latter relate specifically to the two industries within Heilongjiang Province34. First however, it will be instructive to investigate a much broader aspect of the data by a comparison with Provinces where there has not been a cluster policy. This in itself deals with the question of policy effectiveness – has the implementation of successive cluster plans in Heilongjiang actually made a difference as compared with these industries in other Provinces?

## 7.2 Comparative Analysis of Provinces

If the explicit policies and plans for both industries have been effective, in the sense that their growth in several respects has significantly outpaced other Provinces with these two industries then this should be very clear even in the descriptive statistics. The next set of Tables presents this comparison for the green food industry but separated into two distinct periods – before 2003 and

[34] Note that it was not possible to obtain the same data categories for both industries in the nine Provinces – as explained in Chapter Two

after 2003 – in other words before the first of the three cluster plans was introduced in Heilongjiang and afterwards.

A total of nine Provinces have been selected for these Tables because these are the nine that boast both a green food and a pharmaceutical industry. Of these nine, one in particular, Jiangsu Province, stands out as very strong in terms of Green Food, while four others also have developed a very strong GF industry and a number have developed a stronger pharmaceutical industry. All the data analysis that follows is derived from Appendix 2 which gives relevant data for these nine Provinces and data on employment, qualified manpower and innovation for both of the industries in Heilongjiang. [35] This means that the data analysis below focuses more on the GF industry than on pharmaceuticals which does represent a limitation in this study. However the data that has been collected plus the qualitative data in the previous Chapter on the pharmaceutical industry does tend to all point in the same direction. Therefore even the limited data does indeed tell a very consistent 'story' for this industry within the Province.

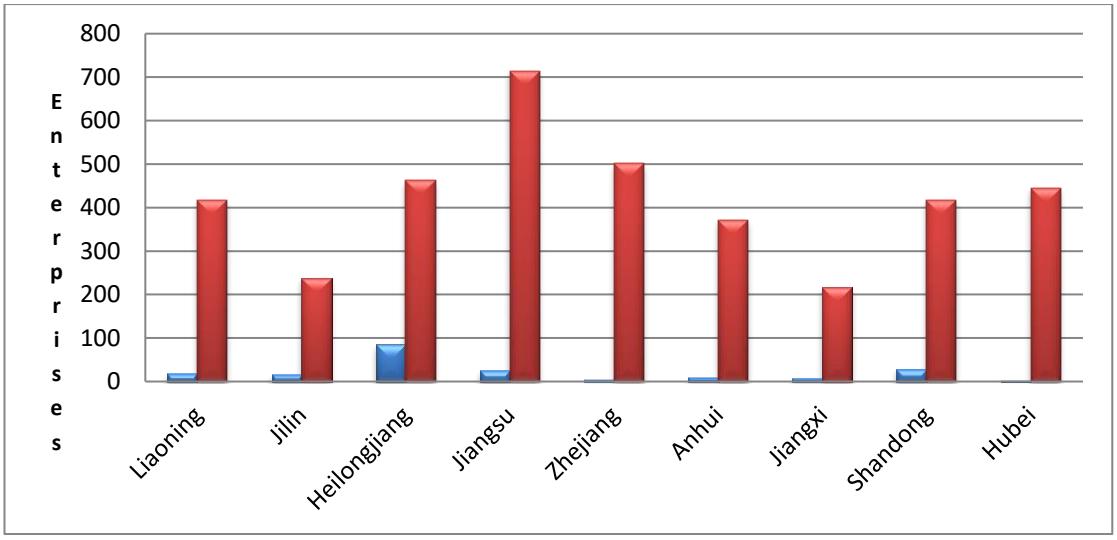
Before we consider these it is useful to point out the context: China has a total of 22 Provinces, four municipalities, five autonomous regions and two special administrative areas.[36] In 1996 out of all the regions of China nine (provinces) hosted 43 per cent of all green food enterprises. In turn Heilongjiang hosted 44

[35] Not all categories of data could be found for both industries – in fact the data for the pharmaceutical industry is very difficult to collect, as explained earlier.

[36] 22 'standard' Provinces; Municipalities are Beijing, Tianjin, Shanghai and Chongqing; Autonomous regions are Guangxi, Inner Mongolia, Ningxia, Xinjiang and Tibet; the two SAR's are Hong Kong and Macau.

per cent of the green food enterprise total for these nine Provinces. Hence, well before the targeting of the Province for cluster policy it was already the single largest in green food enterprises seven years before the policy was implemented. Now let us fast forward to 2007. By then these nine Provinces hosted 66 per cent of all green food enterprises in China. However Jiangsu province which had 25 such firms in 1996 had 713 by 2007 while Heilongjiang now had 462. And this was already four years into the Heilongjiang cluster policies. In fact we can visually inspect this data to reveal that there is little evidence (in terms of number of firms) that the policy, in itself, had made any difference by 2007.

**Chart 7.1 Growth in GF Enterprises by Province (Blue = 1996, Red = 2007)**

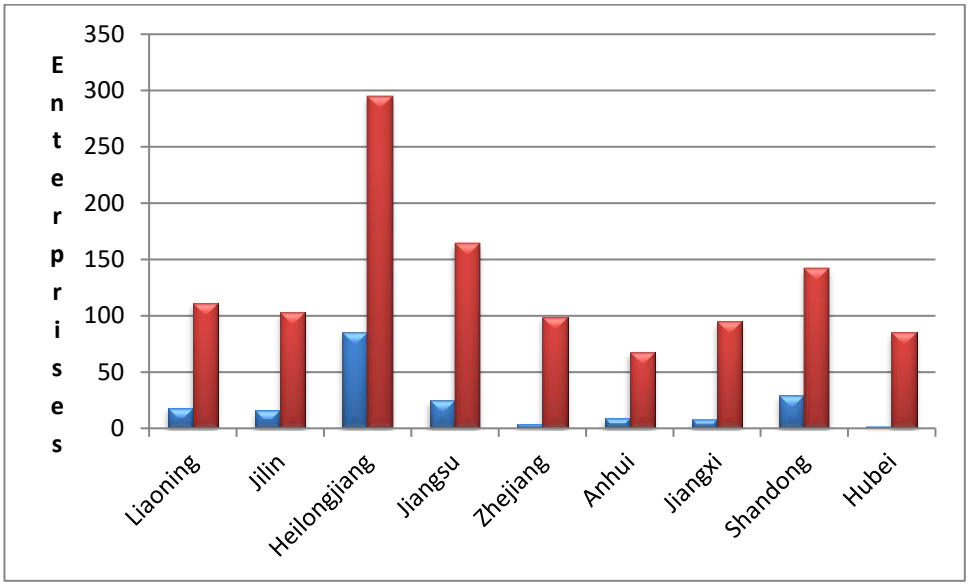



Source: Appendix 2

By 2007 Heilongjiang was the third largest in terms of the number of GF enterprises while several other Provinces expanded their numbers by a very significant amount. By 2010 the Province boasted 518 GF enterprises while in Jiangsu the number had risen to 778. But what about before the policy began? Were these other Provinces already developing their green food industry faster than Heilongjiang? Consider Chart 7.2 below: we find a rather surprising story: Heilongjiang was still the largest host of GF enterprises at the start of the policy in 2003 although several others were 'catching up[37]'.

[37] In particular the Provinces of Liaoning, Jilin, Jiangsu and Shandong were increasing the number of GF enterprises very fast.

**Chart 7.2 Growth in GF Enterprises by Province (Blue = 1996, Red = 2003)**

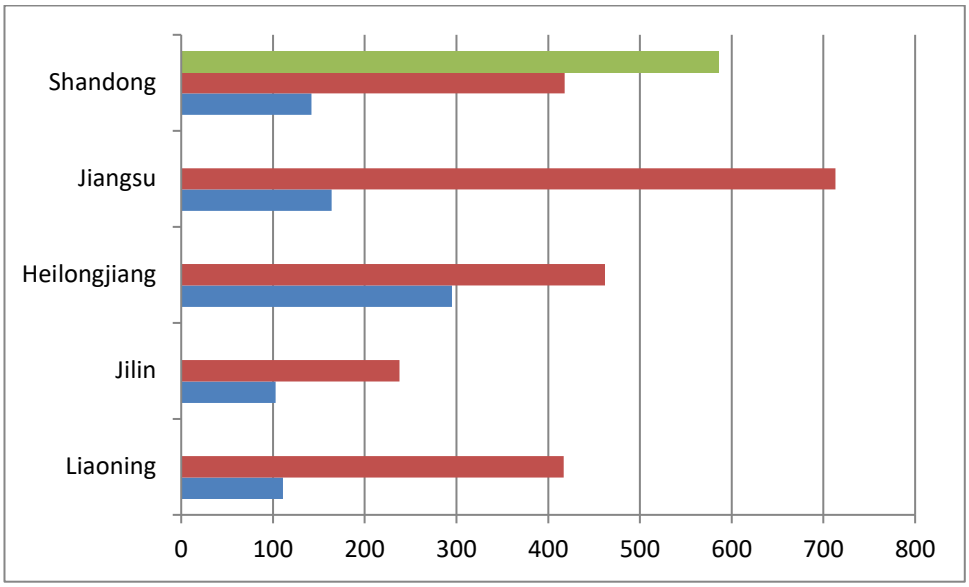



Source: Appendix 2

It would appear that the Province was in a prime position in 2003 to benefit from its focused green food cluster policy laid down by central Government. Yet, as Chart 7.1 clearly shows the opposite had happened – the Province by 2007 fell down the 'league table' in terms of the number of firms involved in green food production.

This clearly points to one of the arguments in the literature (see Chapter Three) that industrial clusters cannot be created by policy – they can only arise from natural agglomeration processes that firms clearly identify and recognise as being an advantage to efficiency – hence they will migrate from where they are to the site of the agglomerated activities.

**Chart 7.3 Growth in GF Enterprises by Province (Blue = 2003, Red = 2007, Green = 2010).**




Source: Appendix 2

If we expand the comparison to some of the other (main) GF Provinces we see that there has been significant expansion in the number of enterprises in five of the Provinces and more so in some than in Heilongjiang, especially between 2003, 2007 and 2010. In other words, the implementation of the GF policies between 2003 and 2010 in Heilongjiang appears to have made little difference to the Provinces' GF growth rate as compared with Provinces where no such policies were being implemented. Indeed it could be argues that there is more evidence of a cluster in some of these Provinces than in Heilongjiang, but a cluster based on natural agglomeration than policy direction.

Nevertheless, pure numbers of enterprises do not in themselves depict a cluster or an absence of one. Although we *would* expect the trends to have looked

different. However a clear prediction of cluster theory (Martin and Ottaviano,1998 *op cit*, Chapter Four) is that where one exists we should expect to observe a significant element of innovation – either in technology inputs and/or product outputs and quality. We will leave the quality issue to the next step.

In terms of innovation in green food there is no doubt the derivation of different varieties of crops and their subsequent consumable products is a very strong indicator of an industry that is developing in terms of product strategy, competitiveness and leadership – whether by policy or not. Examining the number of new GF varieties produced across these nine Provinces we do indeed find a significant increase in the number of new GF varieties.

In 1996 there were a total of 276 different varieties of green food crops and their products. By 2003 this had increased to 1,980 – this is a massive rate of variety development. Comparing Heilongjiang with the other eight Provinces we find that the number of varieties increased from 115 to 585 in this period.

The closest Province in terms of new varieties was Jiangsu with 252 (up from 44). By 2007 the data shows that Jiangsu had developed 1,924 different GF varieties; the corresponding data for Heilongjiang was 1,065. Let us consider this in terms of the number of enterprises as in Table 7.1 over page:

**Table 7.1 Ratio of GF Product Varieties to Number of GF Enterprises**

| Province | 1996 | 2003 | 2007 | 2010 |
|---|---|---|---|---|
| Heilongjiang | 1.35 | 1.98 | 2.31 | 2.38 |
| Jiangsu | 1.76 | 1.54 | 2.69 | 2.63 |

Calculated from Appendix 2

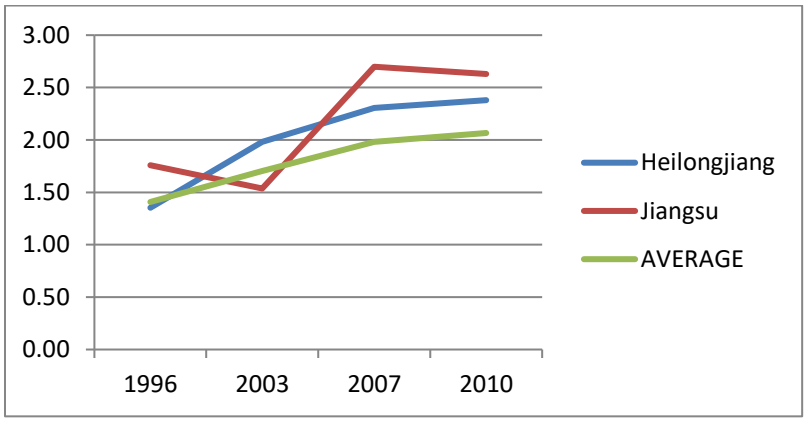
Prior to 2003 both these Provinces appeared innovative in the sense that for every firm a multiple of varieties of GF were being produced, on average. By 2003 this multiple increased in Heilongjiang but fell in Jiangsu. However after the 2003 policy implementation in Heilongjiang the multiple actually improved more in Jiangsu![38]

We also see an increase in innovation in most of the nine main GF Provinces over the period 1996 to 2010 however there is no doubt that such innovation grew more after 2003 in Heilongjiang and in Jiangsu than in the other Provinces. Indeed both outstripped the average growth by a significant amount – this is clear from the Chart below. Although innovation in terms of crop and product variety increased substantially overall it is also clear that it was more sustained in Heilongjiang than in other Provinces, including Jiangsu. The rate of growth in

[38] It is extremely difficult to measure 'innovation' however the number of new products is often cited as one of the better indicators. In China, this is also the only indicator available in the GF industry.

all of these nine Provinces slowed down after 2007 but much more so in Jiangsu than elsewhere[39].

**Chart 7.4 Growth in GF Innovation (Product Variety/Enterprises)**




Source: Derived from Appendix 2

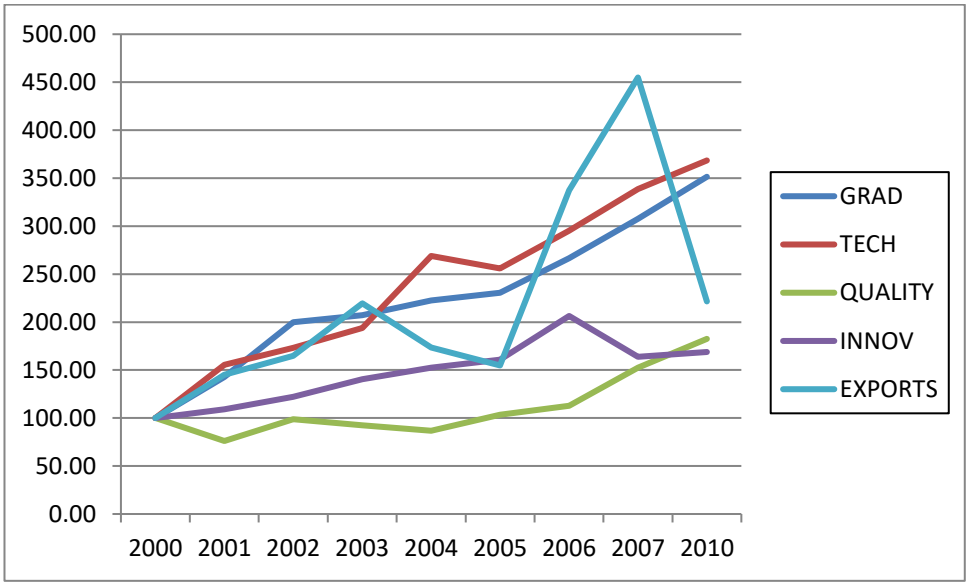
Overall, the hypothesis[40] that a cluster policy would lead to innovation in the GF industry is supported only in the sense that more product innovation did take place in Heilongjiang after the policy implementation than before. However there is no evidence to suggest it did so at a faster rate than in Provinces where there was no such policies. Although it may be reasonably argued that the innovation process in Heilongjiang is possibly more sustainable given that its growth rate has not actually declined but kept moving forward throughout the 2003 to 2010 period.

Now let us consider other elements of the cluster 'map' from Chapter Four:

[39] In fact it actually fell – this is perhaps due to the difficulty of increasing innovation after the Province had already exceeded others in product variety development.

[40] Only in the sense that a test of this hypothesis is simply unnecessary since visual inspection of the data is sufficient to reject the hypothesis. In any case the sample size is too small – we need at least 25 observations even for a simple T-test and we do not have these as explained in Chapter Two.

**Chart 7.5 Development of GF Cluster Elements (2000-2010)***




*Note: All data have been calculated as indices with the year 2000 = 100.

Source: Derived from Appendix 2.

As indicated in the interviews with the green food managers there has been a very significant increase in the number of qualified technicians and graduates working in the industry. In both cases we see an acceleration in the employment of these staff after 2003 and after 2007 – both of which began and reinforced the cluster policy respectively.

There is no doubt this element of the cluster policy was well established early in the plans. Innovation has also been rising albeit more slowly but this is largely to do with the problem of not being strongly connected to the global scene in GF (as indicated in the previous Chapter). This is also reflected in the highly variable

performance of GF exports which fell very sharply after 2007.[41] The quality of GF products has been steadily increasing in terms of the number of varieties classified and certified as double A showing a determination to improve on this. However as the GF managers pointed out in the interviews this has been held back also by a lack of new technology investment.[42]

Overall, several of the key elements we would expect to see in an industrial cluster (as per Chapter Three) are present in the case of green food in Heilongjiang Province: significantly more skilled manpower, steady innovation and steadily improved quality standards, engagement with the higher education and training sectors, some evidence of knowledge exchange and 'learning' and substantially increased output.

The Provincial output increased from 2000 to 2010 by nearly 800 per cent (see Appendix 2). In terms of the GF industry there is a substantial degree of agreement between the qualitative data (interviews) and the quantitative data (official sources) that many of the cluster elements identified from the theoretical literature are indeed present. The degree to which these elements are themselves connected can be measured through a simple correlation analysis as given in Table 7.2 below. There are no negative correlations here and many of associations are very strong such as the correlation coefficient between

[41] This is mainly due to the global decline in demand that affected all Chinese exports after 2007.

[42] Double A means it meets the USA standards for food quality.

graduate employment and product quality as well as technicians. However the lowest correlation is actually found between innovation and quality – this is surprising since we would expect these to be highly correlated. On the other hand, the weakness of technology inputs to the innovation process is more than likely to be a major factor here.

**Table 7.2 Correlation Matrix of GF Cluster Elements (2000-2010)**

| | ***GRADM*** | ***TECHM*** | ***QUALITY*** | ***INNOV*** | ***EXPORTS*** | ***OUTPUT*** | ***POLICY*** |
|---|---|---|---|---|---|---|---|
| **GRADM** | 1.000 | | | | | | |
| **TECHM** | 0.971 | 1.000 | | | | | |
| **QUALITY** | 0.826 | 0.770 | 1.000 | | | | |
| **INNOV** | 0.798 | 0.839 | 0.484 | 1.000 | | | |
| **EXPORTS** | 0.682 | 0.686 | 0.539 | 0.667 | 1.000 | | |
| **OUTPUT** | 0.953 | 0.887 | 0.781 | 0.677 | 0.646 | 1.000 | |
| **POLICY** | 0.917 | 0.906 | 0.890 | 0.641 | 0.550 | 0.865 | 1.000 |

Source: Derived from Appendix 2.

Of special interest is the correlation between the introduction of the 2003 and 2007 cluster plans and most of the cluster elements. This exceeds 90 per cent in the case of qualified manpower, nearly 90 per cent in the case of quality and output but significantly less in the cases of both innovation and exports. Clearly these two policy 'boosts' have had a very positive effect on the industry.[43]

[43] The policies were included in the matrix as 100 (no policy), 200 (initial policy 2003) the reinforcement of the policy as 300 (2007) and again as 400 (2010). Other combinations (such as 0 and 1, 2 etc produced the same result).

## 7.3 Location Quotient Analysis

However, as also explained in Chapter Four an alternative quantitative analysis of the extent to which the GF industry is indeed a cluster or a developing cluster is the application of two standard techniques used in regional economics – the location quotient and the shift-share effect of the industry. These are presented below in the case of the green food industry.

The LQ is a simple calculation designed to show to what extent an industry is or has become 'agglomerated' within a particular region relative to the rest of the spatial economy. We know from the literature in Chapter Three and the NEG theories that such agglomeration is widely recognised as a key indicator of the presence of an industrial cluster. The calculation of the LQ for any given industry is presented below:[44] It could be argued that the LQ is merely a mechanical device that itself does not explain the agglomeration process – but that is not the purpose of its use here. We already have strong evidence (qualitative and quantitative) that the Heilongjiang GF industry is indeed a developing cluster – the LQ is merely an attempt to validate that evidence using an alternative approach and to further support the hypotheses/propositions developed in Chapter and Four. The calculation method is as follows:

$$LQ_i = (e_i \Big/ \sum_{i=1}^{n} e_i) \Big/ (E_i \Big/ \sum_{i=1}^{n} E_i)$$

[44] This is the standard equation used in all LQ studies.

$e_i$ = index of industry ‘i’ in one region

$\sum_{i=1}^{n} e_i$ = index of all industries in the same region

$E_i$ = index of industry ‘i’ of the whole economy

$\sum_{i=1}^{n} E_i$ =index of all industries of the whole economy

The closer to zero the $LQ_i$ outcome is, the lower the agglomeration level of the industry in the special targeted region; whereas, the greater the value of $LQ_i$ the higher the agglomeration level of the industry in the region. When $LQ_i$=1, industry ‘i’ is not spatially focused on any specific region.

The green food industry’s output value and total GDP of both Heilongjiang Province and China between 2001 and 2010 is employed for this calculation. The green food industry’s gross output value of Heilongjiang Province is be denoted as $e_i$; whereas, the total GDP of Heilongjiang Province is represented as $\sum_{i=1}^{n} e_i$. Green food industry’s gross output value for China is $E_i$, and China’s total GDP is $\sum_{i=1}^{n} E_i$.

The results of the $LQ_i$ calculation for the selected period is shown in each year (see Table 7.3 over page).

**Table 7.3: LQ results for Heilongjiang Green Food Industry**

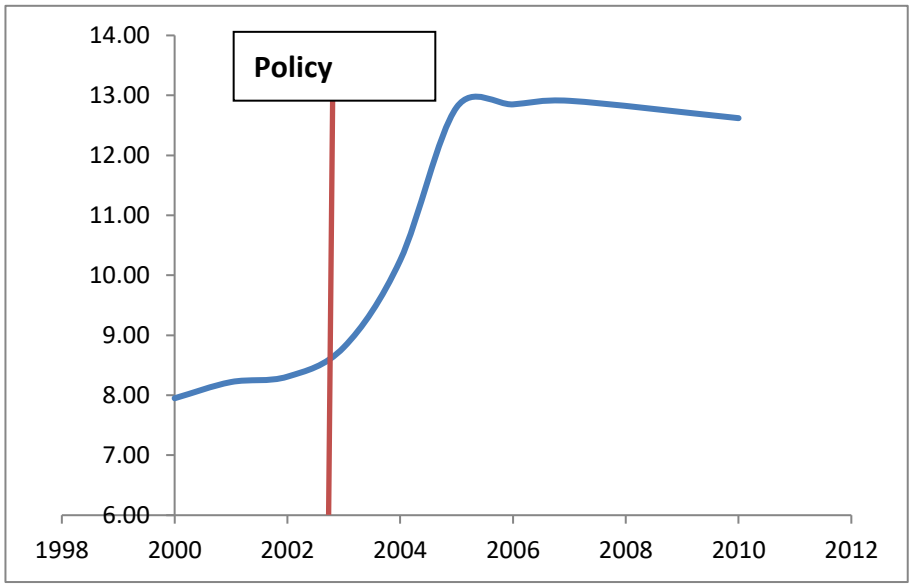
| | 2001 | 2002 | 2003 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|---|
| ei | 127 | 150 | 190 | 327 | 400 | 581.4 |
| ∑ei | 3390.1 | 3637.2 | 4057.4 | 4750.6 | 5511.5 | 6065 |
| Ei | 500 | 597 | 723 | 860 | 1030 | 1729 |
| ∑Ei | 109655.2 | 120332.7 | 135822.8 | 159878.3 | 183217.4 | 249529.9 |
| $LQ_i$ | 8.22 | 8.31 | 8.80 | 12.80 | 12.91 | 12.62 |

Source: Calculated from CSY and Heilongjiang SY (various years).

It is clear from the table above that $LQ_i$ figures for each year are much greater than 1, which indicates that the green food industry clustering level is very high. From 2005 the LQ appears to have stabilised around the 12 to 13 level indicating the level of agglomeration in the industry may well have reached saturation point.

This is perhaps unsurprising given that the Province has actually been ‘overtaken’ in terms of the number of GF enterprises in a few other Provinces (see Section 7.2 above). Nevertheless an LQ is high as this is a clear indication that a significant degree of agglomeration has taken place in the Province since 2001 and accelerated after 2003. The increase in the agglomeration (LQ) index and its stabilisation is best viewed as in Chart 7.6 below.

**Chart 7.6 Development of GF Location Quotient (2000-2010)**




Source: Calculated from CSY and Heilongjiang SY (various years).

The agglomeration of GF firms in Heilongjiang Province accelerated after the policy start in 2003 and thereafter began to stabilise from about 2005. This is partly due to the consolidation of many of the smaller firms into the larger enterprises.

However it also suggests there may well be a saturation limit within the Province although there is no theoretical basis for this argument that could be found in the literature.[45] If we now add the LQ data to the correlation matrix above we can

[45] Even so, it does appear the agglomeration process may well be logistic indicating that saturation of GF is actually beginning around two years after the policy began. This could well be a function of the scale of demand rather than a physical of other economic limit to the number and size of firms in the industry. This is an area that warrants future research.

see which of the cluster elements appear to be very strongly associated with location.

**Table 7.4 Correlation Matrix of Cluster Elements (with LQ added)**

| | *GRADM* | *TECHM* | *QUALITY* | *INNOV* | *EXPORTS* | *OUTPUT* | *POLICY* | *LQ* |
|---|---|---|---|---|---|---|---|---|
| **GRADM** | 1.000 | | | | | | | |
| **TECHM** | 0.971 | 1.000 | | | | | | |
| **QUALITY** | 0.826 | 0.770 | 1.000 | | | | | |
| **INNOV** | 0.798 | 0.839 | 0.484 | 1.000 | | | | |
| **EXPORTS** | 0.682 | 0.686 | 0.539 | 0.667 | 1.000 | | | |
| **OUTPUT** | 0.953 | 0.887 | 0.781 | 0.677 | 0.646 | 1.000 | | |
| **POLICY** | 0.917 | 0.906 | 0.890 | 0.641 | 0.550 | 0.865 | 1.000 | |
| **LQ** | 0.704 | 0.788 | 0.470 | 0.866 | 0.694 | 0.517 | 0.575 | 1.000 |

Source: Appendix 2.

The three elements most strongly associated with the industry's location quotient are the two types of qualified manpower and innovation. This of course makes perfect sense: in the qualitative analysis in Chapter Six all respondents had very positive comments to make on the production and recruitment of locally produced technicians and graduates hence we would expect these to be highly correlated with location.

Additionally, innovation itself is the most strongly correlated element – indicating that there are synergies and economies of scope to be achieved with agglomeration as predicted by theory (see Chapters Three and Four). Interestingly, the reinforcement of the cluster policy itself does not appear to be

strongly correlated with location. This is somewhat surprising given the pre-eminent role given to policy by both sets of interviewees in Chapter Five. However, as discussed in Chapter Three the creation of an industrial cluster may well be helped by policy but it is rarely determined by it. This would also appear to be the case in China indicating that even in a socialist command economy there are limits to the effect that policy can have on the formation and development of industrial clusters. Indeed we shall see this is certainly the case for the pharmaceutical industry. Returning to the GF industry it is useful to examine the nature of the relationship between cluster development and the key elements discussed in Chapters Three and Four in terms of the correlation matrix presented in Table 7.4 above. The question is – what should be selected as the dependent variable?

We could use output since this, theoretically, should expand in line with agglomeration. However this in itself does not ‘capture’ one of the fundamental predictions in cluster theory that spatial agglomeration must result from the formation of a cluster. This is because, the New Economic Geography literature argues we should expect to see firms recognising the advantages of a cluster such as labour pooling, cost reductions, economies of scope, knowledge sharing and ‘learning’. Hence it seems logical that the dependent variable needs to be some measure of agglomeration itself over time. The most appropriate is the

location quotient itself since this does provide a clear and consistent indicator of whether firms are spatially concentrating over time or not. We already know this has not happened in the case of the pharmaceutical industry but has occurred in the case of the green food industry. Therefore we are in a position to test the various hypotheses/propositions that manpower quality, product quality and innovation should be positively and significantly associated with the clustering (agglomeration) process itself. We can also test the extent to which a cluster policy has been important in this process. This is done through a dummy variable (policy on, policy enhanced, policy reinforced)[46] Hence we can postulate the following simple (but theoretically sound) model:

*LQ (clustering) = f (qualified manpower, product quality, innovation, policy)*

The coefficients for each of the independent variables should be positive and significant given the arguments presented in the literature and their entry in the cluster conceptual map as presented in Chapter Four. The results for the regression model for the GF industry are presented in detail in Table 7.5 below. The first point to note is the very high adjusted R square (0.724) which would seem to suggest a reasonably good model fit of the data in respect of the four independent variables. However not one of the latter are statistically significant and the only variable which appears to be 'attempting' to reveal any significance

[46] Corresponding to the 2003, 2009 and 2010 policies introduced in the Province.

is the innovation variable. An examination of the others shows P values that are far from significant while the F statistic for the equation is extremely low. As argued in Chapter Two and Chapter Five the time series is far too short (only 10 years[47]) for the application of such a tool and in the case of the pharmaceutical industry it is even shorter due to the significant difficulty in finding similar official data as that for the green food industry. In addition there is a very high degree of multi-collinearity that can be seen in the correlation matrix above.

**Table 7.5 Regression Results for the GF Cluster**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Multiple R | 0.92852 | | | | | | | |
| R Square | 0.86215 | | | | | | | |
| Adjusted R Square | 0.7243 | | | | | | | |
| Standard Error | 1.182279 | | | | | | | |
| Observations | 9 | | | | | | | |
| ANOVA | | | | | | | | |
| | *df* | *SS* | *MS* | *F* | *Significance F* | | | |
| Regression | 4 | 34.96847 | 8.742117 | 6.254272 | 0.051768706 | | | |
| Residual | 4 | 5.591133 | 1.397783 | | | | | |
| Total | 8 | 40.5596 | | | | | | |
| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
| CONSTANT | 1.442216 | 2.816041 | 0.512143 | 0.635532 | -6.376366488 | 9.260798 | -6.37637 | 9.260798 |

[47] Giving just 8 degrees of freedom.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| QSTAFF | 0.006765 | 0.020665 | 0.327347 | 0.759821 | -0.050610603 | 0.06414 | -0.05061 | 0.06414 |
| QUALITY | 0.015521 | 0.028162 | 0.551124 | 0.610884 | -0.062669693 | 0.093711 | -0.06267 | 0.093711 |
| INNOV | 0.041392 | 0.027364 | 1.512666 | 0.204911 | -0.034581666 | 0.117366 | -0.03458 | 0.117366 |
| POLICY | -0.00156 | 0.014419 | -0.10852 | 0.918811 | -0.041598555 | 0.038469 | -0.0416 | 0.038469 |

In essence the regression model adds very little to our understanding of the agglomeration process in the GF industry in relation to a number of key elements predicted to be 'essential' to the process itself. However this does not mean the hypothesis that these are fundamental can be rejected. We would require a far longer time series to test this properly and the data simply does not exist. In addition as discussed in earlier Chapters the question of measurement may well be a key problem here. The LQ may not be the best dependent variable in this context while 'innovation' can be measured in many different ways. Even the categorisation of product quality is not without its measurement problems.

It could also be argued that even ten years of policies is just not enough for a proper evaluation of the clustering process for green food in Heilongjiang Province. Nevertheless, the non-parametric analysis and calculations for the GF industry are consistent with both the qualitative and quantitative data presented above and do indeed suggest that the GF industry is very much a *developing* cluster within Heilongjiang Province albeit not a *mature* cluster.

In contrast the same calculations[48] for the pharmaceutical industry are much less impressive as can be seen in Table 7.6 below.

**Table 7.6: LQ results for Heilongjiang Pharmaceutical Industry**

| Year | **2001** | **2002** | **2003** | **2005** | **2007** | **2010** |
|---|---|---|---|---|---|---|
| ei | 77.8 | 86 | 99.6 | 118.3 | 123 | 129 |
| ∑ei | 3561 | 3902 | 4433 | 5510 | 6217 | 7077 |
| Ei | 2721 | 3238 | 3876 | 5620 | 6601 | 6679 |
| ∑Ei | 95933 | 102398 | 135823 | 183868 | 210871 | 246619 |
| $LQ_i$ | 0.770 | 0.687 | 0.787 | 0.713 | 0.586 | 0.673 |

Source: Calculated from CSY and Heilongjiang SY (various years).

First, the LQ never rises above 1 over the whole period indicating there is no agglomeration[49] within the Province for this industry. In addition the LQ itself actually declines, even from the 2001 level (before the cluster policy) and the 2003 policy itself has made no impact (or the 2007 policy) on the agglomeration

[48] The paucity of official statistics required to measure the cluster elements for the pharmaceutical industry has meant it was not possible to generate a correlation matrix or regression model as was the case for the GF industry.

[49] Or certainly none that would indicate a shift in the status of the industry to a cluster as the term implies (see Chapter Three).

level. This is perfectly consistent with the qualitative analysis in Chapter Six where the senior official responsible for the industry and the enterprise managers conceded that there is little communication or sharing between enterprises. In terms of the LQ, the pharmaceutical industry in Heilongjiang Province has not yet formed a functional cluster as would be recognised in regional economic theory or the new economic geography models. One factor in this could well be that this industry was not consolidated into larger enterprises as was the case for green food. Additionally the official data that is available for this industry suggests a much slower development in most of the cluster elements identified in Chapter Four.

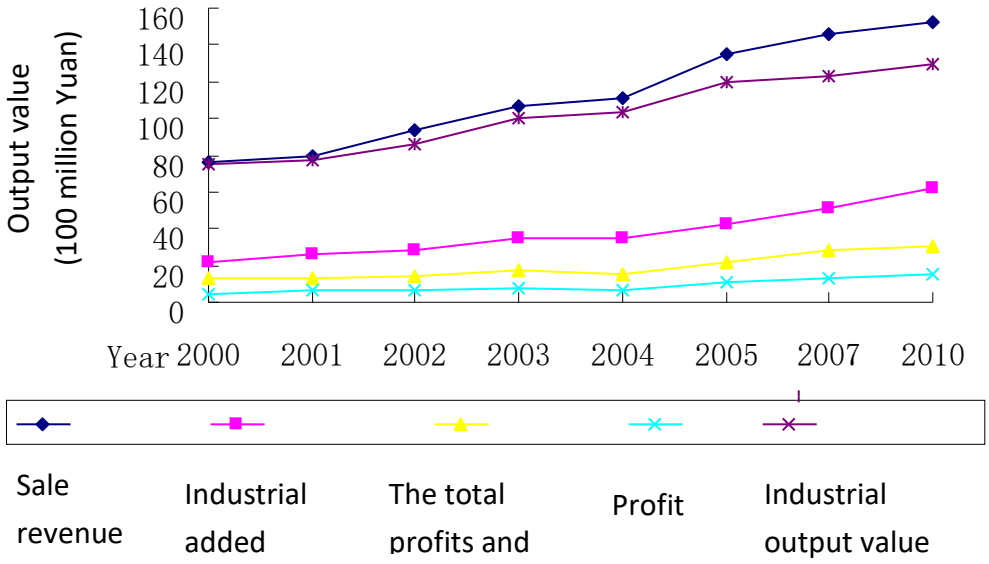
It would be ideal to be able to undertake a similar comparative analysis (of Provinces) however it was not possible to do so for the pharmaceutical industry. Data on specific elements such as product variety could not be found in the relevant yearbooks or from industry sources across Provinces.[50]

However some relevant data was collected that does shed some light on the development of this 'cluster' within Heilongjiang Province itself. For example the growth in output has been substantially below that of the GF industry while the

[50] The researcher does not have a clear explanation for this. However it is the case that this industry tends to be surrounded by a degree of 'commercial confidentiality' and 'official confidentiality' that is not the case for the GF industry. Therefore it has proved very difficult to obtain reliable data. This in itself very much weakens the theoretical argument that knowledge sharing, labour sharing and a 'learning network' will be clearly evident in industrial clusters. This may only be the case if in fact the cluster is not shrouded in 'confidentiality'.

financial indicators from pharmaceuticals have not performed particularly strongly.[51] The data below show a very gradual increase in several aspects of the industry in Heilongjiang Province.

**Chart 7.7: Growth in Finance Indicators and Output of Heilongjiang Pharmaceutical Industry (100 million Yuan)**




*Source: Year 2000-2010 Local Statistics Communiqué of National Economic and Social Development

Output has only risen by about 50 per cent over the whole ten years whereas as we already seen this was over 700 per cent in the GF industry. All the financial indicators indicate a healthy but very slow expansion across the time period. This is not consistent with an industry that has been earmarked as a key

[51] The author was not able to find financial indicators for the GF industry in the official statistics while the interviewees would not divulge this information due to confidentiality.

industrial cluster. However it is consistent with the views of the industry managers who argued that as a cluster it is still developing – clearly it has a long way to go to come close to the developments in the GF industry.

For example, although a small number of the pharmaceutical enterprises interviewed pointed to a substantial proportion of qualified staff the overall increase in these across the industry has not been very high as indicated in Table 7.7 below. In fact the absolute number of technicians hardly changed between 2003 and 2010 whereas the number of graduates increased slightly.

**Table 7.7: Growth in Qualified Manpower in the Pharmaceutical Industry in Heilongjiang**

| | **2003** | **2004** | **2005** | **2006** | **2007** | **2010** |
|---|---|---|---|---|---|---|
| Employment | 45580 | 46420 | 46480 | 46630 | 46440 | 48650 |
| Technicians | 8690 | 8830 | 8540 | 8500 | 8550 | 8670 |
| Graduates | 4500 | 4780 | 4790 | 5120 | 5200 | 4900 |
| % Technicians | 19.07 | 19.02 | 18.37 | 18.23 | 18.41 | 17.82 |
| % Graduates | 9.87 | 10.30 | 10.31 | 10.98 | 11.20 | 10.07 |

Source: Appendix 3b.

Total employment has risen relatively slowly compared with the GF industry although it should be noted that between 2000 and 2002 this had actually fallen. Hence the new policy gave something of a boost to the industry but clearly this has been marginal.

On the other hand the investment in research and development did increase significantly from an overall share of under half of one per cent of the Provinces' GDP to nearly one per cent.[52] However, as indicated in Chapter Six, most (if not all) of this investment represents domestic sources of equipment and local effort (which is a very good thing) but it does not really help the industry to develop to a point where it can become internationally competitive. This was a common theme from the enterprise managers' interviews as explained in the previous Chapter.

**Table 7.8: Heilongjiang's investment in R&D from 2001-2010:**

| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|---|---|
| Expense on R&D (Billion Yuan) | 16.7 | 19.1 | 22.6 | 28.2 | 38.9 | 48.4 | 60.5 |
| R&D share of local GDP (%) | 0.47 | 0.49 | 0.5 | 0.5 | 0.7 | 0.8 | 0.85 |

Source: Local Statistics Communiqué of National Economic and Social Development (various years).

R&D investment is a crucial factor for the pharmaceutical industry as it is closely related to innovation ability. However most of the products within China's Pharmaceutical Industry are duplication; new products hold a very small share. In addition, according to the 2007 plan (see Chapter Two) and the interviews' responses from the government and enterprises, investment in R&D has been gradually increased in Heilongjiang Province.

[52] This represents almost a fourfold increase in the R&D expenditure in the industry.

This shows there is a recognition of the importance of emphasis on scientific and technology investment but the R&D contribution is still less than 1%, which is lower than some other regions of China where no cluster policy has been implemented and this is clear from the Table below.

**Table 7.9: R&D Investment in Pharmaceuticals by Province (2009)**

| Province | Jilin | Liaoning | Henan | Zhejiang | Beijing | Shanghai | Heilongjiang |
|---|---|---|---|---|---|---|---|
| R&D Expenditure (Million Yuan) | 40.9 | 159.4 | 103.8 | 564 | 503.5 | 311 | 57.6 |

Source: Local Statistics Communiqué of National Economic and Social Development

Despite being a centre of cluster policy Heilongjiang has not developed a significant Research and Development 'hub' in the pharmaceutical industry as might be expected. Indeed other than Jilin Province all the others with a significant pharmaceutical industry had investment volumes significantly larger than in Heilongjiang. This to some extent contradicts the suggestion by some enterprise managers that the local higher education institutions are making a significant contribution to research in the field. Nevertheless such an assertion will always be subject to personal opinion based on personal experience and so we cannot generalise this argument.

The leading products of the enterprises are too similar and duplication is widespread. In addition the balance of the Medicinal chemicals and Proprietary Chinese medicines has deteriorated in recent years, which is another indication of very little innovation in the former in the traditional part of the industry. There are a number of issues facing the industry that as yet have still to be resolved but have been problematic for many years. There is a relatively weak basis for enterprises to innovate, and this can be seen in the following Table.

**Table 7.10: Product Mix in the Pharmaceutical Industry**

| | 2003 | 2005 | 2007 | 2010 |
|---|---|---|---|---|
| 'Modern' medicines | 8000 | 7779 | 6242 | 6058 |
| Chinese medicines | 16000 | 24000 | 22000 | 23680 |
| Ratio | 1:2 | 1:3.1 | 1:3.5 | 1:3.9 |
| | | | | |

Source: Year 2003-2007 Heilongjiang Statistics Communiqué of National Economic and Social Development

The number of Chinese 'traditional' medicines has increased significantly however the majority of these have long been derivatives of more fundamental products. Even so it does show a degree of innovation in this respect. However the same cannot be said of modern medicines. The number of products has

actually declined thus raising the ration of these to Chinese traditional medicines over the period from 1 to 2 to nearly 1 to 4.

One reason for this might be that the techniques for making modern medicines have not improved much over this period. This would be totally consistent with the comments made by many of the enterprise managers – that acquiring imported technology remains a major impediment to the industry. Hence a reliance on ‘innovating’ within the traditional sector of the industry where product knowledge is much deeper and the structure of these products is more simplified.

Heilongjiang is very rich in resources of wild medicinal herbs, there are 856 varieties of plant and animal materials in the Province, and the total reserves are around 2.7 billion tons. The Harbin Pharmaceutical Group owns 6 main series, more than 20 formulations, and up to 1000 varieties; in terms of processing techniques, about 40% of antibiotics and chemicals use international production standards.

By 2010 there were 218 pharmaceutical enterprises in Heilongjiang as shown in the Table below. By far the three largest enterprises are Harbin Pharmaceutical

Group, Haci Group and the Lingtai Group. More than 70 of the 218 enterprise moved into the Heilongjiang Pharmaceutical District[53] between 2001 and 2010.

**Table 7.11 Number and Type of Enterprises in the Heilongjiang Pharmaceutical Industry (2010)**

| Type-> Total = 218 | Western Drugs | Chines Hebal Medicines | Medical Equipment | Biological Products |
|---|---|---|---|---|
| Number | 109 | 70 | 23 | 16 |
| Percent | 50 | 32 | 10.6 | 7.4 |

Source: www. fwol.cn

Although the Heilongjiang pharmaceutical industry is meant to be primarily based upon traditional Chinese herbs in fact half the enterprises are engaged in medicinal producing drugs that are actually Western in origin (or under licence). Only one third of the firms are engaged in producing traditional medicines. This perhaps explains why the managers in the sample in Chapter Six could not agree that 'talking' and 'sharing' were of any particular value to them. It also explains to a large extent why this industry has not yet formed even the basics of an industrial cluster as per the theoretical definitions discussed in Chapter Three.

[53] This is the Limin Technology area. This initiative has resulted in some agglomeration but as shown above it is still very low compared with the green food industry.

It is essentially an industry with four very distinct parts to it and not a largely homogenous cluster at all. The above analysis leads to a very clear assessment of the cluster policies in Heilongjiang: the GF industry is certainly revealing many of the elements we would expect to see from an industrial cluster while the pharmaceutical industry is not doing this. To add another perspective to this assessment we now turn to the effect that the policies have had on the share of employment of these industries.

### 7.4 Shift-Share Analysis

As explained in Chapter Three and Four another useful indicator of the emerging prominence of an industrial cluster is the effect it has on the share of employment relative to the specific industry across the economy. It can be a strong indication that a specific industry is indeed emerging in a particular region. As cluster theory suggests, we should see this emergence from a standard technique in regional economics – shift – share analysis.[54] If both the GF and pharmaceutical clusters have indeed been emerging in Heilongjiang Province then this should be reflected in their share of employment as compared with the rest of the economy in these industries. We now turn to an examination

[54] As argued in earlier Chapters and in this Chapter the time series available has made it impossible to undertake a realistic and reliable regression analysis of the data for both industries. However SSA does not require a significant time series of data to establish if in fact a structural change in employment within a specific industry has or is taking place.

of this ‘prediction’ from Chapter Four. Before this it will be useful to provide a brief introduction to the concept of SSA itself.

As explained earlier Shift-Share Analysis (SSA) is a widely used technique for the analysis of regional economies. SSA, as a methodology, is comprised of traditional accounting-based models although there are many applications of the method, see Fothergill and Gudgin (1982); Barff and Knight (1988); Harrison and Kluver (1989); and Knudsen (2000).

The concept of shift-share was originally proposed by Dunn (1960) as a forecasting technique for regional growth, usually employment. The main purpose was to determine the extent to which the difference in growth between each region and the national average is due to the fact that the region is performing better than average in all industries or to the fact that the region happens to be specialised in fast growing sectors.

Thus, shift-share analysis decomposes employment growth (or decline) in a region over a given time period into three components: (1) a national growth effect, (2) an industry mix effect, and (3) a competitive effect. A national growth effect is that part of the change in total employment in a region due to the rate of growth of employment in the economy as a whole. An industry mix effect is the change the region would have experienced if each of its industries grew at their

national rates minus the national growth effect. Yet, a competitive effect is the difference between the actual change in employment and the employment change to be expected if each industrial sector grew at the national rate. The sum of these three effects equals the actual change in total employment within a region over the period of analysis. The latter effect in particular ought to be indicative of the emergence of a successful industrial cluster.

Shift-share analysis is not a behavioural model; it does not explain why a region grows or declines differently from the economy. In this context shift-share analysis has been criticised as an essentially simplistic accounting system capable of revealing little useful economic information (see Knudsen, 2000). However in the absence of systematic, regular and high quality time series data it is difficult to avoid the conclusion that shift-share at least offers a context within which a degree of analytical endeavour can be achieved. In the context of this study, shift-share at least provides a ‘first pass’ view of the changes that have occurred in Heilongjiang Province since the policies for clusters actually began. Combining the results of this analysis with the above location quotient data, the analysis of the statistical trends and the qualitative data analysis from Chapter Six we are able to arrive at a sensible interpretation of what all of these data are telling us.

The main focus of shift-share analysis is on the difference between regional and national growth rates. The traditional shift-share model decomposes growth of economic variables such as income or employment into the national and regional components. Using this framework the components of growth in Heilongjiang Province in the context of China's national growth are:

1) The effect of national growth or national share (N).

2) The difference in the industrial structure or composition of Heilongjiang Province and the nation, i.e. the industrial mix component (IM).

3) The amount of growth not due to nationwide growth or industry wide growth, i.e. the Competitive Effect (RC).

Shift-share analysis utilizes the above definitions to determine the strength of each effect and, thus, to infer to what extent a particular region is composed of mainly leading or lagging industries. The results of this type of 'accounting' can be used to inform the design of local and national economic policy – particularly in relation to the allocation of capital, technology and labour resources across the economy. This use of shift-share would appear to be of particular value in China where the Central Committee continue to determine the allocation of resources over long periods of time using the five year plan model. The

shift-share equations for the three components of growth occurring in the $i^{th}$ sector and the $j^{th}$ region during the period of analysis can be written as:

Regional employment growth due to growth in national economy:

$$\left(\frac{E_N^t}{E_N^{t-1}} - 1\right) E_{ij}^{t-1} \times N_{ij}^t =$$ National Component:

Employment growth due to the region's mix of industries:

$$\left[\left(\frac{E_{iN}^t}{E_{iN}^{t-1}}\right) - \left(\frac{E_N^t}{E_N^{t-1}}\right)\right] E_{ij}^{t-1} \times IM_{ij}^t =$$ Industrial Mix Component:

Employment growth due to the region's competitiveness:

$$\left[\left(\frac{E_{ij}^t}{E_{ij}^{t-1}}\right) - \left(\frac{E_{iN}^t}{E_{iN}^{t-1}}\right)\right] E_{ij}^{t-1} \times RC_{ij}^t =$$ Regional Shift Component:

Hence: $E_j = \sum_{i=1}^{n} (N_{ij} + IM_{ij} + RC_{ij})$

Where:

Ej is the actual growth in the "j"th region;

$N_{ij}$ is the national growth by economic sector "i" in region "j";

$IM_{ij}$ is the industrial mix component of economic sector “i” in region “j”;

$RC_{ij}$ is the competitive effect of economic sector “i” in region “j”;

n is the number of sectors in region “j”.

National Component

This component reflects the expected growth in the region had it grown at the same rate as the national economy.

Industrial Mix Component

This component measures the influence of fast or slow growing industries within a regional economy. It is, thus, theoretically possible to identify leading and lagging industries within any given regional economy, relative to the national economy.

Competitive Component

This component is used to measure the extent to which a given sector in a given region is performing better than the national average. Thus, it can be interpreted as indicating higher total factor productivity at the regional level compared with the national level. Hence, it is often referred to as the ‘dynamic’ or competitive component in regional growth. The results for the SSA in Heilongjiang Province are given in the Table and Charts below:

**Table 7.12: Total Shift by sector from 1997 to 2010 in Heilongjiang Province**

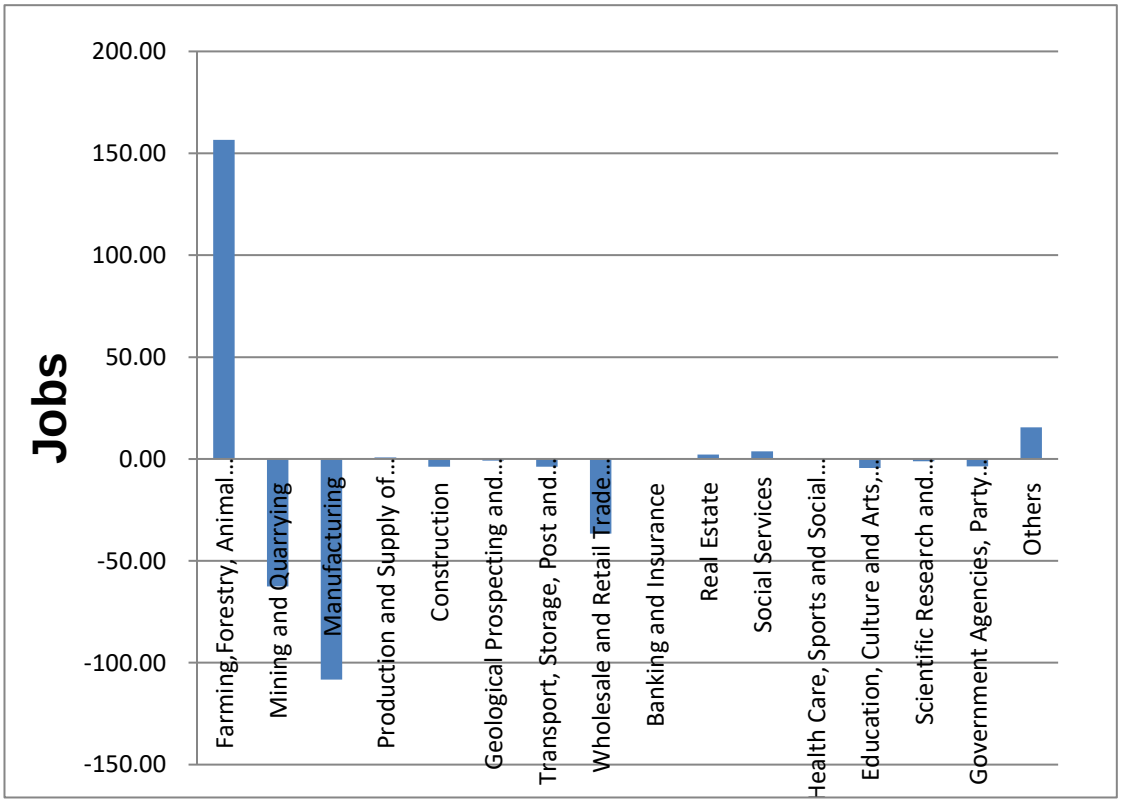
| Industry | Total shift |
|---|---|
| Farming, Forestry, Animal Husbandry and Fishery | 156.65 |
| Mining and Quarrying | -62.63 |
| Manufacturing | -108.30 |
| Production and Supply of Electricity, Gas and Water | 0.77 |
| Construction | -3.84 |
| Geological Prospecting and Water Conservancy | -0.81 |
| Transport, Storage, Post and Telecommunication Services | -3.83 |
| Wholesale and Retail Trade and Catering Services | -36.70 |
| Banking and Insurance | -0.02 |
| Real Estate | 2.09 |
| Social Services | 3.72 |
| Health Care, Sports and Social Welfare | -0.18 |
| Education, Culture and Arts, Radio, Film and Television | -4.39 |
| Scientific Research and Polytechnic Services | -1.11 |
| Government Agencies, Party Agencies and Social Organizations | -3.67 |
| Others | 15.54 |

Source: Data collected and organized from China and Heilongjiang Yearbooks.

Under the shift-share equation $E_j = \sum_{i=1}^{n} (N_{ij} + IM_{ij} + RC_{ij})$ and the explanation of the decomposition components shown previously, Table 7.12 shows the total shift of employment in terms of different industries in Heilongjiang Province relative to the national economy. The green food industry is within the general category of farming while pharmaceuticals is included in manufacturing. The first

point to note is that overall, agricultural employment in the Province has remained relatively constant since 1997 – the positive shift (relative to the rest of the economy) is mainly the increase in the number of jobs in the green food industry.[55] However the very small growth in employment in the pharmaceutical industry (see above) has not made any significant impact on the overall decline of manufacturing. The structural changes in employment within the Province are clear from the Chart below.

**Chart 7.8: Total Shift by sector from 1997-2010:**




[55] Note that a proportion of these are also included in manufacturing. It is not possible to separate out both GF and pharmaceuticals from these national categories completely.

The first thing to notice in the Chart above is that there has been a significant gain in the agricultural industry which is the only significant increase in the whole picture. On the other hand, there is an obvious decline in employment in manufacturing and mining which are the two key traditional sectors in Heilongjiang Province. Taken together this decline is larger than the employment gain in the rest of the Heilongjiang economy. Furthermore, some modest gains are brought by the production and supply of electricity, gas and water and part of the tertiary sector—notably real estates and social services. The construction sector of the secondary industry and some of the tertiary sectors such as transport, retail, education, scientific research and government agencies have actually seen a slight decline in employment over the reference period of analysis. There also has been a notable increase in employment in the sector of 'others' which may contain some miscellaneous which were not categorized from tertiary industry during the reference period. One of the reasons may well be the large job losses that have occurred in the traditional sectors prompting the need for the provincial government to increase spending on these services. Nevertheless, the 'picture' is a clear one: traditional industries are in absolute decline in terms of employment, agriculture hugely 'mopping up' a lot of this and the latter is dominated by the growth in the green food industry.[56]

[56] No other part of the 'farming' sector from official statistics shows employment growth except the green food industry. Hence, it is reasonable to conclude that the large positive shift above can only be due to this industry.

However we need to understand the components of these changes if we are going to be able to conclude if GF (in particular) is actually an emerging cluster. This is presented in Table 7.13 below:

**Table 7.13: Contribution to Total shift by sector from 1997-2010 in Heilongjiang Province**

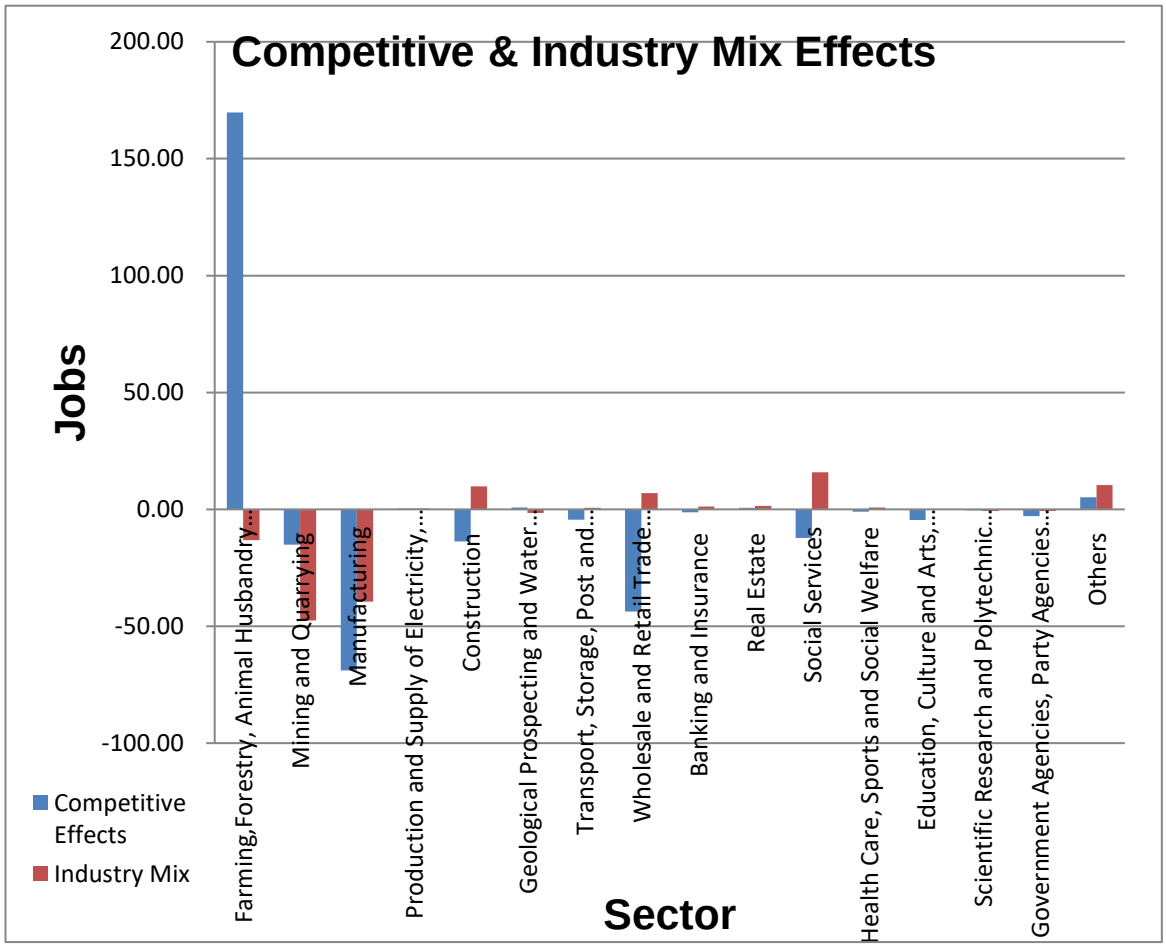
| Industry | Competitive components | Industrial mix components |
|---|---|---|
| Farming, Forestry, Animal Husbandry and Fishery | 169.80 | -13.15 |
| Mining and Quarrying | -15.04 | -47.59 |
| Manufacturing | -68.89 | -39.42 |
| Production and Supply of Electricity, Gas and Water | 0.44 | 0.34 |
| Construction | -13.70 | 9.87 |
| Geological Prospecting and Water Conservancy | 0.76 | -1.57 |
| Transport, Storage, Post and Telecommunication Services | -4.46 | 0.63 |
| Wholesale and Retail Trade and Catering Services | -43.67 | 6.97 |
| Banking and Insurance | -1.23 | 1.21 |
| Real Estate | 0.67 | 1.42 |
| Social Services | -12.15 | 15.87 |
| Health Care, Sports and Social Welfare | -1.01 | 0.83 |
| Education, Culture and Arts, Radio, Film and Television | -4.58 | 0.18 |
| Scientific Research and Polytechnic Services | -0.41 | -0.70 |
| Government Agencies, Party Agencies and Social Organizations | -2.96 | -0.71 |
| Others | 5.16 | 10.37 |

Source: Data collected and organized from China and Heilongjiang Yearbooks

Table 7.13 reveals the competitive effects and industrial mix factors corresponding to Table 7.12. The most significant performance obtained from the figure above is the fall in employment growth in terms of industry mix, whereas the huge positive contribution to the regional employment is in terms of the competitive effects in the agricultural sector. The increasing competitive effect demonstrates the significant importance of the agriculture industry especially the ‘green food’ sector.

On the other hand, the lack of industrial mix of agriculture shows weak association among the main sectors of the industrial clusters and their forward, backward, supporting and related industries. As explained in Chapter Six and earlier in this Chapter the degree of integration between GF and other sectors is not as high as one would expect from cluster theory. Chart 7.9 over page combines both components into a bar chart in terms of industries which will obviously evidence the questions above:

**Chart 7.9: Contribution to Total shift by sector 1997 -2010:**




Source: Derived from Table 7.12

There is no doubt that the GF industry has made a very substantial contribution to the agriculture sector overall and during the period of analysis. However we cannot be absolutely confident that this has wholly been the result of the GF cluster policy since extracting sector specific data is not always possible from the available national statistics or from the Provincial data. Nevertheless, the GF industry data presented in the first part of this Chapter is consistent with this interpretation, that the GF industry is indeed an emerging and relatively strong

industrial cluster. However, given the data earlier on the pharmaceutical industry, combined with the qualitative analysis there is no indication at all that this industry has made a significant contribution to the Province's 'share' of employment. Indeed we know total employment has hardly increased over a ten year period. Taking all of the above evidence and that provided by the government and enterprise managers a reasonable conclusion is that in terms of trends in the data, location quotients, shift-share components and interviews the GF industry can be categorised as a developing cluster while the pharmaceutical industry cannot.

When we link these two industries to the cluster 'map' from Chapter Four it is very clear that only GF actually includes most (although not all) of the elements we would expect to see given the theoretical propositions arising from the literature analysis.

In the following Chapter the evidence from the qualitative and quantitative data above is discussed in some detail with a view to making 'sense' of these data in terms of the literature and the theoretical cluster elements discussed earlier.

# Chapter Eight: Industrial Clusters in Heilongjiang Province: analysis of the evidence

## 8.1 Introduction

Regarding the statistical findings relating to the industrial clusters in Heilongjiang Province in terms of the ‘Green Food’ and ‘pharmaceutical’ industries this chapter will provide an analysis of the evidence presented in Chapters Six and Seven above.

## 8.2 The ‘Positives’ in the Green Food industrial cluster

Referring to the ‘cluster theory’, there are a series of crucial indicators that would boost the formation and expansion of industrial clusters as set out in Chapters Three and Four. These include natural resources, a skilled labour force, technology and labour pooling, knowledge sharing, agglomeration and innovation driven enterprises. According to the Heilongjiang statistical yearbooks and government data, the existing provincial area of forest land is 14.67 million hectares and the forest coverage rate is 41.9%. The total area of the grassland is 4.33 million hectares and the water area which ranks the fourth highest of the whole nation is 2.33 million hectares. More than half of the province land remains in good condition. The majority of the 11.5 million hectares arable land is black earth. It is one of the world's only three black belts. Wild animals and plants are rich in resources. The higher plants are about 2400 varieties; 1000 of which are edible, and some of them are still unused. These are environmental

and ecological conditions very well suited to the development of green food in abundance.

As stated by interviewees from the Heilongjiang Green food development office and the Heilongjiang Development and Reform Commission, in recent years, Heilongjiang Province has been exporting a variety of green food to Russia, South Korea, Japan and other countries. However the official data on exports shows slow progress in export growth and also that it is highly dependent on global economic conditions – as the green food export volumes demonstrate with their sharp decline after 2007.

The governor from the Heilongjiang Green food development office stated that Heilongjiang owns plenty of green food processing enterprises. It formed a group of famous brands by cultivating well-known brands and promoting brand extension. It also formed a series of targeted and driving enterprises which process soya, rice, dairy, beer and mountain products. The ‘Wondersun’ Stock Limited Corporation, ‘Beidahuang Rice Group’, ‘Jiusan Oil and Fat Corporation’, ‘Harbin Beer’, and ‘New Sanxing’ enterprises have entered the provincial and national levels as leading enterprises. This was the direct result of the various plans which consolidated the industry into larger enterprises from the hundreds of much smaller ones that had developed in the 1980’s and 1990’s. There is no

doubt that this particular strategy has been a success in terms of employment, output and innovation. It has also enables scale economies and some degree of knowledge sharing both of which are considered central to the success of an industrial cluster.

As indicated in Chapter Three long-term industrial cluster development would only succeed if built on science education. As explained in Chapters Two and Five there are a number of tertiary research institutions in Heilongjiang Province. The Governor from Heilongjiang Development and Reform Commission gave some examples such as Harbin Institute of Technology, Harbin Engineering University, Northeast Agricultural University, Heilongjiang Bayi Agricultural University, Northeast Forestry University, Harbin University of Commerce, Heilongjiang Provincial Academy of Social Science and Heilongjiang Academy of Agricultural Science. He added that these institutions possess many senior faculty and researchers. This has proved very important in the production of qualified manpower for the industry in terms of scientific technology and education. In Harbin as an example, there are 36 institutions of higher education, and by the end of 2010, there were 40,000 people involved in research which included 33,000 scientists and engineers. Furthermore, several green food enterprises such as ‘Harbin Beer’, ‘New Sanxing’, ‘Harbin Kaoke’ and ‘Lushanchuan’ have fostered their own research teams and advanced facilities.

Both science and technical expertise contribute significantly to the green food industrial cluster development.

The various cluster plans that the central and Heilongjiang provincial government have issued have been a series of encouraging and supporting policies. These policies aimed to encourage the development of large enterprises, improve product quality standards, accelerate brand integration, increase exports and integrate with the global market. Meanwhile, there are plenty of specialised institutions and personnel at all different levels of the city, district, county and town that are responsible for promoting the development of the green food industry. These policies have been providing a guarantee for the Heilongjiang Province green food industry cluster development.

The interviewees from Heilongjiang Green Food Development Office as well as Heilongjiang Development and Reform Commission explained that, after the green food industry has stepped in a new stage, the Heilongjiang Province adjusted the agricultural and rural economic structure. This put the ‘development of safe and high quality green food products’ as the key measures for economic restructuring. Particularly, it also developed the local green food brands on top of the new provincial economic competitiveness list. In recent years, the provincial government has enacted a series of developing schemes that specialised in the

development of green food. It focused on a number of important issues such as ‘Heilongjiang Province 2000-2010 green food development-planning’ and ‘Heilongjiang green food industry development implementation plan’. From the management perspective, the provincial congress worked out ‘Heilongjiang Green Food management ordinance’ to further standardise the green food production and management activities.

From the production technology perspective, competent authorities set up production technology regulations to promote the green food industry development and especially enhance policy and funding. In addition, the provincial government stressed policies especially in support of the large enterprises, improvement of product quality standards and acceleration of brand integration. This can be seen as an attempt to foster the ideas of Francois Perroux (growth pole theory, see Chapter Three) that the large enterprises of the green food industry in Heilongjiang have been driving the development of the industry within the regional economy. This supports the development strategy as part of the ‘2009 Northeast Plan’ discussed in Chapter Two in terms of building its new growth pole with unique advantages and competitiveness to further contribute to national economic growth.

Also, implementation of specialised institutions at different levels of the city, district, town and county was achieved at the same time. This implementation aimed to support the local green food development in terms of base construction, product quality, employment and quality inspection. These policies have been providing protection and assurance for the local green food industry development.

### 8.3 Brand reputation

With continuous effort for more than ten years, the Heilongjiang green food industry has been expanding rapidly, pushing all the crucial indicators to the top of the national list. Indicators include enterprise and export sales amounts, and product quantity, quality, and sales. They indicate that the Heilongjiang green food industry has entered a new era for sustaining and accelerating development.

At present, Heilongjiang green food is well reputed at home and abroad. The green food production has been spread into several product ranges including grain, oil, dairy, meat, egg, vegetable, herb, mountain products, beer and beverages. Along with switching from single product certification to series certification and increasing the number of ‘Double A’ products and from small-scale operation to large scale enterprises within an industrial cluster, the Heilongjiang green food industry has rapidly developed (see Chapter Seven).

Within the Heilongjiang green food enterprise group, the green food processing enterprises occupy a large share with many large enterprises in grain, soya, dairy, mountain products and beer product series. Information obtained through the interviews showed that these enterprises are ‘Heilongjiang Jiusan Oil & Fat Corporate’, ‘Heilongjiang Wondersun Dairy Corporate’, ‘Beidahuang Rice Group’, and ‘Heilongjiang Huarun Alcohol Corporate’. They also include ‘Wuchang Lufeng Rice Group’, ‘Harbin Kaoke Soya Food Corporate’, ‘Harbin Beer Group’, ‘Huarun New Sanxing Beer Corporate’ and several others. Furthermore, many of these excellent enterprises as ‘Wondersun’, ‘JiuSan’, ‘Beidahuang’, ‘Harbin Beer’, and ‘New Sanxing Beer’ have already been on the provincial and central leading enterprise list. In addition, ‘Heilongjiang Jiusan Oil & Fat Corporation and ‘Beidahuang Rice Group’ were on the top ten economic return list of the national food processing industry in 2009. This development of these large enterprises has laid a solid foundation for the Heilongjiang green food industrial cluster development. A strong brand is the recognition by consumers of local industry strength and high value intangible assets such as French perfumes, Italian fashion, Swiss watches and many more. The benefit could be shared by all the enterprises in the region once the regional brand formation was complete.

Heilongjiang Province already formed a series of well-known green food brands through years of cultivating such as ‘Jiusan soya salad oil’, ‘Jiusan soya nourishment’, ‘Wuchang Rice’, ‘Beidahuang Rice’, “Xiangshui Rice’, and ‘Jingpohu Rice’. The brands also include ‘Zhenbaodao Rice’, ‘Wondersun Dairy’, ‘Longdan Dairy’, “Jinxing Dairy’, ‘Luler Dairy’, ‘Harbin Beer’, ‘New Sanxing Beer’ and ‘LuShanchuang Mountain products’. The regional brand effect could be shared by all other enterprises in Heilongjiang Province and enhance the regional image for cluster expansion.

As stated earlier, Heilongjiang green food industry has made several remarkable achievements after experiencing more than ten years of development. Interviews with Heilongjiang Green Food Development Office and Heilongjiang Development and Reform Commission showed that central and regional governments have focused on brand merging and reorganising over the years. Brand merging and reorganising enhance productivity, strengthen efficiency and increase the production quality. Along with this the issue of brand integration has attracted the concern of all parties and has a certain degree of consensuses in terms of the following:

- Brand integration is the basic mechanism for exploiting the market;
- It is an effective measure to satisfy consumers and;

- it is the only path to introduce famous brands
- it achieves reliable assurance for green food quality and sustaining development

According to the some of the interviewees brand integration in the Heilongjiang green food industry started in the late 1990s. The province's rice brands have been gradually integrated with the eight main brands that include 'Beidahuang', 'Bingdeng' and 'Wuchang'. Soya brands have been merged with their five famous brands such as 'Jiusan', 'Hagaoke', and 'Lujin'. Moreover, corn brands have been categorised into 'Huarun', 'Binghua', 'Longfeng' and 'Bizhu' which are the four famous brands.

As mentioned by interviewees in Heilongjiang Green food development office and Heilongjiang Development and Reform Commission, based on major development of 'grade A' green food products, the Province has been increasing the number of 'grade AA' to be in line with international standards. For example, the sown area and yield for 'AA' products in 2001 was zero; however, they now occupy 3.09 million hectors and contributed 733 thousand tons in 2010. It is obvious that the improvement in 'grade AA' product is a crucial step to enhance the product quality and reduce the gap between China and the rest of the world.

However this is not being reflected in growth in export markets as we will see below.

### 8.4 Problems of the green food industry cluster

Although the economic indicators for Heilongjiang green food industry have been increasing in the last 10 years and made many notable achievements, the industry has not been meeting up with international standards. The shift share analysis in Chapter Seven signals the weak industrial structure of agriculture in Heilongjiang Province, although the competitiveness is relatively strong. This relatively weak interaction between the industry and related sectors is alluded to by Government officials (see Chapter Six) although it is nevertheless much stronger than in the case of the pharmaceutical industry.

Although there has been significant improvements in the number of double A products compared with the expanding green food production output, the certified number of ‘grade AA’ products is still less than 10% of total planting in green food. The sown area of ‘grade AA’ accounts for only 8% of the total green food sown area. This is clearly not a sufficient base for engaging in large scale export development – even although this was and remains a key element in the cluster policy.

The technicians' proportion of the GF labour force declined in the last few years which made it more difficult for enterprises to sustain development.[57] In 2007, the technicians' number decreased more than that in 2004 although the total staff within this sector increased more than 3 fold between 2000 and 2010.

Most of the time, financial investments are the base for the development of leading enterprises which demand energetic support from financial institutions and relevant policies. As several of the interviewees suggested gaining access to finance, especially for importing equipment has a negative effect on investment and especially in R&D. Future policy needs to offer more channels to generate finance for the large leading enterprises because they have the potential capacity to be the vanguard for industrial innovation.

According to the interview record from governors and managers of green food enterprise, although Heilongjiang Province successively set up a number of green food enterprise groups through alliance, merger, purchase and joint-stock system, it is still weak in terms of amount of large enterprises with international competitiveness. These series include 'Jiusan' fat and oil Group, 'Beidahuang' rice Group and 'Harbin' beer Group. like 'wondersun' Dairy Group, 'Heilongjiang' Dairy Group, 'Ludu' Group, 'Heisen' Group and many others.

[57] However the absolute number has been rising, even though the proportion has fallen slightly.

The setting up of these groups was to increase the industry's ability to raise output and to become or at least develop an international strategy. The current position of Heilongjiang green food industry is that it needs to accelerate the process of internationalisation to match the world's requirement for organic food, and match the certification authority and standards of other countries. The reason of the weakness may be due to the lack of linkage between academic institutions and green food enterprises as discussed earlier. Also, the insufficient investment in R&D definitely slows the pace of integration at the international level. Although the government have made contributions and achievements in this issue through the policies of the Northeast plans (see Chapter 2), it is still a key issue that needs to be further targeted in future development strategies.

The Green food industry has been developing rapidly in Heilongjiang. Major green food products are milk, rice and soya bean products, in 2010, the output value of green food processing was RMB 18.2 billion, an increase of 10.8% from 2005. Heilongjiang province is rich in high quality land for green food development. As its new focus on regional economies is developed[58], the central government has already set up a series of relevant measures to enhance this. Through firstly supporting the leading enterprises to enhance the form of green

[58] Regional development was a key part of the most recent 5 year Plan.

food industry groups, and also strengthen the green food processing techniques to improve the output quality. As the intense competition in the international agriculture product market grows each year, the high quality brand advantage of green food will be a major element in marketing strategy. Although the green food export volume from Heilongjiang Province is not high at the moment, its green food products already dominate the domestic market, and clearly it has the potential to export more.

With the effort of both the government and enterprises and its natural geographic resources, the Province needs to become much more involved in the international market in the future if the potential is to be realized. But raising exports is only one aspect of the green food industry as an industrial cluster in the Province. It is essential that both forward and backward supply chains from the industry are strengthened. This will enable faster transmission of good practices in the industry and its suppliers and contribute to maximizing employment growth.

Therefore the policy implications are several: a greater focus on meeting export required standards, a greater emphasis on securing and strengthening the

supply chain in both directions[59], a willingness to share best practice across the industry and initiatives by the Provincial government to enable all of these to take place.

In addition there needs to be a stronger focus on marketing both within China and overseas. This should involve the creation of high quality and identifiable brand names in green food. There is no reason why Chinese green food should not become a household brand name across the globe. All of these required developments will take time, a clear strategy and investment at national, provincial and producer level. Therefore an integrated strategy needs to be put in place in order to maximize the potential of this very important industrial cluster. This is happening to some extent already but it requires a more urgent focus since competition in this sector at the global level is becoming even more difficult. The sooner that Heilongjiang Province can capitalize on its clear internal) comparative advantages the better for the cluster and for the future development of related sectors within the Province. The quantitative data presented in Chapter Seven clearly point to the existence of a developing cluster within the green food industry – there is no doubt about this. All of the trend indicators, the location quotients and the shift-share data strongly suggest that this industry does indeed represent an industrial cluster in the context of the theoretical basis of a cluster examined in Chapters Three and Four. The

[59] This problem was mentioned by several interviewees (see Chapter Six).

interviews also support this argument and the responses are strongly consistent with the quantitative data. However, as explained above there remain several serious problems facing the green food industry in the Province. Nevertheless, the evidence provided in Chapters Six and Seven all suggests that the three policies (plans) introduced first in 2003 have had a very positive effect on this industry.

### 8.5 The Pharmaceutical industrial cluster

The interviews with Limin Economic and Technological Development District of Harbin indicate that the natural advantages of the pharmaceutical industry are that the province is very rich in resources of wild medicinal herbs. There are 856 varieties of plant and animal materials in the province and the total reserves are around 2.7 billion tons. The Harbin Pharmaceutical Group owns 6 main series, more than 20 formulations, and up to 1000 varieties; in terms of processing techniques, about 40% of antibiotics and chemicals use international production standards. Furthermore, the interviewees (Chapter Six) explained that, at the present time, there are 218 enterprises existing in Heilongjiang; the three largest enterprises are Harbin Pharmaceutical Group, Haci Group and the Lingtai Group. The Harbin Pharmaceutical Group, a holding company of other enterprises in the industry, was the first listed company in the industry and based in Heilongjiang. In 2009, its sales revenue accounted for 70% of the total of the Heilongjiang pharmaceutical industry. More than 150 enterprises (out of 218) in

Heilongjiang hold the GMP certification. GMP refers to the Good Manufacturing Practice Regulations promulgated by the US Food and Drug Administration under the authority of the Federal Food, Drug and Cosmetics Act.

These regulations, which have the force of law, require that manufacturers, processors, and packagers of drugs, medical devices, some food, and blood take proactive steps. These steps are to ensure that their products are safe, pure, and effective. GMP regulations require a quality approach to manufacturing, enabling companies to minimise or eliminate instances of contamination, mix-ups, and errors. Hence a significant claim can be made that this industry has been adopting international quality standards. We also know from Chapter Seven that a significant effort has been made in recruiting high quality, well educated manpower. However as shown in Chapter Seven, the industry's financial indicators do not show a substantial increase and LQ results for the pharmaceutical industry do not indicate any significant degree of clustering. This finding is very much in tune with one of the main criticisms of the NEG models – that they are generic and have little or nothing to say about agglomeration or clustering in terms of specific industries (see Chapter Four). This also suggests they would not be particularly helpful in the design of cluster policy.

### 8.6 Problems facing the pharmaceutical industrial cluster

The enterprises in the Heilongjiang pharmaceutical industrial cluster lack in harmonizing with each other and competition is much more present than cooperation. The industrial chain among the large, medium and small enterprises is not well connected. Specialization and cooperation networks of enterprises have not been formed. Yet these are central to the development of an industrial cluster (see Chapters Three and Four).

The pharmaceutical industry is an academic research reputation based industry. At the present, the provincial collaborative mechanisms have not been built between institutions of higher education and pharmaceutical enterprises. This is in contrast to the effort that has gone into the green food academic base. This directly slows institutions' research achievements to be converted to innovation resources for the enterprises. There also remains the problem of 'guanxi' which is not operating well within this industry – as discussed in Chapter Six this may well be due to the fact that many of these firms are relatively small and have not been established for long. Nevertheless it means that cooperation, knowledge sharing and labour pooling are not taking place across the industry to anything like the scale that is required for an industrial cluster to flourish.

According to the location quotient indicator of the pharmaceutical industry in Chapter Seven, the clustering level of this industry is not as strong as the green

food industry's level. It owns 218 pharmaceutical enterprises and a special pharmaceutical industry district. Moreover, the clustering effect has not been playing its role properly. This illustrates the lack of supervision of the government and industrial institutions.

This latter point was hinted at by several of the interviewees but not explicitly stated. In terms of employment the industry has hardly expanded since the cluster policy was introduced in 2003. There has been growth in output and hence productivity but very little job creation. However the number of graduates and technicians have increased significantly. But there is no evidence from the shift-share data that the 'cluster' has had any significant impact on the industry's total share as compared with the rest of the economy.

Referring back to industrial cluster 'types' as presented in Chapter Three how, on the basis of the evidence gathered in this Thesis, can we categorise Heilongjiang's two clusters? This is done below using the same typology as presented in Chapter Three. We will employ the two tables of two different industrial cluster types to examine both the green food and pharmaceutical industrial clusters in Heilongjiang Province. The symbol '√' will be inserted after each characteristic to identify the extent to which the 'examined' industrial cluster match the typologies presented in the literature (see Chapter Three). The nature of these Tables mean that they do cross over several pages.

**Table 8.1: The Green food industrial cluster**

| | **Italianate** | **Satellite** | **Hub-and -spoke** |
|---|---|---|---|
| Main features | Mainly SMES √<br>Strong specialization√<br>Strong local rivalry and networking(competition)<br>Trust-based relationships √ | Mainly SMEs, dependent on external firms often based on cheap labour | Large local firms and local SMEs clear hierarchy√ |
| Main strength | Flexible specialization√<br>High product quality√<br>Innovative potential√ | Cost advantage√<br>Skills/tacit<br>√knowledge | Cost advantage√<br>Flexibility<br>Weight of large firms√ |
| Main weakness /vulnerability | Path dependence, slow adoption to radical change in economic environment or technology | Dependency on external actors for sales, inputs, and know-how limited scope for local activities to create competitive advantage√ | Whole cluster depends on the performance of few large firms |
| | | | |
| Typical trajectory | Stagnation/decline<br>Changing internal division of labour, outsourcing of certain activities to other locations<br>Emergency of hub-and-spoke structure | Stagnation<br>Upgrading, integration of backward/forward steps, offering complete package to external clients√ | Stagnation/decline(if large firms stagnate/decline) √<br>Upgrading, changing internal division of labour (large firms outsource activities locally ) √ |
| Promising policy interventions | Collective action to shape locational advantages, public-private partnership√ | Typical instruments of SMEs upgrading (training at all levels, technology extension) √ | Partnership between large firms/business associations and public SME support agencies to strengthen SMEs√ |

| **Types** | **Spontaneous clusters** | | |
|---|---|---|---|
| | **Informal clusters** | **Organized clusters** | **Innovative clusters** |
| Examples | Suame Magazine (Kumasi, | Nnewi (Nigeria) | Jutland |

| | Ghana) | Sialkot(Pakistan) | (Denmark) Belluno (Italy) |
|---|---|---|---|
| Critical actors | Low | Low to medium | High√ |
| Size of firms | Micro and small | SMEs | Large√ |
| Innovation | Little | High | Continuous√ |
| Trust | Little | High√ | High√ |
| Skills | Low | Medium√ | High√ |
| Technology | Low | Medium√ | Medium√ |
| linkages | Some | Some√ | Extensive |
| Cooperation | Little | Some, not sustained√ | High |
| competition | High | High√ | Medium to High√ |
| Product change | Little or none | Some | Continuous√ |
| Exports | Little or none | Medium to high√ | High |

**Table 8.2: The Pharmaceutical industrial cluster**

| | **Italianate** | **Satellite** | **Hub-and -spoke** |
|---|---|---|---|
| Main features | Mainly SMES √<br>Strong specialization√<br>Strong local rivalry and networking(competition) √<br>Trust-based relationships | Mainly SMEs, √ dependent on external firms often based on cheap labour | Large local firms and local SMEs clear hierarchy |
| Main strength | Flexible specialization√<br>High product quality√<br>Innovative potential√ | Cost advantage√<br>Skills/tacit √knowledge | Cost advantage√<br>Flexibility<br>Weight of large firms |
| Main weakness /vulnerability | Path dependence, slow adoption to radical change in economic environment or technology | Dependency on external actors for sales, inputs, and know-how limited scope for local activities to create competitive advantage | Whole cluster depends on the performance of few large firms |
| Typical trajectory | Stagnation/decline<br>Changing internal division of labor, | Stagnation√<br>Upgrading, integration of | Stagnation/decline(if large firms stagnate/decline) √ |

| | | | |
|---|---|---|---|
| | outsourcing of certain activities to other locations Emergency of hub-and-spoke structure | backward/forward steps, offering complete package to external clients√ | Upgrading, changing internal division of labour (large firms outsource activities locally ) √ |
| Promising policy interventions | Collective action to shape locational advantages, public-private partnership√ | Typical instruments of SMEs upgrading (training at all levels, technology extension) | Partnership between large firms/business associations and public SME support agencies to strengthen SMEs√ |

| **Types** | **Spontaneous clusters** | | |
|---|---|---|---|
| | **Informal clusters** | **Organized clusters** | **Innovative clusters** |
| Examples | Suame Magazine (Kumasi, Ghana) | Nnewi (Nigeria) Sialkot(Pakistan) | Jutland (Denmark) Belluno (Italy) |
| Critical factors | Low | Low to medium | High√ |
| Size of firms | Micro and small | SMEs | SMES √ |
| Innovation | little | High | Continuous√ |
| Trust | little√ | High | High |
| Skills | Low | Medium√ | High |
| Technology | Low | Medium√ | Medium√ |
| linkages | Some√ | Some√ | Extensive |
| Cooperation | Little√ | Some, not sustained | High |
| competition | High√ | High√ | Medium to High |
| Product change | Little or none | Some√ | Continuous |
| Exports | Little or none√ | Medium to high | High |

It is quite clear from the tables above that both green food and pharmaceutical industrial clusters do not strictly belong to any of the traditional types. They are more likely to be crossing different characteristics of each style. However, the most common feature of both clusters is that they have been promoting and

running under policy interventions with little cooperation among the enterprises[60] within the clusters.

In addition the features of both clusters do not entirely match the key elements identified from the academic literature. The green food cluster does match a number of these but by no means all of them whereas pharmaceuticals remains very much an industry in the Province that has the potential to become a cluster but this appears to be a long way off.

To summarise, the key elements of an industrial cluster hypothesised in Chapter Four are present to only some degree in both industries but to a greater degree in the green food industry. Whether we measure these in terms of the data trends, the location quotients, a correlation table or shift-share data (all undertaken in Chapter Seven) or in terms of the responses of officials and a sample of enterprise managers the clear outcome is that the Province does indeed host a strongly developing industrial cluster in green food but perhaps only the very beginnings of one in the pharmaceutical industry.

### 8.7 Regional Policy Revisited

The thesis put forward by Williamson, Krugman and Krugman and Venables (see Chapter Four) is that agglomeration of industry will eventually lead to

[60] But more in the green food cluster.

regional convergence of incomes although the latter suggest this is unlikely unless certain conditions are met. Despite very strong policy initiatives for industrial clusters in Heilongjiang Province in fact the Province has not ‘caught up’ with the coastal regions of China in most respects. The analysis above makes it very clear that pharmaceuticals has not developed into a cluster while the green food industry does show strong signs of possibly becoming a cluster. Indeed there are Provinces in China where both sectors have progressed more despite not having a focused cluster policy.

In a recent article, Zhang and Heng-fu Zou (2012), argue that inequality in incomes, FDI and many other economic variables has actually increased in China despite an emphasis on regional policy over the past four 5 year plans.

They argue that the spillover effects that were expected from the rapidly developing coastal regions simply were not strong enough while the regional policies themselves actually made matters worse for the lagging regions. This is because they did not benefit from preferential incentives to FDI and domestic firms given to the coastal regions. Hence a very attractive social and economic infrastructure had already been set down in these areas by prior policy since the early 1980’s. This made it even more difficult for lagging regions to converge with the richer ones.

These preferential policies also introduced more advanced technology and management methods to the original SEZ's thus giving these the very conditions for agglomeration that were supposed to have been 'transmitted' to the poorer regions. They also argue that these coastal regions effectively moved into a self-sustaining take off making them core regions and the rest peripheral.

Zhang and Heng-fu Zou also argue that the real basis of the regional inequality and agglomeration in the coastal (certainly not the North East) regions was an urban bias implemented since 1985. They point out that the share of Government budgets allocated to specific urban centres between 1986 and 1992 rose to as high as 62 percent This would be consistent with the argument put forward by Jacobs (1969) (see Chapter Four) in which he argues agglomeration is a phenomenon driven by cities and not regions per se. Other authors have found similar results in relation to regional divergence in China.

Zhang and Zhang (2003) find that 20% of differences in GDP per capita between Chinese provinces can be attributed to differences in trade shares. Ge (2006) shows that openness to trade and FDI is positively correlated to the agglomeration of industries in China's coastal regions. In a more comprehensive study, Kanbur and Zhang (2005) construct a time-series for regional inequality in China between 1952 and 2000 and use the constructed time series to test the

association between regional inequality and the three factors they believed to have led to the rise in regional inequality in China; the bias against China's agriculture and comparative advantage measured by the share of heavy industries in the gross value of output, the openness to trade measured by the ratio of trade volume to GDP and decentralization measured by the ratio of local government expenditures to total government expenditures. In particular, three hypotheses were to be tested: the first states that the heavy-industry development strategy in the pre-reform period was a major contributor to the large urban-rural divide and overall inequality, the second states that decentralization increased regional inequality during the economy's transition from a planned to a market economy, the third states that greater openness was associated with greater regional inequality. The results of the analysis confirmed the authors' expectations; the heavy industry coefficient is significant and has the highest value in the pre-reform era and is more correlated with urban-rural inequality; in the post-reform period, the coefficient of heavy industry becomes insignificant while the coefficients of decentralization and trade are both positive and significant. Decentralization was found to be associated with both rural-urban and inland-coastal inequalities while the trade ratio was found to be associated mainly with inland-coastal inequality. Many of the above arguments would certainly be recognised by the enterprise managers in Heilongjiang Province who strongly argued that their operations are held back by the lack of

FDI, lack of technology and lack of easily accessible finance. All of the factors that gave the coastal Provinces such a boost in the early days of China's opening up policy.

There are clearly many contradictions between the intended outcomes for China's regional policies and those that have emerged. The specific case of Heilongjiang Province shows that even a concerted effort to develop two highly focused clusters has not been particularly successful. This would suggest that regional divergence is the most likely outcome of agglomeration and that the ideas put forward by Jacobs (urbanisation as the real driver) may well deserve further investigation if we are to better understand how agglomeration process not only occur but why their effects can be so counter-intuitive.

The final Chapter of this Thesis presents conclusions and a discussion of future paths for research in this subject. The Chapter also presents an assessment of the contribution to knowledge in this area made by this work.

# Chapter Nine: Conclusions and Discussion

## 9.1 Summary of Theoretical Arguments

As stated in the introduction to this study, improving the competitiveness of regional industries by cultivating and developing industrial clusters has become a new economic growth matter in recent decades. This study has focused on Heilongjiang Province in Northeast China and examined a number of hypotheses/propositions that have been derived from the theoretical literature on industrial clusters. Relatedly the Thesis has examined the extent to which these two industrial clusters in Heilongjiang Province have been successful in terms of the criteria often used to measure the success of a cluster policy. This latter aspect of the Thesis is particularly related to the relevance (in China) of Western academic literature on industrial clusters.

The development of industrial clusters in Heilongjiang Province has very much been a matter of specific plans and policies from central Government and implemented at Provincial level through the relevant industrial administrative authorities within the Province. The plans (three of them) began in 2003 although there were already indications that these two industries were starting to show signs of ‘clustering’ in terms of agglomeration processes, manpower and innovation through product development.

The main tenets of industrial cluster theory suggest that such phenomena will reveal definite indications of location specific advantages that firms will seek and they will acquire these advantages through a number of processes. These include agglomeration within a spatially defined region, economies of scale or scope through knowledge sharing, labour pooling (exchanging labour), innovation, cooperation leading to ‘co-opetition’, integration with local education and research institutions and ‘enterprise learning’.

The result of these processes will be the development of a well-defined industrial cluster which leads to the creation of higher employment, higher output, new enterprises and ultimately a more competitive region. The role of policy in creating or ‘enabling’ an industrial cluster is however ambiguous in the theoretical and empirical literature. All of the above elements are expected to be

found in an industrial cluster or at least nascent in a developing cluster. The Western literature in particular emphasises these.

In the Chinese literature on the subject many of these points are recognised however stress is also put on the cultural embedding of social behaviour within the business environment. In particular the role of interactive learning process between core members of industrial clusters (human resources flowing between member enterprises; cooperative interaction between enterprises; and informal communication) are normally culturally determined. Additionally much of this literature emphasises the role of FDI in shaping an industrial cluster whereas this is identified in only a few studies in the Western literature.

A number of Chinese academics also emphasise the regional brand effect that a cluster can create in the minds of consumers. This in turn enhances regional competitiveness and regional brand effects arising from industrial clusters become an important external pull that attracts firms to clusters. In both sets of literature it is often argued that it is a requirement for successful clusters that government establishes effective regulations and efficient infrastructure to enable the cluster to develop, even though the counter-argument that clusters should be and often are spontaneous is to be found throughout the Western literature in particular. Bringing all of these ‘tenets’ of industrial cluster theory

together a number of hypotheses/propositions were generated that could be either statistically tested or closely examined using a range of qualitative and quantitative data. The results are summarised below:

## 9.2 Summary of Key Findings

These are presented in terms of the specific hypotheses/propositions generated from the literature and the NEG models examined in Chapter Four.

*After the introduction of the various Plans:*

***1. New Products (or varieties) have increased (innovation).***

This has been evidenced very clearly in the case of the green food industry but has not been demonstrated in the case of pharmaceuticals. The development of new products is defined as one type of innovation and measured as such in this Thesis. The GF industry has generated a significant degree of such innovation between 2003 and 2010. However the pharmaceutical industry continues to depend on innovating primarily in traditional medicines which by their nature tend to be very similar. This indicates a weak form of innovation as opposed to the type that truly creates new and innovative products. Industry respondents argue this is largely the result of not being able to import technology.

***2. R&D spending, output and employment have increased significantly.***

Both output and employment in the green food industry has expanded significantly. R & D expenditure has improved but in pharmaceuticals the

increases have been at a slow pace. However in both industries there is strong evidence of substantial changes in the numbers of qualified technicians and graduates. But this is only one positive element from the cluster map. Although the pharmaceutical industry has increased its numbers of highly qualified staff in fact the total employment in the industry has hardly changed over the period of the three cluster plans. This is in contrast to the green food industry where total employment has increased almost four fold during the same period. This can be seen in the shift – share data where agricultural employment remained constant but green food employment increases resulted in the whole of agriculture increasing its share relative to the rest of China. No such evidence could be found in the case of the pharmaceutical industry.

***3. Firms have engaged more in cooperation and knowledge sharing.***

There is some evidence of this in the case of green food enterprises but almost none in the case of the pharmaceutical enterprises. The qualitative analysis demonstrates that this is largely the result of the age of the enterprises, consolidation of firms into larger ones and the operation of trust (or guanxi) in both industries. As argued in the Chinese literature the role of trust is paramount in business dealings and business relationships.

In green food where there are much larger and older established enterprises and managers did express that they often exchange ideas. This practice is not

common in the pharmaceutical industry. In considering the location quotient results this is hardly a surprise. The pharmaceutical industry LQ results are very poor indeed in terms of cluster development. In fact they indicate there is almost no evidence of this cluster being developed. In contrast the green food LQ results are impressive and have shown a steady and increasing value over the period.

***4. Firms have exchanged labour more and learn more from each other than before.***

There is no evidence in either industry that labour (especially highly qualified labour) is exchanged between enterprises. As in (3) above several green food enterprises do 'talk' to each other about new products and methods but this is certainly not the case in pharmaceuticals. The latter was often explained in terms of such firms being too specialised to learn from each other. This is primarily because this industry is actually in four distinct parts – modern (Western) medicines, traditional Chinese herbal medicines, medical equipment and biological products. Hence the enterprise managers find it difficult to accept that cooperation and knowledge sharing is of any real benefit to their particular business.

***5. Quality standards of the products have increased.***

This is strongly evidenced in both industries. Both have developed products that meet international quality standards. But both remain very weak in terms of an international strategy for exports. This is a particular issue in terms of policy recommendations presented in Chapter Eight.

***6. Firms benefit more from research and University support.***

There is some evidence of this in green food but little in the case of pharmaceuticals. The latter industry in the Province in fact has fell behind several other Provinces in terms of total research and development spending, even though these others were not the focus of a cluster plan or policy.

There is also substantial evidence that other Provinces have overtaken Heilongjiang in the green food industry in terms of both enterprise number and innovation. This is also evident in the case of the pharmaceutical industry. Much of the quantitative data focused on the specific (expected) elements to be found indicate that the green food industry is definitely a developing but not yet mature cluster whereas the pharmaceutical industry cannot be said to be developing as a cluster whether in terms of the Western or Chinese literature. In the case of the green food industry we found very high positive correlations between the key elements predicted from theory and identified in the cluster conceptual map produced in Chapter Four. However the regression model, using LQ as the dependent variable is highly spurious giving a respectable adjusted R-squared value but no dependent variables that are significant while the F ratio for the

whole equation is itself insignificant. As argued however this is largely due to the very short time series available and a high degree of multi-collinearity being present. Of particular interest nevertheless is that within the correlation matrix the policy dummy returned one of the lowest correlation coefficients.

This raises doubts as to the role of policy as a driver of clustering and tends to suggest that even in China's State managed system a cluster cannot be simply created and still requires a degree of competition and economies of scope that come from enterprises that have a significant degree of freedom in investment, pricing, import and technology decisions. On the other hand it may well be the case that seven years of policy is not nearly enough for all the elements of a cluster to be evident.

In the case of both industries the analysis of the qualitative data (interviews) is highly consistent with the quantitative data collected. There is significant agreement amongst respondents of the problems facing both industries and amongst the Government officials. However there is not clear agreement on how these can be dealt with in the future. There tends to be a very strong reliance on guidance from the centre and little evidence of initiative. This is of course unsurprising given there is little or no incentive for enterprise managers or local officials to engage in taking business or policy risks that are deemed outside their remit. In terms of the three types of industrial cluster identified in earlier

Chapters and summarised in Chapter Eight neither of these two industries can be easily ‘fitted’ into any of them. Indeed they do not ‘tick’ many of the ‘boxes’ present in any of the three stylised cluster types. Nonetheless neither of these industries are existing in a Western type economy and it would be very surprising if they did tick all of the ‘boxes’.

Focusing on the current weaknesses of these industries, they can be summarised in terms of the insufficiency of investment, lack of linkage with supporting and relevant industries, insufficient research base, weak or no knowledge sharing or labour pooling, weak connection to the global economy in terms of either exports or imports or technology and weak incentivisation to take business risks.

### 9.3 Policy Recommendations

As discussed in Chapter Seven there are many ‘positives’ in favour of the green food industry in Heilongjiang Province however there remain a number of areas that could benefit from new policy initiatives. In particular a reinforcement of the need for enterprises to share more in terms of knowledge, techniques and ideas especially through labour pooling. This could be done through the provision of incentives to enterprises in the form of fewer restrictions on pricing decisions, investment and technology decisions. Those that are willing to share would benefit from such incentives. In addition both local officials and enterprise

managers need to be given more ‘room’ to take business risks without the worry of failure. This could be achieved through guarantees that positions will be protected even if a particular business decision does not pay off. It would also be of particular value to introduce higher level business training programmes for the enterprise managers and a number of the highly qualified staff in order to enhance enterprise management skills and marketing efforts. In this regard more focus needs to be put on capitalising on the products that are already recognised as international standard. Therefore a comprehensive export promotion strategy to embed the green food brands along with training programmes in export management and overseas market analysis would be highly valuable.

Staff who are prepared to enter ‘labour pooling’ also need to be incentivised either through remuneration premia and/or promotion and career development. This is a key requirement for knowledge sharing and creating economies of scope and should be seen as a policy priority. The green food industry by its nature is not considered to be a serious contributor to environmental degradation but the manufacturing processes can be energy intensive. Again, incentives to enterprises for greater energy efficiency would help not only in reducing direct costs but could lead to other forms of innovation especially in terms of production techniques. Finally there needs to be a more vigorous

promotion of exchanges between the industry and academia as well as perhaps a greater focus by local scientific institutions on the technical problems of cultivating, producing and processing green food varieties. Therefore it could be considered as a matter of urgency that the Provinces' science and education infrastructure needs to be more integrated with production, research and the collective learning process considered so vital in the theoretical literature.

In the case of the pharmaceutical industry the evidence presented in this Thesis strongly suggests the industry is very far off from representing a cluster in any meaningful sense, theoretically or empirically. However its structure is very different from the green food industry given that it is essentially four sectors. This explains why 'sharing' is almost unknown in this industry. It may well be the case that the cluster policy itself is too blunt in this respect. A stronger focus on the two sub-sectors of modern medicine and traditional Chinese medicine as separate (potential) clusters may well prove more successful.

This is especially important for industry synergies between Chinese herbal medicine and the green food industry since the latter is involves in cultivating many of the fundamental ingredients. Hence the industry itself would perhaps be better served by policies that are much more product specific. As in the case of green food this will also require a more relaxed approach to taking business

risks, making pricing and investment decisions locally and enabling a more open framework for trade. Similarly with green food a significant training programme would benefit enterprises in terms of marketing and trade promotion.

The question of labour pooling and knowledge sharing is paramount in this industry – it is simply not happening yet is a must for future innovation and the creation of the internal and external economies of scale and scope often cited as crucial in the academic literature. A key constraint for this industry is technology. Enterprises have found it very difficult to access new technology and therefore need to be given more leeway to investigate the business advantages of adopting such technology.

This is likely to have beneficial effects not only on quality but also on production techniques and costs and is also very important in enhancing knowledge across the industry. All of this requires a more localised approach to policy and plans in both industries in order that local conditions and local resources and constraints can be more fully accounted for and recognised by those who are required to implement policy at the Provincial level.

### 9.4 The Contribution of this Thesis

The research presented in this Thesis has several limitations which will be discussed in this Chapter. However, even with these the research has generated

new questions and has provided intellectual contributions in two distinct areas – theory and evidence. These are discussed below.

**Theory**

The theoretical underpinnings of theory focused on industrial clusters are essentially drawn from parts of regional economics and encapsulated within the theoretical framework offered by the new economic geography. The key (Western) antecedents of the latter include Marshall, Weber (1909), Coase (1937), Perroux (1950), Krugman (1991) and Porter (1990). In the Chinese literature on the subject (which has been much more recent) the key research has been undertaken by Wang, Qiu, Chen, and Liu). In modern cluster theory the fundamental concepts used include economies of scale and scope, agglomeration, growth poles, labour pooling, knowledge sharing, transaction costs, innovation, enterprise learning and labour pooling. As pointed out in Chapters Three and Four there is actually very little in these ideas that is new – instead, the new economic geography has 'grouped' them into a set of propositions that conceptually define the existence of an industrial cluster.

In seeking evidence for the manifestation of these concepts within the Heilongjiang cluster in the green food and pharmaceutical industries it is clear that many are represented but also that several key concepts are either not evidenced or are to be found in the data but only in a very weak sense. Bringing

the key concepts of cluster theory together as in the conceptual map presented in Chapter Four it is very evident that the ‘spine’ of the map – cooperation and labour sharing – cannot be evidenced in the case of the Heilongjiang clusters except in a very weak sense. In addition the fundamental idea that knowledge sharing and learning are central to clusters is poorly evidenced in this research. Even the most basic requirement (theoretically) of agglomeration cannot be supported in the case of one of the clusters in Heilongjiang. An obvious question is why?

One of the key drivers of enterprise development in China is the strength of the social networks of those who manage the enterprises. This is fundamental to good business relations (whether private or State) and is a key part of the philosophy of guanxi – that sharing almost anything can only be undertaken on the basis of long established trust relationships at the personal level. This is fundamental in Chinese personal and business relations and its nature even varies between different parts of China. The importance of this (culture generally and localised culture) is not to be found in Western cluster theory and is only marginally referred to in much of the Chinese literature (because it is mainly empirical). Yet it is very clear from the evidence in this Thesis that without guanxi many things simply will not happen – such as knowledge sharing, labour sharing and hence the development of learning enterprises. In the context of China

cluster theory needs to be redrafted to explicitly incorporate this concept and researchers need to consider how it might be measured. In addition there is little in cluster theory regarding time frames – this means there is no specific criterion or ‘guide’ that would suggest to researchers how long a cluster should take to develop.

This is important since, by definition, guanxi relies exclusively on long term business relationship building. Hence, any policy induced cluster will require much more time than has been available to the clusters focused upon in this Thesis. This also suggests a very real weakness in our understanding of cluster theory – the role of policy itself – it is not at all clear how the latter can ‘induce’ good business relationships for example.

In addition cluster theory has almost nothing to say regarding policy within a context of State direction – yet it is very difficult to see how the fundamental concepts of innovation, learning and sharing can be operationalized within a directed policy in which the implementers (local officials and managers) have little incentive to take risks or to be creative. How the role and potential effects of policy itself could be integrated into modern cluster theory is something that requires attention.

Finally, many of the core ideas of cluster theory remain difficult to measure and this may be due to the problem of definitions – the theory has not been successful in arriving at any real consensus on what a cluster actually is nor has it managed this in terms of the key concepts of learning, knowledge sharing and cooperation. Without an unambiguous and agreed definition of these key cluster elements it will prove very difficult in any research within this subject to robustly test many of the theoretical propositions contained within cluster theory. This is even more true when the research is undertaken within very different business cultures and within very different economic systems such as is the case with China.

**Evidence**

As pointed out several times throughout the Thesis the generation and/or collection of data relevant to the theoretical concepts within cluster theory and the purpose of this Thesis has been very difficult. In several respects the data does not exist at all, in others it is patchy and the data that does exist is itself limited in terms of the time series and often in terms of definition. All of the latter relates to officially available secondary data. Despite these problems this Thesis has managed to bring together a set of data that is consistent in terms of establishing trends and patterns that make intuitive sense and that, mostly, confirm the qualitative data generated from the interviews. In addition the work has established clear evidence of agglomeration, innovation, output increasing

and quality improving in one of industrial clusters. Albeit the definite conclusion remains that the pharmaceutical industry is not, in any real sense, developing as a cluster. The research has also been able to clearly demonstrate that both industries are actually developing, in many respects, across other Provinces in China that do not have a cluster policy.

This is also a contribution to knowledge in this subject – the first empirical analysis of active cluster policy within a policy targeted Chinese Province. The utilisation of the limited data available for this work may enable further research when more data becomes available. It may also enable other researchers to make more use of the limited data that is available in other developing regions of the world.

It is also the first time that officials and enterprise managers have been involved in this type of research in Heilongjiang Province. This has enabled the researcher to obtain a deeper insight into the cluster policy implementation than otherwise would have been possible and has also enabled the secondary data to be interpreted with more careful consideration. Although limited in several ways the empirical data, both qualitative and quantitative, has provided new insights into cluster policy in the Province and this also enables us to consider what type

of data is needed in the future for further analysis. As mentioned above this research work has several limitations and these are discussed below.

## 9.5 Limitations of the Research

A very obvious limitation is the availability of secondary data over a reasonable time span. In fact the data obtained only covered the periods from 1996 to 2010 in some cases and 2000 to 2007 in other cases. This meant the regression model applied in Chapter Seven could not be validated in the normal sense. However other data analysis techniques such as correlation, location quotients and shift – share did enable the data to be interrogated sensibly.

The number of interviews of key players (officials and enterprise managers) was limited. This was primarily due to many either refusing to take part or to take part but only willing to answer some of the interview questions. Nevertheless the information gained from the twenty in-depth interviews was sufficient to provide the researcher with confidence that the secondary data made sense when considered within the context of the interview responses. In this respect the researcher is confident that the results presented in this Thesis are both valid and reliable. However future research will require a much deeper and larger set of data if new research questions are to be reliably investigated.

A second limitation of this research comes from cluster theory itself. As pointed out above a number of the concepts contained within modern cluster theory have limited consensus in the literature. This also means the understanding of these within a policy framework may not be complete and that operationalizing these concepts into measurable variables for empirical testing becomes very difficult. A key issue for both industries is their environmental impact given their nature, particularly in the case of pharmaceuticals. Some of the processes are also very energy intensive and perhaps could benefit from more modern technology. These issues have only been touched upon here (see Chapter Three) however very good data is required to properly research these issues and, as discussed above, much more detailed statistics need to be made available if this research work is to be done. It is certainly an area that will require future research. These limitations in addition to data itself need to be addressed in future research.

### 9.6 Future Research

This research started out to determine the success or otherwise of cluster policies in Heilongjiang Province in China. However the resulting investigation has led to a number of new research questions that could be the basis of future research, not only in China but also in cluster research generally.

It is very important that greater attention is paid to establishing a greater consensus around the true meaning of concepts such as knowledge sharing, labour pooling and ‘learning’ enterprises. This needs to be validated by the establishment of unambiguous indicators that can be empirically verified. The role of local business culture needs much greater attention in the literature since this may well be a ‘missing link’ in cluster studies across many different countries. In particular it is very important that the various concepts of culture can actually be measured in some way. This will be a difficult task but is clearly necessary if culture is to be given a more prominent place in the theory of industrial clusters.

The role of policy itself requires deeper acknowledgement within the theoretical framework of cluster studies and even more so where the system contexts are very different.

In the case of China itself more research is needed to establish better statistical databases that can be more easily utilised to investigate the suggestions above. This is of paramount importance since China remains very much a developing economy and evaluating the impact and effectiveness of policy needs very good and very reliable data. This is also very much the case in the context of the environmental effects of these two industries in Heilongjiang Province (and

elsewhere in China) because they are becoming more critical for policy makers. In addition the related energy implications of abating any negative environmental impacts require significant research in the Province. Both of these areas could form a very rich research agenda for the future but do require significantly improved data sources.

Finally, research is required to investigate to what extent an industrial cluster can actually be created in the first place by policy itself. Not only in the context of a managed economy such as China but also elsewhere since there remain many cluster 'initiatives' around the world that are yet to be examined in any detail.

## References

Andersson, T, Serger, S.S, Sorvik, J and Hansson, G (2004), "The Cluster Policies Whitebook," International Organization for Knowledge Economy and Enterprise Development. IKED, Copenhagen.

Andrikopolous, A., Bronx, J and Carvalho, E (1990).Shift-Share Analysis and the Potential for Predicting Regional Growth Patterns: Some Evidence for the Region of Quebec, Canada. Growth and Change, 21(1),1～10.

Asheim, B, & Vang J. (2005). Talents and innovative regions: exploring the importance of face-to-face communication and buzz. *CIRCLE Electronic Working Papers*.

Arauzo-Carod, J. M. and E. Viladecans-Marsal (2009). "Industrial Location at the Intra-Metropolitan Level: The Role of Agglomeration Economies." Regional Studies 43(4): 545-558.

Beaudry, C and Schiffauerova, A (2009). "Who's right, Marshall or Jacobs? The localization versus urbanization debate." Research Policy 38(2), 318-377.

Babbie, E. (1983). The Practice of Social Research. 3 rd Edition, Belmont, CA: Wadsworth.

Baldwin, Richard & Forslid, Rikard, 1997. "The Core-Periphery Model and Endogenous Growth," CEPR Discussion Papers 1749, C.E.P.R. Discussion Papers.

Banks, M., Lovatt, A., O'Connor, J., & Raffo, C. (2000). Risk and trust in the cultural industries. *Geoforum*, *31*(4), 453-464.

Baptista R. and Swann G. (1998), Do firms in clusters innovate more? Research Policy, 27(5), 525-540.

Barboza, D. (2004). In roaring China, sweaters are west of socks city. *New York Times*, *24.*

Barff, R. A., & Knight III, P. L. (1988). The role of federal military spending in the timing of the New England employment turnaround. *Papers in Regional Science*, *65*(1), 151-166.

Becerra, M., & Gupta, A. K. (2003). Perceived trustworthiness within the organization: The moderating impact of communication frequency on trustor and trustee effects. *Organization Science*, *14*(1), 32-44.

Beck,R.J.,and Herr, W M. (1990).Employment Linkages form a Modified Shift-Share Analysis: An Illinois Example. Review of Regional Studies, 20(3),38～45.

Beed, T. and Stimson, R. (1985). Survey interviewing: theory and techniques. Allen and Unwin: London.

Belous, S. and Hartley, R. S. (1990). The Growth of Regional Trading Blocs in the Global Economy, Washington, DC.

Dalum, B., Pedersen, C. Ø. R., & Villumsen, G. (2005). Technological Life-Cycles Lessons from a Cluster Facing Disruption. *European Urban and Regional Studies*, *12*(3), 229-246.

Boshuizen, J., Geurts, P., & Van Der Veen, A. (2009). Regional social networks as conduits for knowledge spillovers: explaining performance of high-tech firms. *Tijdschrift voor economische en sociale geografie*, *100*(2), 183-197.

Bryman, A. (1998). Quantity and quality in social research. Contemporary Social Research Series, Martin Bulmer, London Unwin Hyman. London.

Bryman, A., (2004), Social Research Methods (2/e), Oxford University Press, US.

Cahill, W. D., & Cromwell-Cain, K. (1979). *The shift-share technique of economic analysis: an annotated bibliography* (Vol. 384). Monticello, IL: Vance Bibliographies.

Caves, R (2000), Creative Industries-Contracts Between Art and Commerce, Harvard University Press, Cambridge, MA.

Capello, R. (1999). Spatial transfer of knowledge in high technology milieux: learning versus collective learning processes. *Regional studies*, *33*(4), 353-365.

Chen, C. H., & Wu, H. L. (2005). Determinants of regional growth disparity in China's transitional economy. *Journal of Economic Studies*, *32*(5), 406-419.

Chen, W. J., & Hu, X. Y. (2010). Features and Influences of Industrial Structure from the Angle of Location Quotient in Xinjiang. *Journal of Lanzhou Commercial College*, *5*, 021.

China Green Food Industry Report (2008), available at: www.bharatbook.com/Market-Research-Reports/China-Green-Food-Industry-Report.html

China Statistical Yearbook, 1999-2010

Coase, Ronald H. (2007), "The Nature of the Firm," Economica 4(16) (November): 386–405.

Collier, P. (2008) *The Bottom Billion: Why the Poorest Countries are Failing and What Can be Done About it*, OUP Oxford.

Converse, J. M., & Presser, S. (1986). *Survey questions: Handcrafting the standardized questionnaire* (No. 63). Sage Publications, Incorporated.

Crouch, C., & Farrell, H. (2001). Great Britain: falling through the holes in the network concept. *Local Production Systems in Europe: Rise or Demise*, 161-211.

De Vaus, D.A.(1996). Surveys in Social Research.3 rd edition, UCL Press,London.

Dodgson, M. (1993). Learning, trust, and technological collaboration. *Human relations*, *46*(1), 77-95.

Dunn, E. S. (2005). A statistical and analytical technique for regional analysis. *Papers in Regional Science*, *6*(1), 97-112.

Enright, M. J. 1996. Regional clusters and economic development: A research agenda. In Business Networks: Prospects for Regional Development, edited by U.H. Staber et al., Berlin, Walter de Gruyter.

Feser, E. J. 1998. Enterprises, external economies, and economic development. Journal of Planning Literature 12 (3), 283-302.

Florence, P.S (1948), “Investment, location and Size of Plant”, Cambridge [Eng.] University Press, Cambridge.

Florida, R. (2002), The Rise of the Creative Class-And How It’s Transforming Work, Leisure, Community & Everyday Life, The Perseus Books Group, New York, NY.

Florida, R. (2002). The economic geography of talent. *Annals of the Association of American geographers*, *92*(4), 743-755.

Foddy, W.H.(1992). Constructing Questions for Interviews and Questionnaires. Cambridge University Press.

Fowler Jr, F. J. (2008). *Survey research methods* (Vol. 1). Sage Publications, Incorporated.

Fothergill, S., & Gudgin, G. (1982). *Unequal growth: urban and regional employment change in the UK* (pp. 68-112). London: Heinemann Educational Books.

Freeman, C. (1991). Networks of innovators: a synthesis of research issues. *Research policy*, *20*(5), 499-514.

Gai, W.Q. (2008),'Innovation network—new sight for regional economic development', Beijing University of Publishing House, Beijing .

Galbraith, J.K., Krytynskaia, L. & Wang, Q. (2004) 'The Experience of Rising Inequality in Russia and China during the Transition.' The European Journal of Comparative Economics, Vol. 1, n. 1, pp. 87-106

Giovannucci, D. (2005). Organic agriculture and poverty reduction in Asia: China and India focus. *IFAD Office of Evaluation, February*.

Ghauri, P. G., & Gronhaug, K. Kristianslund (1995). Research Methods in Business Studies: A Practical Guide. *Europe: Prentice Hall*.

Granovetter, M. (1985). "Economic-Action and Social-Structure-the Problem of Embeddedness." American Journal of Sociology 91(3): 481-510.

Han, C.X. and Wei, S.H (2010) 'The Growth Variation of Service Sectors among Cities of different Size in China by the Analysis of Share-Shift Method', industrial economic search, No.47, Series 4.

Haig, M. R. (1928), 'Major Economic Factors in Metropolitan Growth and Arrangement', The Regional Survey of New York and Its Environs,Vvolume 1.

Harrison, B., & Kluver, J. (1989). Reassessing the 'Massachusetts miracle': reindustrialization and balanced growth, or convergence to 'Manhattanization'. *Environment and Planning A*, *21*(6), 771-801.

Heilongjiang Statistical Yearbook, 1999-2010.

Heilongjiang Pharmaceutical Trade Association (Statistical Reports, various years).

He, J.S and W.M.Dai (2008), ‘Ecology model for industrial clusters and analysis for its ecological balance’, Journal of Beijing Normal University(Social Science Edition, (1):126-132.

Henderson, J. V. (1986). "Efficiency of Resource Usage and City Size." Journal of Urban Economics 19(1): 47-70.

Herzog Jr, H. W., & Olsen, R. J. (1977). Shift-share analysis revisited: the allocation effect and the stability of regional structure. *Journal of Regional Science*, *17*(3), 441-454.

He, Y.Z.(2008), ‘Forming Mechanisms and continuance of Industrial Clusters’, Journal of Chongqing University (Philosophy and Social Sciences Edition), (2):15-18.

Hirschman, A. (1958). The Strategy for Economic Development. New Haven, Conneticut, Yale University Press.

Huff,David L.,and Lawrence A.Scherr(1967).Measure for Determining Differential Growth Rates of Markets. Journal of Marketing Research,4(November),391～395.

Jacobs, J. (1969) The Economy of Cities. Random House: New York.

Jay-Mitra (2003), Building entrepreneurial clusters [R]. Final Dissemination Workshop, University of Luton, United Kingdom.

Jian, X.H. (2009), 'Review and Prospect of Chinese Economy', Journal of Research on Economic and Management, 8, F120-3, available at: http://d.wanfangdata.com.cn/Periodical_jjyglyj200908001.aspx

Kanbur, R. and Zhang, X. (2005) 'Fifty Years of Regional Inequality in China: a Journey Through Central Planning, Reform, and Openness'. Review of Development Economics, 9(1), 87–106.

Knoben, J. (2009). "Localised inter-organisational linkages, agglomeration effects, and the innovative performance of firms." Annals of Regional Science 43(3): 757-779.

Knudsen D.C., (2000) Shift-share analysis: further examination of models for the description of economic change, Socio-Economic Planning Sciences, 34, 177-198.

Krugman, P (1990), "Geography and Trade", Cambridge Mass, MIT press, Cambridge.

Krugman, P (1991), "Increasing returns and economic geography", Journal of Political Economy Vol.99 No. 3 pp483-499.

Krugman, P. & Venables, A.(1995.), 'Integration, specialization, and adjustment,' European Economic Review, Elsevier, vol. 40(3-5), p. 959-967.

Lawson, C. and Lorenz, E. (1999), Collective learning, tacit knowledge and regional innovative capacity [J]. Regional Studies, 33.

Leahy, A., A. Palangkaraya, et al. (2009). "Geographical Agglomeration in Australian Manufacturing." Regional Studies(Forthcoming): 1-16.

Ledebur,L.C.,and R.L.Moomav(1983).A Shift-Share Analysis of Regional Labor Productivity in Manufacturing. Growth and Change,14(1),2～9.

Lessman, C. (2011) 'Regional inequality and decentralization: an empirical analysis,' Environment and Planning A, Pion Ltd, London, vol. 44(6), p. 1363-1388.

Lindqvist, G. (2009). *Disentangling clusters: agglomeration and proximity effects* (Doctoral dissertation, Jönköping University).

Liu, H,J. and J.X.Chen (2009), 'A review of studies on industrial cluster polices overseas', Journal of Foreign Economics & Management, (11):37-43.

Liu, S.Y. and Lin,Q.P. (2008), 'A study of formation and running mechanism of industrial clusters', Southeast Academic Research (6):130-137.

Liu,Y.J. (2007), 'Innovation for small and medium enterprises based on cluster model', published by China Economy Publishing House, Beiijng.

Local Statistics Communiqué of National Economic and Social Development (various years, Heilongjiang Province).

Lorenzen, M. Ties, (2002), trust and trade: elements of a theory of coordination in industrial clusters [J]. International Studies in Management and organization, 31(4):14-34.

Losch, A. (1954). *The Economics of Location. Translated from the Second Revised Edition*. Yale University Press, New Haven, Conn.

Lu,K.G (2009), 'New space for Increase—study of convergence capacity of industrial cluster', published by 'Economic Science Press', Beijing.

Martin, P and Ottaviano, G.I.P (2001), "Growth and agglomeration", journal of international economic review, Vol.42 No.4 pp947-968.

Martin, R., & Sunley, P. (2003). Deconstructing clusters: chaotic concept or policy panacea?. *Journal of economic geography*, *3*(1), 5-35.

Marshall, A (1920), "Principles of economics ", Macmillan and Co., Ltd, London.

Ma, Z.D. (2009), 'the formation and evolution mechanism of industrial cluster form perspective of labor division', Journal of Liaoning University (Philosophy and Social Sciences Edition).

Masahisa, F. and Mori, T. (2005) 'Frontiers of the New Economic Geography', Papers in Regional Science, (84) 3, p377-405.

McCann, P. and Sheppard, S. (2003), 'The rise, fall and rise again of industrial location theory', Journal of Regional Studies, Vol.27 Nos 6/7, pp, 649-63.

Meyer-stamer, J and Knorringa, P (1998), “New dimensions in local enterprise co-operation and development: from clusters to industrial districts”, available at: http://www.meyer-stamer.de/1999/atas.pdf (accessed 22 November, 2006).

Miller, D.E. (1970). Handbook of Research Design and Social Measurement. McKay: New York.

Neuman, W. (1997). Social research methods: Qualitative and quantitative approaches (3rd Ed.). Needham Heights, MA: Allyn & Bacon.

Miller, M. M., Gibson, L. J., & Wright, N. G. (1991). Location quotient: A basic tool for economic development analysis. *Economic Development Review*, *9*(2), 65-68.

Saydi, M., Halik, W., Mamat, A., & Yunus, A. (2010). Study on Spatial Differences of Industrial Structure and Economic Growth in Xinjiang Based on Shift—Share Method. *Journal of Xinjiang University (Natural Science Edition)*, *3*, 007.

Myrdal, G. (1957), Economic Theory and Underdeveloped Regions, Gerald Duckworth, London.

Mytelka, L and Farinelli, F (2000), “Local clusters, innovation systems and sustained competitiveness”, working paper, The United Nations University, Institute for New Technologies UNU/INTECH, September 4.

North, D. (1955), ‘Location theory of local expenditures’, Journal of Political Economy 63 (3): 243-258.

Northeast Revitalization Plan (2003), China State Council, State Council Document No. 11.

Northeast Revitalization Plan (2007), China State Council, available at: http://www.gov.cn/gzdt/2007-08/20/content_721632.htm. Retrieved at 2009 31, September, 2008.

OECD (1999), Boosting innovation: the cluster approach. OECD Proceeding, Paris: OECD.

Oerlemans L., Meeus M., Boekema F. (2001), On the spatial embeddedness of innovation networks: an exploration of the proximity effect [J]. Tijdschrift voor Economische en Sociale Geografie, Vol.92, No.1:60-75.

O' Hara, P. A. (2008). "Principle of circular and cumulative causation: fusing Myrdalian and Kaldorian growth and development dynamics." Journal of Economic Issues 42(2): 375-387.

Opinions of the State Council on Further Implementing the Strategy of Revitalizing the Old Industrial Bases Including Northeast China (2009), State Council Document No. 33.

Orjan, S., Lindqvist, G. and Ketels, C.(2003): 'The Cluster Initiative Greenbook', paper presented at the 6th Global TCI Conference : Bromma tryck AB, Stockholm.

Overman, H.G, Redding, S and Venables, A.J (2001), "The economic geography of trade, production and income", Working Paper, London school of Economics and CEPR, London, August 21.

Panne, G. and C. Van Beers (2006). On the Marshall-Jacobs Controversey: It takes two to Tango. DRUID Working Paper No. 06-23.

Pan, H.P and Duan, Z (2009) comparative study of construction industrial structure of middle five provinces based on Shift-Share Analysis Model, Construction Economy, (2009) 12-0080-04.

Perroux, F. (1950). 'Economic Space: Theory and applications.', Quarterly Journal of Economics 64(1): 89-104.

Peter Maskell, Anders Malmberg. (1995), Localized learning and industrial competitiveness[C]. Paper presented at the Regional Studies Association European Conference on "Regional Futures" Gothenburg, 6. -9.

Phillips, E.M. and Pugh, D.S. (1994). How to get a PhD – A handbook for students and their supervisors. Open University Press, Buckingham.

Pittaway L., Robertson M., Munir K. et al.( 2004, ), Networking and innovation: a systematic review of the evidence [J]. International Journal of Management Reviews, Vol.5/6, Issue 3/4:137-168.

Porter, M.E (1990), "Competitive advantage of nations", Macmillan, London.

Porter, M.E (1998), "Clusters and new economics of competition', journal of Harvard Business review, No.2 pp77-90.

Preece, R. (2000). Starting Research: An Introduction to Academic Research and Dissertation Writing. Continuum. London.

Puga, D. (1999) 'The Rise and Fall of Regional Inequalities' European Economic Review, (43) 2, p303-334.

Puga, D. and Anthony J. Venables. (1996), The spread of industry: spatial agglomeration in economic development [R]. Center for Economic Performance Discussion Paper No. 279, February.

Qiu, H.X. and J.N.Xu (2008), 'Local government activities during technical innovation of industrial clusters', Journal of Management World, (10):36-45.

Reynolds, C. W. (1980). *A shift-share analysis of regional and sectoral productivity growth in contemporary Mexico* (No. 41). International Institute for Applied Systems Analysis.

Roelandt, T. J. A., and Hertog, den.P. (1999), Cluster analysis and cluster-based policy making: the state of the art. *In Cluster Analysis and Cluster-based Policy: New perspectives and Rationale in Innovation Policy, edited by T. Roelandt and P. den Hertog. Paris: Organization for Economic Cooperation and Development.*

Romer, P. (1986) Increasing Returns and Long-Run Growth. *The Journal of Political Economy*, 94 (5): 1002-1037.

Rosenfeld, S. A. (1997), Bringing business clusters into the mainstream of economic development. European Planning Studies 5 (1): 3-23.

Rosenthal, S. and Strange, W.C (2004), 'The micro-empirics of agglomeration economics', in Arnott, R. (Ed), Companion to Urban Economics, Blackwell. Oxford.

Saxenian A. (1991), The origins and dynamics of production networks in Silicon Valley[J]. Research Policy, 20, 423-437.

Shen, Z.P. and H.J.Liu (2008), ‘Study on industrial clusters and Regional Economy Development’, Journal of China Soft Science, (2):120-124.

Simmie, J., & Sennett, J. (1999). Innovative clusters: global or local linkages? National Institute Economic Review, 170, 70–81.

Sudman, S. and Bradburn, N.M.(1982). Asking Questions: A Practical Guide to Questionnaire Design. Jossey Bass: San Francisco.

Sun, L.P. and H.L.Sun (2008), ‘Transaction cost of industrial clusters’ published by ‘China Social Sciences Press’.

Swann, P. and Prevezer, M. (1996). A comparison of the dynamics of industrial clustering in computing and biotechnology. Research Policy, 25, 1139–1157.

Tervo, H., and P.Okko (1993): A Note of Shift-Share as a Method of Estimating the Employment Effects of Regional Economic Policy. Journal of Regional Science,23(1),115～121.

Roelandt, T. J., & Den Hertog, P. (1999). Cluster analysis and cluster-based policy making in OECD countries: an introduction to the theme. *Boosting innovation: The cluster approach*, 9-23.

Thrall, G., J. Fandrich, and Elshaw-Thrall S. (1995). Location Quotient: ‘Descriptive Geography for the community reinvestment act’, Geo Info Systems 5(6), 18-22.

Todaro, M. (1971) 'Income Expectations, Rural-Urban Migration and Employment in Africa'. International Labour Review, (104) p 387-413.

Toulemonde, E. (2006), 'Acquisition of skills, labor subsidies and agglomeration of firms', Journal of urban Economics, Vol.59, pp. 420-39.

Tu, S.F. and X.N.Cao (2008), 'Regional brand and regional economy growth based on industrial clusters', Journal of China Soft Science, (12):111-115.

UNCTAD (1977), 'The impact of trade marks on the development process of developing countries', report by the United Nations Conference on Trade and Development, UNCTAD Secretariat, Geneva, June.

UNCTAD (2001), 'World investment report, 2001', Geneva.

UNIDO (2001), Development of clusters and networks of SMEs. Private Sector Development Branch Investment Promotion and Institutional Capacity Building Division.

United Nations Conference on Environment and Development (1992), 'The Rio declaration on environment and development'.

United Nations World Commission on Environment and Development (WCED) (1987)**, '**Brundtland Report'.

Van den Berg, G.J., Holm.A and Van Ours, J.C. (2002), Do stepping-stone jobs exist? Early career paths in the medical profession, Journal of Population Economics 15, 647-665.

Vanhove N (1999) *Regional Policy: A European Approach* 3rd edition (Ashgate, Aldershot).

Venables, A.J. (2001), 'Geography and international inequalities: the impact of new technologies', CEP Discussion Papers 0507, LSE, Centre for economic Performance, London.

Vernon Henderson.J., Shalizi, Z. and Venables, A.J. (2000, 'Geography and development', working paper, London School of Economics, London, June 29.

Wang, B. and Y.Dong (2006), 'From specialization theory in neo economics to evolvement of contemporary industrial clusters', Journal of Academic Monthly, (2): 29-36, 52.

Wang, B.F. (2009), 'A review of theories of industrial clusters from mainstream schools under the global background', Journal of Foreign Economics & Management, (1):12-16.

Wang, H.P. and Zhang, J.H (2007): 'analysis on structural efficiency of tourism industry in Huangshan city', east China economic management, Vol 21, No.1.

Wang, J.C. (2001), 'local industrial clusters strategy under global background', A report for 'National Science and Technology Soft Scientific Research'.

Wang, J.C. (2001), 'Innovation space—enterprise clusters and regional economy', published by Beijing University of Publishing House, Beijing.

Wang, J.C. (2004), 'The Suggestions of the Research on Local Industrial Clusters', Journal of Economic Survey, (2):53-57.

Wang, J.C. (2004), 'Policy suggestions for developing innovative industrial clusters', Journal of Economic Geography, (7):433-436.

Wang, J.C (2005),"Analysis of Industrial Clusters", Journal of Industrial Clusters in China, Vol 1 pp1-5.

Wang, J. and L. Hou,(2008), 'Empirical study of identification method of industrial clusters', Journal of S Science of Science and Management', (11): 117-120.

Wang, Q (2006): 'Research on China's spinning and weaving industry cluster', Journal of Liaoning Technical University (Social Science Edition), Vol.8, No.5.

Wang, Y.H. and Xu,Y.L. (2009): empirical study of service industry competitiveness in Shandong based on Shift-Share Analysis. Research Journal of Shandong University of Finance (2009)01-0085-05.

Wang, Y.P. (2009), 'Industrial Cluster, Developmental Momentum Risk and Prevention', Journal of Contemporary Finance & Economics, (4):87-93.

Weber, A (1929),"The theory of the location of industries", Chicago University Press, Chicago.

Williamson, J.G. (1965) 'Regional Inequality and the Process of National Development: A Description of Patterns.' Economic Development and Cultural Change, (13) 1-45.

Wolfe, D.A. (2006), Social capital and cluster development in learning regions[J]. http://www.utoronto.ca/isrn/documents/Wolfe_SocialCapital2.pdf.

World Development Report (2009) ‘ Reshaping Economic Geography.’ IBRD, 2009: Washington.

Wu, D.J. (2008), ‘Theory analysis of industrial clusters’, Published by ‘China Social Sciences Press’, Beijing.

Wu, L.X (2008), ‘The Progress and Current Issues in Industrial Cluster Studies’, Journal of Shanghai Administration Institute, (3):51-60.

Wu, Q.T.(2009), ‘Coupling mechanism of industrial clusters and regional economic development’, Journal of Management World, (2):133-134,136.

Wu, X.Y. (2010),’Industry self-organization clusters and cluster economics study’, CCP Central Party School Publishing Company, Beijing

Xu, Kuan (2003). How Has the Literature on Gini's Index Evolved in the Past 80 Years?". China Economic Quarterly 2: 757–778.

Xu, W.X. and X.D. Lou (2005), ‘study of high tech industrial cluster resource integration and enhancing the regional new system innovation competitiveness source integration’, Journal of China Soft Science, 4):87-90.

Yu, L., Tong, D., & Deng, J. (2010). The Significance of Establishing Urban Agglomerations of Different Levels Based on Location Quotient: Taking the Pearl River Delta Area as a Case. *Urban Studies*, *1*, 012.

Zeller, R.A. and Carmines, E.G. (1980). Measurement in the Social Sciences. Cambridge University Press: Cambridge.

Zhang, X. and Zhang, H. (2003) "How Does Globalisation Affect Regional Inequality within a Developing Country? Evidence from China," Journal of Development Studies 39:47–67.

Zhang, H. (2004), 'Local Clusters in Global Value Chains—a case of mechanical and electrical industry of Pingguang River in Zhejiang', Journal of Industrial Economics Research, (6):27-33.

Zhang, H. (2005), 'Research on Upgrading Model of Local Clusters in Global Value Chains', Journal of China Industrial Economics, (6):27-33.

Zhang, Q. and Zou, H. (2012) 'Regional Inequality in Contemporary China.' Annals of Economics and Finance, 13-1, 113–137.

Zhang, S.T. and J.M.Yang (2010), 'Developing strategy for industrial clusters based on brand integration', Journal of Science and Technology Management Research (2):1-3.

Zhang, X.Y and Li, X.Q (2010): 'research on development of central plain cultural industry based on Location Quotient, Journal of Xi'an University of Finance and Economics. Vol.123, No11.

Zhu, H.S. (2006), 'Developing Model and Dynamic Mechanism of Industrial Cluster based on FDI', Journal of China Industrial Economics (3):106-112.

Zhou, W.Y. (2009), ‘A economic analysis of new industrial district evolvement’, published by Fudan University Press, Shanghai.

Zhu, R.B. 92008), ‘Analysis on Mechanism of Resistance Industry Cluster's Endogenous Risk by Modulization, Journal of China Industrial Economics, (5):54-60.

# Appendices

# Appendix 1: Questionnaires

### (a) Questionnaire for Policy Makers

1. Which industries do you think are clusters? Why do you think so?
2. Is there any policy now for supporting local industries?
3. If yes, how many of them are from the central government? How many of them are from local government?

4. Which industries do you think are the strongest in Heilongjiang Province now? Why do you think so?
5. Which industries do you pay more attention to? Why? How do you support them?
6. Is there any potential advantage of the other industries? If yes, which ones? And why do you think so? If not, why?
7. Do you plan to use the policy tool to support them? If yes, how will you do that? If not, why?
8. What do you think are the main problem of the industrial clusters in Heilongjiang Province now? Why do you think so?
9. What do you think are the main barriers to the economic growth of these clusters? Why do you think so?
10. Do you have any strategy for that? If yes, what is that? And why do you think it is the appropriate one?
11. What industrial clusters do you think will be the main ones in the province over the next ten years? Why do you think so?

**(b) Questionnaire for the Managers of Enterprises**

- Part 1 : The historical development

1. When was this company started?

2. The initial capital invested for this company?

3. How many departments in this company? And what are they?

4. The functions of each department?

5. How many kinds of equipment belong to this company related to the industry? And how much is the amount?

6. The source of the equipment? (Imported or made in china?)

7. How many of them are imported?

8. How many of them are made in china when the company started?

9. Is there any change of that now? If yes, how was it changed? When? How much? What is the source?

10. The amount of employees of this company?

11. How many of them are from Heilongjiang Province?

12. What other provinces of China are they from?

13. The percentage of employees' qualification level (%)?

Primary school % / Junior high school % / Senior high school %

Collage % / University % / Degree % / Postgraduate degree %

14. How many of them are professional technicians?

15. How many kinds of products do you produce?

- Part 2: Economic data

16. Raw material of product:

Share of imported %? / Share of made in China %?

17. Domestic sales (%) in China:

- Part 3: Management system

18. The purchase system: where are the suppliers of raw materials? Is there any method of costs reduce in recent 5 years?
19. The produce system: utilization efficiently of raw material?
20. The stockpile system: the velocity of stock in trade?
21. The sale system: is there any increase of marketing share in recent 5 years?

# Appendix 2: Data Tables

The following data for Green Food were collected from a number of official sources and have been utilised in various Chapters of the thesis but not reproduced completely within the text. This is to enable other researchers to understand the nature of the data.

**Number of GF Enterprises and Product Varieties (1996 – 2010)**

| Provinces | 1996 | 2003 | 2007 | 2010 | 1996 | 2003 | 2007 | 2010 |
|---|---|---|---|---|---|---|---|---|

| | | ENTERPRISES | | | | Product Varieties | | |
|---|---|---|---|---|---|---|---|---|
| Liaoning | 18 | 111 | 417 | 621 | 31 | 238 | 780 | 1142 |
| Jilin | 16 | 103 | 238 | 314 | 21 | 155 | 512 | 642 |
| Heilongjiang | 85 | 295 | 462 | 648 | 115 | 585 | 1065 | 1542 |
| Jiangsu | 25 | 164 | 713 | 809 | 44 | 252 | 1924 | 2125 |
| Zhejiang | 4 | 99 | 502 | 542 | 6 | 142 | 743 | 864 |
| Anhui | 9 | 68 | 371 | 394 | 10 | 95 | 452 | 512 |
| Jiangxi | 8 | 95 | 217 | 230 | 8 | 128 | 386 | 428 |
| Shandong | 29 | 142 | 418 | 586 | 38 | 207 | 846 | 1210 |
| Hubei | 2 | 85 | 445 | 468 | 3 | 178 | 786 | 964 |
| TOTAL | 196 | 1162 | 3783 | 4612 | 276 | 1980 | 7494 | 9529 |

**Sources: CSY, various years; Provincial Green Food Statistical Database, various years.**

## Skilled Labour Development in Green Food & Pharmaceuticals (2000 – 2010)

**Skilled Labour Development in Green Food & Pharmaceuticals**

| GF | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2010 |
|---|---|---|---|---|---|---|---|---|---|
| Employment | 33400 | 43250 | 47400 | 51240 | 62160 | 66320 | 70280 | 105370 | 128550 |
| Technicians | 5230 | 8130 | 9050 | 10140 | 14060 | 13380 | 15440 | 17710 | 19270 |
| Graduates | 2100 | 3000 | 4200 | 4350 | 4670 | 4840 | 5600 | 6460 | 7380 |
| % Technicians | 15.66 | 18.80 | 19.09 | 19.79 | 22.62 | 20.17 | 21.97 | 16.81 | 14.99 |
| % Graduates | 6.29 | 6.94 | 8.86 | 8.49 | 7.51 | 7.30 | 7.97 | 6.13 | 5.74 |
| PH Employment | 49700 | 44280 | 40500 | 45580 | 46420 | 46480 | 46630 | 46440 | 48650 |
| Technicians | 9600 | 8230 | 7450 | 8690 | 8830 | 8540 | 8500 | 8550 | 8670 |
| Graduates | 3980 | 4160 | 3860 | 4500 | 4780 | 4790 | 5120 | 5200 | 4900 |
| % Technicians | 19.32 | 18.59 | 18.40 | 19.07 | 19.02 | 18.37 | 18.23 | 18.41 | 17.82 |
| % Graduates | 8.01 | 9.39 | 9.53 | 9.87 | 10.30 | 10.31 | 10.98 | 11.20 | 10.07 |

**Source: Statistics collected and organized from Heilongjiang Yearbook and CSY (various years)**

## Indices of GF Industry Development (2000 – 2010) (2000=100)

| YEAR | GRAD | TECH | QUALITY | INNOV | EXPORTS | OUTPUT |
|---|---|---|---|---|---|---|
| 2000 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 2001 | 142.86 | 155.45 | 76.08 | 109.22 | 145.10 | 345.21 |
| 2002 | 200.00 | 173.04 | 98.71 | 121.99 | 164.71 | 429.50 |
| 2003 | 207.14 | 193.88 | 92.56 | 140.43 | 219.61 | 461.69 |
| 2004 | 222.38 | 268.83 | 86.93 | 152.48 | 173.53 | 397.13 |
| 2005 | 230.48 | 255.83 | 103.54 | 160.99 | 154.90 | 381.03 |
| 2006 | 266.67 | 295.22 | 112.71 | 206.38 | 337.25 | 521.46 |
| 2007 | 307.62 | 338.62 | 152.56 | 163.83 | 454.90 | 625.86 |
| 2010 | 351.43 | 368.45 | 182.50 | 168.79 | 221.57 | 777.39 |

Sources: CSY, various years; Provincial Green Food Statistical Database, various years.

**Heilongjiang Green Food and Agriculture Gross output value and GDP (100 million Yuan), 1999-2010**

| Year | **Green food Gross output value (100 million Yuan)** | **Agriculture Gross output value (100 million Yuan)** | **Green food share of agriculture%** | **Total GDP of Heilongjiang (100 million Yuan)** |
|---|---|---|---|---|
| **1999** | 26.0 | 660.5 | 3.9 | 2,866.3 |
| **2000** | 72.3 | 625.1 | 11.6 | 3,151.4 |
| **2001** | 127.0 | 711.0 | 17.9 | 3,390.1 |
| **2002** | 150.0 | 776.7 | 19.3 | 3,637.2 |
| **2003** | 190.0 | 903.3 | 21.0 | 4,057.4 |
| **2004** | 327.0 | 1,136.6 | 28.8 | 4,750.6 |
| **2005** | 400.0 | 1,294.4 | 30.9 | 5,511.5 |
| **2006** | 476.0 | 1,391.1 | 34.2 | 6,201.4 |
| **2007** | 581.4 | 1,700.6 | 34.2 | 7,065.0 |
| **2010** | 947.8 | 2066.4 | 45.8 | 9675.5 |
| **Average Increase Rate %** | 43.2 | 12.2 | --------- | 13.1 |

Source: Statistics collected and organized from China green food website http://www.greenfood.org.cn/sites/MainSite/

**Heilongjiang Employment by green food related industries (10,000 people), 2000-2010**

| Industry/ Year | 2001 | 2002 | 2003 | 2004 | 2004 | 2006 | 2007 | 2010 |
|---|---|---|---|---|---|---|---|---|
| **Agriculture** | **808.5** | **808.3** | **811** | **827.7** | **812.1** | **804.4** | **806.1** | **789.7** |
| **Manufacturing** | **185.7** | **181.5** | **178.8** | **181.7** | **191.2** | **189.4** | **189** | **199.3** |
| **Green Food Manufacturing** | **3.3** | **4.3** | **4.7** | **5.1** | **6.2** | **6.6** | **7** | **10.5** |
| **Total** | **1600.6** | **1592.6** | **1615** | **1614** | **1681.1** | **1748.9** | **1784.2** | **1827.6** |

Source: Statistics collected and organized from Chinese Yearbook and Heilongjiang Yearbook

**Heilongjiang output value per employee by industry (1,000 Yuan per person per year), 2000-2010**

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2010 |
|---|---|---|---|---|---|---|---|---|
| **Agriculture** | 8.80 | 9.58 | 10.91 | 14.00 | 16.09 | 17.26 | 21.53 | 23.6 |
| **Green food Manufacturing** | 124.88 | 178.51 | 209.41 | 208.55 | 249.24 | 260.43 | 224.67 | 271.6 |
| **Manufacturing** | 70.57 | 76.82 | 90.02 | 105.80 | 136.23 | 157.76 | 176.00 | 184.4 |

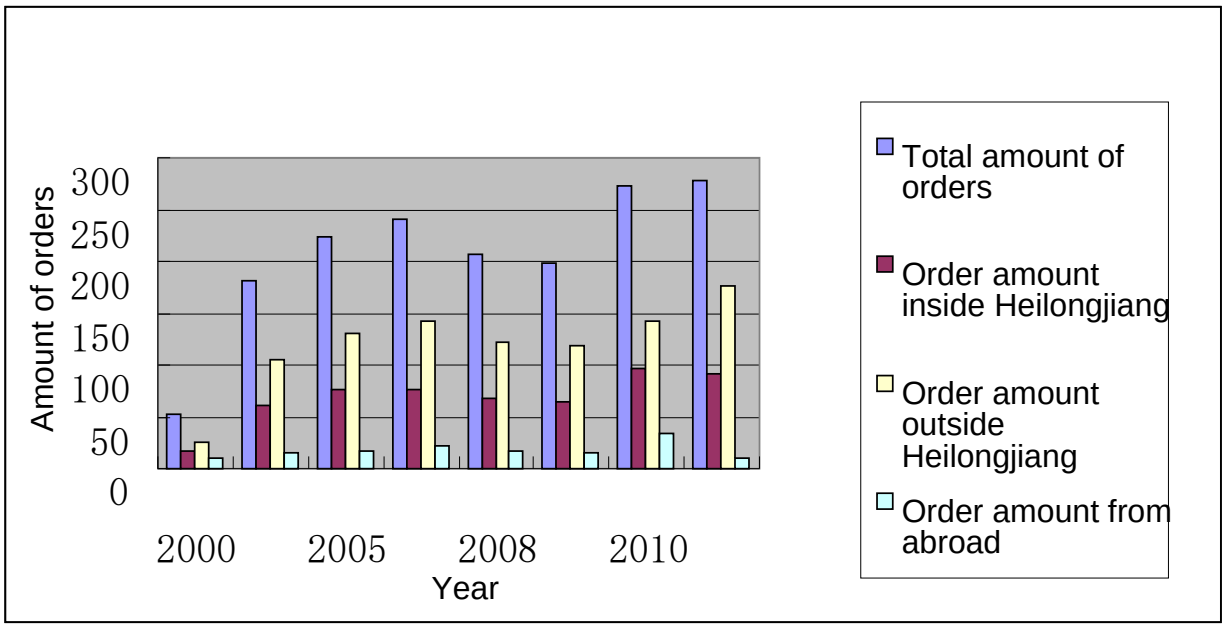
Source: Statistics collected and organized from Chinese Yearbook and Heilongjiang Yearbook

**Heilongjiang Main Agriculture Product Yields, 2001-2010**

| | 2001 | 2003 | 2005 | 2007 | 2010 |
|---|---|---|---|---|---|
| **rice** | 1016.3 | 842.8 | 1172.5 | 1658.5 | 2105.8 |
| **corn** | 819.5 | 830.9 | 1379.5 | 1568.5 | 1734.0 |
| **soya** | 537.5 | 616.1 | 800.7 | 527.28 | 687.3 |
| **milk** | 192.4 | 304.0 | 444.2 | 478.4 | 531.5 |

Source: Collected and organized from Heilongjiang Yearbook

**Heilongjiang green food processing industry amount of orders (10,000 tons), 2001 - 2010**




Source: Statistics collected and organized from China green food website http://www.greenfood.org.cn/sites/MainSite/

**Heilongjiang Main Green Food product yield as a proportion of the total agriculture product yield (%), 2001-2010**

| Product/Year | **2001** | **2003** | **2005** | **2006** | **2007** | **2010** |
|---|---|---|---|---|---|---|
| **Rice** | 16.1 | 15.3 | 27.9 | 32.1 | 48.6 | 54.3 |
| **Corn** | 1.6 | 3.8 | 18.2 | 23.2 | 31.2 | 33.7 |
| **Soya** | 4.4 | 5.3 | 11.7 | 17.1 | 24.7 | 26.7 |
| **Milk** | 34.5 | 42.9 | 41.9 | 37.9 | 43.6 | 47.4 |

Source: Calculated from Heilongjiang Yearbook

**Location Quotient (2000 – 2010) for GF and PH Industry**

| YEAR | LQ(GF) | LQ(PH) |
|---|---|---|
| 2000 | 7.95 | 0.774 |
| 2001 | 8.22 | 0.772 |
| 2002 | 8.31 | 0.687 |
| 2003 | 8.80 | 0.787 |
| 2004 | 10.25 | 0.752 |
| 2005 | 12.80 | 0.713 |
| 2006 | 12.85 | 0.648 |
| 2007 | 12.91 | 0.586 |
| 2010 | 12.62 | 0.683 |

Source: Calculated from Heilongjiang Yearbook

# Appendix 3: The Economic Development of China with Special Reference to Agriculture

The whole economic background of the nation and the region of China should be understood in order to demonstrate the regional economic development. Since 1949, China has had a significant experience from the exploration of the economic development approach. The blind follow of 'Stalin mode' at the beginning since 1949 made the national economy closed and stagnant.

However, along with the reform and opening-up policy which had been introduced in 1978, the Chinese Economy has been gradually recovering and leaping to a higher level. In this chapter, the development of the Chinese Economy will be addressed respectively to further demonstrate the extent to which the strategy of economic development supports the regional economy and promotes the formation of local industrial clusters.

**The general circumstance of China's economy**

Prior to 1978, since the founding of People's Republic of China in 1949, China had maintained a centrally planned and command economy which was performed by a large share of the country's economic output and was directed and controlled by the state to set up the production goals, controlled prices, and allocated resources throughout most of the economy. In the 1950s, individual household farms were collectivized into large communes. To support the rapid industrialization, the central government undertook large-scale investments in physical and human capital during the 1960s and 1970s. And as a result, by year 1978 nearly three-fourths of the industrial production was produced by centrally controlled stated-owned enterprise according to centrally planned output targets. Then, the central goal of the Chinese Government was to take the Chinese Economy relatively self-sufficient and the foreign-invested firms were very rare and the private enterprises were nearly non-existent.

At this period, government policies made the economy almost stagnant and inefficient which mainly resulted from the few profit incentives offered to firms and farmers. Therefore, there was no competition in certain areas. Moreover, prices and production controls caused widespread distortions in the economy. At that point, the huge shortage of commodities by the planned economy made the Chinese living standards substantially lower than those of many other developing countries. Consequently, the government was hoping to implement a

gradual reform which would significantly increase economic growth and raise the living standard.

At the beginning of 1979, the central government formally introduced the ‘reform and opening-up policy’ along with launching several economic reforms. The central government initiated price and ownership incentives for farmers, which enabled them to sell a portion of their crops on the free market. It also allowed them to adopt a pilot household, contract, responsibility system which linked farmers’ income and output rather than giving them equal salaries. The successful rural reform was not only increasing the income of farmers, but also accumulating huge and useful experience for reforms in cities. Based on that, the government established four special economic zones along the coast for the purpose of attracting foreign investment, boosting exports and importing high technology products into China. In addition for the reform of economy, it followed in stages and sought to decentralize economic policymaking in several sectors especially for trade. Economic control of various enterprises was given to provincial and local governments, which were generally allowed to operate and compete on free market principles rather than under the direction and guidance of state planning. Additional coastal regions and cities were designated as open cities and development zones, which allowed them to experiment with free market reforms and offer tax and trade incentives to attract foreign investment. Furthermore, state price controls on a wide range of products were gradually eliminated. The operating details and the effect of the economic zone and open cities will be addressed later in this chapter. Before this, however, the next section briefly reviews the Chinese economic model prior to the historical turning point of 1978. Now it is worth looking back at the evolvement of the economic model in China in the following section by setting year 1978 in between—the most important historical turning point.

## Basic features of China’s economic model prior to 1978

Prior to the reform and open-up policy, China's old economic model was essentially the ’Stalin’ mode. The main elements and basic features of the mode were: the State-owned economy was on absolutely dominant position, the income distribution was almost an equal allocation, the government imposed the highly egalitarianism centralized and unified management of planned economy, priority to the development of heavy industry to focus on the pursuit of high speed catch-up strategy, depending on the high investment and high consumption of extensive economic growth, which resulted into the deformed industrial structure situation that the heavy industry (including military industry) was too ‘heavy’ and light industry was too ‘light’, agricultural drag behind and urbanization lagged after industrialization. It was a typical dual economic structure with the coexistence of a more advanced industry and city and extremely backward agriculture and rural land. The critical problems resulting from this model were: seriously short in live products, waste and low efficiency and quality which led the average living standard cannot be improved. In addition, at least 250 million people living in rural areas cannot afford basic food and clothing, which almost made the economy on the brink of a collapse.

At the beginning of the foundation of People’s Republic of China in 1949, like many independent developing countries after World War II, China was deeply influenced by Stalin’s socialist industrialisation theory. There was also limited experience of large scale economic construction. These conditions made China view the development of heavy industry as a priority in order to achieve industrialization with the Soviet Union's aid for 156 major projects. Due to the lack of capital resources for large-scale construction and insufficient utilization available of foreign capital, China could only accumulate funds required for the construction. The accumulation of funds was through the high concentration of planned economy system which forced down the price of all input factors.

However, the prioritising of heavy industry development and the accompanying planned economic system put most of the resource allocation rights under the government control. Moreover, weak market forces were unable to optimize resource allocation as a basic role. The enterprises which were supposed to reflect market signals and scarcity level of resources were unable to play their basic role due to the dual restriction from government and the planned system. These enterprises were acting in accordance with the program without a motivating force to increase marketable products or economic efficiency. The highly centralized planned economic system and the fast one-sided pursuit of the heavy industry development eventually forced the formation of the extensive economic development mode.

The statistics indicated that from 1952 to 1978, the average annual growth rate of total social output value, industrial & agricultural output value and the national income were 7.9%, 8.2%, and 6.0% respectively (Jian, 2009). In comparison with 1949, the manufacturing industry's share of the national income increased from 12.6% to 46.8% whereas agriculture's share dropped from 68.4% to 35.4 %. At the same time, the aggregated economic volume has increased considerably. The industrial output value climbed from 34.33 billion Yuan (RMB) in 1952 to 499.2 billion Yuan in 1980 which is an increase of 14.54 times (Jian, 2009). Most importantly, China initially set up a relatively complete independent national economic and industrial system before the reform and opening-up policy was introduced. Thus, it provided a substantial material and technical foundation for the development in the future.

But the main feature of extensive economic growth in China was the focus on economic growth rates and pursuing the one-sided priority to develop heavy industry. Yet, it was basically at the expense of sacrificing the agriculture, light industry, and tertiary industry. Eventually, this situation led to imbalanced economic development, relied on extension economic growth mode which featured by high input-high output to expand production, and focused on

quantities rather than efficiency. This development approach had a serious disadvantage which was a one-sided development of heavy industry that led to an imbalanced industrial and investment structure. During the implementation of China's first 'five year' plan (1952 -1957), the share of heavy industry of the total output value increased from 15.3% to 25.5% which was necessary as the increasing industry need to suit the developing situation around the beginning of the foundation of the nation in that period. Till1978, the share of heavy industry of the total output value increased to 41.1% which was the highest increase since 1949. Moreover, investments in heavy industry occupied 50.9% of the total national investments in infrastructure, whereas the share of light industry was only 6.1% of the total investments and the share of investments in agriculture was even less. After 1952, the investment in heavy industry was many folds higher than that in agriculture and light industry. The policy of highly focused on industry development led to a one-sided pursuit of high speed expansion and ignored the overall balance. For instance, in 1960, the total value of industrial output increased by 25% whereas the value of the agricultural output decreased by 25%.

Consequently, it resulted in an uncoordinated development of the national economy. During the period between 1957 and 1978, statistics indicated that the gross national income per capita of Chinese residents increased 1.96 times. Yet, the national population consumption level index increased by only 44.0%. This 1.8 % increase per year is considered relatively insignificant (Chen and Shen, 2009). In 1978, per capita consumption of grain was only 196 kilos and that of cooking oil was 1.6 kilos. However, in comparison with 1949, this consumption level decreased as it was 205 kilos of grain and 1.7 kilos of cooking oil (Chen and Shen, 2009). This situation was supported by what leader Deng Xiaoping said as 'during the twenty years from 1958 to 1978, the income increased very little on farmers and workers, people's living standard is very low and the productivity without much development'.

Obviously, although the excessive speed of pursuing extensive economic growth achieved a significant contribution to China's economic development, the series of crucial disadvantages generated needed to be immediately and thoroughly reformed. Since 1978, due to this situation and the removal of the basic political barriers (China's Cultural Revolution), the Chinese Government has embarked on the exploration of new economic models.

**Basic features of China's new economic model**

Until today, China's economic model is gradually being constructed by the reforming of 'Stalin' mode. In general, the current model includes four major aspects which are: Basic Economic System; Economic Structure; Economic Growth Mode and Economic Development strategies.

Referring to the basic economic system, China shifted from the pursuit of a single form of public ownership to the coexistence of diverse forms of ownership based on public ownership as the mainstay, in order to form a mixed economy system. It also moved from the single mode of goods distribution and serious egalitarian allocation to a coexistence of variety of distribution ways considering both equity and efficiency. There is also a strong encouragement for some people getting rich first, and it stepped to the final goal of achieving the common prosperity as the whole nation. China has fundamentally changed the traditional planned economic system and has set up a socialist market economic system. Unlike the laissez-faire market economy system, the socialist market economic system gets the best out of the function of the market, price and competition. It is mainly based on the market mechanisms of resource allocation and also focuses on reasonable government macro-economic control and strategic guidance; yet, not completely abandoning the necessary role of the country in managing the economy.

According to the economic structure aspect, since the reform and open-up policy was introduced, China's economic structure has been constantly adjusted and potentially rationalized based on the national and international environment. Since 1978, the light industry has rapidly developed and agriculture has been strengthened as the previous structure of the heavy industry was too ‘heavy’ and the light industry was too ‘light’. The deformed backward agriculture sector has been transformed to the current developing target of the equipment manufacturing industry, high-tech industries and services; the situation of incompatibility between industrialization and urbanization and lag of urbanization has been changed. In addition, the implementation of the development strategy in Western China (introduced in 2000), the strategy of revitalising northeast old industrial bases (proposed in 2003) and the strategy of central area economic rising (formulated in 2006) are all attempting to reduce the regional disparities and achieve a regional coordinated and balanced development.

From the economic growth perspective, China's economic growth over a long period has been relying on the extensive mode, which mainly depends on high input and high consumption to develop the economy. Yet, this situation has changed and the new model stresses on the need to rely on technical progress, intensive growth mode of low-input with high-output and high efficiency, and manage enhancement. The extensive economic mode mainly resulted from prioritising the development of heavy industry. Thus, this system was significant in Northeast China as it was the old industrial base.

From the view of the economic development strategy, China has successfully implemented the strategic transformation from the catching-up strategy of giving the priority to the development of heavy industry into modernization strategy. This transformation came about mainly by stressing on speed and quantity while

disregarding quality and efficiency. Stressing on these two factors helps improving economic performance which then refines efficiency and quality at a reasonable real speed. China also shifted from insisting on self-dependent and closed-door policy into opening-up to the world to use both national and international markets and resources. Furthermore, implementing the strategy of revitalizing China through science-technology and education and the strategy of sustainable development were considered significant.

China's economic model has a focuses on forming incentive mechanisms through institutional reformation which aims to mobilize the local enterprises and the labours' initiative. This is one of most important reasons why China's mode has succeeded and the economy rapidly developed. During the reform and opening-up process, through a series of new concepts they were brought forward, in terms of the introduction of the household contract management responsibility system, expansion of business ownership, profit retention and bonus system, enterprise contract system, joint-stock system and the development of diverse forms of ownership economy, allocation according to production factors such as technological capital and administrative ability, decentralization policy, fiscal responsibility system, tax reform measures –those moves energetically mobilized all different groups of people as farmers, workers, managers, technicians and enterprises and local governments' initiative and creativity of production, operation, and economic development other than the previous absolute equalitarianism period of irrespective of people's initiative and ability.

**China's Economic achievements since 1978**

By realizing the flaws and problems indicated by previous policies and guidelines, the Chinese Government has adjusted its economic control system

and jumped to a higher level. Since the Third Plenary Session of the 11th Central Committee of the Communist Party of China in 1978, China has entered the new historical period of reform and opening-up. Over more than 30 years, the Chinese Government has achieved the remarkable and brilliant accomplishment of the socialist modernization. This accomplishment took place due to unswervingly propelling the institutional reform and firmly promoting opening-up to the world. It resulted in a well-off level of food and clothing instead of an inadequate one which was historical leap of people's living standard. This incredible success has made China win its international position and social influence. The priority measure for economic development is economic growth, and the main indices of economic growth are targeted on the total economy accumulation, growth rate and the per capita gross national income (GNI).

In April 1987, Deng Xiaoping elaborated on a goal which indicated that China will spend another 50 years after it becomes "well-off" quadrupling once more the industrial and agricultural output value. He also added the per capita output value will increase to $4,000 USD. Furthermore, in the middle of the next century, China can reach the height of moderately developed countries. This boldly demonstrates that socialism is superior to capitalism. According to this concept, in October 1987, the 13th National Party Congress formally established a "three-step" strategic plan for modernization. The plan aimed to double the GDP by 1980 and resolve food and clothing issues. Then, it would double the GNP by the end of the 20th Century and bring people's living standard to a higher level of being "well-off". Lastly, it also aimed to increase the GDP per capita to the level of moderately developed countries by the mid-21st century, bringing Chinese people richer lives and achieving modernization.

Eventually, the 'first step' strategic objective was completed three years ahead. In 1987, the GDP was 2 times the GDP of 1980; however, was expected in year 1990. In 1995, the 'second step' objective was achieved by doubling the GDP of

1987. The second objective was achieved five years earlier which smoothed the road for the ‘third step’ objective and a new stage of development. The national economy has grown rapidly in the implementation process of the ‘three-step’ strategic objectives.

From 1979 to 2007, the actual average annual growth rate of GDP was 9.8% (2008 China yearbook), not only significantly higher than the average growth rate of 6.1% rate between 1953 and 1978, but also much higher than the world economy average annual growth rate of 3.0% during the same period. It was about the same level as Japan's average annual growth rate of 9.2% on its economic take-off stage and the same figure for Korea of 8.5% on its economic take-off stage. (National bureau of statistics, 2008)

In 2008, under the general decline on the global economy, China's per capita gross national income (GNI) was $3,266 (US Dollar) compared to a figure of only $190 in 1978 (Jian, 2009). According to the World Bank’s classification criteria of GNI which is the main criterion for classifying economies worldwide, it jumped from the low income group to the lower middle income group in 30 years.

**World Bank Classification of GNI**

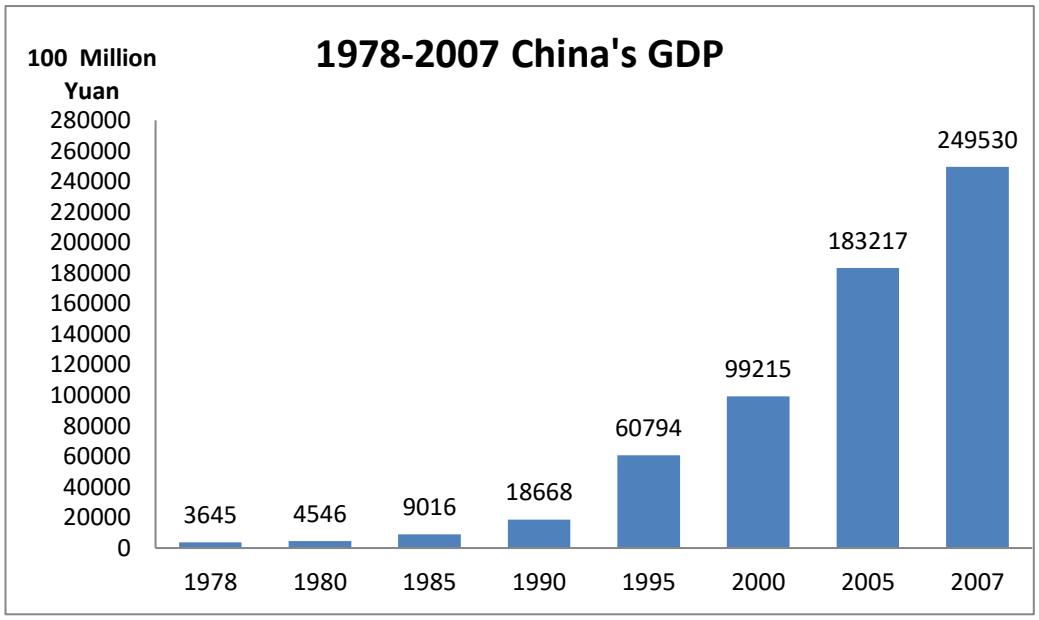
| **Income group** | **Classification criterion** |
|---|---|
| Low income | $995 (US Dollar) or less |
| Lower Middle income | $996-$3,945 |
| Upper Middle income | $3,946-$12,195 |
| High income | $12,106or more |

Source: Worldbank website

GDP increased from 364.5 billion Yuan to 24.953 trillion Yuan from 1978 to 2007 as shown in Figure A1 below. It took the economy 8 years to reach the level of 1

trillion Yuan from year 1978 to 1986, and another 5 years to reach 2 trillion Yuan until year 1991. In 2001, the average annual increase was about 1 trillion Yuan. Following the great achievement of 10 trillion Yuan of GDP in 2001, the national economy has entered the high-speed growth phase from 2002 to 2006, with an average annual increase of around 2 trillion Yuan, which increased the GDP to over 20 trillion Yuan in 2006. The economy's accelerated expansion has strongly reduced the distance between China and the main developed countries in the world.

**Figure A1: China's GDP from 1978 to 2007**

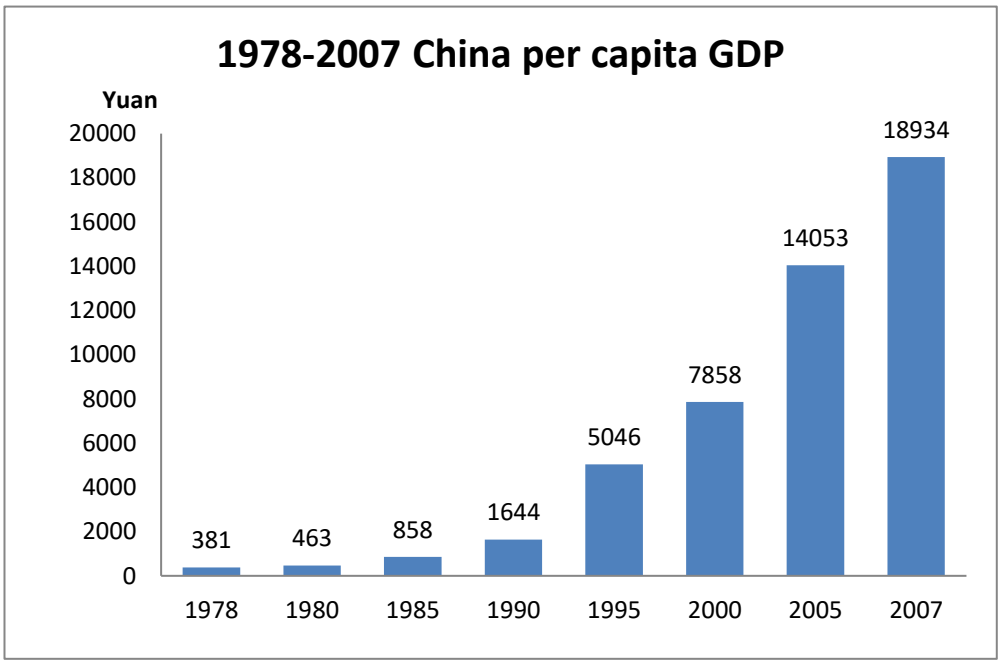



**Source: Chart derived from China Statistical Yearbooks**

Over the three decades, China's gross domestic product (GDP) has increased from 364.5 billion Yuan (RMB), which was ranking the tenth in the world and accounting for 1.8% share of the total world economy in 1978 to 30.067 trillion Yuan in 2007. It ranked the fourth in the world and accounted for over 6% share of the total world economy, closer to the figure for the USA, Japan and Germany. According to the International Monetary Fund (IMF) report in 2008, China's GDP in 2007 was equivalent to 3.2801 trillion US Dollar which is roughly equivalent to 23.7% that of the USA, 74.9% of Japan and 99.5% of Germany.

As Figure A2 shows below, Per capita GDP has significantly increased. Per capita GDP jumped from 381 Yuan in 1978 to 1,112 Yuan in 1987, and then reached 2,311 Yuan in 1992. In 2003, it was 10,542 Yuan which exceeded the level of 10,000 and rapidly climbed up to 18,934 in 2007 which is nearly 10 folds of that of 1978, and the average annual growth was 8.6%.

**Figure A2: China's per Capita GDP from 1978 to 2007**




*Source: original figure was derived from China Statistical Yearbooks

The rapid economic expansion and development also strengthened the national financial position. The total national revenue was only 113.2 billion Yuan in 1978, yet had been almost doubled in 1985 at 200.5 billion Yuan. In 1993, it increased more to 434.9 billion Yuan and made a breakthrough of 1 trillion Yuan which was exactly 1.1444 trillion Yuan. Until 2003, it was 2.1715 trillion Yuan. Thereafter, in 2007, the total national revenue was 5.1322 trillion Yuan. The trend is very significant as shown in Figure A3: between 1979 and 2007 the average annual growth rate was 14.1%. The increase in financial strength has been the solid guarantee funds and consistently made great contribution promoting economic development, strengthening economic and social vulnerability, improving living

standard and effectively responding to the various risks and natural disasters.

**Figure A3: China's Financial Revenue between 1978 and 2007**


*Source: original figure was derived from China Statistical Yearbooks

With the incredible economic development, the foreign exchange reserve has been historically transferred from scarce to abundant. In 1978, China's foreign exchange reserve was 167 million US Dollar (Jian, 2009), which was only 0.17 US Dollar per capita, even less than 1 Yuan (RMB). The shortage, then, was the basic characteristic of foreign exchange reserve. However, since the reform and opening-up policy launched, China's foreign trade economy has been rapidly growing, expanding, and overcoming the shortage of the foreign exchange reserve. In 1990, the foreign exchange reserve was 11.1 billion US Dollar, until it reached 105 billion US Dollar in 1996. Additionally, in 2006, the figure exceeded 1 trillion US Dollar — exactly 1.0663 trillion, ranking the first worldwide. In 2007, China's foreign exchange reserve reached 1.5282 US Dollar, still being the world's leading country.

Large enterprises have been emerging and growing hastily. With the fast economic development and the continuous expansion of economies of scale, number of large enterprises increased. This situation was a remarkable sign for the 30 years' reform and opening-up to the economic development achievements. According to "Fortune's list of Fortune 500" in 2007, China occupied 22 enterprises on the list, within those the 'China Petrochemical Corporation' was ranking the 17th whereas it ranked 23rd in year 2006, acquired China's best ranking of 'Fortune 500' and the first enter of the top 20 in the world.

**Increased Supply Capacity**

During the 30 years of development, the supply capacity of commodities and services has significantly advanced and basically overcame shortage issues.

Over the 30 years to ensure agriculture, especially the supply of the main agricultural products has always been the major concern of the Government. The supply ability of agricultural products has strengthened. The added value of the first industry (agriculture) increased from 102.8 billion Yuan in 1978 to 2809.5 billion Yuan in 2007 at an average annual increase of 4.6%. Major agricultural output has increased by several folds. For example, the grain yield increased 64.6% in 2007 to count for 501.6 million tons (2008 China yearbook).

The industry productivity has been expanding sharply. In 2007, the added value of the industry exceeded 10 trillion Yuan – 10.7367 trillion Yuan. Since 1978, it increased 23 folds at an average annual growth rate of 11.6%. The output yield of main industry products has been increasing constantly. In 2007, the fast development of the agriculture and industry has climbed up the rank of China's main products. Within the main agriculture product range, many of those were sustainably ranked the first on the world list. For instance, the supply of grain

was 456.32 million tons, meat was 68.66 million tons, and cotton was 7.62 million tons. Furthermore, rapeseed supplied 10.57 million tons, peanut supplied 13.02 million tons, whereas tea and fruits supplied 1.12 million and 181.36 million tons. Sugarcane (112.95 million tons) and soya bean (17.2 million tons) were ranking the second and the fourth respectively. For the industry main products yield, steel (565.61 million tons), coal (2526 million tons), cement (1360 million tons), chemical fertilizer (58.25 million tons) and cloth (67.5 million kilometres) were ranking the first. Generated electrical energy (3281.6 billion kilowatt-hours) was ranking the second, while sugar with yield of 12.71 million tons was ranking the third. Additionally, crude oil production was ranking the fifth with 186.32 million tons. Ranks of other major products were all advanced. Basically, as the most populous country in the world, China should produce the greatest output volume of major production, or otherwise it would not be able to meet the needs of whole population. Yet, it is worthwhile to point out that the output yield of the major products was all in shortage. It was not close to the top of the world's list before 1978, when the new policy of reform and opening up was adopted. China has made a remarkable achievement on the industrial and agricultural production by both horizontal and vertical comparisons.

At the same time, the status of a big manufacturing industry nation has preliminarily set up with its great power. According to a report from the United Nations Industrial Development Organization (UNIDO), between 1995 and 2000, the average annual growth rate of China's manufacturing industry was 9.3%. This rate was 6.1% faster than industrialized countries, 4% faster than developing countries. From 2000 to 2006, the average annual growth rate was 11.2% which was 9.4% faster than industrialized countries and 4.2% faster than developing countries. According to constant price of 2000, the added value of China's manufacturing industry accounts for 11.4% of the world's share which was 5.1% in 1995.

Since 1978, the deeper understanding and the larger investment in the tertiary industry have enabled a rapid development for the tertiary sector. In 2007, the tertiary industry achieved an added-value of 10.0054 trillion Yuan. This achievement was 18.6 times more than year 1978 base on the comparable price; growing at an average annual growth rate of 10.8% over the 30 years. Various services sectors have achieved rapid growth within the tertiary industry which has formed a commercial prosperity and multi-level categories of commodities market system and various economic components. It also resulted in multiple distribution channels and market diversification with commodity markets. The total retail sale of social consumer goods was 8921 billion Yuan, which was 56.2 times greater than that in 1978, increasing at a 15.0% average annual rate (national bureau of statistics, 2008). At the same time, the financial market system has been established and financial products have been gradually enriched.

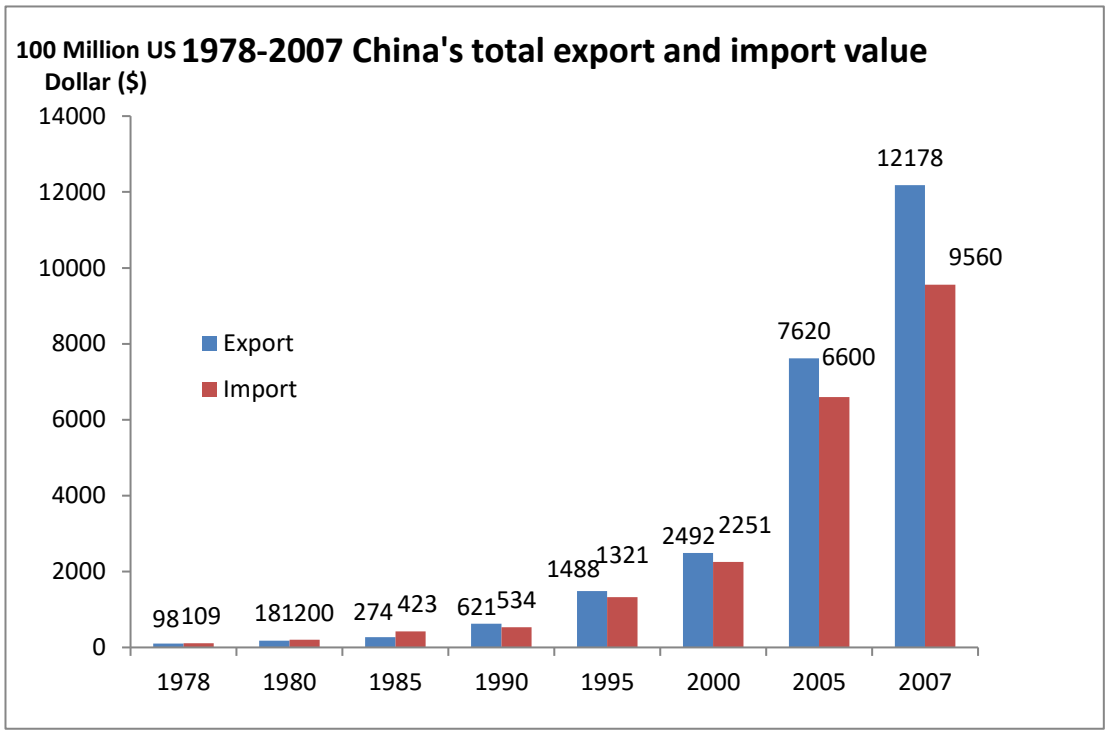
**Implementation of the opening up policy**

Before the reform and opening-up policy, China was mainly on the close-door policy and engaged in a very small foreign trade. In 1978, imports and exports total volume was only 20 billion US Dollar and the use of foreign capital was blank. Over more than 30 years, China's progressive realization of the ‘reform and open-up policy’ has pushed China’s economic international status and international influence from weak to strong. The situation of the international economic relation is one of the important factors that influences and reflects a country’s economy development. The development of an economy is usually regarded as three main indictors which are: foreign trade, foreign direct investment and foreign exchange reserve.

The rank of foreign trade volume rose from the 29$^{th}$ in 1978 to the 3$^{rd}$ in 2007 (State Statistics Bureau, 2010). As shown in Figure 2.4 below, by the end of

2007, China's total input and output volume was 2.1737 trillion US Dollar. It increased 104.3 folds from 1978 (20.6 billion US Dollar) at an average growth rate of 17.4%. The output volume increased 18.1% while the input volume increased 16.7%, demonstrating that growth was balanced and stable. Moreover, in 2008, the foreign trade volume reached 2.5616 trillion US Dollar (Jian, 2009). Meanwhile, the contribution of foreign trade to national economy has been constantly increasing. The total foreign trade volume in 2007 accounted for 66.8% of the total GDP which was 9.7% in 1978. The figure in 2007 also accounted for 7.7% of the world's trade volume which ranked after US and Germany (national bureau of statistics, 2008). In 2008, the foreign direct investment (FDI) was 92.4 billion US Dollar ranking the second place while in 1978 there were no investments. The foreign exchange reserve increased from 167 million US Dollar in 1978 to 19.46 trillion US Dollar in 2008, ranking the first in the world (national bureau of statistics, 2008).

**Figure A4: China's Export and Import Value between 1978- 2007**




*Source: original figure was derived from China Statistical Yearbooks

**Infrastructure Development**

Infrastructure is a main indictor that reflects a national economic development. Since the reform and open-up policy, China has carried out a large-scale infrastructure construction. All large and medium-sized cities are changed to an entirely new look, the convenient land, sea and air transport networks were initial formed. In particular, 'Shenzhou VII' and 'ChangE I' spacecrafts were the magnificent feat of science and technology and the monument of civil infrastructure. Also, the telephone network and highway construction constituted notable achievements. Along with the human society that has entered the information age; the telephone network is one of the most important infrastructure investments. In 1978, China's landline telephone user amount was 1.92 million households. The only mobile phone and Internet user was Nil. By the end of 2008, the amount of landline telephone subscribers soared to 34.081 million households. Mobile phone user amount increased to 64.123 million. Moreover, mobile phones had been ungraded several times from a 'brick-like' into the 'mini' style with multifunction. Internet user amount increased to 300

million; and all ranked first in the world. Furthermore, super freeway is a modern and advanced mode of transport, which was just constructed since 1988 in China. And at the end of 2001, China's highway traffic mileage was accumulated to 1.9 thousand kilometres which was the second highest amount in the world, ranking after the United States. While the United States started the construction of high-speed roads as early as the implementation of 'Roosevelt's new deal' in 1930s, the in-between period is more than 70 years. China's highway took 20 years and exceeded 60 thousand kilometres on traffic mileage since it was established.

For 30 years after 1978, the accelerated progress of the reform and rapid economic growth has been promoting the economic structures optimizing and constantly upgrading. Under the force of reform and opening-up policy, outstanding changes have been made on the economic restructuring. The economic development and growth model have laid-out new patterns over the time. The industrial structure has basically realized the collaborative development of three industries (agriculture, industry and tertiary industry) – these are only two industries: which is mainly dependent on the agriculture and industry. Over the economic restructuring period, agriculture has been continually strengthening. Agriculture has been sustainably developing and the tertiary has been rapidly expanding. From 1979 to 2007, the average annual growth in value-added of agriculture, industry and tertiary industries were 4.6%, 11.4% and 10.8% respectively (2008 China yearbook). The ratio of the three industries' output value switched from 28.2:47.9:23.9 in 1978 to 11.3:48.6:40.1 in 2007. In comparison with 1978, in 2007 the agriculture proportion decreased by 16.9%, the industry proportion rose by 0.7% and the tertiary share significantly increased by 16.2%.

The industry structure basically has transferred from low-tech, labour- intensive,

single category to labour-intensive, technology intensive and a complete range development pattern (if it was labour intensive and remained so then there's no need to mention this point because you're talking about a change). Within more than 30 years, traditional industries such as metallurgy, energy, textile, machinery, and navigation have been constantly adjusted and upgraded under the reform implementation. Many high-tech industries such as electronic information, biological engineering, aerospace, medical and pharmaceutical manufacturing and new energy technologies have thrived and became the engine for the Chinese industry great development. In 2007, China's high-tech industry share was 1162.1 billion Yuan which was 4.7% of the total GDP (Jian, 2009). The pace of urbanization is clearly speeding up; the proportion of urban population of total has been increasing year by year. The urbanization level climbed up from 17.9% in 1978 to 44.9% in 2007, which is a 27% increase at a 0.9% increase annually. The urban population grew annually by 14.53 million and the rural population declined annually by 2.16 million. A large number of rural populations moved from rural to urban areas, hence, promoting the coordinated development of the urban and rural economies by diverting resources from the rural to the urban sector. Along with the urbanization and industrialization forward movement, the capacity of employment in urban areas has been majorly enhanced. From 1978 to 2007, the urban employment share of the total national employment increased from 23.7% to 38.1%. At the same time, the substantial increase in urban job vacancies has driven the constant labour force migration from rural to urban areas. The rural employment proportion relative to the total employment decreased from 76.3% in 1978 to 61.9% in 2007. This situation is accelerating the progress of urbanization and reallocating the labour surplus.

China shifted from the pursuit of a single form of public ownership to the coexistence of diverse forms of ownership based on public ownership as the

mainstay. This shift formed a mixed economy system of coexistence of different forms of ownership; from the single mode of distribution and serious egalitarian allocation to coexistence of variety of distribution ways and both equity and efficiency, strongly encouragement of some people getting rich first which also emphasized to achieve common prosperity of the distribution system ultimately. China has fundamentally changed the traditional planned economic system and preliminarily set up the socialist market economic system. Unlike the laissez-faire market economy system, the socialist market economic system brings out the best function of the market, prices and competition mainly based on the market mechanisms of resource allocation. It also focuses on the government which has a reasonable macro-economic control and strategic guidance. Furthermore, a necessary role of the government would be managing the national economy such as western laissez-faire market.

The State-owned economic stratagem was fundamentally changed into the coexistence of diverse forms of ownership pattern. In 1978, the share of the state-owned industry output value was 77.6% and the collective industry output value was 22.4%. The State ownership had an absolute advantage, until 2007, within all the above-scale industry enterprises, it was (what was?) just 29.5% of the total output value from the state-own or stated share-holding industry enterprises and 2.5% from the collective enterprise (2008 China yearbook). Meanwhile, the rapid development of the non-public owned economy has played an increasingly important role to promote the economic growth, expand employment and activate the market. From statistical records, in 2007, non-state-owned enterprises were 68% of the total above-scale industry output value. From the employment perspective, in 2007, the urban employment of the state-owned and collective organizations was 24.3% of the total urban employment which was almost 100% before 1978.

## Improved Living Standard

Economic development, in its fundamental purpose, is to improve people's living standards. The main indicators which would most reflect the level of people's living standard and the changes would be employment, people’s income, disposable income and the Engel coefficient. The latter is an indicator used to show the proportion of income spent on food. It is used to illustrate the difficulty of people acquiring basic needs of life and basically the smaller the result the better living standard people with). Indicators also include amount of rural poverty population and average life expectancy.

China’s classification for the poverty level is those people who do not have enough income to cover their food and clothing expenses. The amount of rural poverty population was decreasing from 250 million in 1978 to 14.79 million by the end of 2007. China has made outstanding contributions to reduce the poverty population in the world and received high recognition from the United Nations and the World Bank. Over more than 30 years, along with the enhancement of people’s living standard, people’s wealth has been increasing accordingly; meanwhile, the employment has been constantly growing. As a populous country, to achieve the employment synchronous or faster growth along with the economic development is a crucial segment to ensure that wealth is shared by most people. After 1978, the government has energetically set up a series of employment policy guidelines and issued the corresponding fiscal and financial policy to increase employment. In 2007, the total employment was 7.699 billion which is 2 times the employment in 1978, increasing by 12.7 million people annually. At the same time, billions of rural surplus labours have migrated to non-agriculture jobs (National bureau of statistics, 2008).

The urban disposable income per capita was increased from 343 Yuan in 1978 to 13,786 Yuan in 2007. The indicator in 2007 is 6.5 folds the indicator in 1978,

growing at a 7.2% growth rate annually. During the same period, the rural residents' net income increased from 134 Yuan to 4140 Yuan, which is 6.3 folds increasing at an average annual growth rate of 7.1% (National bureau of statistics, 2008). According to the increase of the income, the consumption level of both urban and rural residents has been significantly enhanced. During the three decades, the urban consumption level has increased 4.9 fold whereas the rural consumption level has increased 4.4 fold.

There is a big difference between the standard of living of rural and urban populations which makes the Engel coefficients different. However, during the past three decades, there were huge changes in the indicator for both rural and urban areas. The rural Engel coefficient decreased from 67.7% in 1978 to 43.7% in 2008. On the contrary, the urban Engel coefficient decreased from 57.5 % to 37.9 %. The average life expectancy in China increased from 35 years old to 68 in 1978 and then to 73 years old in 2008. It signals better living condition and improved health and medicine status. Otherwise, the countries which listed on the lower- middle income on the world would not reach the same level of life expectancy as high income countries.

Generally, the capitalistic economy is surplus economy whereas the traditional planned economy is the shortage economy. Before the reform and open-up policy, China has been suffering from a typical shortage economy in which virtually almost all industrial and agricultural products are supplied under government's allocation. After 30 years under the 'reform and opening-up' has been implemented, the essential achievement of China's economic development is the general characteristics of the economy had switched from a serious shortage economy to a relative surplus economy ---a big, rarely qualitative and quantitative change.

**Social and Regional Development**

Before the reform and opening-up policy, the social undertaking was even falling behind the economic development. Over the 30 years efforts, along with China's growing economic power, social development has been receiving extra attention. Under the scientific development, the coordination development between the society and the economy has been significantly enhanced and a big achievement was sequentially realized by science and technology. During the three decades, the Chinese Government has kept increasing the investment in the science and technology area. The investment expenditure on research and development in 2007 was 371 billion Yuan which was 9.6 times than that in 1995 (National bureau of statistics, 2008).

First of all, the eastern coastal regions using their existing infrastructure and policies relative to the rapid development, give full play to its advantage, to enhance the economic growth and comprehensive national strength. Prior to 1979, the balanced development of the regional economic strategy was mainly in use, although it was beneficial to the Midwestern region of China development. Yet, practically, it has formed the uniform distribution of investment and lack of efficiency because of the investment mismatching. Thereafter, to a certain extent, that developing pattern affected the entire national economy. Since 1979, the government has realized that the economy was affected and increased the share of investment with preferential policy to the coastal areas. It initially broke the funds into an equal allocation and policy configuration on egalitarianism, to develop and promote the coastal areas potential economic power in order to enhance the first development of coastal areas. The rapid development of coastal areas was a solid foundation for the national economy expanding and comprehensive national power strengthening. Secondly, the development of coastal areas was also aiming to be a demonstrative and incentive effect to the Midwest of China to explore the

approaches of the industrialization and modernization. Doing so would turn its empirical experience into lessons for Central and Western regions in their further development. Furthermore, this ‘first development’ model would definitely increase the economic strength of the coastal areas and improve the socio-economic development level and people's living standards. These conditions were initial and critical necessities for the country and its residents in the 1970s. Meanwhile, this change would increase motivation and induce the Western regions to achieve the economic and social development through their own efforts and national supporting policy

Finally, forming the economic disparity would promote the mobility of production factors and optimization of resource allocation. The relatively faster development of the eastern coastal regions formed an economic gap between different regions and thereby promoted mobility of economic resources and production factors. Prior to 1979, under the traditional planned economy system, various types of production elements were fixed in terms of their location which resulted in low efficiency and waste of resource allocation. Since 1979, the eastern coastal regions had a relatively rapid development while the Central and Western regions were relatively lagging behind. Now the economic disparity has closed and allowed resources to flow to the eastern coastal regions, which also made a relatively high return and improvement on allocation of resources. The optimization of resource allocation is the basic motivation of socio-economic development.

After experiencing the rapid development in the eastern coastal regions, the fifth Plenum of the 14th Communist Party of China Central Committee in 1995 set up a new policy based on coordinated regional economic development and gradually reduced the regional development disparities as it was its main target. Since 2000, the western development project has started comprehensively. In

2003, the Chinese Government formally issued the strategic policy and guidelines of ‘revitalizing the Northeast’s old industrial base of China with funding and project targeting support. In April 2006, the government issued a ‘number of opinions for promotion of rise of central region’ which brought forward the overall requirements and strategic positioning for improving the central region. Thus, from the Pearl River Delta, Yangtze River Delta, Bohai Bay to the Northeast, Chengdu economic zone, and North District, the numbered regional economic zones have been increasing. The regional economic development in China has gradually completed the layout from ‘point to line’ and vigorously promoted the balanced and comprehensive development of the Central and Western China.

Under the restriction of the historical stage and the influence of the former Soviet mode, in the period of socialist construction, China followed an extensive mode of economic growth. In the period of reform and opening up, the central government proposed to change the mode of economic growth and development and adopted a series of measures to adjust industrial structure. It also aimed to increase the innovative capability and promote the change of the economic development mode. From scores of years of exploration, the significance of sticking to the concept of scientific development to further strengthen the independent innovative capability was realized. The rarely-seen worldwide financial crisis in 2008 and the periodic adjustment of China’s economy have brought many pressure as well as driven the Chinese Economy to total transition. To make full use of what happened, planning and focusing on the key point and promoting the transition of the economy from every field and various levels are not the only tasks, but also pursuing a long term strategy to maintain a sustainable development for the economy.

Under the general development history of the Chinese Economy as addressed above, there is no doubt that the country has gained the harvest under fully implementation of the ‘reform and opening-up’ policy over the 30 years.

However, within the whole progress pattern, to gradually open the eastern coastal area at the beginning (started in 1979) was the most crucial step. The preliminary significant effect by around 1989 indicated that the implementation of a targeted policy or strategy could be applied to the Chinese Economy rather than the balanced development of regional economic strategy in previous years. Furthermore, the introduction of the special economic zones in 1980 was the engine which has been driving the national economy to a higher level. It has revealed the potential capacity of each region under the effective policy guidelines and a reasonable allocation of resources. Based on the successful experiment, the central government decided to set up a series of plans for developing regional economies focusing on more coastal, western, northeast and the mid-central areas.