Explaining the Growth of an Industrial Cluster
- Theories Tested on the Ningbo Die & Mould Cluster

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Studying here at Kristianstad University for a master degree of international business and public administration must be memorable in our life. In the past ten months, we have learned a lot and experienced a lot. This will be beneficial to both our work and life in the future.

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David, Eagle & Chris
Abstract

Purposes: The aim of our dissertation is to find an applicable theoretical framework that could explain the growth of the Ningbo Die & Mould Industrial Cluster. The theoretical framework is also expected to be applicable in the Ningbo Endogenous Industrial Clusters.

Research questions:

● What is the definition of industrial cluster according to different researchers?
● What are the factors behind the presence of the Ningbo Die & Mould Industrial Cluster?
● Can the emergence of the Ningbo Die & Mould Industrial Cluster be explained by any existing theories of industrial cluster, and if so, which theory is the most appropriate?
● Is it possible to develop a model that is capable of explaining and analyzing the growth of the Ningbo Die & Mould Industrial Cluster?

Theoretical framework: Mainly based on Porter Diamond Model, supplemented by other relevant models and our working experience, we have set up our own theoretical model, in which a factor hierarchy with five category factors and 29 sub-factors was structured. Meanwhile, a specific cluster, the Ningbo Die & Mould Cluster, was selected to conduct the survey of questionnaires. The different managers of the enterprises were chosen as respondents and we tried to test the validity of our own theoretical model.

Results: The collected data from the survey was analyzed through the SPSS program, we adopted Factor Analysis, Descriptive Statistics, Correlation Analysis to draw conclusions. The findings of our dissertation suggest the local government should put more emphases on different factors in the course of clusters’ growth.

Key words: Porter Diamond Model  Double Diamond Model  Nine-Factor Model Factor  The Ningbo Die & Mould Cluster  Correlation Analysis
# Table of Content

## Chapter 1 Introduction

1.1 Background ................................................................. 7
1.2 Problem ........................................................................ 8
1.3 Purpose ........................................................................ 9
1.4 Limitation ..................................................................... 9
1.5 Research Questions...................................................... 10
1.6 Outline ......................................................................... 10

## Chapter 2 Methodology

2.1 Research Philosophy ................................................... 12
2.2 Choice of Method ....................................................... 13
2.3 Data Collection Methods .............................................. 14
    2.3.1 Secondary Data .................................................... 14
    2.3.2 Primary Data ....................................................... 15
2.4 Criticism of Sources .................................................... 16

## Chapter 3 Conceptual Framework

3.1 Introduction .................................................................. 18
3.2 The Definition of Industrial Cluster .............................. 18
3.3 The Drive Factors of the Emergence of Industrial Clusters 20
    3.4.1 Porter Diamond Model ...................................... 23
    3.4.2 Other Models and Their Explanatory Values .......... 27
3.5 Our hypotheses and a modified model .......................... 30
    3.5.1 The factors of Ningbo mould manufacture cluster .... 30
    3.5.2 Our model ......................................................... 36

## Chapter 4 An Introduction of the Ningbo D & M Cluster

4.1 Current Status............................................................ 38
4.2 Categories of the Industrial Clusters in Ningbo .......... 38
4.3 The Development of the Die & Mould Industry .......... 40
    4.3.1 An Introduction of Die & Mould Products and Markets 40
    4.3.2 A History of The Die & Mould Industry in Ningbo .... 42
    4.3.3 The Current State of the Ningbo Die & Mould Industry 43
        4.3.3.1 Number of Enterprises and Their Distribution .... 43
        4.3.3.2 The Sale Increase ........................................ 44
        4.3.3.3 Asset Increase ............................................. 45
        4.3.3.4 Profits Increase .......................................... 45
        4.3.3.5 Employees Increase .................................... 46
        4.3.3.6 Exports Increase ....................................... 47
4.4 Characteristics of the Ningbo Die & Mould Industrial Cluster ................................................. 47
  4.4.1 Geographical Proximity ........................................................................................................ 48
  4.4.2 Strong Competitiveness ...................................................................................................... 49
  4.4.3 Professional Producing ..................................................................................................... 50
  4.4.4 Technology Improvement .................................................................................................... 50
  4.4.5 The Ningbo Die & Mould Association ................................................................................ 51

Chapter 5 The Empirical Study ............................................................................................................ 51
  5.2 Population and Sample ............................................................................................................. 55
    5.2.1 The Sample ...................................................................................................................... 56
    5.2.2 The Sample Method ........................................................................................................ 56
    5.2.3 The Result of Sample ....................................................................................................... 56
    5.2.4 The Representativeness of the Sample ......................................................................... 57
  5.3 Questionnaire ............................................................................................................................. 57
    5.3.1 Questionnaire Structure .................................................................................................. 57
    5.3.2 Administer the Questionnaires ....................................................................................... 58
    5.3.3 Enhancement of Response Rate ..................................................................................... 58
  5.4 Pilot Test and Revision .............................................................................................................. 59
  5.5 Language of the Questionnaire ............................................................................................... 59
  5.6 Reliability ................................................................................................................................ 59
  5.7 Validity .................................................................................................................................... 60
  5.8 Generalizability .......................................................................................................................... 60

Chapter 6 Analysis of the Survey Data ............................................................................................... 61
  6.1 Statistical Methods .................................................................................................................... 61
  6.2 Characteristics of the Respondents ......................................................................................... 62
    6.2.1 Distribution of Ownership Character ............................................................................. 62
    6.2.2 District Distribution of the Respondents ........................................................................ 63
    6.2.3 The Distribution of the Respondents Position ............................................................... 63
    6.3.1 Factor Analysis Results of the Sales Distribution .......................................................... 64
    6.3.2 Factor Analysis Results of the Age Distribution ............................................................ 65
  6.4 Descriptive Analysis .................................................................................................................. 66
  6.5 Correlation Analysis ................................................................................................................ 68
    6.5.1 Q-Sales Correlation ......................................................................................................... 69
    6.5.2 Correlation between Age and Q .................................................................................... 73
    6.5.3 Correlation between Sale and Age .................................................................................. 76
  6.6 Summary ................................................................................................................................... 76

Chapter 7 Conclusions ....................................................................................................................... 78
  7.1 Summary of Dissertation ......................................................................................................... 78
  7.2 Conclusions .............................................................................................................................. 79
    7.2.1 The Framework of Our Model ....................................................................................... 79
    7.2.2 The Survey ..................................................................................................................... 80
    7.2.3 The Analytical Results for the Given Influence Factors .................................................. 80
Chapter 1 Introduction

This chapter presents the background of the dissertation. The research problems and the purpose of the dissertation are also discussed. Further, the limitations, the research questions are defined. Finally, the overall outline is presented.

1.1 Background

Our initial research inspiration is drawn from both our working background and Porter’s Diamond Theory. In Ningbo municipality, two of our group members are in charge of the industrial industry development and planning. Nowadays, Porter’s theory is very popular in our country; some local governments even stimulate industrial clusters by practicing Porter’s theory. To be frank, we just knew a little about Porter’s theory before studying in Sweden. In the course of International Business we learned about this theory in some detail. After further reading, we are still very interested in this field and we began regarding it as our research topic.

Nowadays in China, Industrial clusters, a “geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities”(Porter 1990), have been seen as a successful tool to enhance the economy. This phenomenon initially emerged in the early 1970s. because of the increasingly high competition, especially facing the challenges from foreign companies after China’s entrance into the WTO, large amount of small or medium enterprises concentrated in a specific location, interacted with each other directly or indirectly. Many industrial clusters are continuing to emerge in special regions. The emergence and growth of industrial clusters, on the one hand, improve the local economy. On the other hand, the clusters also increase the industrial competitiveness in the domestic or international markets. To some extent, some
industrial clusters have become “a domestic factory” or “world factory”. As a relatively developed region, our hometown Ningbo has formed some typical industrial clusters and some of them also play a significantly important role in creating jobs and local wealth, such as industrial clusters producing die & mould, garment, stationary, knit goods, home appliance etc. These kinds of clusters have gained an obvious competitive advantage in both national and global markets.

After reviewing the relevant literature, we found that many economists have devoted time to this research field from different perspectives, primarily researchers such as Alfred Marshall, Alfred Weber and Michael Porter. Among those, Micheal Porter is one of the most popular researchers in this area. Since the 1990s, most of the works about industrial clusters are case studies about different nations and regions. Admittedly, Porter’s theory and other research results are valid in developed countries, but we are not sure that Porter’s theory and others models are universal. Can they be applied to explain the formation of Chinese and especially Ningbo’s industrial clusters? After heated discussions and deep thoughts, we gradually formulated and clarified our research topic and research ideas.

1.2 Problem

As mentioned above, the research about industrial clusters is well documented. But there is also a considerable debate regarding the actual definition of an industrial cluster; how can we identify an industrial cluster, and what factors drive the emergence and growth of an industrial cluster? Although many theories, especially Porter’s theory, have been proved to be valid in developed countries, it is not sure that those theories are universal. Are they also valid in developing nations, particularly in China? Due to our limited knowledge and ability, we are just interested in the formation of such industrial clusters in Ningbo such as the Die & Mould Industrial Cluster, the Garment Industrial Cluster, the Stationery Industrial Cluster, and the Knit Goods Industrial Cluster. Since those clusters have some common characteristics, we
just focus on the Ningbo Die & Mould Industrial Cluster and try to find what factors have driven the formation of them, to what degree different factors have influenced them, and how those factors have driven them. So in sum, our research objective is to apply mainly Porter’s theory to explain and analyze the formation of industrial clusters in Ningbo, and see whether or not we can make some modifications in order to develop a new model.

1.3 Purpose

The purpose with our dissertation is to investigate and clarify the driving factors behind the emergence of the Ningbo Die & Mould Industrial Cluster mentioned above. Furthermore, we would like to try to analyze whether existing theories of industrial cluster, mainly Porter’s Diamond Model, can be used to explain the emergence of the Ningbo Die & Mould Industrial Cluster. If it cannot, we want to create our own explanatory model to why the Ningbo Die & Mould Industrial Cluster emerges. Finally, we also try to examine the value of our model by using an empirical case study.

1.4 Limitation

First of all we have reviewed the relevant theories and empirical researches in the field of industrial cluster. Due to time constraint, we have only been able to investigate a limited amount of researches and publications about industrial cluster. This fact can be viewed as one limitation. Furthermore, since English is not our native language, we sometimes have some thriving ideas about our research topic, but we really do not know how to express ourselves precisely. This problem also influences and to certain degree limits the depth of our research. Another limitation in our empirical study comes from the fact that we now live and study in Sweden, but our research targets are far away in Ningbo. We cannot deliver questionnaires by ourselves, and we also cannot conduct interviews face to face, only by telephone. This also limits the depth of our research. Finally, since we just selected one of Ningbo
industrial clusters namely the Ningbo Die & Mould Cluster, it maybe that the results concluded from the research cannot be used to all industrial clusters in Ningbo.

1.5 Research Questions

With this dissertation, we will try to illuminate the following research questions:

- What is the definition of industrial cluster according to different researchers?
- What are the factors behind the presence of the Ningbo Die & Mould Industrial Cluster?
- Can the emergence of the Ningbo Die & Mould Industrial Cluster be explained by any existing theories of industrial cluster, and if so, which theory is the most appropriate?
- Is it possible to develop a model that is capable of explaining and analyzing the emergence of the Ningbo Die & Mould Industrial Cluster?

1.6 Outline

To conclude this chapter, we here present the outline of the rest of the dissertation. **Chapter 2:** In this chapter, the choice of methodology is discussed. The research philosophy is described. A description about the data collection follows, including both secondary data and primary data. Finally, the criticism of sources is presented.

**Chapter 3:** In this chapter, the theoretical framework is presented. Firstly, we will give a brief introduction about what previous researches in the field of industrial clusters have studied. Secondly, we will review the definition of industrial cluster made by different researchers. Thirdly, we will provide a comprehensive review about the driving factors of industrial clusters from different perspectives by previous researchers. Finally, we will present some existing industrial cluster models mainly Porter’s and evaluate their capability to explain the formation of industrial clusters.

**Chapter 4:** Firstly, a brief overview of industrial clusters in Ningbo will be
introduced, including its current status and categories. Secondly, an introduction to its products, history and development of the Ningbo Die & Mould Industrial Cluster will be made. Finally, the characteristics of the Ningbo Die & Mould Industrial Cluster will be described.

**Chapter 5:** The empirical method will be presented in this chapter. Firstly, the research objective will be described in some detail. Secondly, the research population and sample will be discussed. Thirdly, some relevant issues about questionnaire will be demonstrated. This chapter also contains reliability, validity and generalisability of the dissertation.

**Chapter 6:** In this chapter, the data collected from the survey will be analyzed. Firstly, three statistical methods to analyze the data, including factor analysis, descriptive analysis and correlation analysis will be presented. Secondly, the characteristics of the respondents will be discussed. Finally, three types of analysis results and discussions will be described one by one in some detail.

**Chapter 7:** The conclusions and inferences are presented. Firstly, the summary of the dissertation is presented. Secondly, we conclude the result of the study, and reveal some inferences that we have found from the analysis of the data. Lastly, some further research problems are discussed.
Chapter 2 Methodology

In this chapter, the choice of methodology is discussed. A description about the data collection follows, including both secondary data and primary data.

2.1 Research Philosophy

Generally, there are different ways of thinking about the development of knowledge, namely positivism, interpretivism and realism. Positivism is a research philosophy which works with an observable social reality and produces law-like generalizations. Researchers who adopt a positivistic approach try to be independent, which means that they do not want to affect or be affected by the subject of the research (Saunder, Lewis & Thornhill, 2003). Since the social world of business and management is ever changing, and all organizations in the business world are unique, so the interpretivist argue that the generalisability is not of crucial importance. It is therefore the role of the interpretivist to seek to understand the subject reality of those that they study in order to be able to make sense (Saunder, Lewis & Thornhill, 2003). Meanwhile, a realistic research approach is based on the belief that an objective reality exists which is absolutely independent of human thoughts. Large-scale forces and processes that are external to, or independent of individuals will therefore affect the way in which these people perceive the world, whether they are aware of or not. However, realism therefore shares some philosophical aspects of society (Saunder, Lewis & Thornhill, 2003).

In light of about mentioned research philosophy, our philosophy is a positivistic one. By utilizing the existing theories and models, we tried to examine the driving factors behind the emergence and development of the Ningbo Die & Mould Industrial Cluster, and then we set up our own model. After doing so, we made some hypotheses and conducted a proper research strategy and analyzed the empirical data to try to draw...
some conclusions. Therefore, when we conducted our research we tried to be as neutral as possible and tried to exert little subjective opinions in this research.

### 2.2 Choice of Method

In general, there are two broad research methods, namely the deductive and inductive approaches. The former method starts the research in which we develop a theory and hypotheses, then design a research strategy to the hypotheses; the latter one means that we collect data and develop a theory as a result of our data analysis (Saunders, Lewis and Thornhill, 2003).

A deductive approach is referred to as “testing theory”. It works from the more general to the more specific. Sometimes this one is formally called a “top down” approach. That is to say, we might begin with creating a theory about our topic of interest, and then narrow it down into more specific hypotheses that can be tested. Ultimately this will lead us to be able to testify the hypotheses with specific data which will or will not testify our original theory.

On the contrary, an inductive approach is viewed as a “building theory”. It works the other way, moving from specific observations to broader generalizations and theories. Informally, it is called a “bottom up” approach. In other words, we start with specific observations and measures, begin to detect patterns and regularities, formulate some tentative hypotheses that we can explore, and finally end up developing some general conclusions and theories.

As mentioned previously, the purpose of this dissertation is to clarify the driving factors behind the emergence of Ningbo industrial clusters, and also to test it existing theories of industrial clusters, mainly Porter Diamond Model, can adequately explain the emergence of Ningbo industrial clusters. To this end, we chose to adopt a deductive approach and, therefore, we began the process with a literature review.
especially focusing on Porter theory. With this as a fundamental base we tried to create our own model. After that, the questionnaires as well as, the telephone interviews were conducted to test our model and also to enable us to draw some conclusions.

2.3 Data Collection Methods

There are two significantly different types of data collection: secondary data collection and primary data collection. In our dissertation, we have used both methods.

2.3.1 Secondary Data

Secondary data is the kind of data that has already been collected for some other purpose, normally consisting of documentary data, survey based data and multiple sources (Saunder, lewis and Thornhill, 2003). Our dissertation is based on documentary data as well as some multiple sources.

Secondary data come from written documents such as books, journal and magazine articles, government publications or statistics. Most of the secondary data came from the Kristianstad University library and the Internet, the Ningbo Statistical Bureau, the Ningbo Die & Mould Association, whereas some information was sent to us from our colleagues in Ningbo.

Researches done in the field of industrial clusters are well documented, but due to our time constraint, it is impossible for us to conduct an extensive literature review. We have chosen to present the well known and well supported researches in our dissertation, instead of introducing the whole range of different theories.

When we studied previous researches in the field of industrial clusters, we mainly paid attention to the question why industrial clusters emerge. Since most of the
researches in the field are case studies, particularly in developed countries, each research was reviewed with a focus on the following issues: main objectives and type of research, theoretical framework, methodological approach and crucial findings or conclusions.

In the reviewing process, some of the most recognized researchers about industrial cluster such as Alfred Marshall(1922), G Becattini(1979), Micheal Porter(1990), Rabellotti (1995), Jacobs Deman(1996) and Rosenfeld (1996, 1997) were selected. We especially emphasized on collecting models about existing industrial cluster theories to see if they could be used to explain the emergence of Ningbo industrial clusters. We also analyzed some famous and recognized theories such as the Porter Diamond Model (1990), the Rugman and Cruze Double Diamond Model (1998), the Moon, Rugman and Verbek Generalized Double Model(1998) and the Nine—Factor Model(1994). As described above, most of those theories are based on case studies from different nations or regions. Hence the conclusion could be safely drawn that many of those theories are not fully appropriate to explain the emergence of Ningbo industrial clusters.

2.3.2 Primary Data

Primary data is an original record created at the time when the event occurs. To academic research, it means the information that has to be collected by the researcher for the first time. In our dissertation, the primary data mainly comes from questionnaires and interviews.

The aim of our research is to clarify the different ideas about the driving factors of industrial clusters in Ningbo, and also to test our own model of industrial clusters. In order to match the purpose, we have chosen to examine two target groups. One group represents relevant government departmental officials and the like, including officials of Ningbo Development and Reform Bureau, scholars of Ningbo Macro Economic Research Institute and some association leaders. Some of them have witnessed the
emergence and growth of Ningbo industrial clusters; others are now involved in making policies to promote industrial clusters. It should be pointed out that some scholars from Ningbo Macro Economic Research Institute were very interested in this research and they were also willing to help. Considering our research method, we just conduct a telephone-interview and wish to gain some ideas of our research work in this target group.

Another group consists of managers from Ningbo industrial cluster companies, who should have experienced the clustering process and have deep feeling about the clustering emergence. In this target group, we conduct a questionnaire survey to test our model.

In order to meet different need and also get a high response rate, we conducted a simple random on the population of die & mould enterprises. Also, according to our sample principle, we selected 200 enterprises’ managers as respondents. Our questionnaires were sent to our colleagues in Ningbo Development & Reform Committee via the Internet. Then they loaded down and copied the questionnaires and delivered them to the participants.

**2.4 Criticism of Sources**

As discussed previously, we adopted a deductive approach, so it is necessary for us to begin with a literature review. Since the field of industrial clusters is well documented, there are a lot of existing theories and models. But unfortunately, on the one hand, many of those researches investigate industrial clusters just from their competitiveness perspective, few of them exactly explain the reasons why industrial clusters emerge and develop; on the other hand, a large number of researches are case studies from different nations and regions especially in countries, so those researches just give some specific reasons about the emergence of specific clusters. In general, all those existing theories and models which were presented in the literature review
can not completely applied to explain the emergence of Ningbo die & mould industrial cluster.

When it comes to our research objective, there are more than 2000 enterprises within Ningbo die & mould industrial cluster. But due to statistical restraint, many small enterprises which has its annual sales below 0.5 million RMB are still excluded from our research, because we could not get precise information from Ningbo Statistic Bureau. So we were consciously more critical to information made available to us from Ningbo Statistic Bureau.
Chapter 3 Conceptual Framework

In this chapter, we will give a brief introduction to various studies in the field of industrial cluster, included Porter and some other famous researchers. Based on their theories, we establish a modified model, which we named Ningbo D&M Industrial Clustering Factors Model.

3.1 Introduction

The researches about industrial clusters and the likes can trace back to Alfred Marshall. But it is not until M.E Porter that industrial clusters have become very popular for the economists and policy-makers around the world. The concept of clusters has emerged as a central idea in competitiveness and economic development over the last decade. Drawing upon a long tradition of literature, the reasons for cluster formation and the benefits of clusters for productivity and innovation are becoming well known (Porter, 1998). Although the literature on industrial clusters is wealth and is still increasingly tremendously, most of the literature just focuses on the reasons for the success of such kind of regions and does not deal in general with the question how these spatial structures come into existence. In most of the case studies, this question is presented for the specific situation of the region that is observed. That is to say, those studies to some extent can be described as that all are with very specific explanation for specific emergence and development of a specific cluster.

3.2 The Definition of Industrial Cluster

When it comes to the definition of industrial cluster, there exist a number of cluster definitions, and that makes it difficult to pin down what the term cluster means. Some emphasizes special location, some focuses on special relationships, and others innovation. Just like Martin and Peter Surley state “we know what they (clusters) are called, but defining an industrial cluster exactly what they are is much more difficult”.

18
The very basic definition of an industrial cluster is “geographical concentrations of industries that gain performance advantages through co-location”, presented by Doeringer and Terkla in 1995. This definition highlights the importance of location, while it ignores the interrelations within a cluster.

Micheal Porter work on clusters has proved by far very influential. His cluster theory has become the standard concept in the field, and policy-makers world over have seized upon Porter cluster model as a tool for promoting national, regional and local competitiveness, innovation and growth. Porter defines an industrial cluster as “a geographically proximate group of interconnected companies, specialized suppliers, service providers, firms in related industries and associated institutions in particular field that compete but also co-operate”. He further provides a simple definition of two types of clusters: vertical clusters and horizontal clusters. The former are made up of industries that are linked through buyer-seller relationships, whereas the latter includes industries which might share a common market for the end products, use a common technology or labor force skills, or require similar natural resources (Porter 1990). The Porter definition of an industrial cluster emphasizes both the importance of location and relationships.

Rosenfeld (1997, 107) describes an industrial cluster as “a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue, that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats”. It is obvious that Rosenfeld definition highlights the importance he places on the role of social interaction and firm cooperation in determining the dynamic nature of a cluster.

Jacobs and Deman present more in-depth discussion of the different definition of industrial clusters. Jacobs and Daman argue that “there is not one correct definition of the cluster concept….. Different dimensions are of interest”. They expand from the
definitions of the vertical and horizontal industrial clusters to identify key dimensions that may be used to define clusters. These include the geographic or spatial clustering of economic activity, horizontal and vertical relationships between industrial sectors, use of common technology, the presence of a central actor (large firm, research center) and the quality of firm network, or firm cooperation (Jacobs and Deman, 1996).

According to Jacobs and Deman, there may be different actual definitions of industrial cluster depending on the dimension of research interest. Thus a lot of case studies adopt the Jacobs and Deman’s view on the definition of industrial cluster. For example, the OECD (199, 157) has produced a different working definition, placing great emphasis on the knowledge dimension: clusters are characterized as network of production of strongly interdependent firms, knowledge-producing agents and customers linked to each other in a value-adding production chain.

As evidenced in the literature cited above, we think the Port’s definition of industrial cluster is applicable for our research. As he defined, industrial clusters can be regarded as groups of inter-related industries. They have two key elements. On the one hand, firms in the cluster must be linked through vertical and horizontal or direct and indirect relationships, on the other hand, groups of interlinked firms or associated institutions should be located in the close proximity to one other.

3.3 The Drive Factors of the Emergence of Industrial Clusters

The clustering process is dynamic one, including such stages as emergence, growth, maturation and decline, so industrial clusters develop over time, they are not a phenomenon that just appears or disappears overnight. While the exact driving factors of the evolution of clusters is still the subject of much research, a number of observations stand out from case studies and also conceptual thinking.

This is the case that clustering has intellectual roots dating back to British economist
Alfred Marshall and his writings on industrial districts in the early 1900s, who noted the tendency for specialized companies to concentrated in industrial districts, which result in cost reduction.

Alfred Weber, another influential economist, formulated a least cost theory of industrial location which tries to explain and predict the location pattern of the industry at a macro-scale. It emphasizes that firms seek a site of minimum transport and labor cost. Thus the point for locating an industry that minimizes costs of transportation and labor requires analysis of such three factors as material index, labor and agglomeration and deglomeration (Alfred Weber, 1909). It can be said that both Alfred Marshall and Alfred Weber, to some extent, described the mechanism of clustering process from cost reduction perspective. In Alfred Marshall and Alfred Weber'language, businesses in general locate where it makes the greatest economic sense, either in terms of accessing the market for their product, the labor pool, or required resources.

However it is Micheal Porter (1990) seminal analysis of the competitive advantage of nations, and why some countries produce relatively so many more competitive firms, that brought the concept of industrial clusters to the attention of both analysts and policy-makers. Micheal Porter argues that competition is a driving factor behind cluster development. He described clustering as a dynamic process, and when one competitive firm grows, it can generate demand for other related industries. As the cluster develops, it becomes a mutual reinforcing system where benefits flow backwards and forwards throughout the industries in the cluster. Porter figures out that it is the competition between rival firms in the cluster that drives growth, because it forces firms to be innovative and to improve and create new technology. This, in turn, leads to new business spin-offs, stimulate R & D, and forces the introduction of new skills and services. Since many of the industries within the cluster employ a similar labor force, also the labor force can freely move to other related firms in the cluster, thus transferring knowledge to new firms and continuing to promote
competition and therefore growth. This growth can either lead to increase the vertical integration of the cluster, or it can lead to the horizontal integration of the sectors. Meanwhile in order to describe the clustering process in depth, Porter developed a so-called “Diamond Model”.

Other factors driving cluster development are also discussed in the literature from different perspective. Doeringer and Terkla (1995) view the benefits of agglomeration economies observed in industrial clusters as one factor leading to cluster development. In their language, firms that locate closely to a specific region can benefit from lower transportation and transaction costs, as well as to a skilled labor force. Agglomeration economies can also spur competition, which encourages information, and technology transfer among related firms. The transfer of knowledge and technology can help to drive the overall growth of the cluster.

Face-to-face interaction is also seen as a driving factor in the process of cluster development. (Doeringer and Terkla 1995, Rosenfeld 1997). Particularly, this interaction is most beneficial to small, specialized firms. In the process of interaction, the firms collaborate to provide specialized services, transfer the information and technology and share a common infrastructure. Through this collaboration, it can strengthen the cluster and also promote further growth.

There are also many other case studies which address the driving factors of cluster formation and development. In the case of Third Italy, historical aspects that led to an entrepreneurial spirit, a trustful atmosphere and helpful politics are suggested to be the determinants(cf. Bei Ottati 1994 and Rabellotti 1997). Another example is Route 128 that research funds from the Department of Defense are described as the initial driving factor. (cf. Rosegrant and Lampe 1992). While the research of North Jutland shows that a mixture of a wise creation of new institutions at the Aalborg University, the existence of a change of the market are regarded to be the crucial factors for the
evolution of this cluster(cf. Dalum1995).

In summary, cluster development in general can be attributed to several factors, which includes knowledge and technology transfer, development of a skilled labor force in related industries, the benefits of agglomeration economies, and social infrastructure, in particular it also differs from nation to nation and region to region.

3.4 The Explanatory Value of Relevant Models

There are some existing models in explaining the development of industrial clusters. Among them, Porter Diamond Model prominently stands out. From competitiveness perspective, Micheal Porter promoted the Diamond Model to explain a specific national or regional competitiveness. In our view, this model to some extent also can be applied to explain the emergence and development of industrial clusters. Based on the Porter Diamond Model and trying to introduce some amendment to the Diamond Model, many researchers, from their own standpoints, developed their explanatory models to a nation competitiveness. They also can be viewed as models to explain the emergence and evolution of industrial clusters. In this part, we would evaluate these models particularly the Porter model in some detail.

3.4.1 Porter Diamond Model

Micheal Porter popularized the concept of industrial clusters is his book, the Competitive Advantage of Nations. In Porter language, the specific nation competitiveness results from its industries and its industrial competitiveness comes from the industrial clusters. In order to explain the specific industrial cluster competitiveness, Porter put forth the Diamond Model. It can be figured as the follows: The four corners of the Diamond include factor conditions, demand conditions, industry strategy/rivalry and related and supporting industries.

1. Factor conditions: these include factors of production such as a skilled labor force,
specialized infrastructure, educational institutions that all firms in the cluster can
draw on. Porter states that “to increase productivity, factor inputs must improve in
efficiency, quality and specialization to particular cluster areas”. Such
specialization will contribute to increased productivity. And if specialized factor
conditions are only available at one location, then it is less likely that the same set
of conditions will be available elsewhere. Thus, demand for services and products
from firms in this specific cluster will rise, because no other location provides the
same set of services and products.

2. Demand conditions: The presence of sophisticated and demanding local customers
will force industry cluster firms to continuously innovate and stay on the leading
edge. Cluster firms must cooperate with their customers in order to meet their
needs. Additionally, meeting the demand of sophisticated local customers will
help cluster firms to compete more successfully in global markets.

3. Firm strategy/rivalry: This aspect of the diamond refers to the conditions
governing corporate organization and aspects of rivalry among firms in the same
cluster. If cluster firms choose to continuously upgrade and invest, then they will
remain competitive. In addition, if these firms compete with others in the same
industry cluster, they will be motivated to constantly innovate in order to
differentiate themselves from their rivals. Both firm strategy and rivalry contribute
to regional competitiveness drawing on regional innovation dynamics.

4. Related and supporting industries: The third aspect of the diamond refers to the
presence of capable, locally-based suppliers and of competitive related industries.
These supportive industries create a web of necessary providers on which firms
can draw up. Cooperation between firms and their suppliers creates innovation,
because it is vital to those firms to exchange information and knowledge about
new processes and products.
5. Chance: Usually referred to such big reform and breakthrough as general invention, technology, war and foreign marketing needs, “Chance condition is crucial to the industrial competitive advantage.

6. Government: The ability of governments can influence the competitiveness of industrial clusters through different means such as regulations, tax-cuts and so on. In Porter view, the competitive diamond is the driving force making for cluster development, and simultaneously the cluster is the spatial manifestation of the competitive diamond. Porter also argues that the more developed and intense the interactions between these four sets of factors, the greater will be the productivity of the firms concerned.

With the popularity of the Porter diamond theory, bulks of criticism emerged from the different perspective. Such as Penttinen (1994), he generalized the different criticism from different eight aspects as the follows:
Figure 3-1: Porter Diamond Model

1. It is not necessarily that the region which has a competitive advantage on the factor conditions, has a competitive clusters, there exist many “lonely star”.
2. Diamond model do not consider foreign direct investment and transnational corporation.
3. The theory is perhaps only suitable for resource-based industrial economy.
4. In the model, more emphasis should be placed on the cultural and historical differences between the different countries.
5. As a whole, the model may be invalid, Porter’s view too imprecise, and the only theoretical significance; he only packaged the old theory to a new one and a little bit theoretical innovation.
6. It is unclear on the effect of the micro variables in his model.
7. It is unclear that the model is a dynamic or static.
8. The study itself may not be strictly managed.
Indeed, although Porter is celebrated economist and his theory is a grand one. He just gives us some general ideas and theoretical framework about industrial clusters, since his thoughts about industrial clusters results the research of ten developed countries. Due to its drawbacks described previously, Porter Diamond Model actually cannot completely applied to explain the emergence of industrial clusters everywhere. Based on our empirical experience, we have a strong feeling that some other factors underpinned the Ningbo successful industrial clusters and we also can make some modification to the diamond model.

3.4.2 Other Models and Their Explanatory Values

As mentioned earlier, there are some debates about Porter Diamond Model. It is persuasive for the Diamond Model to explain the advanced countries competitiveness, because such developed countries as America, Japan, German and Great Britain themselves have characterized as a good domestic economic environment. In other worlds, their domestic firms can establish competitive advantages depending on their home base. But to small country economy especially developing countries, they do not necessarily obtain their domestic economic environment equivalent to the diamond model, some of them lack enough large market, others lack capital and technology conditions. How can they create competitive advantages? Apparently, Porter diamond model do not give a reasonable answer.

From the start of the diamond model, some researchers further expand the diamond model. Rugman and Cruz (1998) argues that only home country diamond cannot explain and analyze the competitive sources of Canadian firms, because of the America-Canada Free Trade Agreement, multinational activity between two countries are increasing. It is necessary to apply multinational activity to explain the Canadian firms’ competitiveness. Based on this point, Rugman and Cruz developed double diamond model, which is a combination of American diamond and Canadian diamond:
Because Rugman and Cruz double diamond model was established focusing on the analysis of Canadian economy, it cannot be applied to analyze other small country economy particularly outside the Northern American Free Trade Zone. Given the limitation, Moon, Rugman and Verbeke (1995) further expanded from the Double Diamond model to the Generalized Double Diamond Model, which is appropriate to all small country economy:
In this model, the diamond consists of domestic diamond, international diamond and global diamond. The inner line represents the domestic diamond; the outside line refers to the global diamond, the line between them stands for the international diamond, which means multinational activity.

Another new model, the Nine-Factor Model, was introduced by South Korea scholar Cho, D.Sung (1994). Based on the South Korea experience, Cho, D.Sung argues that the determinants of competitiveness can be grouped into two divisions: 1. material factors, including resource endowment, commercial environment, related and supporting industries and domestic demand. 2. Human force factors, these consist of labor force, politicians and bureaucrats, entrepreneurs and professional managers, which all create, inspire and control other four material factors and improve the competitiveness. This model can be illustrated as the follows: (Figure 4)

**Figure 3-4: Nine-Factor Model**

[Diagram of Nine-Factor Model]

Generally speaking, a model is theorized on specific real economy. It is impossible to
create a theoretical model that can be universally applied. Just briefly described above, although Rugman, Moon and Cho expanded the diamond model, their theoretical models are based on the specific economic background, thus these models inevitably have their own limitations. Meanwhile we also should recognize their research significance, particularly under the circumstance of globalization and economic integration. To our research, these models really give us some clues to considering the driving factors of the Ningbo Die & Mould Cluster.

3.5 Our hypotheses and a modified model

Based on the upped theories we will discuss our opinion of Ningbo Die & Mould industrial clustering factors as follow, and we will set up a model, we also will table a hypotheses.

3.5.1 The factors of Ningbo mould manufacture cluster

Just as the upper study mentioned that the four referenced models are all relative to the industrial cluster development, although they emphasize particularly on different orientation (See Figure 3-5).
For us, we choose Porter Diamond Model and the Nine Factors Model as our foundation model, the two Double Diamond Models as accessorial, and then draw out a modified model. Our hypotheses are also based on the four different theories (See Table 3-1). We merge, classify and select those variables into 29 hypotheses, finally placed them into a hierarchy (See Table 3-2), according the importance of the factors to the Ningbo Die & Mould Cluster, by using a deductive way.
<table>
<thead>
<tr>
<th>Model</th>
<th>Factor Condition</th>
<th>Variables</th>
<th>Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Porter Diamond Model</strong></td>
<td>Factor Condition</td>
<td>Human Resource</td>
<td>H1, H2, H12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge Resource</td>
<td>H11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Capital</td>
<td>H10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Resource</td>
<td>H3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infrastructure</td>
<td>H4, H5, H6, H7, H8, H9</td>
</tr>
<tr>
<td></td>
<td>Supporting Industries</td>
<td>Suppliers and Buyers</td>
<td>H13, H14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Related Industries</td>
<td>H15</td>
</tr>
<tr>
<td></td>
<td>Demand Conditions</td>
<td>Domestic Demand and the form of Growth</td>
<td>H22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internationalization of Demand</td>
<td>H23</td>
</tr>
<tr>
<td></td>
<td>Firm Strategy, Structure and Rivalry</td>
<td>Strategy and Structure</td>
<td>H16, H17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goals</td>
<td>H19, H20, H21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Personal Goals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Competition among Domestic</td>
<td>H18</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td></td>
<td>H24, H25, H26</td>
</tr>
<tr>
<td><strong>Nine Factors Model</strong></td>
<td>Business Context</td>
<td></td>
<td>H12, H14, H15</td>
</tr>
<tr>
<td></td>
<td>Endowed Resources</td>
<td></td>
<td>H3, H28</td>
</tr>
<tr>
<td></td>
<td>R&amp;S Industries</td>
<td></td>
<td>H11</td>
</tr>
<tr>
<td></td>
<td>Demand Conditions</td>
<td></td>
<td>H22, H23</td>
</tr>
<tr>
<td></td>
<td>Politicians &amp; Bureaucrats</td>
<td></td>
<td>H24, H25</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurs</td>
<td></td>
<td>H29</td>
</tr>
<tr>
<td></td>
<td>Workers</td>
<td></td>
<td>H1</td>
</tr>
<tr>
<td></td>
<td>Professionals</td>
<td></td>
<td>H2</td>
</tr>
<tr>
<td><strong>Double Model</strong></td>
<td>International Factors</td>
<td></td>
<td>H23, H27</td>
</tr>
<tr>
<td><strong>Generalize Double Model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
We set our hypotheses as followed:

H1. The Ningbo Die & Mould Cluster has positively been influenced by the abound of skilled worker;

H2. The Ningbo Die & Mould Cluster has positively been influenced by the abound of talent resource;

H3. The Ningbo Die & Mould Cluster has positively been influenced by the geographic location advantage;

H4. The Ningbo Die & Mould Cluster has positively been influenced by the advantage of transportation infrastructure;

H5. The Ningbo Die & Mould Cluster has positively been influenced by the advantage of communication infrastructure;

H6. The Ningbo Die & Mould Cluster has positively been influenced by the advantage of market infrastructure;

H7. The Ningbo Die & Mould Cluster has positively been influenced by the help of trade association;

H8. The Ningbo Die & Mould Cluster has positively been influenced by the business environment;

H9. The Ningbo Die & Mould Cluster has positively been influenced by the Perfection of related laws/rules;

H10. The Ningbo Die & Mould Cluster has positively been influenced by the local financial support;

H11. The Ningbo Die & Mould Cluster has positively been influenced by the R&D institution support;

H12. The Ningbo Die & Mould Cluster has positively been influenced by the vocational training;

H13. The Ningbo Die & Mould Cluster has positively been influenced by the raw material availability;

H14. The Ningbo Die & Mould Cluster has positively been influenced by the service of suppliers;

H15. The Ningbo Die & Mould Cluster has positively been influenced by the support
of related industries;

H16. The Ningbo Die & Mould Cluster has positively been influenced by the motivation from the rivals;

H17. The Ningbo Die & Mould Cluster has positively been influenced by the managerial skill;

H18. The Ningbo Die & Mould Cluster has positively been influenced by the clarity of property right;

H19. The Ningbo Die & Mould Cluster has positively been influenced by the support of brand names;

H20. The Ningbo Die & Mould Cluster has positively been influenced by the product quality;

H21. The Ningbo Die & Mould Cluster has positively been influenced by the technical invest;

H22. The Ningbo Die & Mould Cluster has positively been influenced by the domestic market support;

H23. The Ningbo Die & Mould Cluster has positively been influenced by the foreign market support;

H24. The Ningbo Die & Mould Cluster has positively been influenced by the central government support;

H25. The Ningbo Die & Mould Cluster has positively been influenced by the local government support;

H26. The Ningbo Die & Mould Cluster has positively been influenced by The Chinese National Economic Policy Reform since 1978;

H27. The Ningbo Die & Mould Cluster has positively been influenced by the technic transfer from developed countries;

H28. The Ningbo Die & Mould Cluster has positively been influenced by the traditional business culture;

H29. The Ningbo Die & Mould Cluster has positively been influenced by the soul of entrepreneur.
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Variables</th>
<th>Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Skilled Workers</td>
<td>Internal Factors</td>
</tr>
<tr>
<td>H2</td>
<td>Talent Resource</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td>Geographic Location</td>
<td></td>
</tr>
<tr>
<td>H4</td>
<td>Transportation</td>
<td></td>
</tr>
<tr>
<td>H5</td>
<td>Communication</td>
<td></td>
</tr>
<tr>
<td>H6</td>
<td>Market Infrastructure</td>
<td></td>
</tr>
<tr>
<td>H7</td>
<td>Trade Association</td>
<td></td>
</tr>
<tr>
<td>H8</td>
<td>Business Environment</td>
<td></td>
</tr>
<tr>
<td>H9</td>
<td>Related Laws/Rules</td>
<td></td>
</tr>
<tr>
<td>H10</td>
<td>Local Financial Support</td>
<td></td>
</tr>
<tr>
<td>H11</td>
<td>R&amp;D Institution Support</td>
<td></td>
</tr>
<tr>
<td>H12</td>
<td>Vocational Training</td>
<td></td>
</tr>
<tr>
<td>H13</td>
<td>Raw material availability</td>
<td>External Factors</td>
</tr>
<tr>
<td>H14</td>
<td>Service of Suppliers</td>
<td></td>
</tr>
<tr>
<td>H15</td>
<td>Related Industries</td>
<td></td>
</tr>
<tr>
<td>H16</td>
<td>Rivals</td>
<td></td>
</tr>
<tr>
<td>H17</td>
<td>Managerial Skill</td>
<td></td>
</tr>
<tr>
<td>H18</td>
<td>Clarity of Property Rights</td>
<td></td>
</tr>
<tr>
<td>H19</td>
<td>Support of Brand Names</td>
<td></td>
</tr>
<tr>
<td>H20</td>
<td>Product Quality</td>
<td></td>
</tr>
<tr>
<td>H21</td>
<td>Technical Investments</td>
<td></td>
</tr>
<tr>
<td>H22</td>
<td>Domestic Market Support</td>
<td>Demand</td>
</tr>
<tr>
<td>H23</td>
<td>Foreign Market Support</td>
<td></td>
</tr>
<tr>
<td>H24</td>
<td>Central Government Support</td>
<td></td>
</tr>
<tr>
<td>H25</td>
<td>Local Government Support</td>
<td></td>
</tr>
<tr>
<td>H27</td>
<td>The Technic Transfer From Developed Countries</td>
<td></td>
</tr>
<tr>
<td>H28</td>
<td>Traditional Business Culture</td>
<td></td>
</tr>
<tr>
<td>H29</td>
<td>Soul of Entrepreneur</td>
<td></td>
</tr>
</tbody>
</table>

Table 3-2: The Hierarchy Classify of the Hypotheses
3.5.2 Our model

We named our model as “Ningbo Die & Mould Industrial Clustering Factors Model”. In this model, we absorbed the distillate from both Porter’s diamond model and other researcher’s model. We take the factors Porter mentioned as general factor, the factors other researcher mentioned as accessorial, and then got our modified model (See Figure 3-6).

Our model has contained the 29 factors which we deducted from the four former famous researcher’s theories, and all these factors seemed had influenced the development of the Ningbo D&M Cluster. From then on, we will devoted our energy into evaluate the factors, testify the correlation between the given factors and the development of our research object---Ningbo D&M Cluster.
Figure 3-6: A Framework of Ningbo Die & Mould Industrial Clustering Factors Model

- Internal Factors
  - Skilled Worker
  - Talent Resource
  - Geographic Location
  - Transportation
  - Communication
  - Market Infrastructure
  - Trade Association
  - Business Environment
  - Related Laws/Rules
  - Local Financial Support
  - R&D Institution Support
  - Vocational Training
  - Raw Material Availability
  - Service of Suppliers
  - Related Industries
  - Rivals
  - Managerial Skill
  - Clarity of Property Rights
  - Support of Brand Names
  - Product Quality
  - Technical Investments
  - Domestic Market Support
  - Foreign Market Support
  - Central Government Support
  - Local Government Support
  - The Technic Transfer From Developed Countries
  - Traditional Business Culture
  - Soul of Entrepreneur

- External Factors
  - Government
  - Market Demand
  - Additional Factors

- Ningbo-Die & Mould Clustering Factors Model
Chapter 4 An Introduction of the Ningbo D & M Cluster

In this chapter, firstly a brief overview of industrial clusters in Ningbo will be introduced, including its current status and categories. Secondly an introduction to its products, history and development of the Ningbo Die & Mould Industrial Cluster will be made. Finally the characteristics of the Ningbo Die & Mould Industrial Cluster will be described.

4.1 Current Status

As one of the most obviously observable economic phenomena, industrial clusters have raised the attention of economists and government officers in China lately. After more than 30-year’s development, 145 industrial clusters have formed in Ningbo, of which 6 clusters have individual annual revenues over RMB 1 billion, more than 10 clusters generate annual revenues of over RMB 500 million separately, and more than 90 clusters of over RMB 100 million. The number of clusters in Ningbo accounts for 27.93% of total industrial clusters in Zhejiang Province. The industrial clusters play a critical role in transforming the economic structure of Ningbo, changing the way of economic growth and promoting the creativity of Ningbo’s enterprises. Ningbo’s industrial clusters have established their competitive advantage in China. These relatively successful clusters are basically endogenous ones (see table 4-1), typical of which are clusters of industrial garment, die & mould, stationery, plastics machinery, household appliances, a.k.a. the traditional industrial clusters of Ningbo. Recently, National authorities have named Ningbo, the City of Garment Brands in PRC, the City of Die & Mould in PRC, the City of Stationery in PRC and the Base of Household Appliances of PRC. The followings are simple descriptions of some typical endogenous clusters.

4.2 Categories of the Industrial Clusters in Ningbo

The formation and development of clusters are very complicated. Therefore, no
unified model can be applied. The industrial clusters in Ningbo have many unique factors, both in the causes of formation and in their characteristics. Industrial clusters can be categorized into two types: the endogenous and the exogenous (UNCTAD, 1998). The two categories are formed according to the driving factors behind the formation, and industrial clusters in Ningbo are of two types: endogenous and exogenous.

The first are the endogenous clusters. They were formed by local entrepreneurs based on the local industrial and commercial traditions and the industrial foundations in the rural areas and small towns. They were mostly set up in the early stage of the Reform in the form of medium and small-scale enterprise clusters. After two-decade’s development and competition, only the clusters with unique competitive advantages have survived, playing an important role in promoting the local economic development and employment. These clusters concentrate on labour intensive industrial which are fully competitive, and produce mid-range and low-end products of various kinds, such as clothing, textile, die & moulds, stationery, hardware, machinery, household appliances, etc. To sum up, these clusters are in fully competitive, labour-intensive industries, mainly producing middle and low-end products, such as the garment industrial cluster, die & mould industrial cluster, stationery industrial cluster, plastics machinery industrial cluster, household appliances industrial cluster, automotive parts industrial cluster, and electronic information in Ningbo.

The second is the exogenous category, which can also be divided into two groups. One group is strategy-oriented. Incentive policies and measures have been launched based on the strategies and scales of these clusters to attract investments to set up relevant enterprises, or to directly move in some target enterprises so that industrial clusters could come into being more quickly. Another group is to expand the industry chains and develop supportive industries so as to cluster similar industrial enterprises.
Examples include the petrochemical industry cluster in Ningbo, and the photo-electricity industry cluster in the Bonded Zone. In the actual process, the two forms of exogenous clusters are often interwoven. To sum up, exogenous clusters are formed with external forces, and they are formed later than endogenous clusters; exogenous clusters have stronger intentions in the course of formation. In order to stimulate the local economy and improve the local employment, the local government has set up several industrial zones using favorable treatments in assignment of land and taxation in recent years. Nowadays, these exogenous clusters are in the process of formation and improvement.

Table 4-1: Types of Industrial Clusters in Ningbo

<table>
<thead>
<tr>
<th>Driving forces</th>
<th>Internal forces</th>
<th>External forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>The endogenous clusters</td>
<td>The exogenous clusters</td>
</tr>
<tr>
<td>Driving entities</td>
<td>Local entrepreneur</td>
<td>Foreign, HK and Taiwan entrepreneurs</td>
</tr>
<tr>
<td>Start-up funds</td>
<td>Raised in Ningbo</td>
<td>Foreign investments</td>
</tr>
<tr>
<td>Technology</td>
<td>Urban state-owned enterprises</td>
<td>International enterprises</td>
</tr>
<tr>
<td>Industry types</td>
<td>Labour-intensive</td>
<td>Labour-intensive Capital intensive</td>
</tr>
<tr>
<td>Samples</td>
<td>Garment, die &amp; mould, stationery clusters in Ningbo</td>
<td>Photo-electricity cluster in the Ningbo Bonded Zone</td>
</tr>
</tbody>
</table>

4.3 The Development of the Die & Mould Industry

4.3.1 An Introduction of Die & Mould Products and Markets

Die & mould products are fundamental to industrial productions. Technological developments in Die Equipments have become an important indicator of how well a nation’s industry has developed. According to statistics, in industries such as
machinery, automobile, electronic, chemistry and construction, 75% of all the raw parts, 50% of all the finish machining, 80% of all parts in electronic industry, and more than 70% of the parts in mechano-electronic industries rely on die equipments. In construction materials, plastics, pottery and porcelain, most of the products rely on die equipments. Thus, die & mould products have been called “mother of industrial”. According to Chinese National Standards, die & mould products can be divided into 10 large categories and 64 small categories (see table 4-2).

Table 4-2 Types of Mould and Breakdown of Different Die & Mould Equipments

<table>
<thead>
<tr>
<th>Mould Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Punching die</strong></td>
<td>Ordinary die cut mould, cut &amp; carry die, compound die, precision die, stretch die, bending die, shaping die, cutting die, and punching die.</td>
</tr>
<tr>
<td><strong>Plastic mould</strong></td>
<td>Thermoplastic injection mould, thermo-set plastic injection mould, thermo-set plastic compact mould, plastic extrusion mould, plastic blow moulding, vacuum adsorption mould, other plastic mould.</td>
</tr>
<tr>
<td><strong>Forged mould</strong></td>
<td>Pressure forged mould, cold forged mould, metal extrusion and compact mould, cutting mould, other forged mould</td>
</tr>
<tr>
<td><strong>Casting mould</strong></td>
<td>Pressure casting mould, low pressure casting mould, olefin casting mould, sand casting metal mould.</td>
</tr>
<tr>
<td><strong>Powder Metallurgy mould</strong></td>
<td>Metal powder metallurgy mould, non-metal powder metallurgy mould</td>
</tr>
<tr>
<td><strong>Rubber mould</strong></td>
<td>Rubber injection shaping mould, rubber compact shaping mould, rubber extrusion shaping mould, rubber casting mould, rubber sealing shaping mould, other rubber mould</td>
</tr>
<tr>
<td><strong>Draw mould</strong></td>
<td>Hot draw mould, cold draw mould.</td>
</tr>
<tr>
<td><strong>Non-organic shaping mould</strong></td>
<td>Glass shaping mould, ceramic shaping mould, concrete shaping mould, other non-organic material shaping mould</td>
</tr>
<tr>
<td><strong>Standard mould parts</strong></td>
<td>Cold die carrier, plastic mould carrier, mandril</td>
</tr>
<tr>
<td><strong>Other mould</strong></td>
<td>Foodstuff shaping mould, package material mould, compound material mould, compound fiber mould, other mould not included in this list.</td>
</tr>
</tbody>
</table>

Table 4-3: Application Fields of Products

<p>| Automotive Industry | Mainly demand medium/large size plating shaping die and injection mould, hot compound for interior |</p>
<table>
<thead>
<tr>
<th>Industry</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IT, communication, electronic Industries</strong></td>
<td>Mainly demand plastic injection shaping mould, foam moulds, plastic adsorption mould, plate shaping die and etc.</td>
</tr>
<tr>
<td><strong>Household electrical appliances</strong></td>
<td>Mainly demand plastic injection shaping mould, foam mould, plastic adsorption mould, plate shaping die and etc.</td>
</tr>
<tr>
<td><strong>Electrical and machinery products</strong></td>
<td>Mainly demand medium/small size precision cut &amp; carry die, thermo-set precision plastic mould, die casting mould, precision forged mould, cold extrusion and upsetting mould, draw mould and etc.</td>
</tr>
<tr>
<td><strong>Aviation appliance, rail way vehicle, ships – Mould for engine devices</strong></td>
<td>Mainly demand thermal forged mould, metal mould for casting business</td>
</tr>
<tr>
<td><strong>Building material, furniture production</strong></td>
<td>Mainly demand metal and plastic extrusion mould, injection mould for plastic pipe and connector, ceramic mould (like brick mould), glass plate and etc.</td>
</tr>
</tbody>
</table>

The major die & mould products are plastic dies, casting dies, pressure dies and rubber dies, of which plastic dies and casting dies are more commonplace. These products serve automobile industry, home electronics industry, communications industry and tools industry. Of these industries that the die industry servers, auto parts and home electronics are two major industries.

According to an estimate made by International Special Tools Association (ISTA) and Federation of Asia Dies and Moulds Association (FADMA), major countries and/or regions that produce die equipments include Japan, USA, Germany, France, Korea and Taiwan. Those that exhibit great potential include Singapore, Malaysia, Portugal and China. In Italy, Swiss and Hong Kong, die equipment industry have well developed, Thailand, Indonesia and India are still developing.

**4.3.2 A History of The Die & Mould Industry in Ningbo**

The Ningbo die & mould industry started in the 1960s. It developed hand in hand with
the local plastic industrial and hardware industrial. Because the die products required at the time were relatively small in size, mould was normally conducted in a workshop inside a factory. Typically, such products were done by an experienced worker with several of his apprentices. The process was manual or semi-mechanic and the quality of the products were low.

The development of industrial, particularly the development of plastic industrial, home electronics and hardware, required higher standards in the die industry. In the late 80s, with more support coming from the central government, Ningbo saw a fast development in the die industry.

4.3.3 The Current State of the Ningbo Die & Mould Industry

With nearly 40 years’ development, Ningbo die & mould industry saw significant expansion. In the new century, average increase reached from 15% to 20%, far above the national average. Right now there are 2012 die enterprises with annual sale beyond RMB 500 thousand in Ningbo, covering all major models. Ningbo has become an important industrial base in China’s die & mould industry.

4.3.3.1 Number of Enterprises and Their Distribution

In 2001, Ningbo had only 385 die & mould manufacturers with annul sale beyond RMB 500 thousand. By the end of year 2005, the number increased to 2012. The number of large-scale enterprises (the annual sales beyond RMB 5 million) increased from 23 in year 2001 to 103 at the end of 2005.

Figure 4-1 The Development of the Die & Mould Industry
4.3.3.2 The Sale Increase

From year 2001 to the end of 2005, the total sales of the large-scale die & mould manufacturers in Ningbo are from RMB 262 million to RMB 1.927 billion.
4.3.3.3 Asset Increase

From 2001 to the end of 2005, total asset values of larger die & mould manufacturers in Ningbo are from RMB 317 million to RMB 2.43 billion. See diagram below (Figure 4-4).

Figure 4-4 The Total Assets of Large-Scale Firms
(Expressed in RMB 100 Million)

4.3.3.4 Profits Increase

From 2001 to the end of 2005, total profits of all large-scale die & mould
manufacturers are from RMB 34.51 million to RMB 248 million. See diagram below (Figure 4-5).

**Figure 4-5 The Total Profits of Large-Scale Firms (Expressed in RMB 10 Thousand)**

![Bar chart showing total profits of large-scale firms from 2001 to 2005.](image)

**Source:** The Ningbo Die & Mould Association

4.3.3.5 Employees Increase

With the continuing development of the die & mould industry, more workers have joined it. From year 2001 to 2005, total production force has increased from 2299 to 13535, boasting an increase rate of 296.6%. This clearly indicates that the die industry has become a very important industry in Ningbo. See diagram below (figure 4-6).

**Figure 4-6 The Total Employees of the Large-Scale Firms**
4.3.3.6 Exports Increase

From year 2001 to 2005, total exports of large-scale die & mould manufacturers are from RMB 43.73 million to RMB 227.95 million, see diagram below (Figure 4-7).

**Figure 4-7 The Total Export Value of Large-Scale Firms**

4.4 Characteristics of the Ningbo Die & Mould Industrial Cluster

As mentioned above, today, a die & mould industrial cluster of large amount enterprises based on a horizontal and vertical level production has been formed in
Ningbo. In the horizontal level, the main features are the competitions in the different aspects, such as the price, the quality, the service after sale, absorbing the talents and R&D so on. In the vertical level, the main features are the cooperation in the different aspects. However, whether in the horizontal level or the vertical level, the connections among them are very complicated. To some extent, they are overlapped. Due to the furious competition and good cooperation, the whole clusters have developed rapidly and become the most famous industrial bases of the product in the domestic or international market. A cluster of independent yet interrelated small enterprises have formed a complementary and cooperative system based on specialization. In a cluster environment, the technology proliferation and R&D initiatives in the Ningbo die & mould industry are greatly enhanced by the effects of geographical proximity, industry linkage and social recognition. In addition, in a cluster environment, fierce competition faced by medium and small-scale enterprises impels them to learn from each other. Due to geographical proximity, knowledge recipient is close to knowledge source, which facilitates the knowledge acquisition. Close collaboration within a vertical specialization system enables enterprises to have the benefit of knowledge sharing, through formal or informal interchange and cooperation, in respect of identifying and assessing changes in market demand, seeking new sales channels and implementing new technology, which further promotes the spread of technology. The cluster has attracted more auxiliary companies, investors, services companies, suppliers and professionals, which enables enterprises to access more resources, business partners and professionals. Through jointly seeking for services providers and suppliers, enterprises have effectively lowered their costs and promoted the spread of advanced concepts, methodology and technology.

4.4.1 Geographical Proximity

The Ningbo Die & Mould Industry has become an industry cluster of strong competitiveness. With private capital as the primary source of investment and with the support of technologies available in the area, six important clusters with distinct characteristics have been formed around Beilun, Xiangshang, Ninghai, Yuyao Cixi
and Yingzhou. These enterprises are highly aggregated geographically and highly complementary to each other in terms of technology and production. The abundant local labor resources have been fully utilized and a complete structure of related and auxiliary industries has been formed, and strong regional competitiveness has been achieved. The business ownership has transformed from family workshops engaging in the production of auxiliary products for import and exports companies to modern corporations and group companies with large-scale production capacities.

4.4.2 Strong Competitiveness

The Ningbo Die & Mould Cluster is a typical endogenous cluster and has a strong representative in the whole Ningbo endogenous industrial clusters. After 30 years of rapid development, the die & mould industry in Ningbo has been improved greatly in the overall scale, technology, production equipment, and management. From 2001 to 2005, the number of large-scale die & mould enterprises (with die & mould as their main business) increased from 23 to 103; the overall capital raised to RMB 2.43 billion from RMB 317 million, with an average annual growth rate of 66.39%, or 37.47% if the factor of incremental number of large-scale die & mould manufacturers was deducted; the sales revenues increased to RMB 1.927 billion from RMB 262 million, with an average annual growth rate of 64.68%, or 35.60% if the factor of incremental number of large-scale mould manufacturers was deducted; the total profits increased from RMB 35 million to RMB 248 million, with an average annual growth rate of 63.15%, or 25.19% if the factor of incremental number of large-scale die & mould manufacturers was deducted. According to investigations and statistics provided by The Die & Mould Associations and government authorities, by the end of 2005, there were 2,012 enterprises engaged in the die & mould, including non-large scale enterprises and those whose main business was not die & mould, with employees over 160,000 and gross values of output of RMB 16.1 billion. Relevant authorities also have named Ninghai as the Production Base of Die & mould of PRC, Yuyao as the Production Base of Die & Mould for Light Industry of PRC, and Beilun as the County of Die & Mould of PRC. In 2005, Ningbo was named as the City of Die
& mould of PRC. At present, Ningbo has several die & mould production bases, such as Ninghai Die & mould Centre, Yuyao Die & mould Centre, Cixi Die & mould Technology Zone, the Die & mould Park of Beilun Development Zone, the Die & mould Park of Jiangbei Entrepreneur Zone, Haishu Die & mould Market, East Zhejiang Province Die & mould Market.

4.4.3 Professional Producing

With the development, professionalism has become a major goal for all the enterprises in Ningbo’s die industry. In larger enterprises in Beilun, Yuyao, professional design companies, modeling center, special parts industrial companies, material companies, standard parts companies, surface heat processing companies and laser fusion center have all worked together to ensure higher qualities. In this way, the local industry has become very efficient, significantly reduced the production cycle, reduced cost and increased the collective power in international and national markets.

In areas such as Yuyao, Ninghai, etc. “The Die City” has become known as the all-in-one place for die related shopping place. The goal of constructing such a marketplace is to allow a more efficient integration of designing, technological training, information services, material transaction. In the mean time, with the investments from foreign countries, “The Die City” has become an unique industry garden for learning from more advanced technologies and organizational experiences.

4.4.4 Technology Improvement

In recent years, many enterprises have improved their equipments. Such an improvement has greatly increased the productivity. Many enterprises also utilized CAD/CAM technologies. Some used CAE to do flow passage analysis, heat field analysis. The design and industrial process are basically paperless. In the industrial side, digital controls imported from Japan, USA and Italy have become a major technology for Ningbo’s die industry. The industrial technology continued to increase, in some areas they have become the best in the nation. In the China’s Tenth Die
Technology and Equipment Expo held in Shanghai, experts surveyed such technology improvements and concluded that 58 items are among the best internationally, 61 items are among the best in China. In the 58 items that are among the best internationally, 9 come from Ningbo. In the 61 items that are among the best in China, 8 come from Ningbo.

4.4.5 The Ningbo Die & Mould Association

With increase of number of die manufacturers, in year 1998, The Ningbo Die & Mould Association was established. This organization serves as a bridge between the government and private enterprises. In year 2001, the information network [www.blmoju.org.cn](http://www.blmoju.org.cn) was also set up. This network has played an important role in activities such as information distribution, technology exchange, and electronic business.

Besides, the Die & Mould Association has helped a lot of enterprises in participating in both domestic and international activities. Up till today, the Die & Mould Association has organized almost 1000 people to go to different parts in the world to learn from more developed countries such as USA and Japan. In the same time, about 1000 domestic and international experts have come to visit Ningbo. In the six years since it was established, The Die & Mould Association held many CAD/CAM application meeting. These have brought much information to help the local die manufacturers while at the same time make Ningbo more known to the rest of the world.

Chapter 5 The Empirical Study
In this chapter the empirical method will be presented. Firstly the research objective will be described in some detail. Secondly the research population and sample will be discussed. Thirdly some relevant issues about questionnaire will be demonstrated. Finally this chapter also contains the validity, reliability and generalisability of the dissertation.

5.1 Research Objective

The object for the empirical test of our 29 hypotheses is managers in the Ningbo Die & Mould Cluster, which is comprised of a large number of geographically proximate enterprises. Hence, our research sample is all enterprises within the Ningbo Die & Mould Cluster, then we choose the managers of the sample enterprises as questionnaires respondents. Ningbo Die & Mould Cluster consists of 2012 small or large enterprises. In terms of sales scale, based on the statistics of the Ningbo Municipal Statistical Bureau, there are 103 enterprises with annual sales beyond RMB 5 million. There are also 1909 enterprises with annual sales lower than 5 million RMB. Among them, the largest enterprise had a 63 million RMB in annual sales, whereas the smallest one only had 0.5 million RMB in annual sales in 2005. Due to limited statistical data, in our research we did not take enterprises with annual sales lower than 0.5 million into account.

Figure 5-1 The Distribution of Annual Sales
In terms of its location, Ningbo die & mould enterprises are concentrated in six main districts such as BeiLun, YuYao, CIQi, XiangShan and Yingzhou which are belong to Ningbo municipality. The quantity of the six main districts account for about 87% proportion of the population.

**Figure 5-2 The Distribution of Districts in 2005**

According to their ownership character, these enterprises within the Ningbo Die &
Mould Cluster can be divided into private, collective, foreign and other kinds of enterprises. Based on the statistics of the Ningbo Municipal Statistical Bureau, in the whole cluster, the proportion of private enterprises is 84.45%, an absolutely prominent role. 5.08% are foreign enterprises, 4.26% are collective enterprises and 6.21% are other kinds of enterprises.

Figure 5-3 The Distribution of Ownership Types in 2005

Source: The Ningbo Municipal Statistical Bureau

Regarding their existing time, 12.2 percent of all enterprises have existed between 0-4 years, 59.2% have existed between 4-8 years, 7.8% have existed between 8-12 years, 18.2% have existed between 12-16 years and only 2.6% have existed more than 16 years.

Figure 5-4 The Distribution of Existing Time
5.2 Population and Sample

Our research strategy is deductive by nature. The purpose of this research is to analyze the driving factors behind the emergence of the Ningbo Die & Mould Cluster. Considering the limitations of time and relevant materials, we adopted a survey method, which is based on an established model and divided hypothetical factors into relevant questions. These questions should be presented in the questionnaire, and then we choose the managers in the enterprises as our respondents. Whereas, the managers of an enterprise can be divided into different position. In our questionnaire, we gave the four alternatives, the president, the general manager, the duty general manager and other managers. Of course, we hoped that the super managers could fill out the questionnaire. At last, we got the results based on independent judgment of the respondents to analyze. According to Pearson’s correlation analysis theory, we chose the relationship between a specific enterprise’s annual sales, existing time and a specific factor as a basis to analyze its correlation. There will be three results, positive correlation, negative correlation and no-correlation. And we will analyze the collected data in the next chapter.

Because of the lack of some enterprises’ information, there are some limitations in our survey. Our survey was just covered the companies with an annual sale of more than
0.5 million., to some extent, it could influence research result.

5.2.1 The Sample

Considering a large number of research objectives in the whole cluster, it is impossible to survey an entire population. However, it is important select a sample of the total 2012 enterprises. It is also important to choose the correct kind of sampling technique. In general, sampling techniques available can be divided into two types: one is probability or representative sampling; the other is no-probability or judgmental sampling. Moreover, the each type of technique can be divided into different techniques based on the research questions and research objectives.

5.2.2 The Sample Method

Considering our research questions and research objectives, we have used probability sampling. Probability sampling is the most common tool associated with survey-based research. Because all the 2012 enterprises have registered in the Ningbo Municipal Statistic Bureau, it is suitable for us to assume a simple random sampling. With the help of the friends of the Ningbo Municipal Statistical Bureau, we got the samples of the survey. In terms of our sampling principle, the samples should meet principles written below.

5.2.3 The Result of Sample

With the help of the Ningbo Statistical Bureau, we have selected the sample of our survey. In terms of their annual sales in 2005, there are 14 enterprises whose annual sales in 2005 was more than RMB 5 million, while the rest of the samples have annual sales lower than RMB 5 million. Also, the sample covers the 6 important different districts where the enterprises are concentrated and covers the different owner types of the enterprises. Through a simple sampling, we have chose 200 die & mould enterprises. In term of sales scale, there are 14 enterprises with annual sales beyond 5 million RMB, 186 enterprises are included in this sample with sales between 0.5 million and 5 million RMB. With respect to the location, this sample
consists of all six districts mentioned above. Regarding enterprises’ ownership character, this sample also contains all enterprises with different kind of ownerships currently existing in China. Of course, among them private enterprises account for large proportion. When it comes to the enterprises’ existing years, this sample also includes enterprises with a longer existing time.

5.2.4 The Representativeness of the Sample

Just as described above, this sample has a strong representativeness, it contains enterprises with different ownership characters, with different annual sales rates, and different locations. Due to the lack of statistical data, we really did not know anything about the number of enterprises with annual sales lower than 0.5 million RMB. Because of this, we argued that those enterprises with annual sales lower than 0.5 million RMB, are not representative in this sample.

5.3 Questionnaire

5.3.1 Questionnaire Structure

Our questionnaire consists of 32 questions, divided into two parts (see appendix). The first part consisted of rating questions, number 1-29. In a rating question the respondents are asked how strongly they agree or disagree with a statement. The rating scale consists of five alternatives. Furthermore, questions 1-29 were category questions as well, which we were designed so that each respondent’s answer could only fit into one category. In our questionnaire, we had five categories of resource factors, external factors, market demand factors, government factors and additional factors. The second part was background information questions which consisted of five questions. Through these questions, we would get the main information about the company, including the sales in 2005, the year of opening, the locating, the ownership character, and the position of the respondent. In the second part, questions 1-3 were open questions and questions 4-5 were close questions which consisted of four alternatives.
5.3.2 Administer the Questionnaires

We sent our questionnaire in Chinese via e-mail to our colleagues in Ningbo Development and Reform Committee. Then they downloaded and printed it, and afterwards they were responsible for faxing it to the selected enterprises. They also informed the respondents to fill up questionnaires. Finally, these respondents would send their answers back to our colleagues by fax.

If there were no answers after five days, our colleagues would phone to ask for respondents and again explained that we did this research just for academic purposes and asked them to fill in the questionnaires.

Considering the sample’s validity, if there were still no answers after 10 days when questionnaire was sent. We then decided not to urge and regard these questionnaires as refusals.

When it comes to returned questionnaires, our colleagues in Ningbo would add up results. And they sent the results to us via e-mail. We then analyzed the results by using SPSS software.

5.3.3 Enhancement of Response Rate

Due to the large size of the population of total 2012 enterprises and sample only 200 enterprises, the most important aspect is the response rate. Therefore, We needed to obtain as high a response rate as possible to ensure that our sample was representative.

To reach a high response rate, we tried to:

● Explain that the purpose was just for the academic research.
● Ensure the questionnaire was reachable by telephone or E-mail.
● Ensure the help of The Ningbo Municipal Statistical Bureau, The Ningbo Die & Mould Association and The Ningbo Development & Reform Committee.
5.4 Pilot Test and Revision

Initially, with the help of our tutor and a group of experts who are working in the field of cluster, we have gained some reasonable comments on the representativeness and suitability of our questions. Also, we have gotten some suggestions on the structure of our questionnaire so that we have made the necessary amendment. Afterwards, we planned to conduct a pilot test. The pilot testing is an important process and its purpose is to refine the questionnaire so that the respondents would have no problems in answering the questions and in recording the data. Prior to using our questionnaire to collect data, we have conducted 10 pilot tests on the Chinese students. Also, we have conducted 10 pilot tests in some super managers who are in charge of the die & mould manufactories.

5.5 Language of the Questionnaire

Because Chinese is our mother language, in the first stage, we designed the questionnaire in Chinese and had an intensive discussion in the group. Afterwards, we consulted some experts in the cluster field. Then, we reference the native English questionnaire and translated it to English. At last, with the help of our tutor, we revised it. Due to the fact that our research objectives are Chinese, the Chinese version were sent to the respondents.

5.6 Reliability

Robson (2002) asserts that four threats to reliability exist in research. They are participant error, participant bias, observer error, and observer bias. In order to avoid the participant error, we told our colleges to fax the questionnaire on a ‘neutral time’, such as Tuesday, to reduce participant error. When it comes to participant bias, because our research participants are the owners or managers of the firms and they also knew our official background, hence, they may give a misleading answer, such as showing company success, catering for the government officials Etc. concerned the
such problems, we explained that the purpose of research was just for academic reasons. This way, we hoped to reduce the bias. The observer error is not likely in our research as we choose a questionnaire as our survey method, our questions were also standardized and only one answer could be chosen.

5.7 Validity

Validity is concerned with whether the findings are really about what they appear to be about (Saunders, 2003, 101). A good research must be characterized by high validity. There is still a risk that the questions are misleading or that they are wrongly formulated. The questions we use in the questionnaire must be relevant and suitable for the characteristics we are looking for. Otherwise, we will get systematic errors, which will not be eliminated even if more cases are examined. So, it is very important to keep the validity in our mind when we do the research.

5.8 Generalsability

The purpose with many researchers is to be able to generalize the result to a large population (Saunders, 2003, 105). However, our research objectives only belong to the Ningbo Die & Mould Cluster. To some extent, they are located in the same area and manufacture similar products. Our research purpose was just to find what factors have influenced the development of the Ningbo Die & Mould Cluster. Also, our research purpose was not to produce a theory that would be generalisable to large populations.
Chapter 6 Analysis of the Survey Data

In this chapter the survey is analyzed. We present the results of questionnaire and employ three statistical methods to analyze the data, including factor analysis, descriptive analysis and correlation analysis to testify the hypotheses.

6.1 Statistical Methods

In this dissertation, we try to test our hypotheses empirically. Three types of statistical analysis are performed using the SPSS program.

1. Factor Analysis
The construct validity of the research model must be verified first to make sure that results from the following analysis based on the model are robust. Specifically, factor analysis will be used to verify whether or not a respondent can be represented in the Ningbo Die & Mould Cluster.

2. Descriptive Statistics
Descriptive statistics such as mean, sum, etc., are used to summarize the data.

3. Correlation Analysis
We use correlation analysis as the primary statistical method in this dissertation, which we would like to introduce in greater detail.

Correlation analysis is an important statistical tool for quantitative analysis, which determines whether there is a significant association between the independent and dependent variables. It is widely used in the fields of natural science, technology, sociology, economics, especially in modern econometric study, and available in the SPSS statistical package. Correlations are relationships between two or more variables or sets of variables (Cohen and Cohen, 1983). The numbers of variables correlated may classify basic kinds of correlations. There are bivariate correlations and multiple correlations. Bivariate Correlations are correlations between two
variables, whereas Multiple Correlations are those between one variable and a set of other variables. In this dissertation, we use the Pearson bivariate correlations.

6.2 Characteristics of the Respondents

Assisted by the Ningbo Statistical Bureau and Ningbo Die & Mould Association, the Ningbo Development & Reform Committee successfully conducted the survey during October 26, 2005 and November 10, 2005. According to our samples, we distributed the questionnaires via fax and called the enterprises afterwards to ensure they had received the questionnaire. We explained to the respondents that the purpose of the survey was for academic research and asked them to fill out and return the questionnaires. This method is convenient and cost-saving, similar to the conventional mail surveys. A total of 200 questionnaires were distributed, of which 124 were returned (including 5 that were ineligible).

The active response rate, defined as (total number of responses) / (total number of enterprises in sample – ineligible cases), stands at 64%, a relatively high and acceptable rate.

6.2.1 Distribution of Ownership Character

In the total 119 valid respondents, 96 enterprises are private companies, 7 enterprises are joint-venture companies, 6 enterprises are collective companies, and 10 enterprises belong to other ownership types companies.
6.2.2 District Distribution of the Respondents

When it comes to the districts distribution, among the 119 valid respondents, 28 enterprises locate in Beilun district, 25 enterprises locate in Ninghai district, 18 enterprises locate in Yuyao district, 12 enterprises locate in Xiangshang district, 10 enterprises locate in Cixi district, 8 enterprises locate in Yingzhou district and 18 enterprises locate in other districts.

6.2.3 The Distribution of the Respondents Position

When it comes to the distribution of the respondent position, 72 questionnaires were filled by the president of company, 20 questionnaires were filled by general managers,
12 questionnaires were filled by duty general managers and 15 questionnaires were filled by other managers.

6.3 Factor Analysis Results

6.3.1 Factor Analysis Results of the Sales Distribution

Figure 6-4: The Distribution of 2005 Sales

Mean = 3308.1092
Std. Dev. = 4635.46255
N = 119
Table 6-1: One-Sample Statistics of Sale

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale</td>
<td>119</td>
<td>3308.1092</td>
<td>4635.46255</td>
<td>424.93216</td>
</tr>
</tbody>
</table>

Table 6-2: One-Sample Test of Sale

<table>
<thead>
<tr>
<th>Test Value = 5000</th>
<th>T</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3.982</td>
<td>118</td>
<td>.000</td>
<td>-1691.89076</td>
<td>-2533.3721 -850.4094</td>
</tr>
</tbody>
</table>

As Figure 6-4 shows, the mean sales volume is 3,308,000 RMB, and 93.3% of the respondents we randomly selected have annual sales less than 5 million RMB, while an enterprise with annual sales less than 5 million RMB is legally regarded as middle-and-small enterprise (MSE) in China. This means that the Ningbo Die & Mould Cluster consists of the MSEs. Theoretically speaking, the clustering of MSEs can usually be regarded as one important characteristic of an industrial cluster. Thus, the factor analysis results of sales indicate that the Ningbo Die & Mould Cluster is a typical industrial cluster.

6.3.2 Factor Analysis Results of the Age Distribution

Table 6-3 One-Sample Statistics of Age

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years</td>
<td>119</td>
<td>6.4370</td>
<td>3.51423</td>
<td>.32215</td>
</tr>
</tbody>
</table>

Table 6-4 Distribution of Age

<table>
<thead>
<tr>
<th>Ages</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤4</td>
<td>17</td>
</tr>
<tr>
<td>4-8</td>
<td>74</td>
</tr>
<tr>
<td>8-12</td>
<td>4</td>
</tr>
<tr>
<td>12-16</td>
<td>21</td>
</tr>
<tr>
<td>≥16</td>
<td>1</td>
</tr>
</tbody>
</table>

As shown in Table 6-3, the average age of the enterprises in our sample is 6.44 years. There is a bimodal pattern in the distribution of age, as indicated in Table 6-4 and Chart XX below. The majority of these enterprises (N=74, or 62% of total) have been in operation for 4-8 years. This is consistent with the rapid expansion of the Die &
Mould Cluster in Ningbo over the past six years or so. Another peak of the age
distribution is found in the 12-16 year group, which includes 21 enterprises emerging
from the earlier period of fast development of the die & mould businesses in Ningbo.
There are relatively few enterprises (N=17) that are three years old or younger, 
perhaps because our sample does not include small enterprises with annual sales
below 500,000 RMB.

![Figure 6-5: The Dispersion of Age](image)

6.4 Descriptive Analysis

We conducted a descriptive analysis of the data to present a general picture of the 
factor scores of the 29 factors. In order to make it easy to be understood, we use the 
mean of all items of one individual factor to calculate the scores, disregarding 
weighted loadings. Appendix 1 reveals the most important parameters of descriptive 
analysis: mean, sum, and the percent of each score, which portrayed a clear picture of 
all the twenty-nine factors.

Factors with a mean score greater than 4.0 include No.2, 6, 7, 21, 22, 28 and 29 (Table
suggesting that these factors have played an important role in the development of the enterprises included in our sample.

Table 6-5: Factors with Mean Score Greater than 4.00

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>Score Percent (%)</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>32.0</td>
<td>46.6</td>
<td>13.0</td>
</tr>
<tr>
<td>6</td>
<td>65.0</td>
<td>33.3</td>
<td>1.7</td>
</tr>
<tr>
<td>7</td>
<td>57.0</td>
<td>35.4</td>
<td>7.6</td>
</tr>
<tr>
<td>21</td>
<td>30.3</td>
<td>47.0</td>
<td>17.6</td>
</tr>
<tr>
<td>22</td>
<td>67.8</td>
<td>22.1</td>
<td>10.1</td>
</tr>
<tr>
<td>28</td>
<td>61.3</td>
<td>38.7</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>91.1</td>
<td>8.9</td>
<td>0</td>
</tr>
</tbody>
</table>

Factors with the lowest mean score include No. 8, 9, and 10 (Table 6-6), corresponding to business environment, relevant laws and regulations, and financial support at the local level, respectively, suggesting that the respondents generally have low ratings on these factors.

Table 6-6: Factors with the Lowest Mean Score

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>Score Percent (%)</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>2.1</td>
<td>5.5</td>
<td>28.2</td>
</tr>
<tr>
<td>9</td>
<td>9.2</td>
<td>22.7</td>
<td>33.6</td>
</tr>
<tr>
<td>10</td>
<td>5.9</td>
<td>11.8</td>
<td>24.4</td>
</tr>
</tbody>
</table>

Factors with a greater than 50% rating on score 5 include No. 6, 7, 22, and 29 (Table 6-7), suggesting that more than half of the respondents consider these factors as having played an especially critical role in the development of their enterprises.
Table 6-7: Factors with A Greater than 50% Rating on Score 5

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>Score Percent (%)</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>65.0 33.3 1.7 0 0</td>
<td>551.5</td>
<td>4.63</td>
</tr>
<tr>
<td>7</td>
<td>57.0 35.4 7.6 0 0</td>
<td>534.8</td>
<td>4.49</td>
</tr>
<tr>
<td>22</td>
<td>67.8 22.1 10.1 0 0</td>
<td>544.7</td>
<td>4.57</td>
</tr>
<tr>
<td>29</td>
<td>91.1 8.9 0 0 0</td>
<td>586.8</td>
<td>4.93</td>
</tr>
</tbody>
</table>

Factors with a greater than 30% rating on score 1 or 2 include No. 1, 8, 9, 10, 17 and 26 (Table 6-8), suggesting that the respondents believe these factors have little influence on the development of their enterprises and thus need to be improved.

Table 6-8: Factors with A Greater than 30% Rating on Score “1 + 2”

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>Score Percent (%)</th>
<th>Sum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 4 3 2 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>18.4 13.4 37.8 24.4 6.0</td>
<td>384.8</td>
<td>3.23</td>
</tr>
<tr>
<td>8</td>
<td>2.1 5.5 28.2 50.8 13.4</td>
<td>358.0</td>
<td>3.01</td>
</tr>
<tr>
<td>9</td>
<td>9.2 22.7 33.6 26.9 7.6</td>
<td>356.0</td>
<td>2.99</td>
</tr>
<tr>
<td>10</td>
<td>5.9 11.8 24.4 31.9 26.1</td>
<td>293.0</td>
<td>2.46</td>
</tr>
<tr>
<td>17</td>
<td>17.0 30.3 22.7 28.3 1.7</td>
<td>396.3</td>
<td>3.33</td>
</tr>
<tr>
<td>26</td>
<td>7.1 30.9 28.5 30.1 3.4</td>
<td>366.5</td>
<td>3.08</td>
</tr>
</tbody>
</table>

6.5 Correlation Analysis

As mentioned earlier, we aim to reveal the relationship between the selected factors and the development of the Ningbo Die & Mould Cluster. Thus, all our 29 hypotheses involve the relationship between the independent and the dependent variables. The most appropriate statistical methods are correlation and regression analyses, especially the former, which can reveal whether there are significant associations between variables. We defined three groups of correlation: Q-sales, Q-age, and sales-age. “Q” represents the number of questions in the questionnaire, corresponding
to each factor as specified in our hypotheses, “sales” refer to the annual sales of each company as of 2005, and “age” is the number of years since the company’s founding. Our purpose is to test each of the hypotheses through correlation analysis.

In this section, we discuss findings from our correlation analysis in the context of development of the Die & Mould Cluster in Ningbo.

6.5.1 Q-Sales Correlation

Previous researches have shown that the whole cluster’s annual sale is an appropriate indicator of the cluster’s development level. Thus, if we can prove the factors we mentioned in our hypotheses are positively correlated with sales of the individual companies we surveyed, then they are also positively correlated with the whole cluster’s sales. So, the rating (score 1-5) by our respondents on every question can be regarded as one variable, and the sales of the company as the other variable.

The whole correlation analysis result between sales and associated factors is shown in Appendix 6-2. The calculated results and discusses:

1. A correlation is considered positive and statistically significant if the coefficient is positive and at a significance level between 0.01 and 0.05, as is the case with factors No. 2, 3, 4, 5, 8, 9, 11, 12, 13, 14, 16, 18, 19, 20 and 27. (Table 6-9), reveal that these factors are positively associated with the development of the Ningbo Die & Mould Cluster as we hypothesized in the development model of such cluster.

Table 6-9: Q-Sales Positive and Statistically Significant Correlation

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>8</th>
<th>9</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.021</td>
<td>.033</td>
<td>.047</td>
<td>.021</td>
<td>.037</td>
<td>.049</td>
<td>.014</td>
<td>.021</td>
<td>.046</td>
</tr>
<tr>
<td>R</td>
<td>*</td>
<td>.205</td>
<td>*</td>
<td>.237</td>
<td>*</td>
<td>.239</td>
<td>*</td>
<td>.304</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6-9-1
2. A correlation is considered positive and statistically highly significant if the coefficient is positive and at significance level between 0 and 0.01, as is the case with factors No. 10, 15, 21 and 23 (Table 6-10), these factors correspond to financial support at the local level, support of related industries, product quality, and demand at the international market, respectively. The highly significant and positive correlation of these factors with company size suggests that larger enterprises in the Ningbo Die & Mould Cluster tend to put greater emphasis on cooperation with related industries and quality product, and in the meantime, hold a more international perspective.

Table 6-10: Q-Sales Statistically Highly Significant and Positive Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>10</th>
<th>15</th>
<th>21</th>
<th>23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.004</td>
<td>.009</td>
<td>.009</td>
<td>.007</td>
</tr>
<tr>
<td>R</td>
<td>**.133</td>
<td>**.391</td>
<td>**.214</td>
<td>**.232</td>
</tr>
</tbody>
</table>

3. Correlation coefficients at a significant level greater than 0.05 are considered insignificant, as with factors No. 1, 17, 26, 28 and 29 (Table 6-11), these factors corresponding to labor resources, enterprise ownership reform, reform and open-door policies, regional culture and entrepreneurship, respectively. As mentioned earlier, however, the lack of statistical significance does not necessarily mean that these factors are irrelevant. According to previous studies and our own experience in this area, we believe that these results can be explained by the following reasons.

Factor 1: Considering the fact that the Ningbo Die & Mould Cluster is not a labor-intensive industry, there is hardly a linear relationship between labor supply and
growth of the cluster.

Factor 17: Since most enterprises in the cluster are privately owned, the issue of ownership reform is irrelevant.

Factor 26: Since this factor is the product of an idiosyncratic era, similar to the critical “window of opportunity” in the Porter’ diamond theory, its influence will diminish with time. In the analysis below, we will show that indeed, this factor is positively correlated with the year of establishment of the companies.

Factors 28 and 29: As indicated in the descriptive analysis results (section 6.4), they received very high ratings by the respondents. Perhaps because of these high ratings by most respondents (thus lack of variation among them), these factors lost statistical significance in the correlation analysis. Factors 8, 9 and 10: These are related to the fact that China is still in the midst of developing a market economy, and many institutional infrastructures have yet to be improved. As a result, the under-appreciation of these factors among enterprises in the cluster may contribute to the lack of correlation of these factors with size of enterprises.

Table 6-11: Statistically Insignificant Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>1</th>
<th>17</th>
<th>26</th>
<th>28</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.096</td>
<td>.130</td>
<td>.061</td>
<td>.119</td>
<td>.072</td>
</tr>
<tr>
<td>R</td>
<td>.316</td>
<td>.266</td>
<td>.288</td>
<td>.465</td>
<td>.312</td>
</tr>
</tbody>
</table>

4. Similarly, a correlation is considered negative and statistically significant if the coefficient is negative and at a significance level between 0.01 and 0.05, as with factors No. 7, 22, 24 and 25 (Table 6-12), these factors corresponding to Trade Associations, domestic market and support at the central and local government levels. This suggests that smaller enterprises in the cluster rely more on support from the government and Trade Associations, consistent with the current situation in China. Generally, larger enterprises tend to be more independent in daily operation, and
unless in need of special support of the government for significant investment, they rely much less on the government than do smaller enterprises. In addition, results with factor 22 show that smaller enterprises tend to rely more on the domestic market.

Table 6-12: Statistically Significant and Negative Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>7</th>
<th>22</th>
<th>24</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.023</td>
<td>.031</td>
<td>.038</td>
<td>.049</td>
</tr>
<tr>
<td>R</td>
<td>*-.144</td>
<td>*-.147</td>
<td>*-.190</td>
<td>*-.453</td>
</tr>
</tbody>
</table>

5. A correlation is considered negative and statistically highly significant if the coefficient is negative and at a significance level between 0 and 0.01, as with factors No. 6 and 8 (Table 6-13), which correspond to market infrastructure—here primarily referred to the specialized die & mould market in Ningbo. This suggests that smaller enterprises in the cluster especially rely on such market. Indeed, the existing market for this industry in Ningbo provides services, such as parts supply and retails, primarily to smaller enterprises. In contrast, larger enterprises usually have secured their own market with a relatively mature supply-demand chain, and thus rely much less on such specialized market.

Table 6-13: Statistically Highly Significant and Negative Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>6</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.009</td>
<td>.037</td>
</tr>
<tr>
<td>R</td>
<td>**-.211</td>
<td>*.209</td>
</tr>
</tbody>
</table>

To sum, the analysis processes and results presented above indicate that most of the selected factors correlate positively with sales. This suggests that the bigger the enterprises the more likely they will value the hypothesized factors. Factors with a statistically insignificant correlation coefficient should be interpreted and treated with caution. Just because they are not statistically significant does not necessarily mean that they are irrelevant factors. Where negative correlation results arise, it suggests
that the associated factors are more important for smaller enterprises than for bigger ones.

6.5.2 Correlation between Age and Q

Previous research has shown that a successful cluster must be able to grow and sustain itself. Thus, the survival of each individual enterprise of the cluster can be viewed as an important indicator of success of the cluster. For the same rationale underlying the sales-Q correlation, we performed the age-Q correlation analysis below. Results on the correlation between the age of enterprises and selected factors are presented in Appendix 6-3. Interpretation of the results is the same as in the Q-sales correlation analysis.

1. Factors that are statistically significant and positive include items 22, 24, and 25 (Table 6-14), results with those factors indicate that these factors are positively associated with development of the cluster, especially among those older enterprises. However, the correlation is not highly significant.

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>22</th>
<th>24</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.011</td>
<td>.038</td>
<td>.025</td>
</tr>
<tr>
<td>R</td>
<td>*.147</td>
<td>*.190</td>
<td>*.453</td>
</tr>
</tbody>
</table>

2. Factors 6, 17, 18, 26, 28 and 29 have a statistically highly significant and positive correlation with age (Table 6-15), those factors represent market specialization, ownership reform, market competition, reform and open-door policies, regional culture and entrepreneurship. The correlations of these factors with age are highly significant and positive, suggesting that older enterprises in the cluster may have benefited more from these factors. Indeed, market specialization played a significant role in the formation of the Ningbo Die & Mould Cluster in the early 1990s. Since the
“reform and open-door” policy became a national policy in the early 1980s, its influence has been marginalized gradually, whereas enterprise ownership reform applies only to a minority of older enterprises. Regional culture and entrepreneurship correlate positively with age of the enterprises perhaps because older enterprises tend to value individual efforts of the entrepreneurs to a greater extent. The results with market competition are somewhat surprising.

Table 6-15: Statistically Highly Significant and Positive Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>6</th>
<th>17</th>
<th>18</th>
<th>26</th>
<th>28</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.009</td>
<td>.003</td>
<td>.007</td>
<td>.001</td>
<td>.009</td>
<td>.003</td>
</tr>
<tr>
<td>R</td>
<td>.211</td>
<td>.266</td>
<td>.219</td>
<td>.288</td>
<td>.465</td>
<td>.312</td>
</tr>
</tbody>
</table>

3. Factors 8, 9, 10, 12, 13 and 19 are not statistically significant, thus unrelated to age of the enterprises (Table 6-16), these factors representing business environment, related laws and regulations, local financial support, vocational training, raw materials and brand names, respectively. Factors 8, 9 and 10 lacked statistical significance in both the Q-sales and Q-age correlation analyses, and they received lower ratings on average as shown in Section 6.2.1. Perhaps because these factors have failed to show any noticeable influence, their potential importance is largely ignored by the enterprises. The lack of statistical significance with factors 10, 13 and 19 suggests that they are unrelated to age of the enterprises.

Table 6-16: Statistically not Significant Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>13</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.087</td>
<td>.140</td>
<td>.075</td>
<td>.141</td>
<td>.164</td>
<td>.183</td>
</tr>
<tr>
<td>R</td>
<td>.209</td>
<td>.202</td>
<td>.133</td>
<td>.224</td>
<td>.128</td>
<td>.291</td>
</tr>
</tbody>
</table>

4. Factors 1, 2, 3, 4, 5, 11, 14, 15 and 16 are statistically significant and negative (Table 6-17), these factors representing labor force, skilled and talented personnel, geographic location, transportation, information infrastructure, research and
development infrastructure, suppliers, related industries and enterprise managerial expertise, respectively. This suggests that newcomers in this industry place a greater emphasis on these factors, or in other words, are more likely to have benefited from these factors.

Table 6-17: Statistically Significant and Negative Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>11</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>.035</td>
<td>.025</td>
<td>.032</td>
<td>.047</td>
<td>.021</td>
<td>.043</td>
<td>.028</td>
<td>.024</td>
<td>.016</td>
</tr>
<tr>
<td>R</td>
<td>*-.316</td>
<td>*-.205</td>
<td>*-.237</td>
<td>*-.239</td>
<td>*-.304</td>
<td>*-.290</td>
<td>*-.547</td>
<td>*-.090</td>
<td>*-.221</td>
</tr>
</tbody>
</table>

5. Factors showing a highly significant and negative correlation include 7, 20, 21, 23 and 27 (Table 6-18), corresponding to trade associations, technological innovation, international market and restructure of the economy in developed countries, respectively. This suggests, we believe, that newer enterprises embrace cooperation (factor 7), innovation (factor 20) and a global/international perspective (factors 23 and 27) in their management philosophy, more than do their older counterparts. Meanwhile, newer enterprises pay more attention to product quality (factor 21).

Table 6-18: Statistically Highly Significant and Negative Factors

<table>
<thead>
<tr>
<th>No.(q)</th>
<th>7</th>
<th>20</th>
<th>21</th>
<th>23</th>
<th>27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig</td>
<td>-.002</td>
<td>-.003</td>
<td>-.009</td>
<td>-.001</td>
<td>-.004</td>
</tr>
<tr>
<td>R</td>
<td>-.144</td>
<td>-.228</td>
<td>-.214</td>
<td>-.232</td>
<td>-.414</td>
</tr>
</tbody>
</table>

To sum, these results reveal many factors that are negatively correlated with the age of enterprises, suggesting greater importance of these factors to newer enterprises than to older ones. On the contrary, those factors showing a positive correlation with age are more pertinent to older enterprises. As for factors that do not appear statistically significant, they should be interpreted with caution, as in the Q-sales correlation results. The lack of statistical significance of these factors does not necessarily mean
that they are irrelevant. We will discuss these results below in further detail.

6.5.3 Correlation between Sale and Age

In order to know whether or not the Ningbo Die & Mould Cluster is developing, we calculated the correlation between sales and age of the companies. If we find a positive correlation, it would suggest that the total sales of a company increase with its age.

Table 6-8: Sales-Age Correlation

<table>
<thead>
<tr>
<th></th>
<th>sale</th>
<th>Years</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>.257(***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td></td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>119</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>Years</td>
<td>Pearson Correlation</td>
<td>.257(**)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>.005</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>119</td>
<td>119</td>
<td></td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).

As shown in Figure 4, the correlation coefficient between the two variables is 0.257, significant at the level of 0.005, suggesting there is a significant and positive correlation between sales and age. This finding implies that the advantage enjoyed by the older enterprises in the Ningbo Die & Mould Cluster has sustained and translated into a greater volume of total sales.

6.6 Summary

In this section, we summarize our analyses of the survey data. We employ three statistical methods to analyze the data, including factor analysis, descriptive analysis and correlation analysis.

Two characteristics of the Ningbo Die & Mould Cluster stand out from the factors analysis: first, the cluster is comprised of medium-sized and small enterprises, and second, it has experienced a rapid growth over the past six years or so.
The descriptive analysis examines and classifies each of the selected factors that influenced the development of the Ningbo Die & Mould Cluster. Labor resources, market infrastructure, trade associations, domestic demand, traditional business culture and attributes of individual entrepreneurship are among the most important factors for the development of the cluster. On the weakness side, factors such as business environment, related laws and regulations and local financial support need to be improved.

Finally, we conducted three pairs of linear correlation analysis: q-sales, q-age, and sales-age. The Q-sales correlation analysis shows that local financial support, development of related industries, product quality, and foreign demand are critical factors for bigger enterprises, whereas market infrastructure is especially important to smaller enterprises. The Q-age correlation analysis indicates that market infrastructure, ownership reform, market competition, Chinese reform and open-door policies since 1978, traditional business culture and attributes of individual entrepreneurship have a more salient impact on older enterprises, whereas trade associations, technological innovation, product quality, foreign demand and the restructure of the economies in developed countries are particularly important for newer enterprises. Result from the Q-sales correlation analysis suggests that the Ningbo Die & Mould Cluster continues to be growing.
Chapter 7 Conclusions

The conclusions and inferences are presented. Firstly, the summary of the dissertation is presented. Secondly, we conclude the result of the study, and reveal some inferences that we have found from the analysis the data. Lastly, some further research problems are presented.

7.1 Summary of Dissertation

The aim of this dissertation was to find an applicable theoretical framework that could explain the growth of the Ningbo Die & Mould Industrial Cluster. The aim of this dissertation was to find an applicable theoretical framework that could explain the growth of the Ningbo Die & Mould Industrial Cluster rather than the evaluation of its competitiveness. The research about the competitiveness of the Ningbo Garment Cluster has been made by other Chinese students studying in Kristainstad University last year. The theoretical framework was also expected to explain the growth of Ningbo specific cluster such as household appliance cluster, stationery cluster.

Few researches have been made on issues in relation to the growth of a specific cluster, let alone any specific clusters in Ningbo. Most of the works are case studies about different nations and regions; furthermore, most of these researches are conducted with respect to the industrial cluster’s competitiveness. In general, the determinant factors of industrial cluster’s competitiveness are somewhat clear; however, currently the most important thing is to identify the factors behind the growth of industrial clusters. Our research just focuses on this question.

Since the researches about industrial clusters are well documented, we had just chosen to present the well known and well supported theories and models. Among them, maybe the Porter’s Diamond Model can be regarded as a popular one; however it just describes why a specific region or nation has a competitive advantage.
After reviewing relevant theories and models, we found that most literatures result from case studies, and on the one hand, most of them just focus on the reasons for the success of such kind of regions and does not deal in general with the question how these industrial clusters emerged and developed; on the other hand, most of these researches were conducted in developed countries in terms of regional or national competitiveness. So, all those theories and models are not fully appropriate to explain the growth of the Ningbo Die & Mould Cluster.

Mainly based on Porter’s Diamond Model and some other relevant models, we tried to establish our own theoretical model, in which a factor hierarchy with five group factors and 29 sub-factors was structured. Meanwhile, a specific cluster, the Ningbo Die & Mould Cluster, was selected to conduct the survey of questionnaires. The different managers of the enterprises were chosen as respondents and we tried to test the validity of our own theoretical model.

A total of 200 questionnaires were distributed to the managers within the enterprises of the Ningbo Die & Mould Cluster, of which 119 valid questionnaires were returned in time. All respondents rated a score to each factor according in accordance with their evaluation and our directives. After the results were gotten, we dealt with the primary date and took them into the SPSS program to analyze. Three types of statistical analysis, including factor analysis, descriptive statistics and correlation analysis, were performed by using the SPSS program. Afterwards, a detailed analysis had been described.

7.2 Conclusions

7.2.1 The Framework of Our Model

This study has confirmed that the framework of our evaluating model is very suitable for identifying the factors that affect the development of the Ningbo Die & Mould Cluster. Though the model was structured on the basis of four different theories,
Porter diamond, double diamond, generalized diamond and nine-factor, it is a further extension of the application of all those theories. The entire four theories were droved to explain the district competitive ability issues, while, the ability was based on the development of the cluster, so, they can also be employed to understand the issues of cluster development.

The factor hierarchy has reasonably and logically been structured in our study. Five principal factors were arranged at the first level of the hierarchy, and they were independent of each other. These five factors represent almost all aspects that could strongly influence the development of the Ningbo Die & Mould Cluster, and they were decomposed into 29 sub-factors for easy to understand. To obtain a quantitative analysis, three different of analysis methods are adopted, factor analysis, descriptive statistics and correlation analysis. Those three methods analyzed the feedback from different perspective. But exactly evaluate the whole 29 factors is a tough work, not only for us but also for our respondents.

7.2.2 The Survey

The suitable survey is very important for us to take a research dissertation. Due to the restriction of limited time, limited energy and limited resources, we just take a survey of questionnaire combining with some telephone interviews. However, we got a relative high respondents rate, stands at about 64%. And more than 80% of the respondents were top leaders from the firms in the Ningbo Die & Mould Cluster. Thus, our validness of our research work should be convinced.

7.2.3 The Analytical Results for the Given Influence Factors

We analyzed two kinds of distribution of the respondents through factors analysis. Two characteristics of the Ningbo Die & Mould Cluster stand out from this analysis method. According to the distribution of 2005 annual sales, we got the Ningbo D&M cluster is comprised of MSEs. Based on the distribution of ages we find that the given cluster had experienced a rapid growth over the past six years or so.
The descriptive analysis examined and classified each of the selected factors that influenced the development of the Ningbo Die & Mould Cluster. Labor resources, market infrastructure, trade associations, domestic demand, traditional business culture and attributes of individual entrepreneurship had played an important role on the development of the cluster.

The Q-sales correlation analysis shows that local financial support, development of related industries, product quality, and foreign demand are critical factors for bigger enterprises, whereas market infrastructure is especially important to smaller enterprises. The Q-age correlation analysis indicates that market infrastructure, ownership reform, market competition, Chinese reform and open-door policies since 1978, traditional business culture and attributes of individual entrepreneurship have a more salient impact on older enterprises, whereas trade associations, technological innovation, product quality, foreign demand and the restructure of the economies in developed countries are particularly important for newer enterprises. Result from the q-sales correlation analysis suggests that the Ningbo Die & Mould Cluster continues to be growing.

7.3 Inferences

As we mentioned in chapter 4, the industrial clusters play a critical role in transforming the economic structure of Ningbo, changing the way of economic growth and promoting the creativity of Ningbo’s enterprises. Combining with our research result and our working background, we have an anxious will to give the local government some constructive suggestions that the government should put emphasises on improvement of some positive factors. And now, we illustrate as follow:

Firstly, to accelerate the development of the Ningbo Die & Mould Cluster, factors
such as business environment, related laws and regulations and local financial support need to be improved.

Secondly, the small enterprises need more support from local financial and related industries, and should pay more attention to the product quality and foreign market.

Thirdly, since the newer enterprises rely on trade associations, technological innovation, product quality, foreign demand and the restructure of the economies in developed countries, local government could help or encourage them to improve those factors.

7.4 Reliability, Validity and Generalization

7.4.1 Reliability

In order to avoid the possibility of drawing a wrong conclusion, although there were some limitations mentioned in previous chapter, from the beginning to the end, we were still paying more attention on reliability and validity.

Robson (2002) asserts that four threats to reliability exist in research. They are participant error, participant bias, observer error, and observer bias. In order to avoid the participant error, as we mentioned in 5.7, we chose the suitable method to select a sample and conduct a survey. Therefore, we have done our best to reduce participant error. When it comes to participant bias, because our research participants are the owners or managers of the firms and they also knew our official background, hence, they may give a misleading answer, such as showing company success, catering for the government officials etc. concerned the such problems, we explained that the purpose of research was just for academic reasons and conducted the survey in a convincingly anonymous way. This way, we hoped to reduce the bias. The observer error is not likely in our research as we choose a questionnaire as our survey method, our questions were also standardized and only one answer could be chosen.
7.4.2 Validity

Validity is concerned with whether the findings are really about what they appear to be about (Saunders, 2003, 101). A good research must be characterized by high validity. There is still a risk that the questions are misleading or that they are wrongly formulated. In the course of our research, we have noticed some factors that can affect the validity of our research. Also, we have always kept them in our minds. The questions we use in the questionnaire must be relevant and suitable for the characteristics we are looking for. Otherwise, we will get systematic errors, which will not be eliminated even if more cases are examined. In our research, firstly, all questions were deliberately designed from the relevant theoretical models, communications with the relevant entrepreneurs, and our working experience. Also, all questions are standard and neutral. Secondly, the pilot tests we have conducted in our colleagues and telephone communication with some entrepreneurs of the die & mould manufactories. Thirdly, we only invited the respondents to give individual judgment on the factors just according to the relative importance. Lastly, after analyzing the results we got, we found that most respondents were qualified in finishing the survey. Above measures and techniques we have conducted should improve our research validity.

7.4.3 Generalization

The purpose with many researchers is to be able to generalize the result to a large population (Saunders, 2003, 105). However, our research objectives only belong to the Ningbo Die & Mould Cluster. To some extent, they are located in the same area and manufacture similar products. Our research purpose was just to find what factors have influenced the development of the die & mould cluster in Ningbo. Also, our research purpose was not to produce a theory that would be generalisable to large populations.

Whereas, as we introduced in the 4.2, Industrial clusters in Ningbo can be categorized
into two types: the Endogenous and the Exogenous. And the Die & Mould Cluster belong to the endogenous clusters. The endogenous were formed by local entrepreneurs based on the local industrial and commercial traditions and the industrial foundations in the rural areas and small towns. They were mostly set up in the early stage of the Reform in the form of medium and small-scale enterprise clusters. To some extent, they are similar in some degree. Although we just focused on the die & mould cluster, we have confident that our research could be partly applicable to the Ningbo endogenous industrial clusters, such as the garment cluster, the stationery cluster, the home appliance cluster, etc.

7.5 The Improvement of Methodology

All the researchers would like to adopt a perfect methodology, so did us, but perfection is always impossible. For us, we believe there is no obvious mistake in model creating, but problem emerged in designing of our questionnaire.

Frankly speaking, to meet the primary requisition of our research, the questionnaire should have been designed in a comparison way. But, finally, we gave up, because it was too hard to be designed and too difficult to be understood. Respondents were asked to mark the degree of importance for each factor without pair-wise comparisons, although they were asked to mark the factors under a comparing consideration, but the result of the questionnaire still show the respondents tended to think that all the factors were important, which partly resulted in that the scores are very close to each other.

Two limitations were left in our study. One is we only focused on the 29 sub-factors, ignored the significance of the first-level factors, because we thought that the sub-factor is more direct and important. The other is we didn’t adopt the regression analysis method, although it would make our analysis more validity, ascribe to the extremely difficult to collect such a vast historical dates.
7.6 Future Researches

Our initial research objective was to try to find the driving factors behind the whole Ningbo industrial clusters. But with the research going further and the suggestions coming from the tutor, due to the restraints of time, energy and materials, we found it considerably difficult to conduct such a research. Finally, our research was just focused on the Ningbo Die & Mould Cluster. Since there are some similarities within Ningbo’s industrial clusters, we believed that the results of our research also could be applied to explain other Ningbo endogenous industrial clusters such as apparel cluster, stationery cluster and household appliance.

With respect to our research result, there is a future valuable study. We really can not be sure whether our research results can also be applicable to the Ningbo Exogenous Industrial Clusters. Maybe a further valuable study can be made in future to find some factors behind of their growths.

Another future study is also valuable. In our own model, we had just tested the positive role played by relevant factors within the model in the formation of the Ningbo Die & Mould Cluster; however, we could not make sure how those relevant factors interact with each other. It was not represented in our research results about their importance of relevant factors. Given this point, another future valuable study also can be made.
Reference

Books:


Elisa Giuliani (2002),Cluster Absorptive Capability: An Evolutionary Approach For Industrial Clusters In Developing Countries, Paper to be presented at the DRUID Summer Conference on" Industrial Dynamics of the New and Old Economy - who is embracing whom?" Copenhagen/Elsinore 6-8 June


Sabel, Zeitlin (1985), Historical alternatives to mass production: politics, markets and technology in the 19th century industrialization, Past & Present, 108


Internet:
http://www.mould.gov.cn/
http://www.valuebasedmanagement.net/
http://www.competitiveness.org/
http://www.clusterstudy.com/
Appendix 1

调查问卷

尊敬的老总：
我们三位是受宁波市政府派遣到瑞典攻读硕士的公务员。现在我们正全力以赴撰写关于宁波模具产业形成原因分析的毕业论文。通过研究，我们试图发现宁波模具产业形成和发展的一些具体驱动因素。
这份问卷是专为研究设计的。在此我们保证所有问卷得来的数据信息仅用于论文写作，并且严格保密。
我们衷心希望您能参与这次问卷调查，并对您抽出时间回答我们的问题深表谢意。当然我们恳请您在回答问卷前，能仔细阅读有关要求，并独自完成。如果您有不清楚之处，请随时与我们联系。同时我们恳请您能在 2006 年 11 月 6 日前把问卷以传真于我们在宁波市发展和改革委员会的联系人。
我们期待着您的回复并对您的参与再次表示谢意。

宁波市发展和改革委员会 张永伟
北仑区大碶街道办事处 滕安达
象山县人民法院 陆新建

2006 年 10 月 22 日
影响宁波产业集群形成的因素调查

请仔细阅读下面的评分标准，然后，对照评分标准独立完成影响贵公司发展的因素进行评分（1-5分）。

评分标准：
5分------非常重要，对企业发展曾经或现在起着决定性的作用；
4分------比较重要，对企业发展曾经或现在起着很大作用；
3分------一般重要，对企业发展曾经或现在起着一般的作用；
2分------不怎么重要，对企业发展曾经起过一些微小的作用；
1分------没作用，对企业发展根本没起任何作用。

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16. 企业管理水平

17. 企业产权改革

18. 竞争对手的激励

19. 品牌建设

20. 技术改造

21. 产品质量

22. 国内市场的支撑

23. 国际市场

24. 地方政府支持

25. 中央政府支持

26. 1978年以来的改革开放政策

27. 发达国家的产业转移

28. 区域文化中的重商成分

29. 创业者个人努力

（企业家精神）
贵公司主要背景

1. 贵公司2005年销售额是多少？

   人民币：万元________________________

2. 贵公司成立于哪一年？

   成立年份：________________________

3. 贵公司位于宁波哪个县(市)

   县(市)区：________________________

4. 贵公司的所有制形式？

   私人________________________   集体________________________

   合资________________________   其它________________________

5. 您在公司中的职位

   董事长________________________   总经理________________________

   副总经理________________________   其它高级管理人员________________________
Appendix 2

Questionnaire

October 22, 2006

Dear Respondent:

We are civil officers dispatched by Ningbo municipality and studying at Kristianstad University in Sweden for a master degree. Now we are devoting ourselves to our master dissertation, which is about the driving factors behind the emergence of Ningbo’s die & mould industrial cluster. Through this research, we try to find out some specific reasons for which Ningbo die & mould industrial cluster has been formed and developed.

This questionnaire is designed for this research. We make sure that all information collected from the questionnaire will only be used in our dissertation and will be kept confidentially.

We hope you want to participate in this survey and thank you for taking time to answer the following questions. Please read the interpretation carefully before you fill in your answers and do the questionnaire individually. If you have any questions, please do not hesitate to contact with our colleagues in Ningbo Development & Reform Committee or e-mail us. Meanwhile we hope you can return your answer to our colleague in Ningbo Development & Reform Committee before 6th November, 2006.

We look forward your answer and thank you again for your participation!

Yours sincerely.

Zhang YongWei, Ten AnTa and Lu XinJian
E-Mail: zyw@nbdpc.gov.cn
tengad@hotmail.com
luxinj1127@163.com

Contact person in Ningbo
Dai KeShu
Industrial & High-Tech Sector Development Division
Ningbo Development & Reform Committee
E-Mail: dks@nbdpc.gov.cn
Tel: 0086-574-87186855
Fax: 0086-574-87186855
The Drive Factors of Your Company

Please give an evaluation (to mark a score between 1 to 5) individually to each item that influence your company’s development after reading the following rule carefully:

5---extremely important
4---very important
3---important
2---less important
1---unimportant

1. How important were the following factors for the development of your company?

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<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
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<td>2. Talent resources abound</td>
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<tr>
<td>3. Geographic location advantage</td>
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<td>5. Communication infrastructure</td>
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<td>6. Market infrastructure</td>
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<td>7. Trade association</td>
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<tr>
<td>8. Business environment</td>
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<td></td>
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<tr>
<td>9. Perfection of related laws/rules</td>
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<td></td>
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<td></td>
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<td>10. Local financial support</td>
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12. Vocational training…………………………… □ □ □ □ □

2. How important were the following external factors for the development of your company?
13. Raw material availability…………………….. □ □ □ □ □
14. The service of supplies………………………… □ □ □ □ □
15. The support of related industrial……………… □ □ □ □ □
16. The motivation of the rival………………….. □ □ □ □ □
17. Managerial skill……………………………… □ □ □ □ □
18. The clarity of property right………………….. □ □ □ □ □
19. The support of brand name………………….. □ □ □ □ □
20. Product quality………………………………. □ □ □ □ □
21. Upgrade and investments …………………….. □ □ □ □ □

3. How important were the following Market demand factors for the development of your company?
22. Domestic market support……………………… □ □ □ □ □
23. Foreign market support……………………… □ □ □ □ □

4. How important were the following government factors for the development of your company?
24. Central government support…………………… □ □ □ □ □
25. Local government support…………………… □ □ □ □ □
5. How important were the following additional factors for the development of your company?

27. The technique transfer from developed Countries

28. The traditional business culture

29. The soul of entrepreneur

Background information

1. How much sales were your company in 2005?

¥ (10 thousand) ___________

2. When did your company open?

Year ______________

3. Which district do your company locate in Ningbo?

District______________

4. Which type of ownership is your company?

Private______________ Collective ________________

Joint-Venture _________ Others ________________
5. Your position in your company

President _____________________ General Manager ___________________

Duty General Manager _____________ Other managers _________________

Appendix 3:

Describe Analysis of Data

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### Appendix 6-2: Q-Sales Correlation

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*Correlation is significant at the 0.05 level (2-tailed)*

**Correlation is significant at the 0.01 level (2-tailed).**

### Appendix 6-3: Q-Age Correlation

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<td>-.004</td>
<td>.009</td>
<td>.003</td>
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<tr>
<td>R</td>
<td>-.214</td>
<td>*.147</td>
<td>-.232</td>
<td>*.190</td>
<td>*.453</td>
<td>.288</td>
<td>-.414</td>
<td>.465</td>
<td>.312</td>
<td></td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed).