The Geography and History of Industrial Clusters in Zhejiang Province, China

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Tomoo Marukawa
Institute of Social Science
University of Tokyo

marukawa@iss.u-tokyo.ac.jp
**Introduction**

Zhejiang Province, China, is known as a home of many industrial clusters. Academic interests on Zhejiang's industrial clusters have been attracted for the most part to the peculiar development experiences of Wenzhou, which is characterized by the proliferation of small family firms and their interaction with the market (Yuan 1987, Nolan and Dong 1990, Zhang and Li 1990, Shi et al. 2002, Sonobe, Hu and Otsuka 2004). But recent researches have discovered similar industrial developments in many other parts of Zhejiang Province (Wang et. al. 2001, Zhu 2003, Shi et. al. 2003, Sheng and Zheng 2004). Most of the literature on Zhejiang's industrial clusters, however, are case studies of some large clusters. There exist many smaller clusters in the province, but information on such clusters, such as the amount and size of them, is seriously lacking.

In the case of Japan, the Small and Medium Enterprise Agency conducts a survey on industrial districts every year since 1963 (The Small and Medium Enterprise Agency 1981), which lists as many as five hundred districts and tracks their performance. In Zhejiang, the Provincial government conducted a survey on industrial clusters recently (Project Unit 2003, 2006), but the definition of clusters in the survey was vague. Through many field works in Zhejiang, I realized that many industrial districts exist without being documented by any means. The purpose of this research is to discover the hitherto undocumented clusters in Zhejiang.

This study will also highlight one of the most unique aspects of Zhejiang's industry: the coexistence of diverse industrial clusters adjacent to each other. The economic effect of the agglomeration of small firms engaging in the same industry has been discussed by Marshall (1920) and many other authors. But the agglomeration of diverse industrial clusters in adjacent regions is seldom analyzed or even reported in previous studies. The city of Wenzhou, for example, which is one of the focuses of this study, houses a vast array of industrial clusters ranging from button manufacturing, apparel, shoes, electric parts, automobile parts, valves, and cigarette lighters. Past literature on Wenzhou, however, did not explore the relationship between the diverse industries and the meaning of the coexistence of various industries.

In the first part of this paper, I will draw a complete map of industrial clusters in two cities in Zhejiang Province which have many industrial clusters, Wenzhou and Shaoxing. The maps will not only show the size and scope of industrial clusters which we already know, but also help us to discover new cluster which have not been documented before.

In the second part of this paper, I will explore the historical origins of some
industrial clusters of Wenzhou. Marshall (1920) pointed out the economic rationale of agglomeration, including the facilitation of the diffusion of technology, the realization of economy of scale in the production of intermediate inputs, and the pooling of specialized workers. Itami et. als. (1998) pointed out the economy of flexibility realized by the agglomeration of firms with diverse specialties. These economies, however, only take place when an industrial agglomeration already exists. They do not explain why an industrial agglomeration emerges in the first place. Candidates for the factors that can explain the emergence of a certain industry at a certain place include: first, the local supply of a specific resource, such as natural resource or human resource; second, a historical event or accident that brought the industry in the place. Only few of the industries in Zhejiang can be explained their emergence by the existence of local resources. In most cases, it seems that only history can explain the emergence of the industry.

Data Source
The data source used here to make the maps of industrial clusters in Wenzhou and Shaoxing are The Collection of Information on Wenzhou City's Corporations and Organizations (Wenzhoushi jiben danwei ziliao huijian) and The Collection of Information on Shaoxing City's Corporations and Organizations (Shaoxing shi jiben danwei ziliao huijian) published by China Statistics Press in 2003 and in 2002 respectively. This is the outcome of the Second National Corporation and Organization Census held in 2001. According to the census there were 40,686 business corporations in Wenzhou and 18,580 in Shaoxing. The corporation's name, address, name of representative, telephone number, zip code, the corporation registration number, and its main product or main activity of each of the corporations are shown in The Collection. Though the books are a very useful source of information based on a thorough survey, it has limitations: the Collections only have information on firms with the legal person status, and hence the cottage industries are largely omitted. But the importance of cottage industries is not negligible especially in those industrial clusters that are still in the initial stage of development. But at the moment there is no way to get information on cottage industries other than interviews with people who know about them.

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1 A socks manufacturer in Taoshan town, which itself is a large corporation with 800 employees and appears in the Collection, has 180 cottage subcontractors in Bishan town. These subcontractors may have around ten employees and thirty to fifty knitting machines. In the Collection, however, only 14 socks manufacturing corporations are listed, because the cottage subcontractors usually do not have legal person status. Hence, this 'socks district' in Bishan is neglected in my map.
Identification of Industrial Clusters

The business corporations listed in the Collections are grouped into 621 industries in the case of Wenzhou and 280 in the case of Shaoxing. In the case of Wenzhou, I adopted the grouping of enterprises of the Collection with the exception of “other daily necessity production” which lumps together some of the famous industries of Wenzhou. I subdivided this group into four groups, namely, cigarette lighters and smoking apparatus, buttons, zippers, and the rest. In the case of Shaoxing, there are more problems of grouping than the Wenzhou case. In some cases, I had to regroup the enterprises by their products. The service industries are excluded, because I do not define here an agglomeration of service enterprises as an industrial cluster. Business corporations of each industry are then grouped by their address into 281 locations in the case of Wenzhou, and 107 locations in the case of Shaoxing.

The area of Wenzhou city, which is 11,784 square kilometers with a population of 7.4 million, is divided into 297 township-level subdistricts (jiedao) and townships (xiang and zhen). With regards to the corporations located in the city center of Wenzhou, it was difficult to judge from their address which of seventeen subdistricts they belong to. Hence these corporations are lumped together in the group of Wenzhou City Center (Wenzhou shiqu). Hereafter the 281 locations, including the Wenzhou City Center, Ou hai City Center, and all the xiangs and zhens, are referred to as “townships.”

Shaoxing city, which has an area of 8,256 square kilometers with a population of 4.3 million, is divided into 118 township-level subdistricts (jiedao) and townships (xiang and zhen). The subdistricts of Shaoxing city center (shiqu), Shaoxing county (xian), Zhuji, Shenzhen, Shangyu, are lumped together in the following analysis. Hence we have 107 “townships” in the case of Shaoxing.

Wenzhou’s 40,686 business corporations minus those in the service sector are subdivided into 134,880 subcategories (480 industries times 281 townships) and Shaoxing’s 18,580 corporations are subdivided into 18,725 subcategories (175 industries times 107 townships). A working definition of an industrial cluster here is quite simple: 1) if there are more than fifteen corporations in one of the 134,880 and 18,725 subcategories, and 2) the number of corporations exceeds five percent of the city total, there is a “center of an industrial cluster” of a certain industry at a certain township2.

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2 This working definition is adopted in order to include one small industrial cluster, which I visited in 2001, in the list of Wenzhou’s industrial clusters. It is the rubber shoes industry of Shatou. The Collection lists 17 rubber shoes enterprises in Shatou, which is not far from the number I was told by township authorities when I visited there. This consists one of the smallest industrial clusters in Wenzhou. And yet the
When only 1) holds, I define it a “periphery of an industrial cluster.”

Previous studies on industrial clusters only had vague definitions of clusters. The survey on Japanese industrial districts by the Small and Medium Enterprise Agency, for example, defines a district as “the annual output of the district roughly exceeds 500 million yen.” No restriction is provided regarding the area of industrial districts, therefore some districts are concentrated in one small town (chō), but others are dispersed throughout a prefecture (ken). The definition adopted in the Zhejiang Provincial government survey, on the other hand, was “more than ten enterprises engaging in the same or related industries, and the annual output exceeds 100 million yuan” in the case of the 2001 survey (Project Unit 2003). There is no restriction regarding the area of clusters, and the definition of an “industry” is unclear. The survey identified 519 clusters in 2001, 430 in 2003, and 360 in 2005. Project Unit (2006) admits that this decline is partly due to the changes of the definition of clusters.

The definition adopted in this paper, i.e. more than fifteen enterprises belonging to the same industry in one township, may seem too wide compared to the average number of firms in Japanese industrial districts, 76.8. But behind the fifteen enterprises listed in the Collections there may exist dozens of cottage firms without a legal person status. The average area of a township is 43 square kilometers in the case of Wenzhou, and 74 square kilometers in the case of Shaoxing, which is a fairly limited area that is comparable with the Japanese town (chō).

By the above definition, I identified 153 centers and 82 peripheries of industrial clusters in Wenzhou, 78 centers and 25 peripheries of industrial clusters in Shaoxing. Clusters exist in 65 industries (63 of which belong to manufacturing, one to aquaculture, one to pig raising) of Wenzhou, and 32 industries (all of which belongs to manufacturing) of Shaoxing.

The Map of Industrial Clusters

Figures 1 and 2 show the location of the 153 and 82 centers of industrial clusters of Wenzhou and Shaoxing. The townships colored in black or grey have more than one industrial cluster. The maps indicate that, generally speaking, industrial clusters tend to emerge in the densely populated plains and rarely appear in the mountainous regions. In Wenzhou, most of the clusters are located in the relatively flat industry is the largest employer in Shatou employing 5000 workers, most of them being migrant workers from the inlands, during its peak season. According the 2000 population census Shatou had a population of 16,514 including migrant workers, so roughly one third of the township's population was employed in the rubber shoes industry.
coastal areas, though even these areas are fairly hilly. In Shaoxing, industrial clusters are located more in the northern area which is densely populated than in the mountainous southern area.

However, there are some exceptions to this rule. In Shaoxing, there is a capsule manufacturing cluster in a mountainous township named Ruao. According to the Collection there are 122 corporations engaged in capsule manufacturing in this township, but a news article reports that there are nearly 300 enterprises. Ten thousand workers are engaged in capsule industry which is undoubtedly the most important industry in a township with a population of 31 thousand. Ruao’s capsule manufacturing began to develop since 1980, once occupying 60 percent of the domestic market.

In both Shaoxing and Wenzhou, most of the industrial clusters emerge in the rural district rather than in the urban district. In Wenzhou, only the Wenzhou city center is classified as urban district. Figure 1 indicates that almost all of Wenzhou’s clusters are rural ones. Even the package printing industry, which usually emerges in metropolitan areas in other countries, is located at a rural township named Longgang. Longgang is in fact dubbed the “first farmer city in China.” The printing industry first emerged in the rural areas of Longgang. As the success of the industry made farmers rich, farmers built a city by their own investment and moved there without changing their household registration status as “farmers” (Ji in 2002). Longgang is different from the ordinary Chinese cities which enjoy state subsidies and privileges. The development of many other industrial clusters in Wenzhou has entailed similar processes of self-sustaining urbanization.

The Specialized Districts

The township having the largest number of industrial clusters is the Wenzhou City Center, which has 15 different industrial clusters. It is not unusual, however, for a large city like the Wenzhou City Center with a population of 612,670 to have a rich variety of industrial clusters. What is unusual in Wenzhou and Shaoxing is that there are many rural townships that specialize in a certain industry. In order to highlight the rural clusters, I calculated the location quotient of the industries in the townships. The location quotient (Isard 1960) is defined as follows:

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L_n = \frac{Q_n}{Q_w} / \frac{P_n}{P_w}
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3 The information about Ruao is based on Zhejiang zaixian, April 25, 2006.
$Q_{it}$ indicates the number of enterprises of $i$ industry in $t$ township. $Q_{W}$ is the number of the enterprises of $i$ industry in all Wenzhou or Shaoxing. $P_{t}$ is the population of $t$ township, and $P_{W}$ is the population of all Wenzhou or Shaoxing. If a township has 1 percent of the Wenzhou’s population, but half of all the button manufacturers in Wenzhou are concentrated in the township, the location quotient of the township’s button industry is 50. Thus the location quotient measures the degree of specialization of a township in a certain industry.

Figure 3 and 4 are maps showing the townships which have more than one highly specialized industrial cluster. Here the industries which do not fall under the aforementioned working definition of industrial clusters are excluded. Industrial clusters of which the location quotient are more than 10 are shown in grey and black in the Figures. Figure 3 and 4 also describes the clusters with location quotients of more than 20. Now the Wenzhou City Center and Shaoxing city center have no industrial cluster that has a location quotient of more than 10. (This is not strange, because as the City Center occupies 8 percent of Wenzhou’s population and 7 percent of Shaoxing’s population, more than 80 or 70 percent of the enterprises of a certain industry must be concentrated in the City Center in order to make the location quotient greater than 10.)

In Wenzhou, the clusters having the highest degree of specialization are, the air compressor industry of Longshui, which has 46 enterprises, the non-woven cloth industry of Sanyang, which has 76 enterprises, and the metal-cutting tool industry of Furong, which has 31 enterprises. Though all of these small clusters were neglected in previous studies on Wenzhou’s clusters, these must be important industries for their home township. In Shaoxing, the highest specialized clusters are, the non-ferrous metal industry of Tangpu with 89 enterprises, and the aforementioned capsule industry of Ruao.

**A Comparison of Wenzhou and Shaoxing**

Through the observations of Figures 1 to 4, we can see that there are similarities in the spatial distribution of clusters in Wenzhou and Shaoxing. In both cities, the emergence of industrial clusters has largely been a rural phenomenon, and the development of clusters entailed urbanization. Both cities have a rich variety of industries, ranging from textile industry to machinery industry.

A striking character of Shaoxing, however, is that the northern part of the city surrounding the city center is almost exclusively dominated by the textile industry. Figure 5 shows the centers and peripheries of textile industries. Shaoxing’s textile industry is almost equal to the synthetic fiber textile industry, which embraces all of the
value chain that consist the industry, including filament production, spinning, weaving, dyeing, and even textile machinery and marketing. Shaoxing is one of the most important industrial districts of synthetic fiber textiles in the world. Wenzhou's industries, on the other hand, are more scattered, as the Figures 1 and 3 indicate. Wenzhou lacks a “leading industry” that can be compared to the synthetic fiber textile industry of Shaoxing. Instead, Wenzhou has a lot of small clusters that specialize in niche industries, such as the switches and electric parts industry of Liushi. At the beginning Liushi’s so-called “low-voltage electric parts” industry grew as a result of China's weak safety regulations on electric parts, taking advantage of loopholes of the regulation. From the multitude of fake-goods producers in Liushi, a few competitive firms has emerged, and now the township's production is said to occupy one-third of the national electric parts market.

A Geographical Inquiry into the Historical Origins of Industrial Clusters

As discussed in the Introduction, resources and history may explain the emergence of a certain industry in a certain place. Among the various industrial clusters of Wenzhou and Shaoxing, only two clusters, namely the stone processing industry of Shiyang, Wenzhou and the fish cultivating industry of Wengyang, Wenzhou, can be explained by the supply of local resources. Other industries do not seem to rely on a specific local resource. In this section I will try to explain the emergence of some of the Wenzhou’s industrial clusters. The sources of information here are Yu and Yu (1995), Zhang ed.(1998), and the author’s interviews.

Leather

Zhang (1998: 1174) reports that leather (cowhide) production existed in Shuitou during the Jiaqing era (1796-1820) of the Qing dynasty. During the late Qing days, cowhide production also appeared in Huoxi, Guoxi and Xiongxi (which is now a part of Huoxi) as farmers’ side business. During the Republican period, leather processing using the cowhides produced by the farmers appeared in the Wenzhou City Center. Stimulated by the demand from military, the industry developed into a fairly large cluster during the World War II, having 41 enterprises in the City Center in 1943 (Yu and Yu 1995:47-48). Leather production also emerged in the southern townships of Yanshan (which is now a part of Nanyan), Aojiang and Yishan during the Republican period.

The locations of these townships which had leather production in the pre-war era are colored in Figure 6. In the same Figure, the numbers of leather manufacturers in each township in 2001 as reported in the Collection are indicated by the hatches. We
can clearly see from this figure that the present leather industry clusters in Wenzhou have their origins in the pre-war period, though the location of the clusters has slightly shifted. Guoxi and Shuitou, though they have changed their main product from cowhides to pig leather, still remain to be the most important townships in Wenzhou’s leather industry.

In some townships, on the other hand, the leather industry has disappeared. For example, Wenzhou City Center, which had 41 manufacturers in 1941, leaves only one leather manufacturer in 2001. This, however, is not the result of a natural decline of the City Center’s leather industry. The leather manufacturers that existed in the early years of the People’s Republic era were nationalized into a single state-owned enterprise. The leather industry cluster, however, dramatically revived since the reform, with 210 cottage leather manufacturers in the City Center at 1981. Then in order to eliminate the pollution caused by them, the city government decided to move these firms out of the City Center to Yangyi (Zhang 1998:1175). Hence, leather production in the City Center disappeared and Yangyi emerged as a new leather industry cluster instead.

Leather production in Shuitou has also gone through a period of virtual extinction and a dramatic recovery (Jin 2002: 149). The private manufacturers which existed at the early days of the People’s Republic were later merged into the state-owned enterprises in Wenzhou City Center and other cities, and were moved away from the township. After the reform, workers in state-owned leather enterprises, who had run leather factories in Shuitou of their own before being nationalized, retired or resigned the state-owned enterprises, flew back to Shuitou, and established private businesses again. Hence the tradition of leather industry has been recovered again after the reform.

Leather Products

The development of leather shoes production, which started during the 1900s and 1910s in the City Center (Yu and Yu 1995:35), must have had strong relationship with the development of leather production. Judging from the sequence of events, it might have been the leather shoes industry that had stimulated the development of leather production in the City Center. Leather box production also emerged in the City Center during the 1930s.

The leather shoes industry flourished after World War II, but later it stagnated, and in 1950 there were only 43 firms with a total of 130 employees in the City Center (Zhang 1998:1175). During the 1950s these firms experienced collectivization and nationalization. After the reform, private leather shoes manufacturers started to
proliferate in the City Center and in the neighboring townships of Shuangyu, Guoxi and Oubei. As indicated in Figure 1, each of these townships has more than 100 corporations that are engaged in leather shoe production. There must be hundreds of individual enterprises, which are not registered in the Collection, engaged in shoe production in these townships. Shoe production has become the most important industry of Wenzhou in term of the number of corporations engaged in the industry and in term of output value.

I tried to trace back the historical origins of leather shoes industry in Wenzhou by studying the life histories of the owners of shoe companies, but few of them have had experience in the industry before the reform. The largest shoemaker in Wenzhou, Aokang Group, which is located in Oubei, for example, was established in 1988. The owner of the Group, who was born in 1965, entered the shoe business in 1986 as a salesman (Interview: August 2001 and Zhang 1999). When he entered the business, the leather shoes cluster already existed in Oubei. The only active leather shoes entrepreneur who has experience of the industry before the reform is the manager of Wenzhou Jierda Shoe Company, who was born in 1936 (Zhang 1999). He was apprenticed to a shoemaker in 1948. After collectivization of his workplace, he became a worker of a collective shoe factory in 1958. Being fired by the factory during the 1960s, he started mending shoes by his own, and in 1981, he established a shoe company. This is the only person among the major shoe company owners in Wenzhou, whose life histories are shown in Shao (2000) and Zhang (1999), that have had experience in the shoe industry prior to the reform.

Though it is difficult to trace back to the historical origin of the shoe industry by personal history, Figure 7 does suggest that the present leather shoes industry, which has become the cities' largest industry in terms of output value and the number of firms, having 1589 enterprises in 2001, is a historical offspring of the shoe industry that existed in the Republican period.

The development of leather shoes industry after the reform also seems to be interlinked with leather production. Comparing the location of the leather shoes manufacturers shown in Figure 7 and the location of leather production shown in Figure 6, one can see that townships east of Wenzhou City Center have both the leather shoes industry and leather production. However, leather shoes and leather are not always linked together. For example, Aojiang, which had leather production during the Republican period but now extinct, has 120 leather shoes manufacturers. On the other hand, Shuitou, which has a large leather industry cluster with 145 enterprises, has no leather shoes manufacturer at all. Instead, the township has a leather belt cluster
consisted of 45 manufacturers.

The development of the leather shoes industry after the reform has triggered the emergence of an artificial leather industry cluster in the townships west of the City Center. Yongzhong has 55 artificial leather manufacturers and Longwan has 22 artificial leather manufacturers. This cluster is said to account for 18 percent of all the artificial leather production in China (Zhongguo fuzhuang wang 2003).

The leather coat cluster of Wuniu (see Figure 3) must also be the offspring of leather industry. There are 26 leather coat manufacturers in Wuniu, which account for 68 percent of all the leather coat manufacturers in Wenzhou. Sometime during the 1980s, this cluster was duplicated in the southern suburbs of Beijing by the migrants from this township and developed into a huge cluster with several hundreds of cottage industries during mid-1990s, which is well described by Wang (1995). Then, before 2000, this new cluster in Beijing had suddenly disappeared.

Plastic and Rubber Shoes

Plastic and rubber shoes industry clusters emerged in Shatou, a mountainous township located in the northern part of Wenzhou, and in Baishi, a township at the east of Shatou, and the southern townships of Xinqiao, Louqiao, and Xianjiang (Figure 8). The plastic and rubber shoes industry in Wenzhou is an offspring of the leather shoes industry. In 1979 a man in Xianjiang who had retired from a shoe factory started making shoes from waste plastics using a solder (Yu and Yu 1995:163). Since there was a shortage of daily necessities during those days, even this kind of shoes had a market. The neighborhoods of this man envied his success and they too started producing plastic shoes by mimicking the man. Only three years later, there were 7100 people engaged in the production of plastic shoes in Xianjiang. During the mid-1980s, plastic shoes became difficult to sell, because Chinese citizens had become richer than before so that they did not wanted such low quality products as plastic shoes any more. Hence the shoe manufacturers of Xianjiang started producing rubber shoes. In 1994, as many as 15,000 people, 85 percent of the entire workforce in Xianjiang, were engaged in the production of plastic and rubber shoes.

According to the Collection, however, Xianjiang is not a prominent township in the plastic and rubber shoes industry, having only 20 plastic and rubber shoes corporations. Xinqiao and Louqiao are more conspicuous, having 54 and 46 respectively. The origin of plastic and rubber shoes industries in these townships is unknown. But in the northern township of Shatou the origin can be traced back to Xianjiang. In 1984, a person introduced the method of making plastic shoes from Xianjiang to Shatou. The
township has now developed into a rubber shoes cluster, consisted of 17 enterprises employing 5000 workers during the peak season (see footnote 2).

Metalworking Industries

Wenzhou has many industrial clusters that engage in metalworking. Six industries, namely, lock making, pump manufacturing, valve manufacturing, air compressor manufacturing, bolts and nuts manufacturing, and mold manufacturing can be regrouped into a new category—metalworking industry, since these items share the same production technology: casting and machining. Automobile and motorcycle parts industry also involve the same process, but since the automobile and motorcycle parts industry in Wenzhou involves many other technologies, such as plastic injection and assembling, I do not include them in the metalworking industry.

Tangxia, Oubei and Yongzhong are the three largest industrial agglomerations of metalworking industries, having 402 enterprises, 364 enterprises, and 267 enterprises respectively (Figure 9).

The history of metalworking industry can be traced back to the Republican era. Zhang (1998:1301) and Yu and Yu (1995:23-24) write that the first entrepreneur in Wenzhou who was engaged in the machinery industry was Li Shumeng of Ruian. He established a workshop in 1916 to produce a cotton-working machine he had invented. Then during the 1920s the workshop started producing ship engines and moved to Wenzhou City Center. Many other machinery enterprises emerged in the City Center, reaching to a total of 47 enterprises with 380 employees in 1947. After 1949, these workshops were gradually merged and nationalized into a single state owned enterprise, called Wenzhou Metalworking Factory, which had 473 employees in 1956 (Yu and Yu 1995:106). This factory produced various types of machinery during the planned economy period, including engines, water pumps, and metallurgy machinery.

During the Great Leap Forward period (1958-1960), several new machinery enterprises were established. In 1960, there were 40 machinery factories in Wenzhou. Pumps and valves had been produced in Wenzhou by these state owned or collective enterprises during the planned economy era, though the production volume of these enterprises was small.

The emergence of the metalworking industry cluster in Wenzhou can be traced back to the early 1970s, when some firms run by the people’s communes and brigades in Yongzhong and Oubei started producing valves. According to my interviews, these firms

4 Zhang (1998) and Yu and Yu (1995) write that it was in 1972 or around 1972 that valve production started in Yongzhong, but a government official I interviewed in
firms started in 1972 to invite engineers from state owned valve factories in Shanghai, Shenyang and Suzhou as consultants in order to learn valve manufacturing technology. However, if it were not for the basis of metalworking technology originated in the Republican era and preserved in the state owned machinery enterprises during 1950s and 60s, the rural communes might not even imagined to produce valves.

As the demand for valves surged as a result of the increase in investment to the petrochemical industry in the 1970s, valves were in severe shortage. Therefore even the low-quality valves produced by the rural enterprises of Yongzhong and Oubei had a large market. Many enterprises were established in both townships to take advantage of the market opportunity. The number of valve factories in Yongzhong and Oubei had amounted to 1069 by the end of 1976, and Wenzhou's valve production volume had become the second largest in China, only next to Shanghai. After then, the valve industry in these townships had to endure strict restrictions by the central government, which accused them of making low quality valves, but still in 2001 the valve industry flourishes in Yongzhong (234 enterprises), Shacheng (a township neighboring Yongzhong, 146 enterprises), and Oubei (221 enterprises).

The pump industry, which has a longer history than valves, dating back to the Republican era, is now concentrated in Oubei with 91 enterprises. When and how did the pump production in state owned enterprises, including the abovementioned Wenzhou Metalworking Factory, evolve into an industrial cluster in Oubei is not known. We can infer that Oubei's pump cluster has technological connections with the township's valve industry as well as with state owned pump manufacturers.

The origins of other metalworking industries are neither well documented. However, we can infer from the map (Figure 9) that the bolts and nuts industry, which is concentrated in Tangxia, having 313 enterprises there, and the lock making industry, which is concentrated in Wuting and Tangxia, and the air compressor industry, which is concentrated in Longshui and Longwan have been influenced by the valve industrial cluster.

The origin of mold manufacturing, on the other hand, which is most concentrated in the northern township of Daji, may exist in another place. The region north of Wenzhou, Huangyan, is famous for mold manufacturing. It is most likely that the mold industry cluster in Daji has been influenced by the mold industry in Huangyan.

We can see from Figure 9 that metalworking industries are stimulating each

Yongzhong said it was in 1970.
other, to form a huge complex around Tangxia, Yongzhong, and Oubei. But at the same time we can see that each township is specialized in one or a few industries, differentiating itself from neighboring townships. This is an interesting phenomenon as the industrial structure of each township is basically determined by the spontaneous selection of entrepreneurs.

I suspect that this phenomenon took place because of the industrial clusters in Wenzhou are created by the repetition of imitation. An industry will be introduced to a certain township by a certain entrepreneur, like the person who first made plastic shoes in Xianjiang. The person may only be mimicking a product produced outside of the township, and there must have been numerous failures of imitations in the past, but he certainly is an innovator in the township. Some of the innovators did succeed, taking advantage of the shortage economy and the loopholes in the market. Once the person succeeds in business, the neighborhoods will try to imitate the innovator’s success. The industry will spread in the village or township and hence create an industrial cluster. Then someone in another township will imitate, and there again emerges a cluster of the same industry. But increased competition will cause a decline of profit rates of the enterprises. Under the pressure of competition and declining profit rate, there emerges an innovator who seeks to develop another business, which, as the case of plastic shoes and rubber shoes, has the same market with the former business but involves different technology, or, as the various metal working industries, shares similar technology but has different markets. If the innovator succeeds in his new business, neighboring entrepreneurs will try to imitate his success. Through the alternation of innovation-imitation-innovation-imitation, an industry will spread from one township to others, and then in some townships the industry will evolved into a slightly different industry. This is a hypothetical history to explain the present landscape of various metalworking industries that spread in the townships from Oubei to Tangxia, but it needs to be supported by more evidences.

Concluding Remarks

The first purpose of this paper was, by drawing maps of industrial clusters of Wenzhou and Shaoxing, to discover the unknown industrial clusters. We did succeed in discovering, for example, the capsule industry of Ruao, compressor industry of Longshui, the non-woven cloth industry of Sanyang, the artificial leather industry of Yongzhong, and many others.

The second purpose was to explore the historical origin of industrial clusters in Wenzhou. Some industries, such as the leather industry and valve industry, can be
traced back to their origin by books and interviews. But many industries lack written materials. The maps, however, give us suggestions on the origins of industrial clusters. Case studies reveal that the imitation of neighbors is a driving force that cultivates a cluster. This means that geographical proximity will translate into a technology transfer relationship. The proximity of similar but different industries, such as the various metal working industries, suggests a process of technology transfer and technology change between the neighboring townships. This mechanism perhaps has made Wenzhou into an agglomeration of diverse industrial clusters in adjacent regions. This hypothesis, however, needs to be examined by further studies.

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