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How Industry Cluster of Precision Machinery in Taichung City Forms  
and Its Future

臺中市精密機械群聚之形成原因及未來

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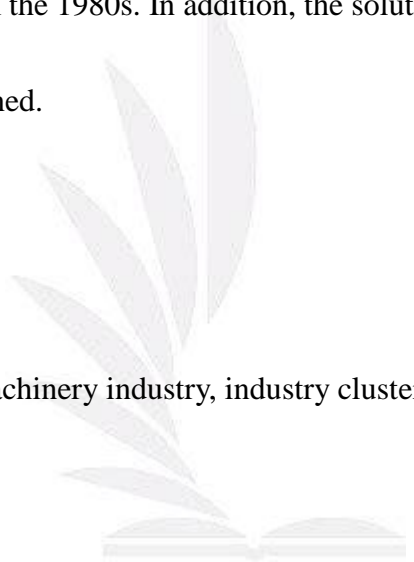
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## **Abstract**

This paper explores how the industry cluster of precision machinery forms currently in Taichung and what kinds of problems this industry has. An industry cluster is groups of related or similar companies gathering in a certain geographic area. They share resources, labor, and services, but compete with one another to increase their own productivity. This paper looks into the changes and formation of precision machinery in Taichung from the 1980s. In addition, the solutions to the problems in this industry are also examined.

**Keyword :** precision machinery industry, industry cluster



## 摘要

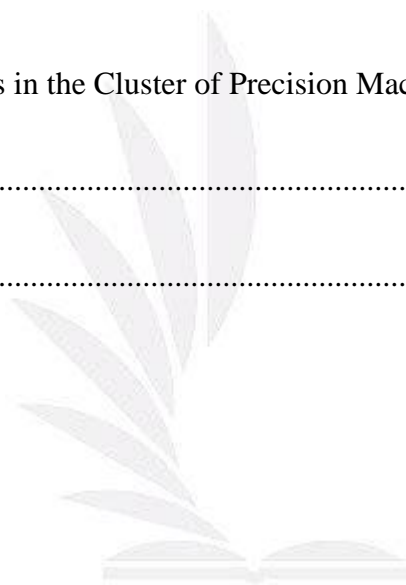
本研究報告探討精密機械的群聚是如何在臺中市形成，以及該群聚面臨到的問題。產業群聚是許多群相關聯的公司聚集在特定的地理區域。這些公司分享資源、勞力和服務，但是它們互相競爭來增加它們的生產力。本研究報告探討從1980年代以來，臺中市精密機械群聚的改變以及該群聚的形成。除此之外，精密機械產業問題的解決方案也是本報告的研究範疇。

關鍵詞：精密機械產業、產業群聚



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## Literature Review

Liang-Chih Chen's "The Evolving Roles of the State and Public Research Institutes in the Technological Upgrading Process of Industries: The Case of Taiwan's Machine Tool Industry" explains how the relationship between local firms and the public research institute changes in four upgrading stages of the machine tool industry. From the interviews with Taiwanese machine tool manufacturers, owners of processing factories, supervisors and researchers in the public research institute, and members of industry association, Chen reveals that local firms redirected the poorly measured policies to work in their favor. These bottom-up efforts of local firms made the state become a seemingly constructive role in the upgrading process of machine tool industry. Benjamin J.C. Yuan, James K.C. Chen, and Algane Jong also show the changes of the machine tool industry, and Benjamin J.C. et al argue that the past review about the situation of the precision machinery is worth being discussed in "A Study of Taiwan's Precision Machinery Industry Review and Its Technical Development Strategy." Benjamin J.C. et al divide the development of Taiwan precision machinery industry into three stages by collecting the data in three periods about industrial characteristics and technique indices. Machine tools in Taiwan have evolved from traditional mechanical tools to a computer numeral control system since the 1940s. Finally, local firms can produce products in product standardization way by

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using computer numeral control system.



## Introduction

This paper examines the formation of industry cluster of precision machinery in Taichung and the problems it faces. My father runs a factory related to bicycle and car part processing. When I go with my father to deliver goods to the client in Dali District in Taichung, I find that there are many other factories related to the precision machinery on the same street. This experience motivates me to search for the causes of the precision machinery. There are several factors that are important to this industry. Subcontracting networks, leading firm's coordination capability and supplier's reliability are essential to the formation of precision machinery in Taichung. Leadwell, which was founded in 1980 in Taichung, had become the largest machine tools manufacturer since its foundation. Its success relied on subcontracting networks with its suppliers. Because of the hard work from these machine tools firms, the subcontracting networks formed in central Taiwan. Maintaining subcontracting networks also requires leading firm's coordination ability and supplier's reliability. However, with more people pursuing better working environments, machine tools manufacturers begin to have problems with recruiting employees. Because local firms in the cluster of precision machinery lacked research and development (R&D) capability, they needed the government's assistance. The two problems needed to be fixed within the industry.

In the first part of this paper, I will examine the development of precision machinery from the 1980s. In the second part, I will look into the formation of precision machinery in Taichung in terms of subcontracting networks, leading firm's coordination capability, and supplier's reliability. In the third part, I mention two problems from the precision machinery cluster and the solutions to them. As I will conclude, the ways the precision machinery cluster in Taichung forms are crucial to the current prosperity of this industry, and solving the problems within the industry is also important.

#### The Development of Precision Machinery from the 1980s

Taiwan was the fourth largest exporter of precision machinery and sixth largest MT producer in 2011, but unlike other leading machine tool countries like Japan, Italy, Germany with more than hundred years of machinery, Taiwan started the precision machinery in the late 1940s. The precision machinery industry began to flourish in the 1980s.

One significant factor affecting the development of precision machinery industry in Taichung is the development of CNC technology. According to Liang-Chih Chen's "Entrepreneurship, technological changes, and the formation of a subcontracting production system: the case of Taiwan's machine tool industry," Chen mentions that



“With technical assistance from Japanese CNC controller suppliers, some Taiwanese MT firms started introducing commercialised CNC MTs to the market. [...] Thanks to the introduction of CNC technology, it became possible to subcontract higher-end MT manufacturing without necessarily compromising the quality of final products” (207). Based on this statement, I believe that some machine tools companies had interactions with Japanese CNC controller suppliers. Because of the Japanese CNC supplier’s help of introducing CNC technology, machine tools made in Taiwan are with a good quality.

With the development of CNC technology, the demand for machine tools from the global market increased. Although Mechanical Industrial Research Laboratory (MIRL) assisted many machine tools manufacturers in upgrading techniques, it faced many problems. According to Liang-Chih Chen’s “The Evolving Roles of the State and Public Research Institutes in the Technological Upgrading Process of Industries: The Case of Taiwan’s Machine Tool Industry,” he concludes that in terms of MIRL, its role of leading machine tool manufacturers to upgrade skills is not evident, and it also encountered many problems when carrying out the mission of upgrading skills, even criticized as not being competent for its job (41). Based on this statement, I believe that machine tools manufacturers received limited assistance from MIRL. What MIRL develops couldn’t meet the expectations of local firms. Even though MIRL provided

skills to local firms, they didn't think that the support could meet their needs.

In a nutshell, the introduction of CNC technology and the limitation of MIRL's assistance to the precision machinery industry are important to the development of the precision machinery industry. Taiwan machine tools industry benefits more from its connections with others than from MIRL's assistance. We need to know how the precision machinery in Taichung thrives to become the cluster of precision machinery industry with its relationship with others and limited technical assistance from MIRL.

## Industry Location and Subcontracting Networks in Taichung Precision Machinery

### Industry

Although machine tools manufacturers might fail due to limited assistance from MIRL, it turned out that they performed well because of subcontracting networks as well as leading firm's coordination capability and supplier's reliability.

An important factor that led to the cluster of Taichung precision machinery was subcontracting networks. According to Liang-Chih Chen's "The governance and evolution of local production networks in a cluster: the case of Taiwan's machine tool industry," he says that "The success of Leadwell, a start-up founded in Taichung in 1980 which, in less than ten years, became Taiwan's largest MT manufacturer in 1989 in the production of CNC machine tools through the aggressive exploitation of local

subcontracting networks encouraged more MT entrepreneurs to start their ventures in Central Taiwan. [...] Owing to the endeavors of these MT firms in cultivating and organizing local suppliers, specialized subcontracting networks for the manufacture of machine tools were formed in central Taiwan” (611). It was amazing that a company established fewer than ten years could be the largest machine tools manufacturer in Taiwan in local subcontracting networks. In particular, this company doesn’t have much capital to invest all kinds of equipment to assemble machine tools. A machine tools company needs the cooperation with suppliers because those suppliers can process some components which a machine company doesn’t have machines to deal with. This kind of cooperation mode can be regarded as an essential element of the precision machinery cluster.

Another significant reason of the development of the precision machinery cluster is leading firm’s coordination capability and supplier’s reliability. In the same article, Chen mentions, “I particularly address issues related to leading firms’ coordination capability and suppliers’ reliability in terms of product quality and delivery, two major factors determining the effectiveness and efficiency of a subcontracting production system” (612). Chen divides this section into four parts: recruiting and cultivating suppliers, supply firms established by former employees, exploring capable local suppliers, and exploring suppliers outside the locality. Maintaining subcontracting

production system is not easy for machine tools companies because they need to control the product quality from suppliers and make sure that suppliers hand in goods to companies on time. Although suppliers used to be machine tools companies' employees, their interactions go on smoothly because both sides know the specification and manufacturing methods. The coordination process could be minimized. Sometimes, machine tools companies may have trouble seeking for suitable suppliers within the cluster, and they are compelled to look for suppliers in other areas.

In conclusion, the subcontracting network, leading firm's coordination capability and supplier's reliability are critical to the formation of the precision machinery cluster in Taichung. However, with people changing attitudes towards work and local firms lacking R&D abilities, local firms need to find ways to attract people to this field, and the government should help these firms upgrade their skills.

## Two Problems and Solutions in the Cluster of Precision Machinery

Although the cluster of precision machinery successfully forms in Taichung, machine tools manufacturers still need to deal with problems of hiring employees and improving their research and development abilities.

The first part is about how to recruit employees in the machine tools industry. In

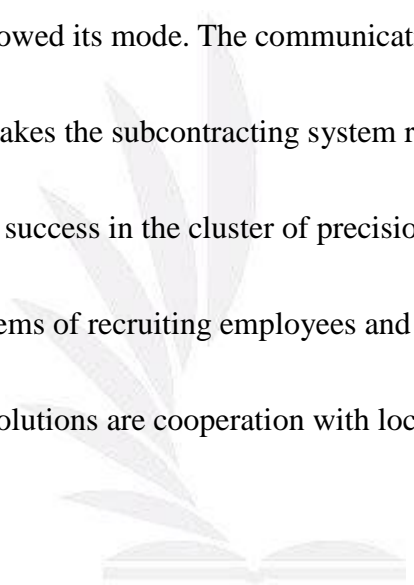
“The Taiwan system of innovation in the tool machine industry: a case study” written by Ching-Chiang Yeh and Pao-Long Chang, they mention that “With higher living standards in society, better working conditions and environments are now demanded, [...] Consequently, Taiwan’s machine tool plants proactively engage in co-operative programs with local schools, hoping to attract graduated co-op students into jobs related to the production of machine tools” (374). People have less motivation to get into the precision machinery industry because they prefer a better working environment. To attract more people to be involved in this industry, machine tools companies cooperate with schools in the hope of making those who are interested in the precision machinery work in this field.

The second part is about how small and medium sizes plants improve their research and development capability. There are many small and medium sizes plants around the precision machinery cluster, but they often lack R&D capability. In the same article, Yeh and Chang say, “Therefore, government should help the plants to build up the key components industry to enhance competitiveness for the industry cluster. Plants also should make the best utilization of government R&D resources and varieties of financial preferential measures to upgrade their technology capability” (378). The state needs to provide the assistance first, and local plants have more chances to utilize the resources and help from the state. Small and medium size

manufacturers need to take the advantage of the resources from the government.

## Conclusion

To sum up, the reasons why the precision machinery industry cluster forms in Taichung are the subcontracting networks, leading firm's coordination capability and supplier's reliability. The success of Leadwell was by subcontracting system, and other related companies followed its mode. The communication of leading firms and the reliability of suppliers makes the subcontracting system run smoothly. Although the above factors lead to the success in the cluster of precision machinery, local firms still need to tackle the problems of recruiting employees and increasing their R&D ability in the industry. The solutions are cooperation with local schools and assistance from the government.



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