The Development of Industrial Clusters Towards a Knowledge-based Economy

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The aims of this study are to: (i) explore the factors contributing to the successful formation of industrial clusters and the overall effects of industrial clustering on productivity; (ii) gain an understanding of the organization and networking of industrial clusters; (iii) examine the flow of human resources between clusters in Chinese Taipei, the U.S., and China, focusing on the drivers of the ‘brain circulation’, along with its contribution to technological innovation; and (iv) highlight the interrelationships that exist between industrial clustering and innovation.

In part (i), drawing on empirical evidence from the Hsinchu Science-based Industrial Park (HSIP), we find that outsourcing is generally adopted by firms within the clusters since this enables them to access the major markets and to save on R&D costs through production specialization. The experiences of HSIP also support the assertion that entrepreneurship, skilled labor, and market access are essential ingredients for the formation of a cluster. In order to determine whether common mechanisms exist to bring together these three ingredients and produce a winning formula, we have attempted to compare the experiences of HSIP to those of Silicon Valley in the U.S., as well as the experiences of the industrial clusters in Penang and the Kelang Valley in Malaysia, Hamamatsu in Japan, and Shanghai in China.

Our studies also show that industrial clustering improves the productivity of individual firms, in part (i). We have been able to gather evidence with statistical robustness to support the role played by the Porter externality and Marshall-Romer in industrial clusters. Although these two externalities differ in nature, they can exist simultaneously in a cluster. If firms in a cluster are more productive than those
outside the cluster, then it naturally follows that firms that locate too distant from the cluster will be driven out of the industry by competition. This, of course, is the main driving force for agglomeration.

In parts (ii) and (iii) we look at the technological linkages between clusters from the viewpoint of networking. Firms can learn from other firms through global production networks within which they operate, collaborating to offer products in the global market, and it is clear that a cluster is an important facilitator for such learning. Clusters form a ‘learning region’ within which knowledge flows and is diffused, amongst the firms residing there. Clusters also provide a bridge between different learning regions to facilitate the effective transfer of knowledge. We conduct an investigation into the state of human resource development within the HSIP, from which we find that industrial output expanded exponentially between 1990 and 1995, along with the infusion of high-skilled labor from overseas. Furthermore, there has been a slowdown in the rate of the so-called ‘reverse brain drain’ since 1995, with foreign workers now accounting for a substantial proportion of labor movement. This suggests that the HSIP is becoming increasingly integrated with the global market, because high-skilled labor within the park has increasingly shifted away from production toward research and development.

We also make an inquiry into the intra-cluster division of labor and networking relationships, using the HSIP as an example, and find that the most prevalent modes of interaction between firms in the HSIP are subcontracting and outsourcing of components and parts. This implies a vertical disintegration of production within the HSIP, and that the duration of subcontracting contracts increases positively with the distance between the partners. Moreover, the potential impacts of industrial clustering on entrepreneurship have been examined and the results reveal some positive correlations. Industries that are more geographically concentrated are found to be more receptive to new entrants, implying that industrial clustering may help facilitate labor pooling since industrial clustering reduces the costs of hiring and discharging workers. The empirical research is in line with the theoretical expectation, indicating that successful industrial clusters are important to the incubation of entrepreneurship.

In part (iv) we suggest that industrial clustering occurs not only in high-tech industries, but also in the so-called traditional industries. It appears that innovation and growth are the two most important elements in the formation of an industrial cluster. Innovation provides the dynamics for competition and restructuring. Innovation also underlines the benefits of knowledge sharing, which is the basic reason for firms to co-locate with one another. At the same time, growth is important both in terms of inducing new entry and facilitating a division of labor within the
industry. Growth in most cases is demand-driven and therefore the link (or access) to the major markets is the key to the formation of an industrial cluster.

Finally, the whole research report finishes with conclusions and policy recommendations. In terms of policy recommendations, we suggest that industrial clustering can be a useful policy for national economic development on various scales. However, there is no one-size-fit-all formula for successful industrial clustering and an economy should allow its comparative advantage to determine what industries should grow into a cluster. Having said that, investment infrastructures and human resources, building innovation capabilities, linking sources of growth, promoting vertical disintegration and subcontracting, and enhancing productivity can be the key ingredients of industrial cluster policies. (project no.707)

The Economic Meaning of the “Taiwan Technological Innovation Survey” and Some Crucial Factors for Innovations, Jiann-Chyuan Wang g, July 2004. (project no.695)

There are three purposes of this project. First, questionnaires of the “Taiwan Technological Innovation Survey” are analyzed with respect to different industries and scales of enterprises in order to offer policy suggestions for the adjustment of government development policies and public resources allocations.

Second, by reviewing the investigations of advanced countries, we have learned of some of the difficulties in innovations faced by industries, and have then proposed some possible means of innovations in the manufacturing and service sectors.

Finally, we suggest some improvements to the “Taiwan Technological Innovation Survey” for further economic analysis and international comparisons.

An Exploration on the Future Operation Model (FORM) of the TaiPower Research Institute (TPRI), Li-Ping Alfred Cheng, September 2004. (project no.690)

The TaiPower Research Institute (TPRI) has long played an important role on supporting the planning and development for the TaiPower Company (TPC) in Taiwan since its establishment. Nowadays, TPC is confronting serious environmental change, including the country’s accession into WTO, and the eagerness for privatization as invoked by people as well as the government. Drastic and potential competition pressure may come from private firms as well as foreign companies. At this moment, as the leading think tank of the TPC, TPRI must take the lead to make a change by restructuring, reinventing, and virtualizing itself as soon as possible in order to make it more efficient and competitive to comply with the foresight of the world.
This project team is articulated to study how, where, and why the TPRI can arrive at in the near future. In searching for excellence, the TPRI is dedicated to re-integrating the current organization into a functionally and virtually operative one so as to enhance its potentials through five virtually-designed working centers: namely, the information center, the technical service center, the testing service center, the incubation center, and the business and profit center. Researching on all of these possibilities, this project’s design is to utilize a foresight and scenario analysis to benchmark domestic and foreign companies on their excellence and key success factors in order to generate TPRI’s new profit pattern.

Combining with some theories and practices of organizational change, portfolio investment, incubation, networking capability, performance evaluation, as well as incentive mechanism design, this research project emphasizes on three dimensions of analysis. From the viewpoint of the foresight management, the performance of ERP, the process flow automation, and the cooperative and competitive activities are the focus. From organizational change, the integration of virtual and physical activities is the focus. On financial profitability and based on the great technology potentials of the TPC, the focus is on opportunities for new investments, new incubating targets, and new services that may be the most important for either spin-offs or internal establishment of new business areas.

This research is expected to explore the relevant and possible operational models for the transformation of the TPRI before and after the implementation of the privatization policy. A certain level of diversification upon the TPC is highly expected, given the expected research results of the project. Based on the research, it is confirmed that this project may highlight a vision and a road map for transforming TPRI into a global and first-class think tank in the near future, given the possibility of revealing its potential after privatization. The resulting report also suggests the transformation direction and profit patterns for the entire TPC into its future.

The main conclusion is subject to the fulfillment of the following conditions: The functionality of transforming informational asymmetry from the now-given structure of the organization to a laterally and virtually-integrated information structure inside the organization.

The functionality for transforming an internal client-server mode of structure into a market-oriented, internal/external demand and supply structure of dual service condition.

The functionality for transforming the attitude based on order-taking services into the mode of competitive ordering for the niche market.
The functional transformation from the current organization-oriented style into market-oriented, regional operations-oriented, and even global markets-oriented modes of operations with flexible and virtual capability.

The functionality for transforming organizational knowledge into intellectual resources so as to direct itself into a learning and sustainable organization.

This research highlights the value proposition for the TPRI from its roots as a Lab and the capacity of research and development. Basically, with the concept of a Lab platform, the five virtual-operation centers play well designed functions for the transformation of the TPRI. To realize this potentiality, more promised resources from the parent company and a deregulation of some regulatory controls are required to sufficiently achieve the end goal.


In order to realize the objective of The Sixth National Technology Conference, we continue the task of part one of this project and evaluate the achievements of the corresponding responsible government agencies which have implemented strategies one and two. Aside from the above objective, there are three more purposes of this project: first, to investigate the effects of innovations on industries’ competitiveness; second, to analyze the effects of government R&D expenditure on that of the private sector - substitution or complementary effects; third, to study the strategy of strengthening the cooperation between industry and universities.


In order to facilitate the industrialization of Taiwan’s agriculture, this research will first introduce the environment of agricultural development and then divide the agricultural proprietors into three groups: traditional farmers, farmers’ associations, and agribusiness. The study then presents the problems faced by these groups and the policy and mechanisms of Taiwan’s agricultural authority. Secondly, this research extensively gathers the related policies and mechanisms of foreign agricultural authorities and private entities. After analyzing the problems of the three groups and the foreign experience, this research next takes into consideration the opinions of the proprietors and finally give some suggestions about the strategy and approaches to guiding the industrialization of agriculture in Taiwan. The suggestions include:

1. For traditional farmers:
This research suggests that individual farmers may increase the scale of their businesses through a horizontal combination with each other, or through a vertical combination with upstream or downstream proprietors.

2. For farmers’ associations:

This research suggests the agricultural authority to finalize the laws dealing with farmers’ association, to encourage local associations to combine with one other, and to enhance the business and the human resources of the farmers’ associations.

3. For agribusinesses:

This research suggests the agricultural authority to encourage the establishment of local professional agribusinesses, to promote the products of these agribusinesses which are of acceptable standards, and to provide loans at low interest rates.

The Impact of EU Enlargement on Taiwan’s Trade and Investment in Europe,

Ying-Hwa Ku, December 2004. (project no. 735)

The enlargement of the EU will cause significant changes in the European political and economic arena. In terms of population or economic scale, the EU has become one of the most important regional groupings in the world. With improved market access for ten Central and Eastern European countries, the production structures will be remodeled in the new as well as incumbent states. As foreign direct investment (FDI) increases in the new member states, the economic growth rates in these countries will increase and the competitiveness of their industries will improve, putting pressure on their competitors in international trade, such as Taiwan.

The purpose of this project is to inquire into the possible impacts of EU enlargement on Taiwan and the suitable responses that Taiwan can make. We find that, in terms of trade, the new members of the EU present a challenge to Taiwan’s exports of telecommunications equipment, electrical machinery, and electronics parts, among others. However, the new members themselves also present new market opportunities for Taiwanese products. In terms of FDI, the advantage of lower production costs in the ten new member states will attract foreign capital, including that from Taiwan. This offers Taiwanese firms a springboard to Western EU markets, which they have previously served from their Asian production bases. The increasing congregation of manufacturing industries in newly-affiliated member states makes the production in Eastern EU even more competitive. We recommend that Taiwanese firms take a closer look at investment and trading opportunities in the new member states and to think harder about localizing some production in Europe in order to improve their competitiveness at the beginning of this new globalization era.