

The Competitiveness of the Consumer Electronics Industry in Taiwan: An Empirical Study of Transformer Industry

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Abstract: Enterprises in nearly the sectors of the economy are facing a highly competitive and complex business such as the advent of globalization. Economic globalization has forced and is still forcing firms to develop new global manufacturing and distribution concepts. Through the development of economic globalization, every governments and firms in the world is proceeding to reform and redevelop in order to deal with globalization. This paper is an empirical study with in-depth interview of the CEOs of the industry, describes and explores the case of competitiveness of the Taiwanese transformer industry as catalogued by the consumer electronics division in order to discover the collaboration possibilities with its vertical integration or/and horizontal division parties. Moreover, this study also issues external and internal factors which affect the competitiveness for the industry. As firms go global, they must face more and more competitors and figure out how to break down barriers between international and domestic organizations and begin building the competitiveness that acknowledges their respect for the success of innovation and dependence on the home country's expertise. As a result, the competitiveness of the Taiwan firms are 1) production and factory management, 2) internal management, 3) collaboration and 4) internationalization.

Key words: Competitiveness, Taiwan, transforme, consumer electronics industry, value chain, competitive advantage.

1. Introduction

According to Small and Medium Enterprise Administration, Ministry of Economic Affairs Taiwan, in 2015, the average ratio of SMEs (small and medium enterprises) to whole industries was over 97% and the ratio of manufacturing industry to SMEs was over 96.53%. The definition of SMEs in Taiwan is that in the manufacturing, a paid-in capital of US\$2.42 million or less and the number of regular employees must be less than 200. One of the characteristics of Taiwan SMEs is that firms can improve their labor productivity if they can increase their production through exportation. The export ratio in 2015 of Taiwan whole industries to manufacturing industry (SMEs) was over 19%. Transformers for using in electronic devices are mostly categorized under electronics-related industry, and around 100 transformers are recorded in both Ministry of Economic Affairs, R.O.C. and Bureau of Foreign Trade [1]. The industry's exports are on an increasing trend which could be bolstering SMEs' lobar productivity-exporting special order products.

The goal of economic policy is to enhance competitiveness, which is reflected in the productivity with

which a nation or region utilizes its people, capital and natural endowments to produce valuable goods and services. Moreover, considering about firms and their suppliers moving to an area to make cluster to bring the industry be competitive is also always conducted. [2] Mix of clusters carries markedly across regions and countries. "Clusters" is an important driver of competitiveness, drives productivity and innovation. Firms that are located within a cluster can transact more efficiently, share technologies and knowledge more readily, operate more flexibly, start new business more easily, and perceive and implement innovations more rapidly [3]. The achievements of Japanese cluster organizations have caused a sensation around the world. This is especially true for environmental technologies, biotechnology, nanotechnology and new materials, production technology and process engineering. According to P.L. Chang (2003 [4], the appearance of technological clusters in Taiwanese firms is high division of industry and strong integration of supply chains. Clusters are partners to tie new bonds between players on different tiers and parts of the value chain. The output of cluster activities would be open to all cluster group members. Value chain drives the competitiveness of firms; and the goals of the activities in value chain are to offer customers a level of value that exceeds the cost of the activities, thereby resulting in a profit margin. By in-depth interview with CEOs, the results of value chain (added-value) and competitiveness is identified.

2. Literature Review

2.1. Competitiveness

According to product-cycle theories, there is a general life cycle of products: initial development, growth, maturity, decline and obsolescence. The early states of the product life cycle-initial development and growth are said to be closely linked to developed and urbanized regions. This is due to the fact that the innovation phase of product development needs highly qualified employees and venture capital. At the end of product's life cycle, production tends to move to less- developed regions in order to take advantage of lower labor and capital costs [5]. Products management and financial management are important factors for firms and human resources management is crucial factor for firms to keep operation [6]. [7] identifies that the competitiveness of a firm must be distinguished to 1) vertical integration and horizontal division, 2) upstream and downstream supply relationship and 3) competition scenario of the same industry.

2.2. Value Chain and Porter's Value Chain

According to Michael E. Porter's value chain (1985) [8], [9], primary activities from inbound logistics to services and support activities from infrastructure, human resource to technology are the values that exceed the cost of activities, thereby resulting in a profit margin. In 2001, Michael E. Porter [10], [11], from an empirical study of Korean, Indian and South American's industries find that most of multinational enterprises through simulating development countries' economic activities in order to create more values. R.J. Liu (2008) [12] explored the collaboration mode of Taiwan- Japan's firms in TFT-LCD industry. His research discovered that the know-how accumulating mechanism of process equipment makers and the technological innovation of Array and Cell production process the enables the industrial architecture of TFT-LCD shift from closed-integral type into open-modular type. This kind of industrial architecture change enables Taiwan TFT-LCD panel firms who adopt the catch-up strategy shift their slow catch-up speed to rapid catch-up to accumulate integral-matching capability and march toward co- creation to create higher added value.

Firms need to develop a unique set of skills that other organization do not have. And the collaboration with their suppliers and customers are also important. [13] This kind of abilities are supposed to be incorporated into the business's activities, but attaining them requires a detailed analysis of these very activities, which Porter groups under another fundamental notion in his thought-the value chain. Porter

introduces a generic value chain in 1985. Value chain focus on cost management and it would bring internal competitiveness for firms that [14], [15] efforts and allows alignment of process with customers. It provides for efficient process which improves the timeliness of operations. The following drawing is the value chain model.

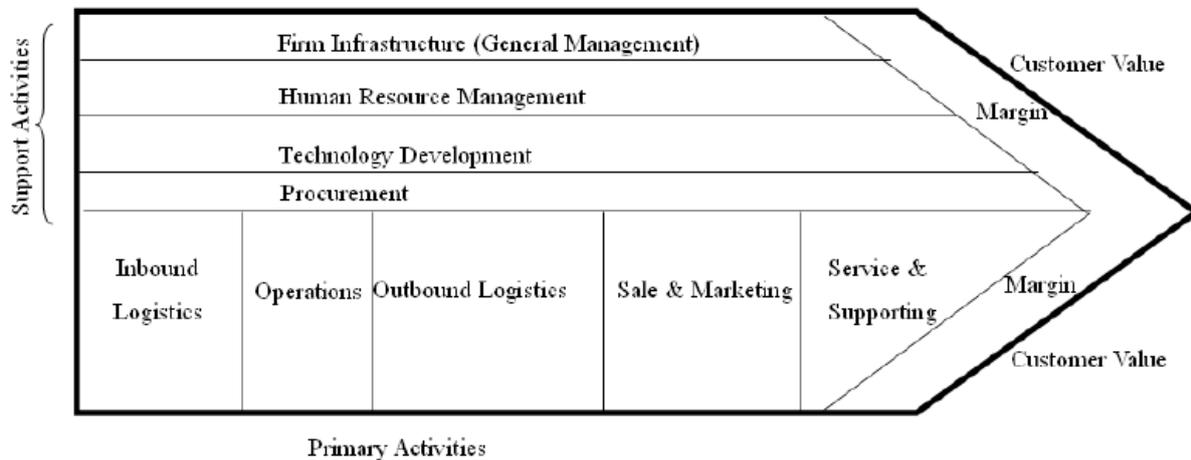


Fig. 1. Michael E. Porter's competitive advantage value chain model [9].

In value chain, there are "primary activities" and "support activities". As Porter conducted, firms might need to be creative in order to develop a novel value chain configuration that increases product differentiation. Moreover, because technology is employed to some degree in every value creating activity, changes in technology can impact competitive advantage by incrementally changing the activities themselves or by making possible new configurations of the value chain. Technology and value chain are explained as follows.

- 1) Inbound logistics technologies: it includes material handling and storage, transportation, communications, educations, testing and information systems.
- 2) Operations technologies: it includes process, educations, material inspections, machine tools, packaging, maintenance, testing, building design and operation and information systems.
- 3) Outbound technologies: it includes: transportation, educations, material handling, packaging, communications and information systems.
- 4) Marketing and sales technologies: it includes media, advertisements, communications, educations and information systems.
- 5) Service technologies: it includes testing, educations, communications, customer/distribution services and information systems.

The business unit is the appropriate level for construction of a value chain, not the divisional level or corporate level. Products pass through all activities of the chain in order, and at each activity the product gains some value. The chain of activities gives the products more added value than the sum of added values of all activities. It is important that not to mix the concept of the value chain with the costs occurring throughout the activities.

3. The Result Form in-Depth Interviews

According to framework of value chain (primary activities), in-depth interviews with CEOs on the Taiwanese transformer industry in Sep. 2015, the coordinated information shows as follows.

- 1) Inbound Logistics:

Taiwan has no nature resources for making transformers same as Japan. The suppliers can provide high-speed services on goods delivery is one of the added added-value for the transformer industry in Taiwan. To shorten the time on purchasing materials to serve final customers' needs efficiently, the relationship between transformer manufacturers and the suppliers are closed. Some of the suppliers' factories are near the firms, and they can provide JIT service for firms. On the other hand, firms enclose forecast to their suppliers helps suppliers prepare materials earlier.

Assembled orders from customers (one season orders or half-year orders) help firms have much more bargain power to the suppliers. However, assembled orders are hard to get because the customers have to predict the market situations and then risk making forecast orders assembled to the firms [16], [17].

Special design and parts of sampling are made in Taiwan R&D, and mass productions are almost transferred to China or the other countries.

2) Operations:

The operations are in overseas like China. The Taiwanese manufacturers have experiences on factory managements. And because there is no language barrier between China and Taiwan, the Taiwanese can transfer the management to China much easier than the other foreign direct investors. Moreover, assembled orders can save operation time and save costs; moreover, it can reduce defection ratio on operation and make the operations much more effectively.

Nevertheless, the quality control of the Taiwanese manufacturers is inferior to the Japanese. Some of the Taiwanese manufacturers even cannot differentiate the differences between unusual product and defections.

3) Outbound Logistics:

The transportation in Taiwan has been developed completely. It includes transportation network and package skills. Firms know how to package products as well to avoid rusting and dumping. Outbound logistics also relates to firms market strategies and international expansions. Firms have to consider where to build factories: to near customers or near materials or more detail about near what kind of customers and what kind of materials (main customers or main materials.) Near customers can reduce the costs of outbound logistics. Supply chain management with high effective logistics management also can reduce costs of firms.

4) Marketing and Sales:

Depends on customers' needs, transformers can be separated to be two types: customization and standard. Firms' standard products with safety certificate (CE, UL, etc.) can attract potential customers to require for samples. And the Taiwanese manufacturers can produce standard products as universal which means the products is suitable for international standard. Most of the Taiwanese transformer manufacturers have a series of certificated products. Firms design and produce customized products usually can bring long time orders from the customers. Notably, while the customers pay the safety-certificates fee, and there is no re-design, it is hard for the customers to transfer orders to the other suppliers.

Firms usually use internet to advertise their products but not trend to join exhibitions on the world. Because they think that joining exhibitions cost a lot and the benefits can not be return immediately; internet (web site) is cheaper and the visibility is almost as same as joining exhibitions.

Firms establish factories in China, it is not only because the lower-labor forces but also the huge market attract them. Most of the Taiwanese transformer firms are located in big cities in China, like Shenzhen, Shanghai, etc. become a kind of "industrial cluster," where then not only can service their customers' nearly but also can get materials faster which means that the supply chain from materials suppliers to final customers are located nearby. The market segmentation is important for the firms. Transformers for audio

equipment using, for car audio using and for cell phone using are different. Transformer manufacturers cannot produce all transformers for different electronic devices. And notably while a firm gets a requirement from new customers that the design is not their fields, they would introduce the customer to the other manufacturers in the industry. Moreover, if firms make similar products and one of them get an order with big quantity that they cannot produce within the delivery date, they will share the order to the other manufacturers as outsourcing.

5) Services:

The products' quality is higher than the other domestic manufacturers in China. And the Taiwanese manufacturers can understand what exactly their customers' needs. However, after few years, China maker can catch up on high qualities products and high services. As an example, few of the famous Japanese customers had transferred their transformer orders from the Taiwanese manufacturers in China to the domestic manufacturers. This is an alarm to the Taiwanese transformer manufacturers.

6) Others:

The Taiwanese transformer manufacturers focus on the series services and communications from suppliers to customers. And also they have higher educated employees who can understand business process as well. Firms focus on employees training in order to service their customers.

According to the CEOs, the current and future developments of the transformer industry in Taiwan are as follows:

- 1) Customers' orders are small quantities with various designs-spend much more time and costs from inbound logistics to services. Firms cannot reach the economy of scales; therefore, the profit is diluted. And the defection ratio on production line is higher. Therefore, "inside integral and outside modular" (refer 3.1.2) will be the tendency.
- 2) Firms develop special transformers, like higher voltage and higher frequency products. Moreover, energy conservation has been a serious issue; how to promote energy efficiency in every aspect and private entitles are implementing the efficient use of energy have become new challenge for the industry. The regulations about RoHS (Restriction of Hazardous Substances Directive), WEEE (Waste Electrical and Electronic Equipment), and REACH (Registration, Evaluation, Authorization, and Restriction of Chemical substances) are noticed. Many customers have started to require for the three test reports. The Taiwanese transformer manufacturers have to understand the regulations and send sample to test. Traditional transformers are going to be eliminated through the international energy consumption tendency.
- 3) Firms have to give up low-end products and focus on high-end transformer producing. Because low-end products do not need high skills or experiences, every new entrant can do mass production immediately, and the profit margin is very much small. Firms attempt to produce high-end transformers must learn from the other developed countries, like the Japanese way, the American way, or the European way: as a later mover.
- 4) Most of the Taiwanese transformer manufacturers are SMEs, horizontal division and vertical integration are needed, and they will help firms to understand the materials and the markets more. Firms prefer vertical integration rather than horizontal division, because the industry is very high competitive (competitive rivalry within an industry). They would like to collaborate with their customers in order to get stable orders or know the tendency of their final market and to collaborate with their suppliers in order to get contracted prices of core, coppers, plastic materials, and the other materials.

About the competitive advantages of the transformer industry in Taiwan, the CEOs' considerations are sorted as follows:

1) Production and Factory Management:

The Taiwanese manufacturers learn from the Japanese and American manufacturing ways. When they go global, they can use innovation to re-develop and reform the production processes by themselves to suit the domestic employees' lifestyle and the level of educations. Because transformer manufacturers need a large number of employees on production lines to make products, factory management is important. Human assets are the most valuable assets to the company.

Moreover, they emphasize production management in order to save costs for firms. Firms focus on BOM (bill of material) and apply software like ERP systems (enterprise resource planning) to plan, revise and integrate business activities on series of production processes from inbound logistics to customer services.

2) Internal Management:

The Taiwanese manufacturers emphasize enterprise self-development. Firms focus on e-commerce and e-business application development, the Internet and computer programming can enhance the communications and relationships of organizations closely. Most of the firms are SMEs and their maneuverability is faster than big firms; they are capable of process engineering or organizational restructuring when necessary. And SMEs can do internal cross-organizational cooperation fast. They are bravely to discover new management ways by their innovation. Firms think that internal factors are much more than externals, because external factors can not be controlled but internal factors can be controlled by the managers of the firms. Firms attach importance to the learning ability of employees and think it is important to make innovation.

3) Collaboration

Firms know their suppliers and the other manufacturers' financial activities as well, because the other manufacturers in the same industry share information and also firms with capitals more than NT\$ 500 millions, their basic financial information are enclosed on Ministry of Economic Affairs 21). They know where to buy materials and the ability on searching new suppliers who can provide new materials are high and this make them advantage on delivery. Moreover, firms would require forecast from customers and provide the forecasts to their suppliers; it causes the delivery date can be predicted and satisfied customers' urgent formal orders. And because some materials are commonly used firms' standard products, if the forecasts from customers are not accurate exactly, parts of the prepared materials can be used to the other products.

4) Internationalization:

Firms established factories overseas in order to take advantage of low labor wage level, near materials or near their customers. And going global bring profits for firms because Taiwan is too small, the market is limited and without nature material resources.

From in-depth interviews with CEOs, the factors to determine the competitive advantage in the Taiwanese transformer industry are emerged:

1) the internal management, 2) internationalization, 3) relationships with their suppliers and customers and 4) production management. Moreover, the CEOs think "the capitals", "employees" and "technologies", are the three important factors on business and "the capitals" is much more important than the other two. And CEOs realize that they are not familiar on their target market because most of them do the job as ODM/OEM factories for international companies.

4. SWOT Result

The competitiveness of the Taiwanese transformer industries are explained. While people talk about competitiveness, the strength, weakness, opportunity, and threat factors must be considered. According to the interviews, the SWOT analysis shows in Table 1 that compares with the Taiwanese transformer

industries.

Table 1. SWOT Analysis

Value Chain Activities	<u>Strength(s): Opportunity (O) & Threat (T)</u>	<u>Weakness (W): Opportunity (O) & Threat (T)</u>
<p><u>Support Activities</u></p> <ul style="list-style-type: none"> •Industrial infrastructure •Human resource •Technology development •Procurement 	<p>The Taiwanese transformer industry</p> <p>S.O.:</p> <ul style="list-style-type: none"> ◆ Clustered upper suppliers: easier to inquiry or purchase materials in one location ◆ High quality employees (on R&D and production line) <p>S.T.:</p> <ul style="list-style-type: none"> ◆ This industry is high competitive ◆ Firms modify equipment and machines in order to cost down 	<p>The Taiwanese transformer industry</p> <p>W.O.:</p> <ul style="list-style-type: none"> ◆ This industry is high competitive ◆ The government does not take care this industry ◆ Most of them are SMEs and the capitals are small ◆ Less brand: ODM/OEM <p>◆ Parts of materials must be replaced, for example, varnish for transformers insulation is hazardous substance</p> <p>W.T.:</p> <ul style="list-style-type: none"> ◆ Firms develop by themselves less observe to the changes of external environment
<p><u>Inbound logistics:</u></p> <p>Firms have to observe the influence of fluctuant international material prices. And they create different level materials and different level's products according to customers' needs. Material warehousing control is important because products are trended to various and less quantities. Materials are up rising.</p>	<p>The Taiwanese transformer industry</p> <p>S.O.:</p> <ul style="list-style-type: none"> ◆ Closer relationships with their current suppliers: forecast, contract prices ◆ Using internet and e-business systems to control storages <p>S.T.:</p> <ul style="list-style-type: none"> ◆ No counterfeit materials ◆ Special materials are controlled by Japan and America, etc. 	<p>The Taiwanese transformer industry</p> <p>W.O.:</p> <ul style="list-style-type: none"> ◆ Imitate mutually products to make new ones by themselves: do not creating ◆ Different kinds of products but small quantity each to causes hard to reduce materials costs <p>W.T.:</p> <ul style="list-style-type: none"> ◆ Lack of motive power to create new products: no innovation
<p><u>Operations (included R&D)</u></p> <p>The technology on making traditional transformers is developed maturely. Transformer. The factory</p>	<p>The Taiwanese transformer industry</p> <p>S.O.:</p> <ul style="list-style-type: none"> ◆ ODM/OEM for international companies and they provide production technologies and factory management methods for firms: learning the experiences 	<p>The Taiwanese transformer industry</p> <p>W.O.:</p> <ul style="list-style-type: none"> ◆ Material delivery causes production schedule needs to be adjusted ◆ Reducing energy consumption design-the threat of substitute

<p>management and quality control are important. Labor charge, social insurance charge, and basic business activities costs are up rising.</p>	<ul style="list-style-type: none"> ◆ High mobility and adoption to satisfy different customers' needs: urgent orders ◆ Good management on quality control S.T.: ◆ Firms produce forecast in order to suit for customers' urgent order ◆ In some season, orders and labor forces are problem: unbalance 	<p>products</p> <ul style="list-style-type: none"> ◆ They lack for studying on new technology or technology upgrade W.T.: ◆ Firms do not share: developing by themselves: lack of study from the other manufacturers in the same industry (especially on energy saving technology) ◆ The ratio of employees leaving company is high (production lines)
<p>Outbound Logistics Both inbound and outbound storage controls are important: customers' forecasts and real order control. Package and warehousing are important. Transportation charge is up rising.</p>	<p>The Taiwanese transformer industry S.O.:</p> <ul style="list-style-type: none"> ◆ Manufacture in both Taiwan and overseas can delivery to customers directly. ◆ Firms have good international trading knowledge and experiences ◆ Transportation charge is cheap <p>S.T.:</p> <ul style="list-style-type: none"> ◆ Activities for customers' JIT systems 	<p>The Taiwanese transformer industry W.O.:</p> <ul style="list-style-type: none"> ◆ Fuel charge is up rising <p>W.T.:</p> <ul style="list-style-type: none"> ◆ Recycle problems and environmental protection rules
<p>Sales and Marketing Firms have to understand their target market in order to produce satisfied products. The demand for consumer electronics affects the supply to transformers.</p>	<p>The Taiwanese transformer industry S.O.:</p> <ul style="list-style-type: none"> ◆ Cooperate with downstream and customers can save marketing investigation (exhibitions, advertisement) costs for firms ◆ Some of the firms consider diversifying their business in relevant or irrelevant industries <p>S.T.:</p> <ul style="list-style-type: none"> ◆ If customers pay safety certificate charge, the product will belong to the customers ◆ Orders are controlled by buyers. Although orders quantity normally stable but prices is a main factor to attract customers 	<p>The Taiwanese transformer industry W.O.:</p> <ul style="list-style-type: none"> ◆ Firms are weak to understand international situations on the go, especially the situations in Europe and the U.S. (international materials center is in London) <p>W.T.:</p> <ul style="list-style-type: none"> ◆ Most of the firms do not have brands. They do as the jog of ODM/OEM to international companies. Price is important. Developing countries like China, India and Vietnam are developing and upgrading their operation abilities and the prices attract customers ◆ Lack for market trend data of customers' love ◆ Own brand is hard to expand to international market because it costs a lot of capitals

<p>Services and Supporting Customer services including speed and communication are important. Firms have focus on employees' education.</p>	<p>The Taiwanese transformer industry S.O.:</p> <ul style="list-style-type: none"> ◆ Employees can speak foreign languages ◆ Firms have plenty production and factory management experiences ◆ Base on current technologies, firms are glade to search for new suppliers who can provide cheaper and better quality materials <p>S.T.:</p> <ul style="list-style-type: none"> ◆ Trading polices: WTO (world trade organization), ECFA (economic cooperation framework agreement), etc. 	<p>The Taiwanese transformer industry W.O.</p> <ul style="list-style-type: none"> ◆ The cost up raised, especially on materials are understood by customers. Firms' revised quotation sometimes can be accepted; however, customers may incline to search second suppliers where can provide lower prices <p>W.T.:</p> <ul style="list-style-type: none"> ◆ Lack of information integration
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The Taiwanese transformer manufacturers are advantage on searching materials to cost down, factories management (overseas), production management (manufacture processes control), and customer services. Firms would like to cooperate with their customers in order to know their market clearly. Moreover, firms collaborate with their suppliers in order to get contract prices and make a long time business with their suppliers.

Furthermore, for the industry, they need to face the tendencies of:

- 1) Energy saving products will be the main stream in the world, especially on consumer electronic devices.
- 2) Environmental protection rules: firms have to do actions on WEEE, RoHS and REACH, etc.
- 3) Material cost-up and cost-down rapidly: The main material of copper price from US\$ 3,310/ton (2005/6/30) to US\$ 6,515/ton (2010/6/30) and cost down to USD5,859 (2017/2/17) . The prices up and down make firms hardly to control their stock: Firms have to predict if the materials will be price down or price raise or the losses will be huge because cooper wire takes around 1/3 weight of a traditional transformer. And the rising wages: China labor wages has been rising and because this is an traditional industry, most of the factories had been moved to China since 1990. Between 1978 and 2007, the average real annual wage for staffs and workers grow more than sevenfold from 3,285 to 24,943 yuan (Taiwan dollars). In the period 1998-2007, wage growth accelerates to an astonishing 13.20%. This period of wage explosion has been coincided with China's preparation for and accession into the WTO.

Case studies show that Taiwanese companies emphasize enterprise self-development; they know their marketing is weak but they do not know how to search new customers overseas. And even they find potential customer, they would worry about customer's financial situations. Moreover, they are also worried about competition from newly-emerging countries and new technology replaces the current technology. Furthermore, about the future development of this industry, since the government subsidizes the hi-tech industry more than it does for traditional industries, firms do not think this industry will be developed in China but firms will try to survive. As the CEOs say, "no dead industry or production, they just move to the other place and find their survival ways there."

5. Conclusion

Under the circumstances of the economic globalization and the varied environments, firms must face more and more competitors and they must overcome these core challenges. Their immediate challenge is to break out of the mind-set that they cannot compete successfully on the global stage. Growth of firms is

important; thus, determining how to learn from the constant flow of new demands, opportunities and challenges is the main task for firms. As a result, the competitiveness of the Taiwan firms are 1) production and factory management, 2) internal management, 3) collaboration and 4) internationalization. We suggests that the firms have to respect on their internal management while the go overseas.

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