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The Hidden Competitiveness of the Japanese Manufacturing Industry

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Abstract

There is pessimism about the manufacturing industry in Japan. The Japanese electronics industry, especially, has been seen as losing its competitive advantage, especially by comparison with South Korean and Chinese products. However, evaluating manufacturing competitiveness is not only a factor of total sales or end-product market share. Measures should also consider the uniqueness of products, such as non fungible production and manufacturing process (custom-made products and processes). Japanese end-product manufacturers such as Sony or Panasonic are losing competitiveness in the market, while industrial component suppliers, which mostly manufacture automotive and electronics intermediate products, have been developing strong relationships and networks. There has not been much research into Japanese intermediate component suppliers and their manufacturing capability. This study proposes that the future trend of Japanese manufacturing competitiveness is in transforming from end-products to intermediate components, and seeks to empirically prove that the key to this transformation is the suppliers' ability to produce non fungible goods.

Keywords*: Intermediate products, the Principle of Full-Set, the ASEAN Linkage Model of the Full-Set Principle, Integrated Manufacturing Process, Competitive Advantage*

1. Introduction

Japan has been making progress in foreign direct investment (FDI) in East Asian countries, and in some other developing countries due to the remarkable economic growth in these countries. FDI has encouraged the transfer of technologies and promoted improved QCD (quality, cost, delivery) measures in local suppliers. Engineering competition in East Asia has established a global supply chain system, which has in turn created opportunities for an international specialization structure.

However, Japan still tends to measure the strength of its manufacturing sector only in terms of the sales or market share of major end-product electronics manufacturers such as Sony, Panasonic, and Sharp. Japanese end-product electronics are losing their competitive advantage and it can be assumed that this trend will continue for the foreseeable future. Global supply chains, with specialized manufacturing structures in East Asia might accelerate the concern over deindustrialization in Japan at the same time.

In contrast with growing pessimism, Japanese automotive and electronics suppliers have been establishing close and significant relationships with ASEAN countries. In fact, the more that

FDI progresses, the stronger the competitive advantage of Japanese industrial suppliers. The competitiveness of the Japanese industrial cluster is rooted in intangible factors such as QCD, and inimitable manufacturing capabilities which are refined by repetitive manufacturing, integrated product and process engineering with clients over a long period.

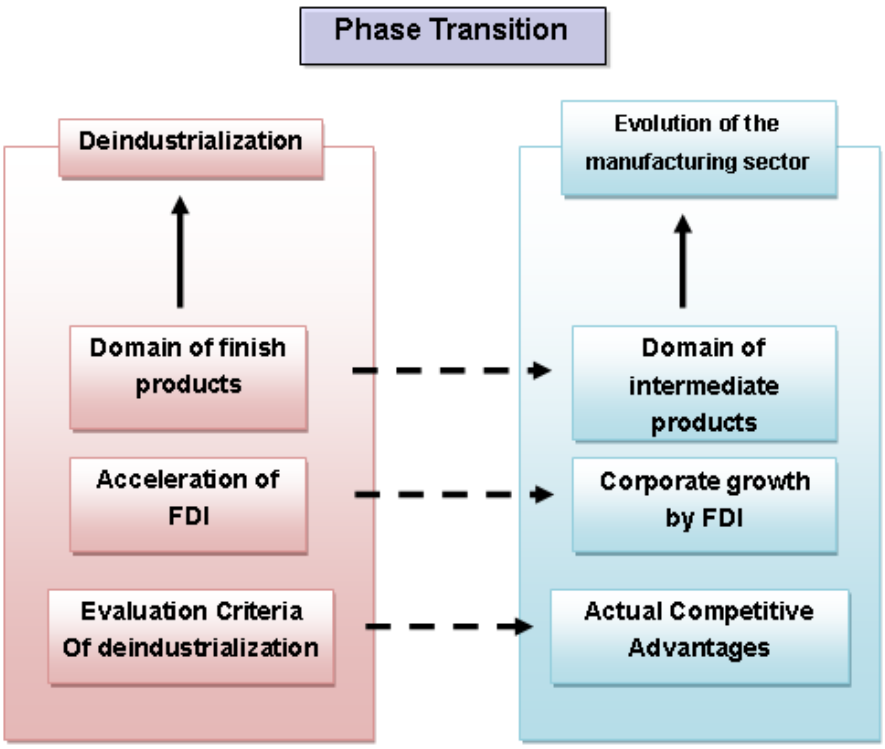


Figure 1: Framework of research question

Thus, it's very important to understand that the Japanese competitive advantage is now shifting from the end-product domain to intermediate components, which consists of unit products, and the non-functional parts domain, supplying Chinese and Korean end-product manufacturers. Therefore, the Japanese competitive advantage in manufacturing has shifted to a behind-the-scenes role that is often invisible to the final consumer.

2. The Background of the Japanese Manufacturing Industry

2.1. The End of the Full-Set Principle

The Japanese economy developed as a processing and trading country which relied on importing raw materials and manufacturing commercial products for export from these materials. Despite the small size of the country Japan has established high-density integrated industrial clusters and technology agglomerates, such as steel, shipbuilding, chemical, automotive, electronics and textile industries. They have also promoted multi-skilled labor and improved productivity at the same time, because there was no concept of reliance on foreign workers, even during periods of rapid economic growth. In addition, unique cultural factors, such as the focus on harmony and unity, resulted in "*keiretsu*", which can typically be seen in the automotive industry's vertically integrated subcontractor system.

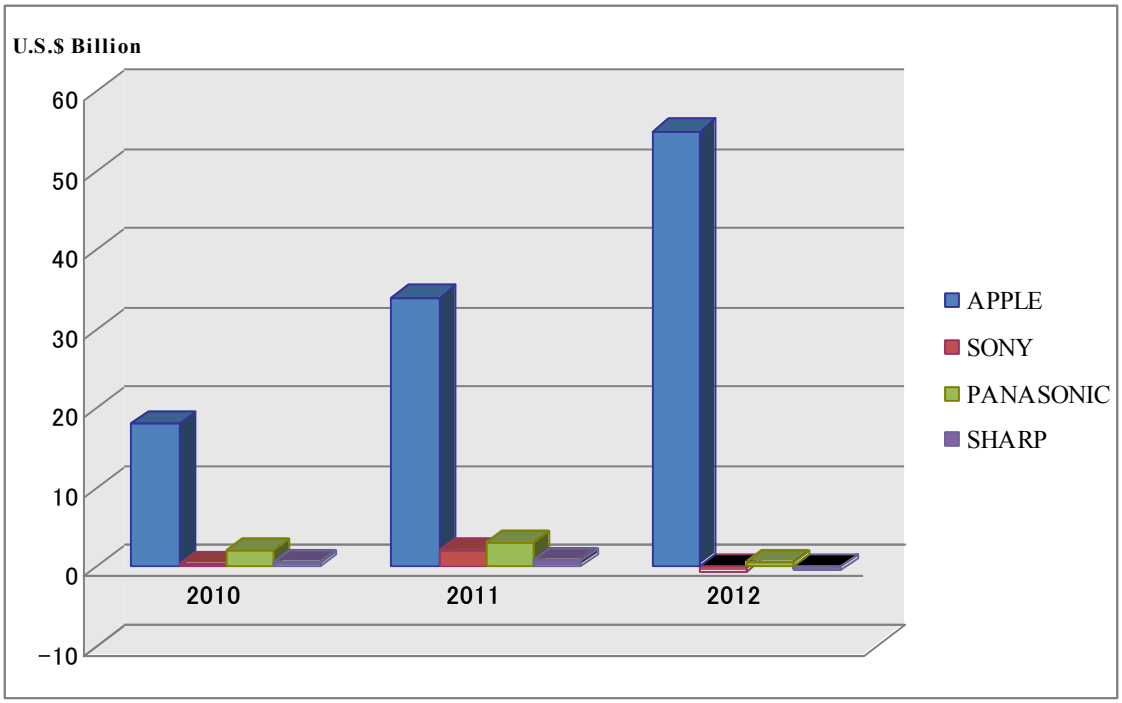
Looking back on the economic history, the principle of full-set manufacturing (exporting all kinds of finished products) became established as the normal model, as well as the driving force behind Japanese development: it has been effective in resource procurement and the acquisition of foreign currency by generating an ongoing trade surplus. Japanese industries' target markets used to primarily be developed countries, such as the U.S., but increasingly this has been shifting towards the Chinese and ASEAN markets as a result of market saturation, stagnation since the collapse of the Japanese bubble economy in the early 1990s, and so forth.

The Japanese version of full-set manufacturing is extremely unusual, because it's based on covering all different kinds of manufacturing processes and industries domestically. However, Japanese basic industry, such as the mechanical industry, has been shrinking since the 1980s because young people tend to shy away from the blue-collar working environment which is typically referred to in Japanese as, “dirty, dangerous, and difficult” *(kitanai, kiken, kitsui)*. There are some entry-level blue-collar job openings in basic industry, but young people don’t want these jobs, so many SMEs are closing down even though many of them possess competitive technology. On top of that, many SMEs in the manufacturing sector are facing succession problems because of a shrinking working population. Thus, Japan's full-set structure is collapsing, so now it’s important to shift the manufacturing paradigm to a full-set model that incorporates collaboration and linkages across ASEAN and other South East Asian countries rather than simply within Japan.

2.2. Circumstances of Japanese End User Products

It would be appropriate to evaluate the Japanese electronics industry as well as automotive industry, because these industries are technology intensive and have always been a symbol of the strength of Japanese manufacturing. Electronics end-products include a wide range of intermediate products, for example semi-conductors, microchips circuit boards, and so on. Japanese electronics manufacturers have been losing competitiveness to American, Korean, Taiwanese and Chinese manufacturers since the early 1990s.

Fig. 2 indicates that comparison of operating income of Japanese leading electronics manufacturers.



(Note)Sony and Panasonic accounting principles based on the U.S. ($1 = 80 yen)

Source：Retrieved from each financial report from HP

Fig 2: Comparison of operating income of Japanese leading electronics manufacturers

It seems that the diversification of market values and shorter product life cycles has been recognized by developing economies in East Asian countries. With a globalized market end-product manufacturers should pay careful attention to the market demands, otherwise even a big investment wouldn't bring the expected returns and ends up in price competition. Therefore, focusing on R&D to create hi-specs products, which is called technology-push theory, might be risky. High technology products rapidly become regular commodities, and decrease in profitability, and eventually the small profit margins wouldn't be able to cover the costs of essential R&D in the future. This might be the case with many leading Japanese electronics manufacturers as seen at Fig. 2.

As noted before, the Japanese competitive advantage in the electronics industry is its comprehensive and integrated production system from raw materials, to trial production process, to finished product and sale. However, this system doesn't allow Japanese manufacturers to compete, as these manufacturing systems prefer high quality over lower price. A certain level of quality and price are sought in the global market so components are outsourced to electronics manufacturing services (EMS) or foundries to decrease the manufacturing cost, thereby gaining access to the EMS' specialized technology and quality.

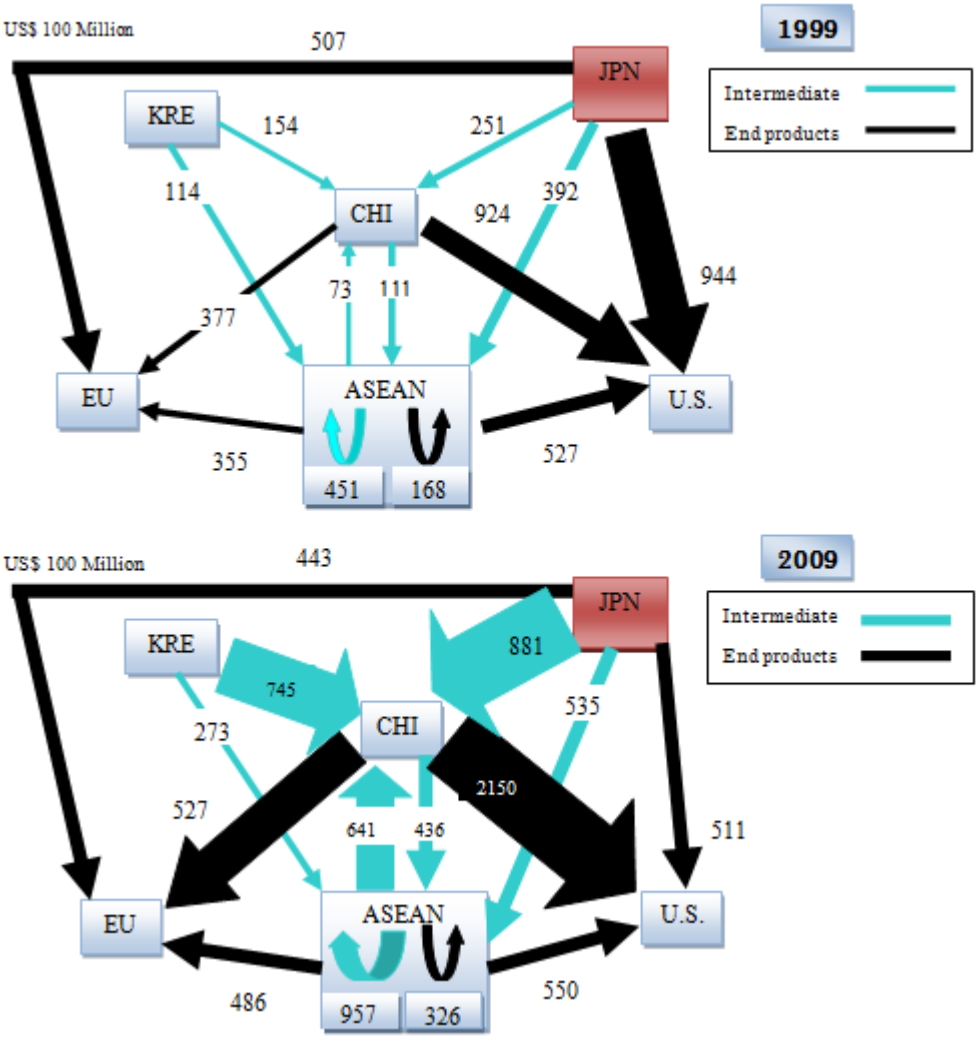
Fig. 2 indicates the result of the current strategy adopted by major Japanese electronics end-product manufactures. For example, PCs use a horizontal specialization model in which products are assembled from modular components produced by specialist manufacturers. On the other hand, digital consumer product manufacturers prefer the vertical specialization model with an integrated manufacturing system, from R&D to the design of production machinery. Integrated manufacturing systems not only contribute to differentiation and shorter lead times, but also specialized technology, which promotes cost reduction. Despite this Sony and Panasonic still

uses a vertical specialization system, but prioritize securing short-term corporate profits, instead of protecting its own R&D and technological DNA. The decline in manufacturing engineering, as a result of the collapsing of the integrated manufacturing system and acceleration of outsourcing is concerning.

There is, at most, a 50% disparity in the self-manufacturing ratio between the above major electronics manufacturers. And it reflects in their revenue. This integrated manufacturing system might be the key to the reactivation of Japanese electronics end-product manufacturers.

2.3. The Circumstances of Japanese Intermediate Components

Fig. 3 shows the export flow of end-products and intermediate components from Japan to the world. It is easy to see that the value of intermediate components exported from Japan to the ASEAN region is increasing. By contrast, end-products exported from Japan to U.S. are decreasing. These trends actively indicate the growing popularity of the ASEAN linkage model of the full-set principle over the Japanese domestic full-set principal.



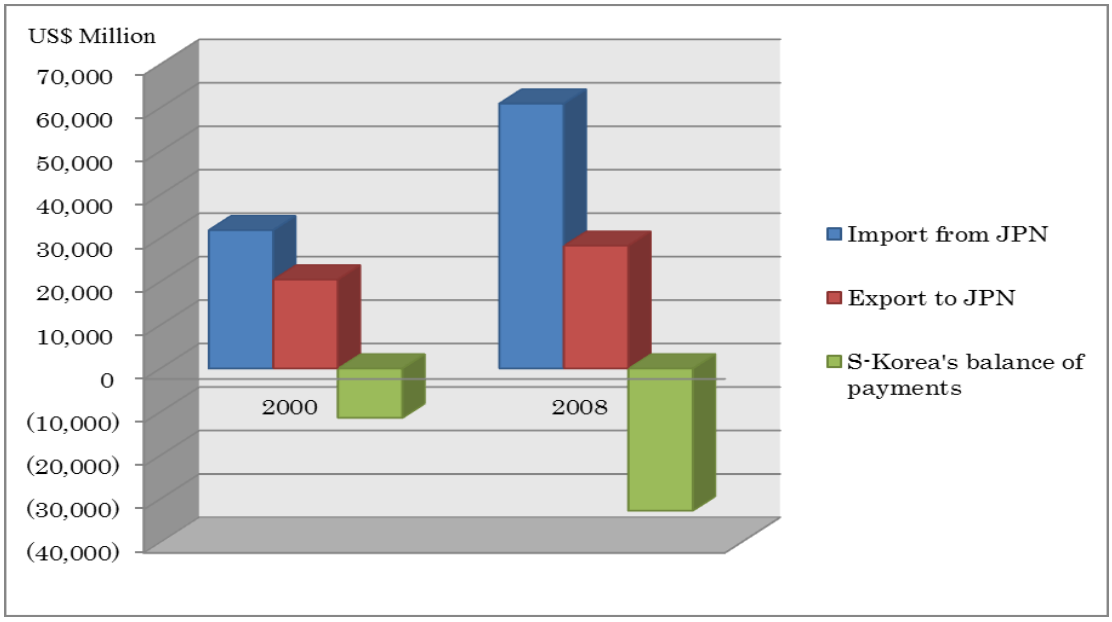
Source: *Trade White Paper 2011*

Fig. 3: Transition trend between end products and intermediate products

It is difficult to quantitatively prove that the Japanese competitive advantage is in the intermediate components domain. However, for a good example of how the technology is non fungible, look back at the earthquake in Niigata Japan in 2004. Many SMEs who manufactured intermediate components were devastated by this earthquake and it disrupted the supply chain. As a result Japanese manufacturing industries have been focusing on establishing BCP (Business Contingency Plan) measures to prevent disruptions in the supply chain.

However, many SMEs were devastated and the supply chain again disrupted by the Great East Japan earthquake in 2011. The reason why major manufacturers couldn't find a way to protect the supply chain was the density of the supporting industry; this density is difficult to measure because it has grown rapidly ever since the 1950s boom and the growth was unplanned and uncontrolled, with different tiers of suppliers, making it very difficult to map the full supply chain. Gradually major manufacturers are recognizing that beyond around the 2nd tier level their knowledge of their supporting industry is limited. In other words, the non fungible capabilities and density of the Japanese support industry are important sources of Japanese manufacturers' competitive advantage. However the manufacturing capabilities and competitive advantage of Japanese intermediate suppliers are not very well known, even by most Japanese, so this is a critical weakness in the Japanese end-products domain, which has resulted in loss of confidence and market share when supporting industries were disrupted.

Meanwhile, Fig. 3 also shows remarkable growth in South Korean intermediate components. Fig. 4 shows the Japan-South Korea balance of payments for intermediate products. Looking at the two figures it clarifies that South Korea's increased intermediate components industry and competitive advantage is undoubtedly contingent on Japanese intermediate components, and as such indicates the potential of this area.



Source : *JETRO "Basic data on the relationship between Japan-S-Korea economic 2009"*

Fig. 4: Japan-South Korea balance of payments for intermediate products

Fig. 4 shows that South Korea is dependent on Japanese non-functional components and raw materials. Therefore, the development of South Korea's intermediate components is dependent on Japanese components, although the density of the supporting industry and its qualities are totally different from Japan.

For example, the South Korean automotive intermediate component industry is growing by up to US $200 million a year, but the volume of exports to Japan is only 3%. Possibly there is a technological, quality or reliability gap between Japan and South Korea and other ASEAN industries that prevents the re-export of products to Japan.

East Asian industries have a different economic background from Japan. East Asian industries are facing global competition from the very beginning and have to achieve good results in a short period of time. East Asian industries have no time to cultivate and develop their own original technologies, nor the know-how to exert competitive advantage. By using Japanese methods such as "*kaizen*" Japanese industry has created its own unique competitive advantage because of these technological capabilities[1] which are based on implicit knowledge, and as such this capacity is non- transferable, as well as non-frangible. Thus, the Japanese competitive advantage in intermediate components industries should be sustainable.

3. Empirical Analyses

3.1. Analysis of the Integrated Manufacturing Structure and Competitive Advantages

Generally speaking "Manufacturing" is associated with the final processes, the end-product, but in modern manufacturing the process normally involves several suppliers, as well as millions of complicated manufacturing processes; in order to produce the end-product each suppliers and manufacturing process must be performed property. Japanese production and manufacturing technologies are unique and provide a competitive advantage. These capabilities have been developed through repeated integrated engineering in response to customer demand.

Fig. 5 is the matrix of Architectural Positioning Strategy (Fujimoto 2004) which will indicate the mechanic of the Japanese intermediate components' competitive advantage.

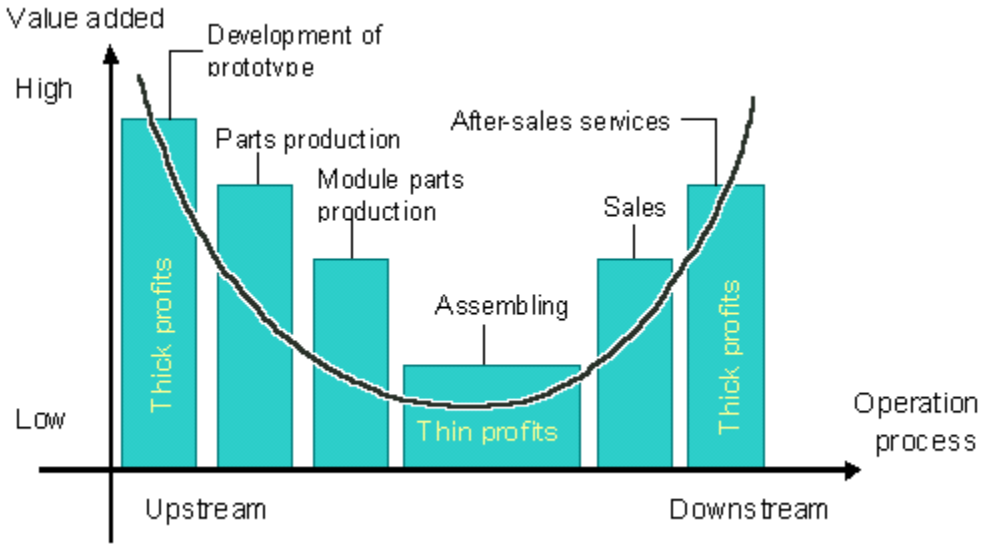
[1] Up to this point in the study, SMEs whose role in Tier 2 or 3 in Japan have been promoted up to the level of Tier 1 or 2 by the FDI. This indicates the fact that SMEs are initiatively learned from clients with new production process and technique as well as invest for expands the facilities. For instance, not only supply the specialized components but also combine and supply different components to make unit products or expand from own manufacturing process to plating process or heat treatment process. In this way, sales and profit are improving as well as come across more than several fold from headquarters in many SMEs occasionally because once SMEs recognized as dependable, demand and expectation from clients with manufacturing process of level or range will be high in overseas.

		Integral *Customer's products* **Modular**
Integral *Own products*	**Integral IN・Integral OUT** Improve technology and competitiveness to keep up with strong leading companies	**Integral IN・Modular OUT** Tendency towards High profit
Modular	**Modular IN・Integral OUT** Correspond to put the common parts to practical use	**Modular IN・Modular OUT** Reducing the cost by the advantage of scale

Source：*Takahiro Fujimoto "Philosophy of Japanese Monozukuri" 2004*

Fig. 5: Architecture Positioning Strategy

Stan Shih's "Smiling Curve" theory proposes that R&D, the design of drawings and manufacturing unit components processes tend to be more profitable than assembly and sales processes. Most fabrication processes in Japan have been transferred to Asian countries because this process doesn't really require engineering integration, and as using Japanese labor is irrational.



Source：*RIETI Economic Policy Review 4, Toyo-Keizai Shimposha 2002*

Fig. 6: Illustration of Smiling Curve

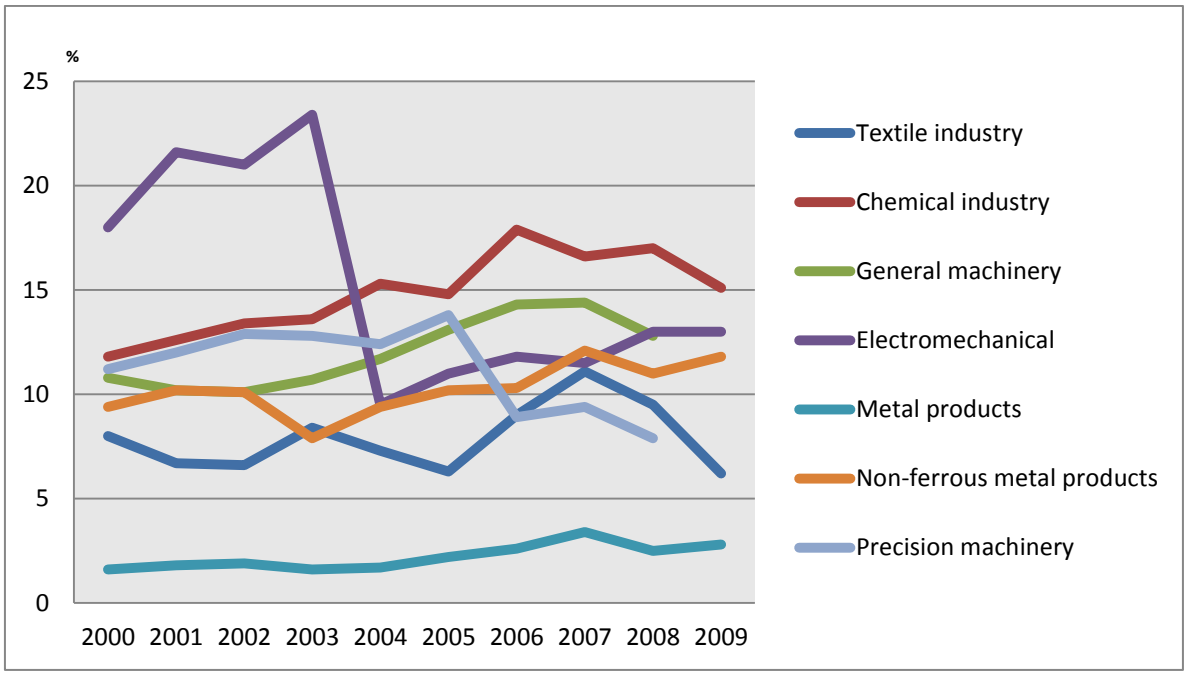
TPS[2] is a typical example of the integrated engineering system, as well as illustrating key concepts in the Japanese competitive advantage. The accumulation of technology, developed through repeated integrated engineering processes between suppliers and clients; these technological accumulations consisted of implicit knowledge such as the design of manufacturing processes and manufacturing technology. This implicit knowledge is black boxed and non-transferable so it will tend to create higher entry barriers as well. According to Fujimoto, "integrated products would function and perform only if specifically designed drawings for products as well as manufacturing process; developed by mutual adjustment and optimization" [3]

However, as can be seen in the matrix in Fig. 5, the characteristic of each position; Japanese intermediate components suppliers tend to position on the two upper levels of the model. "Integral in - Integral out" products are 100% custom made products and these products are not mass produced. If these specific products shift to the mass production stage, they are successful, but if not then, while technology itself has improved, it's difficult to acquire sales or profit. On the other hand, "Integral in - Modular out" products are integrally designed, but those unit products are installed and consumed as general consumption products such as microprocessors in PCs, which will always be mass produced. Products which are in this position would be able to receive not only stable production forecasts, but also higher profit, because these intermediate components manufacturers are based on the integrated manufacturing process and construct higher entry barriers. This is the basic idea and structure of Japanese intermediate components competitive advantage.

However, one needs to find out whether Japanese competitiveness is really non-transferable or not. Fig. 7 shows the overseas production ratio, categorized by industry. This data includes end-product manufacturers, but this could still be dependable because there is a similar trend in intermediate components suppliers, because it will be more efficient for them to supply components to physically near clients.

[2] Toyota Production System: A production system which is steeped in the philosophy of "the complete elimination of all waste" imbuing all aspects of production in pursuit of the most efficient methods.

[3] Fujimoto, T. *Globalization and Japanese Manufacturing* (Hoso University kyouikushinkoukai 2012), P62.



(Note) Chapter from the old classification table as a new industry classification FY 2009
Source : *METI "Basic survey of overseas business activities 2009"*

Fig. 7: Overseas production ratio by industries

As you see in figure 7, the overseas production ratio is under 15%, except in the chemical industry. There is a technical gap between simply providing high quality products at a low volume, and mass production with high quality control. In the broad sense of the term, manufacturing capability; which includes unique design of production machinery, production process, design capability and customer service; is not something that can be built in a day. High-tech products or industries, as well as the unique production processes which are essential, are developed by an integrated relationship with the customer. Thus, to establish and develop integrated manufacturing capability will take a long period of time and it can be assumed that it would be very difficult for foreign countries to transfer or imitate these capabilities in a short period of time.

Production machinery is evolving day by day and it doesn't rely on just technological experience with conventional machinery. On the other hand, each production machine has mechanical properties and habits so it is important to recognize that implicit experience is still valuable in the implementation of quality control. Thus, Japanese manufacturing distinctions are in structured, integrated systems, which are difficult to transfer and imitate; this distinction is different from the structural modular system employed by companies such as Apple or other Asian Companies.

4. Conclusion

The source of the Japanese manufacturing competitive advantage can be transferred from end-product paradigm, which lasted until around the year 2000, to the new intermediate components paradigm in order to quickly establish competitive superiority. It would be difficult for other countries or companies to catch up with or copy the Japanese competitive advantage since this advantage is the cumulative result of more than 60 years of integrated production and

manufacturing expertise by Japanese SMEs, which has been accumulating since the 1950's. Also production and manufacturing technologies usually based on tacit knowledge and are non-transferable. This analysis is based on interview-based research with SMEs operating in the ASEAN area and has been neutrally and objectively considered.

Fujimoto (2003), Nobeoka（2011）and other researchers contend that Japanese suppliers should have been more profitable because of their production and manufacturing technologies, however it is important to bear in mind that most owner-managers are reaching 60 plus years old and it is increasingly difficult for them to develop their strategies to connect their capabilities and profit. Moreover, they are facing trouble finding successors. Thus, even though Japanese process innovation is competitive at this moment, the outlook is not entirely optimistic for Japanese suppliers. It is important for Japanese suppliers to recognize that technology push theory is not always invincible and to respond to the market demands as well as forge a global supply chain across China and ASEAN countries, as these countries are developing significant close cooperation relationships. A paradigm shift is required from Japanese full-set manufacturing to an ASEAN linkage full-set manufacturing paradigm. In order to achieve these Japanese manufacturers need to evaluate and modify their past management and manufacturing practices from a neutral point of view.

5. Implications

Typified by TPS, Japanese manufacturing systems have long been the global symbol of efficiency, and have been studied by many researches up until the 1990s. However, a lot of Japanese manufacturers don't make much profit because they believe the technology-push theory is more reasonable than the market-pull theory, which means that if manufacturers make good quality products, then they will automatically be chosen by the market, rather than responding to or predicting market demands.

This paper draws attention to the fact that the Japanese domestic full-set structure is collapsing, and that market circumstances are changing, with a trend towards an ASEAN linkage full-set structure. This changing of phase, if exploited correctly, offers Japanese manufacturing a significant chance for competitive advantage and growth by refocusing from the end-product domain to the intermediate components domain.

Understanding this phase transition, as well as the competitiveness of Japanese suppliers, and the underlying mechanics of this competitiveness, are significantly important for both manufacturing industries and investors for clarifying the dynamic of the Japanese manufacturing industries. This research also advises both manufacturing managers and engineers to recognize that R&D should follow the market-pull theory, supported by an ASEAN linkage supply chain, not technology-push theory.

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