Innovation in the Japanese Chemical Industry, Which Supports World Electronics Industry

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I. Introduction

This article focuses on innovation by outlining the history of medium-sized chemical companies in Japan and analyzes the factors that resulted in their success[1].

Industrialized countries always face attempts to keep pace with the economic challenges of emerging countries, which have recently entered the industrialization phase, irrespective of era or region. The development of technology standards in emerging countries allows them to enter product areas that were initially monopolized by industrialized countries. Such competitive situations result in industrialized countries losing their competitive advantage to emerging countries, which often have lower labor and production costs. In the1980s, Japan demonstrated enormous competitive strength on an international level in the electronics industry. However, in recent years, with the emergence and growth of companies based in Taiwan, China, and Korea, the market share of Japan's electronics companies have fallen into a slump. Sony's FY2012 ending deficit balance was recorded at its worst. Similarly, Panasonic and Sharp recorded large-scale deficits for the same fiscal year. Evidently, the future of Japan's electronic industry is in jeopardy.

1) The content of this paper is largely based on Kikkawa and Hirano (2011).

To ensure that the decline of specific industries does not cause the overall decline of the economy, industrialized countries face the necessity of perpetually fostering new pivotal industries. However, the development of these industries is rather difficult. The reason for this difficulty is easily understood by exemplifying the state of the U.K., formerly known as the "world's factory." In fact, Japan currently finds itself in the same predicament as the U.K. Despite the slump in the electronics industry, which was once the driving force behind the Japanese economy, no enterprises in other growing industries have emerged to assume the role of a leader for the next generation. For example, Japan's development in the IT industry, has fallen short of other industrialized nations. Japan is yet to create a company in the IT sector that is strong enough to compete with international companies such as Apple and Google. Furthermore, Japan has failed to develop a biotechnology industry.

In this current state, Japan's chemical industry can be considered a pivotal industry for the next generation. The remainder of this paper attempts to clarify four points: (1) Why are expectations focused on the chemical industry in Japan? (2) Within the chemical industry, which companies have a strong competitive edge? When answering this question, it becomes clear that medium-sized companies commonly possess this edge. (3) Why is it that medium-sized companies and not large enterprises have a competitive edge? (4) What successes have these companies garnered? By examining historical cases, this article focuses on innovations that have led to these companies' success.

II. Why are expectations focused on the chemical industry in Japan?

There is low domestic familiarity with Japan's chemical industry. For example, the public response to the question, "Which Japanese enterprises are you familiar with?" is likely to be answered with electronics or automobile companies, such as "Sony" or "Toyota," and not chemical companies. Furthermore, although a review of academic research provides sufficient information on Japan's international competitiveness, most of it cites non-chemical industries, such as the automobile industry (Clark and Fujimoto 1991). There is little research that deals with Japan's chemical industry.

One reason for such low public familiarity with Japan's chemical industry is the nature of the chemical industry itself. Because most chemical products are industrial goods, and not consumer goods, the average consumer is unaware of the utility of such products and does not have as much opportunity to directly see the products.

However, there are two fundamental reasons for this lack of awareness: (1) no Japanese chemical company ranks among the world's top 10, and (2) profitability of Japan's large-scale chemical companies is relatively low. As seen in **Table 1**, although Mitsubishi Chemical Corp. has the largest turnover in Japan, it ranks only 14th worldwide and has relatively low profitability.

In fact, there are many products that we use in our daily lives that are produced by Japan's chemical industry. For example, the liquid crystal displays (LCD) in notebook computers, which many of us use, are largely made from materials produced by Japanese companies. In addition, mostly

Table1. Sales and Net Operating Profit in Chemical Department (2008)

Rank	Company	Nationality	Sales (US$ Millions)	Net Operating Profit (US$ Millions)	ROS
1	BASF	Germany	70,485	3,857	5.5%
2	Dow Chemical	USA	57,514	2,172	3.8%
3	Ineos Group	England	47,000	—	—
4	LyondellBasell	Netherlands	38,420	-3,079	-8.0%
5	ExxonMobil	USA	38,388	2,957	7.7%
6	SABIC	Saudi Arabia	34,407	9,769	28.4%
7	Sinopec	China	33,795	-1,921	-5.7%
8	DuPont	USA	30,387	2,806	9.2%
9	Total	France	29,676	-85	-0.3%
10	Taiwan Plastics Group	Taiwan	27,476	1,322	4.8%
14	Mitsubishi Chemical HD	Japan	18,614	-642	-3.4%
19	Mitsui Chemicals	Japan	14,388	440	3.1%
28	Shin-Etsu Chemical	Japan	11,614	2,253	19.4%
—	JSR	Japan	4,061	598	14.7%
—	Tokuyama	Japan	2,213	352	15.9%
—	Kuraray	Japan	2,289	378	16.5%
—	Nissan Chemical Industries	Japan	1,450	136	9.4%

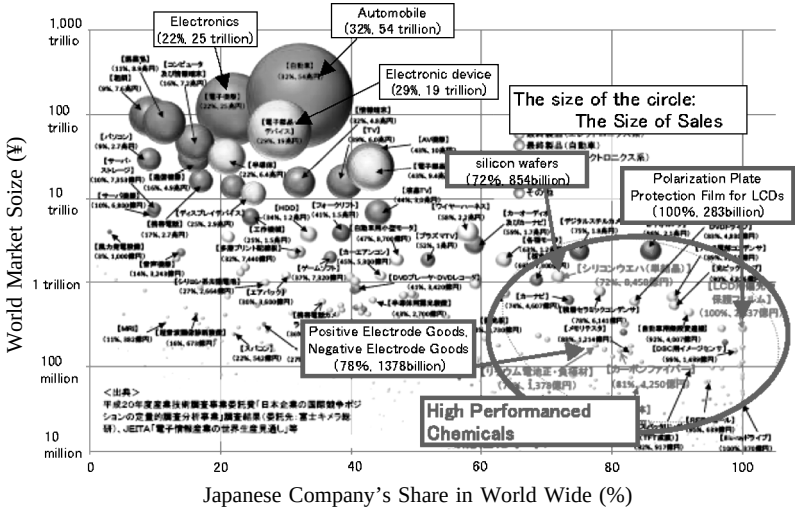
Source: “Chemical Economics” vol.57, no.4; Each Company’s Annual Reports.

Japanese companies also produce the materials for lithium ion batteries that are installed in notebook computers and other products.

There are three specific arguments that support the plausibility of the chemical industry becoming a pivotal one for the next generation in Japan.

First, Japanese companies hold a large global share in the area of specialized chemicals. As seen in **Figure 1**, the global market scale for specialized chemical products is smaller than that of Japan’s former

Figure 1. World Market Size and Japanese Company's Share



pivotal industries, such as automobiles, electronics, and electronic components. However, Japanese companies' global share of specialized chemical components, such as polarization plate protection film for LCDs and the material used in lithium ion batteries, is at the high level of 60-100%.

Although Japanese companies experienced a precipitous loss of market share at the finished product levels in LCD and lithium ion batteries, they maintain strong competitiveness at the component level. At the initial junction, Japanese companies were the driving force behind the development of these finished products and largely dominated the market. Currently, however, they have experienced a rapid loss of market share due to the growth of Korean and other foreign companies. For example, Japanese companies' global share of LCD finished product is only 44%, which is in contrast to the large share of components for LCD and lithium ion batteries.

Second, it is often pointed out that certain companies rely on chemicals for their products (Itami 2009). In the 1980s, the boom period for Japanese companies, machines, equipment, and tools increasingly relied on electronics. Within this environment, Japanese electronics companies grew and became the driving force behind the Japanese economy. With this in mind, the dawn of the 21st century is experiencing a condition that could be labeled "industries' chemical reliance." There are an increasing number of cases in which improvements in the performance and quality of finished products depends upon the improved quality of the chemical components used in them. Hence, the importance of chemical companies has increased and is expected to continue increasing in the future.

Third, a review of Japan's recent economic history shows that the chemical industry is now becoming the country's driving force. It is difficult to determine which industries are pivotal industries within Japan's manufacturing sector. However, an overview of past trends suggests that a manufacturing industry consisting of three or more companies and ranking nationally in the top 50 of its type in terms of net profit could be considered a "pivotal industry." **Table 2** shows the industries to which the top 50 companies (in terms of net profit) belong to and a compilation of their numbers. As shown, prior to World War II, textiles (cotton spinning) and mining were pivotal Japanese industries, and during the high-growth after the War, electric machinery, steel, chemicals, other machinery, and automobiles were vital industries. In the 1980s, electric machinery and automobiles were key industries. Although chemicals were once considered a major industry, it lost its position in the 1980s. At the dawn of the 21st century, however, three companies found their way into the rankings, and the chemical industry regained its position as a key industry.

Table 2. Trends in Industry Consists of Net Income Rankings Top 50 in Japan

Year / Business	1929	1943	1955	1973	1987	2002
Chemical	**1**	**2**	**4**	**3**	**1**	**3**
Pharmaceutical	0	0	0	0	0	5
Sugar Manufacture	3	1	0	0	0	0
Cotton Spinning	4	3	2	0	0	0
Paper Manufacturing	3	1	1	0	0	0
Petroleum	1	1	4	0	1	0
Machinery	0	3	2	3	0	5
Electric Machine	0	2	3	7	6	4
Automobile	0	0	1	3	3	4
Steel	0	7	5	4	1	0
Mining	3	4	1	0	0	0
Railway	6	2	0	0	0	3
Electric Power	10	7	5	2	6	6
Communication	0	0	0	0	1	3
Finance	11	10	13	21	28	7
Retailing	0	0	0	1	0	4
Others	8	7	9	6	3	6
Total	50	50	50	50	50	50

Source: Yamazaki (2004)
Note: Number is the number of firms which went into the rank.

Evidently, the chemical industry in Japan is beginning to resurge.

III. Within the chemical industry, which companies have a strong competitive edge?

This section attempts to determine which chemical companies in

Japan's chemical industry possess a strong competitive edge. First, we calculated the ratio of operational profitability to overall sales volume for 40 Japanese chemical companies in a 10-year span, from 2000 to 2009. Specifically, the analysis was performed on companies having over 100 billion yen in sales volume in 2000 with over 30% of sales volume comprising chemical products.

The results are displayed in **Table 3**. **Table 3** shows the average return of sales (ROS) over 10 years for the 40 analyzed companies and their sales volumes in the final year, 2009. The top 10 companies in terms of ROS are highlighted. This table shows the profitability of large enterprises such as Mitsubishi Chemical Holdings, Sumitomo Chemical, and Mitsui Chemical, were relatively low. While many highly profitable companies are medium−sized chemical companies that have one-fifth of their counterparts. Even though medium−sized chemical companies' sales volume is small from an international perspective, they earn a high degree of profitability (**Table 1**).

One argument is the strength of these medium-sized chemical companies relative to the global production of specialized chemical components. One noteworthy example is a component used to create liquid crystal panels. There are 10 key chemical components in LCDs. JSR (formerly Japan Synthetic Rubber), which occupies the highest global share, supplies over half of these chemical components worldwide, ranking it second in the previously mentioned profitability rankings. Hence, an electronics manufacturer company official stated: "Without JSR products, liquid crystal technology would not be possible. JSR's mark is consistently seen in the improved quality and durability of LCD screens. JSR is one of the largest players of distinction in the creation of the current market for

Table 3. ROS (2000th) and Sales (2009) in Japanese Chemical Company

Rank (Sales)	Company	ROS	Sales (million Yen)
1	Mitsubishi Chemical HD	3.9%	2,515,079
2	Sumitomo Chamical	5.7%	1,620,915
3	Asahi Kasei	5.9%	1,433,595
4	Toray	4.8%	1,359,631
5	Mitsui Chemicals	3.6%	1,207,735
6	Shin-Etsu Chemical	16.7%	916,837
7	Teijin	4.9%	765,840
8	DIC	4.0%	757,849
9	Tosoh	5.3%	628,706
10	Nitto Denko	9.8%	601,859
11	Ube Industries	5.7%	549,556
12	Toyoda Gosei	5.2%	495,002
13	Hitachi Chemical	7.2%	455,287
14	Idemitsu Kosan	3.3%	437,762
15	Kaneka	6.9%	412,490
16	Mitsubishi Rayon	7.3%	365,047
17	Maruzen Petrochemical	3.2%	345,821
18	Kuraray	8.9%	332,880
19	Denki Kagaku Kogyo	7.7%	323,875
20	Daicel	7.3%	320,243
21	Toyobo	5.7%	318,773
22	JSR	11.0%	310,183
23	Tokuyama	7.8%	273,154
24	Chisso	7.5%	261,170
25	Niippon Shokubai	6.4%	244,317
26	Toyo Ink	4.3%	226,074
27	Zeon	6.9%	225,878
28	Yunitika	4.9%	182,239
29	Nippon Steel Chemical	5.8%	179,381
30	Sumitomo Bakelite	6.2%	170,843
31	ADEKA	8.1%	159,997
32	Central Glass	7.4%	154,623
33	Nissan Chemical Industries	10.7%	149,036
34	Dainichiseika Color & Chemicals Mfg	4.4%	143,928
35	NOF	5.5%	143,384
36	Kureha	6.4%	134,606
37	Nippon Soda	4.0%	132,486
38	FP Corporation	5.0%	124,918
39	Takasago International	4.9%	114,347
40	Nifco	8.7%	107,505

Source: Annual Security Report (2001-2010)

liquid crystal televisions." In examples similar to JSR, Kuraray Co. possesses 80% of the global share of polarizing plate material (poval film), while Daicel holds 80% of this share for raw materials needed to create polarizing plate protective film. Each of these companies occupies the highest global share for their respective industries. Furthermore, Chisso Co. holds the second highest global share of liquid crystal production. The liquid crystal market is oligopolistic, with participation shared by two companies: Chisso Co. and Merck of Germany. The same principle of medium-sized businesses being more profitable than large enterprises equally applies to lithium ion batteries, which chiefly comprise four components. Among these, the global share of Japanese companies is 40% for positive electrode goods, 60% for negative electrode goods, 45% percent for electrolytes, and 65% for separators.

IV. How did medium-sized chemical companies establish their current market positions?

Here, we explore how Japanese chemical companies succeeded in developing (innovating) specialized chemical products that became the basis for their current success. The history can be divided into three major stages.

The first stage includes searching for suitable markets for the company. This occurred primarily in the 1970s. With abundant financial resources, the zaibatsu-centered large enterprises chose to diversify into fields such as pharmaceutical manufacturing. On the other hand, having less access to financial resources, medium-sized companies aimed at market diversification that fit their individual business strengths. Furthermore, because medium-sized companies were technologically inferior, they

needed to find markets that did not put them in direct competition with large domestic enterprises or those in Europe and the U.S. The market satisfying these conditions was the product area especially created for the electronics industry. The 20th century could be called the “Era of the electronics industry” due to the advent of various electric and electronic products during the time. In the 1970s, the production of these products gradually began requiring chemical products as parts and materials. This new area had a small market scale and there were not many competing companies. Moreover, from a financial perspective, it was not an area that incurred a large amount of research and development costs, such as those required in the pharmaceutical or pesticide industries. Due to these conditions, Japanese medium−sized chemical companies focused on participating in the area of products for the electronics industry. Examples of early expansion into the arena of electronics materials include Shin-Etsu Chemical’s pioneer efforts in creating electronics materials in 1970, Hitachi Chemical beginning production of photoresist film, and JSR making the most of their own technology by starting the development of resist (photo-sensitive film).

The second stage included technology accumulation through partnerships that occurred during the 1980s until the first half of the 1990s. As now and before, to develop electronic materials, information gathered from customers is extremely important because, if the newly introduced electronic material is not actually installed into a finished product, evaluating the quality and performance is difficult. Therefore, collaboration with customers to improve products after actual installation must not be neglected. With increased customer–supplier interaction, the strong competitive edge that Japanese electronics companies held in the 1980s

benefited Japanese chemical companies. Detailed input from customers greatly improved the quality and performance of the products manufactured by Japan's chemical companies. For example, Hitachi Chemical was able to accumulate electronics−related knowledge and technology through its interaction with the large-scale semiconductor manufacturer and parent company, Hitachi, Ltd. Furthermore, large-scale enterprises did not acknowledge the electronics sector as a desirable market and were late to enter the arena. Hence, medium-sized chemical companies, the early entrants, were able to acquire an oligopolistic position. At this point, however, the role of chemical products in improving the performance of finished products (for example, electronic goods) was still small, and an oligopolistic market share did not directly correlate to high profits. Thus, this period could be considered the preparatory period before the rapid progress that was later experienced by Japan's chemical companies.

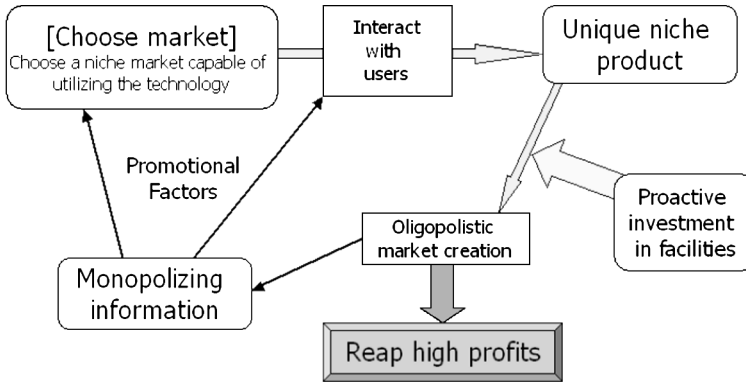
The third stage is the period of maintaining a high global share and realizing high profits. This period lasted from the mid-1990s onward. Electronics-related Japanese companies, with which chemical companies formed partnerships in the previous stage, lost their international competitive edge in the 1990s. However, Japanese chemical companies that supplied products to those enterprises were quick to form new partnerships with Korean and Taiwanese manufacturers that emerged as a result of the loss. Japanese enterprises were technologically superior to Korean and Taiwanese electronics companies, which lacked advanced technologies and component. So they challenged Japanese enterprise by purchasing the latest materials produced by Japanese chemical companies even before Japanese enterprises used those same products. An example of this is the ARC developed by Nissan Chemical. As a result, Japanese

chemical companies continued to hold an international competitive edge on parts and materials, despite Japanese enterprises losing their dominant position in finished semiconductor and LCD products. As this period progressed, a situation developed in which the performance of chemical products, which were parts and materials for LCDs and other finished products, began to determine the performance of the finished products. In this type of situation, wherein specialized chemical products were used as raw material in a variety of product fields, multiple industries' reliance upon chemical products progressed rapidly. This situation also raised the status of chemical companies. Unlike the manufacturing of LCD panels and similar products, which are easily reverse engineered, the "inability to discern the make-up of the product by just looking at it," rendered chemical materials a business field that was not easily penetrated. As a result of the emphasis placed on their parts and materials, as well as the difficulty of entering the market, Japan's chemical manufacturers experienced heightened bargaining power and improved profits, much like Intel's competitive edge in the personal computer industry. The oligopolistic position that Japan's chemical companies gained in electronics materials markets finally became associated with high profits. A typical example is JSR, which experienced a significant operating profit margin increase from 4.0% in the 1980s and 2.9% in the 1990s to 11.0% in the first decade of the 21st century.

V. The success of innovation and profit generation cycles

This section outlines the innovation process realized by Japan's medium-sized chemical companies. We selected 12 highly profitable Japanese chemical companies whose common innovation processes that

Figure 2. Innovation Process for Medium-Sized Chemical Companies



led to high profits. The summary of these is shown in **Figure 2**. The following section touches discusses these processes and the individual situation of each company. In particular, the behaviors of the five companies occupying the top five spots in terms of profitability–Shin-Etsu Chemical, JSR, Nissan Chemical Industries, Nitto Denko Corporation, and Kuraray Co., Ltd–are broadly introduced.

First, Japan's medium-sized chemical companies made careful choices about which new product field they should enter. Their choice of markets was based on two standards: (1) ability to apply their own technology, and (2) a niche area. The ability to acquire an oligopolistic market situation was critical to the realization of high profits. This point will be further deliberated upon later in this paper. One of the reasons for their targeting small markets was the high prospect of achieving an oligopolistic market situation within those markets.

The specific trends for each company are outlined below. Nitto Denko Corporation managed their activities in accordance with the slogan "Global Niche Top." The company was so committed to this strategy that

they registered this slogan as their trademark. Nitto Denko's aimed at maintaining a stable competitive advantage by focusing on several small markets ranging from 1 to 100 billions Yen in market scale. They then raised the barriers to entry by maintaining an overwhelming share. Furthermore, the company did not consider their niche as a simple opening, but defined it as "a sector that is both essential and advanced." Moreover, Nitto Denko continued to expand into business areas, while consistently focusing on their signature technology; adhesives. Similarly, Kuraray Co. Ltd. felt that "although the market may be small, we will be able to take the initiative if we lead in share," and focused on earning profits by holding global shares of product niches and taking advantage of their technological strengths. Kuraray chose business fields based on three conditions: (1) utilizing their company's strengths, (2) allowing initiatives with potential to gain a high share of the industry, and (3) not following other company's strategies. Subsequently, Kuraray proactively expanded into product areas that utilized the company's core technology. Specifically, the company created new products by expanding vinylon and poval technologies, which were successful global industrialization efforts. Within these technologies, poval film, made of poval and film, is used as the chief material in polarizing plates in LCDs. Kuraray produces 80% of these products.

Second, these companies attached great importance to customer interactions and joint development with client companies during the innovation and development of the products. For example, JSR created the photoresist jointly with Toshiba, the user of the product. Nissan Chemical Industries also collaboratively developed "silicon wafer polishing slurry" with their customer. In addition, many companies have begun sending

technology experts and researchers to promote dialogue, gather information, and resolve problems at client companies. JSR sent the researchers who developed specific products to the customer companies to further promote their products and resolve any issues. This type of interaction brought about two advantages for chemical companies. (1) Engaging in joint development with customers led to successful innovation of unique products in niches that differed from other companies. (2) Chemical companies were also able to improve their technological strengths through interaction with users.

Third, the successful development of unique products led to an oligopolistic market position associated with high profits, as previously mentioned. Chemical products cannot be reverse engineered in an attempt to understand their composition. Even if their composition is known, the extremely important know-how of reaction times and temperature adjustments are difficult for other companies to discover. Hence, new entry into the field is not easy. It follows that, within these product fields, oligopolistic situations were created and the bargaining power of chemical companies increased within their supply chains. For example, Shin-Etsu Chemical successfully signs several long−term sales agreements for its silicon wafers, for which they hold the largest global share. Kuraray successfully raised prices for their poval film, even while prices for finished products were trending downward.

Moreover, once these companies create an oligopolistic situation, they strive to maintain that position. Through proactively investing in facilities during periods of expanding demand, these companies are careful not to provide potential competitors the opportunity for new entrance. An example of this is JSR’s strategy in the use of their display materials. This

company dominated the market by proactively investing in facilities, while maintaining its lead in technology. In contrast to Japan's electronic enterprises, which suppressed facility investment and reduced competitiveness during and after the 1990s, Japan's chemical companies continued to proactively invest in facilities during the same period.

To maintain an oligopolistic position through proactive investment in facilities, it is necessary to choose target markets that do not have the immediate potential to become large scale. The reason is an increased possibility of attempted entrance by other competing companies, such as large enterprises with abundant resources or technological strengths targeting a large-scale market. However, when the market is small, larger enterprises are not much attracted toward it. For example, Mr. Asakura, JSR's former President, stated that he was confident that the company could compete with large-scale enterprises in the field of photoresist, their main product, because of the small size of the product market. He believed that large enterprises would not consider the market as their main business target for the future. Hence, Mr. Asakura believed that large enterprises would not make large investments in the development of this product. In contrast, because the photoresist business was a relatively large market from the viewpoint of a smaller enterprise such as JSR, they were willing to invest more energy and manpower in developing the product than were larger enterprises[2)].

Fourth, once created, oligopolistic situations led to cycles of dominance that lead to further market domination. This was due to the

2) Shigeru Matsushima and Kazumi Nishino "*The Oral History of Tetsuo Asakura,*" Innovation Management Research Center, Hosei University, 2010, p. 151.

crucial role played by information, as an invisible asset possessed by medium-sized companies. When client companies experienced problems or found areas of improvement for the chemical parts and materials they purchased, they took the discussion to the companies that they believed possessed the best ability to address them: these with the largest market share. With this information, top companies are able to focus on research and development and redesign or enhance production facilities such that they quickly supply cutting-edge materials to their clients. Using information in this manner, it is possible for enterprises to lower their uncertainty about the future and viability of their innovation process.

An example is the situation experienced at Nitto Denko Corporation. Mr. Muguruma of Nitto Denko Corporation said, “Once you claim the largest share, you have first access to a wide range of information. We are able to discuss a variety of details with customers from the conceptual stage of new product development. We are extremely grateful for this.” Because the materials used in electronics generally have short life spans, being first in line for customer information has critical significance. However, companies that are not within the top ranking of market share, find it difficult to establish customer loyalty and obtain fresh information. Hence, it is possible for companies that have garnered a large market share to build barriers to entry for new participants, along with preserving predominance over rival companies in terms of information. In this manner, dominance leads to further domination.

VI. Conclusion

This paper clarifies the following: (1) In Japan, the chemical industry faces increasing expectations to become the pivotal industry for the next

generation. One reason is found in the large global share of specialized chemicals products market held by Japanese companies. (2) In Japan's chemical industry, it is not large enterprises, but rather medium-sized chemical companies that have high profitability and global shares in their markets. (3) The reason for the strength of these chemical companies is their possession of a large global share of specialized chemical products. Japan's medium-sized chemical companies have avoided competition with large domestic enterprises as well as with U.S. and European enterprises. Further, they have tried to enter markets that are both small and newly emerging, namely the electronics materials field. The profitability of Japan's medium-sized chemical companies, which function under oligopolistic conditions, has increased in conjunction with the heightened importance of chemical parts and materials in finished goods. (4) The process for successful development of specialized chemical products by these companies is as follows: First, these companies capitalize on their unique technology by intentionally choosing and entering a market that has the potential to provide a dominant position. Then, they develop unique niche products and build dominant positions in collaboration with their clients. Thus, these companies are able to reap high profits under these oligopolistic practices.

In conclusion, the following additional points merit attention. Many companies in developed countries prescribe withdrawal from business areas when profits begin to shrink. However, this is not the only solution. Although expectations are rising for Japan's chemical sector as a pivotal industry for the next generation, it is not an emerging industry, such as IT or biotechnology. Yet, future growth in the chemical industry is expected. Reviewing Japan's highly profitable chemical products reveals that the

basic technology for these products is not new. There are many cases of innovatively re-utilizing a company's traditional technology. For example, poval film, the main product of Kuraray Co. Ltd., was developed by the company in 1950 and was once produced as a material for synthetic fiber. Although, later it was completely eliminated as a raw material for synthetic fiber, another use later emerged in the early part of this century as a component material in LCD screens. Manufacturing companies in industrialized countries have employed a strategy of raising stock prices by amputating old businesses. However, it must not be forgotten that raising a company's long-term performance and stock value can be accomplished not only by cutting out those businesses, but by refocusing them using technology as the basis for their growth.

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