How Can a Company Continue an Unprofitable Business?: Case Study of a Japanese Functional Chemical Company

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Abstract: Why do companies continue to invest in projects in the red and in areas from which competitors exit successively? Many companies have exited the two-layered copper clad laminate (CCL) market, which is part of the greater electronics material market. Among companies in that market, Nippon Steel Chemical continued to operate and became successful despite running a deficit for more than 10 years. Like the company's competitors, Nippon Steel Chemical has considered halting investment in research and development of two-layered CCLs. However, the company decided to continue investing because it implemented a system for making decisions that emphasizes assessments of potential major customers, in addition to its own standard internal assessments.

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Introduction

Development of new products and businesses is a time-consuming process (Afuah, 2003; Crawford & Di Benedetto, 2014; Ulrich & Eppinger, 2003). For example, Toray Industries, Inc.'s carbon fiber business took 10 years from the start of research through commercialization and took another 30 years to generate profits (Miyaki, 2015).¹ Business resources and research and development resources are limited (Tidd, Bessant, & Pavitt, 2013; Trott, 2011). As such, companies wish to avoid continuing investments in technologies that are not promising (Cooper & Kleinschmidt, 1995; Wheelwright & Clark, 1992) and go or no-go decisions for projects and businesses are important issues for companies (Cooper, 2008, 2011; Kuwashima, 2003, 2004).

This paper uses a case analysis of Nippon Steel Chemical Co., Ltd.'s² two-layered copper clad laminate (CCL) product called "Espanex" to explore this issue. Espanex is a material in flexible printed circuits (FPCs). It is one of the functional chemicals where Japanese companies have shown a high degree of international competitive advantage in recent years. Being the first to introduce a product such as Espanex to the market, Nippon Steel Chemical maintains the top market share in the two-layered CCL market globally (approximately 30%) till date. In 2016, Espanex won the 62nd Okochi Prize from the Okochi Memorial Foundation due to its

¹ Pharmaceuticals are also famous for requiring much research and development time (Kuwashima, 2003, 2016; Pisano, 1996, 1997).

² Nippon Steel Chemical changed its name to Nippon Steel & Sumikin Chemical Co., Ltd. in 2012.

highly regarded technology.

However, the Espanex business generated deficits for the first 10 years, starting in 1989. Within Nippon Steel Chemical, some individuals strongly expressed the opinion that the company should abandon the business. Some competitors that had been working on two-layered CCL research and development left the market as they could not easily expand their business. Under those circumstances, Nippon Steel Chemical decided to continue the Espanex business. This paper identifies the reason why the company made that decision.³

Business Development Process of Espanex

Research and development process

Research on Espanex (a two-layered CCL) at Nippon Steel Chemical began in 1985. During that time, the primary type of CCL, a material for FPCs, was a three-layered variety, which combined a polyimide film and copper foil using an adhesive. In comparison, two-layered CCLs used no adhesive,⁴ which created fewer defects and greater performance. Furthermore, companies expected to design thinner products with two-layered CCLs than they could using three-layered CCLs. However, products for practical use had not yet been introduced to the market.

Three methods existed at the time for manufacturing two-layered CCLs: the sputtering, laminate, and casting methods. Of these, Nippon Steel Chemical chose to use the casting method. This required overcoming several technical problems, the biggest of which

³ The following case is based on interviews the author conducted at Nippon Steel Chemical.

⁴ Simply put, a three-layered CCL has an adhesive layer between a polyimide film and copper foil, while a two-layered CCL has none.

was improvements to the polyimide material. Normal polyimide has a greater coefficient of thermal expansion than copper. Thus, when adhering the two together in a manufacturing process, differences in thermal expansion leads to warpage. Solving this problem required matching the coefficients of thermal expansion for both polyimide and copper foil.

With two years of research, the research team at Nippon Steel Chemical in 1987 successfully developed a polyimide. This project later encountered various technical issues such as stabilizing the adhesiveness of copper foil and polyimide; however, it subsequently overcame them and introduced Espanex to the market in 1989.

Commercialization process

At the time it began its research, despite the two-layered CCL being higher priced than the existing three-layered CCLs, Nippon Steel Chemical forecasted a certain level of demand for a two-layered CCL (Espanex) in the aerospace and military markets that demanded high precision. Moreover, in private markets, including those for electronics material, the company anticipated a shift from three-layered CCLs to two-layered CCLs in conjunction with higher-quality, higher-functional products. However, when the company began selling Espanex, while the company found the aerospace and military markets as expected, the electronics material market did not generate much in the way of sales.

Electronics material manufacturers did not use Espanex due to the following reasons. At the time, there was only one primary market need for electronics material such as electronic organizers and digital still cameras: downsizing of products. Electronics material manufacturers demanded that suppliers help them downsize components and materials to respond to that need. A two-layered CCL facilitated downsizing although it did not contribute much to the downsizing of many components used in electronics material, such

as semiconductors, storage media, LCDs, and batteries. Compared with the existing three-layered CCLs, two-layered CCLs facilitated downsizing; however, the cost was relatively high. Thus, designers in electronics material manufacturers sometimes opted to use two-layered CCLs in strategically important products but not in volume products. Espanex, a two-layered CCL, had higher performance than three-layered CCLs; however, 10 years after being introduced to the market, the business was still hundreds of millions of yen in projects in the red.

The change in the Espanex business came in the latter half of the 1990s, as the mobile phone market became prominent. The adoption of colored LCD panels and folding phones was particularly influential. Mobile phone screens were initially monochrome, but mobile phones began using color screens at the end of 1990s. Mobile phones needed to process three times more information to use the three primary colors of red, green, and blue. Moreover, there was a move to much greater functionality, with cameras, Internet connectivity, video playback, and high-speed connections. This move required greater density in FPCs and greater performance.

Folding phones became popular at the start of the 2000s. When they first appeared in Japan, mobile phones came in various shapes, including the soap-bar shape. From 2000, the bi-folding “flip phone” became the dominant design. This was critical to the increasing use of Espanex, as the folding hinge, which was used in these phones, required precision tooling and superior bending performance.

These new market needs caused an explosion in Espanex sales, which reached 20 billion yen in 2005. Espanex was later used in the circuit boards of smartphones and PCs; as of 2016, Espanex has the highest market share globally of any two-layered CCL (approximately 30%).⁵

⁵ News release of February 15, 2016, by Nippon Steel & Sumikin Chemical.

Reason for the Continuation of Espanex Business

As shown in the previous section, research on Espanex (a two-layered CCL) began in 1985, with a prototype completed approximately two years later. However, there were practically no sales for more than 10 years thereafter. Normally, companies would shut down this type of business or research. In fact, companies involved in research and development of a two-layered CCL realized that the market would not easily shift from three-layered to two-layered CCLs and, therefore, withdrew from that market. Nippon Steel Chemical determined to continue the business and became successful. How was Nippon Steel Chemical able to succeed in this business?

In reality, Nippon Steel Chemical had continual internal pressure to halt or withdraw from the Espanex business over the 10-year period. In particular, the finance division was of the opinion in mid-term business planning meetings in 1994 and 1997 that “Even with high quality, a high-priced product would not turn into a real business, and investment should be stopped.” In response, the research division made an appeal to continue investment. Amid these arguments, Nippon Steel Chemical’s technology evaluation system provided the impetus for continued investment in Espanex.

Nippon Steel Chemical uses criteria constituting two evaluations: internal evaluations and external (or customer) evaluations. Internal evaluation is a method common to many companies. Some companies make go or no-go decisions for businesses and projects based on these evaluations. However, there is a strong likelihood that researchers will overvalue their own research projects; thus, the results of researchers’ assessments of their own technologies are not trustworthy, while projects with high potential may sometimes be halted. In the case of Espanex, the assessments of the finance and research divisions differed greatly, as has already been noted, and

the project was almost stopped.

In contrast, the other method, which uses evaluations by customers, is often more objective and convincing because it is external. Moreover, Nippon Steel Chemical placed greater weight on the evaluations of major customers in the industry and not just the evaluations of any customer. In making investment decisions, when the results of “internal evaluations” differed from “customer evaluations,” the latter was given preference. When evaluating Espanex, potential major customers, among them the largest companies in the FPC industry, highly praised the performance of Espanex. This caused the finance division and management team to believe in the high potential for massive growth in the Espanex business, as long as customers demanded specifications that could only be achieved by a two-layered CCL and which were impossible with a three-layered CCL. The judgment system that emphasized assessments of potential major customers was the key factor for Nippon Steel Chemical to continue Espanex business despite running a deficit for more than a decade.

Discussion and Conclusion

This paper uses a case analysis of Nippon Steel Chemical to respond to the simple question of “how can a company be successful after continuing to invest in a business despite that business running at a deficit?” At the conclusion of this paper, let us compare the case of Nippon Steel Chemical with that of Toray’s carbon fibers discussed in the beginning. As of 2016, Toray boasted top market share in the PAN-based (polyacrylonitrile) carbon fiber market.⁶ Toray began research and development of carbon fiber in 1961; however, the market never grew until the first part of the 2000s, and

⁶ PAN-based carbon fiber constitutes 90% of the overall carbon fiber market.

the project continually ran in the red (Endo, 2011).⁷ During that time, many western companies that entered the carbon fiber market exited one after the other though Toray stayed the course (Inoue, Sato, & Kuno, 2011). Koichi Abe, Vice President at Toray, explained the reason why it was possible for Toray to make that determination: “most important for us was our ability to comprehend the value of a material (or technology).”⁸

This “ability to comprehend the value of a material (or technology)” was also important in the case of Nippon Steel Chemical, as can be seen in the internal evaluation of the company discussed in the previous section. In fact, researchers at Nippon Steel Chemical evaluated the value of Espanex quite highly. However, Nippon Steel Chemical would not have been able to continue investment in the deficit-creating Espanex business based on internal evaluation alone. In addition to internal evaluation, Nippon Steel Chemical used the evaluations of potential customers and, consequently, made the decision to continue investment in Espanex because their evaluation system placed more importance on these customers.⁹

Unlike Toray, why did the evaluations of customers play such an important role in the case of Nippon Steel Chemical? The answer possibly lies in the fact that Nippon Steel Chemical is a subsidiary of Nippon Steel Corporation, and as such, management tends to be more oriented to the short-term perspective. In other words, when managers are unconstrained by a parent company and can manage a

⁷ Sadayuki Sakakibara, President of Toray, stated in 2007 that at the time, “We have been in the carbon fiber business for forty years, and have generated losses the entire time. In other words, the five presidents prior to me have allowed these losses. My tenure as president was the first to see a profit of about twenty billion yen this year.” (*Toyo Keizai*, 2007, September 8).

⁸ *Nikkei Shimbun* (2016, September 23).

⁹ When evaluating functional chemicals, companies sometimes place importance on the evaluations of their customers’ customers in addition to those of their direct customers (Kuwashima, 2013).

company from a long-term perspective, as was the case with Toray, the company is more likely to continue investing in deficit-generating projects that are deemed to be important to the management team.¹⁰ Toray actually had five successive presidents who were involved in the carbon fiber business and allowed it to run in the red.¹¹ In contrast, the presidents of Nippon Steel Chemical were primarily seconded from Nippon Steel Corporation for short-term engagements and, thus, had a short-term orientation in their management. This can be seen in the actions of the finance division, which strongly argued to halt the Espanex business in the mid-1990s, when company performance turned downward. In situations where a company has a weak long-term management perspective, one way to succeed was to place greater weight on the evaluations of major potential customers, as in the case of Nippon Steel Chemical.

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¹⁰ Takahashi (2013, 2014) called the rule or principle of decision-making that favors future profit over near-term profit the “leaning on future principle”.

¹¹ See Footnote 7.

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