Japanese Forays into the American Medical Diagnostic Imaging Equipment Market Pay Off

Will Mitchell and Avi Fiegenbaum

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Introduction

In many high-technology industries, Japanese firms are mounting strong challenges to American manufacturers, sometimes strong enough to force American firms to retreat from markets they once dominated. In 1987, for instance, the General Electric Company withdrew the recently-acquired RCA Corporation from the consumer electronics sector, leaving it to Japanese, other Asian, and European manufacturers. Although American manufacturers continue to lead many other industrial sectors, they must continually redefine their competitive stances or they will lose those positions also.

Some Japanese firms entering American markets and then expanding within them have benefited from significant support from Japanese public agencies such as the Ministry of International Trade and Industry (MITI), leading some observers to call for counteraction by American governments. Most successful entrants, though, have drawn from a novel mix of individual firm and cooperative alliance strategies, many of which have been based on first selling components to American-based manufacturers and later competing directly for sales to end users. In this paper, we describe a sequential series of cooperative entry and competitive expansion strategies used by Japanese firms to enter many manufacturing-based sectors. We illustrate the strategies by drawing from the history of the medical diagnostic imaging industry. The strategies used by Japanese manufacturers—how they entered and then how they expanded—underlie their growth from minor positions during the 1950s to current competitive strength.

Japanese Success in the American Market

Diagnostic imaging equipment is used to produce pictures and other information about physiological structures within the body. Several types of clinically useful commercial imaging equipment, each of which defines a technical subfield of the industry, are listed in Table 1. As new subfields have augmented conventional x-ray and electrodiagnostic instruments since the 1950s, imaging devices have incorporated leading edge advances in computer, detector, and materials knowledge. We first describe imaging equipment development and commercialization trends and then identify competitive challenges mounted by Japanese entrants to the U.S. market.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Types of Diagnostic Imaging Equipment and Year of Introduction</th>
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<tbody>
<tr>
<td>Instrument Type</td>
<td>Non-U.S.</td>
</tr>
<tr>
<td>Non-U.S. Introduction</td>
<td>U.S. Introduction</td>
</tr>
<tr>
<td>Conventional X-ray</td>
<td>1896 (Germany: Siemens)</td>
</tr>
<tr>
<td>Electrodiagnostic</td>
<td>1911 (U.K.: Cambridge)</td>
</tr>
<tr>
<td>Nuclear Medical</td>
<td>c. 1954 (U.K.)</td>
</tr>
<tr>
<td>Ultrasonic</td>
<td>c. 1954 (Japan: Aloka)</td>
</tr>
<tr>
<td>Digital Radiographic</td>
<td>1981 (Germany: Siemens)</td>
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Will Mitchell is an assistant professor of corporate strategy in the University of Michigan Business School, Ann Arbor, Michigan (Ph.D., University of California, Berkeley). His research focuses on technology strategies employed by firms in globally competitive manufacturing-based industries with particular attention on the sources and methods used to acquire know-how.

Avi Fiegenbaum is an assistant professor of corporate strategy in the University of Michigan Business School, Ann Arbor (Ph.D., University of Illinois). His current interests include regaining and maintaining U.S. competitiveness in global manufacturing industries and understanding firm strategic interaction.
In 1960, the American radiography industry consisted of about 45 firms selling equipment into a $40 million market. The industry was dominated by three American firms, General Electric, the Picker X-Ray Company and the Westminster Electric Company, followed by two European producers, Siemens AG and NV Philips. The five manufacturers shared 70 to 75 percent of the U.S. market for x-ray equipment and a share of the smaller electrodiagnostic instrument market.

In 1990, the radiography industry has become the diagnostic imaging industry, with about 150 firms annually selling $3 billion of x-ray, electrodiagnostic, nuclear, ultrasonic, computed tomography, magnetic resonance, and digital radiographic equipment to American buyers. Among the more than 350 manufacturers that have entered emerging technical subfields of the industry during the past 30 years, several distinct groups can be identified. In addition to the traditional industry leaders, entrants to the new subfields include start-up firms, fly-by-night unrelated diversifiers, related diversifiers based in Europe and the United States, and Japanese manufacturers.

The most successful firms continue to be the established leaders. The industry is still dominated by General Electric, Picker (now part of GEC PLC of Britain), Siemens, and Philips. Together, the four firms control about 70 percent of the American market. Of the 1950s leaders, only Westminster, which left the industry in 1971, has dropped out.

Most other firms have had little success in the industry. Almost all start-ups have failed because of weak technical, financial, or organizational capabilities. Most unrelated diversifiers have left the industry after learning that there are few profits for participants lacking technical and sales backgrounds suited to the imaging market.

Even a group containing experienced American and European medical and electronic equipment manufacturers that made large investments in imaging research, development, manufacturing, and distribution systems has been signally unsuccessful. Several aerospace and military electronics companies, for example, have manufactured diagnostic imaging equipment, believing that their technical expertise would allow them to succeed. All have failed to become general imaging equipment manufacturers. Half a dozen major drug companies have entered, expecting their medical, technical, and market experience to give them an edge in the imaging industry; none is now an imaging market leader, and most have left the industry.

Of all the new entrants to the U.S. market, only the group consisting of experienced Japanese manufacturers has been able to challenge the established leaders. The Toshiba Corporation, Hitachi Ltd., and the Shimadzu Corporation are beginning to approach the status of the historical market leaders, and each has the potential to expand from its existing base. But, at first glance, the challenge appears slight.

Evidence: Changes in Manufacturing Location

The apparent continuing dominance by the traditional leaders of the diagnostic imaging industry masks two important structural phenomena. First, the national ownership of some imaging equipment manufacturers has changed. Second, as successful Japanese competitors have emerged, the national location of manufacturing has changed.

The change in national ownership is demonstrated in Figure 1. In 1959, about 75 percent of the x-ray and electrodiagnostic equipment sold in the United States was marketed under the brand of an American-owned firm, with about 20 percent being distributed by European firms and 3 percent by Japanese manufacturers. By 1988, the American-owned company share of imaging equipment sales had shrunk to about 45 percent. European firms accounted for most of the change, also selling about 45 percent of the market value of imaging equipment. Japanese companies still trailed, accounting for about 6 percent. The principal factor underlying the change was the acquisition of American firms by European companies. The 1981 GEC purchase of Picker is the most notable, but both Siemens and Philips have acquired several U.S. companies.

If we stopped with Figure 1, we would see a major expansion by European manufacturers and little impact by Japanese firms. Apparent market share, however, tells only part of the story. Although the European firms have gained market share by acquiring American competitors, they usually have continued to manufacture goods sold to American...
Figure 2
Manufacturing Location Share

buyers in the United States. As shown in Figure 2, the European-owned firms have only slightly expanded the relative amount of imaging system manufacture that takes place in Europe.

Figure 2 also shows, however, that the small Japanese ownership share masks the second phenomenon: the change in national location of imaging equipment manufacture. Japanese manufacturing locations are becoming increasingly important. Moreover, the emergence of the Japanese manufacturing role is not limited to Toshiba, Hitachi, and Shimadzu. The list of Japanese participants also includes at least 20 others, some producing goods in wholly owned plants, others participating in Japanese-based manufacturing joint ventures with European and American firms.

Five Japanese Entry and Expansion Strategies

Most Japanese entrants into the global imaging industry have been large, diversified firms, often part of networks of companies possessing broad bases of financial, technical, manufacturing, research, development, and distribution strength. Thus, they have had the resources needed to build long-term positions in the industry. The firms have used those resources to enter and expand within the U.S. market through a sequential series of five strategies, 5 which are listed in Table 2. The number of firms entering the American market via each strategy and the number later expanding is noted in Table 3.

We refer to the first two strategies as cooperative strategies. Many Japanese manufacturers have used the cooperative strategies to enter American markets for imaging equipment only to later expand via what we have labelled as two types of competitive strategies. Recently, we have seen the emergence of alliance-type strategies between American and Japanese manufacturers, a category that we tentatively label a rebirth of cooperation stage.

Cooperative Strategies

The first cooperative strategy is the supply of components that are incorporated into imaging systems manufactured by European and American firms. Japanese manufacturers have acted in this role since the 1950s. The practice is found in all technical subfields of the industry, from the oldest conventional x-ray products to the newest positron emission tomographic nuclear medical scanners.

The second cooperative strategy is the supply of systems that are sold with European and American imaging systems manufacturers' labels. Japanese manufacturers have played this role since the 1960s. The activity is most common in the older subfields such as x-ray, electrodiagnostic, nuclear, ultrasound, and computer tomography. Hitachi, for instance, manufactures many of the computed tomography systems sold by Philips. The strategy is also common in niches within those subfields. In x-ray mammography, for example, Acoma X-Ray Industry Co. Ltd. supplies about 25 percent of the systems sold in the United States. Japanese manufacturers are also moving from the established subfields into the newer product areas, as Japanese firms now supply magnetic resonance and digital radiography systems sold by American and European firms.

Competitive Strategies

Many firms have expanded beyond the cooperative strategy stages. A common competitive expansion strategy is the sale of Japanese-manufactured products through indirect and direct distribution networks. Indirect distribution through sales representatives was the norm until the mid-1970s. Even now, many Japanese firms sell products through distributor networks in the United States; in 1988, for example, Acoma began to contract with American dealers to sell its mammography units. Indirect distribution is not an effective way of selling complex equipment, however, and the market share of Japanese-firm branded products often has been small. In the less complex electrodiagnostic instrument area, though, products manufactured by Japanese firms such as the Nihon Kohden Corporation and NEC-San El Instruments Ltd. dominate the market.

Since the late 1970s, starting with Toshiba in 1976, several Japanese medical equipment manufacturers have established direct sales systems. This is the strategy of the
Table 2
Japanese Manufacturer Entry and Expansion Strategies

Cooperative Strategies
1. Sell components to American and European system manufacturers
2. Sell systems to American and European system manufacturers

Competitive Strategies
3. Sell own systems
   a. Domestic distributors (private label and own brand)
   b. Direct distribution
4. U.S.-based assembly plants

Rebirth of Cooperation?
5. Japanese-based manufacturing joint ventures with American and European system manufacturers

Table 3

<table>
<thead>
<tr>
<th>Entry Strategies</th>
<th>Entrants (Number Expanded)</th>
<th>Number of entrants following expansion strategies</th>
</tr>
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<tbody>
<tr>
<td>1. Components</td>
<td>30 (19)</td>
<td>5 12 10 3 3</td>
</tr>
<tr>
<td>2. Systems to mfg</td>
<td>7 (6)</td>
<td>3 3 2</td>
</tr>
<tr>
<td>3a. Distributors</td>
<td>7 (4)</td>
<td>4</td>
</tr>
<tr>
<td>3b. Direct sales</td>
<td>3 (1)</td>
<td>1</td>
</tr>
<tr>
<td>4. U.S. assembly</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5. Japanese-based yrs</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

1./2. Cooperative entry strategies 37 (24) 10
3a./3b. Competitive entry strategies 10
5. JV entry 4
51

Electric Corporation, is the strongest of these. YMS sits with Toshiba and Hitachi atop the Japanese imaging market and, through GE, is becoming an important supplier to the U.S. market. YMS now manufactures most of GE's ultrasound product line, much of its computed tomography line, and in the last three years has also begun to manufacture a magnetic resonance imaging system. Picker-Toray-Fujii, a joint venture of Picker, Toray Industries, Inc., and Fuji Electric Co., is now responsible for most of Picker's ultrasound and nuclear production and is also developing magnetic resonance imaging systems. Siemens, too, has recently formed a joint venture with the Asahi Optical Co. Ltd.

American, European, and Japanese firms have complementary motives for entering the alliances. The Japanese partners, most of which are minor players in Japanese and global medical diagnostic imaging equipment markets, enter into the joint ventures in order to gain access to technical, market, and regulatory knowledge held by the American and European firms. The American and European manufacturers, in turn, enter the ventures to acquire high quality design and manufacturing capabilities, often at lower cost than available in the United States.
The design and manufacturing capabilities that the American and European firms are seeking from their Japanese partners are those that were offered as part of the cooperative component and system supply strategies of Japanese imaging equipment manufacturers. With the expansion into competitive stances of the cooperators, however, American and European firms either have lost access to the capabilities or fear that they will be withdrawn. Thus, they have sought manufacturing and design cooperation with other Japanese firms.

We include a question mark in our name for this stage, however, because it is not clear how stable the present cooperation will be. Joint ventures and other alliances are notoriously unstable. Some ventures break down because the venture fails to produce a successful product. Others collapse because the ventures did produce successful products, which are taken over by the stronger partner. If the second case holds true, it is not clear that the American or European firm always will be the stronger partner. Although the Yokogawa Medical Systems venture appears to be coming under the dominance of General Electric, which has expanded its ownership from 51 percent to more than 75 percent, other ventures may come to be controlled by the Japanese partner. A 50/50 joint venture formed by the SmithKline Beckman Corporation and the Fujisawa Pharmaceutical Company Limited in 1981 to market a Fujisawa antibiotic in the United States, for instance, became a wholly owned Fujisawa subsidiary in 1987. Such cases provide a base for further expansion into American and European markets.

Conclusion

We have shown, through empirical evidence from the medical diagnostic imaging industry, how the competitive challenge from Japanese manufacturers has evolved. If the Japanese firms had jumped directly to the competitive strategies, they probably would have failed. The firms would not have understood the U.S. market – Toshiba’s first ultrasonic scanners, for instance, were too small for many American patients – and potential users would not have understood the firms. But by taking the sequential road of entry and expansion from cooperative to competitive positions, firms such as Toshiba and Hitachi gradually have moved into strong positions.

At the same time, because the earlier strategic steps are less expensive than the later stages, Japanese firms that have not been as broadly successful as Toshiba and Hitachi have limited their entry costs. The five-stage sequence, therefore, has been both a ladder and a toe. For successful firms, it has provided a ladder to the top. For less successful manufacturers, it has provided a low-cost way of testing the American waters.

What may appear remarkable to some is the negligible role played by the Japanese government in supporting the expansion of the Japanese manufacturers. Instead, the successes have resulted from sensible strategies pursued over the long term by independent businesses. In industries where these patterns of sequential cooperation and competition are found, which are industries throughout the manufacturing-based sectors in the United States, the competitive challenge to American firms is not to lobby for fairer trade. It is to retain and increase their independent manufacturing and design capabilities.

Endnotes


