

Chapter 4

Industrialized Housing in Japan, Western Europe, and Canada

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Despite the growth of factory-based housing in the United States and the American tradition as an innovator of mass-production technology, other industrialized nations top the United States in terms of homebuilding technologies. U.S. firms can learn much from foreign developments.

The sophisticated manufacturing facilities of foreign housing industries constitute the major difference between U.S. and foreign firms. Most American plants lack modern equipment, relying on unskilled laborers and worker-operated machines. Skilled operators and high-speed assembly lines make Scandinavian factories more capital-intensive, especially those in Sweden. Some Japanese companies have automated to the point where they employ robotics and computer controls for production. The Japanese are beginning to market homes through “showrooms” that provide customers with an enormous range of design options.

¹Unless otherwise noted, the material in this chapter is based on research conducted by the Stephen Winter Associates, New York, N.Y.

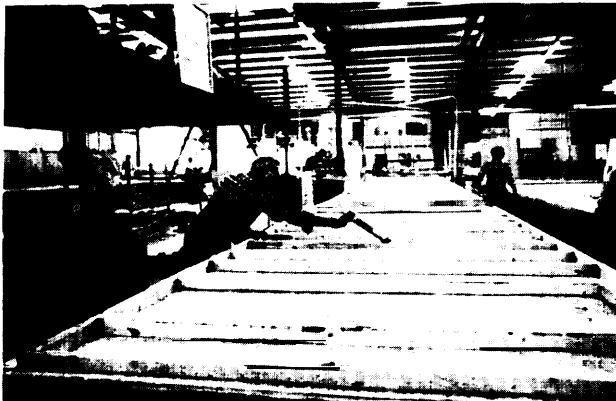


Photo credit: Don O. Carlson

An American manufacturing facility. Workers glue panels by hand, rather than with automated techniques.

Japan, Sweden, and other Western European nations now see the United States as a major market for manufactured housing. Foreign penetration, which was unthinkable just a few years ago, has now raised considerable concern and debate within the industry. At the same time, some members of the U.S. industry believe that the existing domestic approach can satisfy American market demand, and negate the potential of foreign investment in research and development. One observer of the U.S. “manufactured” (mobile) home industry contends that the Japanese and Europeans are “obsessed” with technology.² The vice-president of one of the largest firms in the United States visited a construction research facility in Japan and asserted that “he could not believe all these [research] employees just running wild” and that “if he were head of Taisei he would fire every one of the R&D staff and save the company \$25 million per year.”³ However, other observers argue that the U.S. industry has grown complacent with the assumption that construction is a “nontraded” commodity. They fear that the lack of U.S. research and development robs American homebuyers of both qualitative improvements and cost reductions, and increases the opportunity for foreign producers to penetrate markets.⁴

In order to assess the potential impact of foreign competition, as well as to provide some points of comparison with the U.S. housing industry, this chapter examines industrialized housing in nine selected countries. Also, it will address a range of domestic and international factors that affect foreign penetration of the U.S. housing market.

²Arthur D. Bernhardt, *Building Tomorrow: The Mobile/Manufactured Housing Industry* (Cambridge, MA: The MIT Press, 1980).

³Albus Trip Report, July 7, 1985, cited in Daniel W. Halpin, Final Report Task 3, “Technology in Architecture, Engineering, and Construction,” contractor report for the Office of Technology Assessment, Mar. 17, 1986.

⁴See for example the article by Don Carlson in *Technology and the Future of the U.S. Construction Industry* (AIA Press, 1986).

JAPAN

Japan's housing construction industry is based on high-volume concentration in a small number of firms, design flexibility, and capital-intensive, high-technology production. Table 10 summarizes the characteristics of Japan's five largest business enterprises, which as a group produced 56,000 units of industrialized housing in 1983. Several of these firms, including Matsushita, Asahi, and Sekisui, own stock in housing companies. Misawa spent 1.5 percent, or \$7.5 million, of its 1984 sales on research. Sekisui spent 0.2 percent, or \$2.5 million.⁵

However, the 170,000 factory-built homes that are sold each year represent 15 percent of the Japanese housing market (see table 11). Most houses are still produced by traditional "post-and-beam" frame methods; a small number, about 7 percent, are multi-family structures or are built with American 2 by 4 inch wood stud techniques.

Several large corporations control home manufacturing: Misawa, Daiwa, National Homes, Sekisui Heim, and Sekisui Chemical. These five companies account for 86 percent of Japan's total production. Their factories are highly automated, using such modern equipment as robotic welders and main-frame computers. Each plant can produce thousands of units per year.

⁵James McKeller, "Industrialized Housing: The Japanese Experience," Alberta Department of Housing, December 1985, p. 95.

Many of these houses are wood-framed modulares with walls constructed on a wooden lattice, rather than with the stud wall construction employed in American modulares. Building elements, such as walls and floors, are assembled into small modules in the factory and trucked to the site. These modules often lack the factory finish of an American modular.

The one notable exception to the wooden lattice system is the precast autoclave lightweight ceramic (PALC) system, developed by Misawa Homes with extensive funding from the Japanese Government. Modulares of this material, which resembles European lightweight concrete, contain a homogeneous envelope that functions as structure, insulation, fireproofing, and interior/exterior finish. Currently, Misawa produces this type of house in only 1 of 23 plants, but claims that PALC units require just 170 man-hours to construct—as opposed to 3,300 man-hours for standard "post-in-beam" techniques, or 1,000 man-hours for pre-stressed wooden panel systems. This represents an extraordinary gain in productivity.⁶

Misawa has developed elaborate equipment for fabricating these insulated wall panels with a variety of interior and exterior finishes, and has engineered automated devices to fabricate panels con-

⁶ibid.

Table 10.—Comparison of the Top Five Factory Housing Companies in Japan, 1983

Rank	by production	1, Sekisui House	2. Misawa Homes	3. Daiwa House	4. National House	5. Sekisui Chemical
Total production (83)	40,436	30,650	20,794	20,444	12,237	
Year founded	1960	1962	1955	1963	1947	
Factories producing housing	4	22	12	4	6	
Total employees	8,014	1,105	5,672	2,010	6,038	
Total assets (million yen)	597,497	138,208	289,198	69,346	290,937	
Equity ratio	26.7	20.0	34.0	25.2	18.0	
Major shareholder (percent owned)	Sekisui Chem (20.3)	Misawa Co. (9.6)	—	Matsushita (58.6)	Asahi Chem. (16.2)	
Ownership by Japanese banks (%)	13.4	10.4	14.9	6.7	8.6	
Foreign ownership (%)	12.8	11.3	15.8	6.0	10.3	
Sales breakdown (%)						
Building materials	—	69	87	63	—	
Housing construction	79	—	—	27	38	
Other construction	—	13	—	—	—	
Housing lots	—	—	—	10	—	
Real estate	21	—	13	—	—	
Other activities	—	18	—	—	68	
Sales—March 1984 (million yen)	443,742 (Jan. 84)	126,216	285,689	97,924	324,018	

SOURCE: Japan Company Handbook, First Section Firms, First Half 1984, The Oriental Economist, cited in James McKeller, "Industrialized Housing: The Japanese Experience," Alberta Department of Housing, December 1985, p. 81.

**Table 11.—Factory Home Construction in Japan
(as a percent of all home construction)**

1971	8.5
1975	10.9
1979	10.8
1980	12.6
1981	13.6
1982	14.4
1983	15.3

SOURCE: Building Center of Japan, 1964. Cited in James McKeller, "Industrialized Housing: The Japanese Experience," Alberta Department of Housing, December 1965, p. 76

structed from 1-by 4-inch "studs" and thin plywood sheets.

Most Japanese prefabricated homebuilders maintain sales offices throughout the country. In 1980, for example, Misawa sold 13,000 units through franchise dealers, employing 1,700 sales personnel in 163 branch offices. Manufacturers sell through "home show parks," where model homes of many different firms appear in the prime retail locations of major cities. Accordingly, land costs represent a major investment. The Sendai Park, located on the site of Osaka World Fair, shows 48 homes and is the largest such facility. The Tokyo Housing Fair displays homes in Shinjuku. The Asahi Broadcasting Co. operates both of these home show parks, charging approximately \$7,000 per month for each house; the fee covers land, management, and advertising.

After viewing these displays, the prospective homebuyer can, with the help of an architect, custom design his house using a simple CAD (computer-assisted design) system. Upon completion of the design, a materials list is generated instantaneously. The buyer then receives a price, and the order goes to the factory.

Widespread export of Japanese industrialized housing or manufacturing technology has not occurred. Misawa plans to construct a PALC plant in South Korea, and intends to arrive in the United States within the next several years. All of the major manufacturers have expressed an interest in the U.S. market. They would welcome joint ventures, but do not wish to commit to large-scale investments. Daiwa is employing conventional U.S. technology in Houston and California, perhaps to learn the market before making a significant capital expenditure. Misawa has entered into an "agreement" with U.S. Home, but the details have not been revealed.

Japan may need to modify its products in order to penetrate foreign markets. Aside from differences in taste, Japanese domestic markets emphasize fire-resistance and the ability to withstand earthquake tremors to a greater extent than U.S. markets. Energy efficiency receives little attention, due to the mild Japanese climate; few Japanese residences have central heating.

SWEDEN

The Swedish industrialized housing industry may be the most highly developed in the world. In the mid-1960s, Sweden set a national goal of building 1 million new homes in a decade. This goal was achieved by reorienting the nation's homebuilding industry around factory production, and the trend continues today. Following the initial 10-year period, 40 percent of all single-family homes were produced

in factories. By 1983, that figure had risen to nearly 90 percent (see table 12). The Swedes maintain exceptionally high standards of quality, and offer multiyear guarantees for parts and workmanship.⁷

⁷For a recent review of developments in Swedish manufactured housing see L. Schipper, S. Meyer, and H. Kelly, *Coming From the Cold: Energy-Wise Housing in Sweden* (Cabin John, MD: Seven Locks Press, 1985).

**Table 12.—Factory Construction of Single-Family Homes in Sweden
(as a percent of all single-family home construction)**

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	
Factory built	(a/a) 60	55	55	43	42	48	44	49	49	58	65	82	89
Site built	(a/a) 40	45	45	57	58	52	56	51	51	42	35	18	11
Total units (thousands)	35.7	42.8	43.2	53.3	36.1	42.7	40.2	40.6	38.2	32.6	26.8	23.4	19.3	

NOTE: "Factory built" means produced substantially or entirely from factory elements, "Site built" means produced principally from loose wooden elements on site. The sharp increase in construction in 1974 resulted from a rush to take advantage of a tax rebate program before it expired.

SOURCE: Central Bureau of Statistics, Construction and Housing Loan Statistics, Stockholm.

Of the approximately 55 Swedish industrialized housing companies, 12 are considered to be "large." Building systems include small and large wood-framed, highly insulated panels, which may be handled by either workmen or a small crane. Factory techniques represent the state of the art. Typically, computer controls operate factory production lines, allowing for flexibility in the type of the units produced. Swedish houses incorporate many innovative technologies not in use in the United States; interestingly, some are produced by subsidiaries of American firms.

Swedish manufacturers export homes to West Germany, Austria, Switzerland, Holland, Norway, Denmark, Finland, the Middle East, and North Africa. The Swedes have begun shipping to the United States, on a limited scale. Swedish Wooden House has erected high-quality, energy-efficient housing in the United States for several years. Skanska, the major international construction and engineering firm, has entered the U.S. market in both commercial and residential construction. Also, as of March 1986, no fewer than 20 American corporations were engaged

in importing Swedish houses, with a combined projected 1986 sales volume of 1,500 units. Nearly all plans to establish manufacturing facilities have grown out of joint ventures with Swedish factories.

Currently, an overcapacity exists in Swedish homebuilding factories, and production is at half its peak level. As a result, the Swedes may attempt to increase exports. The high-quality house represents the most likely product for the United States, erected with local custom builders in subdivisions of 10 or more units.

Sweden's dramatic progress in the housing sector has resulted from a broad national consensus and direct government policies. The government subsidizes mortgages, including costs related to energy and water conservation, and spends three times as much money on direct building research than the United States.⁸ Including spending through universities and industry research, Sweden's total building research budget approaches \$200 million per year.

⁸Ibid.

FINLAND

Industrialized housing in Finland is widespread, including 60 percent of single-family homes built per year, although the Swedish industry is still greater. The predominant form employs the small panel, followed by units with large panels and modulars. Panelized systems may be closed in by the manufacturer, or delivered as kits to the owner/builder. Modular construction is also gaining popularity. As a whole, the residential construction industry enjoys an annual growth rate of 20 percent.

Finland's industrialized housing industry and its wood products industry are interrelated. Many firms produce the lumber and materials that will be used for individual home units.

The Finnish experience in exporting building materials like wood products and granite, the export

orientation of Finland's economy, and its global placement of trade-oriented consular officials all place the country in a strong export position. Traditionally, trade has been with Africa and the Middle East, specializing in camp buildings. More recently, panelized homes and precut log houses have been exported to Great Britain, Sweden, South America, the United States, and—most of all—the Soviet Union. Finnish houses are found in 90 countries. Makroskan USA, a subsidiary of Makrotalo Oy, one of the eight large house manufacturers in Finland, and MakroEngineering, a manufacturer of house-factory equipment, are currently finishing a project in Massachusetts. They now seek builders interested in using their system, as well as other joint manufacturing ventures. Also, they sell factory equipment.

DENMARK

The Danish industrialized housing industry aims for both domestic and export markets. Nearly 80 percent of the detached housing produced since the mid-1960s has been factory-built, most of it panelized. At the same time, international contractors like A. Jespersen & Son and Larsen & Nielsen have constructed large projects throughout the world, primarily in the Middle East, using a prefabricated concrete system produced in local factories.

The small panel system, produced by such companies as Hosby Huse, Hellebo, and Roslev-Huse, represents the most likely export to the United States. Hosby Huse has already constructed a prototype unit at Brookhaven National Laboratory, the first in a cluster of energy-efficient houses from abroad.

CANADA

Canada's housing construction industry does not compare to that of the United States, basically due to the small Canadian housing market—150,000 units per year. However, Canadian manufacturers have experience in exporting precut, panelized, and modular building systems, especially Viceroy, Britco, and Freure Homes. Viceroy sold 1,200 of its precut home packages in 1984, and topped that a year later. The firm now plans to expand aggressively in North American markets, and expects to establish manufacturing facilities in Florida and Canada. Viceroy credits its success to both outstanding design and the high quality of their materials.

Some industry members believe that despite shrinking demand, the market share for industrialized housing will increase as Canadian housing con-

struction shifts from large developments, where there is an economic advantage to site building, to dispersed rural housing. Factory-produced homes should have a cost advantage over site-built houses erected by small rural builders.

Housing exports from Canada to the United States may increase rapidly in the near future. Most Canadian housing factories are situated near population centers, within range of the United States. One American inspection and certification agency has already been contacted by five Canadian manufacturers about exporting homes to the Northeastern States. The relative strength of the U.S. dollar has served as an economic advantage, generating low shipping costs.

GREAT BRITAIN

For over a century, the British have led in design and construction of industrialized buildings. They shipped prefabricated schools and commercial buildings to the Middle East, Africa, and Asia long before many of today's large firms entered these markets. Most British building systems rely on metal framing, given the domestic shortage of construction lumber.

British real estate investors have been active in the major U.S. cities for some time, and British com-

panies have entered the U.S. housing market by using traditional building techniques. Britain's Barratt Homes, which last year built approximately 11.5 percent of Britain's private housing, has established an American subsidiary, and hopes to complete 4,000 to 5,000 homes annually during the next few years. Another British firm, John Laing Homes, now operates in southern California. Laing plans to complete 200 units in 1986, and 1,000 units a year thereafter.

FRANCE

Along with the British, French firms have been among the top five international contractor groups for many years. Recently, several French companies have entered U.S. markets as real estate investors and developers. For example, Les Nouveaux Constructeurs produces conventionally built housing in Los Angeles, and expects to complete 300 homes per year by 1988 and 500 by 1990. The firm's management believed that California had a stronger and

more sustainable economic base than other areas of the United States.

In a joint venture with U.S. Home, Maison Phenix has built a limited amount of steel and concrete housing in Florida. Also, Filled has attempted to sell French-designed metal-framed housing and commercial buildings.

NORWAY

Traditionally, Norwegian contracting firms have been active in the Middle East, Africa, and Malaysia. Sandgruppen A/S, the largest group of contractors in Norway, now operates in the Orlando, Florida, area as the Selmar Corp. Selmar will construct the Norwegian Pavilion at Disney World's EPCOT Cen-

ter, and also has plans for conventionally built condominiums and townhouses in the Orlando area.

At least one other Norwegian homebuilder, G. Black Watne A/S, currently operates in the United States, in the Austin, Texas, area.

WEST GERMANY

West German firms, like Phillip Holzmann AG and its subsidiary, the J.A. Jones Construction Co., have penetrated U.S. markets for nonresidential construction and development. The United States accounted for over \$2 billion worth of contracts, or 41.7 percent of the foreign volume of West German firms in 1985, according to *Engineering News Record*.

Although internationally active in the production of factory-built housing, West German producers have not yet entered U.S. housing markets.

OTHERS

At the 1986 NAHB housebuilders show, firms exhibiting either housing systems or components included those mentioned above, as well as firms from Holland, Italy, and Belgium. Additionally, housing-

related products from foreign sources—appliances, tiles, heating and cooling systems, and decorative items—were shown. Foreign exhibits accounted for approximately 15 percent of the total exhibit space.