A VIEW OF THE U.S. METAL CASTING INDUSTRY

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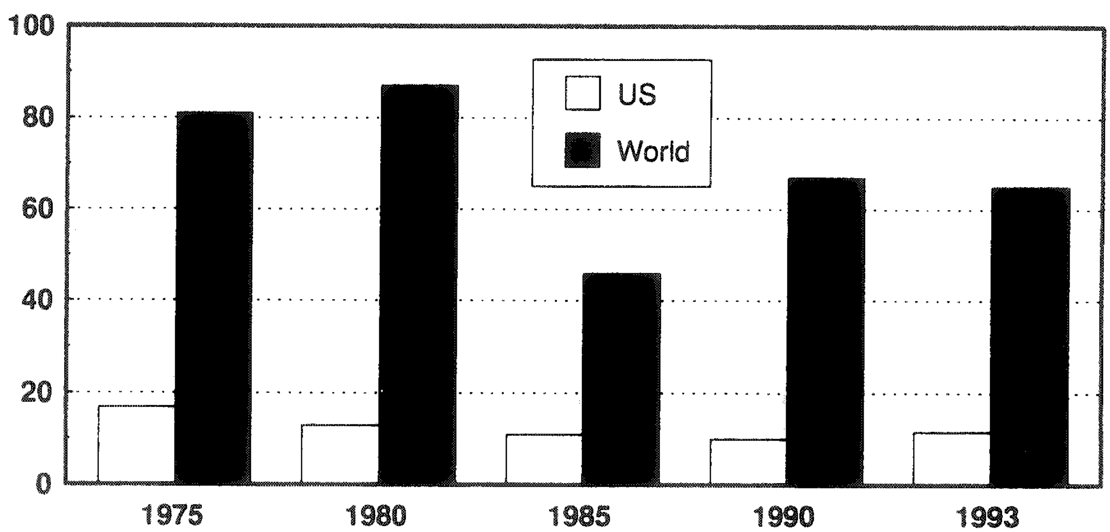
METAL CASTING INDUSTRY AT A GLANCE

The U.S metal casting industry is primarily classified under Standard Industrial Codes 332 (Iron and Steel Foundries) and 336 (Non-Ferrous Foundries). The industry is considered a critical part of the U.S. economy and many other industries rely heavily on foundry products. For example, 90 percent of all manufactured durable goods and 100 percent of all manufacturing machinery require cast-metal products. Currently, the United States is the second largest producer of cast-metal products, with China being the largest. Figure 1 shows a comparison between U.S. metal casting production and world metal casting production levels.

Figure 1. U.S. and World Casting Production

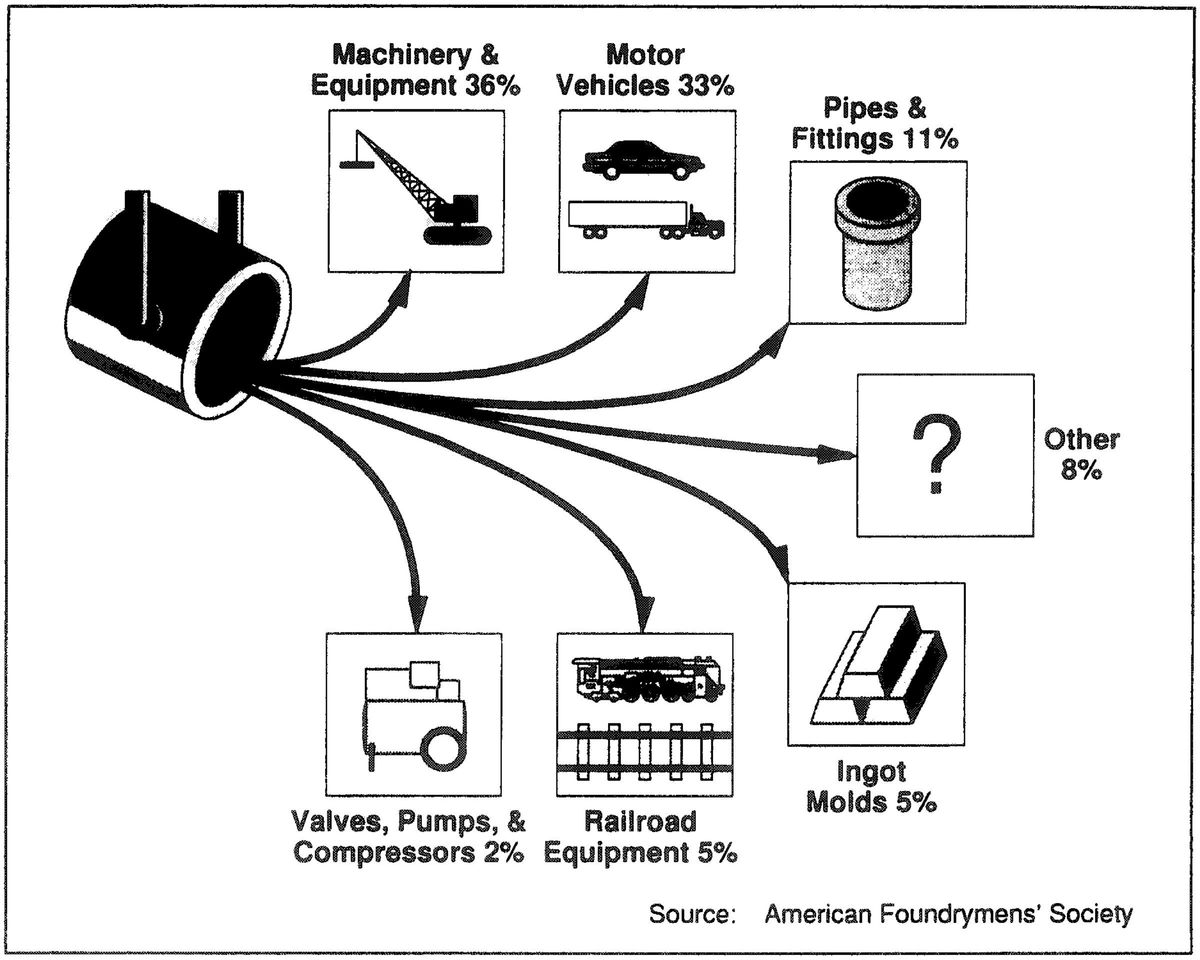


Source: "26th Census of Metal Casting Production - 1991," Modern Casting, December 1992 and American Foundrymens' Society

Metal casting is defined as a process in which molten metal is poured or injected into a cavity, allowed to cool and solidify, and then released from the mold. Currently, this process is used by more than 3,000 foundries employing over 200,000 people to produce a variety of products (see Figure 2). Ferrous castings represent about 86 percent of domestic cast metal shipments by weight, while non-ferrous castings (made from aluminum, zinc, copper, and other metals) account for the remaining 14 percent. It has been estimated that most homes require up to one ton of cast-metal pipes and parts for bathtubs, sinks, fixtures, hardware, and furnace and air conditioning systems. The industry produces both final products as well as components for other manufactured products. For example, some cast-metal products such as heart valves and propellers for aircraft carriers are used directly, while other cast products are used as components in such products as automobiles, aircraft, appliances, and power tools.

In 1991, an estimated 3,118 foundries were in operation. These foundries included 1,692 cast aluminum, 1,029 cast brass or bronze, 810 cast iron, and 465 cast steel plants. The industry consists primarily of small businesses or "Mom and Pop" operations. Approximately 80 percent of these foundries employ fewer than 100 employees, and only seven percent employ more than 250 people. The industry as a whole produced approximately 10.97 million tons of ferrous and non-ferrous castings in 1991. Of those 10.97 million tons, 9.40 million tons (almost 86 percent) were ferrous castings and 1.57 million tons (approximately 14 percent) were non-ferrous castings. Production by captive foundries, which produce for in-house consumption (e.g., the "Big Three" automotive foundries), accounted for 22 percent in the same year. The total value of shipments for 1991 was close to $19 billion.

Figure 2. Major Markets for U.S. Casting Shipments in 1993



THE INDUSTRY IN TRANSITION

As late as 1978, the U.S. metal casting industry enjoyed record production with little or no challenge from foreign competition. Since then, however, production levels have dropped from a high of 20 million tons to approximately 11 million tons -- a reduction of almost 45 percent. (Table 1 highlights the industry's production levels between 1978 and 1991.) During the eighties, the industry went through dramatic changes. Not only did production levels drop, but the number of foundries decreased by roughly one-quarter. These closings primarily affected small and medium-size casters of gray iron, steel, brass and bronze, and aluminum. Generally, large foundries with 250 or more employees achieved some of their highest rates of capacity utilization, whereas smaller foundries (under 20 employees) recorded some of the lowest capacity utilization.

Table 1. U.S Casting Production (Million Tons)

Year	Ferrous Castings				Non-Ferrous Castings				Total
	Gray Iron	Ductile Iron	Malleable Iron	Steel	Aluminum	Copper	Zinc	Other	
1972	13.493	1.835	0.961	1.596	0.928	0.381	0.399	0.044	19.637
1975	10.622	1.824	0.731	1.938	0.688	0.256	0.286	0.034	16.379
1980	9.399	2.400	0.450	1.878	0.769	0.244	0.172	0.029	15.341
1985	6.093	2.608	0.376	0.940	1.114	0.235	0.255	0.035	11.656
1986	5.570	2.763	0.320	0.829	1.102	0.238	0.243	0.044	11.109
1987	5.701	3.053	0.321	1.013	1.110	0.239	0.246	0.043	11.726
1988	5.941	3.206	0.323	1.187	1.158	0.250	0.244	0.046	12.355
1989	5.638	3.321	0.299	1.184	1.097	0.237	0.231	0.043	12.050
1990	5.120	3.190	0.276	1.136	1.067	0.216	0.208	0.045	11.258

Source: "Metal Casting Industry Census Guide," *FOUNDRY Management & Technology*, April 1992.

The foundry closings resulted in a reduction in overall employment by the industry. By 1992, the industry employed only about 199,000 people -- 33 percent less than the 308,000 it had employed in 1980. The number of production workers also dropped significantly during the same period. Between 1980 and 1988, the available data (shown in Table 2) indicate that total industry employment declined by 26 percent, while the number of production workers declined by 31 percent. This downward trend also occurred during a period of relatively stable labor costs; annual increases in hourly rates throughout the 1980s averaged only 3.5 percent, which was significantly below the rate of inflation for the period. The effect was a loss of income for those foundry workers who were still employed.

Table 2. Metal Casting Industry Employment Statistics

Item	1972	1975	1980	1985	1987	1988	1989	1990	1991
Total Employment (000)	300	297	308	231	216	227	225	216	206
Production Workers (000)	253	245	249	176	170	173	N/A	N/A	N/A
Avg. Hourly Rate of Production Workers ($)	4.39	5.67	8.35	10.52	10.79	11.00	11.20	11.60	N/A

Sources: U.S. Bureau of Labor Statistics, U.S. Industrial Outlook, 1986, 1987, 1989, 1990, and 1991, U.S. Dept. of Commerce.

This downsizing of the industry was also accompanied by increased capital expenditures by a small segment of the industry. In 1991, total capital expenditures (i.e., the costs of new process equipment, new foundries, and controls) amounted to $1.648 billion. Of this, approximately 60 percent was used for plant additions and 10 to 15 percent was used for building new foundries, while the remaining 25 to 30 percent was used to purchase new equipment, mainly for production control and productivity improvement. In the future, it is anticipated that the requirements of the various environmental regulations, particularly the Clean Water Act of 1990, will force the industry to continue upgrading and modifying current practices.

FACTORS CONTRIBUTING TO THE DECLINE OF THE INDUSTRY

Several factors have contributed to the decline of the metal casting industry over the last decade. The most important of these are a general reduction in demand for metal casting products, increased competition from foreign producers, the increasing costs of compliance with environmental regulations, and increased use of substitute materials (e.g., plastics, ceramics, and composites).

The demand for cast-metal products is heavily dependent on the demand for products that contain cast-metal components, and the two largest users of cast-metal components are the automotive and machinery manufacturing industries. In recent years, both of these industries have faced stiff competition from foreign manufacturers of engines, transmissions, and other assembled products. To date, the greatest challenge facing the domestic metal casting industry is competition from foreign automobile manufacturers; whether the cars are produced overseas or assembled inside the United States, the majority of the cast parts used in the vehicles are made overseas. As a result, the steady growth in auto imports has significantly reduced the demand for U.S. cast-metal products. According to recent data provided by the U.S. Department of Commerce, U.S. imports of both ferrous and non-ferrous cast-metal products rose steadily between 1982 and 1992. Fortunately, as shown in Table 3, The impact of these imports on the domestic metal casting industry was at least partially offset by a significant increase in U.S. exports of metal castings during the same period. Exports of both ferrous and non-ferrous products (as a percentage of production) more than doubled between those years.

Table 3. U.S. Import and Export Levels for Castings (%)

Measure	1982	1987	1989	1992[a]
Imports as Percentage of Consumption	4.1	8.0	11.1	13.3
Ferrous	3.2	5.6	7.1	8.0
Non-Ferrous	0.9	2.4	4.0	5.3
Exports as Percentage of Production	3.3	6.7	11.2	13.8
Ferrous	3.8	4.1	6.7	7.8
Non-Ferrous	1.7	2.7	4.5	6.0

[a] estimate

Source: *FOUNDRY Management & Technology*, November 1990.

Increasingly strict environmental and health and safety regulations have had a dramatic impact on the everyday operations of the U.S. metal casting industry as well as on its long-term planning. Regulations imposed by the Environmental Protection Agency and the Occupational Health and Safety Administration have forced the industry to substantially increase expenditures for non-production equipment. Annually, the industry must now spend over $1.25 billion to comply with existing Federal, state, and local environmental regulations. Approximately 40 percent of this amount goes for the treatment and disposal of process residues such as dust, sludge, sand, and slag. Smaller U.S. foundries have been particularly burdened with expenditures on pollution control equipment. Similar investments are not required of many of the industry's foreign competitors. Moreover, these non-productive expenditures will mean further delay in the acquisition of more up-to-date and sophisticated equipment by the most troubled segments of the industry.

The entire metal casting industry has also seen traditional markets shrink as several client industries increasingly substitute other materials for cast-metal parts. In the automobile industry, for example, the demand for cast products has declined sharply as a result of that industry's attempt to reduce vehicle weights. This trend is expected to continue as the automobile industry further increases its use of lightweight materials such as aluminum, magnesium, zinc, and thermoplastics, in order to meet Corporate Average Fuel Economy (CAFE) standards.

INDUSTRIAL COMPETITIVENESS

The U.S. metal casting industry has been powerless to influence many of the factors that have contributed to the industry's decline in competitiveness over the past decade. Many of these factors were the inevitable result of changing world needs for cast-metal products. In many instances, however, the industry's reaction to these changes was sluggish at best. Although this slowness to react is generally attributed to the industry's fragmented nature, it has brought into question the industry's reputation as the producer of quality products. For a variety of reasons, many foundries have been slow to recognize and respond to changing production needs, particularly the need to adopt new and more advanced technologies and practices and to better educate and train personnel -- both of which are key factors in the production of high-quality products. In contrast, responsiveness to changing markets and readiness to adopt new production strategies have contributed to the success of many of the industry's foreign competitors and a similar willingness to change is fundamental to the U.S. metal casting industry's future in the world marketplace.

The adoption of advanced technologies and practices has been the pivotal factor in a resurgence of certain segments of the U.S. metal casting industry. Some large U.S. foundries that have kept pace with changing needs and have adopted state-of-the art technologies rank among the best producers in the world, particularly with regard to high-value-added products. The continued growth in U.S. exports of cast metal products is largely attributable to these forward-thinking foundries. The American Foundrymen's Society has projected that their production of cast-metal products will reach 15 million tons in the next few years. The growing market and today's favorable monetary exchange rates will provide the remainder of the industry with a golden opportunity to make similar investments in advanced technologies and production practices.

The education and training of U.S. foundry personnel are important factors in the competitiveness of the industry. A survey of industry experts conducted in 1993 revealed that the training of U.S. foundry personnel consistently ranks behind that of foreign competitors at all levels -- from production workers through line supervisors and plant managers. Table 4 summarizes the results of a survey on educational levels among workers in the U.S. metal casting industry and its major competitors. Experts believe that relatively lower education and training levels have caused the U.S. industry to lag behind its competitors in the rate at which it adopts new technologies. Whereas close to 50 percent of the casting technologies used in Germany and Japan are considered state-of-the-art, experts consider the U.S. foundries to have only 20 to 40 percent of their technologies in that category, with only the largest U.S. foundries being in the high end of that range. The average U.S. foundry also takes up to two years longer to adopt new technology than its Japanese and German counterparts. Higher levels of training and education have provided these competitors with greater ability to understand and apply new technologies to improve productivity, flexibility, and profitability.

Table 4. Education Levels in the Metal Casting Industry

Expenditure	U.S.	Germany	Japan	Korea
Average Production Worker's Level of Education	9th-10th Grade	12th Grade	12th Grade	10th-12th Grade
New Production Workers' (Entering the Work Force) Level of Education	11th-12th Grade	12th Grade	12th Grade	10th-12th Grade
Production Workers Attending Technical Training	0-5% 2-5 days/yr	50% 20 Days/yr	50% 20 Days/yr	40% 10 Days/yr
Average Line Supervisor Level of Education	12th Grade - 2 yrs college	2-4 yrs college	2-4 yrs college	12th Grade - 2 yrs college
Line Supervisors Attending Technical Training	30-75% 3-10 days/yr	100% <25 days/yr	100% <25 days/yr	50-75% 5-10 days/yr
Average Plant Manager Level of Education	>4 yrs college	> 4 yrs college & 2 yrs graduate*	>4 yrs college	>4 yrs college
Plant Managers Attending Technical or Mgmt. Training	60-90% 8-10 days/yr	100% 25 days/yr	75% 25 days/yr	75% 10 days/yr

*Common to have graduate degree (e.g., Ph.D. Metallurgy)
Source: Estimates from industry experts

As shown in Table 5, the industry's major competitors, Japan, Germany, and Korea, are significantly more competitive in the manufacture and sale of low-end products in the global marketplace. Virtually all U.S. exports of foundry products are high in value added or involve the use of sophisticated technology. These are primarily the products of the small segment of the U.S. industry, mentioned earlier, that has kept pace with technological innovation.

Table 5. Casting Exports: U.S. and Major Competitors (%)

Measure	U.S.	Germany	Japan	Korea
Exports as a Percentage of Total Production	5-10	70	60	80
High-Value-Added or Higher-Degree-of-Technology Casting[a]	100	70	50[b]	10-20
Lower-Value-Added or Lower-Degree-of-Technology Casting	0	30	50[c]	80-90

Examples: [a] Cast iron - a large tonnage, low-value product; investment castings - a small-tonnage, high-value product
[b] Stainless steel valves
[c] Non-critical Automotive castings
Source: Estimates from industry experts

Some observers have inaccurately attributed the inability of U.S. foundries to compete effectively in the low-end market to the relatively higher wages paid to U.S. foundry workers. As shown in Table 6, this may be a factor with respect to competition with Mexico and Korea, which enjoy relatively cheap labor. It is less easy to explain the low-end market successes of Japan, which pays labor rates similar to those of U.S. foundries, or of Germany, which has double the U.S. pay rates. Experts estimate that labor costs account for more than 46 percent of the production cost of a component in the United States.

Table 6. Average Foundry Wages: U.S. vs. Competitor Nations

Country	Avg. Hourly Wage ($)
United States	16.17
Germany	29.94
Japan	16.16
Korea	4.93
Mexico	2.35

Source: Process Metallurgy International, Inc., June 1993.

CONCLUSION

During the past decade, the metal casting industry has witnessed a new era characterized by rapid and significant changes in market conditions and increasing competition from foreign producers in both domestic and global markets. This turbulent decade has resulted in the closing or consolidation of many U.S. foundries. As a direct consequence, U.S. foundries today are far more competitive than they were in the past. The most successful ones have built the world's best production lines, exhibit certain forward-looking characteristics, and are competing successfully in the global market.

Many of the successful U.S. foundries share a number of key characteristics. They exhibit a high degree of productivity, which has been achieved through a combination of new technologies and motivated employees. Other specific traits associated with these successful foundries include the following:

- *Progressive Management.* Management capable of quickly adapting to changes in technologies, business climate, and social structures.

- *Employee Involvement.* Production worker involvement in everyday operations in order to attain needed flexibility and quality.

- *Capability To Produce High-Quality Castings.* Establishment of a program to ensure that product quality is of paramount concern as it is the key to long-term success.

- *Flexibility.* Responsiveness to customer needs on short notice, facilitated by increased use of the just-in-time methods. Foundries must be able to adapt shorter runs and switch from one pattern to another with minimum time and costs.

- *Ability To Control Costs.* Quality and flexibility are undoubtedly essential; however, the ability to produce castings at the lowest cost is the key to profitability.

The adoption of these characteristics along with new and advanced technologies will enable the foundry industry to produce higher-quality products in a more cost-effective manner. This will enhance the industry's competitiveness as well as that of the other U.S. industries that use cast-metal products.