

Sloan/ESI Lecture Series

**THE CURRENT AND FUTURE COMPETITIVENESS
OF THE AMERICAN STEEL INDUSTRY**

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In my brief remarks I would like to address three aspects of the competitiveness of the US steel industry.

1. The extent of and how the steel industry improved its competitive position.
2. Briefly comment on the changing nature of international competition.
3. Examine future technologies and the status and future roll of research in the development of these technologies.

In the early 1980's most of the US steel industry was literally a basket case and a prime example of the decline in the US competitiveness in many manufacturing industries. Several major companies either were in or on the verge of entering bankruptcy. Imports were at all time highs (over 25%), capacity utilization was less than 50%, production costs were higher than our international competitors and nearly every company was losing money. The industry responded by closing inefficient plants, making good strategic investments and working with and sometimes against organized labor to improve productivity.

From 1983 to 1990 over 45 million tons of inefficient capacity was closed which represented over 30% of the total. Investment in critical technologies such as continuous casting and secondary refining were made in only those plants which were competitive. For example, the percentage of steel continuously cast grew from 35% to over 91% from 1984 to 1995.

In the late 1980's Nucor built the first steel plant in the world based on thin slab casting which produces a slab of 2 to 3 inches compared to a conventional slab of 8 to 12 inches. This reduces a significant amount of rolling and the associated capital and operating cost. Furthermore, the technology is economically viable on a much smaller scale, 1 mtpy, compared to 3 mtpy for conventional casting. The liquid metal is supplied by melting scrap in an EAF. The total capital cost were only \$250

per annual ton of production compared to over \$1000 for conventional processes and the operating costs were \$50 to \$100 per ton less.

As a result of this breakthrough, in the 1990's approximately 20 million tons of new capacity is being built in the US. The vast majority is based on the EAF (Scrap) - Thin Slab casting technology. Whereas thin-slab casting can be viewed as an incremental technological change it caused a revolution in the competitive nature of the industry. It greatly enhanced competitiveness by lowering the cost of entering the flat rolled market.

In early 1980, at large integrated plants it took over 10 man hours of labor to produce a ton of steel. Today at the same plants it takes less than 3 and in the new EAF-Thin Slab Casting plants less than one man hour. Industry wide labor productivity has increased by nearly 300%. Few industries can make such a claim. It should be noted that virtually all of the new capacity is being built where there is no union. The main objective of avoiding unions is to eliminate the work restrictions. Steelworkers in both union and non union still receive 35% higher compensation than the average for all manufacturing.

Large measurable improvements in quality have been made. Customer surveys made by the International Trade Commission confirm the US producers meet, or exceed, international standards. As an example, rejection rates of steel because of poor quality by automobile producers dropped by over 90% from the mid 1980's. Typical rates were about 5% and are now less than 0.5%.

The researchers from the Sloan Steel Industry Study identified the key elements of the successful competitive companies. First was the selection of a market for which you have a competitive advantage. Initially for Nucor it was the low quality end of the long product market such as reinforcing bar. Later as it gained experience and established the EAF-Thin Slab Casting they entered the low quality end of the hot band market with a cost advantage of \$50 to \$100 per ton. USX

identified the highest quality flat rolled market which required integrated steel production without the residual impurities associated with the use of scrap in EAF production. They then concentrated their available capital in a limited number of plants which could be competitive. Lukens Steel and Oregon Steel Mills concentrated on plate which was no longer being produced by the large integrated firms and have, in general, been successful.

The second key element was establishing a High Performance Workplace. Decision making was decentralized and people were held accountable for the success or failure. Work teams with cross training was implemented, when allowed. Also, when possible, visible, immediate and direct financial incentives for workers and managers were implemented. However, both cross training and incentives were sometimes in conflict with unions. Some firms were successful by empowering the workers with the responsibility to make many of the decisions. Others were equally successful in which management made all the decisions and communicated them and the reasons for them effectively to the workers. Usually the middle road did not work when no one took direct responsibility. Furthermore, the Sloan Study found that no single HR practice improved performance. However, a well designed system of teams, training and incentives did improve performance. Finally, a culture of trust and communications was established in all cases.

In all the successful companies there was strong effective leadership. Executives were willing to make bold decisions, take reasonable risks and when necessary make unpopular decisions. The leaders had a vision as to what would make the firm competitive, a definite plan to achieve the vision and communicated the vision and plan. The key elements of the vision and plan are market selection, strategic capital investing, setting clear measurable and attainable goals and rewarding performance.

I would like to briefly comment on how the nature of international competition has changed significantly. In the 1970 competition came from Japan initially because of lower cost and later higher quality steel. However, the US industry is now the low cost producer for its market and can produce over 95% of the steel qualities required. However, imports still remain high. In 1993-94 imports were required to fulfill the steel requirements for US manufacturing since US production alone could not supply its entire needs. Low cost slabs from emerging economies such as Korea and Brazil became a major factor as did steel from the EU and the former Soviet Union countries because of its over supply. Steel dumping still exists and there is strong evidence of an international steel cartel which regulates steel trade to make the US the only true open market. Therefore, imports will continue to be a major factor limiting profitability and the ability to make needed capital investments.

Finally, I would like to discuss the future industry, its technologies and the research and development required to develop these technologies. The major economic drivers for new technologies are the need to reduce capital and other fixed costs, possible shortages in raw material, environmental concerns and increasing customer demands. The steel industry is the epitome of a capital intensive industry. It has the highest capital to value added ratio of any major industry. It requires full utilization of its capital to be profitable. Because of the high capital cost normally the steel industry loses money when capacity utilization gets below 80% and makes money at over 90% utilization.

With regards to raw materials there is sufficient ore, coal, and low quality scrap available for the foreseeable future. However, due to high capital costs, environmental concerns and reduced suppliers of coking coal, a major coke shortage in the US by 2010 is anticipated. The Sloan Study examined the current and future coke supply and demand. Currently, the US steel foundry industry uses

27 mtpy of coke and is a net importer of 3 mtpy. By 2010 the coke requirement will decrease to 20 mtpy because of process improvements and a shift to scrap based production but production could decrease to 10-12 mtpy resulting in a shortfall of over 8-10 mt which may not be able to be filled by imports.

There are large quantities of post consumer scrap available but this scrap is contaminated with impurities in particular residual elements such as copper. High quality steels require low residual scrap. Consequently, processes to produce scrap substitutes such as direct reduced iron or to purify scrap are required.

Therefore, the steel industry will continue to go through a technological revolution which began with the implementation of thin-slab casting.

The Sloan Study identified the key technologies required for the early 21st century:

1. An ironmaking process which uses coal instead of coke.
2. Processes to recycle waste oxides representing about 2 mtpy.
3. Process to produce clean scrap or scrap substitutes.
4. Near net shape casting processes such as strip casting to reduce energy, processing costs and capital cost.

In the successful restructuring of the US industry purchased technology from abroad was extensively used. This is possible when you are playing "catch up" with international competitors. But the US has caught up and has a unique set of economic drivers and cannot completely rely on purchased technology in the future. At the same time it's R&D capability has been cut by nearly 70%. The Sloan Study found US integrated firms spend about 0.5% of sales on R&D and minimills spend little or nothing, while major international competitors spend over 1%. Furthermore, for the key future technologies the Study found that on average 75% of the US companies said these technologies were critical to their future

competitiveness yet only 35% had significant R&D programs on the development of the technology.

It is apparent the industry must use its R&D capabilities efficiently to remain competitive. On pre-competitive issues collaborative research is desirable. More resources should be applied to longer term developments. Also some argue that since many of the drivers for change are the results of government regulation it has an obligation in aiding in the development of technologies aimed at meeting these regulations. The government agencies such as DOE and EPA can act as catalysts for change by providing cost sharing and the framework for collaborative research.

In summary, the US steel industry has made a truly remarkable recovery. However, competitive forces and government regulations indicate the industry must continue its technological revolution and be a leader not a follower. Well designed government support will greatly aid in these efforts.

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