OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

20223 Consultant: Stuart SINCLAIR
[illegible]

Strategy Options in the International Steel Industry

I. INTRODUCTION

This chapter discusses the strategies being adopted by steel producers in various countries. In so doing it attempts to offer a number of organizing frameworks which can be used to assess the steel industry as well as others. It also attempts to blend much recent management thinking and writing with a more traditional industry analysis approach. This yields some insights about the range of options for strategic change which the different types of competitors in the industry can choose from; the options which companies in so-called "mature" industries face (it turns out, in fact, that the options for improvement and change are virtually limitless) and it offers some predictions about the ways in which the various strategic sub-groups in the industry worldwide will develop.

This point about strategic sub-groups is worth noting, for it is clear that in an industry with wordwide sales of some 650 million tons/year and many hundreds of participants, not all competitors confront one another, nor do those who do confront one another directly necessarily compete in exactly the same way. In the airline industry, for example, USAir and Air Zimbabwe never compete directly, so do not fall into the same sub-group; nor do Austrian Airlines and Varig. But Air Zimbabwe and British Airways compete on selected routes (London to East Africa, primarily) so for some purposes inhabit the same sub-group, even though the bulk of British Airways' revenue is derived elsewhere. By contrast, American Airlines and United compete head-to-head for virtually all of their revenues, both in the domestic US market and internationally, so that they clearly compete in the same sub-group, and even share the same basis of competition, much though they continually try to create "breakout" strategies which change the basis of

competition to their own advantage (examples include frequent flier schemes and various tie-ins with hotel and car rental partners.) Similarly, in the steel industry, strategic sub-groups abound, within countries as well as across borders. Moreover, given the industry's size and scope, there are many possibilities for different strategies and management philosophies (be they implicit or explicit) also to co-exist. The different strategies which exist today will be discussed in sections IV and V, and the ways in which the various strategic sub-groups are likely to evolve in future are discussed in sections VI and VII.

Among the most obvious moves which competitors might make to enhance their competitiveness, in the steel industry or anywhere else, is that of doing very little beyond appealing for aid from governments or other trans-national entities such as the European Commission. (EC) Appealing for trade protection, through tariffs, non-tariff barriers and/or voluntary export restraints (VERs) is another form of this action. Going a step beyond this, companies might elect to reform themselves, largely using traditional efficiency approaches like reduction of white-collar work-forces, reduced product or process cycle-time in their plants, tighter control of working capital and so on.

On a more ambitious plane, there is another level of management improvement, which entails the "re-engineering" (or fundamental scrutiny of the way works is carried out) of critical processes such as order entry and other accounting procedures at the support level, and fundamental process redesign (say, regarding the way materials flow around the plant and are handled after cooling) at the technical level. A great deal of this type of effort is underway in the US and, increasingly, in Europe too.

Yet a further level of improvement, and one which has so far been seen mostly in companies in so-called "leading edge" industries such as airlines, trucking and telecommunications, many of which have undergone dramatic changes as a result of being de-

regulated, but which is still relatively unfamiliar in the steel industry, in that of "re-envisioning" the company entirely. This last, and most ambitious, approach, entails going well beyond the previous approaches, and drastically redefining the boundaries of the company, its relationships with customers and suppliers (and even erstwhile competitors, on occasion) thus effecting major change to its boundaries, its cost structure and its financial performance. Typical outcomes of re-envisioning include a much smaller company with a greater degree of "focus", that is, concentration upon particular product and/or customer sets. Each of these terms will be defined in Section V, where an effort will be made to anticipate what types of steel producers are likely to resort to each of these various approaches for self-renewal and enhanced competitiveness. (Numerous case-studies of such efforts are contained in Davis and Davidson, 1991, and in Clark and Fujimoto, 1991.)

By way of introduction, some data helps illustrate the diversity of results which steel producers have produced over the past five years. Table 1 shows sales, sales growth and return on equity (ROE) for a sub-set of the largest US steel producers. Note how very different the rates of growth of sales are, and how different their financial outcomes. Clearly, these companies are doing different things and are pursuing their chosen customer sets in different ways. But, as will be discussed in Section III, for the most part these different outcomes do not reflect dramatically different growth-rates of the products which each producer has chosen to specialize in; nor do they reflect major differences in the growth-rates of different customer types (oil and gas and automobile customers being exceptions.) Instead, the data suggests that the landscape of output has in fact been fairly flat, implying that the differences in financial performance have at least something to do with execution - meaning management attention to marketing, financial control, and so on, and also to choice of basis of competition. The different ways in which producers have chosen to approach these management variables, or performance levers, will be discussed in

S e c t i o n I V .

Table 1

Selected US Steel Producers: Financial Results, 1987-92

Company	1992 Revenue ($m)	1987-92 Sales growth	1987-92 ROE
Oregon Steel Mills	451	40.3% per year	25.6% per year
Worthington	1,003	1.9	16.5
USX-US Steel	5,011	N/A	14.7
Birmingham	419	11.3	14.2
Nucor	1,572	15.9	13.2
Inland	3,511	2.1	Negative
Weirton	1,081	-2.8	Negative
Armco	1,910	-11.8	Negative
Bethlehem	4,043	N/A	Negative
LTV	4,396	-4.9	Negative equity
Median	*767*	*2.3*	*9.5*

Note: Median is of group of 21 largest US producers. USX data includes results from Marathon energy group.

Source: Forbes, January 4, 1993, p. 171

II. BROAD INDUSTRY TRENDS

This section presents a quick overview of the competitive environment within which producers have been operating. Since most of these topics are covered in more detail elsewhere in this book, only those aspects of the topics which need to be discussed to understand competitors' strategies are mentioned.

a.pricing:

Pricing trends during the 1980s and 1990s were very unfavorable for steel companies. Indeed, US domestic prices barely rose at all in real terms during the entire decade of the 1980s, and have been under further pressure since. Commodity-grade hot-rolled steel prices in the US fell to around $265 per ton in late 1992 from a peak of $350 in 1989. Breakeven in late 1992 was estimated at about $7/ton more than the current pricing level. The outlook is for prices to remain low for some years, even though aggregate economic activity will pick up in the world after 1992; this is largely because of the remaining overhang of excess capacity and the fact that further mini-mill capacity, which can operate profitably at much lower prices than conventional mills, is coming on -stream.

Early in 1993 several producers attempted yet again to introduce price increases. British Steel announced a 11-13% increase in strip mill product prices and other European producers were expected to follow suit in an attempt to mitigate the fact that European prices had fallen by about 30% since 1989.

The outlook for pricing will turn out to be an important factor in shaping the steel industry's environment, for not only does the prospect of the mini-mills' effectively imposing a price ceiling on sheet products mean squeezed margins for integrated producers, but it also suggests that a re-ordering of power within the mini-mill sector itself, reflecting scale and execution differences

among the mini-mills, may be on the horizon.

b. government actions:

Much as in previous decades, the 1990s have been characterised by continuing government intervention for steel producers. This has taken two main forms:

• subsidies and structural adjustment assistance, provided through multilateral agencies such as the EC. This aid is often provided in the form of worker re-training funds, and dislocation grants intended to ease the entry of hundreds of steel workers at a time into the pool of the unemployed. A fund of $975 million has been suggested as an EC-wide initiative to retrain some of the 50,000 steelworkers expected to be made redundant before 1996 as about 10 million tons of capacity (out of Europe's 130 million tons) is shuttered. (An even bigger capacity reduction of about 26 million tons of crude steel and 18 million tons of rolled product capacity has been discussed more recently. *Wall Street Journal,* 9 February, 1993.) The German Steel Federation recommended cuts of 30 million tons of capacity, with most of the cuts to take place in Italy and Spain, countries where, as will be noted shortly, there has been relatively little retrenchment so far. (*Financial Times*, April 6, 1993.)

This new European initiative would be on top of an estimated $35 billion of subsidies provided over the period 1980-85.

The magnitude of past steel subsidies is indicated by the following figures. Between 1975 and 1991, EC and government aid to steel workers was estimated at $23.8 billion in Italy, $16.4 billion in the UK, $14.3 billion in France, $7.7 billion in Belgium, $4.2 in (West) Germany, $3.8 billion in Spain, and $2.9 billion in other EC countries. (*Los Angeles Times,* March 16, 1993.) In Japan, comparable actions were taken under the umbrella of the so-called "recession cartel" which reduced capacity during the 1980s cut employment by about 10% over the 1986-92 period,

to about 306,000. It is thought that a similar arrangement is being revived in Japan, so that capacity may be further reduced to about 100 million tons from its 1992 level of 115 million tons.
• individual government support, often *ad hoc* in nature, which has varied effects. An interesting lesson from the Klockner-Werke collapse of late 1992 was the assertion by its management that they failed largely due to their uncompetitive prices, and that their cost of producing steel was high in part because of their being required to buy expensive coal from the Ruhr at about DM 90 per ton more than the world price. Eventually even this complex network of cross-subsidies was unable to prevent major job losses in either the steel or the coal industry Ruhr Kohle announced in March 1993 it would cut 20,000 mining jobs in response to falling coal demand from steel works. (*Financial Times*, March 27, 1993.)Thus, the system of subsidies for coal and steel industries, which has become a staple of the landscape of European political economy, has been acting counter to one another's interests -- in this case at least.

c. trends in new capacity:

In many of the older, integrated steel producers, capacity has been reduced substantially. US Steel, for instance, cut its capacity by more than half during the 1980s, reducing raw steel capacity to about 12 million tons, and shedding 225,000 jobs, or 58%, since 1980. By 1993, European output in 1993 is forecast at 131 million tons (versus 132 in 1992) with British Steel's share of that output expected to be 16.7 million tons. (*Financial Times*, 1-14-93) Although there have been many such major cutbacks in capacity, mostly in the developed countries, there will be major increases in capacity in the developing countries over the next decade and beyond. Among the four least predictable elements in the total steel capacity outlook are the following:

• A particular "wild card" in capacity is the fate of the large amount of steel producing capacity in

Eastern Europe. Efforts by German producers to take over and rehabilitate this capacity have been stalled by low prices and excess capacity found during the last few years. For instance, Krupp Stahl looked at absorbing the largest producer in former East Germany, Eko Stahl, but initially decided that the $500 million needed to bring it up to acceptable quality levels was an investment that would not earn an acceptable return. Later in 1993 however Germany's privatization bureau, the Treuhandanstalt, decided that it might make sense to reshape Eko Stahl into a showpiece steel producer. It therefore approved spending $460 million to build an electric arc furnace and thin strip casting mill. The German Steel Federation opposed the plan, since although 70,000 or so jobs in ex-Eastern Germany depend on Eko Stahl, in ex-Western Germany thousand of steelworker layoffs are looming too. (*Wall Street Journal*, March 30, 1993.)

• In the former USSR, some estimates suggest that all the old open hearth capacity may be removed by the year 2000, with continuous casting capacity expected to grow. But the collapse of traditional intra-Eastern European trade patterns, reflecting the general fall in output and lack of a region-wide trading currency mean that revenue, and thus cash for investment, will be severely limited. Raw steel output in the CIS fell by 15% in the first three quarters of 1992 relative to its prior year level, with exports down by 30%. Elsewhere, production in Poland in 1992 is estimated at 9.9 million tons; in Romania, at 1.5 million tons; in Hungary, at 1.7 million tons and in Czechoslovakia, at 11.3 million tons. (*Metals Bulletin*, 2 November, 1992.)

• Chinese steel output represents yet another major wild card. Shougang, one of China's largest producers, has revealed ambitions to double its output by 2000 to about 20 million tons/year and to this end in early 1993 acquired a iron producer in Peru, Hierro Peru. Shougang is interesting in that it is unusually broadly diversified, with its 200,000-strong workforce responsible for machinery and equipment manufacturing as well as steel-making. In this respect it resembles some

of the Korean producers, whose growth-paths entailed widely diversified undertakings as government credit and other forms of assistance encouraged concentration of economic activity in about 40 major *chaebol*. (*Financial Times*, 1-14-93.) Ambitious expansion plans are being developed in China's other steel producers, including Wuhan and Baoshan.

• Meanwhile, steady (and in some cases spectacular) capacity gains are coming from the mini-mill producers across the world. For instance, in Japan, such mini-mills as Tokyo Steel Manufacturing, Kyoei and Tao Steel Company are expanding; even in Eastern Europe, mini-mills are on the horizon, with several Polish mills planning to change over their operations to mini-mills in the decade ahead. A careful evaluation of US mini-mill growth, and how it will affect other types of sateel producers, is contained in sections IIIb and VIb.

d. trends in customers' needs and preferences:

Just as significant as changes in the gross volume of demand for steel products is the appearance of several new trends in customers' preferences in steel which emerged in the 1980s. These are important as switching devices, which imperceptibly at first , then irresistably over the medium-term, move demand between different strategic sub-groups. These trends include:

• a desire to be able to specify precisely when and where each steel shipment would arrive, so that customers' own efforts at just-in-time production processes could be assisted. This was not easy for all steel producers to offer, of course, since it entailed their own plants, and inventory systems being realigned.

• a desire to specify much tighter quality tolerances, so that flaws in their inputs were greatly reduced. Among the early steel customers which went to great pains to measure the quality of its various suppliers' inputs was Xerox, which adopted the practice in part from its Japanese partner

• a desire to be able to order much smaller batches than hitherto were offered by steel producers, again partly to assist in moving to lower-inventory practices, but also to cut working capital.

• a desire to automate payment practices to steel producers, through such systems as EDI (electronic data interchange) and ACH (automated clearing house), both of which are electronic order payment procedures which simplify and codify the business of dealing with invoices among habitual vendor/customer relationships.

• a desire to have more information surrounding the steel product itself, so that customers could know exactly which shipments of which products were where, and when they would arrive. Much of the responsibility for this type of value-added actually has lain outside the steel industry itself, and has been provided by the new generation of sophisticated trucking and airline competitors unleashed by de-regulation in some countries (notably the USA.) As already noted, these are some of the same companies which have been innovating through fundamental re-envisioning efforts.

• a desire to reallocate, either marginally or more fundamentally, the border between the steel producer and the customer. Examples of this would entail having the customer specify which carrier would pick up the steel, and when; having the steel producer carry out more value-added activities on the steel prior to shipment; and so on.

Naturally, different types of steel producer can match or exceed these needs to very varying degrees. A big, unreformed steel producer could barely meet any of them: these producers are not used to being able to fine-tune their output, and tell customers about where it is and when it will arrive, and instead rely upon long runs of basic products sold to a solid base of customers who want the same thing month in, month out. However, as the 1980s progressed it became apparent to the more observant producers that this customer base was shrinking, in some cases, dramatically. In the auto industry, for instance, it was clearly not "business as usual;" and the surviving auto

companies were thriving at least in part because of their suppliers' ability to go well beyond the old norms as regards quality, price and service on all the dimensions described above. The pattern was echoed in many other industries, to the point that virtually all steel producers by the end of the 1980s were finding that they needed to re-examine the way they could anticipate and match customers' needs during the coming decade.

e. international trade in steel and steel products:

This topic has been covered in an earlier chapter. Here, it is useful to note the main changes which are shaping the competitive landscape.

• The EC agreement with Poland, Czechoslovakia and Hungary with effect from January 1992, which limits their steel exports to Europe. From 13 million tons in 1991 these exports had grown rapidly in 1992 and were finding markets in lower-grade applications. EC steel imports were up by about 50% to 3% of steel consumption. France, Germany and Italy have informal agreements which limit the share of steel from Eastern Europe to about 20% of apparent consumption. (*American Metals Market*, 11-18-92.) Spain is among the countries most opposed to further liberalization of import barriers to the EC, notably those facing Eastern European steel producers.

• A ten year long VER imposed by the United States expired on March 31, 1992 and was followed quickly by many anti-dumping cases being filed by US producers. Some 12 steel companies filed 84 cases in September 1992, leading to the US Commerce Dept imposing preliminary countervailing duties on lead and bismuth steel bars from the UK, Germany and France. These duties affected EC exports of about 2 million tons, worth some $800 million per year.

In fact imports of steel to the USA have not grown steadily and in recent years have tended to be replaced by output from domestic mini-mills. Imports as a percentage of apparent consumption were 16.3% in 1980, peaked at 26.6% in 1984, and since then have fallen back to 17.8% in 1991. Nonetheless, import restrictions to the US were seen by domestic producers as an essential

prerequisite for moving prices upwards, even as, as will be seen later, the real threat to integrated producers' interests lies with a far more pervasive and uncontrollable source - the mini-mills.

Overview of environmental factors: The upshot of all the factors just listed on competition among steel producers is probably as follows. Price-based competition, expressed through the vehicle of international trade, will continue to be troublesome for the flat-rolled products which are the domain of the large, integrated producers. Trends in customer needs will continue to play into the hands of those producers (many of whom, as will be seen, are mini-mills) which are able, for an increasingly wide range of steel items, to produce runs of varying lengths at relatively short notice for a variety of customer specifications. Government actions will be largely irrelevant to the competition played out between these two strategic sub-groups, except insofar as they have the effect of slowing down the rate at which integrated capacity is taken out of the market and thus prolong the time-period over which prices remain depressed. Even here, the impact of government action on price-levels may be modest in that new capacity, with all the attendant effect upon steel prices that this implies, is going to be built by mini-mills anyway. These patterns of government action are likely to persist, even though studies (e.g. by the Economic Policy Institute in Washington, DC) show that steel protection cost the US economy some $868 million per year between 1984 and 1989.

Having looked at the environment likely to be found in the US and Europe, and indeed any region where there is competition among steel producers in general and competition between integrated and mini-mill producers in particular, the discussion now turns to examine the state of affairs within those two sub-groups (in Section III), the various strategies being pursued within those sub-groups (in Sections IV and V,) then the struggle which is erupting betwwen those sub-groups

(in Section VI.)

III. A SHORT PROFILE OF STEEL PRODUCERS

The following tables present a short overview of the main world steel producers, drawing on data compiled since 1990.

a. a profile of the integrated producers:

Table 2 shows the size and ranking of the top 25 producers in 1990. It shows that two producers are significantly larger than the rest; then there is a group of eight or so second-tier producers (containing many operating from the USA) then a third tier of producers in the 4 to 6 million tons/year category. The smallest of the 25, Krupp Stahl, is producing some 4.31 million tons/year, which is one-seventh the size of the largest producer, Nippon Steel. The table also shows that there are relatively few developing country based producers in the top league: Posco and China Steel are the only ones in the top 25.

Table 2: Ranking of steel producers by output, 1990

Rank	*Name*	*Output, million tons*
1.	Nippon Steel	28.76
2.	Usinor Salicor	23.26
3.	Posco	16.22
4.	British Steel	13.75
5.	USSteel	12.35

6.	NKK	12.11
7.	Ilva	11.51
8.	Sumitomo Metal	11.14
9.	Thyssen	11.14
10.	Kawasaki	11.12
11.	Bethlehem	9.91
12.	Sail	8.69
13.	Arbed	7.67
14.	LTV Steel	7.44
15.	Kobe Steel	6.56
16.	Iscor	6.34
17.	BHP	6.15
18.	China Steel	5.89
19.	Dofasco	5.21
20.	National Steel	5.20
21.	Hoogovens	5.15
22.	Inland Steel	4.84
23.	Armco	4.83
24.	Cockerel Sambre	4.37
25.	Krupp Stahl	4.31

S o u r c e : I I S I

Another view of the largest producers (mostly in the United States) comes from looking at their output-mix and its stability over time. Table 3 shows for the US industry the share of different

steel products within total output over time; it is notable for the stability of output-mix during a decade in which a great deal of capital investment and flux in the customer base has taken place. One major change has been the shrinkage in the pipe and tube market, which has fallen by two-thirds in ten years. Limited US pipe capacity means that even with this major fall in demand, imports are still a significant source of consumption, whereas in most of the other segments where demand has fallen, imports have generally taken the brunt of the fall.

T a b l e 3

Output-mix of major US producers, 1982 - 1992, % of total

Product	*1982*	*1985*	*1988*	*1992*
Sheet, strip & tin mill	52.4	55.9	53.3	5.34
Plates, structurals, shapes	12.5	12.4	15.0	15.9
Bars and rods	21.4	21.3	22.0	21.1
Pipe and tubing	8.2	5.6	5.3	4.8
Other	5.6	4.8	4.4	4.8

S o u r c e : I I S I

Yet another view (see Table 4) comes from examining the US producers' sales by customer-type. Here a different story emerges - one of change at the level of individual producers masked by relative stability in overall mix. (The fall in the share of auto producers is the one significant change. A contraction in oil and gas demand is masked by the "other" category.)

T a b l e 4

Steel shipments by end-user, USA, 1984 - 1992, % of total

Customer type	*1984*	*1988*	*1992*
Steel service centers & distributors	24.9	25.1	26.3
Steel for converting, processing, etc	8.6	11.6	8.2
Construction	13.8	14.4	10.9
Automotive	17.5	15.0	12.9

Source: Salomon Brothers estimates

An indication of the differences among producers within these totals comes from the following data: Bethlehem Steel sells 46% of its output (by tonnage) in the form of sheet and strip, whereas this accounts for 74% of USX's; Birmingham Steel sells 10% of its output to service centers whereas Inland sells 32% of its through this channel.

Market shares within the US have moved fairly significantly over the past decade, buttressing the view, presented first in Table 1, that a number of different strategies are being pursued with very different degrees of success. As Table 5 shows, shares moved by as much as 50 percentage points between 1980 and 1990. LTV's share fell by about half, for instance.

T a b l e 5

Market share trends, major US producers, 1980 - 1990

Producer	*1980*	*1984*	*1988*	*1990*
Armco	6.4	5.5	5.2	4.2
Bethlehem	13.2	12.1	12.2	10.5
Inland Steel	6.3	6.8	6.0	5.5
LTV	15.9	15.3	10.7	8.0
USX	20.4	16.0	14.5	13.0
Other US companies	37.8	44.3	51.4	58.2

Source: Salomon Brothers estimates

These market share figures might suggest a consolidated industry, since they show the biggest five producers taking 41.2% of total US sales in 1990. In fact, however, the industry is relatively fragmented and almost certainly becoming more so. In the US, what is important to note in Table 5 is the growing share of the "other" group, which has risen by over half in ten years, to 58.2%. Elsewhere, there is also typically a dominant sub-group, but their grip is also tending to be shaken loose. In Europe, there are 21 steel producers with capacity of 2 million tons/year or more, with the ten biggest having about a 65% market share. (*Wall Street Journal*, June 26, 1992) In China, of 1,400 registered steel producers, the largest ten account for 13% of total output. The major companies are Baoshan Iron and Steel Co (which produced 6.5 million tons in 1992), Anshan Iron and Steel (0.7 milion tons/year) and Wuhan (5 million tons/year.) In India, seven companies produce 7.7 million tons out of total output in 1991 of 17.1 million tons, whereas a further 161 mini-mills, none of which is bigger than 0.25 million tons/year in capacity, produce the rest.

An important reason for this fragmentation is the growth of the mini-mill sub-group, which is about to be profiled. The mini-mills have forced down the concentration ratio of the industry, both

because they have accounted for most of the growth of steel output over the last twenty years and because they tend to be small, since they do not rely upon economies of scale.

b.aprofileofmini-millproducers

Worldwide, the mini-mill producers have made major strides in taking share away from integrated producers. Since 1972, when their share of world steel output was about 14%, they have grown to take about 27% of world steel output in 1992. The US mini-mill sector consists of 40 producers of whom the largest 15 account for 76% of mini-mill output.

Mini-mills' output-mix in 1991 in the USA was as shown in Table 6.

Table 6

Mini-mills' output-mix, 1991, by tonnage

Bars	48%
Semi-finished	3%
Structurals	28%
Sheet	21%

Source: Shearson Lehman

The channels used by mini-mills are also different from those of the integrated producers..Table 7 shows the distribution channels or end-users they served in 1991.

Table 7

Mini-mills' sales channel and end-user mix, 1991

Service centers	36%
Construction	18%
Transportation	18%
Containers	4%
Machinery	6%
For further conversion	14%
Other and exports	3%

Source: Shearson Lehman

IV. OVERVIEW OF STRATEGIC CHOICES

In the past, these two strategic sub-groups, the large, integrated steel mill and the mini-mill, have for the most part not confronted each other directly. There has, over the past ten years, been a sliding past of one against the other in that the large mills have gradually ceded control of many of their construction industry sales to mini-mills. This relatively peaceful co-existence is, however, very likely to be changing now, as the mini-mills - or some of them, at least - are entering the flat-rolled portions of the steel market. This 40 million tons/year (in the US alone) market is critical to the integrated producers, suggesting that a major battle is shaping up. A fundamental re-shaping of the financial landscape is also in the offing, since the mini-mills' entry into the flat-rolled segments is likely to change the prevailing price structures there, and in the process remove the one remaining area of reasonable returns for the integrated producers. Clearly, there will be differences among integrated producers, in that some are lower cost than others, but there is nonetheless an inherent floor to their costs arising from the technology they have elected to re-invest in (to the tune

of about $35 billion in the US alone) over the past decade.

Given the magnitude and importance of this impending change, it is appropriate to step back and distinguish and evaluate the disparate strategies which different steel producers are riding into the fray with. As the Introduction pointed out, there may hitherto have been many ways to compete in steel, but the number of ways will almost certainly be reduced in the coming decade and it is therefore important to try to identify the winning and losing strategies.

As would be expected in an industry with so many different competitors, with different national raw material endowments to draw upon, and different government policy regimes affecting them, there are many different strategies at work. Indeed, the range of strategies has been unusually broad, with the main dimensions including:

a. choice of fundamental strategy: This (often implicit) decision addresses the decision of whether to compete on the basis of low cost, unique quality levels, unique product characteristics or specifications, service attributes, service levels, etc. Underpinning such basic choices as these are companies' implicit or explicit decisions about how much effort to put into "re-engineering" or other fundamental self-scrutiny.

b. choice of served markets: This primarily concerns choices about which areas to serve and whether to be a regional or national player. Regional choices also imply choices about customer types, given the uneven distribution of customers across any country. For instance, in the USA a location in the South implies customers in the oil and gas industry and construction will be pursued more than customers in the auto industry.

c. product-mix choice: This varies quite widely by company. For instance, US Steel has a larger than typical share of tubular products, and as the gas and oil markets in the US have contracted in the last decade, sales of this product have fallen off markedly.

d. choice of contractual arrangements: This includes the length of the contracts under which output is sold. Inland Steel tends to sell much of its steel in long contracts, which has, among other things, the effect of reducing the company's exposure to the price swings which the "spot" market suffers from.

e. choice of value added steps: The primary choice here is that of whether to be an integrated producer or less than fully integrated. In the latter case there is the secondary decision of what contractual relationships to have with the companies outside one's own value chain - the partners, joint ventures, arm's-length suppliers or customers, etc. Some producers have chosen to maintain large, national steel service center operations (Inland Steel's Ryerson division is an example), while others have elected to remain producers only. The fact that there may be some consolidation underway in the steel distribution business gives an interesting twist to this factor, in that changes in the bargaining power of customer groups has long been seen as part of the "five forces" (the others being potential entrants, suppliers' bargaining power, substitutes and rivalry among existing competitors) which shape long-run industry rates of return. (See Porter, 1980.) For instance, in 1991 Kilsby-Roberts, Republic Supply and Earle M. Jorgensen joined together to form a $900 million/year steel distribution business with 75 locations and 2,000 terminals linking customers and order-takers. (*Information Week*, August 26, 1991.) The importance of this trend lies in its potential ability to reduce rates of return for non-integrated producers ralative to integrated producers in a given served market.

A second choice to be made here is that of the channel, or distribution path(s) chosen by each producer. Some producers elect to have all their output sold by full-time sales representatives; others have found that once a customer relationship is established, it can more efficiently, and even more effectively, be handled by telemarketing and automatic order entry. The choices here will be shaped by the product mix, the number and type of customers, the extent to which customers' needs vary, and the maturity of the customer relationship and the product set. A familiar product-

mix sold to a established customer base will imply totally different channel choices from a new and unstable product being sold to a fresh customer. (For a detailed discussion of product-mix maturity as it affects industrial producers' channel choices, see Robertson and Barich, 1992.)

f. choice of technology: In the case of the steel industry, the technology chosen has a major effect upon many of the other strategic variables listed above. For instance, by the early 1980s the choice of mini-mill production over integrated meant that the output-mix would be heavily weighted to rebar and certain other products, with relatively little plate. Similarly, mini-mills, by virtue of their being relatively new, have very different labour costs and retiree cost structures, thus the basis upon which they can compete is very different from other producers. There is therefore a degree of interdependence between these choices, and mini-mills are discussed separately here since so much of their strategic posture and options for the future is determined by that one fundamental technology choice.

g. relative importance given to strategy choice over implementation: Interesting new work has raised the question of whether is some industries, producers (typically Asia) do well by better implementation rather than through skill at frequent strategic repositioning. While there must clearly be some threshold of strategic logic to the dogged implementer's position, or it will surely fail, this is a thesis which seems to hold up in some high-technology industries (Egelhoff, 1993.) For the steel industry, the implication might be that Japanese and Chinese based producers might triumph over some of their Western competitors by continually paying more attention to process and product enhancement than by carrying out major strategic realignments such as pursuing different customer groups. However, as will be argued later, the fundamentals of mini-mill competition will probably soon be imposing more important strategy problems than excellence of execution alone can resolve.

The fact that there are so many choices to be made from even the above, abbreviated, list, means that managers in the steel industry face many "degrees of strategic freedom" - that is, face many

options for competing. A glance at the strategies of Worthington, Inland and Chaparral, for instance, each of which is discussed later, illustrates the large degree to which even three of the largest steel producers have elected to operate in very different ways. By contrast, in the auto industry, where the number of producers has been whittled down from hundreds in the 1930s to about 50 in 1960 and to perhaps 10 serious contenders now, there are many fewer degrees of freedom, and thus a correspondingly greater onus on management to choose and execute within one of a handful of available feasible strategies. Section V will now argue that the number of feasible choices in the steel industry will also be drastically reduced in the coming years.

V. COMPETITORS' CHOICE OF STRATEGIES COMPARED

This section identifies then evaluates the various strategies which steel producers across the world have adopted, illustrating each with a brief case-study of a particular steel producer.

a. retrenchment strategies:

Most of the large volume producers have followed broadly similar strategies during the last five years or so. They have slimmed down capacity, and/or cut back grossly unprofitable product lines and have tried to take a page out of the leading-edge manufacturers such as some of the Japanese auto manufacturers by improving product quality and cutting work-in-process inventory.

Example: Inland Steel: Among the larger US competitors (Inland is the 22nd largest producer worldwide and the fifth-largest in the US), Inland has adopted one of the more imaginative approaches. It has, however, failed to be consistently profitable and in early 1993 was yet again struggling, for perhaps the third time in a decade, to redefine itself. Among the innovative steps it took during the 1980s were a massive reduction in gross steel-making capacity, two huge and

hightly ambitious joint ventures with first-ranked Nippon Steel and a drift up-market with its output-mix.

Among the steps Inland took which all the old producers have to take is a charge to reflect a new FASB ruling (FASB 106) on retired workers' anticipated future healthcare expenses. In the first quarter of 1992 Inland took a $660 million charge for this item, depleting shareholder equity in the company to $400 million. (USX took a similar charge of $1.1 billion and Armco one of $700 million) With the older producers having a ratio of retirees to current workers of as many as 3:1, these charges, which are not a cash item but do reduce shareholders' equity dollar for dollar, represent a major difference against the mini-mills with their generally younger work-forces. The other major problem on the balance sheets of older, integrated producers is their unfunded pension liabilities. As of December 1992, Bethlehem Steel had a laibility of $1.85 billion, Armco, $195 million, CSX, $193 million, and LTV, $2.99 billion. (*Wall Street Journal*, February 4, 1993.)

Other integrated producers have been retrenching, although in different ways and to different degrees.

Thyssen Stahl, Germany's largest steel-maker, has recently pursued a mixture of insisting on more subsidy and retrenching. Accompanying the announcement of its 1992 results was a request for a "cartel of structural crisis," which would include efforts to cut some 7-8 million tons of hot-rolled steel capacity in Europe, particularly from Italy and Spain. Thyssen Stahl's own work-force will be reduced by 8,000, or about 14% of its 57,700, over the coming two years. Even the specialty steel division, which ten years ago was the type of division European steel producers expected to lead them permanently out of trouble, turned in what it referred to as "catastrophic" results, with losses rising from 79 million marks to 354 million marks. Sales in 1992 fell 5.1% to 9.9 billion

marks and group net profit fell to 35 million marks, from 317 million marks the preceding year. Shortly after this, it was announced that Thyssen would merge with Hoesch Stahl AG, and that one of their huge blast furnaces, at Dortmund or Rheinhausen, will close. (*Wall Street Journal*, 11 February, 1993.)

A different route to a similar result has been that of LTV, which entered Chapter 11 bankruptcy protection in 1986. After selling off its aerospace unit for $476 million the company expects to emerge from Chapter 11 in 1993. Assisting in this is a 12% stake being taken by Sumitomo Metal Industries.

Other large companies have yet to engage in such serious retrenchment. In Italy, for instance, the large IRI-owned company Ilva, which lost $1.4 billion in the first eleven months of 1992, a new Japanese managing director is taking over with the intention of turning around a much smaller and more focussed entity. Ilva has existed in its current state up till now by massive subsidies from the Italian government. Arbed, the Luxembourg-based steel producer announced early in 1993 that it also would restructure and place less emphasis on heavy beams production than hitherto. (*Financial Times*, March 27, 1993.)

Japanese retrenchment includes Nippon Steel closing three of its 13 blast furnaces by 1993, and planning to shutter a further two. Kawasaki plans to invest $1.2 billion to cut costs and to make its mills work more like mini-mills. NKK and Sumitomo, both of which reported zero net income for 1992, are also examining ways to cut back. Much of this retrenchment is a response to severe output falls (expected to be as much as 8% from 1992 to 1993) despite strong export sales to China. (*Financial Times*, March 20, 1993.)

Even small producers have recognised the need for retrenchment and greater efficiency. Grupo Villacero, the new owner of Sicactsa, announced work-force reductions from 4,094 to 3,246, and other steps which together will reduce costs by 30%. Output now is about 1 million tons/year. (*Mexico Business Monthly*, September 1992.) In India, retrenchment has taken yet a different form, with the Planning Commission deciding to reduce the amount of capital it will make available to steel producers. Its decision anticipates the relaxation of price controls which will allow steel companies to raise their prices enough to generate more internal cash-flow to fund investment in efficiency-enhancing techniques. (*Economic Times*, May 18, 1992.)

In Eastern Europe, two of Poland's largest integrated plants, at Katowice and Krakow, will be merged into one smaller plant using continuous casting lines, while in Hungary, it is expected that only two major steel complexes (those at Dunaujvaros and Dimag) will survive, while the others close. (*Financial Times*, February 19, 1993.)

Interestingly, some newly-formed developing country-based producers are also retrenching. In 1993, China's fourth-largest steel company, Wuhan Iron and Steel, announced no less than 80,000 job losses in the hope of cutting the cost incurred in operating its 5 million ton plant. It is aiming at a workforce of closer to 40,000 than its current 120,000 in the future. A benchmark it apparently referred to is British Steel, which in 1982 made 12.2 million tons with a work-force of 40,000. (*Financial Times*, February 5, 1993.) Similarly, Posco of Korea plans a 20% staff cut by 1996 and is also ordering equipment that will not use blast furnaces or coke ovens, once again trying to emulate the mini-mills without actually becoming one. (*Wall Street Journal*, February 2, 1993.)

Retrenchment, then, is:

- perhaps the most "natural," response, in that it directly deals with the apparent problem, which is size
- widely pursued among the integrated producers
- lagging in Southern Europe, where government actions have delayed the moves seen in the Northern European countries
- beginning to affect producers in developing countries to some extent.

b. niche strategies

Producers adopting niche strategies deliberately do not confront large, undifferentiated markets but instead try to identify then serve selected segments, and to serve them in ways which are not readily imitated. To some extent all steel producers are trying to get to grips with niching. For the large producers, however, the problem is that their very size dictates looking for large markets and these are the ones which have tended to offer the most cyclical and least attractive pricing in recent years. US Steel for instance, reports that "We are no longer the "supermarket" for steel products of past years... We are responding to selected markets ..." (US Steel, *Annual Report*, 1991, page 8.) But this is a hard road to follow, because of the capacity implications of focussing down on a smaller number of customer sets.

Example: Worthington: This US competitor has consistently followed a form of "niche" strategy (as they term it themselves) by eschewing many of the value added steps typically carried out by larger, older competitors. Instead, it has focussed on carrying out a small number of steps. Worthington occupies a position between the integrated mills (who are effective, traditionally at least, in large, standard orders), the metal service centers (who carry out limited processing closer to the end-user than the large mills) and the end-users themselves. Its basis of competition lies in

offering short, customized runs at short notice. Worthington has in fact pursued several variants of niche strategy at once. In addition to this value-added selectivity, Worthington has explicitly chosen to focus in three other dimensions:

Regional niches: Worthington has further narrowed its focus by serving selected customers and selected regions of the country, primarily in the SouthEast and the MidWest. Worthington has only modest shares of consumption at each of its major clients (it has about 1,700 customers in all) thus allowing it scope for expansion when it needs it.

Customer niches: Worthington has elected to serve the auto industry particularly well, and was the first steel processor to be awarded the Q1 quality rating by Ford Motor Company. For its auto customers it produces precision parts to very tight tolerances, such as those needed in automatic transmissions, power steering systems and anti-lock brakes. To meet these needs, Worthington has invested in a considerable amount of new equipment, including the world's most advanced pickling equipment, high-grade annealing, and a cold rolling reversing mill.

Product extension niches: In addition to its core steel production, Worthington has chosen to enter and dominate selected product categories which make use of its steel production. Notable are its suspended ceilings division (first entered via acquisition in 1984), which sells over 500 different parts in different finishes through the acoustical distributor channel; and the pressure cylinder business (also entered through acquisition, in 1971) in which it has become an innovator of steel-based refrigerant gas containers.

The financial results this strategy delivers are interesting. Worthington has markedly higher inventory turns (i.e. sales divided by inventory assets) than other steel companies; between 1981 and 1991 this ratio averaged 6 times. It was able to achieve a return on shareholders' capital of between 16% and 24% in most years, although it was unable to escape a fairly strong cyclicality in that rate of return. Total returns to shareholders have been excellent, with an initial 100 share

investment of $750 in 1968, when the company was floated, growing to 3,240 shares worth $89,000 in February 1993.

Niching has worked fairly well up till now for medium-sized steel producers. This is because in the larger developed country markets there is enough regionality of demand for small steel "economies" to co-exist side-by-side, just as there is in the natural gas or some other industries. This balkanization of demand allows pockets of "rent" (or super-normal pricing and thus returns) to persist even as the aggregate, national industry grinds out lower and lower clearing prices. Apart from regional niching, product niching (in pipe, large structurals, etc) has also offered an avenue of escape, but mini-mills now seem likely to threaten this to some extent. When it is time to offer a summing up of the feasible strategies going forward for the rest of the century, in section VII, various niche-based strategies will indeed figure on the list.

c. joint ventures

Large, long-term, capital-intensive endeavours naturally lend themselves to joint ventures. This is seen increasingly in the aircraft industry, aerospace, entertainment and elsewhere.
Along with several other strategic responses, several types of joint ventures have become very popular in the steel industry.

joint ventures to penetrate foreign markets: These are increasingly common as trade barriers in steel proliferate. An example is Korea-based Posco's 50/50 joint venture with USX, California-based UPI.To initiate the venture, Posco supplied $200 million, and USX provided the plant (which it otherwise would have shut, since it could not compete with Japanese steel being sold in the Western states of America on price or quality.) One thousand workers are employed there.

Posco supplies high quality hot rolled steel (known as "hot bands") to the joint ventur, which then produces cold-rolled steel for automobiles, office furniture, cans, building, etc. To date Posco has supplied some 700,000 tons per year to the joint venture, and its operation has reduced import penetration of steel on the West Coast by about half. However the pricing agreement with which Posco entered the venture is becoming increasingly onerous, particularly as the booming export markets of Asia , which are setting premium prices, impose a high opportunity cost on Posco's commitment to the venture. Ironically, even though Posco is losing money on the operation, USX was among the steel producers which filed an anti-dumping case against its own partner. (*Forbes*, March 29, 1993.)

joint ventures to learn from "leading edge" producers: These joint ventures are akin to General Motors' efforts in the mid-1980s to set up NUMMI, a jointly-owned and run factory with Toyota at Fremont, California.

The joint venture announced in 1992 between Posco and the Shanghai Municipal Government in China represents an interesting new form of joint venture in that Posco will be responsible for the beginning and end of the value chain, and the Chinese partner the middle. In practice what this will mean is that Posco will send 110,000 tons/year of black plate, the plant's primary raw material, to China. The 50-50 joint venture plant will then convert this into tin-plate. Posco will then take responsibility for marketing the finished output, through a network of steel marketing outlets in the Dalian and Weihai economic and technological development zones. Since imports currently account for 80% of China's tin-plate consumption, selling the plate will probably not be too much of a problem. (*The Export Sales Prospector*, October 1992.)

joint ventures to reduce the cost of adding capacity in volatile markets: This category embraces the joint ventures which Inland Steel undertook with Nippon Steel of Japan and desribed above.

joint ventures to share risk: Nucor Corp and Oregon Steel Mills Inc announced during 1992 that

they would build a $400 million steel mini-mill on the West Coast of the USA, taking an important step towards entering sheet steel segments, the last bastion of the old mills. Using thin slab technology, this joint venture is of course not totally without risk, and the established producers on the West Coast will certainly try to undercut the new plant's prices.

d. diversification: There has been relatively little large-scale diversification by steel producers, in part because the huge problems they have wrestled with in the past decade has reduced their stock market float, and thus undercut their ability to buy other companies. This fact - perhaps a blessing in disguise for many steel producers - means that the strategy of moving into other businesses has been restricted to a few examples. In Japan, Nippon Steel has bought into NMB Semiconductor, and in early 1993 increased its shareholding by $286 million. It intends to take over the Minebea semiconductor business and run it as Nippon Steel Semiconductor.

Another Japanese example is that of Kobe Steel, which is even thinking of removing the word "Steel" from its name, as a result of cutting the share of steel in its revenues from about 50% now to a possible 25% by the year 2000. An example of a diversification venture coming to grief comes from Nisshin Steel, one of Japan's leading stainless steel producers, which had total revenue in the year to March 1993 of 400 billion yen, or around $3.2 billion. During the era of *zaiteku*, or financial engineering, in the late 1980s, Nisshin established a financial services group called NSK. This group eventually ran a $1 billion stock portfolio for trust funds, originated loans, and took part in other financial services ventures. In 1993 NSK was shut down, a victim of the Japanese stock market collapse. (*Financial Times*, April 1, 1993.)

Elsewhere in Asia, Posco of Korea is investing in cellular telephony, a business which it expects to grow faster than steel. Among the factors prompting this policy is that it sees Korean steel exports to Japan slowing down (although they grew fast from 2.1 million tons in 1987 to 3.4 million tons in 1992, resulting in Korea becoming the largest source of steel exports to Japan.) Recent

announcements from Posco on its "Posco 2000" plan indicate that it hopes to achieve as much as 30% of its projected $20 - 30 billion global revenue from non-steel businesses. In 1989 Posco established POSDATA Ltd., a data communications company, and in 1990 it set up POSCO Huls Co., to produce silicon wafers for semi-conductors. (*Korea Economic Daily*, October 2, 1992.)

e. product substitution strategies

One of the few possible changes in demand-mix on the horizon is the possible greater substitution of steel for concrete in building projects. Steel beams have several advantages over concrete, especially for buildings of less than seven stories and for bridges with short spans. In the UK, for instance, the share of steel in this type of construction work has grown from 38% in 1980 to about 58% now. US producers, partly through the agency of the American Institute for Steel Construction are trying to convince construction firms to use more steel, thereby raising its share from 44% in 1991 to a possible 52% by 1996.

Some of the integrated producers have worked hard to change their product-mix. Inland Steel, for instance, with its I/N Tek and I/N Kote plants, built with Nippon Steel, can now carry out elaborate annealing, pickling and galvanizing processes. The plant's cost, in excess of $1.1 billion, implies some faith in the magnitude of both the served market and Inland's likely share of it, but beyond this there is the question of whether this rather traditional "escape up-market" strategy can have more than a palliative effect. Similarly, other producers have moved into wire rod and have gradually moved out of lower-value segments in the wire market.

Many smaller adjustments to output mix are always being made. For instance, Armco Steel announced in April 1993 that it would sell its steel-coil coating business to Material Sciences Corporation. (*Wall Street Journal*, April 8, 1993.)

f. fundamental strategic responses such as "re-envisioning"

As mentioned in the Introduction, a small number of companies (some of them in the steel industry) have set out in the last three to five years to re-invent completely they way they do business. Much of the discussion of these companies is, however, bedevilled by the myriad new terms which academics and management consultants have coined to describe various aspects of this transformation. Among the terms recently coined are "core competencies," "re-engineering," "re-envisioning," "corporate transform ..ions," the creation of "high performance organizations," and the company as a "learning laboratory." To paraphrase one economist, they have "gate-crashed the literature, thus avoiding the entrance fee of a definition."

In fact many of these terms do have relevance in the steel industry and the example of Chaparral Steel, based in Texas, USA, will be used here to describe this type of competitive response, what type of success it has met with, and the extent to which it may be applicable more broadly within the steel industry.

First, however, these terms need to be defined more fully. They are arranged here in a rough heirarchy, starting with the least ambitious and leading to the most thorough-going. As will be apparent from the discussion of each, however, such a classification must necessarily be tentative since few companies have gone through more than one or two such passages, and there is as yet little rigorous empirical work to provide a good taxonomy.

Core competencies: This term became widely used in the management literature after 1989, following the publication of two widely-read articles in *The Harvard Business Review* by C K Prahalad and Gary Hamel. The intent of the articles was to argue that competition over the long-term does not take place at the level of products but rather at the level of companies' underlying skills and abilities. Focussing on the product/market matrix as a way to decide where to grow a company and where to invest is therefore misleading, particularly as demand fragments and as product life-cycles become shorter, according to this view. Instead, companies need to take a long

term view about what set of core competencies will be needed to compete decades out in broadly defined industry sectors. Among the telling statements contained in the second article are the following:

- "You can miss the strength of competitors by looking only at their end-products."
- "There are major companies that have had the potential to build core competencies but failed to do so because top management was unable to conceive of the company as anything other than a collection of discrete businesses."
- "Core competence is communication, involvement and a deep commitment to working across organizational boundaries."
- "Top management cannot be just another layer of accounting consolidation - it must add value by enunciating the competence acquisition process." (Prahalad and Hamel, 1990)

There is a lot of scrutiny of the core competencies ideas going on in American industry now, and Annual Reports often refer to the concept. The 1991 US Steel *Annual Report* comments on the five new strategies which the company has adopted, which are couched in terms of competencies rather than strategic refocussing. Inland Steel refers to its efforts at training workers in a new way to be part of the way the company responds to new opportunities. For instance, Inland has a plan called "JobLink 2000", which establishes employee multi-skilling, a skill-based pay system and in-plant training provided through its BEST University scheme. This is seen as an essential adjunct to the technological research Inland does on steel process reform, to which objective it has dedicated a team of 220 professionals working with their equivalents at Nippon Steel.

re-engineering: This term became very popular in the management literature, following the publication of an article in The *Harvard Business Review*, (Hammer, 1990) whose theme was "simplify before you automate." The basic thesis was that much of the money spent on

computerizing companies' internal workings during the 1960-1980s period had been wasted, since what was typically happening was that cumbersome, ineffective and fault-prone internal processes were being automated but not reformed. What was really needed was the re-drawing of the process lines within the company, followed by automation where appropriate. Examples of these faulty processes could include order entry, customer inquiry, check-in procedures in hospitals, accounts payable, and so on. For processes such as these, the basic recommendation was that instead of having many different functional areas pick up then hand off each order or inquiry, newly-formed process teams should instead carry responsibility right through from the time it enters the company until the time the customer is satisfied. Process re-engineering requires three steps: first, mapping how many different individuals and functions "touch" a process today; second, simplifying and speeding up the flow; third, re-organizing around the completion of high-quality, high-integrity flows and abandoning the old organization chart.

The steel industry has started to embrace this thinking too. Inland Steel found that it could collapse five separate steps into one, cutting the time taken to cold-roll steel from days to 45 minutes at its New Carlisle, Indiana, plant, which it opened in 1990. Similarly, Inland's I/N Tek plant cuts processing time for cold-rolled sheet metals from 12 days to less than one hour and needs only one-third of the labour needed by previous processes. In a simpler version of this, Armco found that by re-examining and simplifying its processes, it could cut 1700 salaried employees from its payroll in 1992. Similarly, in early 1993 Wheeling-Pittsburgh, the eleventh-largest steel producer in the US, with output of 2.1 million tons in 1992, announced a 15% reduction in its white collar staff. To illustrate the differentials which are possible, Nippon Steel has recently been compared to Tokyo Steel, which has 60 sales and marketing staff to sell $1.6 billion-worth of products per year, while Nippon Steel has 7,800 such staff to generate $19.8 billion of revenue in its last fiscal year - a sales productivity ratio of about ten to one. (*Wall Street Journal*, February 2, 1993.)

The easiest route to re-engineering for many companies is out-sourcing, that is, the placing of

entire processes or responsibilities in the hands of specialist vendors. EDS, with 1992 revenues of $3.7 billion, is an example of a third party computing specialist which has grown rapidly by taking over facilities which clients have decided to out-source. Among the steel producers which have elected to do this is Armco Steel, which in 1993 chose IBM to handle all its data processing and communications functions. Under the contract Armco's 90 data processing staff will become employees of IBM but continue to work from Armco facilities. The contract is valued at several million dollars annually. Bethlehem Steel has a similar contract with EDS. (*Wall Street Journal*, February 5, 1993.) (A thorough analysis of out-sourcing decisions is contained in Venkatesan, 1992.) Out-sourcing among US steel producers has become extremely common. Paine Webber has estimated that the percentage of total labour time used by American steelmakers accounted for contracted labour has grown from 3% in 1981 to about 8% by 1991. (*Wall Street Journal*, March 17, 1993.)

Among developing country producers, there is also some intrerest in reengineering. Posco has undertaken a number of projects which fit into that category. Notable is the fact that the company's Kwangyang works have been designed so that it takes only 4.5 hours to transform molten iron from the blast furnace stage to fully-formed hot rolled coils in the new hot strip mill. At other plants a more typical cycle time is 4 to 5 days. (*Korea Economic Daily*, October 2, 1992.)

corporate transformation: This term implies a number of separable steps, taken in the hope of leaving the company radically re-structured and also, and more importantly, far better able to deal in future with major exogenous disturbances. In the way in which Blumenthal and Haspeslagh (1992) construe the term, it generally includes four elements:

- a restructuring of the corporate portfolio: the traditional buying and selling of businesses, so as to enter and exit segments of businesses which appear most attractive.

• major operations improvement: akin to the re-engineering concept, this entails striving to improve the internal efficiency of the company drastically

• strategic transformation: this is less clear-cut a term. Actions taken here might include substantial lay-offs of middle management, intended to bring decision-making closer to the point where actions need to be taken; speeding up of internal processes such as investment evaluation

• corporate self-renewal: this again is not clear-cut, but tends to mean getting the company in such a position that it can "renew" itself competitively time and time again, against a variety of exogenous shocks. Actions which could be undertaken to achieve this could include emphasizing learning, both formal and informal, within the company; and using information more creatively to ensure that the opinions and needs of current and past customers are carefully analyzed. Examples of re-engineering work in the steel industry include efforts at four companies:

• Inland Steel has divided its entire workforce into two hundred teams, with instructions that they should each find ways of cutting costs in their part of the operation by no less than 40%. Team-work appears to be an important part of the way mini-mills compete, for there there are few demarcations between types and grades of labour.
• Starting from a very different structure, Nucor has set up unusually fluid arrangements for work-content and has embraced the principle of paying more for "multi-skilling" rather than recognising seniority in a particular craft or function. This is one of the factors which have given Nucor the lowest manufacturing cost of any US steel producer.
• Bethlehem Steel, regarded by some as a traditionally slow-moving competitor, in early 1993 announced that it would split its operating divisions apart more clearly and push autonomy down to two units, its flat-rolled mills in Burns Harbor, Indiana, and Sparrows Point, Maryland, while allocating head office sales and marketing staff to focus on one of other unit. In this respect its

actions follow its earlier decision to have its Steelton, PA rail products business operate as a business unit. (*Wall Street Journal*, 1-15-93.)

• Birmingham Steel has also tranformed itself by using varieties of labor-incentivizing schemes which stress team responsibility and shop-floor autonomy. Labor hours per tons of steel there in 1992 were 1.3, down from 2.5 four years before. The chairman, James Todd, believes this is largely due to the fact that for each ton of steel produced, a pre-set amount of money is paid into a bonus pool. At the end of each week, the pool is divided up among the workers who maintained full attendance and quality levels. The relatively low base pay ($8 to $10 per hour) is thus supplemented by bonuses. The training which must accompany this approach to team-work was not offered to the entire labour-force. When he took over the company in 1984, Mr Todd laid off half the 1,250 workers, focusing on intensive retraining and reorganizing of the rest. (*International Business*, February 1993.)

the learning laboratory: This term can be seen as a variant on the fourth part of the "corporate transformation" idea -- it implies the ability of a company to become so adept at self-examination and improvement that it can withstand major threats from outside. A good example of the term in use is furnished by a case study of Chaparral Steel.

Example: Chaparral: The background to Chaparral Steel is not the familiar litany of small-scale steel producers' problems, such as high costs, customer base erosion and balance sheets' being stretched as the usual business cycle depresses both prices and volumes in recessions. In fact, Chaparral Steel started out healthy and just get healthier. From the inception of the company in 1975, it was setting records, such as producing a record 67,666 tons in a month, the highest ever seen from a single electric furnace continuous casting configuration. In 1989 its output of steel per worker-year was 1,100 as against a US average of only 350 and a Japanese average of 600. Other

ratios were similarly impressive: 1.5 man-hours per rolled ton of steel versus a US average of 5.3 and a Japanese average of 5.6 in that year. As a result of these cost and high quality performance levels, Chaparral has transcended a niche position and by 1990 was the tenth-largest steel producer in the US. dominating steel rod supplies for the oil industry and mobile home frame supplies.

There are three main elements to Chaparral Steel's strategy, and although they are separable the real strength of the company lies in the fact that all three are tightly inter-twined. They are:

• research and production are effectively one activity: all production is seen as an opportunity for learning and improvement. Thus, there are no "stable" or "mature" processes; experimentation is constant. This is, of course, unlike most companies, be they continuous process or manufacturing, where research, engineering, manufacturing engineering and production are typically different functions which meet and mediate problems only intermittently and not at all fluidly.

• innovation is seen as not the exclusive preserve of engineers but of virtually everybody who is on the factory floor.

• equipment and processes are adjusted and adapted all the time.

The tight link between the three characteristics leads the Chaparral managers to be eager to show others around their plant, but also confident that its secrets will not thereby be learned and copied by others. As CEO Gordon Forward has said, we can show them everything, "and we will be giving away nothing because they can't take it home with them." This is because, in the words of one academic who has studied the plant, "the learning laboratory cannot be constructed piecemeal... it is comprehensible only as an organic whole."

(Leonard-Barton, 1992, p. 24)

The results of this approach for Chaparral have been very satisfying, with most analysts recommending the stock consistently.

g. growth under privatization: developing country producers' experience

Overview of developing country producers' outlook

While recent data and interpretations of developing country-based producers are not as abundant as they are for developed country producers, it is clear that many of them face similar issues to those facing developed country producers. Several examples of developing country-based producers pursuing strategies of retrenchment, joint ventures and diversification have already been cited. A more thorough review of the strategic options and issues facing producers in such countries as India, China and Mexico indicates that:

• growth of capacity is expected to be very rapid, reflecting high rates of economic growth and thus fast-growing demand for steel products. Table 8 provides some indications of the capacity leap expected.

Table 8

Selected developing countries: projected growth of steel output, millions of tons/year

Country	*Output, 1992*	*Projected output, 2000*
China	80	100
India	17 (1991)	67 (2010)
Mexico	7	

Sources: various

• mini-mill production is taking hold and forcing integrated producers to modernize.

In India, for instance, there are seven large integrated plants (five owned by the Steel Authority of India Ltd., and one each at Tisco and Rashtriya). These plants possess about 17 million tons of

capacity. But there are also some 161 mini-mills, each with capacity of less than 250,000 tons/year, all privately-owned. Similarly, much of the growth of capacity in Mexico is anticipated to be in mini-mill production, particularly in semi-finished products such as steel slabs and wire rod.

• capital markets inhibit large-scale investment: In many developing countries, the equity markets are still under-developed, meaning that internally generated retained earnings, plus bank borrowings and (where available) government loans and grants, are the main sources of cash for investment. In India, for instance, only one steel producer - Tisco - is publicly quoted and its stockmarket float is small enough to prevent even it from investing on a large scale.

• Price controls are being lifted: In India, for instance, this is now happening. In China, the big gap between the free market steel price and the offical state price has been opening up as the economy has boomed, but price reforms are expected.

• the easing of international trade restrictions allows faster growth of imports: As already noted, China is starting to import considerable amounts of steel to help build up its infrastructure. Among the producers which have benefitted from this trend are Posco. Similarly, North Korea has for the first time imported steel from South Korea. It has arranged a barter trade arrangement through a trader in Hong Kong to procure 5,000 tons of cold-rolled steel worth $2.1 million each quarter. In return North Korea will provide zinc ingots. Posco sent its first shipment of 5,000 tons in mid-1992. (*Korea Economic Daily*, July 10, 1992.)

Broader trends at work in many developing countries include the following:

• The most demanding customers still tend to look first to developed country producers for highest-quality and/or odd run-length orders. There is, however, beginning to be some change here, with a few contracts from very demanding customers like Volkswagen going to developing country

producers -- notably Posco.

• An interesting trend which mitigates some of the trends just enumerated is that developed country-based steel consulting firms are helping build new plants in developing countries, allowing them - virtually in one bound - to catch up with the latest thinking and design practices found in developed countries. This consulting firm transmission mechanism is one not fully anticipated before. A good example is the case of United Engineering, Inc., which has built some 125 steel mills across the world since its founding in 1901. A new partnership with Mitsui and Co of Japan has led to United obtaining contracts to build a number of leading-edge plants. Examples of its recent work include the Ang Feng Steel Co of Taiwan, which has begun building a $127 million, 2 million tons/year plant only 300 metrers long. This small "footprint" allows the plant to operate with markedly lower real estate and construction costs than a more conventional plant of comparable capacity. (*International Business*, February 1993.) Other recent plants being designed by United are one for the National Steel Corp of the Philippines' $90 million plant, and a $70 million hot strip mill to be erected in Chile. Future sales efforts will target the Middle Eastern countries, where it is believed there is scope for building mills in the half billion dollars and up category.

• A further trend which is encouraging is that of US based steel companies setting up, and in some cases re-capitalizing, subsidiaries in developing countries. Armco, for instance, is contemplating an initial public offering for its subsidiary in Chile; it anticipates raising $30 million by selling 60% of its Chilean subsidiary. (*Forbes*, March 29, 1993.)

• Finally, there is some evidence of increasing cooperation outside purely commercial channels. For instance, the South-East Asia Iron and Steel Institute has grown since its founding in 1971 to embrace 20 members, with a further 73 associate members in Japan and 34 in Australia. (*Korea Economic Daily*, July 18, 1992.)

The special case of Posco

Many, if not all, the above factors are at play in the case of Posco, Korea's largest steel producer and by 1993 the world's third largest producer. A few comments on the rapid and impressive emergence of this producer (which was only founded in 1968) help to show just what is attainable if the right management and incentives are in place; they also reveal the importance of government help in the early days of the Korean economic miracle. (The utility of state aid of various kinds in Korea today is much more debated.)

Posco's recent growth can be understood from the following facts: In October 1992 it completed the fourth and final expansion phase of its huge Kwangyang Steel Works, which lifts total company capacity up to 21 million tons per year. The fourth phase, which has capacity of 3.3 million tons, includes a coke plant with annual throughput of 1.46 million tons and a sintering plant with capacity of 4.67 million tons. There is also an all-weather quay which cost 8.7 billion won. With each successive phase of production, there has been more and more local content. Whereas Phase 1 used only about 12% local content, this final phase used about 93%. Total expense for the plant has come to 14 trillion won. (*Korea Economic Daily*, October 2, 1992.) Since its inception, Posco has produced a cumulative output of 160 million tons, of which 42 million have been exported. The company has been profitable since 1973, when it reported its first profit of $11.6 million. Through growth and efficiency it has attained a dominant position in its local market (its Korean market share has grown from 42% in 1973, to 69% in 1985, and to 72% in 1991) and claims to sell within Korea at prices up to 10% to 30% below those of competitors. In the broader Asian market, Posco is emerging as a major force. Its exports to China, for instance, have grown from 250,000 tons in 1991 to 1 million tons in 1992. In so doing it has seriously reduced demand for Japanese steel in China, which have fallen from around 4 million tons in 1989

to 1.75 million tons in 1990. (*Metal Bulletin*, September 28, 1992.)

Posco's growth has embraced buying leading edge technology from many countries. Its most recent announcement entails buying a 600,000 - 700,000 tons/year COREX iron-making plant from Voest-Alpine - which makes it the only producer, aside from Iscor in South Africa, to use this process. The plant will produce iron by the direct reduction of steam coal and iron ore. (*International Coal Report*, November 2, 1992.)

Posco has vertically integrated in a number of ways. It has developed the Greenhills Coal Mine in Canada and the Mount Thorley Coal Mine in Australia. Other countries haveen been drawn into Posco's activities in other ways too. It has set up a galvanized corrugated sheet plant in Vietnam, called POSVINA.

There cannot be dozens of Poscos. There is not enough steel demand in the world; particularly in light of the huge capacity excesses hanging over Europe. But there can be dozens of developing country producers which imitate some of the aggressiveness and management tightness which have characterized Posco's growth. The degree to which this can be true is assessed in the final section.

VI. THE CLASH OF STRATEGIES IN PROSPECT

a. The mini-mill sub-group in retrospect

An examination of the mini-mills' evolution to date suggests five important points:

• the growth of the mini-mills in US output has been very rapid: from around 3% of output in the 1960s they grew to account for 38% of outpu: in 1991 and, according to some projections, will take 45% of the market by the year 2000.

• the early point of entry for mini-mills was simpler, relatively low-value added products, notably rebar (or reinforcing bar). Some 40 mini-mills still sell this product. Its price has tended to move up a little lately as some of the better-managed and/or better-funded mills have moved up the value-added curve towards other products, reducing rebar supply.

• the share of merchant products in mini-mills' output-mix has grown in the last decade, as it requires very different processing equipment to accommodate the myriad shapes, sizes and order quantities. Products in this product family sells for some $75-100 more per ton than does rebar.

• the structurals market was penetrated by Chaparral first, in the mid-1980s. Now the mini-mills dominate this product too, with the large integrated producers all but out of the segment except for Bethlehem Steel, which retains the type of equipment needed to deal with very large structural sizes.

• there has been a marked degree of similarity so far in the way mini-mills compete. Since each of the mills, individually, has been small in both absolute terms and relative to the total steel market in its region, their absolute cost advantage, derived from using scrap as their primary input, has let them grow very fast. While there have been significant management challenges facing them, notably the need to fund from-the-ground-up capital expenditures with often slim margins betwen scrap input prices and steel output prices, they have been sailing with the wind rather than against it. Among their significant other advantages, are, of course, their small, non-unionized labour-forces with very few retirees to pay for. In this respect, as in many others, the mini-mills differ from the integrated producers, in that there is far more diversity in the competitive paths the integrated producers have chosen to pursue.

b. Prospects for a major realignment within the mini-mill sub-group:

There may now be a change in the horizon in the way this part of the steel industry looks. Some

analysts are arguing that the requisite factors are in place for a sharp consolidation, and to the extent that this occurs, it could have a very big effect upon the other strategic sub-groups in the industry, mini-mills or not. The evidence for this realignment argument is as follows:

• so far the mini-mill sub-group has been fragmented. The top 15 mills account for about three-quarters of total mini-mill output, and here are a further 25 others producing the balance of 27 million tons of capacity. Table 9 shows the disparity in capacity in 1991, along with estimates of their potential capacity in 1996.

Table 9

Estimated Mini-Mill Capacity, 1991 and forecast 1996, million of tons/year

Producer	*1991 capacity*	*1996 forecast capacity*
Nucor	3.7	9.25
Northstar	2.7	3.7
Birmingham	1.7	2.7
Florida	1.7	1.7
Chaparral	1.5	2.0
Northwestern Steel & Wire	1.5	1.5
NS Group	1.4	1.4
Lukens	1.0	1.2
Commercial Metals	0.9	0.9
Georgetown	0.85	0.85
Bayou	0.8	0.8
Oregon Steel	0.75	1.5
Raritan River Steel	0.67	0.67
Atlantic	0.6	0.6

Cascade	0.6	0.6
New Jersey Steel	0.5	0.5

Source: Morgan Stanley estimates

The factors which are likely to help consolidate this part of the steel industry are two: their cost structure and the recent availability of reliable, cost-effective technology for letting mini-mills enter the huge flat rolled product segments for the first time.

• The cost structure of the mini-mills varies widely, but there is certainly more similarity among mini-mills than there is between mini-mills and the integrated producers. Scrap accounts for about 40% of mini-mills' total costs; energy for 12% and labour for 12%. Even though many of the mini-mills pay performance bonuses (a factor noted in the context of Birmingham and Chaparral), these bonuses are performance-related and total labour cost per hour, including benefits, average out at about half that of the large producers. Average labour input per ton of steel is around 2 hours for mini-mills, as against 3 to 4 hours or the integrated producers. At a fully-loaded hourly wage of $32/hour this yields a cost advantage to the mini-mills of $65-180/ton. Only Lukens and Bayou have unionised labour-forces.

• Technological changes are now afoot which will allow Nucor, the first to adopt this technology, to make high grade flat-rolled steel using melted ferrous scrap at a reasonable cost. At its Crawfordsville, Indiana plant, expected to have a capacity of 0.8 million tons, and a second facility at Hickman, Ark., capital cost per million tons of capacity installed is put at $200 million. Since only some of the mini-mills are publicly-quoted, and can therefore draw upon the equity markets for funding, and since margins have been narrow for many of the lower value products like rebar, it is apparent that only a sub-set of mini-mills over the next 5 to 8 years will be able to take advantage of this German technology. But to the degree that they do so, it is possible that a few mini-mills can start to generate free cash flow sufficient to acquire one or more of their mini-mill

bretheren.

The question then arises as to why they would want to. The answer to this has two parts.

• First, there are some limited economies of scale, probably including scrap purchasing, administrative and sales expense. However, since the latter two categories are typically very tightly managed in mini-mills, the extent of the potential further economies should not be over-stated. Indeed, the pursuit of non-existent scale advantages has been one of the steel industry's major sources of disappointment over the post-war period.

• Second, and much more significant, are the revenue growth prospects. As has been noted, the huge flat-rolled market is now coming within reach of the better-capitalised of the mini-mills. Diagram 1 shows the breakdown of these markets, along with their estimated sizes. This indicates the magnitude of the opportunity which is now becoming contestible. The low cost structure, coupled with the segment revenue opportunity outlined above, points to an incremental margin swing of roughly $4,000 million over the next (say) ten to fifteen years (this is derived from multiplying 40 million tons per year of flat-rolled products times a $100/ton rule of thumb cost differential (exact estimates varying between $65 and $180/ton) between mini-mills and integrated producers.) The immense scale of this swing suggests that mini-mills will try very hard to enter the flat-rolled segments and scoop up some of these returns.

The very act of entering these segments will, of course, affect pricing there. So far, mini-mills have entered only the "easy" segments: "For the moment, Nucor's hot and cold rolled steel is essentially a commodity product used for applications such as oil drums, siding and decking. Nucor does not produce the high quality coated steel used by auto or appliance makers..... although the evidence is anecdotal, we suspect the announced price increases for commodity sheet products did not hold up ... because of Nucor's take-no-prisoners strategy towards high operating rates." (Standard and Poor's, *Industry Surveys*, August 27, 1992, p. S4.)

c. conflict between mini-mills and integrated producers:

In the past there have been marked differences in performance between mini-mills and integrated producers. Table 10 shows the considerable differences in return on equity they have registered.

Table 10

Return on equity comparison, mini-mills and integrated producers, 1982-1991

Year	*Mini-mills' ROE,%*	*Integrated ROE,%*
1982	18	-35
1983	9	-25
1984	17	-12
1985	2	-28
1986	10	-41
1987	17	15
1988	29	26
1989	19	14
1990	12	-4
1991	2	-41

Source: Morgan Stanley estimates, based on sample of producers.

Competitors in many industries have found that by ceding the low end (defined in terms of unit price, feature/functionality, or channel) in the belief that they can defend the higher value part of the market, their actions have in fact fed better-financed competitors who ultimately always make an attack on the high end too. Examples are legion. The big three US auto manufacturers, whose

analysts believed that small cars would never take more than 8-10% of the market in the 1960s, turned their back on small car competition, thereby nourishing in Honda, Toyota, Nissan and others competitors which could later confront the medium and high priced segments. Similarly, Xerox decided to allow Japanese producers to dominate the low end copier market before finding that this nearly killed its hold on the complex copier market. (Kearns and Nadler, 1992.) In the case of the integrated producers in the steel industry, it is hard not to have some sympathy for this "retreat to the high ground" point of view. Is there any other escape?

• The first approach would be to build one's own mini-mill. In April 1993 Armco made an announcement to the effect that it would build a one million tons per year, $100 million thin slab minimill at Mansfield, Ohio. It plans to have half the output be specialty steel and half be traditional carbon steel. Other producers are talking about doing the same thing: USX intends to begin construction within 18 months, Dofasco from Canada plans to build a minimill in the US, and Acme Metals is also contemplating minimill production. *(Wall Street Journal,* April 8, 1993.)

But this strategy must confront three objections:

1. It is unlikely that these newcomers would be able to attain even the average rate of return in the mini-mill sector. Their attitudes, cost structure and management processes would almost certainly not allow the rapid fine-tuning and quick response which characterizes the best of the mini-mills. While the integrated producers might be able to increase their own weighted average rate of return by entering mini-mill production, there would be an opportunity cost to shareholders' putting fresh resources into that technology. Shareholders could earn a higher rate of return from investing directly in mini-mills themselves.

2. The wide differences in rates of return within the mini-mill sector suggest that a relatively poorly-performing mini-mill can easily generate returns which are less than stellar. For instance, data on Bayou and New Jersey Steel shows that both have had their troubles, Bayou losing money

in 1991 and 1992 and now facing about $40 million of new investment needs to realize a $6 million/year cost savings, and New Jersey Steel also losing money in 1991.

3. More fundamentally, the strategy of straddling mini-mill technology in itself does nothing to fix the integrated producers' core business - the operation of large integrated steel mills. If their immense investments in this capacity (much of it made within the last decade) are to be treated as a sunk cost with no economic value, this is tantamount to self-liquidation. This is akin to General Motors investing several billions of dollars in their Saturn "greenfield" division without creating any processes for the five core auto manufacturing divisions to learn from the innovations being made at Saturn. In this sense a potentially worthwhile renewal effort was turned into an exercise in unrelated diversification. Bethlehem Steel, which lost $449 million in 1992 has announced a plan which sounds a little like this, in that it intends to invest several hundred million dollars on revising its structural steels plant, which makes products for construction. Although it will embrace some elements of mini-mill technology - it will use an electric arc furnace, for instance, and a new caster - it is not likely that the new plant will have enough of the characteristics of a true mini-mill (cost-efficient production over runs of varying lengths, including short runs, etc) to make the effort worthwhile. As one analyst stated in early 1993 on hearing the news, "I'm not sure they should do this .... if they're going to spend this kind of money and [still] be a high cost producer, it makes no sense." (*Wall Street Journal*, January 28, 1993.) Evidence on the size of the challenge comes from the fact that the Kimitsu Works plant of Nippon Steel, the largest plant of the world's largest steel producer, is not even among the forty lowest-cost plants worldwide. It is Nucor and Chaparral who run four of the five lowest cost plants in the world. (Paine Webber estimates.)

• A second approach would be to take the higher value-added ground, and to do it well enough that, for once, it did in fact constitute a sustainable strategy that created worthwhile returns to equityholders. Inland Steel has, arguably, done a fair job at this, but there is still the inescapable question of the size of the addressable market, as Diagram 1 shows. Even in the huge US market,

there is maybe 15 million tons/year of true "value added" steel bought and sold; is this enough for a major producer like Inland to pin its hopes to, given the strength of the incumbent producers in those segments, and the fact that mini-mills' encroachment may start to drive down prices even in these hitherto premium-priced segments?

• A third approach might be to joint venture with a regionally-focussed mini-mill and hope to create a regional powerhouse which selectively serves customers with difficult -to- produce and/or difficult -to -ship products. This is a version of the niche strategy seen in the likes of Worthington and it has something to commend it, but at root its feasibility turns on the degree of levelling effect of the mini-mills' entry into flat-rolled product segments will have on the entire price structure. Since the view taken in this book is that prices will remain under downward pressure, this is likely to be a palliative but not a fundamental solution, and given the need to make investment decisions in the light of opportunity costs, probably no solution at all.

The upshot of these many complex forces is likely to be the steady encroachment of the better-funded mini-mills into the one another's territory and customer-bases (through acquisition and better meeting customers' needs) paralleled by the penetration of a few pioneering mini-mills into the flat-rolled terrain of the integrated producers, starting with that of the highest-cost and least-flexible ones. Thus, one can envisage the coming together of the changes in customers' needs detailed in section IId, the disparities of cost structure reported in section VIb, and the map of steel product segments laid out in diagram 1. This confluence of forces will very probably not be to the benefit of most integrated producers; but, as will be discussed in the last section, may be to the benefit of a small sub-set of them.

VII. OVERVIEW OF THE STEEL INDUSTRY IN 2000

The result of the forces described above will almost certainly be a steel industry with a number of different characteristics from today's. This last section discusses the possible evolution of the steel industry first in overall, global terms, then in terms of producers located in developed and developing countries.

a. overall global evolution:

Among the most important factors shaping the outlook will be the following:

• The most advanced steel producers will map onto, and hold high shares of, purchases by sophisticated steel buyers. These buyers need not be huge customers: many of the old large buyers like General Motors will be buying much less steel by then. The more discriminating customers have been cutting the number of steel producers they buy from. Ford Motor has already been cited as an example. Similarly, Maytag, the world's largest white goods supplier, has reduced from six to three the number of steel producers it deals with. Since white goods companies account for 20% of flat rolled steel demand in the US and other developed countries, this is a significant development. Again, German auto manufacturer Opel switched its 30,000 tons/year steel order from Thyssen Stahl to a consortium of producers including Klockner, Ekostahl (in former East Germany), Arbet (in Luxembourg) and Cockerill (in Belgium.) (*Financial Times*, January 29, 1993.) Significantly, this need not mean the exclusion of developing country based producers. Posco has secured a contract from Volkswagen de Mexico to supply 2,000 tons per quarter of cold rolled steel. (*Metal Bulletin*, April 30, 1992.)

• An interesting observation about the possible evolution of demand patterns towards the end of the century comes from Tom Peters (Peters, 1992, p. 573) who argues that most of the recently-opened up mass markets started out as niche markets. Examples include the Apple Macintosh and

its imitators in the personal computer market. These niche markets are, moreover, entered into and explored on a tentative basis by producers - no longer should companies go out looking for vast new markets to conquer. This implies that the march of the niche steel producers may be accelerated and the contraction of the mass market-minded steel producers accelerated - at least to the extent that the new bases upon which customers choose their steel producers (see the list in section IId above) is borne out in practice.

An example of this is the growth of Oregon Steel Mills, which went public in 1988 as an employee-owned company. After spending some $170 million in new plant, and renegotiating its energy contract to cut its energy costs per ton by 67%, Oregon decided that the best way to keep growing was precisely through niche markets. Thus in 1987 it bought Napa Steel, a large diameter pipe producer, and has since been expanding this product line fast. By 1992 pipe accounted for about 75% of Oregon's profits, or about $50 million. (*Forbes*, 1-4-93, p. 170.)

• Rates of return to advanced producers will tend to be high and stable, because it will still be hard to imitate what they have done. Although the evidence presented in this chapter has tended to argue that integrated rates of return will remain low and indeed for many producers fall as the flat-rolled market is entered by mini-mills, there is an important counter-trend to note: the possibility of technological convergence reducing the dispersion of rates of return across the survivors in the industry. This could come about because of several factors, notably:

- large scale producers' plans to build their own mini-mills, greatly increasing mini-mill capacity from its 1992 level of about 21% of US consumption today, leading to total mini-mill output rising from 27 million tons in 1992 to some 40 million tons in the year 2000.
- mini-mills starting to branch out and build flat-rolled capacity, sometimes involving developing country based producers as partners. For instance, Oregon Steel is looking at building a 1 million

ton HBI (hot briquetted iron) plant in Venezuela, to produce output by 1996, at an estimated cost of $160 million.

- smelting and casting techniques moving over to thin-slab casting, which will allow producers of very different scale levels to build high quality thin slab steel.

• Many of the old steel companies which fail to reform themselves will continue to wither. The collapse of Klockner in Germany during the final weeks of 1992 is an example of how large, undifferentiated companies have very little chance of survival, even when major continuing government subsidies are available. There is simply too little need for what they offer, and until there is a major correction in capacity (say, of the order of 10-20 million tons each in Europe and North America) this pattern of expensive failure will probably recur. It is likely that these pressures will be worse in Europe than in the US, since costs in Europe have not been reduced as much as they have in the US, and the eagerness with which most European producers (with some notable exceptions like British Steel) have scaled back and re-engineered has been less than in the US. Italy and Spain are countries where state-controlled producers have barely started down this path at all. In Italy recent estimates suggest that 5 million tons of capacity need to be closed to reduce the country's capacity to a more sustainable 25 million tons/year. *(Corriere della Sera*, October 11, 1992.)

Although there may be this continuing slow eclipse of the older producers, a significant countervailing factor is that during the 1980s and 1990s some of them - for instance, Inland Steel - transformed themselves into the world's lowest-cost producers. Birmingham Steel's work-force has lower steel costs per ton than the cost of shipping steel from Asia to the USA. Even though its work-force's average earnings are $55,000 per head, because labour costs have been drastically

cut, from $51/ton in 1988 to $42/ton, with labour hours per ton cut to only 1.36, Birmingham has become a truly low cost producer. Further evidence of this producer's emerging cost position is the fact that its cost of converting a ton of scrap is falling fast. In 1990 it was $139/ton; in 1992 it was $112, and its target for 1993 is $100. Similarly, USX's labour costs were 40% of its total costs in 1982 but by various process redesign efforts, USX cut its labour costs to 20% of total cost, equalling the Korean average of 20% in 1992. (*Wall Street Journal*, 12-23-92) Thus it would be wrong to count out these producers once and for all.

c. developing country producer prospects:

Some of the trends at work for developed country producers may prove to be unfavourable for producers based in developing countries. Among the most important is the rapid rise of the mini-mill, which has in a sense re-invented the industry's ability to compete from the US, Japan and Europe and which allows older producers there to meet many of the difficult needs which customers now demand. Similarly, the emergence of some US integrated producers as surprisingly low cost vendors of certain large-volume product lines undercuts the raw cost advantage which producers in countries like South Korea enjoyed for much of the 1980s. Producers in developing countries may also be disadvantaged by the fact that their local customers are not, in general, as demanding as they are in Japan, the US and Europe, and so the domestic marketplace pressure which forces constant re-examination and improvement is less intense. (The importance of this pressure is a major part of Michael Porter's explanation for the international division of labour in the 1990s: Porter, 1990.) A mitigating factor here is the spread of overseas, often Japanese-based, private investment into developing countries, which tends to spread global "best practice" customer requirements faster than indigenous demand alone would. Much of the Japanese investment in Asia requires first class assembly and processing skills and quality levels to be maintained. Even in

China this force is at work: 1992 foreign investment inflows there are estimated to have reached $6 billion, much of it to create capacity for export as well as to meet soaring home demand. (*Barron's*, January 18, 1993.)

The very rapid growth of GNP in China is helping producers elsewhere in Asia to sell there. Korean-based Posco, for instance, expects to ship 1 million tons of steel to China in 1993, an amount comparable to its exports to the US. Posco is also considering becoming involved in up to five plants inside China, but has reservations about this for fear that newly-engineered Chinese producers might later flood the Korean market with Chinese steel. (*Wall Street Journal*, 11-17-92)

The role of international design and consulting firms in spreading best practice thinking beyond the borders of the developed countries is also a promising development for producers based in developing countries.

All in all, however, the prospects for developing country-based steel producers seem dim beyond their own borders. There will be a few exceptions, such as Posco, as just cited. At the physical borders of, say, the US and Mexico, there will probably also be a fair amount of cross-border trade in some of the less commodity-like or common products. But for the most part, the desire by governments to help their nascent or growing steel industries get off the ground (even where not state owned) will mean that the bulk of the order growth is likely to be domestic, and that as internationally traded steel prices stay under tremendous pressure while the next phase of the world steel industry's shakeout proceeds, selling within one's own borders will probably not look too unappealing.

d. Strategy choices in prospect:

Much of the evidence assembled in this chapter makes it appear likely that after decades in which

many different strategy choices have co-existed in steel making, henceforth there may be many fewer plausible options going forward. The more obvious winning options are likely to include the following:

• mini-mills with a real cost and quality differential, moving from conventional rebar into a richer output-mix, including flat-rolled products. Perhaps three US-based mini-mills could share 15 million tons/year of sales through taking this path. Similarly in Japan, a handful of better-run mini-mills can probably pursue this path profitably.

• smaller, regionally-focussed mini-mills with a heavy emphasis on rebar may also have a role in the steel industry. Perhaps 10 or 15 such US producers with collective output of 15 million tons/year could earn adequate returns in this way.

• dramatically lower-cost, joint venture-intensive integrated production is a further possible option. Inland Steel might appear on this list, along with USX, LTV and a few others. Perhaps these companies' total output will continue to creep downward, to perhaps 15 million tons/year by the late 1990s.

• fast growth of tolerable (but not exceptional) quality products behind developing country tariff walls and local purchasing preferences will allow many newer developing country-based producers to earn adequate returns. In India, Mexico and China there will probably be dozens of these, each with a long tail of smaller, less well-funded competitors who snap at their tails and periodically pick off odd orders. The major five or so producers in each country may have 60 to 150 million tons/year of capacity.

• very large volume, very low cost production is a further option, with Posco perhaps the leading candidate. A secure home base and good export orders (in Posco's case, to China and the rest of Asia) and joint ventures (including more options from the list shown in section Vc) will fuel this option.

Although this list is long, it is notable that it does not seem to find a ready home for some of the most familiar names in current steel making, such as Bethlehem Steel, Usinor Salicor and Ilva. For these companies, resort to continued subsidies and regional assistance is likely to be the only feasible path to follow unless they can redefine their business to fit into one of these options. This is not to deny that other options could not exist, or be created by an individual producer's ingenuity, but it is to suggest that some options will certainly be infeasible. Total steel output from these "winners" (which admittedly includes a fair number of walking wounded) could amount to 220 million tons/year, suggesting a further 450 million tons being made by companies pursuing none of these strategies, but very probably staying marginal in financial terms.

Conclusion

• A lot more interest in "re-envisioning," "corporate transformation" and the like is probable. Although these approaches entail, as the discussion above suggested, a radical overhaul of the way a company carries out its business and in the ways it deals with its customers, it is often the only way to break out of the traditional rates of turn that steel producers have been able to gain. When combined with major efforts to become a low-cost producer, this type of initiative can become a powerful source of competitive advantage.

• The onward march of the mini-mills will continue, but the great efforts made by some of the integrated producers means that, depending on the exchange rate, some of them have truly become very low cost producers. Since some of them (like Inland Steel) are also very close to major centres of steel consumption, they should not be counted out by any means. A prolonged and unresolved battle for the US flat-rolled segments, a struggle involving as much as $4 billion of margin swing, is where the next great upheaval will probably take place: its outcome will help future observers to refine the list of strategic options presented above.

BIBLIOGRAPHY

Barbara Blumenthal and Philippe Haspeslagh, 1992, *Corporate Transformation: Amalgams and Distinctions*, INSEAD Corporate Renewal Initiative, Working Paper 92/74/SM

Kim C Clark and Takahiro Fujimoto, 1991, *Product Development Performance: Strategy, Organization and Management in the World Auto Industry* (Boston: Harvard Business School Press)

Stan Davis and Bill Davidson, 1991, *20/20 Vision: Transform Your Business Today to Succeed in Tomorrow's Economy*, (New York: Simon and Schuster)

William Egelhoff, 1993, "Great Strategy or Great Strategy Implementation - Two Ways of Competing in Global Markets," *Sloan Management Review*, Winter, pp. 37-50.

Michael Hammer, 1990, "Reengineering Work: Don't Automate, Obliterate," *Harvard Business Review*, July-August, pp. 104-112.

David Kearns and David Nagler, 1992, *Prophets in the Dark* (New York: Harper)

Dorothy Leonard-Barton, 1992, "The Factory as a Learning Laboratory," *Sloan Management Review*, Fall, pp. 23-36.

Tom Peters, 1992, *Liberation Management* (New York: Knopf)

Michael Porter, 1980, *Competitive Strategy* (New York: Free Press)

ibid., 1990, *The Competitive Advantage of Nations* (New York: Free Press)

C K Prahalad and G Hamel, 1990, "The Core Competence of the Organization," *Harvard Business Review,*

ibid., 1989, "Strategic Intent," *Harvard Business Review,* May-June, pp. 63-76.

T. S. Robertson and H. Barich, 1992, "A Successful Approach to Segmenting Industrial Markets," *Planning Review*, November/December, pp. 4-48.

Ravi Venkatesan, 1992, "Strategic Sourcing: To Make or Not to Make," *Harvard Business Review*, November-December, pp. 98-107

International Iron and Steel Institute, various reports

Standard and Poor's *Industry Surveys*, 1992, "Steel and Heavy Machinery: Basic Analysis" August 27.

Financial Times, various issues

Los Angeles Times

International Business

Information Week

International Coal Report

The Export Sales Prospector

Mexico Business Monthly, various isues

American Metals Market, various issues

Economic Times (India), various issues

Forbes, various issues

Business Week, various issues

Metals Bulletin, various issues

Corriere della Sera, various issues

Barron's

Korea Economic Daily

Various stockbrokers' reports

Annual Reports, various