

# World steel demand and supply dynamics

## Implications for ferroalloys

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**Hatch Beddows**

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# World steel demand and supply dynamics: implications for ferroalloys

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- Hatch, Hatch Consulting and Hatch Beddows
- Purpose of this presentation
- Steel demand
- Steelmaking and steel industry structure
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## Our organisation

- Hatch supplies business, process and technology consulting, design and engineering and construction, operations and project management to the mining and metals, energy and infrastructure industries worldwide
- Established 1955 and employee owned
- 7300 highly skilled people serving clients worldwide
- US\$16BN of projects now under management in 60 countries

## Our values

- Safety
- Quality
- Innovation
- Sustainable development
- Effective risk management

We deliver unprecedented and sustained results for our clients

HATCH

## Global reach and resources

7300 people Nov. 2006



(Yellow indicates regional hub)



## Hatch Consulting is the leading management consultancy dedicated to the mining and metals industries

- **Hatch Consulting** is the world's leading management consultancy specialising in the mining and metals industries and provides high level support services, ranging from corporate and business strategy development through strategic market studies to implementation of new technologies, management and operating practices
- Hatch Consulting is organised into specialised practices by industry and service, combining to provide precise solutions, expertly delivered to the exact needs of each individual client
- **Hatch Beddows** is the strategy and market development practice, specialising in steel and ferroalloys industries, and providing strategy development and implementation services
- **Investment and Business Planning** (IBP) provides economic, environmental and technical evaluations of minerals properties and processing facilities, due diligence, pre-feasibility and feasibility studies and related investment planning and appraisal services
- **HB Advisors** (HBA), a FSA-regulated joint venture company, provides corporate financial advisory and transaction execution services

## Some examples of ferroalloys consulting projects carried out by Hatch Consulting and Hatch Beddows in 2006

- Due diligence review of ferroalloys smelter, Mn mines and hydro-electric power plant for a prospective investor
- Global study of CO<sub>2</sub> emissions from the production of Mn and Si alloys and associated electric power generation
- Feasibility study for expansion of Mn ore mining and processing operations for a major integrated alloys producer
- Simulation modelling of Mn ore processing activities for a major integrated alloys producer
- Due diligence review of a large ferroalloys plant in China for a major integrated producer of Mn and Cr alloys
- Due diligence review of the operations of a major silicon producer for a prospective investor

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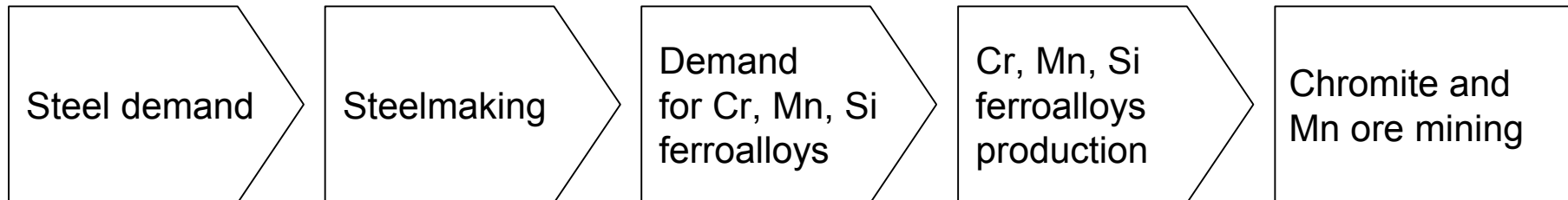
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PURPOSE OF THIS PRESENTATION

**We should like to share some of our thoughts on the future outlook for the steel industry and implications for Cr, Mn and Si ferroalloys**

*“Consumption is the sole end and purpose of all production”*

Adam Smith, 1776



Change in the steel industry will lead to new challenges and opportunities for suppliers

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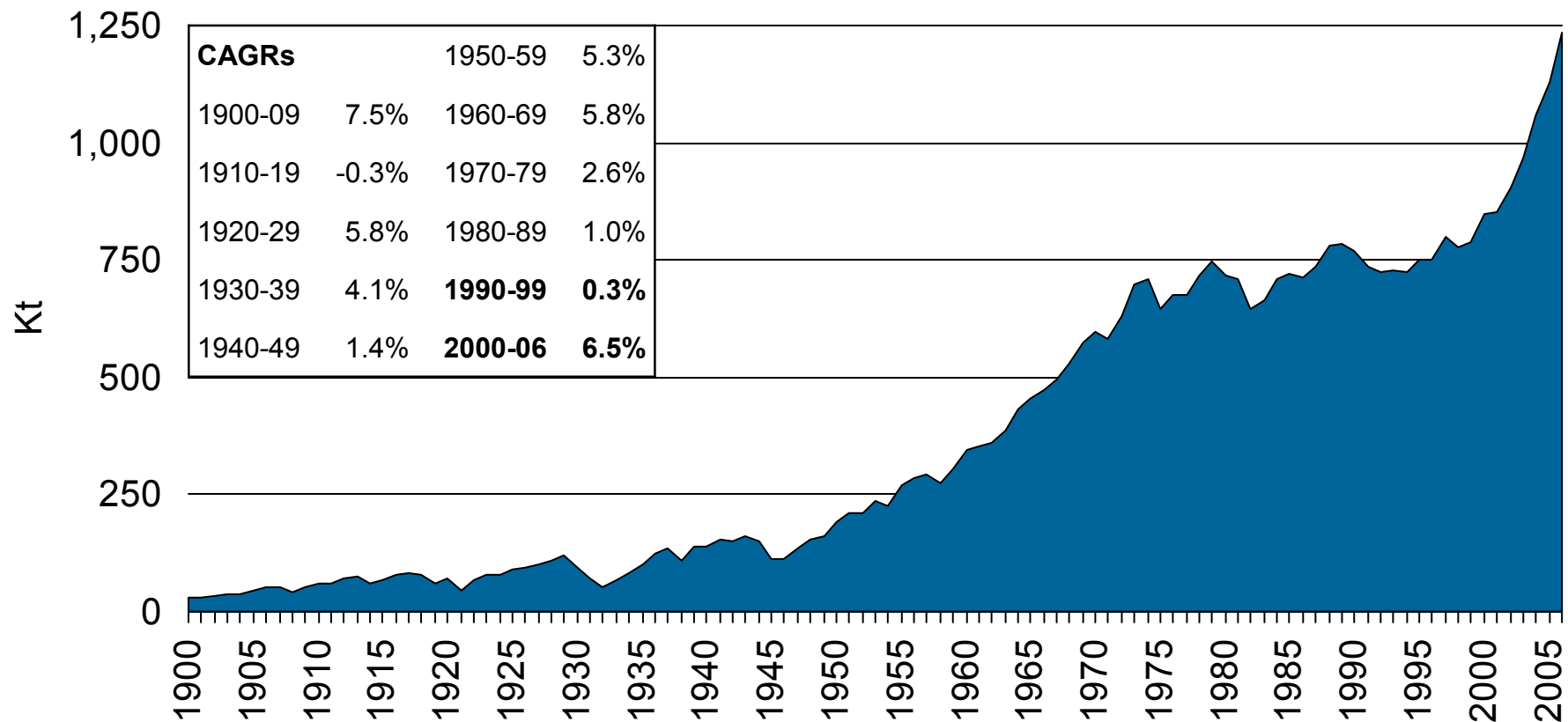
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## STEEL DEMAND

**Strong growth in steel demand has attracted much attention in recent years. It is not unprecedented but stands in stark contrast to the 1990s**

### Global crude steel production

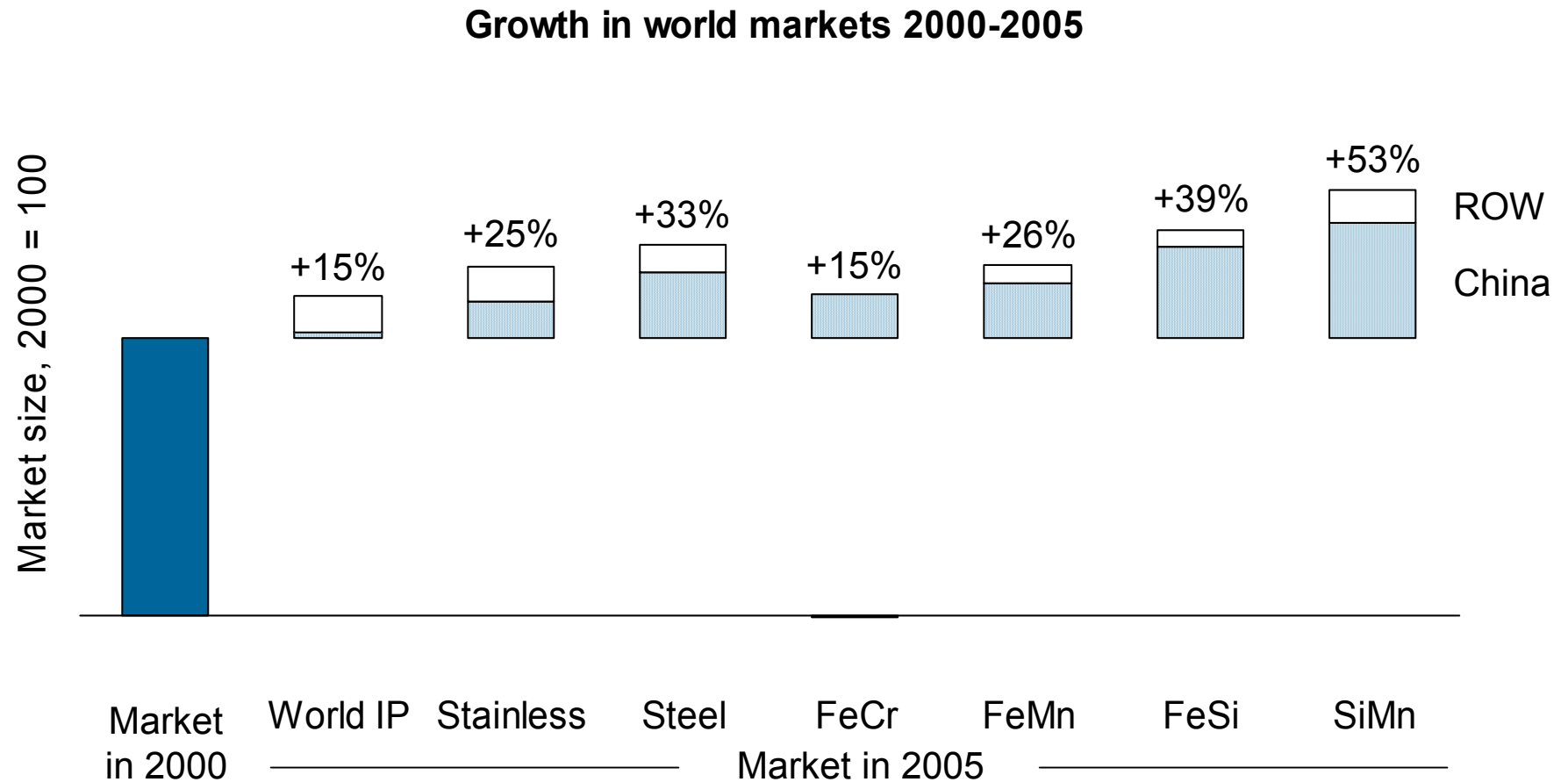


Data: Hatch Beddows, IISI



STEEL DEMAND

World steel output been rising at over twice the rate of industrial production and demand for Mn and Si ferroalloys faster still in the last five years



Data: Hatch Beddows, ICDA, IISI, IMF, IMnI, ISSF. Note: Steel indices based on production. Ferroalloys indices based on consumption



## STEEL DEMAND

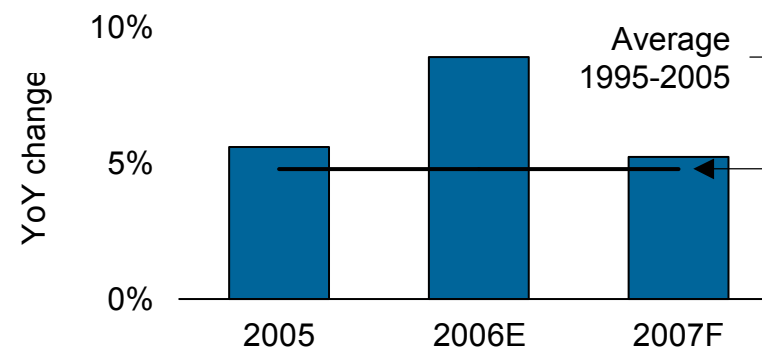
# Short-term cyclical outlook sees carbon and stainless steel demand growth slowing but still strong in 2007

### Total world steel demand, 2005-07

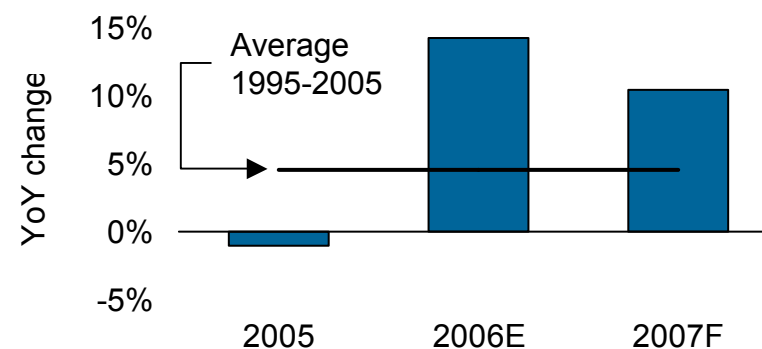
	Finished steel, Mt <sup>1</sup>			YoY changes	
	2005	2006E	2007F	2005-06	2006-07
N.America	140	152	151	8.7%	-0.7%
S.America	32	36	39	11.5%	7.2%
Europe	170	184	185	8.4%	0.4%
CIS	44	47	51	6.9%	9.5%
China	327	374	413	14.4%	10.4%
India	38	42	46	10.0%	9.1%
Japan	78	79	81	0.8%	2.8%
Other Asia <sup>2</sup>	144	146	149	1.3%	1.8%
M.East	34	37	41	9.7%	8.8%
Africa	22	25	26	9.8%	4.5%
<b>Total</b>	<b>1,029</b>	<b>1,121</b>	<b>1,179</b>	<b>8.9%</b>	<b>5.2%</b>

Data: Hatch Beddows, IISI, ISSF. Note: All data in table and charts are for apparent consumption. 1. All grades including stainless. 2. Includes Oceania

### Carbon steel demand



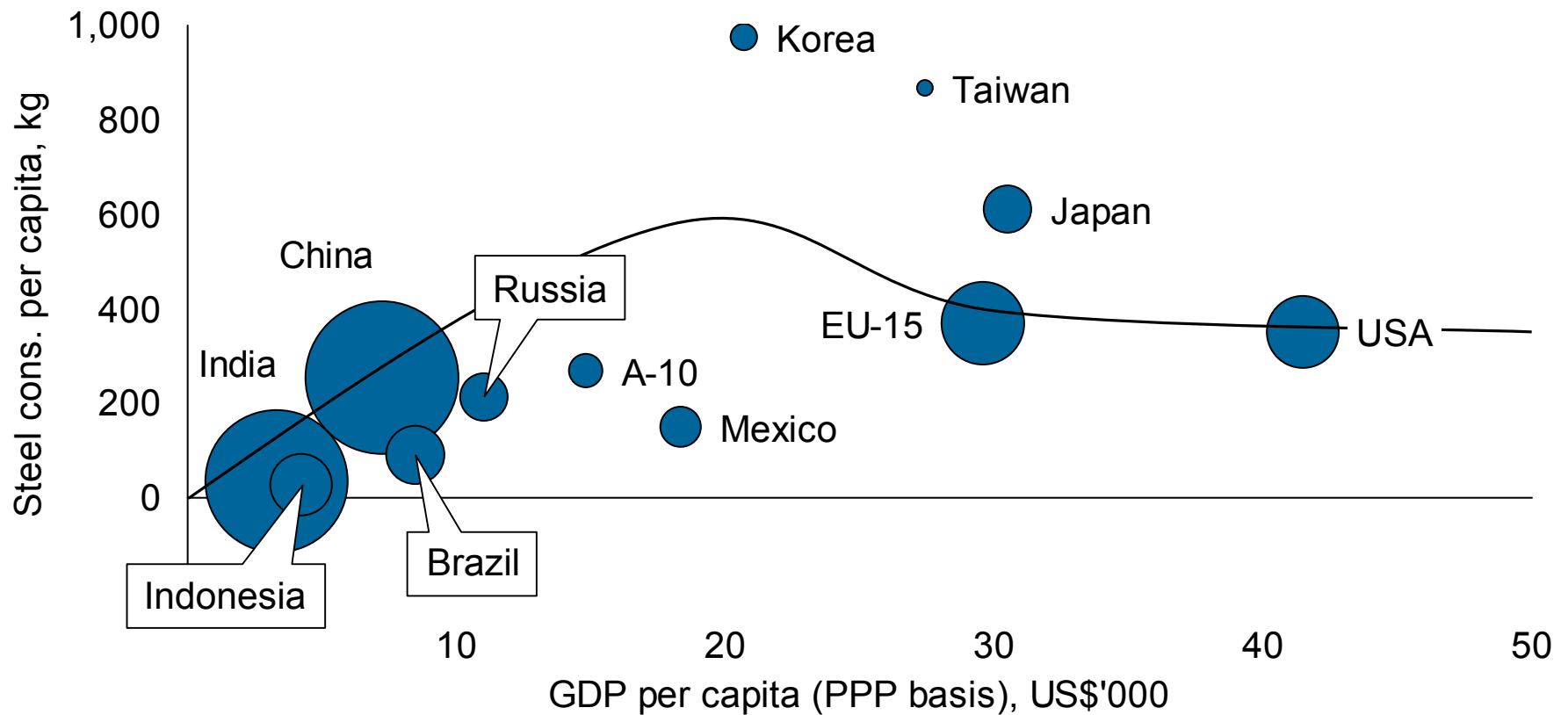
### Stainless steel demand



## STEEL DEMAND

Steel demand is driven by population, economic growth and development.  
Half of the world's population lives in high growth, developing countries

### Steel consumption and income per capita



Data: Hatch Beddows, IISI, IMF, UN. Note: 2005 data. Size of bubbles is proportional to size of population in each country or region

## STEEL DEMAND

The inherent potential for long-term growth in steel demand is substantial...  
 Maybe ~500Mt in the next ten years or so...?

### Long-term perspective on potential steel demand, Mt<sup>1</sup>

Region	2005	LT CAGR <sup>2</sup>	~2015	Key differences
North America	140	1.5%	162	
South America	32	4.0%	48	
Europe	170	1.5%	197	
CIS	44	4.0%	64	
<b>China</b>	327	6.0%	586	<b>259</b>
<b>India</b>	38	8.5%	86	<b>48</b>
Japan	78	0.5%	82	
<b>Other Asia<sup>3</sup></b>	144	4.0%	211	<b>67</b>
Middle East	34	5.5%	58	
Africa	22	3.5%	32	
<b>Total</b>	<b>1,029</b>		<b>1,525</b>	<b>496</b>

Data: Hatch Beddows. Note: 1. Finished steel consumption. 2. Long-term compound annual growth rate. 3. Includes Oceania

But volume is not the only factor in steel consumption that will affect ferroalloys demand

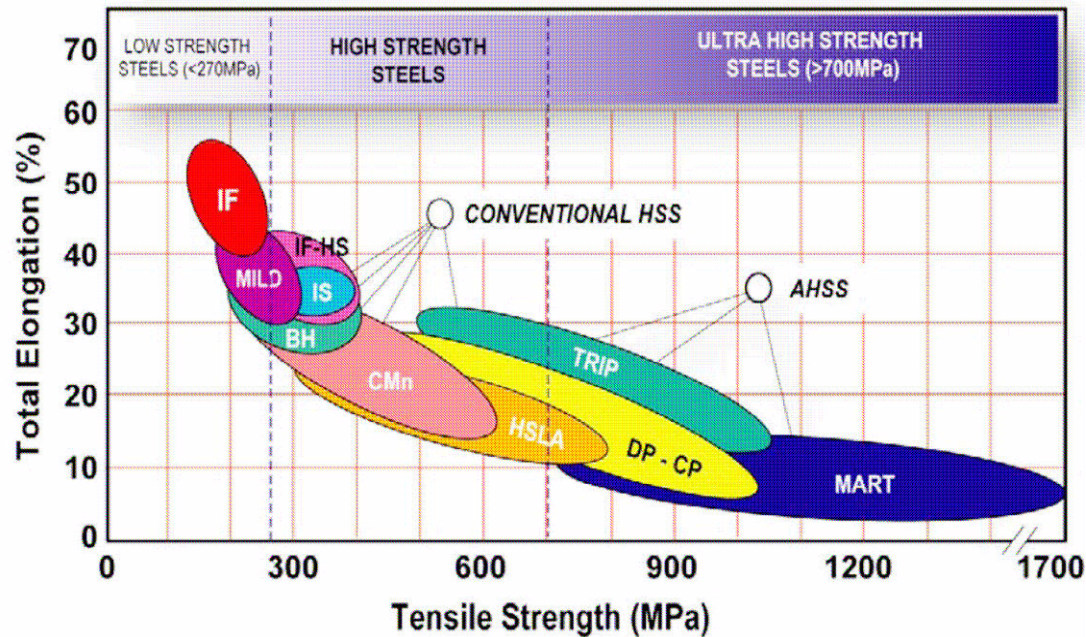


## STEEL DEMAND

The range of grades the steel industry produces is changing over time...

- Consider, for example, the developing range of high strength steels
- These offer users opportunities to downgauge for weight savings in the final application

### Strength and formability of mild and high strength steels



#### Key

IF : Interstitial-Free

MILD : Mild

BH : Bake Hardenable

CMn : Carbon Manganese

HSLA : High-Strength Low-Alloy

TRIP : Transformation Induced Plasticity

DP – CP : Dual-phase – Complex-phase

MART – Martensitic

Data: Hatch Beddows, [World Auto Steel](#)

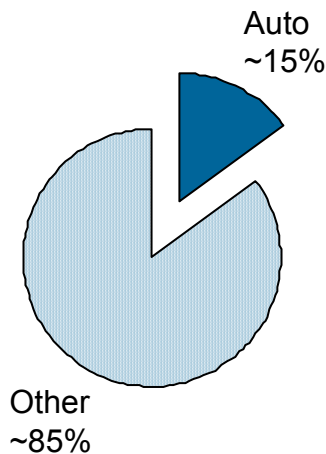
## STEEL DEMAND

# Driven by the changing needs of end users, especially in the auto industry...

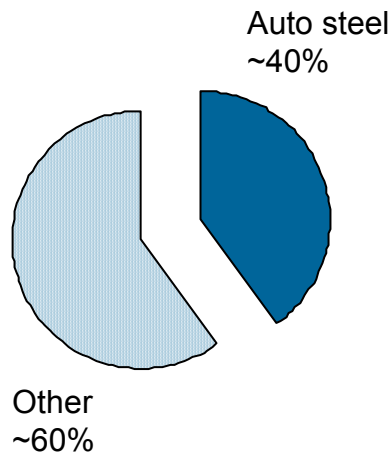
- The auto industry tends to drive the development of new steel grades
- HSS reduce vehicle weight for higher fuel efficiency and lower exhaust emissions
- Steels developed for the auto industry often find applications in other uses over time

### Automotive in world steel

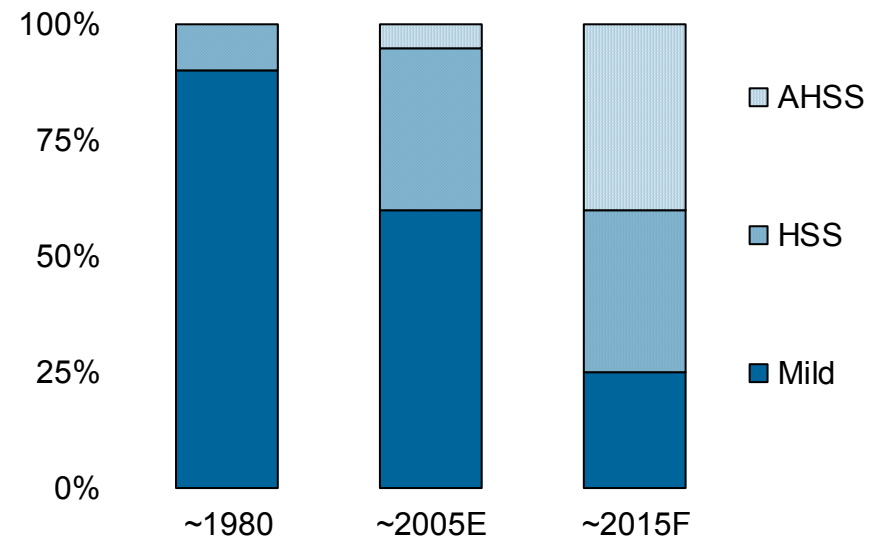
Share of consumption



Share of R&D spend



### Steel sheet mix in passenger cars<sup>1</sup>



Data: Hatch Beddows, IISI. Note: 1. Typical European upper mid-range model. HSS – high strength steels. AHSS – advanced high strength steels

## STEEL DEMAND

**With important implications for ferroalloys demand because of variations in alloy content by steel grade...**

- The Mn content of some high strength steels is three-to-six times that of mild steel
- The Si content of certain high strength steels is many times more than mild steel
- There are significant variations in the alloy content of different stainless steels

### Alloy content and mechanical properties of high strength steels – some examples

Type of steel	Alloy content, %wt				Steel properties	
	C	Mn	Si	Ti	TS, MPa	Elongation, %
Mild steel	0.05	0.24	0.01	-	384	43
Solution hardened steel	0.08	1.46	0.02	-	487	30
Dual-phase steel	0.05	1.25	0.89	-	618	27
Precipitation hardened steel	0.09	0.80	0.01	0.07	636	22
TRIP steel	0.15	0.99	1.48	-	644	37
Martensitic steel	Min	0.18	0.40	-	NA	5
	Max	0.46	1.65	-		

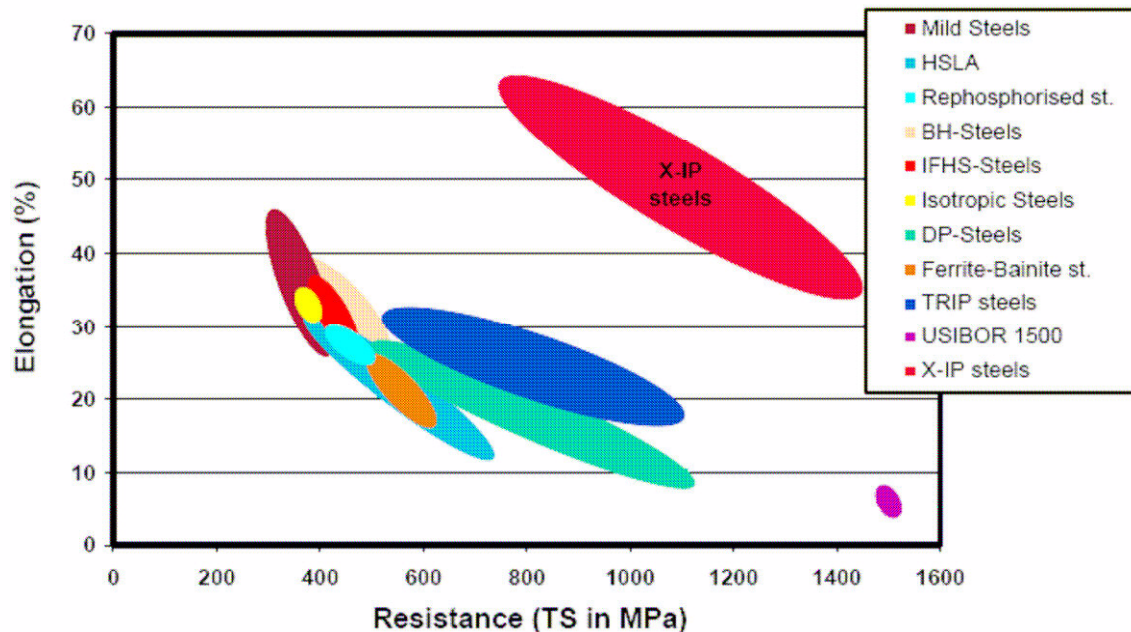
Data: Hatch Beddows



## STEEL DEMAND

# The development and commercialisation of new steel grades could add to the potential growth in demand for ferroalloys

- Reducing vehicle weight to improve performance remains a priority for automakers
- High Mn austenitic alloys may be the next generation of ductile high strength steels
- But remember there will be an offset through lightweighting to any rise in demand for HSS



Data: Hatch Beddows, ArcelorMittal, ThyssenKrupp Stahl

- Arcelor and TKS are developing a new range of super high strength TWIP steels for automakers
- Branded X-IP steels, these products combine exceptional strength with ductility and extend the scope for automakers to save weight in vehicle design
- These are fully austenitic steels based on a high Mn metallurgy
  - 17% - 24% Mn
  - 0.5% - 0.7% C
- The first grade to be introduced is X-IP 1000

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## Future patterns of steelmaking will reflect a number of factors

- Distribution of steel demand
- Costs of steelmaking
- Availability of alternative raw materials and energy supplies
- De-integration of steelmaking and rolling
- Consolidation of ownership and control
- Backward integration by steelmakers into raw materials
- Impact of environmental controls and government industrial policies
- Introduction of leading-edge technology in iron and steelmaking, casting and rolling

Where steel is wanted is *not* necessarily where it will be made

## Costs of steelmaking vary widely by region with important implications for the location of new capacity

- De-integration of steelmaking and rolling may be viable where costs between regions are > US\$70-75/tonne apart
- De-integrated operations may be at an advantage with the flexibility to better respond to changing patterns of steel demand around the world

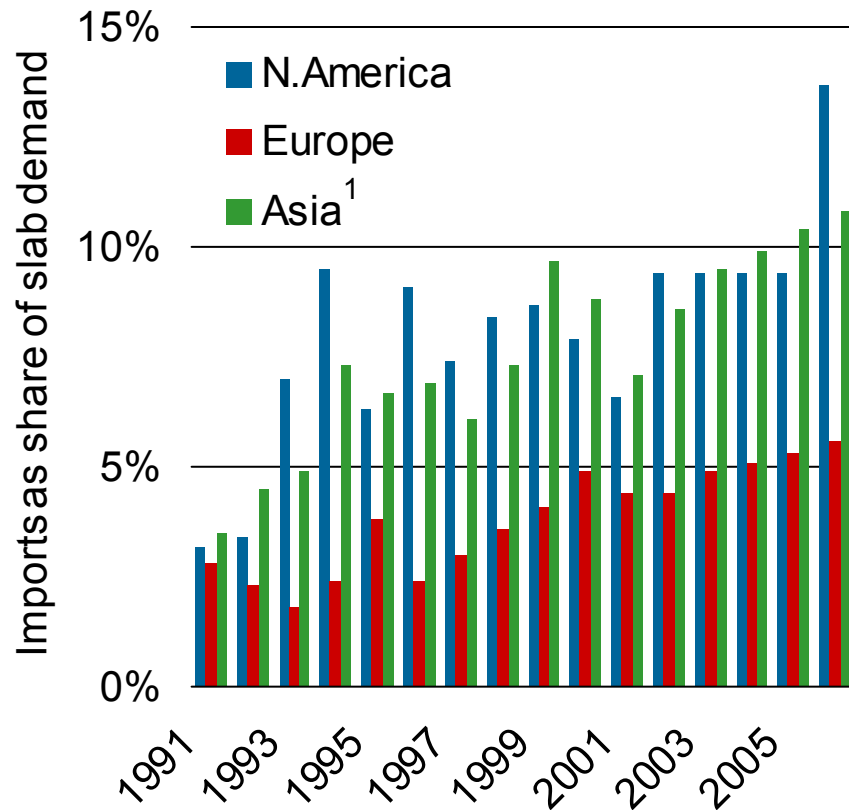
### Cross-matrix comparison of indicative regional slab production costs<sup>1</sup>

	Brazil	Russia	India	US EAF	China	Japan	E.Eur	W.Eur	US BOF
Brazil	-	-15	-25	-55	-70	-85	-90	-95	-105
Russia	15	-	-10	-45	-60	-70	-75	-85	-95
India	25	10	-	-30	-45	-60	-65	-70	-80
US EAF	55	45	30	-	-15	-25	-35	-40	-50
China	70	60	45	15	-	-15	-20	-25	-35
Japan	85	70	60	25	15	-	-5	-15	-20
E.Eur	90	75	65	35	20	5	-	-5	-15
W.Eur	95	85	70	40	25	15	5	-	-10
US BOF	105	95	80	50	35	20	15	10	-

Data: Hatch Beddows, WSD. Note: 1. 2005 data. Calculations are based on regional average costs. Table reads left to right and a negative number signals a comparative cost saving and competitive advantage

**A number of low cost steelmakers have already moved to acquire rolling operations in industrialised regions; other projects are under construction**

**Rising demand for traded slab**



Data: Hatch Beddows, IISI, ISSB. Note: 1. Excluding China

**De-integration: some examples**

Company	Steel plant	Overseas rolling
Evraz	NTMK, Russia	Palini e Bertoli, EU
ISD	Alchevsk, Ukraine	Czestochowa, EU DUNAFERR, EU
NLMK	Lipetsk, Russia	DanSteel, EU Duferco, EU / US
Severstal	Cherepovets, Russia	Rouge Industries, USA
SCM	Azovstal, Ukraine	Ferriera Valsider, EU



## STEELMAKING AND STEEL INDUSTRY STRUCTURE

# Regional variations in the alloy content of steelmaking mean future patterns of steel production will have important implications for ferroalloys demand

### North America

- High cost, mature market
- Potential LT decline in steelmaking

### Europe

- High cost, mature market
- Potential LT decline in steelmaking

### CIS

- Low cost steelmaking
- High growth market

### China

- Substantial existing steelmaking capacity
- High growth market

### India

- Low cost steelmaking
- High growth market

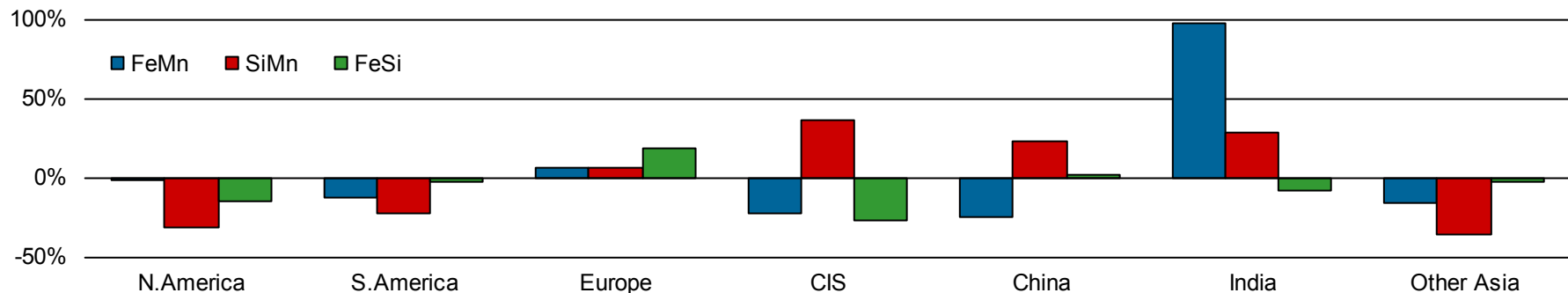
### SE Asia

- High growth market

### South America

- Low cost steelmaking
- High growth market

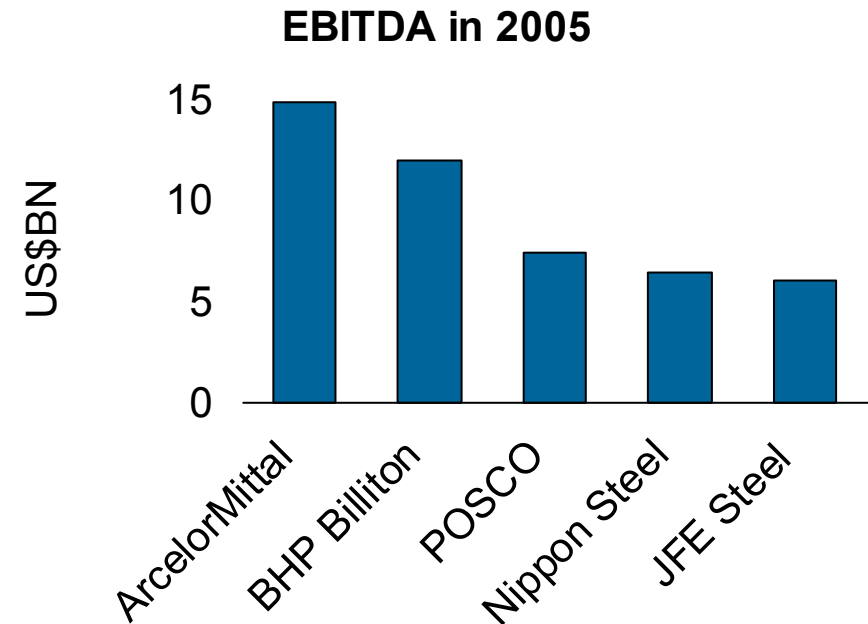
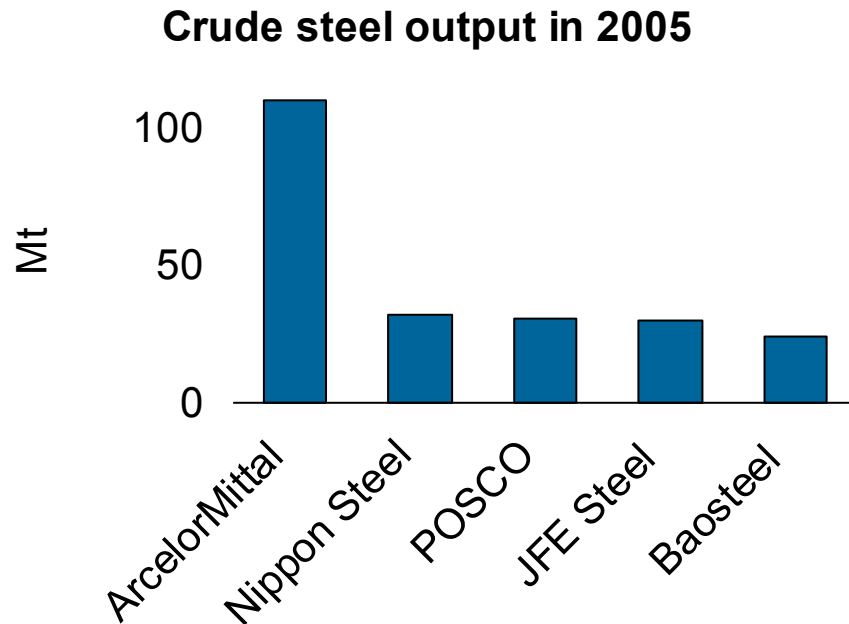
## Regional variations in average Mn and Si alloy content of steelmaking<sup>1</sup>



Data: Hatch Beddows, IISI, IMnI, ISSF. Note: 1. 2005 data. Variance compared with world average alloy content per tonne of steel (all grades). FeSi excludes consumption in making magnesium, which accounts for > 25% of consumption in China, the world's largest magnesium producer

## The Arcelor-Mittal merger creates a steel company on an entirely new scale...

- In 2005, ~110Mt crude steel produced proforma, almost four times that of its nearest rival
- 2005 EBITDA ~US\$15BN, which outstrips the earnings of any mining company and is greater than the total revenues of many other steelmakers



Data: Hatch Beddows, ArcelorMittal, Factiva, IISI. Note: ArcelorMittal data are proforma

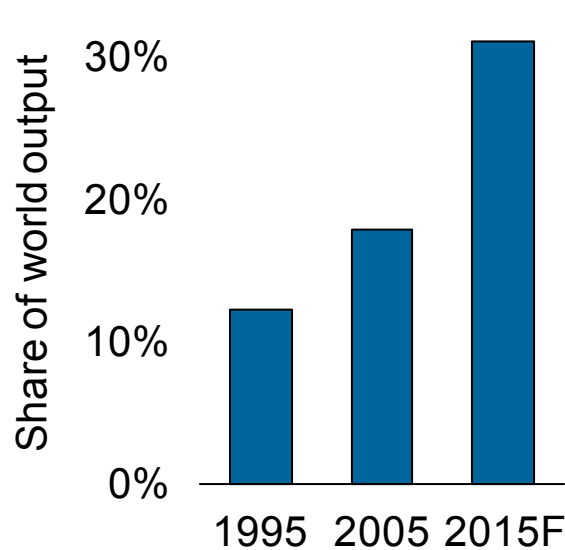
## With significant strategic consequences for the ongoing consolidation of the steel industry

- ArcelorMittal is close to 50% self-sufficient in iron ore and 20% in coking coal and continues to seek opportunities to increase its coverage
- If ArcelorMittal's flat-rolled assets in Europe become self-sufficient in iron ore it would pose a threat to commercial product producers (Corus, Riva, Salzgitter)
- Steelmakers self-sufficient in iron ore and partially in coking coal command a clear advantage over their competitors and are likely to become increasingly dominant
  - Steelmakers in Russia, most in India, some in Brazil and Ukraine and maybe ArcelorMittal
- Probable strategic responses to this challenge
  - BOF steel producers backward integrate into iron ore and coking coal
  - Non-integrated BOF producers push for price reductions from suppliers
  - Steelmakers seek new commercial relationships with suppliers
  - Consolidation continues

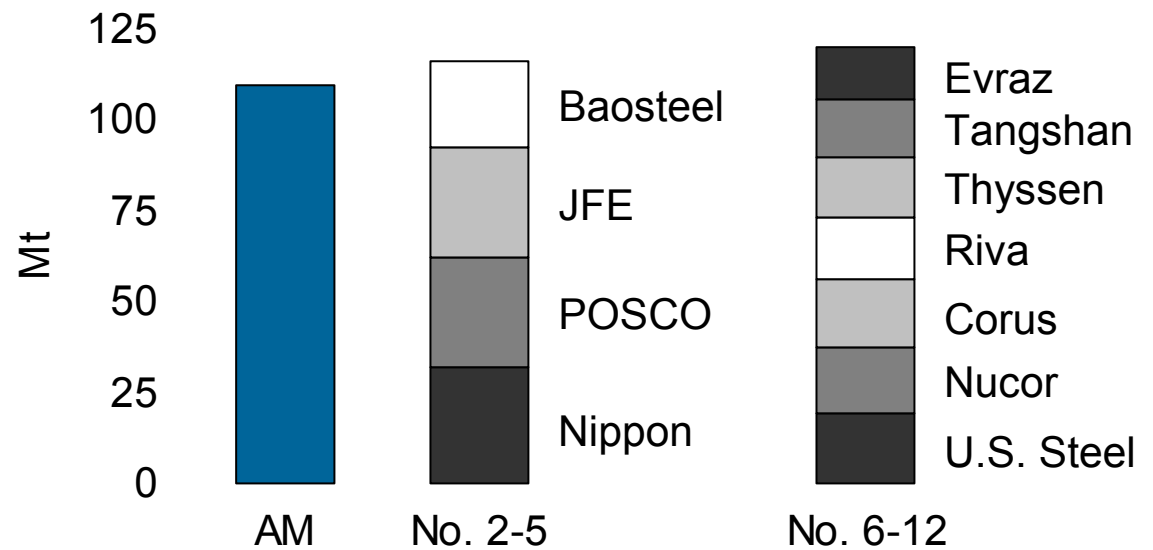
## ArcelorMittal has opened the final chapter in the consolidation story as the steel industry goes global

- Regional consolidation reaching its limits in many product markets in Europe and USA
- If consolidation is to continue it must involve leading companies integrating internationally
- Strong companies will attract capital to become stronger; weaker ones will be acquired

**Top five steelmakers**



**Crude steel production in 2005**



Data: Hatch Beddows, IISI. Note: 2015 forecast share of top five steelmakers based on historic trend in steel industry consolidation

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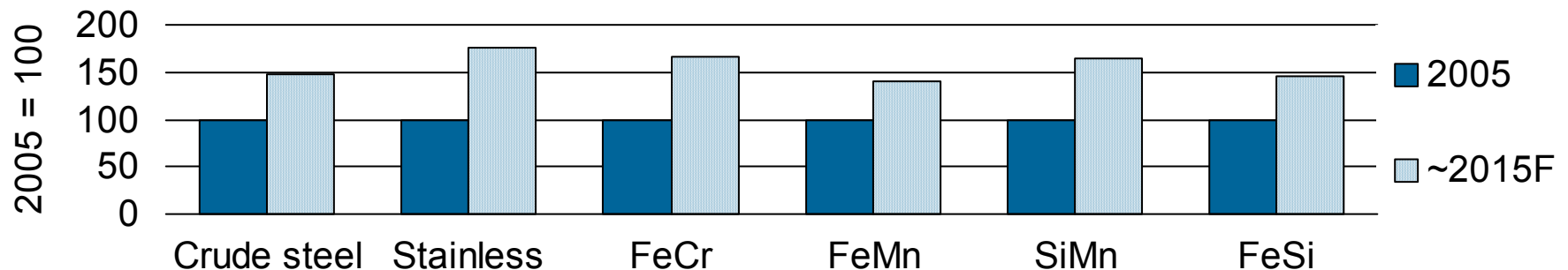
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## Prospects for strong growth in steel demand point to rising consumption of Cr, Mn and Si ferroalloys

- Carbon and stainless steel demand seem set for substantial growth over the next decade, driven by the development dynamic of a number of large populous countries – but there are risks
- The impact on aggregate alloy demand, especially manganese, could be augmented by changing patterns of steel consumption by grade
- Low cost locations are likely to take a leading share of new steel capacity while some high cost capacity elsewhere is likely to close with important implications for the distribution of alloy demand and demand levels because of variations in average usage

**Steel and ferroalloys demand indices**



Data: Hatch Beddows, IISI, ISSF

## Change in the steel industry will raise challenges as well as opportunities for its suppliers

- Higher demand, *ceteris paribus*, has positive price implications but that depends on effective supply side management and does not necessarily extend to margins, which also depend of course on costs
  - It may be most positive for chromite and Mn ore since resources are relatively scarce
- Suppliers to the steel industry will need to anticipate and respond to changing regional patterns of production, raising questions about products and markets in which to invest
- Changing patterns of steel production could work to the advantage of ferroalloys producers in high growth steel markets or low cost steelmaking locations
- Change in the structure of the steel industry is likely to continue
  - Consolidation is likely to lead to a smaller number of larger customers
  - These customers are likely to look for new commercial relationships with suppliers (dual-tier pricing, indexation, streamlining of suppliers)
  - Backward integration is likely to continue but probably not extending to ferroalloys

**Thank you for your attention**



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