CIS FERRO ALLOYS INDUSTRY: COMMERCIAL OPPORTUNITIES, TECHNICAL CHALLENGES AND STRATEGIC IMPLICATIONS

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ABSTRACT

CIS countries are home to some of the world's largest producers of chrome, manganese and silicon ferro alloys and leading suppliers to world export markets. The region's ferro alloys production is rising faster than demand from its domestic steel industry - unit alloy consumption in domestic steelmaking is in fact falling as process efficiencies improve - and there is significant spare capacity available to increase production. CIS producers enjoy certain strategic advantages in the production of ferro alloys - for example, captive ore supplies, low power and labour costs - but must also meet certain challenges - such as lower labour productivity and greater distance to market than some of their competitors. CIS producers are ambitious but new investment is needed to upgrade some aging plants and overhaul outdated process technologies if they are to be more competitive with the world's leading producers and address the environmental issues that are now moving up the agenda.

This paper describes the structure of the region's ferro alloys industry and discusses its advantages and disadvantages by alloy and by country. It considers how the ongoing process of restructuring and new investment in the industry might move forwards, based on its strengths and weaknesses, technical and environmental factors and the strategies of the main players. It asks how the industry might maximise its substantial potential - in particular, for the production of chrome and manganese ferro alloys - and examines the implications this holds for all global ferro alloys players.

1. INTRODUCTION

1.1 Hatch Group

The Hatch Group 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 in 1955, Hatch remains an employee-owned company that today commands global reach and resources: 7,300 highly skilled staff serving clients through offices in 60 countries to deliver over US$16BN of projects currently under management.

Hatch Consulting delivers the Group's business consulting services and is the world's leading management consultancy dedicated to the mining and metals industries. 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 the steel and steel-related industries, including ferro alloys.

Drawing on the range of specialised skills, knowledge and experience available across the Group as a whole, Hatch integrates and supplies a unique combination of commercial and technical services to the ferro alloys industry. The Hatch Group has completed a number of projects in the CIS on behalf of clients whose business is in steelmaking and ferro alloys production and built up a comprehensive knowledge and understanding of the region's ferro alloys production capacity, technical capability and ferro alloys markets related to steelmaking.

1.2 CIS Ferro Alloys Industry: An Overview

The Commonwealth of Independent States (CIS) was formed by republics of the former Soviet Union in December 1991. Four of the current 11 member countries - Georgia, Kazakhstan, Russia and Ukraine - currently produce the chrome (Cr), manganese (Mn) and silicon (Si) ferro alloys that are the focus of this paper[1].

The CIS ferro alloys industry is based on 11 electric arc furnace (EAF) plants, featuring over 175 furnaces (including idle units) with total capacity of approximately 3,200MVA, plus three plants producing high carbon ferro manganese by the blast furnace (BF) route. These plants are controlled by nine companies, of which all bar one are domiciled within the region. In 2005, the CIS industry produced almost 4Mt of Cr and Mn ferro alloys and FeSi with a market value of the order of US$4BN.

Table 1: CIS EAF Ferro Alloy Plants

Company	*Plant and Location*	*Furnaces[1]*		*Ferro Alloys Production, Kt[2]*			
		No.	MVA	FeCr	FeMn	SiMn	FeSi[3]
ChEMK Industrial Group	Chelyabinsk, Russia	35	335	310	-	50	60
	Kuznetsk, Russia	16	290	-	-	-	260
Eurasian Natural Resources Corporation	Aksu, Kazakhstan	26	625	700	-	170	40
	Aktobe, Kazakhstan	16	135	280	-	-	-
	Serov[4], Russia	18	160	200	-	10	20
Interpipe Group[4]	Nikopol, Ukraine	16	710	-	285	585	-
IST Group	Bratsk, Russia	4	50	-	-	-	30
NLMK	Lipetsk, Russia	2	30	-	-	-	20
Privat Group	Stakhanov, Ukraine	8	175	-	-	100	60
	Zaporizhie, Ukraine	14	335	-	90	320	45
Stemcor Holdings	Zestafoni, Georgia	22	365	-	15	105	-
Total	All plants	177	3,210	1,490	390	1,340	535

Data: Hatch Beddows. Note: 1. Includes idle units. 2. Saleable production; 2005 data to nearest 5Kt. 3. Basis FeSi75. 4. It is understood that Interpipe Group is the main shareholder in the Nikopol Ferro Alloys Plant but Privat Group, also a shareholder, has operational control of the plant. The previous privatisation of the plant and its current ownership are reportedly disputed and the subject of an ongoing review. This paper associates the plant with the Interpipe Group since it is understood to be the main shareholder but it should be recognised that the situation is subject to change, pending a final resolution.

In addition, at Tikhvin in Russia, approximately 150 km to the east of St. Petersburg, construction of a ferro alloys plant was started some years ago but subsequently halted for financial reasons. Recently, UK-listed Oriel Resources has secured shareholder approval and reached conditional agreement to acquire IPH Polychrom Holdings B.V., majority owner of the part-built plant, as part of a reverse takeover of Oriel Resources. The company plans to complete the plant, which features four 22MVA EAFs of Russian design, with active (post-losses) capacity of 17MW each, for the production of HC FeCr. Chromite ore will be supplied from

Turkey and, subsequently, from Kazakhstan, where Oriel Resources is developing its Voskhod chromite ore mining project in the northwest of the country.

2. CIS FERRO ALLOYS PRODUCTION, CONSUMPTION AND TRADE

2.1 Production

CIS producers are among world leaders in the production of Cr and Mn ferro alloys and their share of world output is increasing. The region accounts for about one quarter of world output of ferro chrome (FeCr) and silico manganese (SiMn). Its share of world ferro manganese (FeMn) output is smaller, for reasons related to local ore quality, but it is still rising. However, its share of FeSi output is falling as producers switch to other products for competitive and strategic reasons.

Table 2: CIS and World FErro Alloys Production (Kt)[1]

Country	FeCr			FeMn[2]			SiMn			FeSi[3]		
	2001	2005	CAGR	2001	2005	CAGR	2001	2005	CAGR	2001	2005	CAGR
Georgia	-	-	-	5	15	32%	40	105	27%	-	-	-
Kaza-khstan	585	980	14%	-	-	-	110	170	11%	45	40	-3%
Russia	185	510	29%	100	100	-	125	60	-17%	425	420	-1%
Ukraine	-	-	-	300	375	6%	715	1,005	9%	235	105	-18%
Total CIS	770	1,490	18%	405	490	3%	990	1,340	8%	705	565	-5%
World total	4,455	6,450	10%	3,830	4,355	5%	3,760	5,925	12%	3,545	5,015	9%
CIS share	17%	23%		11%	11%		26%	23%		20%	11%	

Data: Hatch Beddows. Note: 1. Saleable production to nearest 5Kt. Totals may not tally due to rounding. 2. Includes BF HC FeMn production. 3. Basis FeSi75. CAGR - compound annual growth rate.

2.1.1 Ferro Chrome

More than almost any other ferro alloy, the pattern of world FeCr production reflects the geography of ore reserves. Southern Africa, which hosts the highest concentration of chromite ore reserves in the world, heads the world output league accordingly and accounted for 50% of world output of high carbon ferro chrome (HC FeCr) in 2005. Kazakhstan ranks second, based on a substantial domestic reserve of high-grade, high-ratio (Cr:Fe) chromite ore and low cost of production, and coupled with a smaller output from Russia, the CIS produced 20% of world HC FeCr output in 2005. The region has raised its world market share by almost half since 2001, contributing almost 30% of the 1.9Mt increase in world production of HC FeCr that has been seen over the last five years.

Unlike HC FeCr, Southern Africa does not lead world output of medium and low carbon ferro chrome (MLC FeCr). Russia is the largest producer of MLC FeCr, accounting for about half of world output of 570Kt in 2005. Kazakhstan is also an important producer, its output is rising and has now reached a level similar to that of South Africa and China, until recently the world's second and third largest producers. CIS countries have a higher share of the world market for MLC FeCr because the high-grade chromite ore available locally, and the smaller furnace size typical of those installed at some plants in former Soviet times, is better suited to this product than the lower grade chromite ore typical of Southern Africa. The latter tends to have a higher carbon content that makes it more difficult to produce MLC FeCr.

Two CIS-based companies produce FeCr. Eurasian Natural Resources Corporation (ENRC) of Kazakhstan, through its KazChrome subsidiary, owns and operates three plants - Aktobe and Aksu in Kazakhstan and Serov in Russia, the latter in a joint-venture with the Kermas Group that also controls South Africa's Samancor Chrome - all of which produce HC FeCr. Aksu and Serov also produce MLC FeCr and the latter is world's largest single producer of this product. ENRC also controls three chromite ore mining operations in Kazakhstan that supply the feedstock for its plants, including the Donskoy Mine, which is the world's largest chromite ore mine, with run-of-mine capacity of approximately 3Mtpa and reserves of 350Mt. Russia's ChEMK Industrial Group also produces HC FeCr at its Chelyabinsk plant, which is one of two plants that it runs in Russia. The other is its Kuznetsk plant but this is currently used primarily for the production of FeSi. Some chromite ore for the Chelyabinsk plant is imported from ENRC's mines in Kazakhstan, and from Turkey, to supplement smaller scale domestic ore output.

2.1.2 Ferro Manganese

If the world pattern of FeMn production does not reflect the geography of high-grade Mn ore reserves to the same extent as FeCr does the distribution of chromite ore deposits, it is at least tied to the supply of high-grade ore since FeMn requires a high-grade raw material input. China is the world's leading producer with over 40% of world output but depends on imported ore from Australia, Gabon and South Africa, in particular. CIS countries have a smaller share of the world market, producing 11% of output in 2005, since although there are large Mn ore reserves in Ukraine, and, to a lesser extent, Kazakhstan and Georgia, the ore is well suited for FeMn production. For the same reason, the region's share of the world FeMn market has not risen in recent years, despite an increase of 21% in the amount of FeMn produced since 2001, all of which can be attributed to Ukraine. FeMn is not currently produced in Kazakhstan, since local low-grade Mn ores are not suitable. However, ENRC has studied the feasibility of starting FeMn production although no public announcement on results has been made to date.

Five companies produce FeMn in the CIS, including three companies producing HC FeMn by the blast furnace route. Ukraine's Interpipe Group is the region's leading producer with almost 60% of total output coming from its majority-owned Nikopol EAF plant at Dnepropetrovsk in the south of the country using third party ore, much of which is imported. Ukraine's Privat Group ranks as the region's second largest producer with almost 20% of output coming from its Zaporizhie EAF plant. (The Group's Stakhanov plant does not currently produce FeMn.) Most of its production is of HC FeMn but it also produces a small amount of MC FeMn by silico-thermic reduction.

The Privat Group also controls Ukraine's two Mn ore mines - the larger Ordzhonikidze mine, which includes both open pit and underground operations, and the smaller open pit Marhanets mine. However, the local Mn ore is low-grade, as noted, and also high in phosphorous, with the result that higher grade Mn ores have to be imported from Gabon, South Africa and Australia for blending in the production of HC FeMn. The Zestafoni EAF plant in Georgia, which was bought by Stemcor Holdings of the UK in 2006, also produces MC FeMn by silico-thermic reduction and is the only other producer of refined manganese alloys in the region. It, too, controls its own Mn ore mining operations at Chiatura but again the local ore is low-grade and not suitable for production of HC FeMn without blending.

Three CIS-based companies also produce HC FeMn by the BF route. Two separate private companies own and operate the Kosaya Gora and Satka plants in Russia and Industrial Union of Donbass (ISD) owns and operates a single plant at Kramatorsk in Ukraine. None of these companies has captive Mn ore.The Russian plants are supplied in part by ENRC from its Mn ore mining operations in Kazakhstan, supplemented by imports of high-grade ore from Brazil and Gabon. Privat Group supplies Kramatorsk from its Ukrainian Mn ore mining operations, which is again supplemented by imports of high-grade ore.

2.1.3 Silico Manganese

Of all the major ferro alloys the market for SiMn has seen the strongest growth in recent years, with world output up by almost 60% from 2001-2005. In Ukraine, which is the world's second largest producer country, output is up by over 40% on the same comparison, in Kazakhstan, which has been growing into a progressively more important producer, by 55%, and in Georgia, production has tripled, albeit from a much lower level. In contrast, Russian SiMn production has more than halved and accounted for only 4% of CIS output in 2005, compared with 13% in 2001.

Despite strong growth in output across much of the region, its share of the world market has actually recorded a small reduction from 26% in 2001 to 23% in 2005, which can be attributed to the even stronger growth in output from China, which is the world's largest producer with a market share of 43% in 2005, up from 32% in 2001 on the doubling of its output over that four-year time frame. Nonetheless, this should not distract attention from the positive factors driving SiMn production in Ukraine and, to a lesser extent, Kazakhstan and Georgia: large reserves of locally available low-grade ore, unsuitable on its own for FeMn but sufficient for SiMn production; low energy and labour costs, which account for a higher proportion of production costs than in the case of FeMn; and, strong growth in regional steel production and associated alloy demand.

Five companies produce SiMn in the CIS. Ukraine's Interpipe Group is the region's largest producer, with about half of total output coming from its majority-owned Nikopol plant using third-party Mn ores, much of which are imported for both corporate and technical reasons, despite the ample Mn ore reserves available locally. he Privat Group ranks second, with about one-third of the region's output coming from its Zaporizhie and Stakhanov plants, the latter having only started SiMn production in 2005, using mainly captive Mn ore from its two local mining operations. Some imported Mn ores are also used for technical reasons. In Ukraine, local Mn ores are relatively high in phosphorous and low-phosphorous ores are imported for blending to achieve the specification required of the final SiMn ferro alloy product.

In Kazakhstan, ENRC produces SiMn at its Aksu plant using captive Mn ore from local mining operations, which is low in phosphorous, but has discontinued SiMn production at its Serov plant in Russia since 2003, following a strategic decision to switch capacity to raising output of MLC FeCr. In Georgia, Stemcor's Zestafoni plant produces SiMn, again using captive ore from the local Chiatura manganese mines, of which around 85% is sold as such and the balance used in the silico-thermic production of MC FeMn. Meanwhile, in Russia, the ChEMK Industrial Group is now the country's sole producer of SiMn at its Chelyabinsk plant.

2.1.4 Ferro Silicon

After two years of very strong growth in 2003-2004, when output doubled, China has come to dominate world FeSi production. In 2005, China accounted for 59% of the 5Mt (basis FeSi75) of world output. In contrast, CIS FeSi output has been falling, with local companies taking the strategic decision to switch capacity to the production of other ferro alloys. From 2001-2005, FeSi production in Russia, the region's largest producer, was flat. In Ukraine, output has more than halved and, in Kazakhstan, it was already small. As a result, the region's share of the world market has fallen from 20% in 2001 to 11% in 2005, although it does appear to have stabilised over the last two years.

"Standard" FeSi usually has a Si-content of around 75% (FeSi75) and this accounts for approaching 90% of world output measured on the basis of Si-content. However, for historical reasons related to local steelmaking processes and technology, CIS countries and some others also produce standard FeSi with a Si-content of 50% (FeSi50) or 66% (FeSi66). FeSi50 and FeSi66 each account for around 5-6% of world output measured on Si-content. Russia and Ukraine dominate FeSi66, producing over 95% of world output in 2005, and also produce over one-fifth of the output of FeSi50. (The other major producers of FeSi50 are China, the USA and Norway.) By comparison, CIS countries produce only 6% of world output of FeSi75. A range of "speciality" grades of FeSi are also produced for niche applications in the foundry and carbon steel sectors, accounting for around 12% of total world output. However, these grades are produced mainly in western countries. CIS countries currently produce very little speciality FeSi.

Five CIS-based companies produce FeSi. Russia's ChEMK Industrial Group is the region's largest producer with almost 60% of total output coming from its Kuznetsk and Chelyabinsk plants. However, Chelyabinsk has been reducing FeSi production to raise output of FeCr in recent years, with the effect to some extent offset by higher output at Kuznetsk, where five new FeSi furnaces have been put into production. Ukraine's Privat

Group ranks as the region's second largest producer with about one-quarter of total output coming from its Stakhanov and Zaporizhie plants. Again, however, FeSi production has been reduced at Zaporizhie as output of Mn alloys has been raised in recent years. The balance of the region's FeSi is produced by ENRC at its Aksu and Serov plants in Kazakhstan and Russia, respectively; IST at its Bratsk plant in Russia; and Novolipetsk at its Lipetsk plant, also in Russia.

2.1.5 Capacity Utilisation

EAF smelting capacity for ferro alloys production across the 11 operational plants in the CIS is estimated at 3,200MVA, including idle units. Only five plants are calculated to have been operating at rates of 80%, or more, in 2005, including two of the three plants operated by ENRC. In contrast, Interpipe's Nikopol plant in Ukraine, which is the world's largest ferro alloys plant, is calculated to have been operating at less than 60% of capacity for reasons related, in part, to (lack of) supply of Mn ore. Stemcor's Zestafoni plant, with capacity of 365 MVA, is calculated to have operating at a rate of only 18% for reasons related, in part, to the condition of the assets.

Overall, EAF smelting capacity across the region is calculated to have been operating at a rate of 73% in 2005. If operating rates could be raised to 90%, it is estimated that the region could add the equivalent of around 1.4Mt to output of HC FeCr; 1.3Mt to output of HC FeMn, 1.2Mt to output of SiMn or 550Kt to the output of FeSi75 - which, to put this into perspective, would have been equal to around 22% of world FeCr production; 30% of world FeMn production, 20% of world SiMn production or 11% of world FeSi75 production in 2005.

2.2 Consumption

The majority of Cr, Mn and Si ferro alloys are used in steelmaking for deoxidization and to impart particular physical properties in finished steel products, with the result that steel production is the main driver of demand for these ferro alloys. Indeed, non-ferrous consumption of Cr units is mainly in the form of Cr metal or chromite ore, with the result that almost all FeCr is consumed in making stainless and alloy steels. Similarly, non-ferrous consumption of Mn units is mainly in the form of Mn metal or Mn dioxide, with the result that almost all FeMn and SiMn consumption is in steelmaking. In contrast, FeSi is also consumed in significant quantities in the foundry sector for the production of cast iron and in the production of magnesium and other ferro alloys, including SiMn, FeMo and FeNi; steelmaking accounts for around 65% of total consumption.

Since CIS countries currently produce little stainless steel, accounting for around only 1% of world output in 2005, the region's consumption of FeCr is correspondingly low, amounting to around only 110Kt (on a gross weight basis) in 2005. In contrast, the CIS is a significant consumer of Mn and Si alloys and, for a number of market and process-related reasons, SiMn is the most heavily used alloy in the region.

CIS countries produced around 113Mt of crude steel in 2005, accounting for 10% of world output, of which 57% was produced by the BF / basic oxygen furnace (BOF) route[2]. A significant proportion (27% in 2005) of the region's output is still produced by the out-dated open hearth furnace (OHF) route. OHF steelmaking would tend to favour low carbon ferro alloys additions and would also tend to exhibit higher unit consumptions due to the less efficient steel furnace production technology.

Table 3 shows, for comparison, consumption of Mn alloys and FeSi in CIS countries and their share of world totals. Two points stand out. First, CIS countries' share of world consumption has fallen over the last five years in all cases, except for refined Mn alloys, although their share in consumption of these products was already low. Second, CIS countries' share in consumption of SiMn and, to a lesser extent, HC FeMn is well above their share of world crude steel production, whereas in consumption of MLC FeMn and FeSi the situation is reversed.

Table 3: CIS and world consumption of Mn Alloys and FeSi (Kt)[1]

	HC FeMn			MLC FeMn			SiMn			FeSi[2]		
	2000	2005	CAGR	2000	2005	CAGR	2000	2005	CAGR	2000	2005	CAGR
Total CIS	390	400	1%	30	40	6%	690	800	3%	320	330	1%
World total	3,100	3,430	2%	715	850	4%	3,760	5,925	10%	3,545	5,015	7%
CIS share	13%	12%		4%	5%		18%	14%		9%	7%	

Data: Hatch Beddows. Note: 1. Apparent consumption to nearest 5Kt. Totals may not tally due to rounding. 2. Basis FeSi75. CAGR – compound annual growth rate

From crude steel production and ferro alloys consumption data we can calculate unit alloy consumption and it is interesting to compare both the average level and trend in consumption of Mn alloys and FeSi in steelmaking in the CIS with the world total. Table 4 shows that CIS countries use approximately 7.1kg SiMn per tonne of crude steel, which is over 40% above the average in non-CIS countries, and that SiMn unit consumption has increased since 2000, although average consumption in non-CIS countries has risen more steeply over the same time frame, due largely to developments in China.

In contrast, CIS countries' unit consumption of HC FeMn and FeSi has fallen over the last five years. However, unit HC FeMn consumption is over 15% above the average in non-CIS countries, where unit consumption levels have actually fallen further over the same time frame. Unit FeSi consumption has fallen by 9% (basis FeSi75) since 2000 and is now over 35% below the average in non-CIS countries. The fall in unit consumption of HC FeMn and FeSi can be attributed, in part, to improved process efficiency in the region's steelmaking and a reduction in the proportion of steel produced by the outdated OHF route and, in part, to the increasing use of SiMn by the region's steelmakers.

Table 4: CIS and Non-CIS Unit Consumption of Mn Alloys and FeSi (kg/tonne crude steel)[1]

	HC FeMn			MLC FeMn			SiMn			FeSi[2]		
	2000	2005	%Δ	2000	2005	%Δ	2000	2005	%?	2000	2005	%Δ
Total CIS	4.0	3.5	-13%	0.3	0.4	33%	7.0	7.1	1%	3.2	2.9	-9%
Non-CIS	3.6	3.0	-17%	0.9	0.8	-11%	4.1	5.0	22%	4.3	4.6	7%

Data: Hatch Beddows. Note: 1. Based on apparent consumption of ferro alloys. 2. Basis FeSi75

The decision for a steelmaker about whether to use SiMn or HC FeMn plus FeSi depends on a number of factors including: steelmaking process; steel product; steel grade; and, intended end-use application. In some cases the ferro alloy selection will be determined by the technical parameters of the steelmaking process and / or properties required of the steel product for its final application. Where, technically, a choice can be made between alternative ferro alloys this will be based on least cost calculations in relation to the Mn, Si and, importantly, the carbon content sought for the final steel product.

There are a number of interrelated commercial, market and process-driven reasons for the high unit consumption of SiMn in CIS countries compared with the world average:

- The steel industry of the former Soviet Union (FSU) was designed and built to use the SiMn alloys that could most effectively be produced from the abundant but low-grade Mn ore reserves of Ukraine and, to a lesser extent, Russia, Kazakhstan and Georgia at a time when the region was relatively isolated from international trade and access to higher-grade ores for HC FeMn production. The legacy of this inheritance can still be seen today even after the substantial investments in the region's steelmaking infrastructure of the last 10-15 years.

- The region still has substantial reserves of low-grade Mn ore suitable for SiMn production, especially in Ukraine, and ample low-cost smelting capacity, with the result that a good supply of SiMn remains readily available.
- The region's Mn ferro alloys producers do not currently have captive access to the higher-grade Mn ores (+48% Mn) that with high ratio (Mn:Fe) ores are required for HC FeMn production (+78% Mn).
- The region's good supply of electric power and relatively low unit power cost supports production of SiMn, which requires more energy per alloy unit than HC FeMn. Depending on ore mixes and furnace operation, SiMn production typically uses 3.5-4.5kWh/tonne of SiMn (saleable production), compared with 2.8-3.5kWh/tonne of HC FeMn.
- For most of the last 15 years since the fall of the FSU, SiMn has provided a more cost-effective means of introducing Mn and Si units into steelmaking than HC FeMn and FeSi in CIS countries, as well as neighbouring European markets. This has encouraged preferential demand for this product where steelmakers can choose within the constraints of technical considerations.

2.3 Trade

The CIS is a net exporter of all Cr, Mn and Si ferroalloys. Since the region's stainless steel industry is small most of its FeCr production is exported. In 2005, Kazakhstan and Russia exported over 1Mt of HC FeCr and 250Kt of MLC FeCr, mainly to the EU, Japan, China and Korea. In total, exports were equivalent to almost 22% of world FeCr output.

The CIS is also a net exporter of Mn ferro alloys, although the aggregate data disguise differences within the region. Ukraine and Georgia are net exporters of SiMn and FeMn (although Georgia produces only MC FeMn and only a small amount), whereas Russia is a net importer of both products. Kazakhstan is a net exporter of SiMn but imports FeMn, which is not produced locally. CIS SiMn exports are sold mainly to the EU, Japan, Korea and the USA. In 2005, net exports amounted to almost 550Kt, or 9% of total world output. Ukraine and Kazakhstan are the main suppliers to Russia. CIS FeMn exports are sold more widely although, again, the EU is a major market. Ukraine is the main supplier to Russia.

Kazakhstan, Russia and Ukraine are all net exporters of FeSi. However, exports have fallen in recent years, with companies switching some output to other ferro alloys, as discussed, and domestic demand increasing with rising steel production. In 2005, CIS net exports of FeSi were approximately 235Kt (basis FeSi75), compared with 385Kt in 2001. The main export markets are the EU, Turkey and the USA. Exports to Asia have fallen as Chinese production has risen.

The CIS is a major supplier of FeCr and, to a lesser extent, Mn alloys to world markets. However, trade relations are sometimes tense and the region's exports subject to certain restrictions. In September 2006, Euroalliages filed an anti-dumping complaint against imports of SiMn from Kazakhstan and Ukraine, among other countries, while in the same month, the US Department of Commerce decided to continue existing anti-dumping duty orders against imports of SiMn from Ukraine, among other countries. More recently, in November 2006, Euroalliages filed anti-dumping complaints against imports of FeSi into Europe from a number of countries, including Kazakhstan and Russia.

3. CIS STEEL INDUSTRY, FUTURE FERRO ALLOYS DEMAND AND SUPPLY

At a broad level, the future of the steel and steel-related raw materials industries currently looks bright, based on a powerful demographic-driven demand dynamic. China, India and other populous developing countries are rapidly industrialising. Russia and other countries in the CIS, it might be said, are reindustrialising. These countries have an already large and rapidly rising demand for steel and other materials for use in construction and industry. The BRIC (Brazil, Russia, India, China) countries finished steel consumption increased by 14% to almost 400Mt in 2005, or 40% of the world total[3], and yet steel consumption per capita in these four countries is well below the level of industrialised countries in Europe, North America and Asia. The fact that three billion people currently live in the BRIC countries with relatively low levels of steel consumption per capita serves to underline the long-term potential for growth in steel demand on a global scale.

Considering CIS countries specifically, the IISI has forecast that finished steel consumption in the region will rise by 26Mt, or 60%, over the ten years to 2015[4]. Given this, and assuming that the growth in demand will be met entirely by an increase in local steel production and that unit ferro alloy consumption in steelmaking remains unchanged, it can be calculated that local ferro alloys consumption would increase as follows: FeMn +100Kt; SiMn +210Kt; and FeSi +85Kt (basis FeSi75). If average regional operating rates are assumed to apply, it can be calculated that the additional power consumption required to supply this increase in demand for Mn ferro alloys and FeSi would be around 255MW. If it is then assumed that this additional demand will be met by local production, and that there are no further expansions from current capacity, then the average operating rate of capacity in the CIS ferroalloys industry would rise to around 81% of capacity, from 73% today.

However, CIS countries, and Russia in particular, have a number of natural advantages in iron and steelmaking, including: ample local supplies of key raw materials (iron ore, coking coal and scrap); low energy and labour costs; a large and growing regional market; and a number of ambitious, cash-rich steel producing companies with captive raw materials supplies. Indeed, it is highly likely that Russia and Ukraine will increase their share of world iron and steelmaking in future, with the result that local demand for Mn alloys and FeSi will rise by more than the above calculations suggest, even after adjusting for probable improvements in process efficiency, over the next ten years. Nonetheless, one major point still stands and that is CIS ferro alloys producers have ample capacity available both to increase output to meet local growth in demand and maintain - or possibly even raise - exports to world markets. Those that may have been hoping for a long-term decline in exports from the CIS as the regional steel industry expands are likely to be disappointed.

4. THE CIS AS A LOCATION OF CHOICE FOR FERRO ALLOYS PRODUCTION

CIS countries command certain strategic advantages for the production of Cr and Mn ferro alloys and, to a lesser extent, FeSi relative to other countries and regions around the world. However, CIS countries are also confronted with certain disadvantages but, on balance, the region appears to be an attractive location for production of ferro alloys and to offer promising long-term investment potential. Figure 1 summaries its strengths and weaknesses. These are discussed in more depth in the following SWOT (Strengths – Weaknesses – Opportunities – Threats) analysis, which draws out key strategic elements from the earlier examination of the production and markets for Cr and Mn ferro alloys and FeSi in the CIS.

4.1 Strengths

For the production of Cr and Mn ferro alloys, access to raw materials is the most critical strategic consideration. Kazakhstan hosts the world's second largest chromite ore reserves, after Southern Africa. Moreover, the ore is high-grade and has a high chrome-to-iron ratio. Ukraine hosts the world's second largest Mn ore reserves, again after Southern Africa, although the local ore is relatively low-grade and high in phosphorous. Kazakhstan also has significant Mn ore reserves, which are also relatively low-grade but low in phosphorous. CIS countries, including Russia, also have good access to carbon reductants for ferro alloys production.

Based in part on good local access to key raw materials, CIS countries are well-placed along the world cost curve and most of the region's leading producers of HC FeCr, SiMn and FeSi are in the bottom cost quartile of the world's producers[5]. The exception is HC FeMn since the region's producers rely in part on imports of high-grade Mn ore at market prices. Russia and Kazakhstan also enjoy low electric power costs, which is a significant competitive advantage in the production of FeSi and, to a lesser extent, SiMn. Average regional labour costs are also low, and in Kazakhstan and Ukraine lower even than in China.

Assisted by these advantages, regional producers have grown to become strong suppliers of Cr and Mn ferro alloys. ENRC is a fully integrated producer of FeCr and SiMn and Privat Group of Mn ferro alloys. ChEMK Industrial Group has some captive chromite ore and Stemcor Holdings owns and operates the Chiatura Mn ore mines that supply the Zestafoni ferro alloys plant in Georgia. The lower ore costs for integrated producers of Cr and Mn ferro alloys have significant positive implications for free cash flows; certain regional producers have grown cash rich in recent years and have been able to build up strong balance sheets. Although plant

Country	Ferro Alloy	Ore	Power	Reductants	Labour	Location	Score[Φ]
Kazakhstan	HC FeCr	●	●	◑	◑	⊗	5
	HC FeMn	⊗	●	◑	◑	⊗	2
	SiMn	◑	●	◑	◑	⊗	4
	FeSi	○	●	◑	◑	⊗	3
Russia	HC FeCr	◑	●	◑	◑	○	5
	HC FeMn	⊗	●	◑	◑	○	3
	SiMn	○	●	◑	◑	○	4
	FeSi	○	●	◑	○	⊗	2
Ukraine	HC FeMn	⊗	○	◑	◑	◑	2
	SiMn	◑	○	◑	◑	◑	4
	FeSi	○	○	◑	◑	◑	3

Data: Hatch Beddows. Note: ● Strong advantage (2) ◑ Advantage (1) ○ Neutral (0) ⊗ Disadvantage (-1). [Φ]Score out of a maximum of 10 points.
A positive score indicates an advantage compared with the world average; the higher the score, the stronger the advantage.

Figure 1: CIS Countries' Strengths and Weaknesses in Factors of Production for Ferro Alloys

facilities are often old, and production equipment does not always employ the most recent technologies, most of the region's ferro alloys producers operate profitably.

CIS countries also command a number of natural advantages for steelmaking and prospects for future strong growth in the region's steel production point to the potential for similarly strong growth in the region's ferro alloys consumption. A growing domestic market is a possible further source of strength for the region's ferro alloys producers.

4.2 Weaknesses

While CIS countries enjoy a number of significant advantages over others for the production of ferro alloys, there are also weaknesses. Kazakhstan is landlocked and its producers, along with a number of others in Russia, are relatively remote from major steelmaking regions and markets for ferro alloys. For the production of HC FeMn, low-grade local Mn ores require sweetening with higher-cost imported ores over which the region's producers have no direct control. For SiMn production some sweetening with imported low-phosphorous ores is also required.

Labour productivity is lower than in industrialised countries and the local culture and management structure is such that the operating staff is sometimes an obstacle to cost consciousness with the result that production plans are not necessarily designed to maximise profit margins. However, the impact is offset to some extent by labour low cost rates. Some of the region's producers are operating at relatively low rates of capacity utilisation, with potentially adverse implications for unit production costs. Moreover, some of the plant and equipment in the region's ferro alloys industry is outdated and requires upgrading or replacing. However, these weaknesses also offer opportunities for new investment to improve the performance and competitive position of the region's ferro alloys industry.

Production of Mn ferro alloys and FeSi in certain CIS countries has a heavier environmental footprint than in many other countries around the world[6]. Measured in terms of CO_2 emissions per tonne of ferro alloy production, including CO_2 emissions associated with the generation of electric power for the furnace, emissions are above world averages in Russia in the production of HC FeMn; in Kazakhstan and Russia in the production of SiMn; and in Kazakhstan and Ukraine in the production of FeSi. This reflects a range of factors including the high proportion of coal-fired electric power in the overall energy mix, process efficiency and, the case of HC FeMn, production of part of total output by the BF route. However, it should also be acknowledged that production of some products in certain CIS countries – for example, Mn ferro alloys in Georgia and Ukraine – has a lighter than average environmental footprint in terms of CO_2 emissions per tonne of ferro alloy production.

4.3 Opportunities

As noted, the need to upgrade some plant and equipment offers opportunities for investment in the ferro alloys industry in CIS countries, which would help to improve process efficiency, raise productivity and advance the competitive position of the region's ferro alloys industry. There are also a number of other opportunities. In particular, scope for further consolidation of the Mn industry in Ukraine offers an opportunity to build on the strengths of its established producers and the fact that it is dependent on imports of high-grade ore for production of HC FeMn may offer further opportunities for suppliers of high-grade ores to ally with local producers.

There may be opportunities for new or existing producers to invest in developing new mining or smelting capacity in CIS countries, while being ever mindful of the overall regional and world market balances for ferro alloys. UK-based Oriel Resources is one example of a new entrant to the industry with investment plans. The company's stated strategy is to develop projects in Kazakhstan to become a low cost, long-term supplier of chrome and nickel to the stainless steel industry in Asia, Europe and the CIS. One of the main projects that it is planning is the Voskhod Chrome Project for a 700Ktpa chromite ore mine based on an indicated resource of approximately 19Mt in the northwest of Kazakhstan and associated proposals for completion of the

88MVA Tikhvin ferro alloys plant in northwest of Russia to produce HC FeCr supplied by way of an offtake agreement for about one-third of the planned Voskhod mine's chromite ore output.

There may also be opportunities for certain of the region's ferro alloys producing companies, which control chromite or Mn ore resources, to invest in non-captive smelting capacity in major steelmaking regions. This could include integrating with capacity currently used for production of FeSi, but burdened with relatively high energy costs, that would be suitable for switching to output of Cr or Mn ferro alloys. Moreover, as the steel industry, the major customer for ferro alloys, continues to consolidate it may become increasingly important, if not essential, for world leading producers of ferro alloys to be able to offer a genuinely global service.

4.4 Threats

Certain potential threats can also be identified to future production of Cr and Mn ferro alloys and, in particular, FeSi in CIS countries. China has come to dominate world production of FeSi in the last four-to-five years and, although Russia and Kazakhstan benefit from low electric power costs, Chinese producers also benefit from the same low labour costs and ample local supplies of coke as CIS countries, plus the added advantage of a much larger domestic market for FeSi. Certain CIS producers have already switched exports of FeSi from Asia to Europe and other markets, but at the expense of lower ex-plant prices, in the face of increased competition. China's FeSi production will probably continue to increase in the coming years and, since Chinese producers benefit from most of the same advantages as those in the CIS, it is likely to remain a source of strong competition to CIS FeSi producers, as well as others around the world.

The threat of anti-dumping actions is one that potentially affects all producers of Mn ferro alloys and FeSi exporting from CIS countries. It is a serious threat – witness the anti-dumping actions in the EU and USA in the autumn of 2006 – that could have a substantial negative impact on the region's industry and one that requires a carefully considered and robust management strategy. However, in the case of FeCr, the fact that production in the EU and USA is limited means that the risk of anti-dumping actions against this product is probably small.

The potential for rising costs of production – in particular, power and transport costs – are threats to the currently good competitive position of many of the region's ferro alloys producers. In the case of transport costs, the risk is amplified by the fact that these are usually denominated in local currencies and inflation remains a higher risk across the CIS than in most mature regions. Indeed, general currency, economic and political risks are further threats to region's ferro alloys industry.

5. CONCLUSIONS

Nonetheless, CIS countries command a number of advantages for the production of Cr and Mn ferro alloys and, to a lesser extent, FeSi. Moreover, CIS-based companies have the ambition and many of the resources to be among world leaders in the production of Cr and Mn ferro alloys. While the risk of rising trade tensions should be taken seriously, especially in a world where the Doha round of trade talks appears to be all but dead, CIS producers can be expected to play an increasingly important role in the future supply of Cr and Mn ferro alloys. This potential is enhanced by the scope for new investment in modern processing and control technologies, which could help to improve process efficiency, raise productivity and advance the already strong competitive position of the region's Cr and Mn ferro alloys industry. In contrast, FeSi production is unlikely to rise to the same extent in the face of competition from China and certain of the region's producers may prefer to switch some capacity to producing HC FeCr in Kazakhstan and Mn ferro alloys in Ukraine. Nonetheless, the CIS is likely to remain an important, if not a leading, producer of FeSi and the overall potential for development of the region's ferro alloys industries has important strategic implications for all those involved in these industries worldwide today.

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