1. History and background of the steel industry

This chapter addresses the history and background of the world’s steel industry. It highlights the growth of this industry in the twentieth century in section 1.1, the rise of the ‘BICs’ (Brazil, India, China) in section 1.2, and the consolidation of the steel industry in section 1.3.

I worked in the steel industry for 36 years, from 1965 until 2001, and bear extensive witness to changes in this period.

1.1. The growth of the steel industry in the 20th century

The growth of the steel industry has been substantial over the past hundred years: from 22 million tonnes in 1894 to 1.059 million tonnes in 2004 (Beddows 29), and to more than 1.400 million tonnes in 2010. The industry grew relatively slowly until the end of the Second World War. From that period to 1973, it grew at an annual rate of 6% per annum in volume terms until the first oil shock that caused the slowing down of the growth rate in the 1970s. From the mid-1970s to the mid-1990s, growth averaged 1%-2% per annum until the impact of China began to be felt in the late 1990s when again the growth rate expanded to 4%-5% per annum (Beddows 1).

I entered the steel industry in 1965, in the middle of the first high growth period. As project engineer, I worked on the expansion programs of Hoogovens, the well-known Dutch steelmaker located in the IJmuiden region, for more than 10 years. As project manager, I was responsible for the last big expansion program of that period: the 7.3 million ton steel plan, concluded in April 1976. From 1977 until 2001, I was involved in the sale of steel technology by Hoogovens/Corus Group to major steel companies all over the world. From 1985, I worked as Managing Director of the Business Unit of Hoogovens/Corus responsible for this international activity of the Group.

In the following overview, I will chronologically guide the reader through the changing vanguard position of national steel industries during the last fifty years: USA: 1945-1970, Japan: 1970-1985, South Korea and Western Europe: 1985-2000, and the BICs: 2000-present. Of course, the years are approximately. See Box 1 for the overview.

In 1965, the US steel industry was still the vanguard industry. At that time, it was normal practice to visit the US in order to become acquainted with modern steelmaking. At the end of the Second World War, over 50%

9 Rod Beddows, who is located in the London office of Hatch International, is one of the most well known advisors in the steel industry. The majority of the figures and facts in this section are taken from my interview with him on 22 May 2007.

10 Source: World Steel Association, Steel Statistical 3.

11 Hoogovens Group merged with British Steel Corporation in 1999. The name of the newly formed entity was Corus Group.
of the world’s steel production was located in the US, and they maintained their leading position in technology and capacity until the end of the 1960s. The vanguard position was the result of the huge effort of the US industry in general, which was founded on the New Deal policy created during the presidency of Franklin D. Roosevelt.

In the early 1970s, the situation changed, and the Japanese steel industry took over the vanguard position from the US. Trips to the US were replaced by trips to Japan in order to study and acquire the latest technology in steelmaking.

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<th>Box 1: Vanguard positions in recent steel history</th>
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<td>USA → Japan → Western Europe/South-Korea → BICs</td>
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- **USA vanguard 1945 -1970s**: global dominance based on strong position built up during the Second World War as part of the New Deal policy, and damaged steel industries in Europe. Decline due to investments in old technology and risk-averse behaviour, combined with the short-term orientation of US firms.

- **Japan vanguard: 1970s-1980s**: based on rapid, state-led industrial development, an institutional response to new technologies since the 1960s.

- **Continental Europe/South Korea: vanguard 1990s-21st century**: based on introduction of new technologies, high levels of education and long-term orientation. The UK could not follow Continental Europe because of the short-term orientation of British firms.

- **BICs vanguard 21st century**: based on the high demands of strong growing market, entrepreneurial push, long-term orientation, and reduction of the technology gap with Western Europe, South Korea, and Japan. China produces 50% of the total world steel production. Initially, the Russian steel industry started to follow Brazil, China and India but lost track. BRICs changed to BICs.

This change was the start of a complete new global restructuring process. This global restructuring of the steel industry has been well described by Anthony P. D’Costa in *The Global Restructuring of the Steel Industry*.

He emphasises three important developments: 1) a **spatial development**, 2) a **technology change/innovation** development, and 3) a change in the **institutional settings** of a country.

The technological frontier shifted from open-hearth furnace technology in the post-war period to the basic oxygen furnace technology. This shift presented itself as a strategic problem for firms with heavy investments in open-hearth
furnaces. For latecomers in general, this was a unique opportunity to move from the rearguard to a vanguard position. In the same vein, the emergence of smaller, more flexible electric arc furnace technologies constituted another important technology change in steelmaking, offering new opportunities for technology-led industrial restructuring. ‘The massive investment program guided by the state, supported by the banking sector, and aggressively pursued by steel firms resulted in a rapid expansion of steel capacity. Unlike the US, the larger size firms and plants in Japan have been conducive to rapid adoption of the new technologies resulting in fast and huge innovations with scale advantages’ (D’Costa 22).

The ‘Nippon’ model formed a perfect economic and social environment for this move. Visits to our Japanese colleagues at that time were not just related to new technological developments but also to new managerial methods and the influence of the lifetime-job philosophy. It was my first introduction to Toyotism with its just-in-time philosophy, quality circles, permanent improvements, and knowledge mobilisation. I was impressed by this total ‘industrial package’ of the Japanese society.

The necessary restructuring of the US steel industry was confronted with heightened capital mobility away from the steel industry. The steel companies could not meet the demand for high dividends and short-term financial results of the rising star of the Anglo-Saxon economic model. Implementation of new technologies and product development in the steel industry are long-term actions. Necessary investments failed to materialise and slowly but surely the steel plants became outdated and inefficient. This process continued until the beginning of the 21st century. The take-over of the industrial vanguard position in the steel industry by Japan shows the important role of national governments and institutional settings on the development of the steel industry. Governments, in the past but also still today, consider the steel industry as a strategic industrial sector12. ‘Late-industrial countries like the BICs overcame the initial structural barriers of investment and technology, making industrial policy the single most important instrument to regulate the pattern and direction of industrial change’ (D’Costa 23).

Because of this state-involvement, ‘the steel industry is far less internationalised than other industries. Foreign ownership in the steel industry is limited’ (D’Costa 29). The role of multinational companies remained small until the end of the 20th century. Due to the same reason, the steel industry is

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12 For a detailed study of the economic regulations within the West-European steel industry, from the beginning of the Industrial Revolution until the foundation of the European Coal and Steel Community, I refer to Dany Jacobs’ Gereguleerd Staal (Jacobs, Gereguleerd). He describes the strong political influence of national governments in numerous restructuring processes within the steel industries of France, UK, Belgium, and Luxembourg. He maps the rich variety of regulatory mechanisms: private (through agreements with producers), public (through the state) and “anonymous” (through the market).
less concentrated than other basis materials industries. During the last decade, this situation started to change. I will address that at a later stage.

The first oil shock in 1973 slowed down the high-growth rate in the steel industry. For me, it was quite clear that I had worked on my last expansion program for Hoogovens. Although I could complete the project, the targeted level of 7.3 million tons of steel has never been reached. Production capacity remained unused; overcapacity was once again a fact in the steel industry, as it had been in the past. This development, of course, was partly the result of the previously mentioned popular state-involvement disrupting the supply-demand market rules.

The downturn in the advanced capitalist economies made it easier for late-industrialisers to acquire technologies (D’Costa 24). Quite a number of steel makers in the advanced economies began to transfer their technologies to late-industrialised countries. Hoogovens was one of them. In 1977, I became involved full-time in this technology transfer as mentioned before. I worked on many projects all around the world and gathered the experience of working in different social and economic environments.

The introduction of modern technologies by late-industrializing countries started the global restructuring of the steel industry. Countries like India, Brazil, and China began to transform from rearguard to vanguard.

Technology transfer takes numerous forms. It can range from pure technology transfer by licensing to substantial turnkey projects. Some technology suppliers even became partner by supplying foreign equity to a new joint venture. The Japanese investments of companies like NSC in the Brazilian steel industry are typical examples of these commercial arrangements. My company limited itself mostly to technology transfer via case-by-case projects purely based on engineering and supply. Management considered participations and turnkey responsibilities to be too risky.

For me these different forms of technology transfer meant that I started to learn the differences and the impact of the institutional settings on the day-to-day business with my clients. The mere transfer of technology is not sufficient for technological mastery. Rather, the national institutional context and an innovation system geared toward building technological capability are of paramount importance. A typical example for me was the transfer of hot blast stove technology to the Steel Authority of India Limited (SAIL) in the 1980s. SAIL is the largest steelmaker in India and state-owned. I signed a rather substantial contract with the Vice-Chairman of SAIL based on technology transfer via a licensing agreement. By engineering four projects one after another, our engineers were to transfer the knowledge to their colleagues. Our role should be downsized from 100% engineering plus supervision in the first project to just limited supervision in the fourth project. In practice, we did finish the first project in Bhilai, one of the plants of SAIL in East-India, although far behind schedule because of the bureaucratic
character of the client’s organisation. However, the other three projects were delayed several times because the education of our Indian colleagues was not effective. Each time we had educated a few of them they were transferred to new jobs somewhere within the huge SAIL organisation. As a result, we had to start all over again. In the mean time, the head office of SAIL did pay the royalties on technology transfer on time according to the contract. The initiator of the technology deal, the Chairman of SAIL ‘whose project’ this was, ended up in jail for some unknown reason. The organisation of SAIL was not able to secure the technology on time and ended up paying far too much for a far too limited scope of technology. India is a typical example of an internally incoherent institutional setting, pushed and pulled by various social groups. D’Costa talks about ‘over-politicisation of industrial relations’ (D’Costa 103), leading to severe overstaffing and labour strife. Institutional weakness and institutionally unnecessary complexity like in India make it impossible to marshal the necessary infrastructural resources, to acquire new technologies or induce local technological development. This weakness includes the educational resources of the steel regions in this country. Although we did have substantial training and education programs for local engineers and operators as part of the technology package, the transfer was never very successful.

The recent opening up of the Indian steel industry to private entrepreneurs generates a more favourable picture. Transfer of knowledge via the involvement of local industrial partners forms a more solid ‘embedded’ approach. Indian institutional thinking and handling became very real and close for Corus after the take-over of by Tata Steel.

My first experience with Tata Steel was in the 1980s. Tata Steel was the first private steel company in India, with a completely different management style than SAIL. The social embeddedness of the Jamshedpur steel plant is well known in the steel industry. I personally was involved in successfully training and education projects on-site.

On the other hand, there are the institutional settings of South Korea and China, both examples of strong, internally coherent states, comparable to the Japanese situation. The technological transfer is well organised and embedded in the local economy. The transfer of technology to China during the last decade shows that this country has a solidly embedded approach to technology.

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13 In personal discussions with executives of SAIL, I learned about the social responsibilities of organisation like SAIL in developing certain regional areas. I do not agree with Anthony D’Costa’s strong statement of ‘over-politicisation’. SAIL has another responsibility in addition to just making profit. It has to contribute to the social embeddedness of its steel plants into remote regions. Tata Steel in Jamshedpur, the first private steelmaker in India, represents another example of social embeddedness in this country. The embedded approach is a well-known social phenomenon in this country.
transfer, securing excellent best-practice technologies.

State ownership of steel assets was predominant in the steel sector until very recently. A substantial change in this institutional approach to the steel industry started in the mid-1980s, with the privatisation of British Steel, being the first major example. Privatisations accelerated through the 1990s, especially with the dramatic collapse of state ownership in the Soviet-Union. This transfer in ownership changes the institutional environment of steel companies.

For almost nine years starting in 1992, I was personally involved, in the privatisation of the Mexican steel industry. The Mexican government privatised the national steel industry Sidermex with British Steel as their advisor. The steel company was split up into four pieces and sold on the market. The northern plant of Altos Hornos de Mexico SA (AHMSA) in Monclova was acquired by an industrial group, Grupo Acerero del Norte (GAN), with zero experience in steelmaking. They contracted Hoogovens as their expertise partner and operational advisor for the steel operations. During nine years, our team worked side by side with their Mexican colleagues, implementing new technologies and modern management and operation tools. Our team differed in size from a minimum of 20 up to more than 100 engineers and operators. The transfer of best practices differed from case to case, depending on the quality and the willingness of the Mexican staff to follow up and implement our advice. Training and education as the most outspoken embedded elements were the key elements of the cooperation. However, the motives of the sale by GAN were dubious. They were entrepreneurs from outside (of course closely related to the authorities in Mexico City organising the privatisation), taking over the facilities and trying to implement their rules. The Mexican government did not feel any responsibility any longer. The original management and workers, together with the local industrial and political environment, were just victims of the deal and felt no responsibility at all for the whole situation.

The privatisation of the Brazilian and Russian steel industry followed the same dubious route, under the rising star of neoliberalism.

An overview of the history of the steel industry of the 20th century has to end with the impact of the strong growth of the Chinese steel industry beginning in the late 1990s. Our first contacts with and contracts for the sales of technology already began in the 1980s but it took until the beginning of this century before China became our most important client. As previously mentioned, their institutional settings guaranteed a successful and fast adoption of new technologies and best practices by local partners. Contract negotiations are short and to the point, project execution is fast and correct, which is a world of difference with our experiences in India.

Summarising my experiences: there is a straight line from India to Mexico, to Japan/Korea and to China, showing the importance of the involvement of local stakeholders in the transfer of technology.
The growth of the Chinese steel industry changed the world of steelmakers. The strong increase on the demand side resulted in increasing prices worldwide, but also in a strong increase in prices of basic resources like iron ore, coal and energy. This brings us to the next section in which I describe the situation in the steel industry at the beginning of this century.

1.2 The steel industry in the 21st century

‘In terms of the physical location of production, the industry has globalised. In 1894, when 22 million tonnes of steel was produced, there was virtually no production outside of the US, UK, Germany, France and Russia’ (Beddows 2). After the end of the Second World War, 75% of the world’s steel production was located in the US, UK and Russia of which more than two-thirds in the US (as described in section 1.1). Reason for this change was ‘the substantial destruction of the Continental European steel industry due to the Second World War’ (Beddows 2). In 2005, the world’s crude steel production passed the 1 billion tonnes milestone of which China produced 40%. In 2010, the world’s crude steel production was 1.4 billion tonnes. It will reach 1.5 billion tonnes before 2015. Nearly all of this growth will be in the emerging markets.

Nowadays, China, India, Japan, South Korea, Russia, Brazil, Germany and the US are the major steel producing countries14.

The steel industry of China, India and Brazil (the so-called BICs15) took over the leading role of the US, Japan, and the EU. This change is of great influence on the strategic thinking in the steel industry. As will be described more in detail in chapter 6, the entrepreneurial thinking in these countries replaced the more prudent and managerial thinking of the traditional steelmakers. For the first time in history, this resulted in the creation of real international steel companies like ArcelorMittal and Tata Steel, a move away from the traditional national basis of steel companies as described in section 1.1. It also led to a growing consolidation of the industry (Beddows 5).

The rise of the BICs will also introduce institutional innovations, as I will describe in section 2.4. This will have its repercussions on the world’s steel industry.

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14 The top 10 crude steel producing countries are (million tonnes per annum in 2010): China 627, Japan 110, US 80, Russia and India 67, South Korea 58, Germany 44, Ukraine 34, Brazil 33, Italy 25 (World Steel Association, Steel Statistical 3).

15 At the end of the last century, it was customary to include Russia in the team of China, India and Brazil, and to refer to them as the BRICs. The lagging behind of Russia during the last century changed the term BRICs into BICs. In December 2010, China invited South Africa to join the BRICs and to change the name in BRICS. That means that China still includes Russia. However, given the fact that South Africa is just a small player in the steel industry, I prefer to use the name BICs.
1.3. The consolidation of the steel industry

There is a progressive consolidation of crude steel production. The share held by the top five producers of crude steel increased from 12% in 1995 to 21% in 2005. ‘If this trend is carried forward, approximately 40% of crude steel production will be in the hands of five companies by 2020’ (Beddows 9).

In my interview with Ian Christmas, Director General of the Brussels Office of the World Steel Association, on 30 March 2007, he confirmed the need for concentration in the steel industry:

‘Concentration in industry can be based on technological developments asking for optimising of unit size, or on economical/financial reasons. In my opinion, the first reason does not exist in the steel industry. On the contrary, mini mills brought down the unit size. The need for concentration is purely economically. The first main target is the closing of inefficient units, and the balancing of production costs within the company. This is in principle more a local aspect of steelmaking.

I consider the situation on the raw material supply and the global clients in the automotive industry as the first need for internationalisation. Possible areas of concentration are marketing, R&D and distribution/selling. But these aspects can also be covered via strategic alliances. I expect most initiatives from ‘big money movers’ in the BICs or the raw material suppliers’.

The consolidation in the steel industry is horizontal in nature. ‘One steel company takes over another steel company or two steel companies merge to create a larger steel company operating at a larger volume’ (Beddows 6). Beddows distinguishes two types of horizontal consolidation: a regional one and a global one. The rational for the regional consolidations is: 1) reducing overhead costs; 2) reloading of the order books on different assets to produce longer production runs and better economies; 3) savings on capital allocation through better utilisation of assets and a better phasing of capacity expansions; 4) transferring of best practices between assets and management systems; 5) savings on procurement costs, especially of raw materials and energy (Beddows 6).

The search for pricing stabilisation is of great importance in the steel industry, where the market has been highly volatile both for production and for prices. This volatility is a result of steel being at the early stage of the industrial production cycle. Historically, ‘prices of steel products have been capable of varying up to 30% across a six-month period’ (Beddows 7). A typical example of a regional consolidation was the creation of Corus as a merger of British Steel Corporation and Hoogovens in 1998. Examples of
global consolidation are the South Korean steel company POSCO building a green field steel plant in India, US Steel building a position in Slovakia and Europe in general, and the eye-catching example of ArcelorMittal. Mittal started as a small Indian steelmaker, and via an aggressive entrepreneurial strategy of father and son Mittal, they became the largest steelmaker in the world, active in 60 different countries. Mittal became the first steelmaker with a crude steel capacity of more than 100 million tonnes, representing about 10% of the world steel output.17

Recently, on 3 February 2011, Nippon Steel Company and Sumitomo, two major Japanese steel companies, announced the consideration of the integration of their businesses. The target for a possible merger is 1 October 2012 (Nippon Steel Corporation and Sumitomo Metal Industries 1).

There are a number of drivers for this horizontal global consolidation process. The most well known drivers are: 1) the objective to achieve global customer coverage, 2) the increase in scale that can enable purchasers to exert some pressure on raw material costs and the purchase of consumables and other supplies, 3) the possibility of using low costs production units for the global market, and 4) the spread of political or general market volatility risks (Beddows 7).

The second possibility for consolidation is vertical consolidation. Upstream consolidation is based on securing raw material supply. Two third of the seaborne trade in iron ore is in the hands of three companies: Rio Tinto, BHP and Vale. Prices for iron ore have exploded. ArcelorMittal and other major steelmakers are buying iron ore mines to become less dependent on the three major suppliers. On the other hand, almost all major Russian steel companies are already self-sufficient in coal and iron ore.

‘Downstream consolidation has been a constant theme in the steel sector for the last two or three decades. It has taken place in the simpler manufacturing process steps such as distribution, pipe and tube and roll forming. However, the apparent attractiveness of the industry is counterbalanced by the difficulty of managing two very different activities within the same company culture. Downstream consolidation has lost part of its attractiveness’ (Beddows 8).

Today, consolidation in the steel industry limits itself to the core business of steelmaking and upstream investments in the raw material supply. ‘Back to the core business’ is the leading strategy. In the past, especially in the 1970s, steel companies sometimes adopted the opposite strategy of diversification of their industrial activities. The background of this strategy was the spread of

risks. The Tata conglomerate is an exceptional case as a typical example of the diversification strategy with a wide range of industry-oriented and service-oriented activities both within and outside the steel industry. As explained in my introduction, in this thesis I refer to the steel industry with its recent ‘back to the core business’ strategy. This industry, with its long-term orientation, heavy investments and labour-intensive character, forms the right background for the introduction of ACG.

After the merger between Arcelor and Mittal in 2002, further horizontal global consolidations were expected, but until now, new consolidations failed to occur. Only very recently, the above-mentioned intention of Nippon Steel Company and Sumitomo has been announced. Upstream consolidation, however, is still on the move.

It is unclear what the influence of the recent financial crisis in 2008 will be on the short and long-term future of the steel industry. Steel prices, iron ore, coal and energy prices have decreased. Steel prices recovered partly, iron ore prices recovered very quickly. Overcapacity could become an almost forgotten item on the agenda of the world steel industry.

Given the need for consolidation, the question is if the steel industry has to follow the same route of mergers and acquisitions as applied to other industrial sectors. The record of accomplishments of international mergers and acquisitions is not convincing. More than 60% ends up as a failure and 80% does not bring the synergies and strategic targets as defined at the start\textsuperscript{18}. Why should the steel industry take the same road? I personally was involved in the merger of British Steel Corporation and Hoogovens, which was a perfect example of the 60% score.

ArcelorMittal appears to be successful so far, at least from an economic point of view. However, the extreme positive market conditions and connected high steel prices at the start of the new group prevent a serious judgment. The company has to prove itself first through the recent down-cycle before a final judgment can be given. For the period 2008-2011 the financial results of ArcelorMittal decreased 7.8%. This performance is worse than the performance of six other important steelmakers like Bao, Vöestalpine, Posco, ThyssenKrupp, Nippon Steel and US Steel. Financial specialists are negative about ArcelorMittal’s profit improvement potential (Depuydt \textit{ArcelorMittal}).

The Mittal organisation follows the classic merger and acquisition route in creating their global steelmaking emporium. This means that Mittal and the associative philosophy route of my thesis are each other’s opposite. As I described before, SAIL and Tata can be find in a middle position. On the line Mittal – Tata/SAIL – ACG the former steelmaker Hoogovens is located between Tata/SAIL and ACG.

\textsuperscript{18} Figures presented by Hans Schenk, in my personal interview. For more details, see chapters 2 and 3.
My experience in steel regions like Chicago (USA), Oita (Japan), Bhilai (India), Monclova (Mexico), IJmuiden (Holland) and many others has taught me that forced consolidation from outside is a sure-fire route to the strong negative score of this type of consolidation as mentioned before. It will destroy positive living conditions of steel plant employees and its environment of suppliers and other stakeholders. The fact that the consolidation and internationalisation of steel companies has just begun and that many steel regions all around the world will be confronted with it, demands a reconsideration of the situation and development of new ways of consolidation and governance of future consolidated steel companies.