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by

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DISCUSSION PAPER

The emergence of the 'coastal steelworks' in the European Coal and Steel Community (ECSC), 1952-1967

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Abstract

The coal and steel production was key in the post-war rebuilding of the European economy. However, after WWII, Germany still had the technological knowledge and experience to quickly regain its pre-war position as the dominant economic force in Europe. In response to this 'problem', the political leaders of six Western European countries founded the European Coal and Steel Community or ECSC, which they hoped would provide a common legal framework for the coal and steel industry. When the ECSC was founded, all six founding countries of the ECSC produced steel and all but two also produced substantial quantities of coal. However, there were considerable differences in the 'regional concentration' of the coal and steel companies and before 1952 (the first year of the ECSC), a (relatively) small geographical area was responsible for more than 90 % of both the European coal and steel production. We have then looked at how the relative importance of this 'industrial triangle' in the total coal and steel production of the ECSC has decreased between 1952 and 1967 and we discuss the different causes of this decrease. More specifically, we show how the importance of the so-called 'coastal steelworks' has increased between 1952 and 1967.

JEL classification:: L7; M21; N54; N64; 031; R11
Keywords: ECSC, regional concentration, coastal steelworks, industrial triangle

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1. Introduction

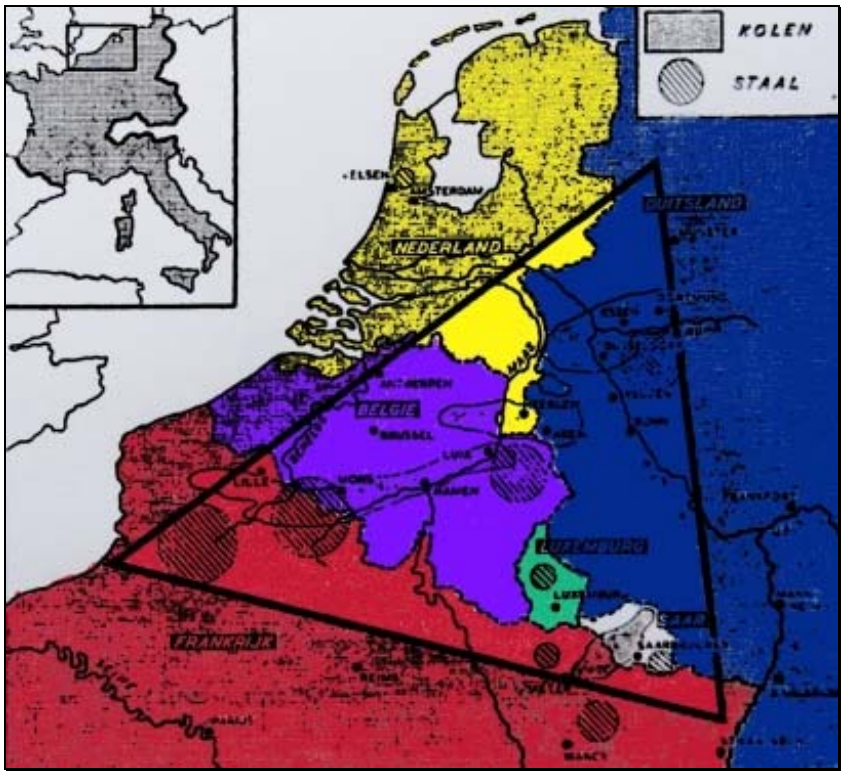
The coal and steel production was very important for both the post-war rebuilding of the European economy and the economic prospects of Europe in the long term. However, the post-war political situation led to major conflicts about who would own and control the production of coal and steel. The main problem was the German coal and steel industry, which had been the dominant economic force in pre-war Europe. After WWII, Germany still had the technological knowledge and the experience to regain this position quickly and therefore, the allies were understandably not inclined to give (West) Germany its (economic) independence back [1].

In response to this 'problem' and to the need to take steps towards more European 'integration', the political leaders of France, West Germany, Italy, Belgium, The Netherlands and Luxembourg created - through the 'Treaty of Paris' of 1951 - a 'legal community' - the European Coal and Steel Community - that would submit the major part of the European coal and steel industry to a common legal framework. [2] This would in turn make it possible to exert 'common' control over the companies operating in the European coal and steel industry, which in itself was the key industry in the post-war rebuilding of the European economy [3].

In most publications and sources regarding 'the ECSC' and/or 'Western Europe', the countries as a whole were considered[4]. Therefore, figures for the production of the coal, iron ore and steel industries were also given for each ECSC country / Western European country as a whole and only very seldom, we have been able to find figures for the industrial subregions of each country. There were huge differences within the six ECSCS countries with regards to the (economic) importance of the coal and iron ore mines in the different subregions and hence, the coal, iron ore and steel industries in these countries were characterised by so-called 'regional concentration'.

In this paper, we analyse this 'regional concentration' of the coal, iron ore and steel industries in each of the six ECSC countries during the period 1952-1967. As a starting point for our analysis, we refer to a publication of 1944 [5], in which - to our knowledge for the first time - Western Europe was no longer seen as an 'amalgam' of countries producing coal, iron ore and steel, but rather as an 'accumulation' of regions within the different countries that were producing more or less of each of these products and that exceeded country borders. In the same publication, the concept of the *'industrial triangle'* , a relatively small region with more or less the shape of an 'inverted' triangle in the middle of Western Europe, was also mentioned for the first time and before WWII, this triangle was considered as the 'industrial heart' of the European coal and steel industries.

Figure 1: The ECSC and the Industrial Triangle



Source: Voorlichtingsdienst van de H.A., "De toekomst van de steenkool en de concurrentie op het gebied van de energie in de gemeenschap." EGKS, *Europese Gemeenschap voor Kolen en Staal*, (Luxembourg 1959), 62.

Subsequently, we investigate whether this triangle was as (economically) important in 1952 - when the ECSC started - as it was at the end of the 1930's and whether this triangle remained as important between 1952 and 1967. The year 1952 was chosen as the start year of our investigation because 1952 was the year that the ECSC effectively started. We have chosen the year 1967 as the end year of our investigation because 1967 was the last year during which the so-called 'High Authority' (cf. infra) was the executive body of the ECSC. In 1967 and by means of the 'Merger Treaty' (or 'Brussels Treaty'), the three executive bodies of the ECSC, the EEC (European Economic Community) and Euratom were merged into one institutional structure: the Commission and Council of the EEC.

In this paper, we also investigate whether factors like 'industrial innovation' were responsible for a 'status quo' or rather a shift in the importance of the industrial triangle in the period 1952-1967 and whether (and if so, why) other ECSC regions outside of the industrial triangle became important producers of coal, iron ore and steel as well.

Lastly, we'd like to submit that by conducting the research in this paper, we have contributed and added to the existing literature about the ECSC. Firstly, rather than focusing on he ECSC countries as a whole (which has very often happened in the previous literature about the subject),

we have looked at the different subregions in each of the ECSC countries and we have conducted a (much) more detailed analysis of the coal and steel industries in each region. Secondly, this analysis also shows that the importance of the 'industrial triangle' has gradually decreased in the first 15 years of the ECSC's existence, and this in favour of the so-called 'coastal steelworks' (cf. infra).

2. The steel production methods between 1952 and 1967

Before we will further discuss the different steel production methods of the ECSC (cf. infra), we will briefly describe the 'general' steel making process. In order to produce steel, different types of coal, iron ore and iron scrap are needed [6]. Iron is produced by melting iron ore and removing impurities. Steel is a purer form of iron in that it has a lower carbon content [7]. Since the eighteenth century, iron was produced in a vertical shaft furnace, the so-called 'blast furnace' [8]. During the nineteenth century, the blast pressures and furnace size increased to boost productivity and to reduce the amount of cokes needed [9]. Nevertheless, the so-called 'pig iron' that was drawn from these 'blast furnaces' had a relatively high carbon content which made it brittle and only suitable for 'casting' (ie pouring into sand moulds to create shaped pieces of iron). To reduce its carbon content and make the iron more malleable, this 'pig iron' was reheated in a shallow coal-fired furnace, stirred - initially manually but later mechanically - and subjected to oxygen in order to 'burn out' carbon. The resulting product, called 'wrought iron', could be more easily rolled and hammered into finished shapes such as rails, plates or beams [10]. This 'wrought iron' was produced in finery forges in e.g. Sweden, and imported.

Subsequently, steel was manufactured from the 'wrought iron' by the reverse process of adding carbon to carbon-free 'wrought iron'. This process - which was called the 'cementation process' - was very time consuming and extremely expensive, and therefore, until the 1850s, steel was still far too expensive to e.g. make bridges or the framework for buildings. Hence, 'wrought iron' was used for these applications, with steel only being made in small quantities for very specific uses such as tools and cutlery [11].

However, in the latter half of the 19th century, several innovations allowed for the different 'steel making processes' - previously carried out by separate firms - to be integrated within the same plant, which in turn paved the way for the mass production of steel [12].

Lastly, apart from cokes and iron ore, iron scrap - which either originated from rolling crude steel and was then referred to as 'generating', 'new' or 'circulating' scrap or which was 'obtained' from so-called 'obsolescent equipment' (such as ships, automobiles, railroads, etc…) and was then called 'capital' or 'old' scrap - was sometimes used in the 'blast furnace' to produce 'pig iron' [13].

Between 1953 [14] and 1967, the 'crude' steel production of the ECSC increased from 39,65 million to 89,89 million ton [15]. During the period we studied (ie 1952 to 1967), five different steel

production methods were used which resulted in five different types of 'crude' steel : 'Bessemer' steel, 'Thomas' steel, 'Siemens-Martin' steel, 'Electric' steel and 'L.D.' steel. Each of these 5 production methods needed coal (as fuel) and iron ore (as raw material) to a larger or smaller extent.

The (acid) Bessemer process, invented in 1856, in which air was blown through molten iron ore to eliminate its 'impurities' (such as silicon, carbon and - mainly - phosphorus), was the first inexpensive industrial process for the mass production of steel from molten 'pig iron'.[16] Although it wasn't suitable for all types of 'pig iron' (i.e. 'pig iron' with a high phosphorus content), the Bessemer process was a very fast process, through which it became possible to accelerate the steel production and integrate the iron and steel making within the same plant (which in turn led to saving fuel i.e. cokes) [17]. However, as not all types of 'pig iron' could be used, only a limited amount of - inexpensive - scrap could be used in the so-called 'Bessemer converter' and the fast Bessemer process only allowed (very) little time for a chemical analysis or adjustment of the alloying elements in the steel, other steel production methods were developed to overcome these problems.

The Thomas(-Gilchrist) process, invented in 1878, was a considerable improvement to the Bessemer process, as it was now possible to use 'pig iron' with a high phosporus content as well.[18] Like the 'Bessemer converter, The 'Thomas furnace' was very fast but it also required a great amount of cokes and 'pig iron' per ton of produced steel.[19] The Thomas process was predominantly used in continental Europe, where there was a lot of iron ore with a high phosphoric content (which e.g. enabled the Lorraine iron ores to be used) but it was used to a (much) lesser extent in the US and the UK. One of the main disadvantages of Thomas steel was that it rusted quicker than Bessemer steel. After the turn of the twentieth century, the Thomas process was increasingly replaced by the 'open hearth' steel production method.

This Siemens-Martin (SM) or 'open hearth' process, invented in 1868, was a new, regenerative process for making steel.[20] The 'open-hearth' furnace used a combination of (cold) 'pig iron', a small quantity of iron ore and steel scrap. Together with the Thomas process, the open-hearth steel production method made it possible for the steel industry to grow rapidly. Moreover, the 'open-hearth' furnace produced a (much) higher quality of steel because it took much longer to complete a 'heat' and therefore, the end quality of the steel could be controlled with much greater precision than with the Thomas and Bessemer processes. The Siemens-Martin process also generated higher quantities of steel than the Bessemer process, and this because the 'volcanic reaction' of the 'Bessemer converter' wasted steel by spewing some of it out of the top of the vessel. In comparison with the quicker Thomas process, the much slower Siemens-Martin process also required (much) less cokes per ton of produced steel.[21] As time went on and in contrast with the Thomas process, the open-hearth process complemented rather than replaced

the Bessemer process, and this depending on which steel (production) characteristics were the most important.

The electric furnace, invented in 1878, was only using scrap whilst consuming large amounts of electricity. It was used where scrap was plentiful and/or where the other 'raw' materials (such as 'pig iron') were (too) costly and/or in mountainous regions (e.g. in Italy) where electricity could be produced from water power. In the electric furnaces, electricity was used as a heat source to achieve very high temperatures in order to melt and alloy metals, without having an electrochemical effect on the metals themselves [22]. Because the whole process could be closely monitored and controlled, it yielded a relatively high quality of steel and therefore, it was also used to satisfy a specific demand, even when and where other 'raw' materials were available [23]. However, although the steel produced in electric furnaces is of sufficient quality for certain, specific uses, the fact that an electric furnace mainly uses scrap steel - instead of raw iron - impacts on the quality of the flat product made from this type of steel, and this because of the limited amount of control over the 'impurities' that are contained within the scrap. Therefore, 'electric' steel making is only economical where there is a plentiful supply of electric power [24].

Lastly, the Basic Oxygen Steel making process or L.D. steel production method - which was effectively introduced in the ECSC in 1958 - represented a considerable improvement of the historically important Bessemer process [25]. By blowing pure oxygen through molten 'pig iron' whilst adding scrap and/or iron ore in a so-called 'LD converter', the carbon content of the alloy is lowered and hence changes the material into low-carbon steel [26]. The 'LD' method was originally invented and developed for iron ore with a low phosphoric content, but as it was gradually more refined, it could be applied to other types of iron ore and eventually, pure oxygen was also used in the 'Thomas', 'open-hearth' and 'electric' types of furnaces. Therefore, in the second half of the 20th century, the LD steel production method would gradually replace both the 'open-hearth' and Thomas/Bessemer processes. However, some major US steel making companies still didn't convert to this production method for several decades and the last 'Bessemer converter' in the USA operated commercially until 1968.

Between 1952 and 1967, there were a lot of changes in the technologies that were used to produce coal, iron and steel in the whole of Western Europe (cf. supra) and therefore, these changes were implemented in the six ECSC countries as well. At the same time, the geography of the output and consumption of raw materials and of finished products also changed considerably[27]. Based on ECSC data, we have analysed which steel production methods were used between 1952 and 1967 [28]. However, in analysing these data, we encountered two methodological problems for which we had to find a solution.

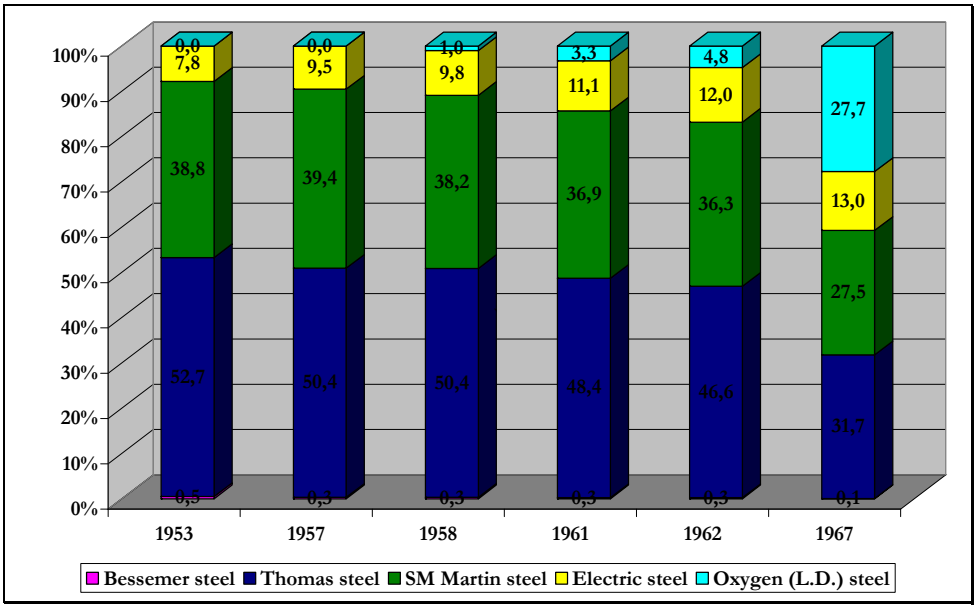
Firstly, we found that in the different statistical publications of the '*Statistical Office of the European Communities'*, such as the *'Energy Statistics'*, *'Coal and other energy sources'* and *'Iron and Steel'*,

different figures were available for the total coal, iron ore and steel production and for the production of the different steel types (cf. supra) of the ECSC between 1952 and 1967. Secondly, although most of the data were available for each ECSC country separately, there were huge country-related or chronological data 'gaps'.

In this respect, we have only found coal production data for the country as a whole for the Netherlands (although we know there was only coal to be found in the southern 'Limburg' province of the Netherlands) and Italy. For the other ECSC countries that produced coal (Belgium, France and West Germany), we found coal production data for the country as a whole and data by region. For the iron and steel industry and for all six ECSC countries, we could only find data for the country as a whole and not for smaller regions. In order to adjust for missing and incomplete data, we estimated the missing production figures for a specific country and year by looking at and comparing with the available data.

Moreover, a further analysis of the coal production data showed that the data available in *'Energy Statistics'* were more accurate than the data in *'Coal and other energy sources'* and therefore, if possible, we used the data from *'Energy Statistics'* in our analysis. With regards to the steel production data, we largely used the data from *'Iron and Steel'*.

Figure 2: The steel production of the ECSC by production method (1952-1967 [29])



Source: EGKS, Bureau voor de Statistiek der Europese Gemeenschappen, *Ijzer en staal*, (1964), no. 1, table 15, 16, 17, 18 and 20, 23 – 27 and (1969), table 15, 16, 17, 18 and 20, 23– 27.

As can be derived from figure 1, in the period 1952-1967, some production methods were increasingly used whilst others were used less. In summary, the share of the 'Thomas steel' and 'Siemens-Martin' (or 'open-hearth') steel in the total steel production of the ECSC has decreased

between 1953 and 1967 whilst the share of 'Electric' steel increased in the same period (and this mainly because of the increased demand for 'special' steel [30]). Moreover, between 1957 and 1961, we see the emergence of another new steel production method i.e. the 'Basic Oxygen Steel making' (BOS) process (or 'L.D.' steel production method) and by 1967, this 'L.D. steel' accounted for almost 28 per cent of the ECSC's total steel production (cf. figure1).

This analysis of the steel production methods for the ECSC as a whole would yield very different results if we would do the same analysis for the six ECSC countries separately. In accordance with their *'factor endowments'* (i.e. the amount of labor, land, capital and entrepreneurship that a country possesses and can therefore exploit for manufacturing purposes) each of the ECSC countries made more or less use of certain steel production methods. The main reason for this is that for certain steel production methods, 'raw' materials and 'fuels' were needed that were available in abundance in some regions / countries, whilst they were scarce or not available in other regions / countries (cf. infra). For example, in the Lorraine region - a French region with a lot of iron ore with a high phosphorus content that could not be used in the Bessemer process - steel was increasingly produced by using the Thomas method. However, after some time, and acknowledging one of the large disadvantages of the Thomas process (i.e. rust), this process was also replaced by newer processes that were less dependent of the availability of raw materials [31]. Moreover, apart from this variable availability of the 'raw' materials and 'fuels' in the different regions within one ECSC country, the national - as opposed to regional - characteristics of the 'common market' in these countries were also important because most regional steel producers were still bound by national rules and 'economic habits'.

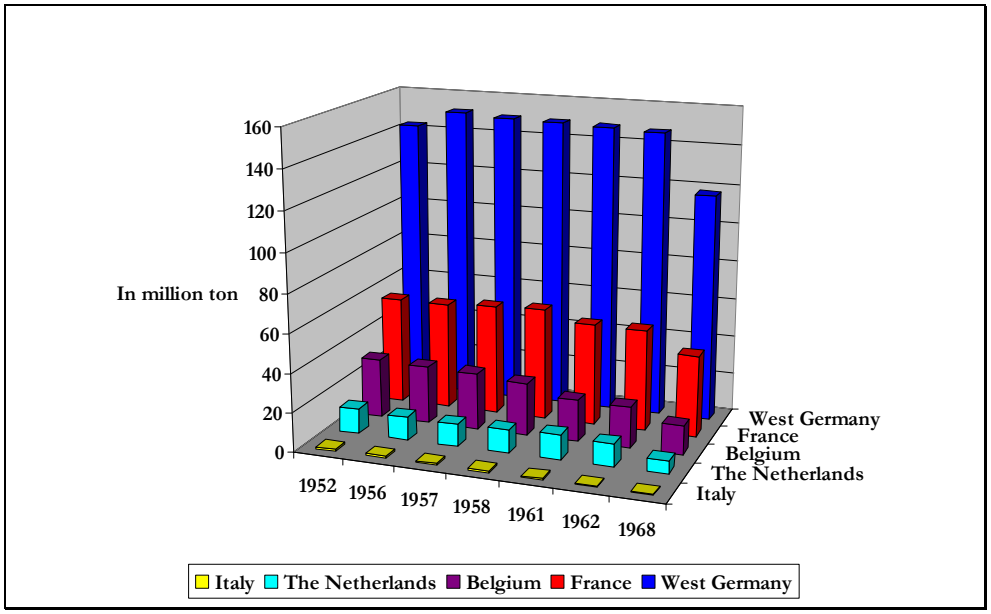
3. The ECSC's coal and steel production

Within the six countries, there were huge differences in the (economic) importance of the coal and iron ore mines, which correlated with their share in the ECSC's total production of coal and steel. Moreover, the implantation of these industries was characterized by regional concentration, with huge differences between the regions in each ECSC country.

As already indicated above, with regard to the coal production, the data for the Netherlands and Italy were given for the country as a whole. For the other ECSC countries, we have found data for the country as a whole and data per region. For the iron and steel industry, we could only find data for the country as a whole and not for smaller regions.

3.1. Coal production

Figure 3: The coal production in the ECSC by country (1952-1967)



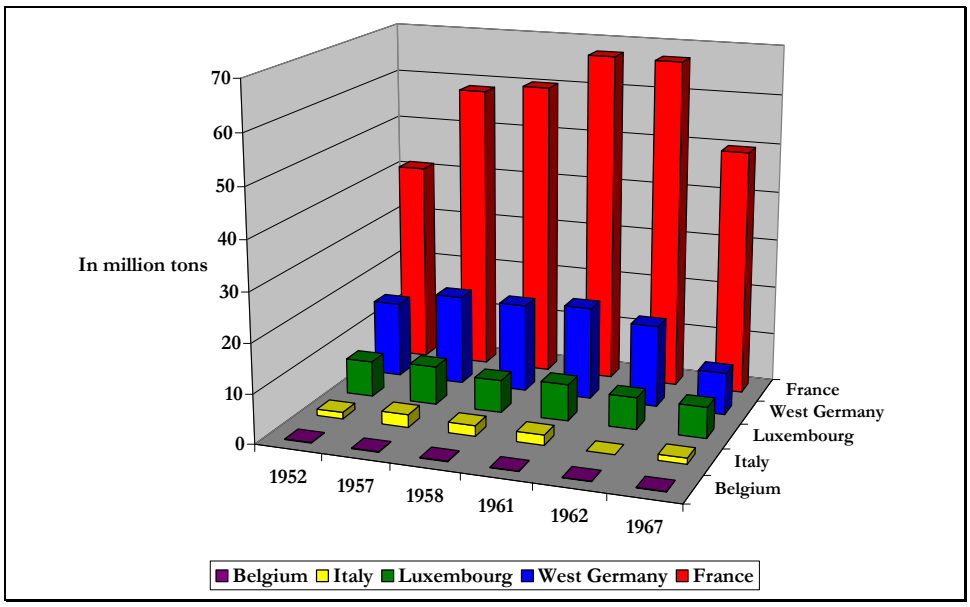
Source: EGKS, *Kolen en overige energiebronnen* (1962), no. 1, 4, (1964), no. 1, 25, (1969), no. 1, 40 and EGKS, *Energiestatistiek, jaarboek 1966: 1950-1965* (1966), 68, *jaarboek 1968: 1958-1967* (1968), 74.

In 1952, the ECSC's coal production was almost at its maximum, after which there was a further (slight) increase and then a decrease from the 'coal crisis' of 1957 onwards. All but two ECSC countries (i.e. Luxembourg and Italy) produced substantial quantities of coal. West Germany and France were the biggest producers of coal, followed by Belgium and the Netherlands. Moreover, within the ECSC countries that produced coal, most of the coal production took place in certain regions within these countries. Throughout the period we studied, the German Ruhr (50 percent) and Saar (6 percent) regions, and the French Nord/Pas-de Calais (12 percent) and Centre-Midi (5 percent) regions (the latter being later 'replaced' by Lorraine) accounted for the biggest share of the total ECSC production.

At the beginning of the 20th century, coal was only produced in the southern part of Belgium (i.e. the Walloon part) but later, coal was also produced in the northern Campines region. On average, Belgium accounted for approximately 10 percent of the ECSC's coal production between 1952 and 1967. Lastly, all the coal mining regions in the ECSC countries were located in a sort of 'inverted triangle', the so-called *'industrial triangle'* (cf. supra).

3.2. Iron ore production

Figure 4: The iron ore production in the ECSC by country (1952-1967)



Source: EGKS, *Ijzer en staal* (1964) no. 1, table 1, 2 and (1969), no. 1, table 1, 3.

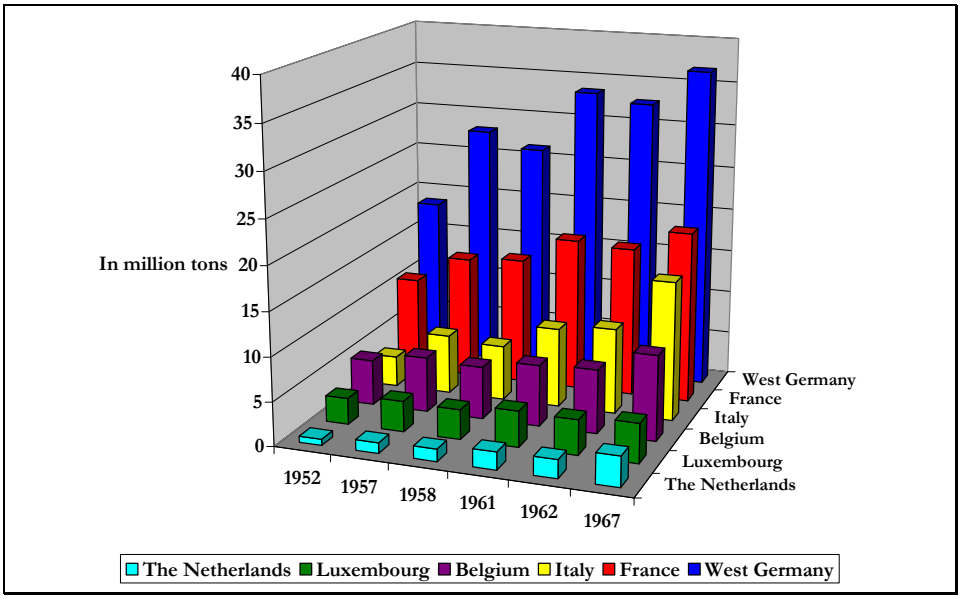
In the period we studied, (almost) no iron ore was produced in the Netherlands, Belgium and Italy. As opposed to the coal production, a considerable quantity of iron ore (which remained more or less constant) was produced in Luxembourg. As with the coal production, France and West Germany were the biggest producers of iron ore. In France, the most important iron ore 'field' was located in the Lorraine region. In Germany, iron ore was found in the Lower Saxony and Rhineland regions, but not in the Ruhr region. Lastly, from 1961 onwards, we see a decrease in the ECSC's total iron ore production.

3.3. Steel production

As can be derived from figures 2 and 3, coal and iron ore rarely occurred together (i.e. at the same place) in sufficient quantity and quality. Moreover, in the past (e.g. just after WWII), the geographical distribution of the coal and iron ore mines had already caused major tensions between the two 'big players' in the ECSC i.e. France (which had a lot of 'domestic' iron ore but only very little 'home produced' coal) and West Germany (where there was an abundance of coal but much less iron ore available) [32]. Consequently, the geographical distribution of the coal and iron ore firms in the ECSC made the ECSC countries 'dependent' of each other. In this respect, the location of a steel plant usually represented an attempt to 'balance' the advantages and disadvantages with regards to the 'assembly costs' of the 'raw' materials and the 'freight' or transport costs.

However, the ECSC was not an 'island on its own'. In the period we studied, coal and iron ore were also imported from outside the ECSC countries. For example, cheap coal was imported from the USA and the UK, the USSR (from the beginning of the 1960s), Australia and South Africa (from the 1960s) and Poland (from 1966 onwards) [33]. Due to this abundance of cheap coal and the increasing 'competition' from other, cheaper 'energy sources' such as e.g. oil, natural gas or electricity that were increasingly used in the production of steel [34] , the ECSC was confronted with a real 'coal crisis' from 1957 onwards. As for iron ore, this was imported from Sweden, South America and Liberia, and to a lesser extent from the USSR, Canada, North Africa and Spain [35]. Therefore, these other coal and iron producing countries that exported their products to the ECSC had to be 'taken into account' when decisions had to be made regarding to the location of (new) steel plants and although the ECSC itself was also a supplier of coal and iron ore for countries outside the ECSC, the foreign trade flows (exports minus imports) for the ECSC as a whole for both coal and iron ore were negative throughout the period we studied [36].

Figure 5: The 'crude' steel production in the ECSC by country (1952-1967)



Source: EGKS, Ijzer *en staal: tweemaandelijkse uitgave* (1964) no. 1, table 3, 22 and 44, 6 – 7, 29 and 56 and (1969), no. 1, table 3, 22 and 44, 6 – 7, 29 and 56.

In the Europe of the two decades after World War II and due to the emerging 'modern consumer society', there was a very high and increasing demand for 'durable' consumer goods such as cars and household appliances (e.g. washing machines or refrigerators). This increasing demand for consumer goods led to an increasing demand for 'steel' products as steel was the most necessary 'raw' material for the production of these goods. In turn, this increased demand for steel led to an increased supply of steel products and (eventually) also an increase in steel prices (due to the increasing 'popularity' of the steel products) [37]. Moreover, after WWII, there

was a 'technical revolution' in the steel industry of the ECSC, and this with regard to all stages of the steel production process, ranging from how 'pig iron' was produced to what the 'finished' steel products looked like.

As already indicated above, in the period we studied, the total 'crude' steel production of the ECSC increased from 39,65 million to 89,89 million ton. We have observed this increase in all six countries, and this especially in the last six years of our studied period (i.e. from 1962 to 1967) (cf. figure 4). This increase was most obvious in West Germany, France and Italy. However, the share of West Germany (from 52,1 to 41,7 per cent), France (from 23,1 to 20,7 per cent) and Luxembourg (from 7,3 to 4,9 per cent) in the total steel production of the ECSC decreased between 1952 and 1967, whilst the share of the Netherlands (from 0,1 to 3,8 per cent), Belgium (from 11,2 to 11,7 per cent) and especially Italy (from 6,1 to 17,2 per cent) increased.

4. The 'industrial triangle'

In a publication of 1944 [38], the region formed by Lorraine and Northern France (in France), the Saar region, Aachen and the Ruhr region (in West Germany), Luxembourg, Belgium and the southern part of the Netherlands was called the '*industrial backbone'* of Western Europe. This region had more or less the shape of an 'inverted' triangle (over 200 miles on all sides, with the apex at the Saar, the eastern side running up to the Ruhr and the western side running along the Franco-Belgian border) and hence, it was called the '*industrial triangle*'.

Moreover, at the end of the 1930's (i.e. just before the outbreak of WWII), approximately 66 percent of the total coal production, 45 percent of the total iron ore production and (more than) 66 percent of the total steel production of 'Europe' - which was (much) bigger than the 'conglomeration' of the six countries that would later form the ECSC - came from this 'triangle'. This also means that Italy was the only ECSC country that was entirely outside of the *'industrial triangle'* (cf. figure 5), although the coal mines and steel plants in the central and western part of France and the German coal, iron ore and steel producing regions near Sulzbach-Rosenberg (Bavaria) and Hanover (Lower Saxony) were also outside of the triangle.

Before World War II, there were already two reasons to regard the *'industrial triangle'* as an economic 'unity' [39]. Firstly, the coal and steel industries that emerged in this region from 1850 onwards relied heavily on the vicinity of coal (as an important 'fuel') and iron ore (as an essential 'raw' material) that were both abundantly available in this region [40]. Secondly, there were cheap transportation possibilities in the *'industrial triangle'* (which made it possible to export the finished steel products) such as the extensive rail and waterway networks of the Rhine, the Dortmund-Ems canal (in West Germany), and the 'Albert canal' and the port of Antwerp (in Belgium) [41]. Taking all this into account, it didn't seem such a 'bad idea' to plan for the industrial triangle to

become the 'economically unified' heart of the newly founded ECSC as - apart from Italy - this industrial triangle was composed of regions in all the ECSC countries.

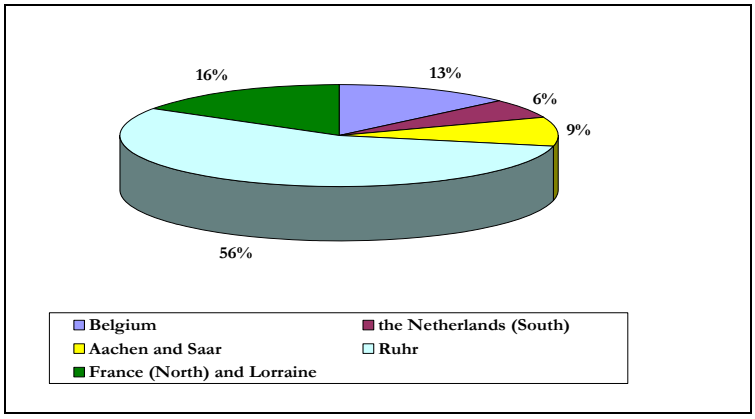
As we will demonstrate below, throughout the period 1952 - 1967, the production of coal, iron ore and steel remained 'concentrated' in this '*industrial triangle'*.

Jean Monnet - one of the 'founding fathers' of the ECSC [42] - was very much aware of the importance of the *'industrial triangle'* for the economic future of Western Europe. The 'Schuman Plan' - of which Monnet was one of the main architects and which was used as a 'blueprint' for the ECSC's foundation treaty - was based on his idea to reestablish the historical 'links' between the German and French coal and steel industries in the '*industrial triangle*'. Moreover, he feared that if the Schuman plan wasn't implemented, a drive to acquire the entire possession of the 'raw' materials and 'fuels', necessary for the steel production, could lead to another war between France and Germany [43].

4.1. The resources for the steel industry: coal and iron ore

In 1938, 66,5 percent of the total coal production of 'Europe' came from the *'industrial triangle'*[44]. However, as already indicated above, there were (coal producing) parts of this '1938 Europe' - e.g. the UK and Poland [45] - that wouldn't be a part of the ECSC that was later founded, which meant that in 1938, the '*industrial triangle*' accounted for an even higher share (i.e. higher than 66.5 percent) of the total coal production in the later ECSC countries.

Figure 6: Coal production of the industrial triangle in 1938



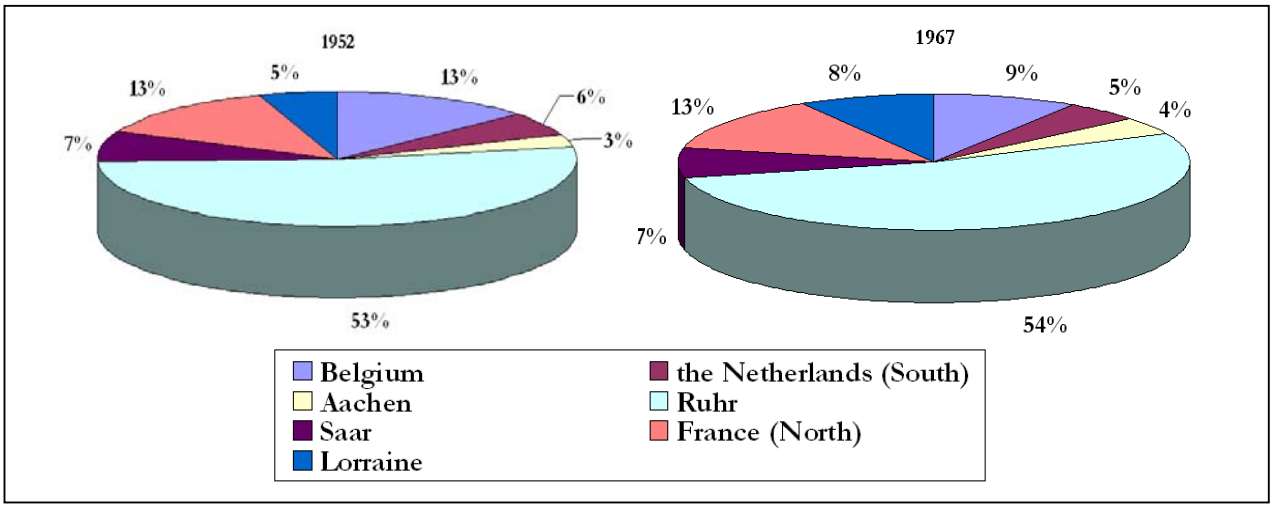
Source: Anonymous: "Economic Reconstruction in Europe." *International Affairs* 20, no. 4 (1944): 535.

As can be derived from figure 6, the German Ruhr region accounted for 56 percent of the 1938 coal production in the '*industrial triangle*'. Northern France (inclusive the 'Pas-de-Calais' region) and Lorraine were responsible for 16 percent of the total coal production, followed by Belgium with 13 percent. The other German regions (i.e. Aachen and the Saar region) accounted for 9

percent and the southern part of the Netherlands for 6 percent of the total coal production. This meant that the German parts of the 'industrial triangle' (which, in 1938, were the Ruhr and Saar region and Aachen) accounted for 65 percent of the total coal production in the 'industrial triangle', which implied that France, Belgium, Luxemburg and Italy were heavily dependent (for their steel industry) on the supply of German coal.

In 1952 and 1967, approximately 93 percent of the total coal production of the ECSC came from the 'industrial triangle', and in 1962, this was even 94 percent [46]. Although the importance of the triangle in the total coal production remained more or less constant throughout the period we studied, there were a few 'shifts' within the triangle.

Figure 7: Coal production of the industrial triangle in 1952 and 1967



Source: EGKS, *Energiestatistiek, jaarboek 1966: 1950-1965* (1966), 68, *jaarboek 1968: 1958-1967* (1968), 74 and EGKS, *Kolen en overige energiebronnen* (1962), no. 1, 4, (1964), no. 1, 25, (1969), no. 1, 40.

As can be derived from figure 7, between 1952 and 1967, the Ruhr region, Lorraine and Aachen became even more important for the ECSC's coal production, whilst the relative importance of Belgium and Northern France (slightly) decreased in the same period. However, throughout the whole period, the Ruhr region, Northern France and Belgium accounted for the biggest part of the coal production in the 'industrial triangle', namely 79 percent in 1952 and 76 percent in 1967. Therefore, as it was responsible for the biggest share of the ECSC's coal production and - as we will demonstrate below - it also accounted for a (very) large part of the ECSC's steel production, the Ruhr region was called '*Europe's forge*' in later ECSC publications [47].

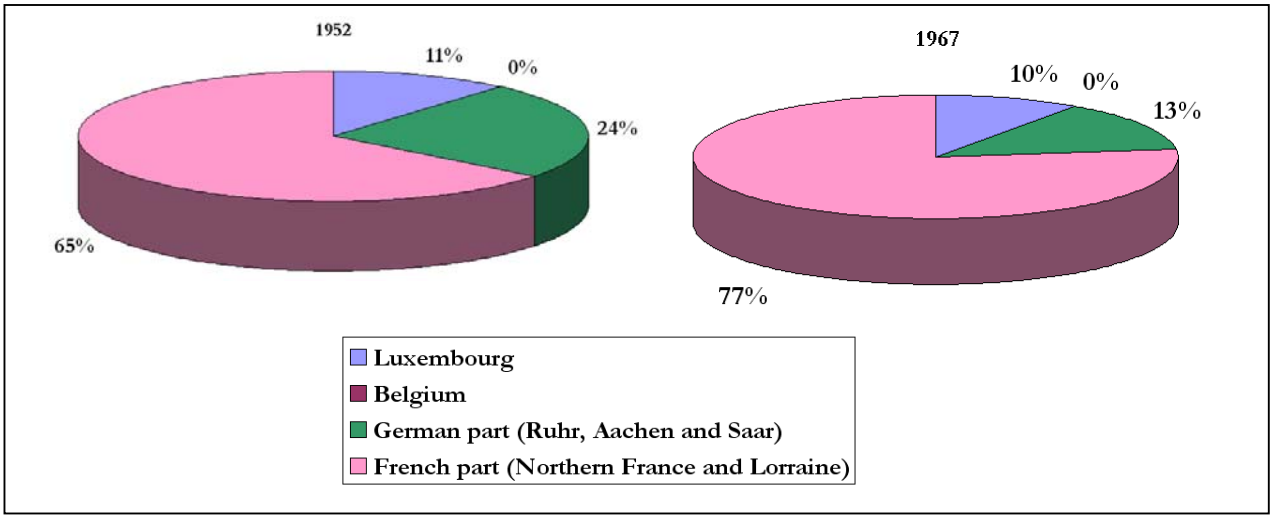
In contrast with the data for the coal industry, which we have found for each country and for the different regions within the ECSC countries (cf. supra), we could only find data about the

iron ore industry for each ECSC country as a whole. Therefore, it was difficult to ascertain in more detail how the iron ore production has evolved in the different regions of the *'industrial triangle'* between 1938 and 1967.

However, in 1938, 45 percent of the total iron ore production of 'Europe' came out of the *'industrial triangle'* [48]. Moreover, as with the coal production, there were (iron ore producing) parts of this '1938 Europe' - e.g. the USSR, Sweden, the UK, Austria and Spain [49] - that wouldn't be a part of the ECSC that was later founded, which meant that in 1938, the *'industrial triangle'* accounted for an even higher share (ie higher than 45 percent) of the total iron ore production in the later ECSC countries.

Between 1952 and 1967, at least 98 percent of the total iron ore production of the ECSC came out of the *'industrial triangle'* [50]. As with the coal production, this unchanged (very) high share of the 'industrial triangle' in the ECSC's iron ore production isn't that surprising as throughout the period we studied, no big (new) iron ore mines were discovered elsewhere in the ECSC countries.

Figure 8: Iron ore production of the industrial triangle in 1952 and 1967



Source: EGKS, *Ijzer en Staal* (1964), no. 1, table 3, 6-7 and table 22, 29 and (1969), no. 1, table 3, 6-7 and table 22, 29.

From figure 3, we can derive that initially, there was a sharp increase in the ECSC's production of iron ore, followed by a decrease. Moreover, as time went on, iron ore became increasingly scarce in the ECSC countries. However, between 1952 and 1967, France (and then especially the Lorraine region) remained the biggest producer of iron ore in the ECSC, followed by West Germany (including the Saar region), although no iron ore was produced in the Ruhr region (cf. figure 8). As with the coal production, there were some 'shifts' within the *'industrial triangle'*, in

that the share of the West German part of the triangle decreased from 24 to 13 percent between 1952 and 1967, whilst the French share increased from 65 to 77 percent.[51]

Despite the fact that overall, the industrial triangle kept its strong position with regards to the ECSC's coal and iron ore production, it is apparent from the data above that throughout the period we studied, increasingly less coal and iron ore were produced, and this both in the ECSC as a whole and in the *'industrial triangle'*. After more than a century of extensive exploitation, there was not enough 'locally sourced' coal and iron ore of a sufficient quality anymore to meet the increasing demand for steel products [52]. Moreover the European coal and iron ore mines started to become exhausted and increasingly deeper layers had to be found and used in order to satisfy the need of coal and iron ore of a sufficient quality. Lastly, there was an increasing supply of (relatively) cheap coal (and iron ore) from abroad (cf. supra). This increasing - quantitave and qualitative - shortage of coal and iron ore as well as the cheaper import from abroad wouldn't only lead to a search for and the development of new (and more economical) steel production methods but also to a search for other regions that were thought to be more 'lucrative' to establish steel plants because of their better 'location' with regard to both the import of 'raw' materials and 'fuels' from 'overseas' and the export of finished steel products (cf. infra).

4.2. The steel industry of the ECSC

The publication *'Ijzer en Staal'* [Dutch for *'Iron and Steel'*] of the ECSC only provided limited information about the production of 'pig iron' and 'crude' steel for Luxembourg, Belgium, the Netherlands and Italy as a whole, and for the different steel producing regions in West Germany and France. In addition and for several reasons including the fact that we couldn't find data for all the years in our studied period and the fact that there was some 'production overlap' between regions that were inside and outside of the *'industrial triangle'*, we had to further divide the steel production in West Germany and France into regions that were different to the regions we used to represent the evolution of the coal and iron ore production in the *'industrial triangle'*, when we divided West Germany into the Ruhr region, Aachen and the Saar region (which were all located in the *'industrial triangle'*), and Lower Saxony (which was located outside of the triangle) and France into Northern France / Pas-De-Calais and Lorraine (which were located in the *'industrial triangle'*) and a central and western region (which were located outside of the triangle) (cf. supra).

In summary and as can be seen in table 1 , we divided the (Western) German part of the '*industrial triangle*' into NordRhein-Westfalen, Hessen-Rheinland-Pfalz and the Saar region and the French part of the triangle into an Eastern and Northern region.

Table 1: The steel production in the 'industrial triangle' (1927-1967)

	1927 [a]	1938	1952	1958	1962	1967
	In million tons					
The 'industrial triangle'	**/**	**30,000**	**35,106**	**46,353**	**52,501**	**65,974**
Luxembourg	2,800	/	3,002	3,379	4,010	4,481
Belgium	4,000	/	5,170	6,007	7,351	9,712
The Netherlands (south)	/	/	0,693	1,437	2,087	3,401
Hessen-Rheinland-Pfalz[53]	/	/	0,527	0,695	0,489	0,646
Saar	2,300	6,000	2,823	3,485	3,850	4,075
NordRhein-Westfalen	/	Ruhr: 15,000	13,429	18,401	23,409	26,111
Northern France	France: 9,900	/	2,338	3,279	3,963	5,464
Eastern France		/	7,124	9,670	11,342	12,084
Total ECSC production	**-**	**-**	**38,641**	**57,997**	**73,002**	**89,885**
	In percent of total ECSC production					
The 'industrial triangle'	-	66,5 of 'Europe'	90,85	79,92	71,92	73,40
Total ECSC production	-	-	100	100	100	100

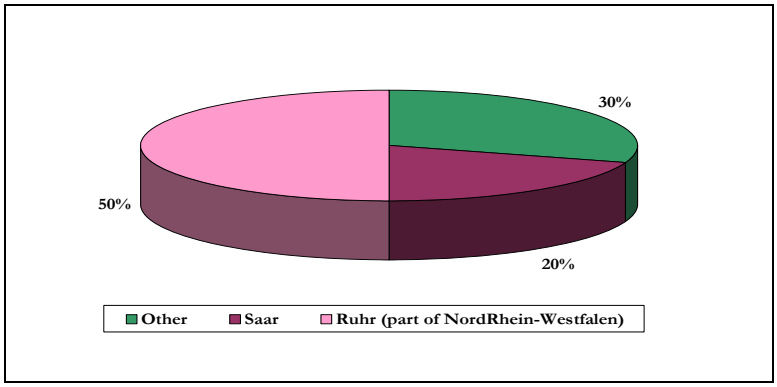
[a] For the year 1927, Svennilson - who only gave data per country and for the Saar region – gave a total production for 'Germany' as a whole of 17, 300 million tons.

Source: Svennilson, I. (United Nations, Economic Commission for Europe), *Growth and stagnation in the European Economy*, p. 125, Anonymous: "Economic Reconstruction in Europe." *International Affairs* 20, no. 4 (1944): 535 - 536 and EGKS, *Ijzer en Staal* (1964) no. 1, table 3, 6-7 and table 22, 29 and (1969), no. 1, table 3, 6-7.

For 1927, Svennilson gave a total steel production for 'France' as a whole of 9,900 million tons and a total production for 'Germany' as a whole of 17,300 million tons. If we compare these figures with the data for the year 1938 and assume that the total steel production increased between 1927 and 1938, the 'judgement' in the publication of 1944 seems to be right, in that in the period 1927-1938, most of the steel production of 'France' and 'Germany' came from Northern and Eastern France, Hessen-Rheinland-Pfalz, the Saar region and NordRhein-Westfalen.

In 1938, 66 percent of the total steel production of 'Europe', was produced in the '*industrial triangle*' [54]. Moreover, in 1938 and as with the coal and iron ore production (cf. supra), the '*industrial triangle*' accounted for an even higher share (higher than 66 percent) of the total steel production in the later ECSC countries.

Figure 9: Steel production of the industrial triangle in 1938



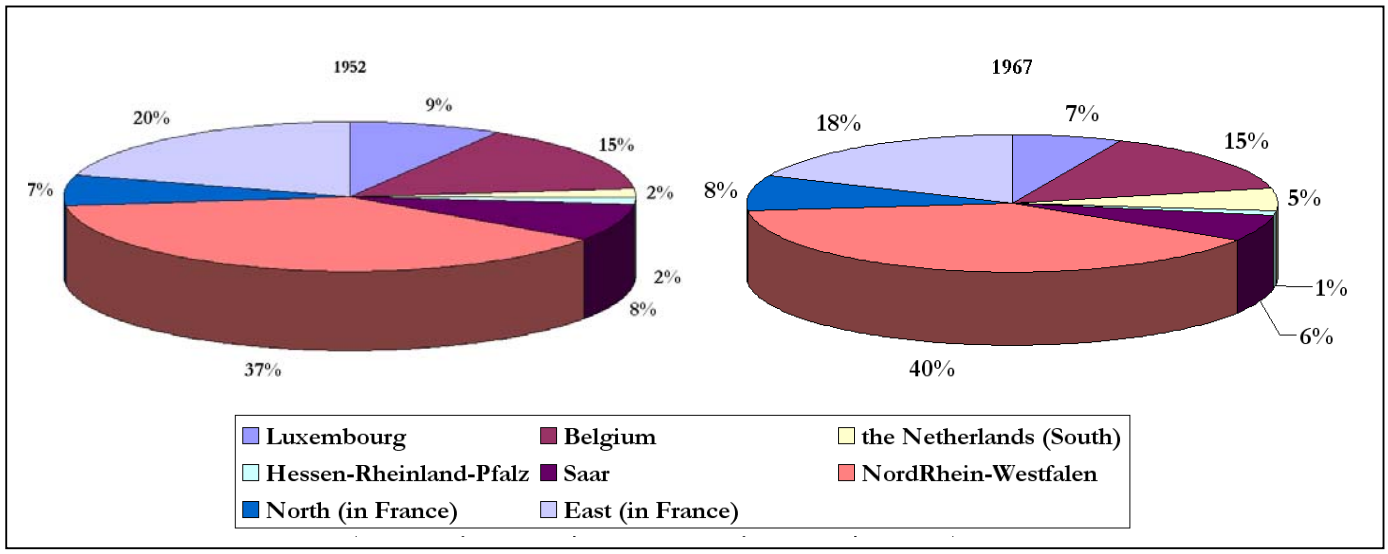
Source: Anonymous: "Economic Reconstruction in Europe." *International Affairs* 20, no. 4 (1944): 535 – 536

Other = Luxembourg, Belgium, the Netherlands (south), Hessen-Rheinland-Pfalz, NordRhein-Westfalen (without the Ruhr), Northern and Eastern France

As can be derived from figure 9, 70 percent of the 1938 steel production of 'Europe' came from the German Saar and Ruhr regions. This meant that not only - as we have indicated above - France, Belgium, Luxembourg and Italy were heavily dependent on the supply of German coal for their own steel industry, but also that before WWII, the main part of the total 'European' steel production took place in Germany.

In 1952, approximately 91 percent of the total steel production of the ECSC came from the *'industrial triangle'* (figure 10). However, this share of the industrial triangle decreased to approximately 73 percent in 1967 [55], and there are several reasons for this (cf. infra).

Figure 10: Steel production of the industrial triangle in 1952 and 1967



Source: EGKS, *Ijzer en Staal* (1964), no. 1, table 3, 6-7 and table 22, 29 and (1969), no. 1, table 3, 6-7.

Lastly and as with the coal and iron ore production, a few 'shifts' of the steel production within the *'industrial triangle'* occurred throughout the period we studied, in that NordRhein-Westfalen, Northern France, Belgium and the southern part of the Netherlands became even more important for the total steel production of the ECSC, and this 'at the expense' of the East of France, Luxembourg, Hessen-Rheinland-Pfalz and the Saar region. However, throughout the period we studied, NordRhein-Westfalen, the East of France, Luxembourg and Belgium still accounted for the biggest part of the steel production in the *'industrial triangle'*, namely 81 percent in 1952 and 80 percent in 1967 (cf. figure 10).

5. The emergence of the 'coastal steelworks'

The above mentioned decrease in importance of the *'industrial triangle'* in the total steel production of the ECSC (i.e. from 91 percent in 1952 to 73 percent in 1967) coincided with a shift from a so-called 'raw material orientation' to a 'market orientation' of the steel industry.

The original reason for the establishment of the steel firms in the 'industrial triangle', the so-called '*raw material orientation'*, was the availability (and vicinity) of the necessary 'fuel' (i.e. coal) and 'raw' material (i.e. iron ore), and usually, the coal/cokes were transported to the place where the iron ore was found.

However, this relative advantage of the 'traditional' geographic concentration gradually decreased over time. The increasing shortage of coal and iron ore of both sufficient quantity and quality together with the cheap import of coal and iron ore from overseas, the emergence of new and alternative 'energy sources', the increased availability of scrap as raw material and the use of new, 'better' steel production methods (i.e. steel production methods for which less coal and/or iron ore were needed and other energy sources could be used) completely changed where new steel plants were established. Moreover, the increased demand for steel needed for the production of consumer goods and for 'special' steel with a corresponding need for a much 'closer' contact with the finishing processes, made the proximity to the market of 'finished' steel instead of the proximity of the 'raw' materials (much) more interesting [56].

For the above mentioned reasons, the so-called '*market orientation'* - in which the choice of the location of a new steel firm was linked to the availability of nearby situated markets for the 'finished' steel products - became more important. As domestic coal and iron ore supplies became scarce and imported supplies were getting cheaper, the newly established steel plants after WWII were increasingly located in the vicinity of tidewater, and this to use 'overseas' supplies as maritime haulage is the least expensive form of transport [57]. Moreover, the finished steel products could be transported over water as well. Another important advantage of these so-called *'coastal steelworks'* - in comparison with more 'country-inward' located firms - was the

possibility to decrease the overall transport costs considerably, which could in turn lead to a higher level of competitiveness with other steel plants [58].

However, the concept of 'coastal steelworks' was not entirely a 'post WWII' concept. For instance, in the interwar period, there were already plans to develop a steel firm on the Gent-Terneuzen canal near Gent, Belgium. This eventually led to the creation of '*Sidmar'* (cf. infra) and the idea to establish a steel firm in the vicinity of tidewater (as the Gent-Terneuzen canal gives access to the North Sea) was proposed by '*Arbed*', a steel firm from Luxembourg. *Arbed* wanted to build a steel firm in the vicinity of tidewater because they feared that in the medium long term, the French iron ore mines from the Lorraine region (from which they got their iron ore supply for the production of Thomas Steel) would become exhausted. Therefore, they needed to have access to the North Sea as they wanted to start compensating the decreasing iron ore supply from the Lorraine region by importing iron ore from 'overseas' (mostly from Argentina and Brazil).
In order to have enough space to build a large steel firm, huge parts of land next to the Gent-Terneuzen canal were already bought in the 1920s. However, the Great Depression and World War II prevented *Arbed* from building this steel plant. Moreover, at the end of WW II, *Arbed*'s main priority was the rebuilding of its own factories that were located in Luxembourg. Nevertheless, taking into account that an expansion of the existing *Arbed* in Luxembourg was not really a possibility because of the regional location of the company - in a region with many small valleys - together with an exhaustion of their own 'locally' sourced iron ore and a shortage of workmen, *Arbed* decided to further pursue their plan to build a coastal steelwork in Gent.
Eventually and with the cooperation of two partners (i.e. holding companies with control over large steel firms through key participating interests), the Belgian *General Maatschappij van België* and the French *Schneider*, a coastal steelwork, named *Sidmar*, was constructed in Gent, Belgium in 1962.[59]

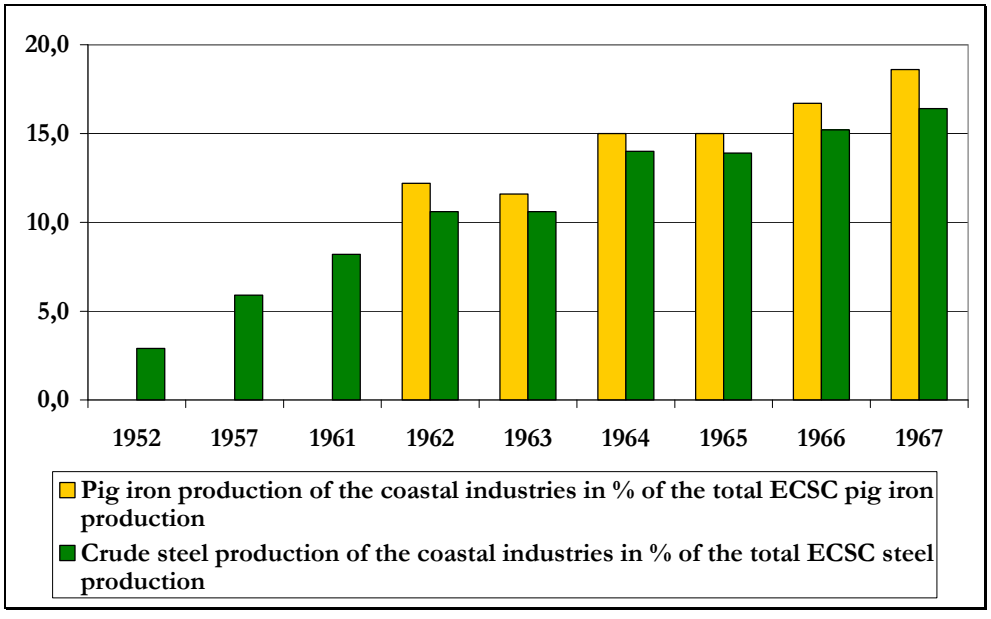
Throughout the period we studied, the steel firms have also increasingly become so-called '*integrated' steelworks*, that would not only control and monitor the 'mills' where the steel was manufactured but also the mines where the iron ore was extracted, the coal mines that supplied the coal, the ships that transported the iron ore, the railroads that transported the coal to the factory, the ovens where the cokes were produced, the processing of the steel, the marketing of the finished steel products, etc. For the reasons mentioned above, those integrated steelworks were often established on new or 'greenfield' sites in the vicinity of tidewater [60]. However, as with the 'coastal steelworks' themselves (cf. supra), the idea to create 'integrated' steel plants wasn't entirely new either. For instance, in 1926, the *'Vereinigte Stahlwerke'* was founded in Germany, and this steel firm already 'combined' the coal mining, 'coking', melting, steel making and the processing of by-products in one 'production unit' [61]. However, it was only after World War II

that the 'integrated' type of steel firm became more popular and the tendency towards a spread of the steel industry outside of the 'industrial triangle' increased.

In 1963, the leaders of the ECSC already realized that especially coastal regions with accessibility for ships with a high tonnage were the most eligible places to establish new steel plants [62], although it has to be noted that these companies could only be established in so-called estuaries, which were relatively rare along the coastline [63]. According to data of the ECSC and for the year 1961, 90 percent of the ECSC's iron ore output and 80 percent of the ECSC's steel output came from totally 'integrated' steel firms [64]. If we look at a map of the steel plants in the ECSC, we can find several examples of big steel firms that were established in or before the period we studied and that were situated in or moved to coastal areas, such as the '*Hoogovens Ijmuiden'* in the Netherlands and *'Usinor'* in Dunkerque, France, both with access to the North Sea, '*Italsider'* in Italy, with access to the Bay of Genua, the Piombino canal and the Bay of Naples, '*Klöckner'* in Bremen, West Germany, with access to the North Sea through the Weser river and '*Sidmar'* in Belgium, with access to the North Sea through the canal Gent-Terneuzen. '*Arbed'* in Luxembourg was not located near the sea, but in 1962, it obtained a majority stake in the newly created *Sidmar* (cf. supra).

Lastly, we have investigated how the share of the 'pig iron' and steel production of the coastal industries in the total pig iron production and steel production of the ECSC has evolved in the period we studied (Figure 11).

Figure 11: The pig iron and steel production of the coastal industries as percentage of the total pig iron and steel production in the ECSC



Source: EGKS, *Ijzer en Staal* (1967) no. 1, table 22, 29 and (1969), no. 1, table 22, 29.

As can be seen in figure 11, the share of the 'coastal' 'pig iron' production in the total 'pig iron' production of the ECSC has risen from 12,2 percent in 1962 to 19,2 percent in 1967. In this respect, it should be noted that before 1962, there were no separate data available for the 'pig iron' production of the 'coastal steelworks'. The share of the 'coastal' ('crude') steel production in the total steel production of the ECSC has increased from 2,9 percent in 1952 to 17 percent in 1967. According to ECSC data until 1961, the 'coastal steelworks' were responsible for the largest part of the total steel production in Italy (where more than a third of the total Italian steel production for 1961 came from 'coastal steelworks') with the other ECSC countries following closely behind but not reaching the production 'share' of Italy. After 1961, there were no more data by country available [65].

6. Conclusions

Firstly, in our analysis and in contrast with most previous research about this topic, we have used data for the ECSC's coal, iron ore and steel industries by region and not by country. In this respect, we would like to submit that this has yielded a (much) more detailed picture of the actual regional concentration of these industries.

Secondly, in 1938, the location of the coal, iron ore and steel industries in the six founding countries of the ECSC was characterized by a form of 'regional concentration'. Most of the coal, iron ore and steel in the ECSC was produced in a relatively small geographical area, the so-called '*industrial triangle*', which encompassed (parts of) all ECSC countries except Italy.

Thirdly, during the period we studied (i.e. 1952 to 1967), five different steel production methods were used which resulted in five different types of 'crude' steel : 'Bessemer' steel, 'Thomas' steel, 'Siemens-Martin' steel, 'Electric' steel and 'L.D.' steel. The choice of a steel production method was related to the availability of the necessary resources i.e. coal (as 'fuel') and iron ore (as 'raw' material). In this respect, the location of a steel plant usually represented an attempt to 'balance' the advantages and disadvantages with regard to the 'assembly costs' of the 'raw' materials and the 'freight' or transportation costs. Nevertheless, in the period we studied, the ECSC obviously didn't exist 'on its own' and in summary, although the ECSC itself was also a supplier of coal and iron ore for countries outside the ECSC, the foreign trade flows (exports minus imports) for the ECSC as a whole for both coal and iron ore were negative throughout the period we studied. Therefore, when it came to choosing a certain steel production method and a place for establishing a new steel firm, the ECSC had to increasingly take into account these foreign producers of the basic resources needed to produce steel.

Fourthly, in this research paper, we also analysed whether the 'industrial triangle' remained as important as main producer of coal, iron ore and steel in the first fifteen years of the ECSC's existence as it did in 1938, and if not, what were the reasons for a shift. We found that between 1952 and 1967, the production of coal, iron ore and steel remained 'concentrated' in the *'industrial triangle'*, although - for several reasons - the (relative) importance of this triangle in the total steel production of the ECSC decreased from 91 percent in 1952 to 73 per cent in 1967.

Fifthly, in 1952, the steel production method and the place were the steel firm would be established were chosen according to the so-called '*raw material orientation'*, in which the most important factor was the availability (and vicinity) of the necessary 'fuel' (i.e. coal) and 'raw' material (i.e. iron ore), after which the coal/cokes were usually transported to the place where the iron ore was found. However, between 1952 and 1967, the '*market' orientation* became more important. In the market orientation, the location of a new steel plant was determined by an attempt to 'balance' the advantages and disadvantages with regard to the 'assembly costs' of the 'raw' materials with the 'freight' or transport costs of cheaper resources from abroad and the necessity of a nearby situated market.

Lastly, the newly established steel plants after WWII were increasingly located in the vicinity of tidewater, and this to use 'overseas' supplies as maritime haulage is the least expensive form of transport. Moreover, the finished steel products could be transported over water as well. These so-called *'coastal steelworks'* also became increasingly 'integrated' throughout the period we studied.

Notes

1. Dirk Spierenburg and Raymond Poidevin, *Histoire de la Haute Autorité de la Communauté Européenne du Charbon et de l'Acier: Une expérience supranationale* (Brussels: Bruylant, 1993), 4.

2. Gerhard Bebr, "The European Coal and Steel Community: A Political and Legal Innovation." *Yale Law Review* 63 (1953): 6.

3. David Gerber, *Law and Competition in Twentieth Century Europe: Protecting Prometheus* (Oxford: Clarendon Press, 1998), 336.

4. For example: Svennilson, I. (United Nations, Economic Commission for Europe), *Growth and stagnation in the European Economy*, Geneva, 1954, Diebold, W. *The Schuman Plan: A study in Economic Cooperation 1950-1959*, 1959, New York, Spierenburg and Poidevin, *Histoire de la Haute Autorité de la Communauté Européenne du Charbon et de l'Acier: Une expérience supranationale*, 1993, Bruxelles and EGKS, Bureau voor de Statistiek der Europese Gemeenschappen, *Ijzer en staal.*

5. Anonymous: "Economic Reconstruction in Europe." *International Affairs* 20, no. 4 (1944): 527-541.

6. The coal, iron ore, iron scrap and steel were categorised in appendix I of the ECSC foundation treaty under code nr. 3000 and 4000 as 'solid fuels' and 'iron and steel. CECA, *Traité instituant la Communauté Européenne du Charbon et de l'Acier, Annexe I: Définition des expressions "charbon" et "acier"* (Bruxelles: CECA, 1952), 186-193.

7. For a detailed analysis, see: David H. Wakelin, "The Nature of Ironmaking." *The Making, Shaping and Treating of Steel: Ironmaking volume,* ed. Richard J. Fruehan, 11th ed. (Pittsburgh, Pennsylvania: the AISE Steel Foundation, 1998): 1-35.

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9. Gordon Boyce and Simon Ville, "Iron and Steel Production (to 1945)." *The Development of Modern Business,* eds. Gordon Boyce and Simon Ville (Basingstoke: Palgrave 2002): 165.

10. Anonymous: "The manufacture of sponge iron and wrought iron." *The Making, Shaping and Treating of Steel*, ed. Richard J. Fruehan, 7th ed. (Pittsburgh, Pennsylvania: United States Steel, 1957): 209.

11. Anonymous: "Evolution of Iron- and Steelmaking." *The Making, Shaping and Treating of Steel,* ed. William T. Lankford, 10th ed. (Pittsburgh, Pennsylvania: Association of Iron and Steel Engineers, 1985): 20-21.

12. Gordon Boyce and Simon Ville, "Iron and Steel Production (to 1945)." *The Development of Modern Business,* eds. Gordon Boyce and Simon Ville (Basingstoke: Palgrave, 2002): 165.

13. Anonymous: "Scrap for steelmaking." *The Making, Shaping and Treating of Steel,* ed. William T. Lankford, 10th ed. (Pittsburgh, Pennsylvania: Association of Iron and Steel Engineers, 1985): 339-340 and Louis Lister, *Europe's Coal and Steel Community* (New York: Twentieth Century Fund, 1960), 420.

14. 1953 is the first year with data for all six countries.

15. EGKS, Bureau voor de Statistiek der Europese Gemeenschappen*, Ijzer en Staal* (Brussel: EGKS, 1964), no. 1, table 3, 22 and 44, 6 – 7, 29 and 56 and 1969, no. 1, table 3, 22 and 44, 6-7, 29 and 56.

16. Encyclopedia Britannica, *Bessemer process*, (2005), p. 168 and Fruehan, R.J. "Overview of Steelmaking Processes and Their Development" in: Fruehan, R.J. (ed.)*The Making, Shaping and Treating of Steel: Steelmaking and Refining volume,* 11th edition, (1998), p. 2-3.

17. Boyce, G. and Ville, S. "Iron and Steel Production (to 1945)", in: Boyce, G. and Ville, S. (eds.*) The Development of Modern Business,* (2002), p.165-166.

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19. Lister, L., *Europe's Coal and Steel Community*, New York, (1960), p. 420.

20. Barraclough, K. *Steelmaking 1850-1900*, Institute of Metals, London, (1990), p. 137-203 and Gale, W.K.V., *Iron and Steel*, Longmans, London, (1969), p. 74-77.

21. "The Open-Hearth Steelmaking Process" in: Fruehan, R.J. (ed.) *The Making, Shaping and Treating of Steel,* 10th edition, (1985), p. 621-624.

22. Encyclopedia Britannica, *Electric process*, (2005).

23. Lister, L., *Europe's Coal and Steel Community*, New York, (1960), p. 419.

24. Jones, J.A.T., Bowman, B. and Lefrank, P.A. "Electric Furnace Steelmaking" in: Fruehan, R.J. (ed.) *The Making, Shaping and Treating of Steel,* 11th edition, (1998), p. 525-527.

25. EGKS, Ijzer *en staal: Toelichting*, (1970), p. 9.

26. De Vries, J. *Hoogovens Ijmuiden 1918-1968: ontstaan en groei van een basisindustrie*, bijlage 9, (1968), p. 700-701 and Miller, T.W., Jimenez, J., Sharan, A. and Goldstein, D.A. "Oxygen Steelmaking Processes" in: Fruehan, R.J. (ed.) *The Making, Shaping and Treating of Steel,* 11th edition, (1998), p. 475.

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28. EGKS, Bureau voor de Statistiek der Europese Gemeenschappen, *Ijzer en staal: tweemaandelijkse uitgave* (Brussel: EGKS, 1964) no. 1, table 15, 16, 17, 18 and 20, 23 – 27 and 1969, table 15, 16, 17, 18 and 20, 23 – 27.

29. 1953 is the first year with data for all six countries.

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51. After WWII the Saar region became a French protectorate, detached from Germany. On 1 January 1957, the Saar region became a part of West Germany. However, in the statistical data of the ECSC the Saar region was in economic respect only seen as part of West Germany from 1 January 1960 on. Until 1960 the Saar region was statistically considered as an 'independent' region.

52. Douglas K. Fleming, "Coastal Steelworks in the Common Market Countries.": 48.

53. There were only separate data available for the region *Hessen-Rheinland-Pfalz* for all the years between 1952 and 1962. After 1962 there was only a global number available for the entire region *Hessen-Rheinland-Pfalz-Badem-Württemberg-Beieren* (eg. 1 345 000 ton steel in 1967). For all the years between 1952 and 1962 the region *Hessen-Rheinland-Pfalz* accounted on average for 48 percent of the total number of the region as a whole. So we used for the year 1967 also an estimated number of 48 percent (e.g. 645 600 ton steel) for *Hessen-Rheinland-Pfalz*.

54. Anonymous: "Economic Reconstruction in Europe." *International Affairs* 20, no. 4 (1944): 535 – 536.

55. EGKS*, Ijzer en Staal* (Brussel: EGKS, 1964) no. 1, table 3, 6-7 and table 22, 29 and 1969, no. 1, table 3, 6-7.

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57. Louis Lister, *Europe's Coal and Steel Community* (New York: Twentieth Century Fund, 1960), 21.

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62. EGKS: HA., *EGKS 1952-1962: Resultaten, grenzen, perspectieven*, deel I (Luxemburg: EGKS, 1963), 42-43.

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65. EGKS: HA., *EGKS 1952-1962: Resultaten, grenzen, perspectieven*, deel I (Luxemburg: EGKS, 1963), 43.