3 Industry in the Baltic Sea Region

3.1 Baltic Sea Region Industrial History

3.1.1 Natural Resources and Early Industrialisation

The distribution of natural raw materials was the determining factor in the development of industry in the Baltic Sea Region. Forests and fields, as well as metal and coal deposits, led to a considerable early proto-industrial economy in many of the countries in the region. This included iron production in Sweden as early as medieval times. Coal was produced in Germany and Silesia in Poland also very early, as were many of the metals used such as copper, tin, lead, zinc and cadmium as well as gold and silver.

Already here it should be pointed out that the proto-industrial activities were connected to serious environmental problems. Thus silver mining in lower Saxony in the early 1700s used so much timber that a forests crisis occurred, a crisis which led to the first attempt to develop sustainable forestry and in fact the first mention of the concept of sustainability. A similar situation happened in mid Sweden later in the same century, as in several other European countries. The crisis was again caused by the enormous demand for timber in iron mining. It was used to heat the mountain enough to produce cracks to recover the iron ore. Wood was also needed to produce the necessary charcoal. To reduce the consumption of wood for heating, the newly formed Swedish Academy of Sciences had a commission to design a stove (so-called tiled stove) to heat houses which was much more efficient than the old way with open fire.

Proto-industrialisation not only caused over-consumption of natural resources but also pollution. The copper mine in Falun in mid Sweden (the richest copper find in the world at the time, decisive for the national economy) according to Carl Linnaeus caused death among all vegetation in the vicinity (due to sulphur oxides). A similar situation was likely occurring in Silesia.

3.1.2 Industrialisation Gains Momentum – late 1800s and early 1900s

Industrialisation gained speed in the region from the late 19th century. This was a time when more than 80% of the work force was still found in agriculture. Industries were established where they could rely on boat transport to receive raw materials and export their products. A very considerable production of sawed timber was established on the Finnish and Swedish coasts. Saw mills were built at the mouths of the large northern

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rivers, on which logs were floated to the coasts, long before roads were built.

Further south the large mills were built to produce flour from the farmer's crops. Southern Sweden, Northern Germany, Denmark, parts of Poland and East Prussia were important agricultural areas with considerable crop and meat production.

Coal mining in Germany, Southern Poland (Katowice region in Poland) and Ostrava region in Czechia, Ukraine, and Russia was the base for increased iron production. Iron production as well as lead and zinc mining paved the way for an important metallurgic industry. A considerable part of this production consisted of arms to fuel the two world wars. The defence industry was large.

The Sovietisation of Tsarist Russia with the three Baltic States led to brutal industrial development in traditional farmland. As a result, industrial cities expanded as the farmers' children went there to find jobs. The industries caused terrible smells. Life expectancy in the cities was much lower than in the poor countryside. Still, cities expanded as immigration compensated for the losses.

Hydropower in Sweden and Finland, metal and coal deposits in Russia and Poland, and oil shale in Estonia led to a diversified industrial structure in the region. Pulp and paper industry and metal industry became the most important branches in the northern part of the Baltic Sea Region. The copper smelter in Rönnskär, the titanium dioxide production plant in Pori, and the metal smelter in Harjavalta were the biggest plants in North. Germany developed a highly diversified industrial structure.

Again it should be pointed out that industrialisation led to very obvious environmental damage. Emissions from the ever burning coal left the tall chimneys and polluted large parts of the Baltic Sea region. Sulphur and nitrogen oxides, heavy metals, particles and various toxic substances were emitted over nature and society. Table 3.1 lists the industrial branches in the Baltic Sea Region which traditionally have constituted challenges for environmental management, and partly continue to do so. These include both branches with large consumption of resources as well as those with serious emissions or both.

3.1.3 Changes in the late 20th Century

The industrial production in the Central and Eastern Europe, CEE, countries in the transition between the centrally-planned and market economies, underwent significant restructuring after the systems change in 1989-91. Many large plants were shut down due to financial problems, often owing to falling demand or problems with the supply of raw materials. Many of them were using outdated technology and did not work well. The products often became outdated as western industrial products became available.

Table 3.1 *Overview of traditionally environmentally problematic industrial branches in Baltic Sea Region.*

Branch	Main products	Main environmental problems	Country
Mining	Brown coal, hard coal, metal ores, minerals, salt	GHG emissions, air pollution, resource consumption	Belarus, Czech, Finland Germany, Norway Poland, Sweden, Ukraine
Energy	Electricity, steam	Coal power plants, as above; hydropower caused large changes in the landscape	Belarus, Estonia, Lithuania, Norway, Sweden
Pulp & paper	Pulp, paper, board	Exhausts to water of fibre, chlorinated toxic pollutants	Belarus, Finland, Poland, Russia, Sweden
Metallurgy	Cast iron, steel, aluminium, chromium, nickel	Heavy metal emissions, large waste	Czech, Norway, Poland, Sweden, Ukraine
Metal	Various metals processing	Heavy metal emissions	Belarus, Estonia, Germany, Norway, Poland, Russia, Sweden
Chemical	Basic chemical, fertilisers, oil products, petrochemicals, Plastic and rubber, pharmaceuticals, specialty chemicals, synthetic fiber, textiles	GHG emissions, emissions of POP, nutrient exhausts	Belarus, Czech, Denmark, Germany Lithuania, Norway Russia, Sweden, Ukraine
Food	Food products, sugar	Nutrient discharges	Belarus, Denmark, Estonia Latvia, Lithuania, Poland, Sweden
Machine	Machinery, vehicles	Heavy metal emissions, air pollution	Belarus, Czech, Denmark, Estonia, Finland, Latvia, Poland, Sweden, Ukraine

After years of disruption industry started to recover and in 1997 real industrial output compared to its level in 1990 was estimated at 90.5% in CEE sub-region. However after the mid 1990s the development has been impressive. Annual growth rates based on GDP in the three Baltic States and Poland in the order of 7% also has touched industry and industrial production has increased more than 50%, in Poland almost 90%, as compared to the EU15 value of 16%. The financial crisis in Russia in 1998 impacted the surrounding countries negatively. Russia after having passed this crisis has had an annual growth rate of close to 11% the last few years.

During the same period industrial infrastructure in Western countries of the Baltic Sea Region was affected by world economy globalisation. Rapid advances in information technologies and networks, and improvements in capacity of international transportation systems made companies less sensitive to where to place production. Heavily polluting industries faced increasing demands for environmental protection and some of them were shut down. Case Study 3.1 illustrates this with an example of changes in the metallurgy industry.

Figure 3.1 A renovated traditional industrial environment in the small town of Gimo in Uppland about 100 km north of Stockholm. *For a hundred years iron production was the almost exclusive industry in Gimo. The owners lived in the mansion and all workers lived in these houses along a central street, called "bygatan." Gimo is still a lively town. Industry there has been transformed several times and is now producing high quality steel products for special purposes. The old houses for workers have been renovated and are again popular, although many of their inhabitants commute to the city of Uppsala. (Photo: Lars Rydén)*

3.2 The Major Branches of Industry

3.2.1 The Classification of Industrial Economy

All major branches of industrial economy are present in the Baltic Sea region. Table 3.2 gives an overview of how industry is classified in the international system, the so-called NACE, which is used for classification of economic activities in the European Community. The main branches of industrial production are briefly reviewed in this section, with some examples from several of the countries in the region.

3.2.2 Agriculture, Forestry and Fishing

The Baltic Sea region has a very large agricultural production in the south, especially Denmark. The food industry provides meat and a series of other agricultural products, dairy products, beer and beverages. A large production of meat and cereals are also typical of e.g. Estonia and Poland. However pre WWII large producers such as Eastern Prussia, today the Kaliningrad region and Ukraine are not as important today. Large slaughterhouses, dairies, mills, bakeries and factories for food are today part of the industrial structure of the region.

Forestry is of increasing importance in the region. Sweden, Finland and Russia in particular are large exporters of timber and sawed timber, and other products such as boards. Also biomass production for energy is important with e.g. wood chips and pellets.

Fishing in the Baltic Sea was at its peak in the early and mid 1980s with total catches of close to one million tonnes yearly. Over fishing and eutrophication have been disastrous for the Baltic fishing industry, and today restrictions are severe in an effort to save the most damaged populations, especially cod. The traditional fishing is minimal and most fish are caught in large boats, industrial fishing. This is one of the reasons for over fishing.

All these sectors are today in the west industrialised and very few individuals are working, up to 3% of the work force. Big machinery is used, and a single person can manage also a rather large farm or forest property. In the Baltic States and Poland, many small farms still exist, but the future will certainly see a dramatic structural change and depopulation of the countryside.

3.2.3 Coal, Petrol, Oil shale and Gas

The Baltic Sea region has large fossil energy resources as coal, lignite, oil and gas. Coal has been mined since medieval times. Since the 1980s and 1990s coal mining has decreased, mostly for economic reasons – they cost more that the income they provide. Closing down coal mines has been going on from the 1960s from West to East with England followed by Germany and later Poland, where about 50% of the mines had closed as of 2004. The production data for Germany can illustrate this. In 1990 the country produced and used close to 400 million tonnes of coal. In 2002 just over half, about 210 million tonnes, was produced.

Working coal mines are situated in three areas in Germany: Ruhr, Saar and Ibbenbüren (21 pits). Germany produced 225 million tonnes of coal in 2000, dominated by lignite (184 million tonnes). Most of the lignite is produced in five areas: between Cologne and Aachen (Rhine coalfield), near Helmstedt, in the Halle-Leipzig area and the Lausitz (13 sites), where a new pit mining of lignite now opens in the near future. The large coal mines in Poland are situated in Silesia, while the largest lignite field is in Belchatow, not too far from Lodz. The power plant in Belchatow produces a large share of Polish electricity.

In Czech Republic several hard coal mine fields (Kladno, Trutnov, Ostrava-Karvina, Oslavany) are still in operation. Lignite is mined in Northern Bohemia. Uranium is still mined with some of the deepest shafts in Europe (1838 m). Four coke plants and a steel mill are situated in Ostrava region.

The Norwegian oil fields in the North Sea have been very important for Norwegian economy over a long period. Today oil production has decreased, though gas production is important.

Russia is by far the largest producer of oil and gas. It is providing much of the energy resources for e.g. Poland, and Belarus. The transport of oil and gas through the region is large and increasing.

Oil shale provides over 75% of Estonia's total energy supply, making Estonia the only country in the world where oil shale is the primary source of energy. Oil shale is produced by majority state-owned Eesti Polevkivi (Estonian Oil Shale) near Kohtla-Järve. After 2006, Eesti Polevki is forecasting its production target will shift downward, to 10.5 million tons per year, as Estonia tries to curb pollution from the oil shale industry in an effort to meet EU environmental regulations. Eesti Polevkivi has indicated that it expects the oil shale industry to continue for another 40 years, but no new mines are scheduled to be built.

On the whole, hard coal is becoming less important and gas increasingly so as an energy source. Large gas pipe lines are planned to connect the Russian and Norwegian gas fields to Germany and Central Europe. Oil transport on tankers over the Baltic Sea, from Russian harbours in particular, is also increasing. The environmental consequences of a possible accident in the Baltic Sea are alarming. As competition for fossil fuels is increasing and resources decreasing prices will soar.

Case Study 3.1
Production of Cadmium in HELCOM area

Production of cadmium has declined slightly during the last decade in the HELCOM area. For environmental reasons, the use of cadmium has been increasingly restricted or banned, and the main demand for cadmium now arises from its use in rechargeable Nickel-Cadmium batteries.

Commercial cadmium is obtained mainly as an impurity in zinc ores: approximately 3 g of cadmium are produced for every ton of primary zinc produced, and cadmium production is more closely related to the demand for zinc than to the demand for cadmium itself. Some cadmium is also produced from the recycling of scrap metals, industrial wastes, dusts and fly ash etc. containing cadmium impurities. Primary cadmium production has slightly decreased since 1990, while secondary production has increased.

OSPAR (2001) has compiled data on European cadmium production as listed in the table below.

Cadmium production in different years in some of Baltic Region countries (in tons).

Country	1985	1990	1993	1998
Finland	564	591-568	785	550
Germany	1095	973	1069	1150
Norway	164	286	213	270

In the period 1996 – 2000 of the HELCOM Contracting Parties, only Sweden reported production of cadmium ore, and only Finland reports production of cadmium metal in the Baltic Sea catchment area. Germany produced 1150 tons of refined cadmium in 1998, presumably outside the HELCOM catchment area. Poland's production of refined cadmium, averaging around 600 t/a in the 1980's, has declined after 1990 and has now ceased.

Source: HELCOM, 2002.

3.2.4 Iron and Metal Mining

The metals industry mainly consists of a few large companies. Norway, Sweden, Finland and Poland are important mining countries. Most of the metals companies are a part of large groups, such as Norsk Hydro, Elkem and Fesil. Aluminium production makes up the largest part of the Norwegian metals industry. Norway produces the largest amount of primary aluminium in Western Europe, and 80-90% of its output is exported.

Poland is one of Europe's top coal and copper producers. Poland's mining industry has suffered declining production and consequently several mining sectors have reported job losses and closures. However, there have been signs of recovery, with the country's silver, zinc and copper production showing an increase over previous years. All of Poland's

Figure 3.2 *Belchatow is one of the largest lignite fuel power plants in the World and the main electricity producer in Poland.*

copper production comes from KGHM Polska Miedz (Polish Copper) SA which produces approximately 520,000 t of refined copper and 1,100 t of silver each year. Poland has several lead, zinc and silver mines.

Sweden has a large mining industry which contributes 0.3% to Sweden's GDP. Sweden has substantial base metal, gold and iron ore deposits, which are being actively exploited and developed. Iron, copper, silver, gold, lead are the main products in metal mining in 12 active mining areas in Sweden (Kiruna, Garpenberg, Zinkgruvan, Garpenberg in Boliden, Bergslagen and Åmmeberg districts). Eight metal mining operations were closed (one of the latest closed – Laisvall in 2001).

Five active metal mining operations for copper, zinc, nickel, gold, chromium (Kemi, Hitura) are situated in Finland.

The several important steel mills in the region, include Nowa Huta in Krakow, Katowice, and Chestochowa in south Poland rely on local coke production and local or imported iron ore. The Swedish steel mills are found in central Sweden, including Borlänge and Sandviken. Several of the smaller Swedish steel mills produce special steel alloys and have a tradition for several hundred years. Several others have been forced to close in the last 10-20 years. There is one steel mill in production in Raahe in Finland.

3.2.5 Stone, Mineral and Cement

Production of natural stone, stone chips, sand and gravel is important part for e.g. the building industry and infrastructure development. It is fairly easy in the north of the region since the glacier has created many eskers which mostly consist of gravel.

A stretch of chalk mines across the Baltic Sea from the Estonian North coast, all the way to Bornholm, forms the base for a cement industry. Large plants are found in Kunda on the Estonian north coast, Slite on the east coast of Gotland and Degerhamn on the west coast of Öland.

The Norwegian mining industry is now undergoing a considerable restructuring process, with a strong increase in the production of industrial minerals, moderate growth in the production of natural stone, stone chips, sand and gravel, and a sharp reduction in the extraction of ore. Norway produces olivine, an industrial mineral, from olivine mines, and is one of the world's three largest producers of nepheline syenite, another industrial mineral.

Two underground mines at Glanshammar near Örebro in Sweden are producing dolomite.

3.2.6 Textile Clothing; Leather

Textile and clothing industry had an important role in the early phases of industrialisation in the 19th century. For the English cotton industry Manchester became a legendary city. In the Baltic Sea region Lodz in Poland has a most extraordinary position in this industrial history, as the city grew tremendously from late 19th century up to 1939, to become Poland's second largest city and a European centre for textile production. After the Second World War although in a state of decline this production continued up to the mid 1990s. Other centres were found in west Denmark and west Sweden.

In the 20th century and especially after the 1970s, this industry has gradually declined due to competition from low-wage countries, first to southern Europe, e.g. Portugal and Spain, and later to Asia. Today, in the early 21st Century, several west European textile and clothing firms have outsourced their sewing operations to transition countries, such as the Baltic States and Poland. This is typically organised in the way that e.g. a Danish firm still buys woven cloth, organises the dying and cutting operations in Denmark, then ships the pieces to e.g. Poland where they are sewn, and then is transported back to Denmark where they are quality controlled, finished, and marketed. Some production remains in the west, e.g. in the industrial district of Herning-Ikast, in Western Jutland. The sector is still successful.

Much of the leather industry, producing e.g. shoes, has also been moved from the west to east over the last half of the 20th century.

3.2.7 Pulp and Paper

Finland, Sweden and Russia together have a majority of the global pulp and paper production. The Swedish and Finnish industry is located on the shores of the Baltic Sea, while the Russian Karelian Republic has its important pulp and paper factories on the shores of lakes Onega and Ladoga.

A	**Agriculture, hunting and forestry**
B	**Fishing**
C	**Mining and quarrying**
CA 10	Mining of coal and lignite; extraction of peat
CA 11	Extraction of crude petroleum and natural gas;
CA 12	Mining of uranium and thorium ores
CB 13	Mining of metal ores; iron, other metals
CB 14	Other mining and quarrying
D	**Manufacturing**
DA	Manufacture of food products; beverages and tobacco
DB	Manufacture of textiles and textile products
DC	Manufacture of leather and leather products
DD	Manufacture of wood and wood products
DE	Manufacture of pulp, paper and paper products; publishing and printing
DF	Manufacture of coke, refined petroleum products and nuclear fuel
DG	Manufacture of chemicals, chemical products and man-made fibres
DH	Manufacture of rubber and plastic products
DI	Manufacture of other non-metallic mineral products
DJ	Manufacture of basic metals and fabricated metal products
DK	Manufacture of machinery and equipment n.e.c.
DL	Manufacture of electrical and optical equipment
DM	Manufacture of transport equipment
DN	Manufacturing of e.g. furniture;
E	Electricity, gas and water supply
F	Construction
	Service
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence; compulsory social security
M	Education
N	Health and social work
O	Other community, social and personal service activities
P	Activities of households
Q	Extra-territorial organisations and bodies

Table 3.2 Branches of industry or production sectors. *Only main categories are included. The complete list contains several thousand items, as most of the categories have subcategories. The list gives an impression of which industrial branches should be looked at when assessing the complete picture of industrially caused environmental impacts. [The list is a based on the EU system NACE, which is part of ISIC (see Internet Resources)].*

Sweden is the world's third largest exporter of pulp and paper, with 80% of exports marketed in the EU countries. The Swedish pulp and paper industry has undergone numerous mergers. The two top companies, Stora and SCA, are among Sweden's biggest industrial groups. Other leading groups are MoDo, the previously state-owned Assi Domän (privatised in 1994), Södra Skogsägarna, Korsnäs and NCB.

In recent years Swedish forest product companies have made major acquisitions in the EU. Recently the Swedish and Finnish forest companies Södra and Metsäliitto and the Latvian Republic have agreed on building a 600,000-tonne per annum kraft pulp mill in Ozolsala, near the town of Jekabpils in eastern Latvia on the shores of the river Daugavpils.

3.2.8 The Chemical Industry

An important chemical industry exists in most of the countries in the region, although Germany has by far the longest tradition and the largest chemical sector. Much of this industry is based on petrochemistry and refineries. Refineries have been established in Norway, on the Swedish west coast, in Poland in Gdansk and close to Plock on River Wisla north of Warsaw, and in Lithuania with the Mazeikiai Crude Oil Refinery. All of them produce a complex series of oil products. For example Mazeikiai Crude Oil Refinery started operating in 1980 and was one of the most modern refineries of the former Soviet Union. Today Mazeikiu nafta is the only crude oil refinery in the Baltic States operating as a typical complex refinery. It has a design capacity of 15 Mt per annum. The modern products of the refinery are different grades of high octane unleaded gasoline, new gasoline VENTUS with multifunctional additives, summer and winter diesel, jet fuel, heating oil, construction, roofing and road bitumen, LPG, sulphur, MTBE.

Another branch of the chemical industry produces fertilisers and nitrogen products, again present in several of the countries in the region. For example in Lithuania there are two fertiliser factories. Following several reconstructions and further upgrading, JSC (joint stock company) and Achema (formerly the Azotas Fertiliser Plant) currently produce ammonia, carbamide, ammonium nitrate, nitric acid, carbonic acid, and various composite fertilisers for gardeners. JSC Lifosa (formerly the Kedainiai

Figure 3.3 *Industrial mass production of chemicals in is one of the large environmental dilemmas of modern society. Pollution from the site of production was originally the largest problem. Today, pollution during consumption and waste, the rest of a product's life-cycle, is often much more problematic. (Photo: Lars Rydén)*

Chemical Fertiliser Plant) currently produces sulphuric acid, phosphoric acid, single and granulated superphosphate, di-ammonium phosphate and aluminium fluoride. Other large plants exist in Novgorod in Russia and Köping in Sweden. These factories use considerable quantities of fossil fuel for the reduction of atmospheric nitrogen.

Pharmaceutical industry originated in Germany in the 19th century, and several of the largest companies are still active, although the largest facilities are found in Southern Germany or even in Switzerland. The Swedish companies Astra and Pharmacia, now merged with American General Electrics, count among the largest pharmaceutical companies in the World. Astra is now operating under the name of AstraZeneca and Pharmacia belongs to Pfizer. This branch is very research intensive.

A series of other chemical branches could be added to the list. These include e.g. the chlor-alkali industry, producing chlorine gas and sodium hydroxide. As they traditionally use the mercury electrode technology they are (were) environmentally problematic. The coal fired power plants produce sulphuric acid as a base chemical, from the sulphur in the coal. The plastics industry uses a series of petrochemicals in the production.

3.2.9 Manufacturing of Machinery, Electrical and Optical Equipment, Car Industry

Metallurgic industry, including the fabrication of all kinds of equipment and car industry is a large and economically dominant branch in several of the countries in the region. Germany was and is the most important country in this respect. Siemens originally produced electrical equipment, motors, generators, etc. Sweden has had a large production of refrigerators, stoves, vacuum cleaners etc with Electrolux Company since 100 years back. ABB, Asea Brown Bovery, originally with Asea as a Swedish company which produced equipment for power transfer and equipment for hydropower plants, later nuclear power plants, etc. The company also produced trains and engines for trains. Before the systems change this sector was also important in the Baltic States. Thus all train wagons for the USSR were produced in Riga, while e.g. Jelgava had a large factory for microbuses.

The car industry has a long tradition in Germany and Sweden. For example Volkswagen, Audi, Volvo, Saab and Scania are well known car producers. The car industry accounts for a very large part of the industrial economy, as a number of producers and maintenance companies are included.

The defence industry is also part of this sector. Before the systems change the defence industry was an important sector in the whole region, and particularly in Russia. Nobel industries, best know for guns, have been and still are important. They had large factories in St Petersburg up to the revolution. The German defence industry, e.g. guns, tanks, air fighters, was large up to the end of the Second World War but is still

important. Fighter planes have been produced in Sweden since the Second World War.

Ship building was up to recently very large in some countries. Classical yards were found in Gdansk (Lenin yard) and Gdynia in Poland; Bremen, and Hamburg in Germany; and in Malmö and Uddevalla in Sweden.

3.2.10 The Power Industry

Some of the largest power companies in Europe are found in the region. These include Fortum in Finland, and Vattenfall in Sweden. The power companies run power plants – including hydropower, nuclear power and coal and gas fired power plants – as well as power distribution infrastructure. (Producers of oil, gas and coal are not included here, and have already been mentioned.)

The power companies are typically state-owned but operate as independent companies. Nationally important power companies are found in all countries. In Estonia state-owned Eesti Polevkivi (Estonian Oil Shale) near Kohtla-Järve, in Latvia Latenergo in Riga using imported gas, and several companies in Poland, the largest being Belchatow near Lodz using lignite. A great number of local power companies also exist, very often municipally owned.

Since the deregulation of the power market a number of fusions of companies have occurred. Many companies are today international.

The development in the power sector is much discussed since the political incentives to reduce fossils to curb the carbon dioxide emissions are increasing. In Finland a decision was recently taken to build one more nuclear power plant, while Sweden has recently closed one plant (Barsebäck). Ignalina in Lithuania, one of the largest nuclear power plants, will be closed in 2009 as part of the EU accession agreements. Waste incineration is increasing, and district heating is built in many cities. Wind power is becoming important in many countries, and is already so in Denmark and Northern Germany.

Figure 3.4 *Hydropower provides 50% of the electricity in Sweden. Porjus hydropower station is the largest in Sweden. The environmental costs of hydropower are mainly related to the large infrastructure requirements, especially upstream reservoirs. (Photo: Hans Blomberg, courtesy of Vattenfall AB)*

Figure 3.5 Iron and metal mining. *Heavy equipment digs and hauls ore inside an enormus open pit mine. (Photo:iStockphoto)*

3.2.11 Construction

The building industry is today in a state of rapid expansion. Building is extensive in many of the major cities in Central and Eastern Europe. The largest construction companies, e.g. Skanska and NCC, are active in many countries in the region, both in housing and in infrastructure expansion, e.g. roads, railroads, bridges, tunnels etc. This sector will continue to develop for many years in the CEE countries too improve the often very poor quality of both housing and road infrastructure.

3.3 Industrial Structure and Restructuring

3.3.1 Industry Restructuring

As many other sectors in the economy, industry is continually being restructured. This is a consequence of developing technology, globalisation and changing markets. Examples are many. Computers substituted for the older typewriters; clothing became cheaper to produce elsewhere; defence contracts were discontinued.

Restructuring may lead to the closure of whole factories and even a whole city, town or area losing the basis of its livelihood. This is painful for the workers and all who depend on them. For one work place in the basic sector of the economy,

such as an industry, there are many more, often 6-8, other working places, e.g. hairdressers, shop assistants, nurses, fire brigadiers, school teachers and so on. In addition there are the up to 50% of the population that are not in the labour market. The closure of a basic industry thus may mean either that a town or neighbourhood disappears as inhabitants are moving out, or to a complete restructuring. This often leads to considerable responsibilities of the both local and national governments to develop new opportunities to support oneself and a new labour market in areas which were heavily dependent on a declining industry.

In the west a number of industrial branches have undergone such changes over many years. This includes ship building, which practically disappeared starting from the 1970s, as ships were less expensive to build in e.g. North Korea and Eastern Europe. Textile manufacturing was greatly reduced as cheaper production took over first in Southern Europe and later in Asia, India and China in particular. The closing of mines, especially coal mines, is another sector where structural change has been accompanied by dramatic political protests, not least because they were typically state-owned. More recent structural changes include the defence industry, where orders (for some!) are decreasing as a consequence of the end of the Cold War.

The system change in Central and Eastern Europe became an all encompassing structural change in all industry and the whole economy. So much technological development was forced onto the sectors at once, markets were lost as a consequence of the break down of the Soviet Union and Comencom.

Restructuring is a natural development in all economic sectors and in the end should be beneficial for the countries, even if painful if too sudden. The introduction of new technologies as they become available has led to increasing labour efficiency of about 2-4% yearly. Thus today a worker produces 100-200 times more value per working hour as compared to early industrialisation 150 years ago. Many hard and dangerous jobs have disappeared and taken over by machinery and will not be missed by anybody. Monotonous jobs have been taken over by robots or computers, more exact and enduring than humans, who will unavoidably make mistakes. The introduction of cleaner technologies is one such development of production that is beneficial, but may lead to fewer jobs.

3.3.2 Economy versus Environment

The different sectors in an economy have very different environmental impacts. This is reported in the so-called national environmental accounts or green budgets of a country. The environmental data are added to the traditional economic data, without changing them, and are therefore called satellite accounts. An international standard to be used, called SEEA,

Case Study 3.2 Kiruna Iron Ore Mine, Sweden

With an ore body 4km long, 80m thick and reaching a depth of 2km, LKAB's Kiruna is the world's largest, most modern underground iron ore mine. Since mining began here over 100 years ago, LKAB has produced over 950Mt of ore, yet only one-third of the original ore body has been extracted. Since mid-1999, Kiruna's haulage level at a depth of 775m has been replaced by the next level down at 1,045m, which will support production until 2018. The operation employs 1,800 people, of whom 400 work in the mine. In 2000, Kiruna produced 13.7Mt of iron ore products (10.9Mt of pellets, 2.6Mt of sinter fines and 200,000t of high-phosphorus ore) with an average grade of 66% Fe. This represented two thirds of LKAB's total Swedish production.

The ore contains a very pure magnetite-apatite mix, containing more than 60% iron and an average of 0.9% phosphorus. The original reserve at Kiruna was some 1,800Mt. The KUJ2000 project has integrated the move down from the 775m level haulage to 1,045m with the upgrading of all of the mine's ore handling systems, which can now handle 26Mt/y. Components include the new automated rail transport system on the 1,045m level, uprating the hoists and crushers, and increasing the ventilation system capacity. Seven 500t-capacity shuttle trains, controlled from the 775m level, collect ore from ten groups of ore passes, and deliver it to one of four crushing stations. 100 mm ore is then skip hoisted in two stages to the 775m level and then to surface. The mine is divided into eight production areas, each containing its own group of ore passes and ventilation systems.

Ore is mined using sublevel caving, with sublevels spaced at 28.5m vertically. With a burden of 3.0-3.5m per ring, this yields around 8,500t for each blast. Electric-powered, remote-controlled drilling and ore handling equipment is widely used. After blasting, load-haul-dump machines carry the run-of-mine ore to the nearest ore pass, from which it is loaded automatically on to one of the trains operating on the 1,045m level. After primary crushing, sampling using a Morgårdshammar automatic sampler to obtain the apatite and magnetite contents, and hoisting to surface, the ore is processed in Kiruna's complex of one sorting plant, two concentrators and two pellet plants to give pellet and sinter fines products.

THE LAKE ORE PROJECT LKAB is investing some $50 million to dewater part of Lake Luossajärvi in order to access 100Mt of ore beneath it. Draining is scheduled for completion in 2001.

Source: The website for mining industries – Kiruna: http://www.mining-technology.com/projects/kiruna/

System of Environmental and Economic Accounts, has been developed within the UN system.

Case Study 3.3 gives one example of such accounts from a report from the Swedish Institute for Economic Research. Twelve sectors in the economy are reported with data on traditional statistics (production value, processing value, and employment), energy statistics (fuel used, electricity and district heating) and emissions (carbon dioxide, sulphur oxides and nitrogen oxides). The data are from 1998. It is clear that the environmental impact per value in the economy is very different. The pulp and paper, power and metallurgic industries stand out as bad performers from the environmental point of view. The service sectors as well as building and construction are producing much value and jobs for each unit of environmental impact.

The data in the green budget of a country does not mean that some sectors in the economy should be closed, but it points to where environmental policy should be focused, and production developed. It is interesting to note that the worst sector, pulp and paper, is now undergoing the largest reforms through the introduction of cleaner technologies.

Industry has, as mentioned above, increased the value per working hour labour productivity, dramatically over its entire history. To improve its environmental profile it needs to also improve its energy and resource productivities as well. Increased resource productivity means that more value is produced with a given amount of resources. This is an important mission of cleaner production. Resource productivity is increasing as internal and external recycling is increasing, with more efficient use of energy and other resources such as water.

Case Study 3.3 Green Budgets – Environmental and Economic Profiles

The green budget, or environmental accounts, of a country includes data on environment together with the traditional data. In a report from the Swedish Institute for Economic Research, the traditional statistics (1-3) are given together with data on energy (4-6) and emissions (7-9) for 12 sectors in the economy.

The data reported are the following:

- Traditional statistics (production value, processing value and employment).
- Energy (all fuel to be incinerated (i.e. not uranium), biomass and electricity and district heating).
- Emissions (carbon dioxide, CO_2, sulphur oxides, SO_x and nitrogen oxides, NO_x).
-

The sectors are very different in terms of economic value per environmental impact. Manufacturing, such as pulp and paper, and the transport sector, is quite polluting while the service sectors are low in this respect.

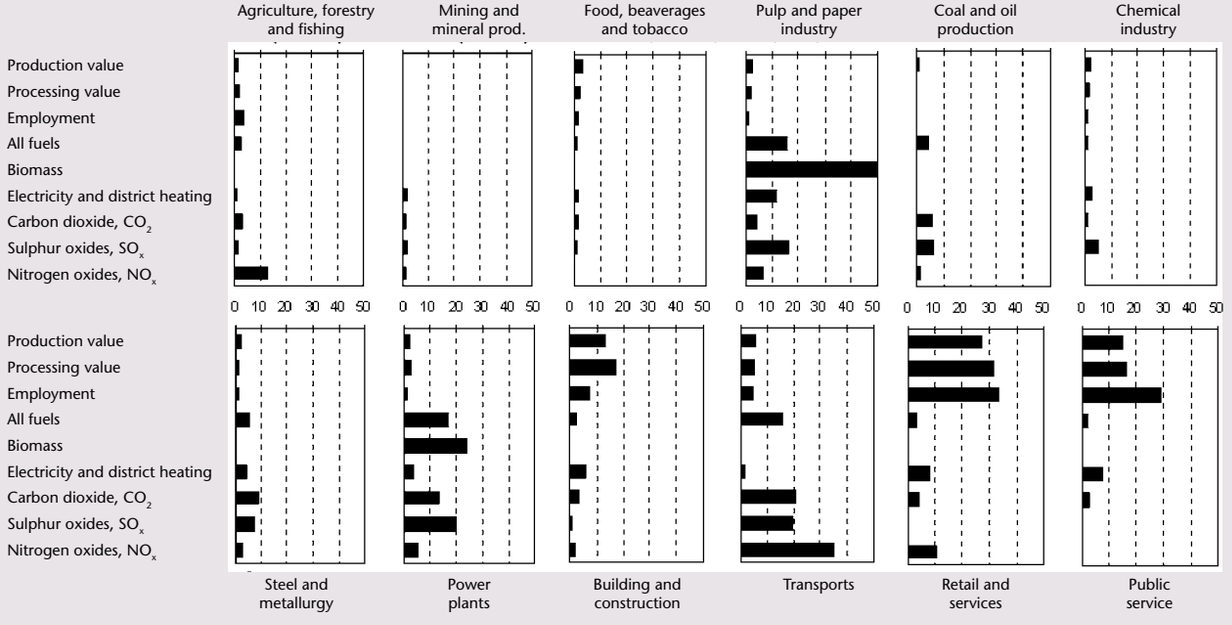

Figure 3.6 Environmental and economic profiles for 12 industrial sectors in Sweden, share of total in 1998. *Figures are given in percent of total for Sweden. Since not all sectors are included the sum of the reported values are less than 100% [SCB, 2001].*

Changes in product design and use also contribute to improved resource productivity. Thus productivity is increasing with dematerialisation and with longevity of the manufactured products. It is increasing with the more efficient use of products, which includes both multi-functionality and increased number of users, for example through leasing or pooling. As labour costs have been much larger than resource costs, labour productivity has developed much further than resource productivity. But we are now in a situation where it is cost-efficient to improve resource productivity, and there is much to be done.

Increased productivity amounts to a so-called decoupling of resource use from production value. This has to be much larger than today in a sustainable society. The decoupling can be seen e.g. the decreased use of energy in western European industry. This is however offset by a larger increase of total resource use, the so-called rebound effect. Sustainability will require an absolute decrease in resource use of about a factor of five according to more recent estimates.

3.3.3 The Change to a Post-industrial Society

Industry can be seen from the point of view of production, employment, economic turnover or resource use. Industrial production has been increasing more or less linearly over almost the entire 20th century and is still doing so. However employment was at its peak between the 1950s and 1970s in the west. In the east it probably occurred just before the system change, that is, 1990. The term industrial society refers normally to the fact that the largest share of the work force is occupied in industry. It was in Sweden about 70% at the peak. But as labour productivity has increased regularly first about 3% and later 4% per year, due to machinery, automation, computerisation etc, the work force has decreased dramatically. In 2005 less than 18% of the work force was found in the industrial sector in the country. In the future very few individuals will manufacture all goods the society needs, just as very few are producing all food we eat. We are on our way into the post-industrial or service society.

Services cannot be undergoing a similar development of labour productivity as in manufacturing industry. There will never be fewer than four people to play a quartet, and a piece of music will always take so many minutes to play, you cannot do it in half the time. We should expect that service sector will remain large in the future. The challenge will be to organise the economy of the society so that we can afford the services we all want, such as health care, as well as child and elderly care.

Also, some services have a very considerable environmental impact. This includes the dramatically increasing tourism industry, with all its travelling. Transport has very different environmental impacts and long distance air transport is problematic from this point of view. Also the destinations of tourism needs to be protected, be they natural or cultural sites.

Study Questions

1. What was the basis of early industrialisation of the Baltic region?
2. What is the main difference between the industry of the Nordic countries and the Baltic CEE countries?
3. What are the main energy resources in the Baltic Sea region?
4. How is industry in the Baltic area being restructured? What is the difference between Nordic and CEE countries?
5. Describe the history of industrial development in the Baltic Sea region.
6. Name the major industrial branches and their environmental problems in the Baltic Sea region. What are the problems in your country?
7. How are the economics of different countries connected to the environment?

Abbreviations

CEE	Central and Eastern Europe.
CIS	Commonwealth of Independent States.
GDP	Gross Domestic Product.
HELCOM	Helsinki Commission (Baltic Marine Environment Protection Commission).
ISIC	International Standard Industrial Classification of all Economic Activities.
JSC	Joint Stock Company.
LPG	Liquid Propane (and Butane) Gas.
MTBE	Methyl Tertiary-Butyl Ether (added to gasoline to increase its oxygen content).
NACE	Classification of Economic Activities in the European Community.
OSPAR	Commission for the Protection of the Marine Environment of the North-East Atlantic.

Internet Resources

NACE – Classification of Economic Activities in the European Community

http://www.fifoost.org/database/nace/nace-en_2002AB.php

ISIC – International Standard Industrial Classification of all Economic Activities

http://forum.europa.eu.int/irc/dsis/coded/info/data/coded/en/gl006814.htm

The Website for Mining Industries – Kiruna Iron Ore Mine, Sweden

http://www.mining-technology.com/projects/kiruna/

The Website for Mining Industries – Kemi Chromite and Ferrochrome Mine, Finland

http://www.mining-technology.com/projects/kemi/

NDH, Ministry of Trade and Industry in Norway – Handbooks and brochures

http://odin.dep.no/nhd/engelsk/publ/brochures/index-b-n-a.html

Environmental Conditions in the Baltic Sea Region

http://www.baltic.vtt.fi/demo/balframe.html