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Industrial Policy: reinforcing competitiveness

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AT	**Austria**
BE	**Belgium**
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SI	**Slovenia**
SK	**Slovakia**
UK	**United Kingdom**

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4. ACCESS TO NON-ENERGY RAW MATERIALS AND THE COMPETITIVENESS OF EU INDUSTRY

4.1. Introduction

4.1.1. Context of the analysis

The accessibility and affordability of non-energy, non-agricultural raw materials[1] is crucial for ensuring the competitiveness of EU industry.[2] The competitiveness of several European sectors such as electronics, cars, chemicals or construction can be hampered by a limited or more costly supply of certain raw materials. Like the US and Japan, the EU is highly dependent on imports for many of its raw materials for industrial and manufacturing purposes. While the EU has many raw material deposits, their exploration and extraction is hindered by increased competition for land use and the higher costs of safeguarding the environment and human health.

The fast-changing geopolitical and economic context affects the supply and demand of these materials. On the one hand, the industrialisation and urbanisation of emerging economies (e.g. the BRICs) has increased global demand for particular industrial raw materials,[3] as these countries have become more important purchasers of such materials on global markets.[4] Also the fast diffusion of emerging technologies is expected to raise global demand.[5] On the other hand, the mining and production of certain raw materials is concentrated in a few countries, and the free and transparent operation of global markets in these raw materials is not ensured. In many cases, distorting measures such as export taxes, quotas, import subsidies, and restrictive investment rules hamper access for EU industry.

Recent sectoral studies have highlighted a number of problems: i) high volatility of world market prices; ii) increased use of short-term supply contracts (e.g. supply of iron ore); iii) monopolisation of supply for certain 'high-tech' materials in certain countries; iv) growing competition and demand from emerging economies and increased concentration of suppliers of raw materials, leading to a more difficult price negotiation position, especially for SMEs.

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1 In the Report, the term of "raw materials" is understood as non-energy, non-agricultural raw materials used for industrial and manufacturing purposes and that are not primarily used to generate energy. For a more detailed definition of raw materials discussed in this chapter, see section 4.1.3.

2 See European Commission (2008a), e.g. Angerer G. et al. (2009), and Öko-Institut e.V., (2009).

3 For example, trade in base metals increased by 21.6 % yearly on the global market over the period 2004-2008.

4 However this should not be taken too far since in 2005 for instance China had import dependency rates ranging from 70-100 % for cobalt, copper, manganese, nickel, and titanium, see Hveem (2010). The European Commission (2009) also pointed out that countries generally considered resource-rich (like China, Canada, Russia, India, or Australia) can be dependent on imports of some raw materials.

5 See for example Fraunhofer ISI, IZT (2009).

The European Commission has launched a number of policy initiatives to address the challenges regarding access (conditions) to raw materials. In particular, the Raw Materials Initiative has highlighted the importance of access to non-energy, non-agricultural raw materials for the competitiveness of crucial industries in the EU-27 economy.[6] The document set out a three-pillar approach towards an integrated strategy. These pillars are:

1. Fair and sustainable supply of raw materials from global markets;

2. Fostering a sustainable supply of raw materials within the EU;

3. Boosting resource efficiency and promoting recycling.

This was later followed up by the identification of 14 critical raw materials.[7] Their critical nature is based on the fact that they are entirely produced in a limited number of countries outside the EU, and have low substitutability and recycling rates. The Communication of February 2011 on 'Tackling the challenges in commodity markets and on raw materials' examined the problems in the wider context of commodity trade and emphasised the role of commodity derivatives and the link between physical and financial markets.[8] The overarching flagship initiative under the Europe 2020 Strategy for a resource-efficient Europe,[9] considers the problem of non-energy industrial raw materials in the wider context of a resource-efficient Europe in a global setting and in relation to related issues such as climate change, biodiversity, land use, deforestation, sustainable consumption and competitiveness. In March 2011 the Council of the European Union endorsed the three-pillar approach and the accompanying actions.[10] The Communication on Trade, Growth and World Affairs (2010) also addressed the strategic importance of access to an undistorted supply of raw materials to ensure the competitiveness of the EU economy[11]. The upcoming Communication on the European Innovation Partnership on Raw Materials will address the role of R&D and innovation in tackling the scarcity of raw materials.

4.1.2. The goal of the analysis

The main objective of this chapter is to analyse the nature and degree of vulnerability of the EU industry in terms of access to raw materials in a systematic and qualitative way. The focus is on the competitiveness effects for certain industries, taking into account the supply constraints on non-energy, non-agricultural raw materials from a sectoral point of view. 'Access' to raw materials is understood in a wider sense, meaning also the access conditions.

As part of this overall objective, this chapter looks into:

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6 European Commission (2008a).

7 European Commission (2010a and 2010b). These materials are antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, platinum, rare earths, tantalum, and tungsten.

8 European Commission (2011a).

9 European Commission (2011b).

10 Council of the European Union (2011).

11 European Commission (2010c).

- Recent trends in global demand, the EU's supply and trade in raw materials, as well as the role of secondary raw materials and recycling in Europe.

- The competitiveness effects of a set of selected sectors for which raw materials are a critical factor in their relative global competitiveness. It examines supply-related issues regarding raw materials, e.g. price volatility, location of crucial materials, changes in contracting terms, etc., and the responses at company level to these challenges, including improving material efficiency, recycling, use of substitute materials, and organisational strategies.

- The role of the EU extracting and recycling industries in reducing the vulnerability of EU industries with respect to access raw materials.

- Potential public policies concerning access to raw materials, e.g. measures to promote resource efficiency, undistorted access to raw materials in third countries, measures to promote sustainable supply from domestic sources (mining plus recycling), and other aspects such as globalisation and trade in waste streams.

In terms of geographical coverage the focus is on a comparison of the EU as a whole with the rest of the world (e.g. the main emerging international players, such as China).

The analysis is qualitative in nature, comprising an independent and systematic analytical exercise based mainly on interviews with industry stakeholders, and on relevant literature and data.

4.1.3. Defining non-energy, non-agricultural raw materials

Non-energy, non-agricultural raw materials can be defined as raw materials that are mainly used in industrial and manufacturing processes, semi-products, products and applications and are not primarily used to generate energy. As such, industrial minerals and purified elements (e.g. feldspar, silica), ores and their metals and metallic by-products (e.g. copper, iron but also germanium, rhenium, rare earth elements) and construction materials (e.g. sand gravel, aggregates) are within the scope, but it also includes materials such as wood and natural rubber. Furthermore, crude oil and gas can be also considered as raw materials for industrial production [12].

This chapter focuses mainly on unprocessed non-energy, non-agricultural raw materials. However, such raw materials are processed into various products and components used by sectors further up the product value chain. These sectors are thus affected indirectly by the same raw materials issues.

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[12] Although raw materials are commonly associated with minerals and metals, in particular the list of 14 critical raw materials identified by the Commission, the concept used in this chapter is wider. Although the latter two are typically used for energy production, they are the main raw materials in the chemical industry. Wood is considered as 'forestry materials'.

4.1.4. Analytical approach: a framework for interpretation

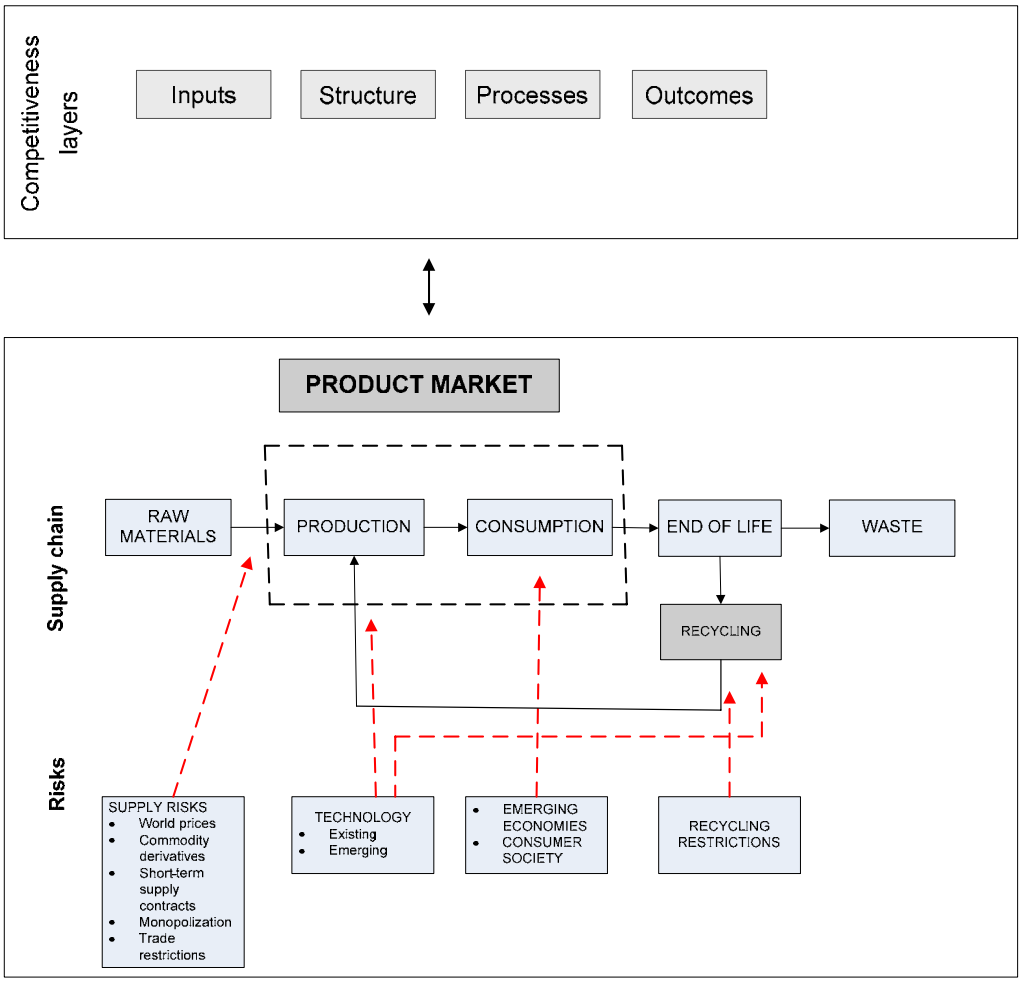
Figure 4.1 depicts the relationship between raw materials and competitiveness, in the context of the supply chain. It will serve as the backbone for the various parts of the analysis.

The top part of the figure indicates four layers of competitiveness that can be distinguished at sectoral level: inputs, structure, processes and outcomes. These are related to the product market, in which both producers and consumers (or businesses in the case of intermediate consumption) operate.

The middle part of the figure shows the raw material flows throughout the production process, going from raw material to waste. An important aspect is the recycling of raw materials, leading to secondary material flows that reduce the import dependency and on top of that are often associated with lower energy processing costs.

The bottom part indicates the related risks. While problems such as increasing material prices and price volatility as well as monopolisation of supply for certain materials and trade restriction measures can be classified as supply risks, the problem of growing competition and consumption in emerging markets concerns the demand side of the product market. Also, risks and (technological) challenges can be identified at the recycling stage can be identified. These risk factors can be further refined, such as increased demand due to the development of emerging technologies, changes in consumer preferences, etc.

Figure 4.1: Raw material use in the production process and the value chain: analytical framework



Source: IDEA Consult.

4.2. Contextual data

This section presents data portraying the EU in its wider global economic context with respect to non-energy, non-agricultural raw materials. The data revolve around five themes:

– Demand: GDP growth of major economic blocks in the world, indicating where increasing demand for raw materials is expected to come.

– Price: changes in the prices of particular raw materials e.g. copper, zinc, aluminium.

– Supply: location of major deposits in the world and the EU's position.

– Trade: major raw material trade flows in terms of value and quantities, indicating that the EU is a major importer.

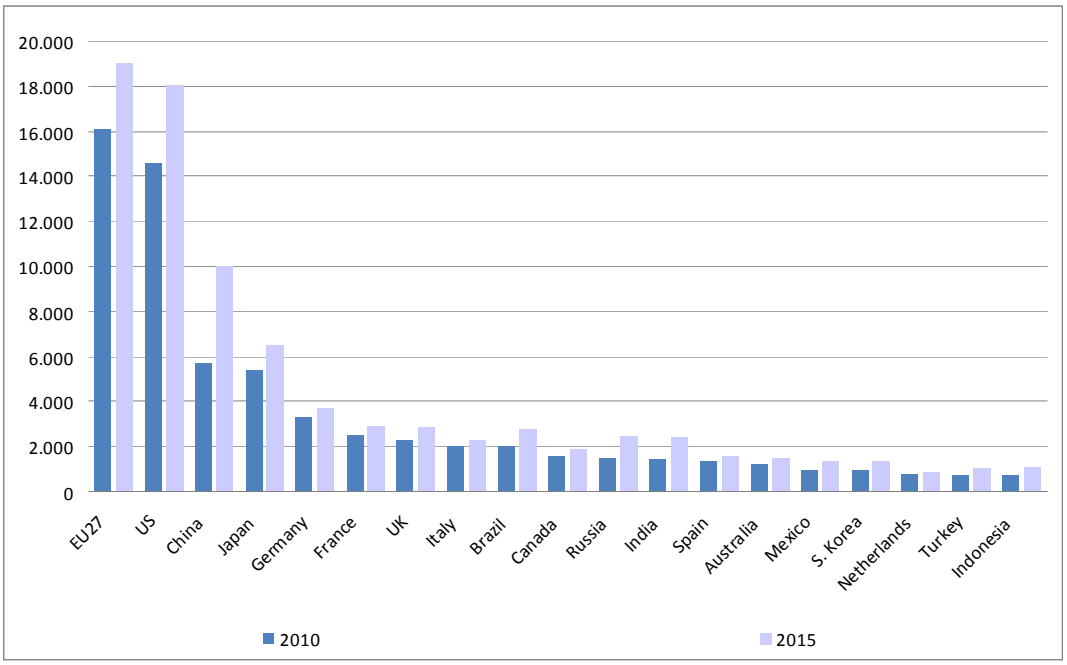
– Secondary raw materials and recycling: estimated waste stream recovery potential.

4.2.1. Global demand and the EU

The key factors driving the demand for raw materials are global economic and population growth and new technological applications. In particular, the growing appetite of the emerging economies for raw materials is seen as major force driving global demand.[13] The influence of China and, increasingly, India is commonly seen as dominant in this context. This is both a reflection of the scale of their economies and their current economic dynamism. Since the 1990s, developing countries have significantly increased their consumption of raw materials to help fuel their economies, and are now among the leading consumers and high long-term demand is expected.[14]

Figure 4.2 shows the GDP of major countries in the world in 2010 and estimates for 2015. The EU-27 and the US are the main economic blocks, both in 2010 and in the near future. Yet for other countries, in particular the BRIC countries, relatively significant changes are anticipated. According to IMF forecasts, India, Russia and Brazil will have economies of similar sizes as those of France, Italy and the UK.

Figure 4.2: GDP and GDP evolution of major world countries



Note: The vertical scale is expressed in billion USD.

Source: IMF.

In 2010, China passed Japan as the world's second largest producer of goods and services. Japan is followed by the major European countries Germany, France, the UK and Italy. For the time being, the United States' GDP amounts to two and a half times the GDP of China. The combined GDP of the EU-27 is about 10% higher than the GDP of the US. According to the IMF's forecasts for the near future, this world

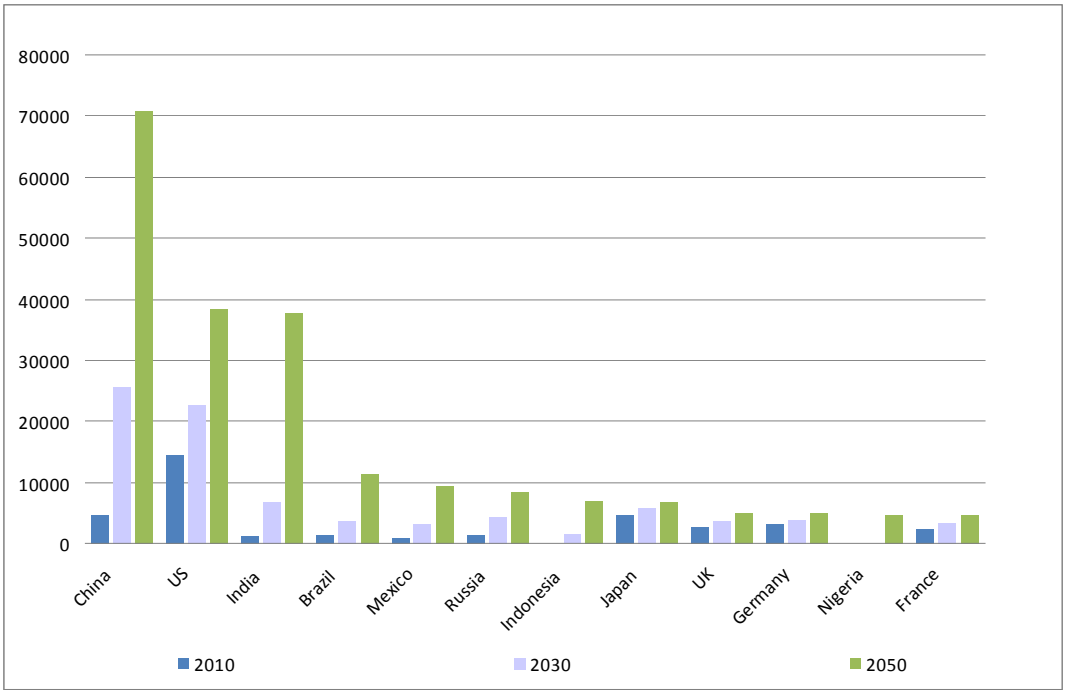
13 See European Commission (2010a).

14 OECD (2010b).

order will not change substantially by 2015. However, it is expected that China's GDP will be more than half of US GDP by 2015.

According to other forecasts[15] the economic world order is expected to change substantially by 2030 (see Figure 4.3). China will likely have surpassed the United States to top the GDP rankings, with India third. By 2050, the traditional large economies such as Japan, UK, Germany and France are expected to fall further back in the global GDP rankings. Of course, one has to bear in mind that long-term forecasts are by their nature very speculative. Yet they point to a certain economic growth pattern that will also have an impact on global demand for non-energy, non-agricultural raw materials.

Figure 4.3: Top-10 countries by GDP in 2050



Note: The vertical scale is expressed in billion USD.

Source: Goldman Sachs, Global Economics Paper, n 170, 'The expanding Middle: The Exploding World Middle Class and Falling Global Inequality', July 2008.

4.2.2. Long-term price evolutions

Demand from emerging economies has pushed up prices for important metals and minerals.[16] China's economic dynamism is described as a major factor in commodity market developments. China currently consumes about 30% of the world's base metals, against about 5% in the early 1980s. Increasing demand from emerging economies 'appears to represent a longer-term structural shift in consumption' and not just a 'cyclical movement'[17]. The literature also suggests that global markets for metals and minerals tend to be volatile, partly due to time lags in the response of

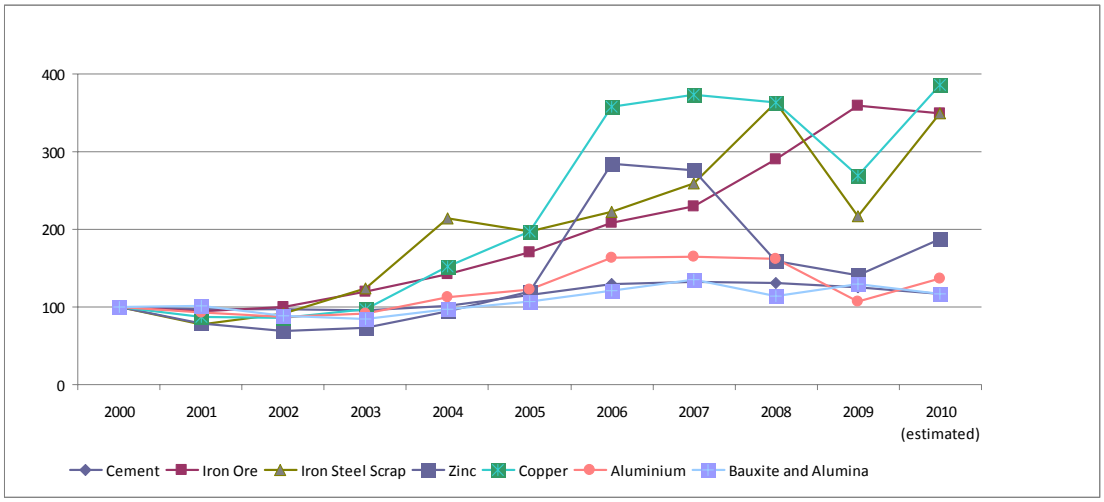
15 See Goldman Sachs (2008).
16 See for example OECD (2010b), European Commission (2011a).
17 J.P. Morgan (2010).

supply to changes in demand, but technological change in products also often changes the demand for strategic metals and minerals, contributing to high price volatility.[18] Furthermore, the export restriction measures often applied, such as quotas and minimum export prices have also contributed to soaring raw materials prices.

From 1990 onwards, prices had been relatively stable up to the year 2002. From 2003, the prices of the materials considered here generally started to increase, sometimes gradually (aluminium, cement, iron ore) and sometimes sharply (copper, zinc, iron and steel scrap). Much of the increase in prices from 2003 to 2008 can be explained by the strength of the demand and the lagged response of the supplying industry (Humphreys, 2009). In the case of copper, prices stabilised again from 2006 onwards, while in the case of zinc, prices fell sharply again. The prices of iron ore and steel scrap continued to increase vigorously up to 2008.

When prices are measured against their year 2000 levels, one can observe that prices for zinc, bauxite, aluminium and cement rose at a gentle pace, with increases of between 20% and 60% during 2000-2008 (See Figure 4.4). On the other hand, prices for iron ore almost tripled during the same period. Prices for iron and steel scrap and copper more than tripled, with an average yearly increase of 17% during this period. While the economic crisis of 2008/9 had a significant impact on the prices of metals, some metal prices, such as copper and iron ore – have recovered to near pre-crisis levels.

Figure 4.4: Price indexes of selected raw materials (2000=100)



Source: United States Geological Survey (USGS).

4.2.3. The EU's supply from a global perspective

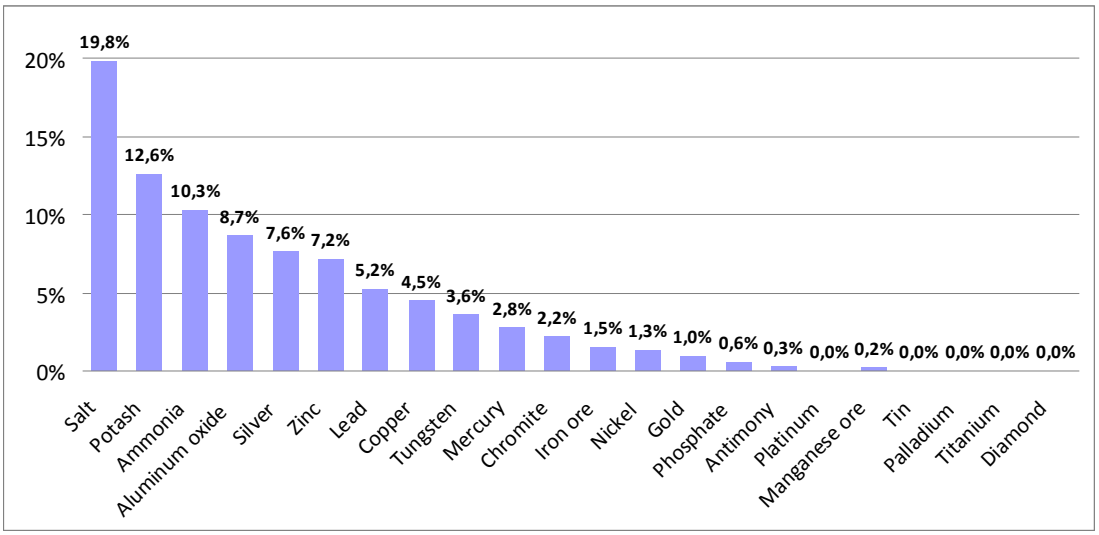
The supply of non-energy, non-agricultural raw materials is described as relatively inelastic in the literature. This is mainly the result of long lead-times in the mining and recycling industry. Investments in the extractive industries are associated with high capital intensity and a long-term payback characteristic, often involving substantial risk.[19] Furthermore, investments are very often influenced by

[18] OECD (2010a).
[19] UNCTAD (2007), p. 83.

environmental considerations and political decisions. This is one of the reasons why supply does not immediately respond to changes in demand, since weak price signals can leave a 'legacy of underinvestment' reaching years into the future.[20] The resulting lag in the response to growing demand can translate into temporary supply gaps.

The second pillar of the EU's Raw Material Initiative focuses on fostering sustainable supply within the EU. Figure 4.5 indicates the share of the EU-27 in world mining production for a set of minerals and metals.

Figure 4.5: Share of EU-27 in world mining production



Source: IDEA Consult based on USGS.

For most mining materials, the EU-27 only accounts for a small share of world mining production. Only for salt and potash is mining production in EU-27 on a global scale, with shares of 20% and 13% of world production, respectively. For some critical raw materials, EU-27 share is below 5% (tungsten) or even non-existent (antimony, manganese, platinum). Due to price increases, the return on investment of recovery and recycling of certain materials has changed over recent years, especially in Europe and North America.[21]

Within the EU, several countries are quite significant producers, yet in terms of global supply the amounts produced are relatively small. Austria was estimated to have been the fourth biggest tungsten producer in the world in 2009. Portugal is also a significant producer of tungsten. Poland is the EU's biggest producer of silver, and also quite active in producing of copper, zinc and lead. Ireland is the EU's largest producer of zinc. Sweden has a variety of raw materials. It is the leading producer of iron ore in the EU, and also processes lead, gold and zinc, too. Bulgaria and Spain are also quite significant producers of gold. Within the EU, Germany produces most of the potash and the largest amount of ammonia and salt.

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20 J.P. Morgan (2010).

21 A good example is platinum: global recovery from car catalysts has risen by more than 10 % every year since 2006, with 39 % of this secondary platinum produced in Europe in 2009.

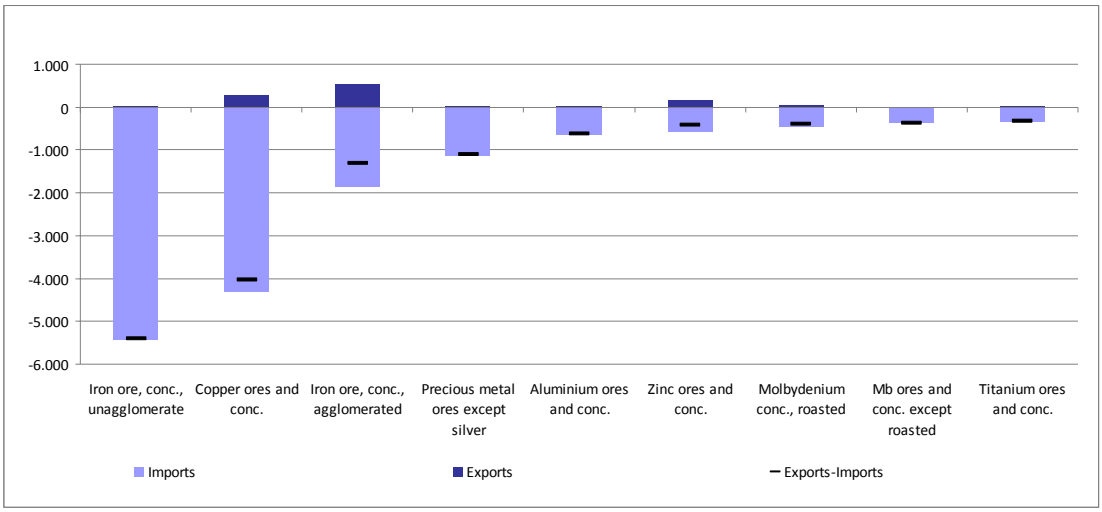
4.2.4. Trade flows

The literature on trade and global supply chains highlights the highly uneven distribution of metal and mineral reserves across countries as a key contextual factor (see for example OECD 2010a). Large shares of important raw materials are concentrated in a relatively small number of countries and other economies have limited domestic supplies and therefore depend on imports. Some of the major producers and exporters of raw materials are located in developing economies. The global supply chains for essential raw materials have become increasingly complex and interdependent, which leaves supply relatively vulnerable. The vulnerability of industry can be assumed to be greatest in sectors unable to replace scarce and expensive raw materials with more abundant and cheaper materials with similar properties (Angerer et al., 2009). The unequal distribution of raw material reserves is also considered to be an important source of trade friction.

4.2.4.1. Trade data

The trade balance for raw materials in the EU-27 leans strongly to the import side (see Figure 4.6 and 4.7.). For the main raw materials, unagglomerate regards the most important materials, such as unagglomerated iron ore and copper ore, imports surpassed USD 5 billion and USD 4 billion in 2009, respectively. Imports of agglomerated iron ore and precious metals each amounted to more than USD 1 billion in 2009. Other important imports, surpassing USD 300 million in 2009, are ores from aluminium, molybdenum and titanium ores.

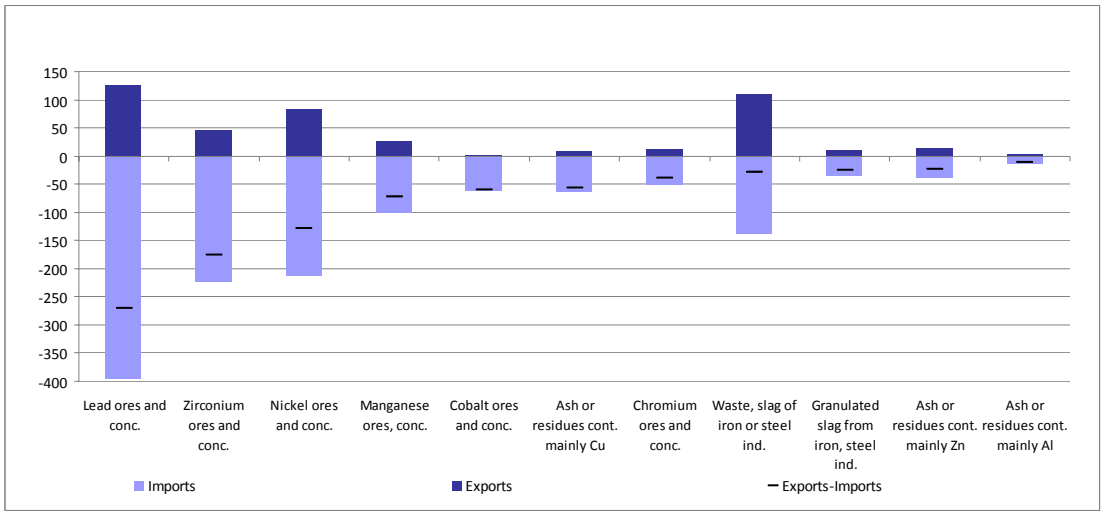
Figure 4.6: Exports and imports of raw materials in the EU-27, 2009 – part 1



Note: values are in million USD.

Source: UN Trade data.

Figure 4.7: Exports and imports of raw materials in the EU-27, 2009 – part 2

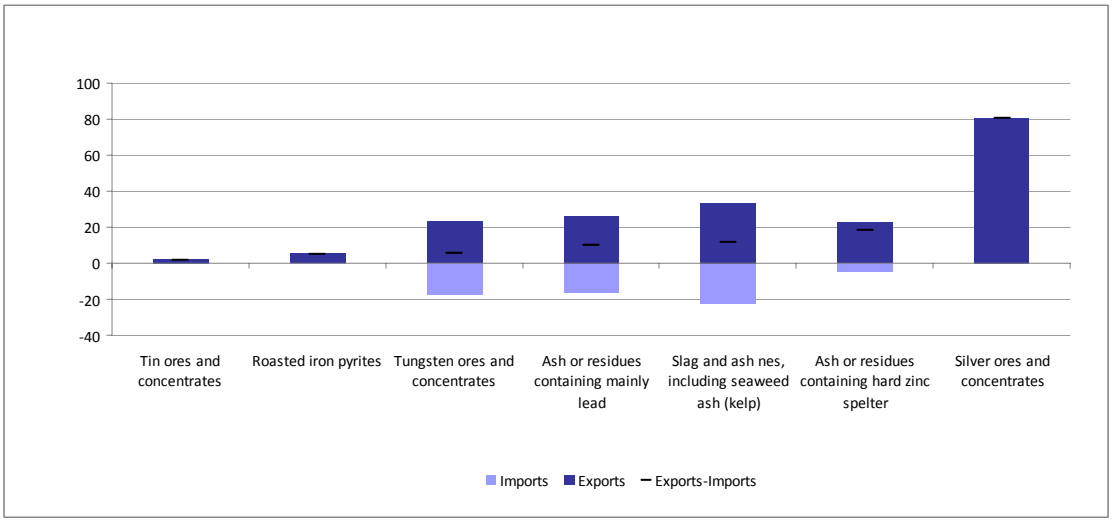


Note: values are in million USD.

Source: UN Trade data.

Within the EU-27 some materials have a positive export balance. However, these balances are much smaller than the positive import balances. Silver has a positive export balance amounting to USD 80 million. Other materials with a positive balance sheet are tungsten and some slag and ash materials (Figure 4.8).

Figure 4.8: Exports and imports of raw materials in the EU-27, 2009 – part 3

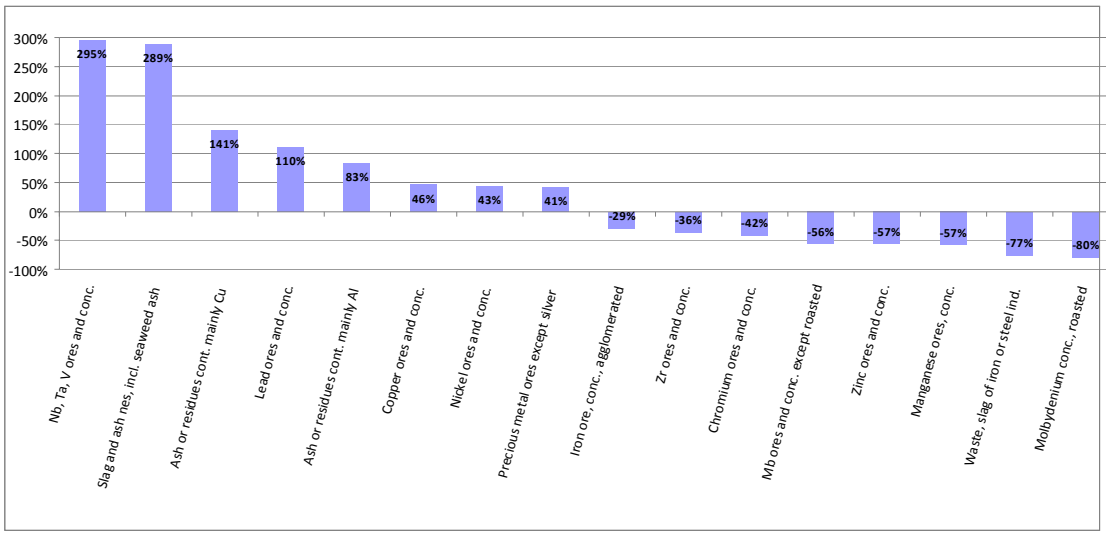


Note: values are in million USD.

Source: UN Trade data.

Over time, it is worth noting that between 2005 and 2009, net imports of some materials into the EU-27 increased strongly (Figure 4.9). This was the case for 'niobium, tantalum and vanadium ores', and for some ash and slag materials. Net imports of lead ores, copper ores and nickel ores also increased. On the other hand, net imports decreased for certain materials - roasted molybdenum concentrates and waste of iron, - and certain ores - zirconium, chromium, zinc and manganese.

Figure 4.9: Relative evolution of imports-exports in the EU-27 between 2005 and 2009

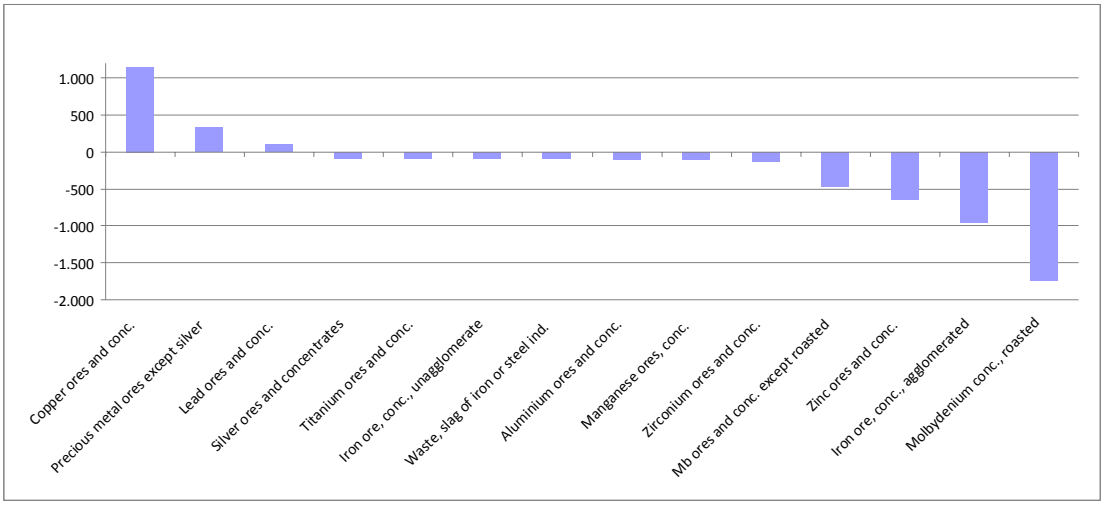


Source: UN Trade data.

Figure 4.10 presents the largest changes in absolute net imports were seen evolution the case of copper with an increase of more than USD 1 billion, and in the case of iron with a decrease of more than USD 1 billion (both agglomerated and unagglomerated) decreased in the same value.[22] Net imports of most materials decreased between 2005 and 2009, by USD 600 million for zinc ores and by USD 500 million for molybdenum ores.

[22] The significant increase in copper imports during this period can be partly explained by the boom in the construction sector, which is the largest user of copper in Europe. The substantial decrease in iron ore imports can be linked to the falling demand for raw materials in the manufacturing industry, especially in the automotive sector, during the crisis.

Figure 4.10: Absolute evolution of imports-exports in the EU-27 between 2005 and 2009



Note: Values are in million USD.

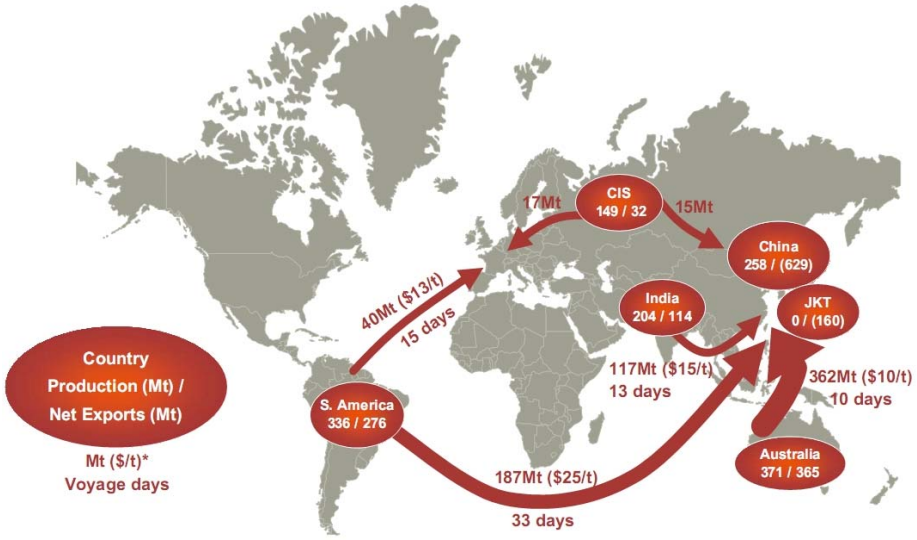
Source: UN Trade data.

4.2.4.2. Trade of iron ore, critical raw materials and rare earths

Iron ore, critical raw materials and rare earths are especially important for the sound functioning of European industry. It is worth taking a closer look at global trade in these materials.

Iron /steel is a very important metal being used widely many sectors. The major flows of iron ore are from the two major production regions (South America, notably Brazil, and Australia) to the major consuming region (Asia, notably China, Japan and Korea) (see Figure 4.11). The two producing regions export a large share of their production. Another important producer, India, only exports half of its iron ore production, being an important consumer too. Europe, with a very low production rate (see Figure 4.4), imports mainly from South America and the Russian Federation. China, as an important producer, has no substantial exports of its iron ores. In fact, China needs to import iron ores from Russia, Australia, India and South America.

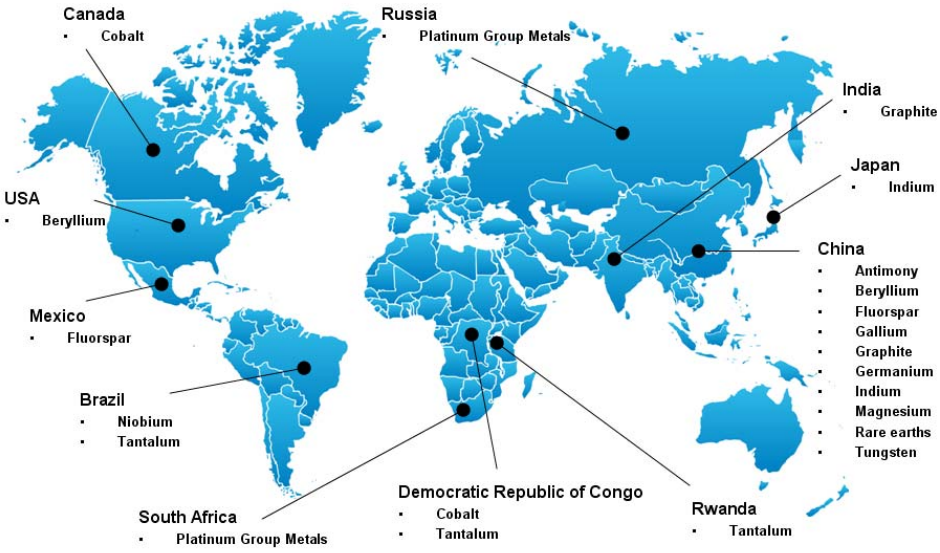
Figure 4.11: Major trade flows of iron ore, 2009



Source: adapted from www.bhpbilliton.com

The above overview of certain selected critical raw materials (see Figure 4.12) shows the high dependency of European industrial countries on other countries, very often third world countries or emerging economies. By far, the most resource-rich country in this respect is China. This country is the world's top exporter of rare earths, graphite, magnesium, antimony and fluorspar. Moreover, it has the largest reserves of rare earths, tungsten, graphite and antimony. Other important countries for these resources are Russia, DR Congo, South Africa, Brazil and Mexico. European dependency can be observed in the import column: very often, the most industrialised countries (Germany, France, Spain, Italy, UK, the Netherlands, Austria and Belgium) are among the top 15 importers.

Figure 4.12: Production concentration of critical raw mineral materials, 2006

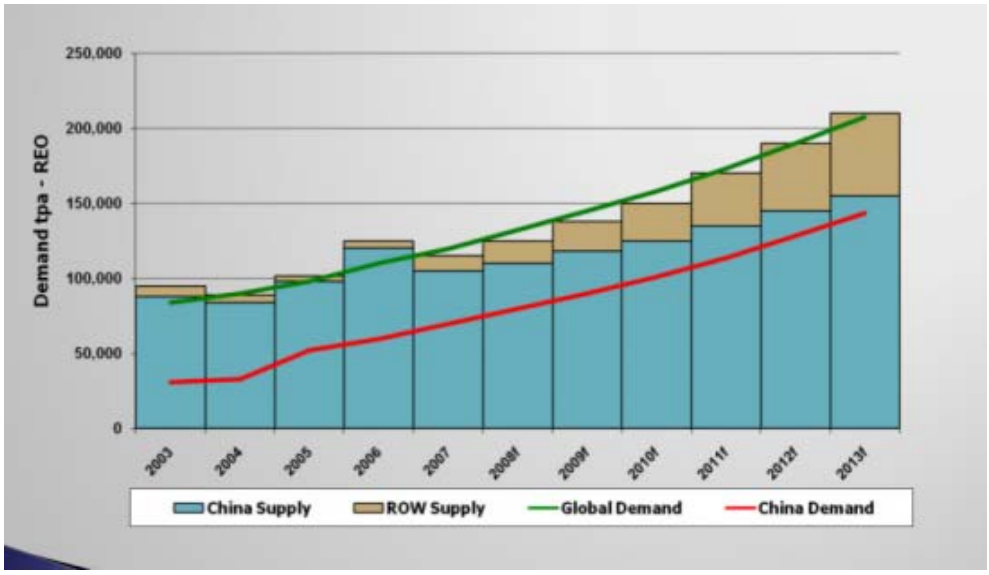


Source: Press release by European Commission MEMO/10/263 on 17/06/2010.

Recent trends often show a similar picture. Following the economic downturn, demand for these critical raw materials fell on a global scale. In 2010, global demand started to increase again, driven by emerging countries, resulting in price increases in general. Combined with the fact that technological evolution is further pushing demand for some of these critical raw materials (graphite, rare earths), prices for 2011 are expected to soar to levels far above those before the economic downturn. Mining projects are (re)starting production and new mining opportunities are being explored worldwide (magnesium, fluorspar, cobalt, antimony). Only in the case of cobalt is production likely to outpace demand, possibly resulting in lower prices.

Rare earth elements[23] are widely used in a variety of applications that are growing on a global scale, such as cell phones, computers, electric and hybrid vehicle motors, wind turbines etc. Rare earth elements are relatively plentiful in the earth's crust;. However, it is difficult to find them in sufficient concentration in places where they can be profitably mined and processed. China, with the most abundant resources in the world, dominates the world market and exports the largest amounts of rare earth compounds and metals, followed by Austria, Japan, Russia and the USA. In recent years, the biggest importers of rare earth have been Japan, USA, Germany, France and Austria. Figure 4.13 shows that global demand for rare earth is expected to outpace Chinese supply if current trends continue. To meet this demand, production and supply by the rest of the world should further increase during the following years.

Figure 4.13: Supply and demand for rare earths, assuming current trends continue



Source: Industrial Minerals Cooperation, http://www.industrialmineralscorp.com.au/ accessed on 2nd February 2011.

[23] Rare earth elements are a collection of 17 chemically similar metallic elements. The term 'rare earth' is a misnomer arising from the rarity of the minerals from which they were originally isolated.

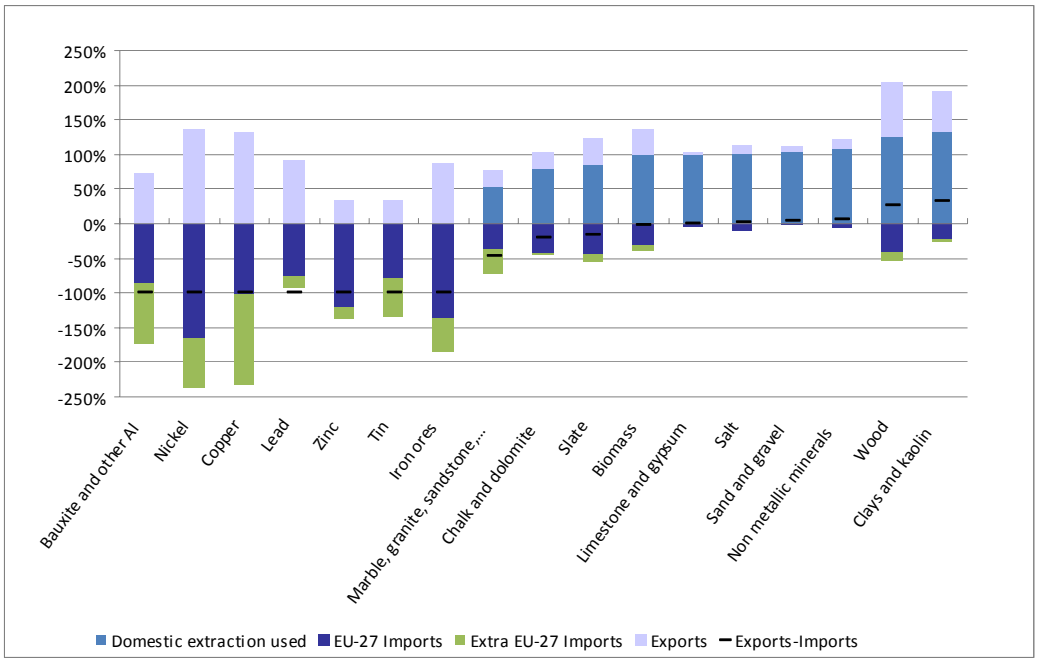
4.2.5. Import dependency: evidence from material flow data from Germany and the UK

A natural question to ask after having discussed the limited supply of non-energy, non-agricultural raw materials in Europe, its relatively large net import rates, and the EU's recovery prospects is to what degree can the EU´s material requirements be covered by own supply. It is clear from the analysis in previous sections that the answer in general is relatively little. However, a more precise answer can be given on the basis of material flow data. These data are shown for two major economies in the EU: Germany and the UK.

Material flow data from Germany and the UK show a 100% import dependency for a range of raw materials, such as bauxite, alumina, nickel, copper, lead, zinc, tin and iron ores, as there is virtually no domestic extraction that can be used in domestic industries. Germany imports substantially higher shares from inside the EU-27 in comparison with the United Kingdom.[24]

For certain materials, domestic extraction has to be supplemented by imports. In Germany, this is the case for marble and granite, chalk and slate. In Germany, domestic extraction fills up the domestic needs for limestone, salt, sand and gravel and certain non-metallic minerals, while there is an extraction overabundance that can be exported for wood and certain clays.

Figure 4.14: Domestic extraction used, exports and imports as a percentage of domestic material input, Germany 2007



Note: DEU: domestic extraction used which is the total amount of the domestic mining/quarrying extraction used in domestic industries or for export. DMC: domestic material consumption:, which is

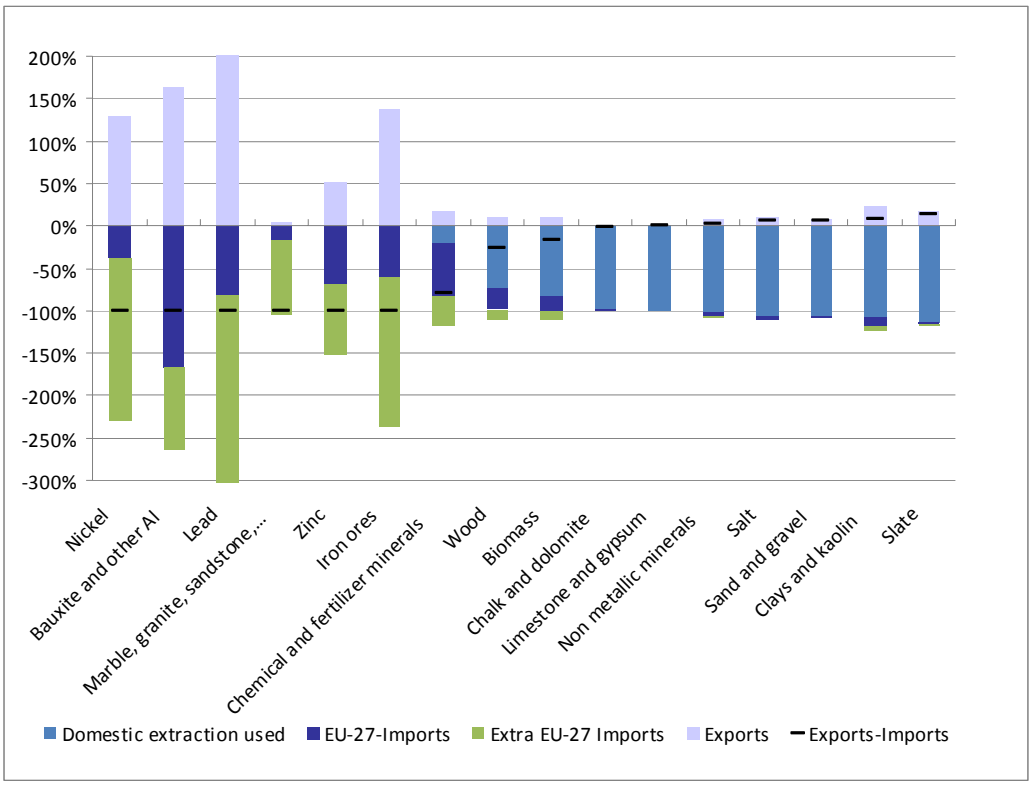
[24] However, it should be noted that these intra-EU-27 imports may be re-exports from EU countries. The recorded exports of Germany and the UK of these materials are also re-exports.

the total of the domestic extraction used and the difference between imports and exports, which is the total amount used of a certain material in domestic industries.

Source: Eurostat, Material Flow Accounts.

In the UK, however, significant amounts of fertiliser materials, wood and biomass are available from domestic sources, though additional imports are needed. Domestic extraction meets domestic demand for chalk and limestone. Small surpluses can be exported in the cases of salt, sand and gravel, certain clays and slate.

Figure 4.15: Domestic extraction used, exports and imports as a percentage of domestic material input, United Kingdom 2007



Source: Eurostat, Material Flow Accounts.

4.2.6. Secondary raw materials and recycling

A substantial increase in world output has boosted the demand for raw materials used for industrial and manufacturing purposes. At the same time, the quantity of waste produced has risen, so the potential to use more secondary raw materials as inputs has also increased. As the previous section reports, although the EU's global position is relatively modest as a supplier of primary raw materials, in terms of secondary raw materials, there is still substantial potential.

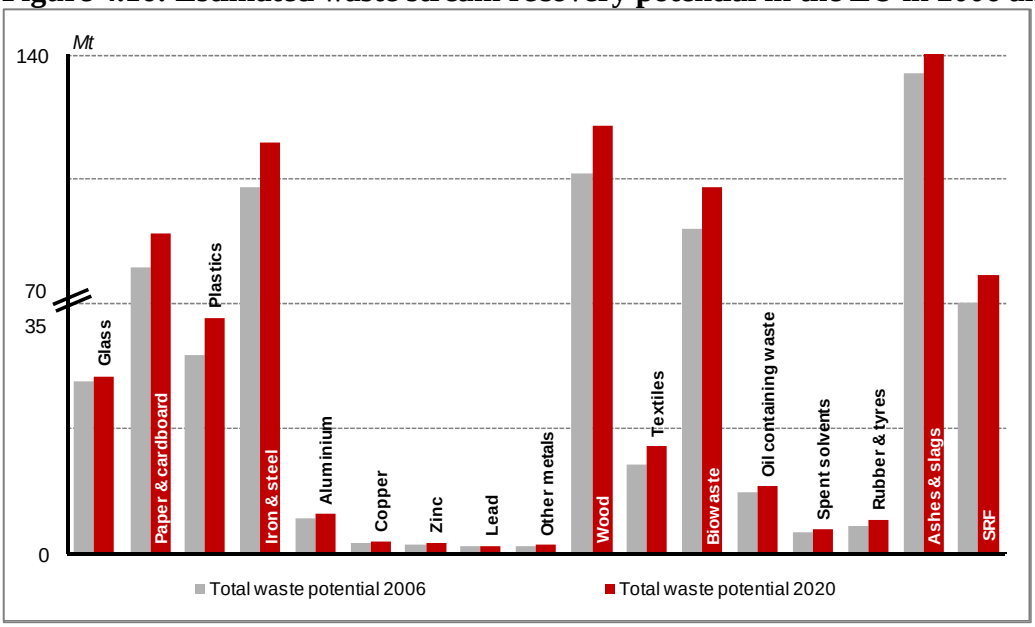
Recycling has often been identified as an important component of improved and sustainable resource management. Together with the development of substitute materials, recycling and improved resource management may reduce the current global population's current resource footprint, implying a decoupling of economic growth and environmental impact.

As regards the recovery and reuse of raw materials good waste management is a crucial point. The EU has seen a significant change in waste management in general,

driven by EU and national legislation[25] and supported by rising prices for both energy and non-energy raw materials.

Birnstengel and Hoffmeister (2010) estimated that in 2006, 23 % of the EU's total waste stream could be recovered as secondary raw materials, amounting to 675 million tonnes. Somewhat more than half was actually being recovered for energy and material, leaving 45 % of the potential still largely unused, mainly dumped as landfill or incinerated without energy recovery. Figure 4.16 indicates the EU's recycling potential for each of the 17 identified waste streams for 2006 and projections for 2020. It is evident that the potential differs across waste streams. The biggest potential is found for paper, plastics, bio-waste and wood, but also for iron and for ashes and slag.

Figure 4.16: Estimated waste stream recovery potential in the EU in 2006 and 2020

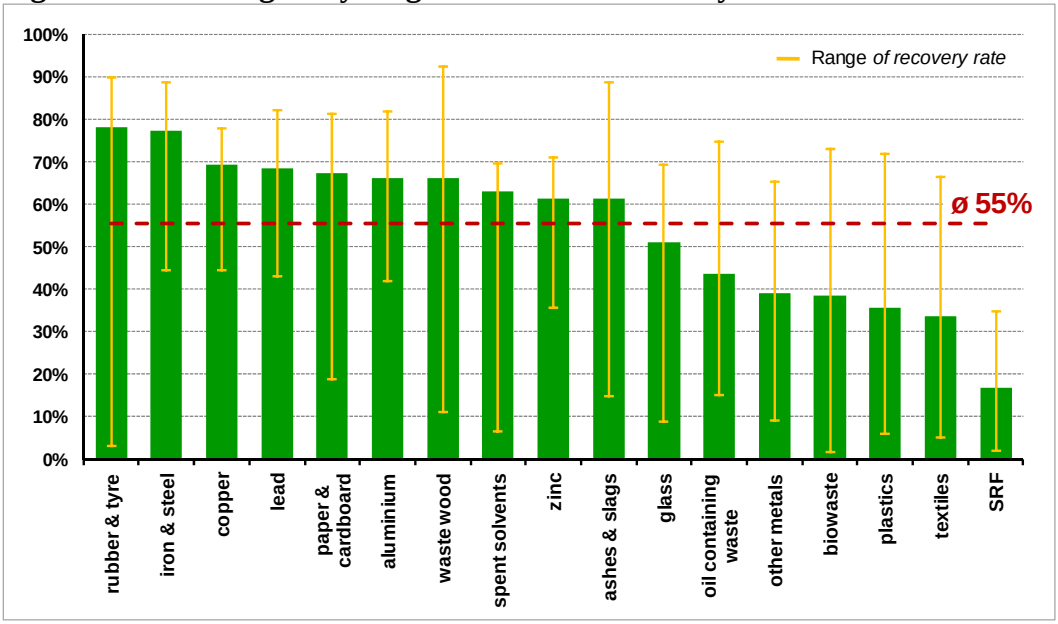


Source: Birnstengel and Hoffmeister (2010).

To a certain degree, the potential depends inversely on the actual EU recovery rate. However, the variance across Member States also plays a role. Ceteris paribus, the higher the variance, the higher the potential. Figure 4.17 shows the EU recovery rate per material and the range of recovery rates across Member States. One can observe that for the major raw materials (rubber and tyres, iron and steel, copper, lead, paper and cardboard, aluminium, solvents, zinc, glass and ashes) the recovery rates are more than 60 % for the EU as a whole. For other metals, plastics and textiles, recovery is still on the low side.

[25] For example: the setting of targets for recycling, landfill taxes and restrictions etc.

Figure 4.17: Average recycling rates for the EU-27 by waste stream in 2006



Note: the yellow whisker plots indicate the ranges over the Member States. The green bars indicate recovery rates for the EU-27 as a whole.

Source: Birnstengel and Hoffmeister (2010), p.4.

One may conclude that for certain metals and minerals there is still substantial untapped potential within the EU as a whole for the recovery of non-energy raw materials.[26] Conversely, for other materials such as copper, aluminium, lead, zinc as well as 'other metals', recovery is gradually reaching its full potential.

4.3. Qualitative analysis results

The following section complements the statistical evidence with qualitative information from expert interviews for a selection of industries. They were selected through an iterative process, starting with a literature review, followed by inquiries among experts for an independent view and subsequently discussions with industry representatives.[27] In this section, the positions of the selected sectors in the value chain are first identified, then the main competitiveness issues with respect to raw materials shortages are discussed. Following this, policies related to each sector and the role and challenges of the European non-energy extractive industry are illustrated, since the industry plays an increasing role in reducing dependency on imports of raw materials.

4.3.1. Interrelation of the selected industries in the value chain

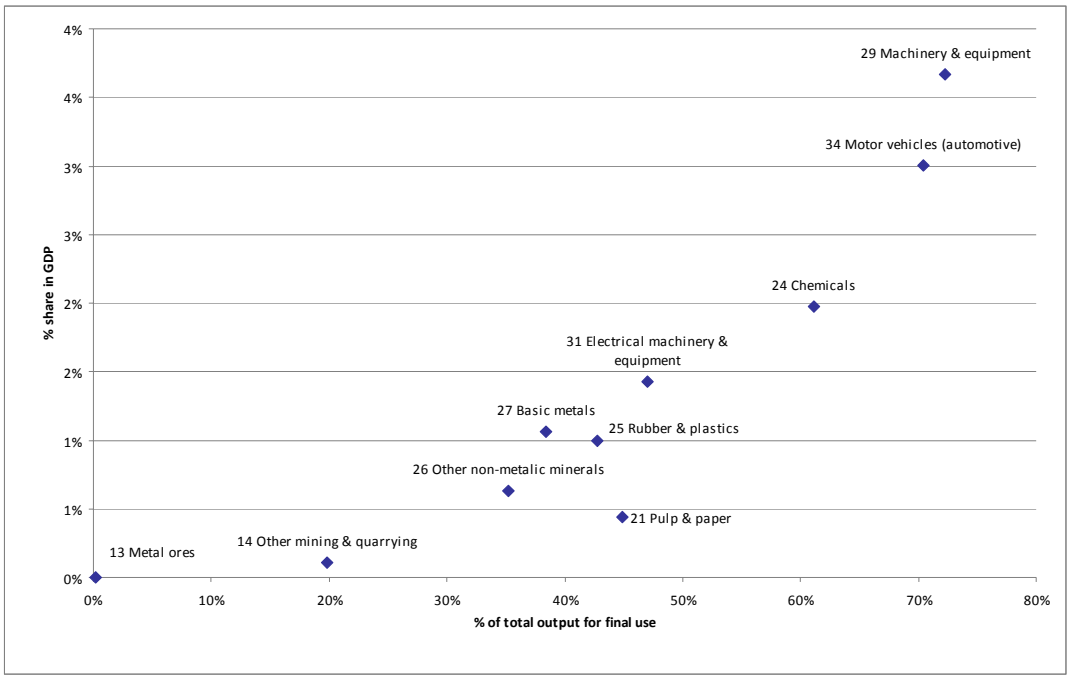
An important aspect is the interrelation of the raw material intensive industries and the way in which raw materials risks and consequences pass through the value chain. To give an example, the Figure 4.18 for Germany presents the share of the selected

[26] For recycling rates for metals, various recycling metrics and current estimates on global end-of-life recycling rates, recycled content, and old scrap ratios, see UNEP (2011).

[27] For the list of interviewed persons see References.

industries to GDP and their position in the value chain. The latter is calculated as the percentage of output produced for final use.[28]

Figure 4.18: Location of the selected industries in the value chain – Germany 2007



Note: the numbers refer to the NACE classification.

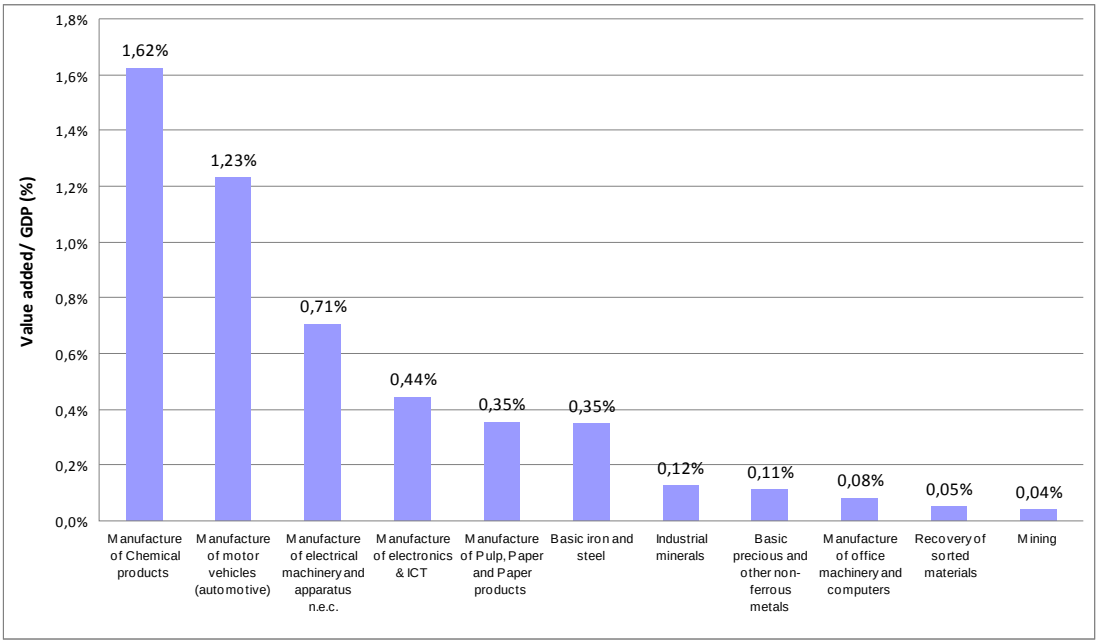
Source: IDEA Consult based on Eurostat: symmetric input-output table for Germany, 2007.

An important observation is that industries higher up in the value chain contribute to a larger degree to the economy's GDP. While in certain EU Member States such as Sweden, metal ores and other mining and quarrying might have bigger weights in the economy, it is characteristic for EU economies that these activities account for relatively small shares in overall GDP.

In order to present a picture closer to the situation of the EU-27 and to the selected sectors discussed later, Figure 4.19 shows the % share in GDP for the EU-27 as a whole. In general, one can observe a similar pattern for the EU-27 as for its largest economy, in terms of relative position. Yet there are a few important differences. The German economy has relatively higher shares for most of the selected sectors. The share of machinery and equipment is much lower for the EU as a whole than for its main economy. Based on the economic importance of the manufacturing sectors and their high raw material intensity, the impacts of shortages of raw materials on the steel, non-ferrous metal, automotive, chemical as well as paper and pulp industries will be investigated in the next section.

[28] Since no input-output table is available for the whole of the EU-27 (or even part of it) the results for the largest industrialised economy are presented.

Figure 4.19: Share of selected industries in the EU-27 GDP, 2006



Note: 'Basic iron and steel', 'Basic precious and other non-ferrous metals' and 'Recovery of sorted materials', based on data 2008.

Source: Eurostat.

4.3.2. Raw materials insufficiency and related competitiveness issues

The competitiveness effects of non-energy raw materials on the selected European industries are illustrated in this section. Two main competitiveness issues can be identified in terms of raw materials shortages. The first concerns cost competitiveness effects on essential raw material inputs for production, stemming from different sources, such as increasing global demand, trade restrictions, transportation costs etc. The second issue concerns the solutions and strategies that industries tend to adopt to tackle the relative shortage of raw materials, including increasing material efficiency, using recycled and substitute materials, as well as choosing various organisational strategies. Finally, the policy implications relevant to each industry are presented.

4.3.2.1. Cost competitiveness effects

The input effects resulting from shortages of raw materials differ across industries, not only in terms of subject, but also in terms of weight. The price increase in globally-traded raw materials has hit most industries, ranging from steel and non-ferrous metals, to sectors such as car manufacturing. There are several reasons for rising input costs for raw materials. Those most important for the sectors selected will be illustrated here.

First, prices for most raw materials have been escalating over the last decade (see section 4.2.2). Prices of raw materials depend mainly on the time lag with which supply follows demand. Increasing demand from emerging countries has been a major factor accounting for the rise in prices. Clearly, these lagged adjustments have an important effect on price levels and there volatility.

Second, besides supply scarcity and adjustments, supply concentration is also a factor in determining prices. A large share of many raw materials is concentrated in a small number of countries, which often apply export restriction measures.[29] Export restrictions lead to a decrease in export volumes, thus affecting global competition and supply chains. Export restrictions contribute to pushing up international raw material prices due to curbs on supply to the global market, while domestic consumers of raw materials enjoy lower input costs for production. Certain countries often support their domestic industries by offering them lower prices for raw materials (and energy). So the gap between domestic and international prices provides an artificial cost advantage for domestic consumers[30].

Third, Europe faces a competitive disadvantage in terms of transport and trade costs for raw materials whose sources are concentrated in other continents, e.g. in Asia, Africa or South America.

Finally, the oligopolistic nature of production for many raw materials, as well as changing contract terms, also affects prices. Due to the relatively strong bargaining position of suppliers, the duration of contracts has been switched from long-term to short term, and negotiations take place more frequently. This leads to price volatility, and in many cases, price increases.

All of these dimensions may raise production costs directly or indirectly. When this increase is not equalled in other regions of the world, Europe's competitive position deteriorates. The more raw material-intensive an industry is, the stronger the effects on competitiveness are likely to be. The impacts of issues concerning raw materials can differ depending on their place in the value chain. Process industries such as non-ferrous metal industry are directly affected, while industries active further down the value chain, such as the car industry, undergo knock-on effects from the same raw material issues. The market structure and power relations between industries along the value chain determine the extent to which a shortage of raw materials is transmitted to downstream industries and, ultimately, to the final consumer. Below, selected sectors are given as examples to illustrate the related cost competitiveness effects.

- Steel industry

As one of the key sectors in the EU, the steel industry is a good example to illustrate the channels through which prices for the main input material for production have been escalating for the main input material. This puts additional competitive pressure on producers if costs to downstream industries and consumers can not be passed on. Rising costs for raw material in this sector stem from different sources such as the oligopolistic structure of the iron ore market, trade costs and unfair trade conditions.

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29 According to WTO, export restrictions are "a border measure that takes the form of a government law or regulation which expressly limits the quantity of exports or places explicit conditions on the circumstances under which exports are permitted, or that takes the form of a government-imposed fee or tax on exports of the products calculated to limit the quantity of exports."

30 OECD (2010a).

The steel sector is very dependent on the supply of raw materials. In 2010, costs of raw materials accounted for roughly 70% of total costs, and iron ore[31] for more than 40%. Even though the EU produces iron ore, a significant portion of iron ore needs (84%) is imported from overseas. Accordingly, costs of raw material have a considerable impact on profitability and strategic investment decisions.

Following a strong increase in market concentration over the last decade, three big suppliers[32] control the market for the supply of iron ore. Over a third of the world supply of iron ore and 67% of world seaborne iron ore are concentrated in the hands of these three major exporters. One of the consequences of this oligopolistic structure is that iron ore prices have outpaced mining costs significantly. Prices for iron ore are now about four times the cost of production (about USD 30.00/tonne) at main mines[33]. Producers' market power has increased significantly, resulting for example in the introduction of short-term contracts which transfer the price hikes, and associated risks, more easily further downstream in the supply chain. Since 2010, after a tradition that lasted 40 years, contract prices are set on a quarterly basis, reflecting a switch of power from the steel industry to the mining industry. As well as higher prices, the steel industry also faces price uncertainty. This affects the its ability companies to hedge against the risk of higher prices in future make forward-looking business plans, more generally.

As prices of iron ore are set globally, increased input prices would not necessarily create an advantage for countries with better access to iron ore. However, producers in regions with abundant reserves usually enjoy a strategic cost advantage over steel producers that need to import iron ore from abroad. The cost of raw materials in production has been highest for Western Europe, while Russia, India, South Africa and Brazil are among the most competitive steel producers in the world, partly due to local access to iron ore resulting in lower raw material costs.[34]

The competitiveness of the European steel industry is also affected by high transport costs for imported iron ore and other raw materials. According to Eurofer[35], transport costs represent up to 15% of the production costs. It is clear that countries with better access to raw materials have a competitive advantage because of lower transport costs.

Export restrictions are partly responsible for the limited supply of iron ore available or for higher prices on the global market. The forms of export restriction most often applied are export taxes and quotas, which have contributed to raising international prices for iron ore and scrap. Export taxes imposed mainly by emerging countries can range from between 5-20% for iron ore and 10-35% for scrap, pushing up international prices significantly. Additionally, emerging countries producing steel are

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31 Iron ore is the main input for steel industry. Other important raw materials used in steel production are coal, coke.

32 Rio Tinto, BHP and Vale.

33 Oxford Analytica (2011).

34 Russia has benefited from material cost advantages from all fronts, due to abundance of iron ore, coal/coke, scrap and energy. (SteelConsult International (2005)).

35 European Confederation of Iron and Steel Industries http://www.eurofer.org/index.php/eng/Issues-Positions/Transport, accessed on 14.07.2011.

also imposing export restrictions on the export of scrap, giving an unfair cost advantage to the local industry.

The combination of the above factors, basically pushed by the increasing demand from industrialising economies, has resulted in serious price increases for both iron ore and scrap. The cost structure of steel production has gone through a significant change. In 2005, the cost of iron ore in the production process for Western Europe accounted for slightly above 20% against an estimated 40% in 2010.[36] The extra costs and risks (because of difficult planning and hedging) are also problematic for the steel industry's customers, as costs are passed on down the supply chain as far as possible.

- Non-ferrous metals industry

The non-ferrous metals[37] industry can be characterised by competitiveness issues similar to those the steel industry faces. Trade restrictions and subsidies are often applied by countries producing raw materials. The industry incorporates a range of activities along the value chain, including mining, smelting, recycling and refinery upstream, and second processing and fabrication intermediaries further downstream. The products of the industry, non-ferrous metals, are important inputs for a range of economic activities, such as transport, mechanical engineering, aerospace, construction, packaging, electricity and energy, consumer electronics, medical devices etc.

The inputs needed by the non-ferrous metal sector include virgin metal ores and concentrates and recyclates. The European non-ferrous metal industry is highly dependent on the imports of these metals, including ores, concentrates and refined metals and scrap. Raw material costs can range from 49% to 85% of total production costs in the industry, depending on the subsectors and type of products. The balance of supply and demand determines the price of the metals on the exchanges.

The non-ferrous metal industry, like the steel industry is very often targeted by trade distortion measures, in the form of export restrictions, trade subsidies and state support in non-EU countries.[38] These measures, coupled with increasing global demand, have resulted in prices hikes and volatility on the global market. They result in relatively higher input costs and higher levels of uncertainty for the European non-ferrous metal industry. Several metal-producing countries, such as China, Russia, and Ukraine have applied trade restrictions on exports of many non-ferrous metals and their scrap, such as aluminium, copper, nickel and tungsten[39]. Export quotas and bans reduced export VAT rebates have often been placed on these materials. Export taxes on them typically range between 5 and 30%, depending on the producing country and the type of raw material.

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36 AT Kearney (2010).

37 Non-ferrous metals cover common metals (mainly aluminium, copper, zinc, lead, nickel and tin) and precious metals (gold, silver, platinum, and palladium) and minor metals (e.g. tungsten, tantalum, cobalt, and germanium).

38 Ecorys (2011a).

39 European Commission (2008a).

One of the most debated trade restriction issues has recently been the export quotas, export taxes and VAT refund imposed on rare earth exports from China. Rare earths are not non-ferrous metals, though they are sometimes used as inputs for non-ferrous metal production. World prices in these raw materials are currently typically 20-40% higher than Chinese domestic prices.[40]

In addition, indirect or direct subsidies, such as providing access to lower-cost energy for export-oriented smelters, or stimulus packages, ensure competitiveness advantages for the raw material producing countries, notably Russia and China.

- Automotive industry

The automotive industry, as a downstream industry, feels the indirect effects of limited access to raw materials. Due to rising raw material input costs in the steel and non-ferrous metals industry, it faces serious challenges, since cars are complex products consisting largely of steel, non-ferrous metals, as well as polymers, rubber and glass. The industry is also affected by the risk associated with the use of critical raw materials. As a result of the future developments in car-design, the demand for critical raw materials is expected to increase. Environmental standards and requirements and customer convenience play an especially crucial role here. According to the European Automobile Manufacturers Association (2010), the demand for rare earths and lithium will rise, due to more use of advanced electronics, magnetic materials, new surface treatment systems and alternative propulsion technologies.

Rising prices of raw materials may have a significant negative impact on the materials input costs of the sector, so customers are expected to face higher prices for end-products. A study on resource productivity[41] points out that if the prices of more raw materials inputs used in the car production go up, the product price for the final customer would also go up significantly.

- Chemicals industry

The competitiveness of the European chemicals industry is affected by rising prices for raw materials, and the emergence of newcomers better placed to benefit from control of advantaged feedstocks. The European chemicals industry is a significant supplier to other sectors and its competitiveness is highly dependent on imported raw materials, as these costs account for some 34% of manufacturing costs, while energy accounts for 2%. Oil and gas are the main inputs for the industry, so new players from oil-and gas- producing countries and emerging economies, especially China and India create challenges for the European chemical industry. The Middle East increasingly uses its favourable feedstock availability to develop its own integrated chemicals production chain, thereby strengthening its position in a wider range of basic petrochemicals. The European chemicals industry is gearing up to face the emergence of companies in the Middle East and Asia, where proximity of feedstock is considered

[40] OECD (2010d).
[41] European Commission (2007a).

is an advantage for chemicals producers, while developed countries try to leverage their traditional strength in technology and expertise.[42]

Trade barriers and unfair trade practices imposed by non-EU countries such as export restrictions, export taxes for ethylene feedstock, gas, palm oil, and key minerals (e.g. fluorspar), also create a substantial burden for the European chemicals industry.[43]

- Pulp and paper industry

The pulp and paper industry also faces challenges stemming from a shortage of raw materials, even though wood, the primary raw material for the industry, is widely available in Europe, especially in Finland and Sweden. The competition for raw materials in this sector is not primarily due to non-EU countries protecting their resources nor to the depletion of the materials. For wood, the challenge is due to the bio-energy industry competing for access to the material, facilitated by European environmental regulations, and by the difficult mobilisation of wood due to the small ownership structure of forests, biodiversity protection and varying efficiency levels in Member States' action plans. Furthermore, the rise in exports of recovered paper to non-EU countries creates an additional pressure on the industry. Industry representatives estimate that the supply of wood will not be able to meet demand for both industries (biomass and paper) at current rates.[44]

Raw materials consumption in the last two decades went through a significant change in the European pulp and paper industry. Use of wood pulp decreased more than 10 percentage points during this period, and was practically replaced by the use of recovered paper. In 2009 some 88% of wood came from EU sources (plus Norway and Switzerland), the remainder originating mainly from Russia. CEPI sees a gap of more than 200 million m^3 between supply and demand of wood by 2020 due to an increase both in traditional demand (e.g. paper and construction) and non-traditional demand (bio-energy).

4.3.2.2. Responses to shortages of raw material at industry level

Companies in different sectors have developed various strategies to reduce import dependency and to mitigate the costs and risks related to shortages of raw materials. These include more efficient use of materials, increased use of recovered and recycled raw materials, and use of substitute/alternative materials as well as organisational strategies such as outsourcing or relocation of the production process. From the long-term sustainability point of view, the first group of solutions are beneficial, while the others may have rather negative effects on European's growth and employment.

Resource efficiency, including raw material efficiency, is one of the most important challenges for European industry. Sustainable production has become an integrated part of EU industries' competitiveness strategy, albeit to various degrees, depending

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42 KPMG (2011).

43 Cefic (The European Chemical Industry Council) http://www.cefic.org/Policy-Centre/Industry-Policy/Access-to-Raw-Materials/, accessed on 05.07.2011.

44 Mantau U. et al. (2008).

on the technological possibilities and the markets in which the industries are operating (see Chapter 5).

Improving material efficiency is a constant objective for companies, since it leads to cost reduction and increased competitiveness. Material efficiency can be improved in the four main steps of product manufacturing, i.e. production of raw materials (e.g. exploration and extraction of raw materials); product manufacturing (streamlining different stages of production, using new production methods); use; and end-of-life[45].

Use of recycled materials can contribute to reducing dependency on primary raw materials, depending on the sector and products. Many raw materials in process industries can be replaced by others. This is especially important for critical raw materials, where abundant materials can be a substitute for potentially scarce and critical ones (e.g. indium for zinc).[46] Minimising losses of raw material, increasing the use of recycled and recovered materials, and substitute/alternative materials are of key importance in reducing primary raw material import dependency, thereby improving the competitiveness of European manufacturing industries. All of these dimensions are supported by the European Commission through initiatives such as the Factories of the Future Research Programme, Sustainable Process Industry Public Private Partnership, and European Green Cars Initiative, etc.

Insufficient supply and rising prices of materials force companies to invest in more efficient modes of production, which can reduce waste. Another increasingly used method, recycling has often been identified as an important component of a better, sustainable resource management. The European recycling industry is the most competitive in international comparison. There is considerable potential to increase the share of recyclates in European manufacturing sectors. However in the sectors selected, the use of secondary raw materials is relatively high compared to third countries. Recycled and recovered material has also been widely used in the EU steel industry, car manufacturing, and pulp and paper. The chemicals industry is different in the sense that the recovered and recycled chemicals and especially polymers (plastics) cannot be used to replace virgin raw materials. Focusing more on R&D efforts, substitute/alternative materials are being increasingly used in some downstream industries.

Various organisational strategies can ensure the supply of sufficient raw materials. These include integration along the value chain, relocation of production or outsourcing. The most common examples will be illustrated in the relevant sectors.

Below, these different responses to shortages of the raw materials are discussed in more detail.

- Steel industry

Resource efficiency and increased use of scrap could be a solution for problems arising from supply of raw materials for the steel industry. Steel is 100% recyclable Due to the long life of steel products, approximately 45% of steel produced in the EU

[45] European Commission (2010a) p.52.
[46] European Commission (2010a).

comes from steel scrap. In comparison, Chinese recycled scrap steel accounts for only 8% of total steel production, while for the U.S., the total is 33%.[47]. Increasing use of scrap steel in the sector makes it possible to reduce dependency on imported iron ore and contributes to sustainable production. However, the steel industry has to contend with the increasing export of scrap from the EU-27, while non-EU countries impose export restrictions on it. According to the criteria of the "End of Waste Regulation", scrap metal is treated as a waste product, so there are no export restrictions. EU-27 exports of ferrous waste and scrap more than doubled during the last decade, generating a significant loss of resources for the European steel industry.

There are several initiatives to increase resource efficiency (including material efficiency) in the steel industry. The European Steel Technology Platform (ESTEP), which brings together research and other institutions, the European Commission and Member States, was set up with the aim to give new impetus to European research into materials and processes. One of the aims of the ESTEP Research Agenda is to ensure more sustainable and profitable steel production in Europe through innovation and new technologies.

New production methods with electric arc furnaces (EAF) can use up to 100% scrap as input for steel. However, as scrap is scarce, partly due to European exports, its use is still quite low and the possibility of boosting the amount of steel produced with EAFs is limited. At present, research is being carried out into making use of secondary powder material (resulting from primary steel making) as a raw material alternative in EAF steelmaking. The breakthrough technology project of the steel sector (ULCOS) receives funding from Research Fund for Coal and Steel (RFCS) and the EU 6th framework programme.

Regarding organisational strategies to mitigate the effects of the oligopoly in the iron ore market, vertical integration is a possibility for steel makers to help tackle raw material scarcity. Traditionally, control over mining activities has often been led by smelters, and there appears to be a trend towards higher levels of vertical downstream integration between the mining and refining stages of production.[48] Backward vertical integration, investing in new mines or buying up existing ones, is often observed in the steel industry outside the EU as a strategy to ensure better access to raw materials and lower transaction costs.[49] Chinese steel companies, for instance, have been actively investing abroad in iron ore mining to secure supplies.[50] This international presence is increasingly facilitated by state support. But EU-based producers have also started to take initiatives for vertical integration, e.g. Arcelor-Mittal, the world's leading steel company, has secured in-house supply of almost half the company's iron-ore needs. For the EU steel industry, it is strategically important to ensure future access to raw materials through increasing vertical integration through acquisitions, mergers and joint ventures/partnerships. However, this option is possible only for

47 Ecorys (2011b).

48 UNCTAD (2007).

49 Ecorys (2008).

50 According to the National Bureau of Statistics of China, at the end of 2008 Chinese outward FDI in the mining sector (including other than iron ore mining as well) accounted for 12% of its total overseas FDI stock.

global players with the financial resources and the geological expertise to make such investments.

- Non-ferrous metal industry

Non-ferrous metals are infinitely recyclable. However, primary resources are essential to cover total demand and produce high-quality products. Recovery and recycling rates within the EU are among the highest in the world. Secondary raw material use in the sector has increased substantially. The two main sources of non-ferrous metal scrap for recycling are industrial waste streams and end-of-life scrap. While industrial waste is used efficiently, as regards the latter there is still much potential to increase use of end-life scrap. Regarding the most important raw materials in this industry, more than 70% of EU refined lead production stems from scrap metal, along with, nearly 60% of aluminium and over 40% of refined copper.

Recycling of scrap metal is essential to maintain the competitiveness of the EU non-ferrous metal industry. However valuable resources have been shipped to developing and emerging countries. This is one of the biggest problems the sector is facing. For example the EU has lost a significant amount of its own copper scrap resources, almost 1.2 million tonnes in 2009, of which nearly 80% has ended up in China. Rising demand for aluminium scrap is even more striking. In 2000, the EU was a small net importer, while in 2009, more than 1.1 million tonnes of aluminium scrap were exported. It is thus important to improve the Waste Shipment Regulation to reduce exports of non-ferrous scrap metal, particularly aluminium and copper.

R&D and innovation have an important role in improving material efficiency, developing new production processes and substitutions in the non-ferrous metal industry. The industry is constantly looking for cheaper substitutes with the same or better qualities than the originals. The European Aluminium Technology Platform, set up in 2005, is a key tool to ensure cost, eco- and material efficiency to support the competitiveness and sustainability of the largest subsector in the non-ferrous metal industry.

- Automotive industry

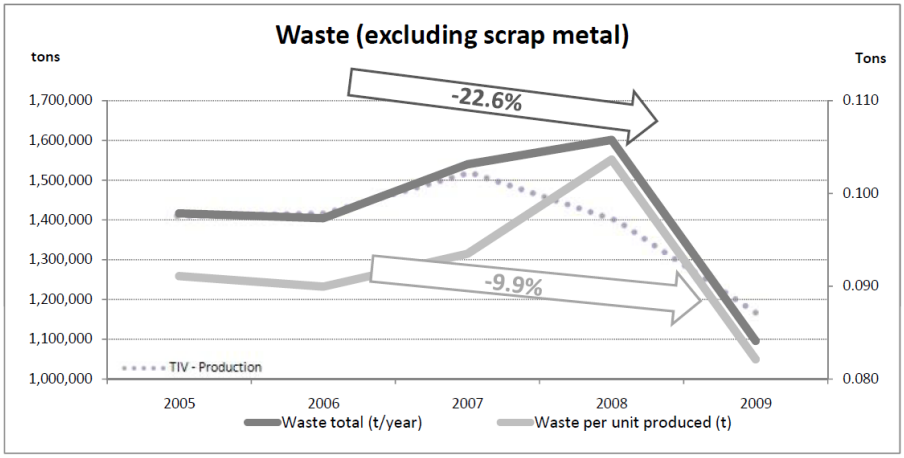
Since cars consist of numerous different parts, the automotive industry is one of the best examples to illustrate how soaring prices for raw material, along with lack of supplies and environmental regulations, have led to more efficiency and more use of non-primary raw materials. Resource-efficient technologies and the use of recyclates and substitutes are the two main strategies the automotive industry is deploying to reduce dependency on raw materials.

The industry is one of the most innovative sectors in Europe. According to ACEA, the sector spent more than EUR 26 billion or 5% of their turnover on R&D in 2009 and accounted for more than 50% of the global patent applications in the automotive sector. The industry files around 6,300 new patents each year in the following fields: materials technology, recycling, ICT and telematics, energy and fuels, drive-train development, aerodynamics and ergonomics. German auto manufacturers, a vital part of the European automotive industry, spent almost 10% of their total turnover on innovation purposes in 2009. Most of this was spent on improving product quality and

developing new technological solutions. According to statistics, only 6.8% of the expenditures on innovation led to cost reduction[51].

Resource-efficient technologies are increasingly being used in the automotive industry. Thanks to efforts by manufacturers to reduce waste in the period between 2005 and 2009 the total waste per unit produced (excluding scrap metal) went down by 9.9% (see Figure 4.20). The total waste in the sector decreased, by 22.6% over the same period.

Figure 4.20: Waste: excluding scrap metal



Note: Data refer to passenger cars.

Source: ACEA, 2009.

The recycling of scrap cars is of key importance, which is adequately regulated by the End-of-Life Vehicle Directive.[52] The Directive on Reusability, Recyclability and Recoverability of motor vehicles[53]set new requirements for vehicle recycling. In 2008 total reuse, recovery and recycling rates varied between 79.8-92.9% in the Member States, with Germany having the highest rate in Europe.

A technical approach to finding substitutions is at the core of the automobile manufacturing industry's R&D agenda.[54] ACEA estimates that the first significant volumes for recycling of electrical vehicles, which contain rare earths, cobalt and lithium, will come around 2025-2030 at the earliest. Demand for these materials is expected to boom around 2015-2020, so the industry hopes to have a new generation of batteries based on other materials by 2025-2030. To meet environmental, safety and price demands, the use of light, smart and innovative materials, such as composites, and the efficient use of high value-added metals will be inevitable in car manufacturing. Research activity focuses on materials such as carbon fibres, natural/glass fibres, high strength steel/aluminium, magnesium technologies, and hybrid materials.[55]

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51 ZEW (2011a).

52 ELV Directive 2000/53/EC, for an assessment of the ELV Directive see Chapter 5, Box 4.4.

53 Directive 2005/64/EC on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC.

54 The automotive industry is a prime sector in driving new technological developments. Because of its high R&D expenses, this industry is determining the directions of research in several area's', see Fraunhofer ISI (2003).

55 Ecorys (2011b).

The European automotive industry is involved in a wide range of collaborative European research and development projects. The European Council for Automotive R&D (EUCAR) plays an important role and provides automotive manufacturers with a platform for identifying common pre-competitive European R&D. Some innovative projects in the field of materials and manufacturing are worth mentioning, see Box 4.1.

Box 4.1: EUCAR Projects in the field of materials and manufacturing

Multi-level protection of materials for vehicles by smart nanocontainers The aim of the project is to develop new active multi-level protective systems for future vehicle materials. A multi-level self-healing approach will combine several damage prevention and reparation mechanisms within one system. These will be activated depending on the type and intensity of the environmental impact.

Multi-functional materials and related production technologies integrated into future industries: This project, which closed last year, aimed to introduce new materials and processes, to reduce cost and development time and increase customisation possibilities. The following achievements have been reported.
- weight reduction of 18% through flange reduction for laser welding of mass flow meter (MFMs)
- single part roof bow by stretch bending to achieve scability and re-use
- 44% increase of MFMs utilisation rate
- 2.7 kg weight reduction with nano-composits for the rear spare wheel well
- 20% increase of frontal passive safety through integration of APM foam into rails

MyCar Project enables an ultimate degree of customisation, which could allow every customer to purchase a unique vehicle. The project will further develop and integrate technologies that enable the vehicle assembly process to become self-adaptive to any kind of market variation, capable of producing cars with an extended degree of personalisation. MyCar aspires to integrate the customer into the automotive industry's assembly processes.

Adaptive Control for Metal Cutting project: This project aims to develop a generic modular adaptive control platform that will allow metal cutting processes to respond to changing circumstances. The main goals are:

- Robust production processes by optimizing the performance of machining processes;

- Reconfigurable production enabled at process level;

- Development of Adaptive Machining Systems for difficult metal cutting operations;

-Achievement of an online quality control system for mass customisation and small batch production.

Source: EUCAR, http://www.eucar.be/projects-and-working-groups/projects-and-working-groups, accessed on 06.07.2011.

However, from a general sector perspective, current critical raw materials might be substituted for various raw materials before they can be recycled. Yet the same materials might be in great demand for applications in other industries, which will then definitely require adequate recycling technologies as a valuable option to sustain future access to critical raw materials.

As regards organisational strategies responding to raw material challenges, outsourcing of manufacturing cars or car parts can be seen as an option to secure access to raw materials. This concerns not only rare-earths, but also aluminium where China has recently turned from net exporter to net importer.[56] Setting up part of the production in China and South-East Asia may enable access to raw materials at better prices. The European car manufacturers have increased production capacities in these emerging countries, which could enable access to input materials at a lower cost by avoiding export restrictions.

- Chemicals industry

Decreasing availability of raw material and increasing prices require raw materials efficiency in the chemical industry too. From economic and sustainability reasons, a decrease in raw material intensity is unavoidable.[57] R&D and innovation play a significant role. In general, the chemical sector is the most innovative industry. Its share of all EU manufacturing patent applications was 16% in 2007.

The industry is largely based on oil and natural gas, but due to material and cost efficiency concerns, the share of renewable raw materials[58] used in the manufacturing process has increased substantially. A broader use of renewable raw materials also contributes to reduce environmental impacts of the use of fossil fuels. However, using renewable raw materials means a challenge as regards competition for land use, due to increasing demand worldwide for biomass, food, fodder and bioenergy.[59] The chemical industry was estimated to account for around 8% of total feedstock use in the industry. There is still significant potential to increase the share of renewable raw materials in the medium and long term. Nonetheless, this process is dependent on developments regarding the overall availability of these renewable raw materials and the degree of economic viability of new production technologies. New processes in the industry, such as chemical leasing (see Chapter 5) or other new materials, such as CO_2 and other unconventional carbon sources open up new possibilities for the sustainable production of fine chemicals.[60] Furthermore, the European Technology Platform for Sustainable Chemistry supports chemistry biotechnology and chemical engineering R&D and innovation in Europe.

As regards organisational strategies the chemical industry can provide interesting examples. Resource-seeking FDI, securing raw material inputs at lower costs (though often coupled with other investment motives) is often applied by raw material intensive industries. Constraints for the further development of the chemical industry in Europe include existing trade barriers and unfair trade practices. These barriers may in certain cases prompt the relocation of activities from Europe to other parts of

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56 McKinsey&Company (2004).

57 In Germany, for example, raw material intensity in the chemical industry decreased by 26% between 1994 and 2007, and a target was set to reduce it by a further 32% by 2020.

58 Plant, animal and microbial biomass which are based on the photosynthetic primary production and are used by man outside the food and feed area for material or energy consumption. These include materials such as plant oils, animal fats, sugar, cellulose fibres, wood etc. (ETC/SCP 2010).

59 ETC/SCP (2010).

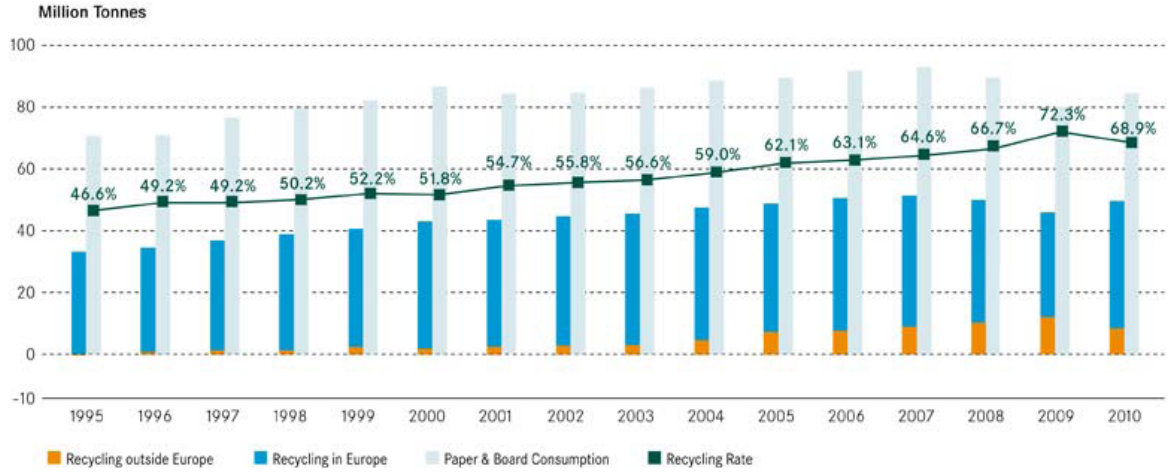
60 For instance, the FP7 NMP Work programme 2012 provides sources for research on production of fine chemicals from CO_2 directly or indirectly.

the world. This strategy provides access to materials under similar economic conditions to those enjoyed by he main global competitors.[61] Obviously relocation can be profitable for companies, yet is sub-optimal from a European growth and job perspective.

- Pulp and paper industry

Raw materials efficiency is one of the key drivers for the competitiveness of the EU paper and pulp industry. The European paper industry is the leader in collection, sorting and recycling of paper. The industry's recycling was 68.9% in 2010[62] and has risen substantially over the last 15 years. Recycling is thus relatively high in Europe compared to third countries (see Figure 4.21). Today, recovered paper accounts for 44% of total raw materials used in papermaking. This means a rise of over 16 percentage points, as compared to 2000. However, as is the case for scrap metal, paper recovered in Europe is increasingly exported, notably to China, where demand for pulp and recovered paper has been growing and the industry is subsidised. About 20% of the recovered papers go outside Europe per year, creating a significant loss for the European industry. The industry plans to increase the use of the recycled inputs within Europe instead of exporting these for use in the rest of the world.

Figure 4.21: European paper recycling



Source: Adapted from European Recovered Paper Council, Monitoring Report 2010, accessed on 29.06.2011.

Further improvement is now sought in the eco-design of end products to improve the efficiency of the recycling process. The Forest Based Sector Technology Platform was set up to assist the forest-based sector, including the pulp and paper industry and its shareholders in fulfilling their future research, development and innovation needs. For example, new technologies are being developed to improve the material and energy efficiency of recycling operations.

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61 For instance, due to current high import duties on bio-ethanol, the chemical industry finds it less expensive to produce bio-ethanol based chemical products outside Europe (e.g. Brazil) and export them to Europe with lower import duties due to the tariff harmonization agreement concluded in the Uruguay Round, even though bio-ethanol is the most important production cost factor.

62 Recovered Paper Council (2011).

4.3.2.3. Policy implications at industry level

The selected European industries are facing serious competitiveness challenges due to raw materials scarcity. They are affected by the distorted global raw materials market and/or by EU legislation and policy.

As regards the steel industry, challenges for European policy in the near future are to make the structure of iron ore supply more competitive, eliminate trade distortions in the supply of raw materials, and create breakthrough technologies towards low-carbon production. It is important that competition policy, including merger control, continue to be enforced in the iron ore supply market where the degree of concentration is already high. Continuing negotiations with resource-rich countries in FTA and WTO may lead to a more balanced trade situation. Furthermore, the EU should continue to promote recycling and to address obstacles to the development of recycling industries. Finally, it is advisable to continue and strengthen the support for investments in research through e.g. RFCS, Research Framework Programme or other funding instruments.

One of the two main issues considered as important for the non-ferrous metal sector is the quality of recycling, in terms of the processes to ensure optimum output. Despite increased recycling, another issue for the sector is access to primary materials (ores and concentrates) so that can respond to increasing demand and provide the required quality. For recycling, turnover time plays an important role. Policies that promote the collection and treatment of scrap and end-of-life goods are welcomed in this respect.

In a complex industry such as car manufacturing, the competitiveness issues are driven by a number of different factors. In the short term a greater and more immediate effect can be achieved by policies to stimulate, increased resource efficiency by improving production organisation and by promoting equal opportunity access to critical raw materials on international markets. Depending on the effectiveness of negotiations, trade policy can bear fruit as well in the relatively short term. In the long term the competitive position of European car manufacturing can best be promoted by supporting research and development efforts to achieve more extensive and more effective use of substitutes for critical raw materials and a greater general material efficiency in general. Policies promoting the recycling of critical raw materials can achieve a positive impact not only in terms of import substitution but also in terms of improving energy efficiency and limiting the environmental impact of the industry.

The EU chemical industry would benefit from further global tariffs dismantling and continued support and promotion of general WTO rules to address trade problems related to the discriminatory supply of raw materials. At bilateral level, the EU should continue to address the issues of unfair trade practices that cause imbalances in access to raw materials and world markets. It is desirable to continue to support the R&D, innovation and the further expansion of infrastructure in order to maintain and promote the technological advantage of the European chemicals industry. In particular support should go in particular towards increasing energy and resource efficiency, reducing CO_2 emissions and expanding the use of renewables. Although it is too early to envisage considerable substitution of fossil-based feedstock by renewables, it is desirable to support market developments towards renewable raw materials with the

focus on the sustainability of the markets for both inputs and outputs. Steps should be taken to define standards and criteria for products, including sustainability criteria.

Given the competing use of wood and land by other industries and for other purposes, it is advisable to stimulate integrated and prioritised land use policies at Member States level. At EU level, a balanced approach embracing different policy themes (waste, recycling, competitiveness and trade, raw materials and management of natural resources) should be considered in order to prioritise on objectives where overlaps occur and to clarify this towards all actors involved, e.g. by defining a cascading order of use. The European Commission has launched initiatives on these matters in the recent past. With respect to exports of recovered paper, waste paper should be recycled close to the place of consumption, keeping secondary materials within European borders.

4.3.3. The role of the non-energy extractive industry

The main company strategies and possible policy responses to tackle the scarcity of raw materials have been discussed in the previous section. Besides these, as the second pillar of the Raw Materials Initiative points out, the non-energy extractive industry has great potential to mitigate import dependency on several raw materials. It is therefore it is worth mentioning its role and the challenges it is faces in more detail.

The non-energy extractive industry can be divided into three main sub-sectors, according to the different physical and chemical characteristics of the minerals produced and on the downstream industries they supply:[63]

- construction minerals and aggregates
- industrial minerals, and
- metallic minerals

4.3.3.1. Challenges in the non-energy extractive industry

The micro-economic analysis[64] revealed that the current EU non-energy extractive industry is in a relatively good competitive position in comparison to the rest of the world. Overall its apparent productivity is higher and in contrast to most of the other industries, its profitability is comparable. This suggests that the EU companies in this sector provide a viable basis for further development and as such an avenue for alleviating some of the raw materials pressure for the downstream industries.

It is estimated that Europe still has significant extracting potential for non-energy raw materials.[65] In the past, given the low prices of raw materials, it was sometimes more profitable to import these than to extract them. That is why there are still several large

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63 See e.g.: http://ec.europa.eu/enterprise/sectors/metals-minerals/non-energy-extractive-industries/index_en.htm.

64 IDEA Consult (2011): Background report on the "Access to non-energy raw materials and the competitiveness of EU industry".

65 European Commission (2010a).

deposits, and there is potential to benefit from these. However, the EU cannot expect to be self-sufficient in providing for its material resource needs.

A number of concerns regarding the competitiveness of the non-energy extractive industry are emphasised by the industry and the European Commission.[66] These issues include the need for a more detailed and systematic monitoring of raw materials in Europe. Geological surveys are carried out at Member State level, yet mutual consistency, as well as the introduction of advanced techniques at EU level, such as GMES,[67] are essential for prioritising and defining further actions and would facilitate a co-ordinated joint knowledge base. Another challenge is the competing land use, mostly related to stringent environmental regulations, such as Natura 2000. Start-up costs are relatively higher compared to non-EU countries, due to relatively higher insurance requirements, more administrative regulations, and administrative fragmentation. The industry indicated that the EU financial sector is less inclined to invest in mining projects than counterparts in e.g. the U.S., Australia and Canada, where more financial expertise and capital is available.

4.3.3.2. The role of innovation in the future of the non-energy extractive industry

The non-energy extractive industry has viewed innovation in resource-efficient and sustainable production technologies as an important driver for its future competitiveness in Europe. There have already been important policy initiatives have already been taken such as the European Technology Platform on Sustainable Mineral Resources, which aims to modernise and reshape the European mineral industry to secure the future supply of/access to raw materials. It plans to do this by supporting the revival of exploration of Europe's mineral potential; developing innovative and sustainable production technologies; implementing best practices; reuse, recovery and recycling as well as new product applications; and creating European added value through RTD-based technology leadership, education and training.

New technology innovations help to overcome environmental and social objections to non-energy materials extraction in the EU. For example, through subsea mining exploitation of raw materials located deep offshore would contribute to solving the complex worldwide equation linking security of supply, sustainable development and industrial competitiveness. Intelligent Deep Mine provides eco-innovative and intelligent exploration and extraction. Optimising extraction and processing of resources throughout their lifecycle or using mines for geothermal energy production at the end of their life are all expected to contribute to sustainable raw materials extraction.

4.3.3.3. Policy implications

One of the major policy issues is working towards an integrated policy vision on developing of the EU non-energy extracting industry, to make it consistent with land use and environmental policies. The industry would expect this to improve the investment climate, especially since investments are typically long-term.

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66 European Commission (2007b).

67 GMES: Global Monitoring for Environment and Security, the EU's earth observation programme.

Much of the authority on mining and land use lies with the Member States. This is a barrier to the creation of a common policy on these matters. A clear European vision could steer Member States in their own policy choices in a coherent manner. That is why the European Commission sees its current role as a facilitator for the exchange of best practices.[68] A European Commission report entitled, 'Exchange of best practices in land use planning and permitting' (2010) presented best practices in the field of land use planning policies for minerals, the geological knowledge base and networking, and integrating subsurface information in GMES. In this respect, three practices are considered important in promoting investment in extractive industries:

– Defining a national minerals policy, to ensure that mineral resources are exploited in an economically viable way, harmonised with other national policies, based on sustainable development principles and accompanied by a commitment to provide an appropriate legal and information framework;

– Setting up a land use planning policy for minerals comprising a digital geological knowledge base, a transparent methodology for identifying mineral resources, long term estimates for regional and local demand and identifying and safeguarding of mineral resources (taking into account other land uses), including their protection from the effects of natural disasters;

– Putting in place a process to authorise mineral exploration and extraction which is clear and understandable, provides certainty and helps to streamline the administrative process (e.g. the introduction of lead times, permit applications in parallel, and one-stop-shops).

On the operational side of mining, the "time to permit" is a hindering factor. Continued dialogue between Member States to align the permitting process according to best practices in other countries is necessary. The system of one-stop shop system, for example, could be elaborated in all Member States.[69]

Insurance requirements are another concern. Aligning these with the actual size of the mine or quarry, rather than the eventual full size, to be reached only in the future, would considerably reduce capital requirements upon start-up.

Finally, promoting for R&D and innovation for sustainable extraction is crucial for this industry's (future) competitiveness.

4.4. Conclusions and policy discussion

The goal of this chapter was to gain a better insight into five aspects of access to non-energy, non-agricultural raw materials and the challenges involved:

1. global demand and supply

2. the competitiveness effects in the selected industries

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[68] European Commission (2011).

[69] University of Leoben (2004).

3. the responses given at industry level to raw materials challenges (including the role of recycling, R&D and organisational strategies)

4. the EU policies that can be developed

5. the role of the EU non-energy extracting industry in alleviating the EU industry's raw materials vulnerability.

The approach in the original research was mainly qualitative in nature, drawing on existing literature and data, and using inquiries among representatives of a selected set of EU sectors for which competitiveness effects were identified. The selection of the sectors was based on insights from the literature review, experts in the field and from the overarching EU association Business Europe. In contrast with existing studies, the specific focus of the present study was on the sectoral and competitiveness angle.

4.4.1. Competitiveness effects

The analysis made clear that the prices of raw materials have been increasing significantly over the long term with a dip during the financial crisis. For the industries surveyed, the share of virgin raw materials was significant ranging from one third in the steel sector to more than two thirds in the paper and pulp industry, chemicals and car manufacturing. Here, non-energy raw materials include not only metals and minerals, but also crude oil, gas and wood.

In comparison with the rest of the world, the micro-economic analysis[70] indicated that steel, non-ferrous metals and chemicals in the EU typically have higher productivity levels, yet end up with lower profitability rates. The trends along the (global) business cycle were usually similar. This suggests that EU companies on average face with relatively higher costs, which makes the issue of increased raw materials prices particularly sensitive. For other sectors such as the EU paper and pulp industry and EU car manufacturing, the profitability, patterns were more complex. In both sectors, a positive productivity gap with the rest of the world could be observed. Yet the EU paper and pulp industry showed a gradual decline in profitability while the EU car industry improved its profitability over time, unlike the companies in the rest of the world. In the car industry, raw materials issue has a different impact than in the paper and pulp industry. A potential explanation might be that there is more scope for the EU car industry to invest in R&D and innovation in trying to find substitutes for expensive raw material inputs. Moreover, the competitive use of wood by less regulated sectors (e.g. waste incineration) and the 'export leakage' of recovered paper due to high demand in the BRIC countries indirectly add to the costs of the paper and pulp industry.

Sector interviews confirmed that market concentration on the supply side contributed significantly to the price increase in raw materials, especially in the case of commodities such as iron ore, copper, zinc and lead. In the case of iron ore, one can observe an increased market power of the global mining companies. This is reflected in their imposition of short-term supply contracts on the steel mills, which in turn try to pass the resulting risks and price increases through to their customers, some of

[70] IDEA Consult (2011).

which are large players, such as car manufacturers, though the others are mostly small players, such as the metal working industry. The effects of market concentration can nonetheless be bypassed through company strategies such as vertical integration. Yet such a strategy that is not feasible for all companies in the EU, and certainly not for most SMEs.

An important aspect for the competitiveness for all selected sectors is the absence of a global level playing field in trade. Virtually all manufacturing sectors surveyed depend to a large extent on imported raw materials. Export restrictions on certain materials in BRIC countries, implicit subsidies, and soft loans place EU companies at a relative cost disadvantage. However, a switch to EU raw materials is often not possible, even though the EU is a global leader in the production of certain minerals. This is because the materials are not available in the EU or not in the specific grades required for product quality process efficiency.

4.4.2. The potential of recycling and innovation

In the investigated industrial sectors two main drivers for reducing dependence on primary raw materials can be identified. The first driver is purely economical, related to economic gains from material efficiency, reuse of recycled materials (such as in the steel, non-ferrous metals, pulp and paper and the car manufacturing industries) and use of cheaper substitute materials. The second driver originates in requirements imposed by safety and environmental regulations, which primarily stimulate recycling activities and resource efficiency, particularly in the chemicals and in the automotive industries.

When the industries described in this report are considered in terms of their relative performance in recycling, the steel, non-ferrous metals and paper and pulp industries are clear leaders. This is mainly due to two facts. First, metals and paper are highly recyclable products, where the quality and utility of the recycled material is almost the same as that of the virgin raw materials. Second, one should note the relative upstream position of these industries in the whole production value chain. There are a number of other downstream industrial sectors (such as car manufacturing, electronics, printing and publishing, etc.) whose end products are subsequently recycled. In the automobile industry, for example, the high degree of reuse and recycling is mainly driven by the high recycling capabilities of the upstream steel and non-ferrous metals industries.[71]

A more complicated situation with recycling is observed in the chemical industry. It possesses quite substantial chemical processing capabilities, which should allow it to perform many of the operations required for the recycling of chemicals. Nonetheless, the intensity of recycling in this industry is primarily driven by safety and environmental regulations, rather than by reuse and cost-saving factors.

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[71] However, not all upstream industries have a high recycling potential. The mining and extraction industry is situated at the very top of the value chain, which is precisely why the concept of recycling does not really apply in these industries. Recycling requires the presence of certain processing capabilities, which the extraction industry does not have.

What is the potential of the EU recycling industry in alleviating EU industry's raw materials vulnerability? Looking at the current situation with recycling in the EU, economic gains from raw materials recycling are relatively high in most of the industries considered. The additional efforts currently undertaken in Europe to expand the recycling activities are primarily driven by the environmental and safety concerns. Additional stimuli for recycling are created by regulations to reduce the CO2 and improve efficiency.

The untapped potential seems to lie more in improving framework conditions, which are linked with policy, and in applying the latest methods and techniques to increase resource efficiency. Examples are materials recovery from municipal solid waste, self-disassembling joints, and specialised plants for complex recycling. Also, promoting the use of product-service systems improves material efficiency and recycling performance as well as reuse. Another interesting avenue for achieving sustainable production is the organisation of local production activities within a setting of industrial symbiosis.

Regarding the potential of the EU recycling industry to reduce vulnerability with respect to raw materials likely promising developments may come from adjusting production technologies to ensure greater reuse and recyclability of raw materials, especially rare earths and energy-intensive materials. It is also worth stressing once again the importance of R&D and innovation, which play an important role in the future development of efficient production processes, recycling processes and substitute materials. Substitute materials are increasingly used in many sectors, such as the chemicals and car industries, and further development is expected, partly due to various research programmes.

One observation is the apparent dichotomy between the solutions presented in the, mostly academic, literature about sustainable production and the implementation and perceptions of industry. Close interaction between industry and research laboratories is therefore very important. However, case studies can be found on successful pilot projects for sustainable raw material use, there is still a wide gap between research findings and concepts and profitable implementation in a market economy/business context.

4.4.3. Policy discussion

Access to non-energy, non-agricultural raw materials can be facilitated by different policy tools. Based on the analysis and EU policy documents on the topic, some important policy conclusions can be identified.

Firstly, the internal consistency of existing regulations and directives at EU level should be ensured. This would promote better operational and regulatory environment for industries affected by the scarcity of non-energy raw materials. Otherwise pursuing one policy goal might hinder reaching another one. Internal consistency should be in line with sustainability objectives and policies, e.g. competing uses of materials or waste incineration versus recycling.

Secondly, in line with the first pillar of the Raw Materials Initiative, fostering a global level playing field in trade and investment is essential in order to ensure the fair and

sustainable supply of raw materials from international markets through strategic partnerships and policy dialogues. Developing strategic partnerships, such as the Africa-EU Joint Strategy Union, can contribute to the sustainable supply of raw materials from third countries while at the same time assisting these countries in reaching development goals. The EU can play a crucial role in creating win-win situations where both developing and developed economies benefit from the sustainable supply of raw materials. Alongside the European Commission, the European Investment Bank and other European development financing institutions will continue to support creating better conditions (e.g. infrastructure).

Pursuing policy dialogues as well as strengthening ongoing debates in pluri – and multilateral fora (e.g. G20, UNCTAD, WTO, OECD) is of key importance in order to tackle existing trade barriers. It is crucial to include raw materials issues, such as export restrictions and investments aspects, in ongoing and future trade negotiations. Speeding up the establishment of a mechanism for monitoring export restrictions and raw materials strategies in other countries outside the EU is essential. In particular, increased state intervention in former centrally planned economies, most notably China and Russia, is a concern. Here, industry interests are pursued at the level of diplomacy, rather than at company level on the market. European industry representatives therefore often call for a 'raw materials diplomacy' at the level of the EU, or the Member States. On the other hand however, fears are also expressed about overregulation and the side effects of policy intervention on the internal EU market.

Thirdly, regarding the second pillar of the Raw Materials Initiative, intelligent development of the further exploration and exploitation of European raw material resources can play an important role in obtaining certain materials for production. In this connection, building an innovative knowledge base of European resources and standardising geological data are of key importance. In the short term, it is feasible to increase synergies between national geological surveys. In the medium term, such synergies will help improve the European raw materials knowledge base. Furthermore, basing national mineral policies, based on sustainable development principles and an appropriate legal framework will facilitate access to European reserves. The exchange of best practices in land use planning policy, national mineral policy and mineral exploration and extraction authorisation processes is expected to contribute to the sustainable supply of raw materials within the EU.

Regarding the third pillar of the Raw Materials Initiative, encouraging and supporting R&D and innovation for substitutes, better recycling techniques and sustainable production (material efficiency) is of key importance in tackling the lack of raw materials for EU manufacturing in the longer term. Here the upcoming European Innovation Partnership on Raw Materials will play a crucial role. Developing new innovative materials can help reduce the use of critical, scarce or hazardous raw materials. Improved conditions for recycling and better recycling techniques, can reduce the cost of recycling, leading to the more efficient reuse of recyclable and renewable materials. Higher recycling rates will reduce the pressure on demand for primary raw materials. To achieve all this, better implementation and enforcement of existing EU waste legislation is crucial. Furthermore, strengthening the Waste Shipment Regulation is essential in order to prevent the illegal dumping of waste products, and reduce the transport of important secondary raw materials to developing countries, in particular.

From the competitiveness point of view, it is important to strengthen the industrial base in Europe. Specific skills development, R&D and innovation play a central role along the entire value chain, including extraction, sustainable processing, eco-design, substitute and new materials, recycling, resource efficiency and land use planning, in addressing the challenges posed by the lack of raw materials.

REFERENCES

ACEA (2009), *European Automobile Industry Report* 09/10.

ACEA (2010), *ACEA Position on the EU's Initiative on Raw Materials, the Sustainable Use of Natural Resources, and on a Resource Efficient Europe.*

Angerer, G. et al (2009), *Rohstoffe für Zukunftstechnologien Einfluss des branchenspezifischen Rohstoffbedarfs in rohstoffintensiven Zukunftstechnologien auf die zukünftige Rohstoffnachfrage*, Fraunhofer Institut für System- und Innovationsforschung ISI, 2009, 404 pp,

AT Kearney (2010), *Steel Challenge, Living with higher and more volatile iron-ore prices,http://www.atkearney.com/images/global/pdf/Steels_Challenge.pdf, accessed on 31.03.2011*

Bilsen V.et al. (2009a), *Study on the competitiveness of the EU eco-industry – Final Report Part I and II*, IDEA Consult/Ecorys, Published by the European Commission DG Enterprise & Industry, Brussels http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=3769&tpa_id=203&lang=en
http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=3769&tpa_id=203&lang=en

Birnstengel, B., Hoffmeister, J. (2010), *Needed Immediately! … an International Resource Management System*, Prognos AG, Berlin, 10 pp.

Bleischwitz, R., Bahn-Walkowiak, B., Onischka, M., Roeder, O. and Steger, S. (2009), *The relation between resource productivity and competitiveness. Part2: Resource productivity*, Wuppertal Institute for Climate, Environment and Energy, Project ENV.G.1./ETU/2007/0041 on behalf of the European Commission DG Environment, 155 pp. http://ec.europa.eu/environment/enveco/economics_policy/pdf/part2_report_comp.pdf

British Geological Survey (2010), *European Mineral Statistics 2004-2008*.

Bundesministerium für Wirtschaft und Technologie (2010), *Rohstoffstrategie der Bundesregierung*, Berlin.

Cabrera, N., Alcock, B., Loos, J. and Peijs, T. (2004), *Processing of all-polypropylene composites for ultimate recyclability*, Proceedings of the I MECH E Part L Journal of Materials: Design and Applications, 218(2), 145-155.

CEPI (2009), *Annual Statistics 2009*. European Pulp and Paper Industry.

CEPS (2010), *Unearthing China's Rare Earths Strategy*.

Council of the European Union (2011), *Conclusions on tackling the challenges on raw materials and in commodity markets*, 3074th Competitiveness (Internal Market, Industry, Research and Space) Council meeting, Brussels, 10 March 2011, 9 pp., Retrieved from http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/119744.pdf

Deutsche Bank Research, *EU steel industry*, 2009, http://www.dbresearch.de/PROD/DBR_INTERNET_DE-PROD/PROD0000000000248298.pdf accessed on 31.03.2011

Diederen (2009), Metal minerals scarcity: *A call for managed austerity and the elements of hope*, TNO, Rijswijk.

Ecorys, DTI, CE, IFO and IDEA Consult (consortium) (2008a), *FWC Sector Competitiveness Studies – Study on the Competitiveness of the EU Steel Industry*, DG Enterprise & Industry, Final report August 2008.

Ecorys, DTI, CE, IFO and IDEA Consult (consortium) (2009b), *FWC Sector Competitiveness Studies – Study on the Competitiveness of the Metalworking and Metal Articles Industry*, DG Enterprise & Industry, Final report November 2009.

Ecorys, DTI, CE, IFO and IDEA Consult (consortium) (2011a), *FWC Sector Competitiveness Studies – Study on the Competitiveness of the EU Non-ferrous Metals Industry*, DG Enterprise & Industry.

Ecorys (2011b), *Study on the competitiveness of the European companies and resource efficiency*.

Edward S. Mason (1952), *Raw Materials, Rearmament, and Economic Development*, in *Quarterly Journal of Economics*, vol. 66, No. 3, pp. 327-341.

ETC/SCP (2010), *Use of renewable raw materials with special emphasis on chemical industry*,*http://eea.eionet.europa.eu/Public/irc/eionet-circle/etc_waste/library?l=/renewable_materials/etc-scp_2010pdf/_EN_1.0_&a=d*, *accessed on 20.06.2011.*

Eurometaux (2010), *Eurometaux's proposals for the raw materials initiative*, Brussels.

EUROMINES (2010), *Annual report 2009*.

European Commission (2001), *Reference Document on Best Available Techniques in the Non-Ferrous Metals Industries*, Brussels, December 2001, Retrieved from: http://eippcb.jrc.ec.europa.eu/reference/brefdownload/download_NFM.cfm

European Commission (2007b), *The relation between resource productivity and competitiveness*, prepared by Wuppertal Institute for the European Commission DG EnvironmentEuropean Commission (2007b), Analysis of the competitiveness of the non-energy extractive industry in the EU, SEC(2007) 771

European Commission (2008a), *The raw materials initiative – meeting our critical needs for growth and jobs in Europe,* Communication from the Commission to the European Parliament and the Council, COM(2008) 699 final, Brussels 4.11.2008, 14 pp.

European Commission (2008b), *Commission staff working document accompanying the Communication on the Raw Materials Initiative* (COM(2008)699), Annex 4. Original data source: Raw Materials Data, Stockholm, 2008, SEC(2008)2741.

European Commission (2009), *European Industry in a Changing World*. Updated Sectoral Overview 2009", SEC(2009) 1111.

European Commission (2009), *Report on the Implementation of Directive 2000/53/EC on End-of-Life Vehicles for the Period 2005-2008*, COM(2009) 635 final, 6 pp.

European Commission, DG for Trade (2009), *Raw materials policy, 2009 Annual report*

European Commission (2010a), *Critical raw materials for the EU: Report of the Ad-hoc Working Group on defining critical raw materials*, Brussels, 85 pp.

European Commission (2010b), *Annex V to the Report of the Ad-hoc Working Group on defining critical raw materials*, Brussels, 220 pp.

European Commission (2010c), *Trade, Growht and World Affairs – Trade policy as a core component of the EU´s 2020 strategy* (COM(2010)0612).

European Commission, DG Enterprise and Industry, (2010d) *Improving framework conditions for extracting minerals for the EU. Exchanging best practice on land use planning, permitting and geological knowledge sharing*, Brussels, 71 pp.

European Commission (2011a), *Tackling the challenges in commodity markets and on raw materials*, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, 02.02.2011, COM(2011)25 final, 23 pp.

European Commission (2011b), *A Resource-efficient Europe*. Flagship Initiative under the Europe 2020 Strategy", COM(2011) 21.

European IPPC Bureau (2009), *Integrated Pollution Prevention and Control, Draft Reference Document on Best Available Techniques for the Non-Ferrous Metals Industries*, Draft July 2009, European Commission, DG JRC, IPTS, Sustainable Production and Consumption Unit, 900 pp. Retrieved from: ftp://ftp.jrc.es/pub/eippcb/doc/nfm_2d_07-2009_public.pdf

European Parliament (2010), *End of Life Vehicles: Legal Aspects, National Practices and Recommendations for Future Successful Approach*. Study by DG Internal Policies, Policy Department A: Economic and Scientific Policy.

Fraunhofer, ISI (2003), *The Future of Manufacturing in Europe 2015-2020: The Challenge for Sustainability*. Case Study: Automotive Industry – Personal Cars.

Fraunhofer, ISI, IZT (2009), *Raw Materials for Emerging Technologies*. The influence of sector-specific feedstock demand on future raw materials consumption in material-intensive emerging technologies.

Helsen, L., Van den Bulck, E., & Hery, J. S. (1998), *Total recycling of CCA treated wood waste by low-temperature pyrolysis*. Waste Management, 18(6-8), 571-578

Helsen, L., Vandenbulck, E., Vanbael, M., & Mullens, J. (2003), *Arsenic release during pyrolysis of CCA treated wood waste: current state of knowledge*. Journal of Analytical and Applied Pyrolysis, 68-69, 613-633.

Henryk Karaś (2009), *Presentation ETP for Sustainable Mineral Resources: the research agenda for the coming years*. Conference on Sustainable Mineral Resources, Lulea, 12-14 October, 2009, Chairman of ETP SMR High Level Group, KGHM Poland.

Hieronymi, K. (2009), *Material Issues in Manufacturing Electronics*, presentation for the international workshop on environment and alternative energy, Garching, November 10th, 2009, 48 pp.

Humphreys (2009), *The Great Metals Boom*: A Retrospective, in Resources Policy, Vol. 35(1), March, pp.1-13.

Hveem, H. (2010), *The Political Economy of Natural Resource Races*, Enhanced State Power, Geopolitics, or Simply Business As Usual?, Department of Political Science, University of Oslo, 39 pp.

IDEA Consult (2011), *Background report on the "Access to non-energy raw materials and the competitiveness of EU industry"* prepared for DG Enterprise and Industry, Manuscript.

Information Office of the State Council (2003), *China's Policy on Mineral Resources*, Beijing. http://www.china.org.cn/e-white/20031223/index.htm

J.P. Morgan (2010), *A Global Cornucopia: Accessing commodities in a long-term portfolio*, New York.

KPMG (2011), *Global M&A: Shifting the global chemical industry* balancehttp://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Reaction/Pages/shifting-global-chemical-industry.aspx#7, accessed on 01.08.2011

Mantau U. et al. (2008), *Wood resources availability and demand*. Implications of Renewable Energy Policies. University of Hamburg – Center of Wood Science; UNECE/FAO Timber Section.

Mayers, C. (2007), *Strategic, financial, and design implications of extended producer responsibility in Europe*: A producer case study. Journal of Industrial Ecology, 11(3), 113-132. Retrieved from http://onlinelibrary.wiley.com/doi/10.1162/jiec.2007.1228/abstract.

McKinsey&Company (2004). *Global sourcing in the auto industry*, McKinsey Quarterly

MIT (2000), *The Automotive Supply Chain Organization*: Global Trends and Perspectives. Working paper.

OECD (2010a), *The Economic Impact of Export Restrictions on Raw Materials*, Paris.

OECD (2010b), *Perspectives on Global Development 2010*: *Shifting Wealth*, Paris.

OECD (2010c), Steelmaking raw materials: Market and Policy Developments DSTI/SU/SC(2010)16, presentation on 69th Steel Committee Meeting Paris, 3-4 December 2010

OECD (2010d): Export restrictions on strategic raw materials and their impact on trade, OECD Trade Policy Working Papers, No 95.

Öko-Institut e.V. (2009), Final Report, *Critical Metals for Future Sustainable Technologies and their Recycling Potential*, Sustainable Innovation and Technology Transfer Industrial Sector Studies United Nations Environment Programme & United Nations University, Paris, 112 pp.

Öko-Institut e.V. (2010), *End-of-Life vehicle directive 2000/53/EC* Annex II: Study on analysis of costs and environmental benefits of heavy metal ban, and proposal for better regulation, Executive Summary.

Oxford Analytica (2011), *Iron ore prices face upward pressure*, http://www.oxan.com/display.aspx?ItemID=DB166296, accessed on 31.03.2011

Posch, A. (2010), Industrial *Recycling Networks as Starting Points for Broader Sustainability-Oriented Cooperation?* Journal of Industrial Ecology. 14(2): 242-257.

SteelConsult International (2005), *New Competitive Realities in the Steel*, http://www.steelconsult.com/ArticleSteelConsultinMillenniumSteel_English.pdf, accessed on 10.06.2011.

Steinbach, V., & Wellmer, F.-W. (2010), *Consumption and Use of Non-Renewable Mineral and Energy Raw Materials from an Economic Geology Point of View*. Sustainability, 2(5), 1408-1430.

The Hague Centre for Strategic Studies (2010), *Scarcity of Minerals: A strategic security issue*, The Hague.

U.S. Department of Energy (2010), *Critical Materials Strategy*, Washington D.C. http://www.energy.gov/news/documents/criticalmaterialsstrategy.pdf

U.S. Geological Survey (2010), *Map of Mineral Facilities in Europe.*

UNCTAD (2007), *World Investment Report 2007.*

UNCTAD (2010), *The Iron Ore Market 2009 – 2010*.

UNEP (2011), *Recycling rates of Metals*, A status report, International Resource Panel.

University of Leoben (2004), *Minerals planning policies and supply practices in Europe*. Report prepared for DG Enterprise and Industry. Commissioned by the European Commission DG Enterprise and Industry under Contract n° ETD/FIF 2003 0781.

Warell, L. and Lundmark, R. (2008), *Price effects of mergers in natural resources industries*, Lulea University of Technology Division Economics, 2008.

Wouters, H. and Bol D. (2009), *Material Scarcity*, Materials Innovation Institute, Delft, 72pp.

ZEW (2011), *Innovationen Branchenreport, Fahrzeugbau*, ftp://ftp.zew.de/pub/zew-docs/brarep_inno/10_Fahrzeugbau.pdf, accessed on 30.06.2011.

Yoshida, F., & Yoshida, H. (2010), *Japan, the European Union, and Waste Electronic and Electrical Equipment Recycling: Key Lessons Learned*. Environmental Engineering Science, 27(1), 21-28.

Interviews

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Annex

Table 4.1: Crosscutting sectoral competitiveness issues related to non-energy raw materials

	Extractive industries		Steel	Non-ferrous metals	Paper and pulp	Chemicals	Car manufacturing
	Mining & quarrying	Industrial minerals					
Competitiveness layers							
Market structure / price setting	Mix of small, medium and large enterprises according to their role in the exploration, development and operation process; Global price setting	Large number of SMEs but also international leaders present in the sector Price negotiated between buyer and seller High transportation costs	Oligopolistic structure of the supply of iron ore Price setting of iron ore by 3 main suppliers Price of steel directly dependent on price of iron ore	Heterogeneity in terms of size of companies and vertical or horizontal integration of their production activities Price taking: companies cannot negotiate prices The industry operates in a totally international market	Small ownership structure; Global price setting	Prices for outputs in their majority are competitive. For many raw materials prices are distorted.	Prices for outputs and most of the inputs are competitive.
Position in the supply chain	High upstream position; Supplier to all industries and products	Supplier to a variety of industries and sectors	Important supplier to other industries (construction, packaging)	Supplier to a large variety of industries and sectors	Close to the end market; Integration of activities such as recycling	Important supplier to other industries.	Can be considered a real downstream producer.
Share of NEIRM in cost structure	NERMs are output of this industry	NERMs are output of this industry	Very important: iron ore 34% on average ; scrap metal 10% on average	Energy-intensive and raw-material intensive industry	Very important: 63,8% of operational cash	The price of raw materials can comprise a substantial share of the end product's price (up to 60%)	The share of NEIRM is substantial: more than 80%.
Framework conditions and policies							
Administrative barriers	Long and sometimes complex authorization process for extractive activities; Compliance with environmental regulations and assessments needed	Legislation controlling exploration/extraction activities is often different depending on private- or state-ownership Large differences in land use policies and practices among MS	Sometimes difficult to distinguish good from bad quality on imported scrap metal; quality standards		Regulations (IPPC, REACH)	Mostly trade policy related restrictions: import and export duties, and quotas.	
Financial barriers	High capital requirements for		Few players on the steel market are big enough				

	insurance at authorization; EU financial organisations are less geared towards investments in the mining sector, because of the inherent long-term risks (Euromines)		to raise the funding needed for vertical integration (investments in iron ore mines)				
Trade	High import dependency for metallic minerals, also net importer for industrial minerals and aggregates Export of minerals with specific characteristics	The EU is the world's largest producer of a number of industrial minerals and the second or third largest producer of a number of others For some Industrial Minerals, two other dominant producers are China and the USA	Export restrictions of raw materials (iron ore and scrap) by several emerging economies Free flow of good quality scrap metal from EU to emerging economies	Subsidies of third-country companies distort competition Illegal shipments (dubious export) should be systematically handled	Export of end products of high quality Net importer of pulp (raw material) Increased imports in China of raw materials (wood, pulp, recovered paper) EU trade hindered by costs of compliance with environmental regulation (CEPI)	The EU has an overall trade deficit for chemicals. CAP induced import rights for bio-ethanol 30-65% of its price	Export dependability; export duties and quotas
National policies	Integrated and prioritized land use policies needed at MS level Competing land use with more progress in environmental regulations			Differences in environmental-related and other regulation among also EU MSs	Integrated and prioritized land use policies needed at MS level	Import duties for bio-based raw materials for industrial use in the chemicals industry should be comparable to those for the fossil-based feedstock	
EU policies	Balanced policies needed; Sensitize MS on land use for extractives activities		Prevent further horizontal integration of the iron ore market Research through Research Fund for Coal and Steel (RFCS)		Balanced policies needed; Sensitize MS on land use and mobilization of wood	The EU industry should be prepared for the emergence of the Middle East as a very important player in the petrochemicals market	
Risks							
Supply risks	Certain raw materials are critical due to the combination of lack of resources within EU, increased use in developing economies and their strategic importance for products	The fact that an Industrial Mineral is extracted in the EU does not necessarily mean serving that market too due to the natural variability in the quality and characteristics of a	Risk of limited access to most important raw materials (iron ore and scrap) because of protectionist measures of emerging economies	With respect to raw materials the EU industry is highly dependent on third countries for imports	Competing use of the raw material wood by less regulated industries; Export of and global price setting for recovered paper	Losing in the race with China in terms of demand for raw materials.	Higher dependency on foreign rare earth as electrical vehicles become more wide spread

	like future environmental technologies; The NEEI has a potential to alleviate the pressure on imported NERMs, but EU mining does/cannot always produce what EU industry needs.	particular mineral found in different parts of the EU and the location of different markets Often very few suppliers					
Trade practices			Export restrictions reduce the supply on the world market and aggravate increases in iron ore spot price Export of valuable scrap as waste	Hidden subsidies in some exporting countries distort the competition in these markets creating unfair competition among EU companies and foreign states		Cost disadvantage for imports of industrial bio-ethanol	
Emerging Technologies						Intensified R&D effort towards development of more efficient production processes for renewable feedstock	Research towards niche support for 'domestic mining' industry mostly for the rare earths
Solutions							
Trade (Pillar 1)	Reduction of import dependency especially for metallic minerals	Dependency especially on China and the US for some materials should be reduced.		Application/optimization of waste framework directive Improved market access for the EU non-ferrous metals industry exports world-wide Level playing field access to raw materials	Costs of compliance with environmental regulation (CEPI) are hindering EU trade	Trade deficit for chemicals is a point of attention.	Export dependability to be reduced
R&D, innovation (Pillar 2)	Research for modern technologies to overcome public and local resistance to extractive activities, to comply with higher safety and environmental standards and to reach 'difficult' deposits more efficiently e.g. ETP		Most R&D concentrates on CO2-reduction (e.g. efficient use of coal), not on recycling or efficiency of other resources.	The location where raw materials are found is important especially if resulting in the relocation of R&D activities impacting the R&D that takes places in EU vs. non-EU countries.	Eco-design for efficient recycling	Breakthrough technologies needed towards more efficient production	R&D for substitutes should be supported

	SMR						
Recycling (Pillar 3)		Not recyclable; highly recoverable	Scrap steel widely used and amounts to 10% of total costs in steel sector Use of scrap steel widely suboptimal because of lack of availability. Steel making procedures with electric arc furnaces (EAF) can use 100% scrap as raw material.	Unique recycling properties Substitution is very important for this industry: improper dismantling (recycling all special metals in the product) should be handled	High recycling rate in EU	Chemicals are needed in order to recycle chemicals. Recycled chemicals not always substitute the raw materials used in production. Recycling of chemicals can have negative environmental impact. It is not always an evident positive strategy.	Steps should be taken to provide for recyclability already during production process.
Resource-efficiency potential (Pillar 3)	Efficient processes of extraction Efficient approach of deposits that are more difficult to reach	The full life-cycle of the end-applications from cradle to grave should be considered: a holistic approach in the implementation of resource efficiency is required rather than fragmented approaches focusing only on parts of the process.	Research is carried out in order to make use of secondary powder material (resulting from primary steel making) as a raw material alternative in electric arc furnaces (EAF) steelmaking.	Location matters: besides recycling, access to primary raw materials is crucial as demand is increasing.	Limited growth potential of recycling rate, but more efficient recycling process; Intention of increased use of recycled products within EU instead of export	Positive effects can be obtained from greater energy efficiency and greater use of bio-feedstock.	Focus should be put on material substitution
Policy and further research	Integration of policy on environment, safety, raw materials and management of natural resources, land use To prioritize on the competing use of land	Industrial mineral may be critical locally but not globally: in terms of data availability for policy monitoring, the geographical factor should be taken into account at the level of countries and even regions Data on the differences of criticality among the different grades of the same raw material also needed.	Policy may pursue a higher use of scrap metal in steel making, as technologies are able to use more in practice More funding will be needed (e.g. in RFCS) to obtain fundamental breakthroughs, together with better cooperation between public and private research institutions	A capital-intensive industry where investments have a long-term nature: it is important for investment decisions that there is a relative 'stability' in the regulatory framework so that planning (especially of innovation activities) becomes viable.	Integration of policy on waste, recycling, competitiveness and trade, raw materials and management of natural resources To prioritize on the competing use of raw materials, the competing use of land and the export of recycled materials	Integration of policy on fossil and renewable feedstock materials. Special attention towards ensuring equal competitive access to raw materials in international markets	Market efficiency is the solution to reach resource efficiency targets, as opposed to regulatory incentives

Note: CAP: Common Agricultural Policy; ETP-SMR: European Technology Platform on Sustainable Mineral Resources, IPPC: Industrial Pollution Prevention Control, MS: Member States, NEEI: Non-energy extractive industry, NERM: Non-energy raw materials, RFCS: Research Fund Coal Steel.

5. EU INDUSTRY IN A SUSTAINABLE GROWTH CONTEXT

5.1. Introduction

The eco-performance of the EU economy is increasingly at the forefront of policy discussion. On the one hand, this reflects the impact of economic activities on the environment (e.g. climate change, environmental degradation, etc.). On the other, it mirrors deep concerns about resource scarcity, coupled with the EU's reliance on external supplies of energy and of raw and critical materials. In this context, policy-makers – along with industry and citizens – face the dual challenge of delivering economic growth and ever mounting demands to improve energy and resource-utilisation efficiency within the economy, on both the production and consumption sides.

This chapter examines the progress made on moving EU industry towards a more sustainable growth path by analysing economic and environment performance trends in industry over the last 10 to 20 years. Particular attention is paid to developments in resource efficiency and in carbon and energy intensity over recent years at country and sector level, to the extent to which economic growth is being decoupled from resources used and environmental impacts and to the potential of the different public policy instruments and industry initiatives to facilitate sustainable growth and promote a strong industrial base in Europe.

This chapter is organised as follows: section 2 provides a brief overview of the policy context and the economic performance of EU industry in the last 10 to 15 years. Against this general background, section 3 presents a general assessment of the advances made in the eco-performance of European industry relative to the trends and developments in its economic performance. This empirical analysis is illustrated by selected case studies, with the aim of obtaining a more detailed understanding of the motives, drivers and effects of particular policy initiatives. Section 4 examines evidence of the levels of investment made in environmental protection and eco-innovation as an indicator of mitigation efforts by industry and future decoupling. A few examples of new 'green business' models are highlighted. Finally, the conclusions are presented in section 5, focusing on the relative strengths and weaknesses of the policy instruments available and the general lessons learned about the optimal design of sustainable growth policies.

5.2. Policy and economic context

5.2.1. EU policy context

The European policy debate has evolved over the last ten years. Initially, the 2000 Lisbon Strategy (relabelled in 2005 as the Growth and Jobs Strategy) and the 2001 Gothenburg Strategy (relabelled in 2005 as the EU Sustainable Development Strategy) continued to move along parallel tracks. Although both these EU policy frameworks aimed to be all-embracing and comprehensive, they allowed some room for interpretation in the balance between economic and environmental performance.

Since 2007, increasing attention has been paid to further development of EU *energy policies* with the aim of reducing dependence on external fossil fuel resources and promoting energy efficiency and renewables. The cornerstone of this policy is the Industrial Emissions (Integrated Pollution Prevention and Control – IPPC – recast) Directive (EC, 2010) and the EU Emission Trading System (EU ETS) (EC, 2003). Recent amendments to the EU ETS (EC,

2009a) and Directives on carbon capture and storage (CCS) (EC, 2009b) and on renewable energy sources (EC, 2009c) are all part of a wider package of reforms directed towards meeting the EU's target of reducing its overall emissions to 20% below 1990 levels by 2020 and increasing the share of renewable energy to 20%. Other important initiatives in the energy domain are the National Energy Efficiency and Renewable Energy Action Plans (NEEAPs and REAPs), which Member States are required to submit under EU directives.

At EU-level, progress has been partial in a broad range of areas. The Progress Report on the EU Sustainable Development Strategy pointed to limited improvements in the area of sustainable transport – at least in the years 2000-2007. Beyond that, a lack of direction was seen in the area of sustainable consumption and production (European Commission, 2007, p.32).

In 2008, the Communication from the Commission on the Sustainable Consumption and Production and Sustainable Industrial Policy Action (European Commission, 2008) was published. It provided a framework for improving the energy and environmental performance of products and fostering their take-up by consumers. The Communication highlighted the challenge of improving the overall environmental performance of products throughout their life-cycle, of stimulating demand for better products and production technologies and of helping consumers to make better choices with the aid of labelling (specific examples of regulatory-driven and voluntary eco-labelling schemes are presented in Boxes 5.2 and 5.6, respectively). Further action was launched to promote cleaner and leaner production and to address international aspects of the production process. The 2008 Sustainable Consumption Action Plan on Green Public Procurement includes references to various regulatory initiatives, such as extension of the Energy Labelling Directive, the Eco-design Directive and the Eco-label Regulation – the later of these being voluntary. Other green public procurement (GPP) measures were also voluntary, as were aspects of the Open Method of Coordination such as cooperation between Member States on common GPP criteria for products and services and on preparation of national action plans. A separate Communication on green public procurement gave fuller details of these measures.

The Europe 2020 Strategy presents a new all-embracing policy framework promoting a strategy for smart, sustainable and inclusive growth. Sustainable growth is understood to mean '*building a resource-efficient, sustainable and competitive economy, exploiting Europe's leadership in the race to develop new processes and technologies, including green technologies, accelerating the roll-out of smart grids using ICT, exploiting EU-scale networks and reinforcing the competitive advantages of our businesses, particularly in manufacturing and within our SMEs as well as through assisting consumers to value resource efficiency*' (European Commission, 2010a, p.14).

This concept of sustainable growth has been further translated into a number of 'flagship initiatives'. The most relevant are found under the heading 'Sustainable Growth'. They include the Sustainable Industrial Competitiveness and the Resource Efficiency flagships. The Sustainable Industrial Competitiveness flagship addresses issues such as industrial innovation, access to raw materials and critical products or resource, energy and carbon efficiency (European Commission, 2010b). The flagship initiative on the Innovation Union is also aligned with these goals: it states that stricter environmental targets and standards establish challenging objectives but ensure long-term predictability, thus providing a boost to eco-innovation (European Commission, 2010c).

Even more recently, the flagship initiative on a Resource-Efficient Europe aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy which will help to 'boost economic performance while reducing resource use; identify and create new opportunities for economic growth and greater innovation and boost the EU's competitiveness; ensure security of supply of essential resources; and fight against climate change and limit the environmental impacts of resource use' (European Commission, 2011, p.3). This flagship initiative aims to make use of *regulatory, voluntary, communication and information instruments.* It also takes account of *public investment*, by aligning this initiative with the proposed reforms on the future of the EU's own major spending programmes, including the Common Agricultural Policy, the Common Fisheries Policy, Cohesion Policy, energy grids and trans-European electricity transport networks.

In conclusion, building on the earlier partial success of previous policy frameworks, EU-wide policies relevant to economic and environmental performance can be seen to have evolved in at least three directions over the last ten years. EU-level policies:

- tend increasingly to treat ***economic and environmental performance*** as dual objectives (intrinsically linked through e.g. 'green growth', 'green' skills and jobs, eco-innovation); the latest Europe 2020 framework appears to have provided greater clarity, reducing the degree of room for interpretation in the balance between economic and environmental objectives, that emerged over time during implementation of the Lisbon and Gothenburg Strategies;

- make use of an increasing ***array of policy instruments***, recognising that a policy mix of all instruments available is needed in order to achieve the objectives set. This includes not only regulatory, voluntary, communication and information but also public investment instruments. This is a clear evolution from the earlier Lisbon and Gothenburg Strategies, with the Community policy pillar and country surveillance of the Europe 2020 Strategy clearly more based on quantitative objectives and having more binding elements;

- recognise increasingly the role of ***other governance layers*** and players, notably Member States, but also regional and local authorities, businesses, social partners and civil society, plus the global level (e.g. via the WTO and G20). This is particularly important as such a 'multi-governance' approach allows alignment of goals at all levels and mobilisation of all policy instruments and resources – thus adding to the effectiveness of policies. Another reason why this approach is important is that policies promoting economic and environmental performance are not always clearly aligned between governance layers.

Finally, building upon the points set out above, before shifting attention to the Member State level, it is important to recognise the difference between the level at which policy decisions are taken and the level where they are implemented. As will be seen later, a growing range of policy measures – though implemented at Member State or sub-national level - are directly or indirectly induced by the above- mentioned EU policy frameworks and action plans.

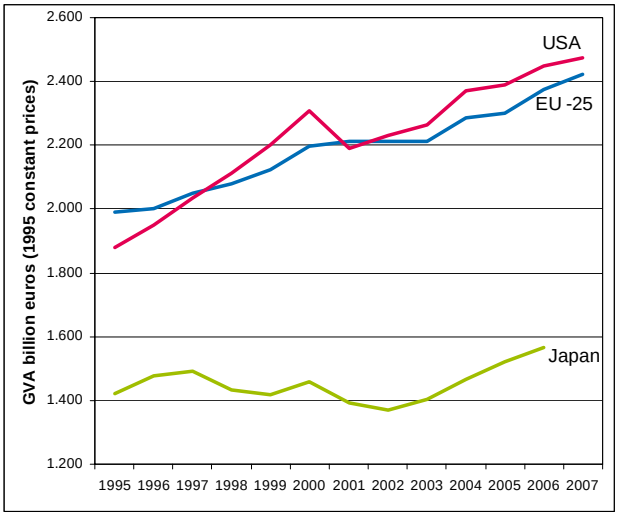
5.2.2. Economic context: industry gross value added (GVA) and employment

The overall economic trend over the last 10 to 20 years, until the recent financial crisis, had been one of steady and continuous growth. Overall, industrial GVA was increasing in every country, although at a slower rate than GVA for the whole economy, reflecting a decline in

the relative importance of industry (for the purposes of this chapter, defined, wherever possible, as sectors A to F under NACE revision 1.1, see Annex I).

Figure 5.1 depicts industrial GVA trends at constant prices for the EU, the USA and Japan from 1995 to 2007. Industrial GVA in the EU-25 increased by 22.1% over this period, ahead of the 10.2% increase in Japan in the same period, but behind the 31.6% increase in the US.

Figure 5.1: Industrial GVA in the EU-25[72], USA and Japan, 1995-2007 (indexed at 1995 prices[73])



Source: Ecorys analysis of EU KLEMS datasets.

Figure 5.2 shows contrasting industrial GVA trends across different Member States over the years 1995-2000, 2000-2007 and 2007-2009. In the period 1995-2000, Ireland recorded total growth of over 50%, supported to a large extent by attracting industrial FDI.

In the period 2000-2007, only Portugal and Malta suffered a decline in industrial GVA: in the case of Portugal this was due mainly to a significant (-15.3%) decline in construction. The Baltic states, together with Slovakia, reported the highest growth in this period, each with total growth over 60%. Other Central and Eastern European Member States also recorded faster and above-average industrial growth, seizing the opportunities brought by EU membership and access to the single market.

Many EU-15 Member States – including the ones with the largest industrial GVA, i.e. Germany, France, Italy and the UK – achieved relatively modest total growth over the full period. Notable exceptions were Finland and Sweden where industrial GVA grew by over 20% in both periods (i.e. 1995-2000 and 2000-2007). The expansion of the telecoms sector and the innovative success of these two economies played a leading role in this (the GVA data show increases in the electrical and optical sectors [NACE rev.1.1 – codes 30-33] of over 750% in both countries over the whole period).

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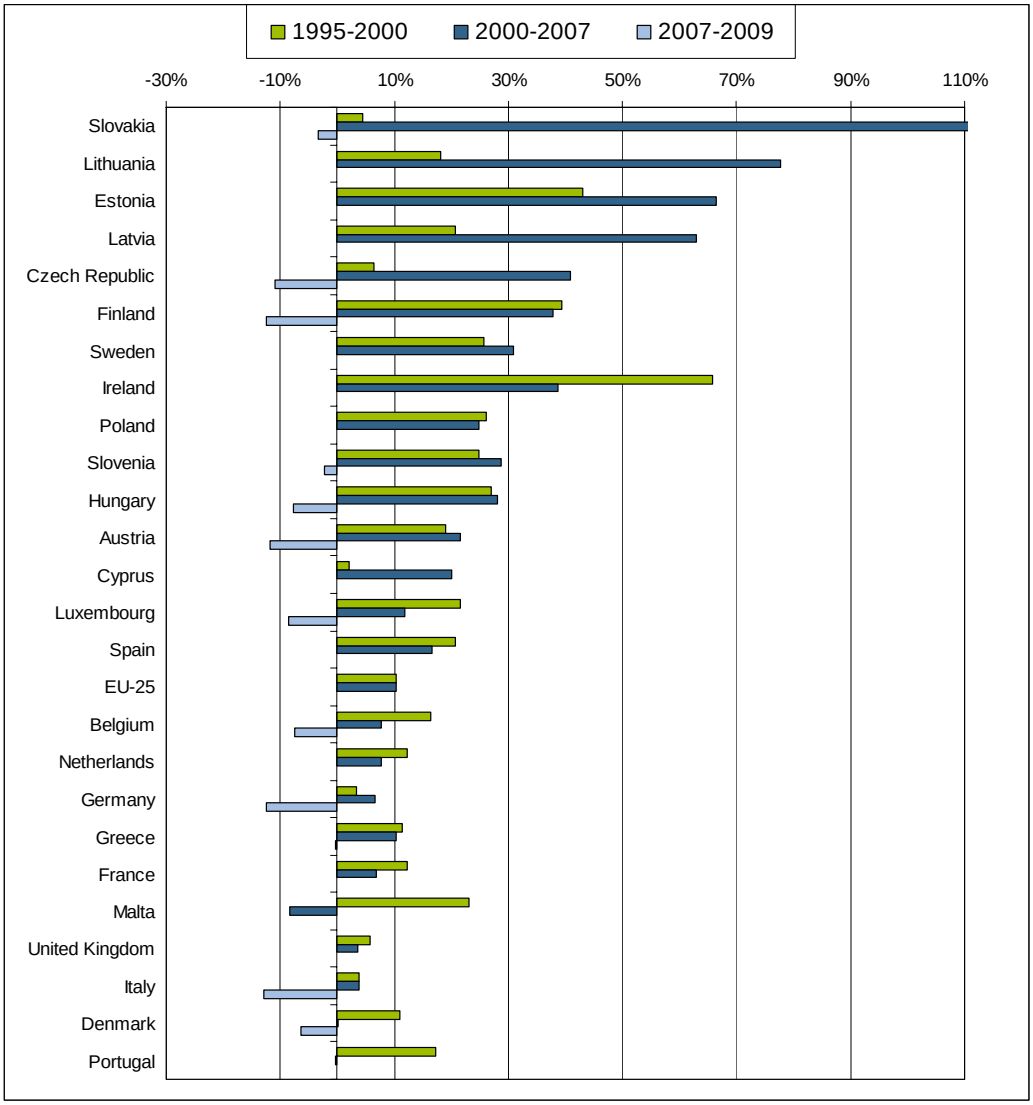
72 EU-27 less Bulgaria and Romania, as EU KLEMS data were unfortunately unavailable for these countries – the use of EU-25 from this point forward refers to this definition.

73 GVA has been indexed to 1995 constant prices using industry and member state specific price deflators, also contained in the EU KLEMS dataset – this process has been used for all GVA and intensity calculations to present the real economic changes as far as possible.

The recent recession following the financial crisis has had a significant impact on EU industry. However, the EU KLEMS datasets are only partially available at the moment, which could only be partially redeemed for some countries for the years 2008 and 2009 with data from the OECD STAN database. Figure 5.2 shows that every country for which data are available suffered a decline in industrial GVA. In total, these 12 Member States reported an 11.5% decline in industrial GVA in this period, with the situation contrasting from one Member State to another. Slovakia, Slovenia and Greece saw the smallest declines, of less than 5%, whereas the biggest, of more than 10%, were in Finland, Sweden, Austria, Germany and Italy (see Box 5.1).

Figure 5.2: Total % changes in industrial GVA EU-25, 1995-2009



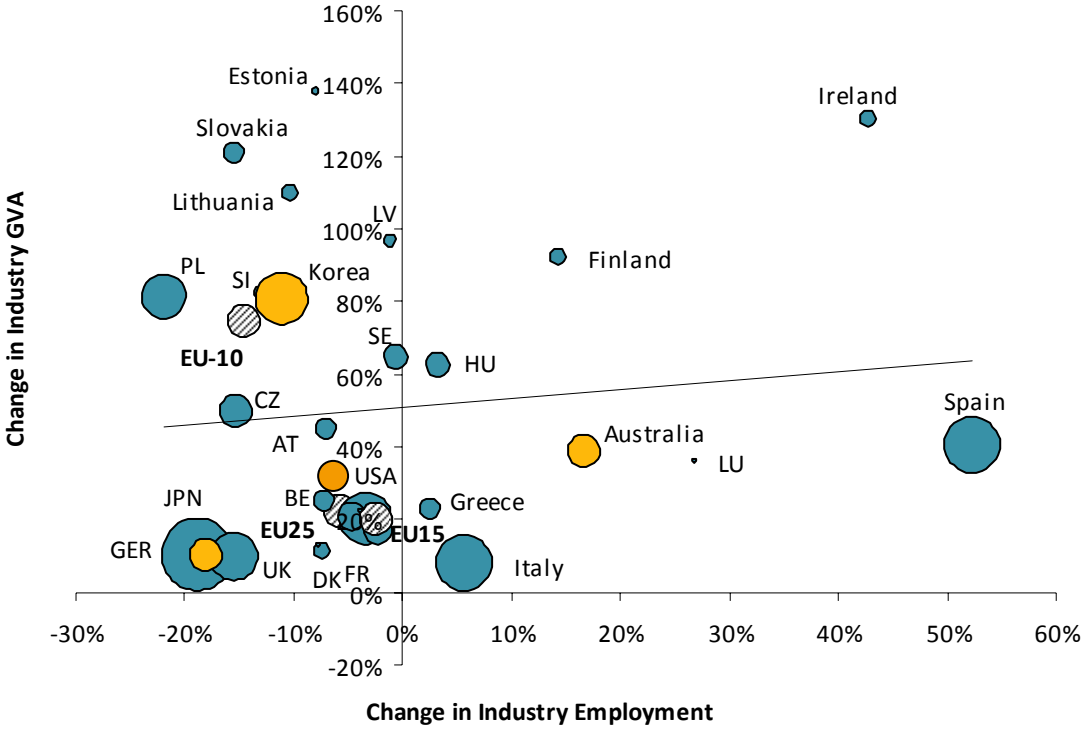
Note: *2007-2009* data available for only 12 Member States (data missing from LT, EE, LV, SE, IE, PL, CY, ES, NL, FR, MT, UK and PT) and produced from a different dataset than data up to 2007, which could account for some of the differences.

Source: Ecorys based on EU KLEMS, OECD STAN

The decline in the relative importance of industry was matched by a decline in industrial employment across the developed world, both in total employment in industry and also as a proportion of total employment.

Figure 5.3 relates changes in industrial GVA to changes in industrial employment in the period 1995-2007. Industrial employment increased in this period in only eight of the countries selected. Ireland and Spain recorded the biggest expansion in employment, driven primarily by rapid expansion of the construction sector. Finland and, to a lesser extent, Sweden saw strong GVA and employment growth fuelled by expansion of their electrical and optical sectors. Germany, Japan and the UK all suffered a significant decline in industrial employment and among the lowest rates of GVA growth. In Germany this was caused by a decline in mining, textiles and construction. In the UK it was attributable to a general decline in manufacturing and a particularly severe contraction in the textiles industry. In Poland, Slovakia and the Czech Republic, although GVA growth was much more vigorous, there was also a significant decline in industrial employment, mostly concentrated in agriculture and the mining and extractive industries but also including manufacturing.

Figure 5.3: Change in industrial employment and industrial GVA, 1995-2007



Notes: Bubble size represents relative total industrial employment in 2007 for each Member State – except for the EU-10, EU-15 and EU-25 aggregates or the USA or Japan, where for visual reasons these have been set to a uniform size.

Data points are unlabelled where visually it was not possible to name all the Member States. Unlabelled points include NL, PT, CY and MT (they cluster with EU15).

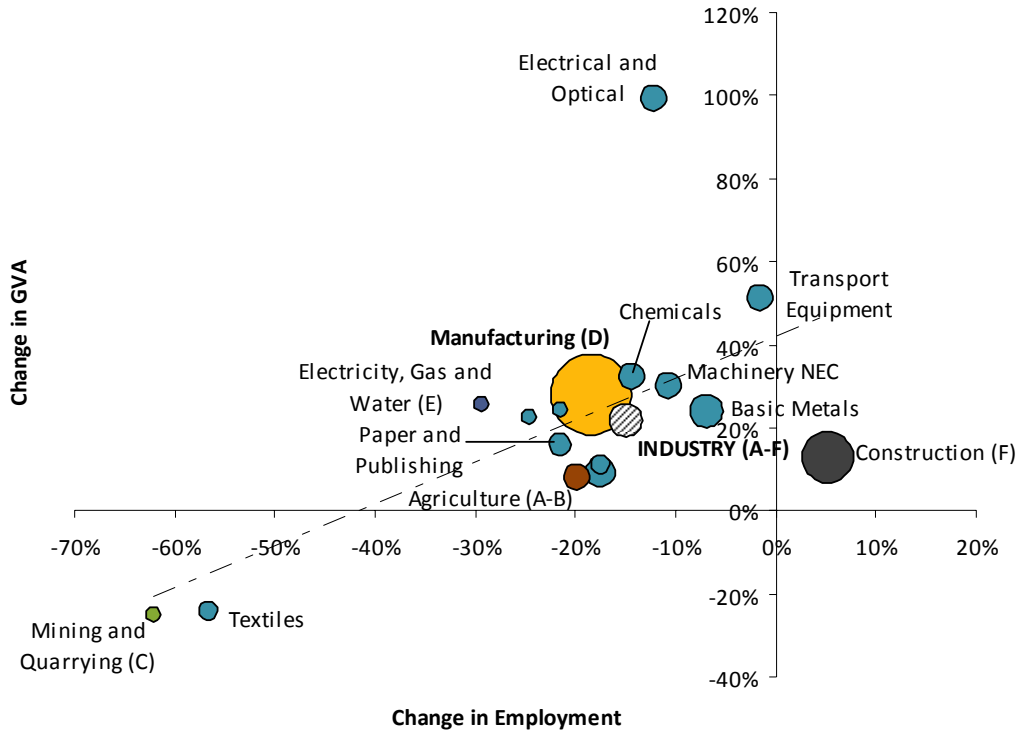
Source: Ecorys based on EU KLEMS database, release November 2009.

Within the EU as a whole a decline in industrial employment of 5.7% was seen, at the same time as industrial GVA grew by 22.1%. Similar proportions were reported by the USA and Japan, but Korea was able to secure greater industrial GVA growth, despite a higher decline in employment (-11.1%), while Australia saw a significant expansion in industrial employment (+16.6%), concentrated, as with growth, in construction and mining.

The EU-15 recorded a lower decline in employment (-2.4%) than the EU-25 but also lower GVA growth, related to relatively mature industrial sectors and labour market differences (e.g. stronger employment protection overall). On the other hand, the EU-10 (EU-12 minus Bulgaria and Romania) reported a sharper decline in employment (-14.1%) but a much higher increase in industrial GVA (+74.6%).

Changes in GVA and employment also varied significantly across sectors. Figure 5.4 presents the changes for the EU-25 sector by sector. The biggest GVA growth was achieved in the electrical and optical sector, almost doubling over the period. Transport equipment also recorded significant growth. The figure shows that, among the sectors where employment declined, textiles and mining and quarrying saw the biggest falls, losing over 40% of employment between 1995 and 2007. Falls of approximately 13 to 14% were recorded in agriculture, pulp and paper, electricity gas and water and other non-metallic minerals. In other sectors employment declined by between 3 and 10%. The construction sector, due to its labour-intensive nature, made by far the biggest contribution to employment growth and remained much closer to a one-to-one relationship between employment and GVA growth.

Figure 5.4: Change in industrial employment and GVA per sector in the EU-25, 1995-2007



Notes: Bubble size represents relative total employment per sector in 2007.
Data points are unlabelled for the other NACE rev. 1.1 manufacturing sectors, where visually it was not possible to name them all – including wood and wood products, food, beverages and tobacco, other non-metallic minerals and manufacturing not elsewhere classified and recycling.

Source: Ecorys based on EU KLEMS database, release November 2009.

Significant increases in productivity per worker have been achieved for the generality of countries and sectors (as reflected by the decline in employment and GVA growth). They are the result of factors such as the technological progress in interaction with the increased

globalisation, associated market developments, increasing specialisation by EU industry in high-value products and value-chain segments, increasing levels of innovation, production automation and technological intensity, etc.

At the same time as productivity and specialisation has increased, increases in industrial GVA are being achieved in tandem with proportionally higher increases in the consumption of intermediate inputs. This is particularly evident in the manufacture of transport equipment. This point to lower marginal added value per unit of output, reflecting longer and more complex value chains often involving greater global competition and a complex blend of inputs needed to meet consumer demands. Only two sectors -electrical and optical equipment and agriculture- run counter this trend, and then by only a small amount.

The structural change taking place in traditional industry is particularly noticeable in terms of employment, with an average of almost 250 000 jobs per year being lost. At the same time, eco-innovation efforts and the transition to a more sustainable economy and industry can offset part of the general industrial relative decline. The potential for sustainable growth and direct and indirect job creation can be particularly significant in specific sectors and areas. The EU is a market leader in the so-called 'eco-industries', a set of eco-related sectors and activities that have been expanding rapidly in the recent years, growing to become a sector equivalent (in terms of employment) to chemicals or electrical and optical equipment in the EU. Annual employment growth in 'eco-industries' averaged approximately 179 000 jobs per year between 1999 and 2008, equal to over 7% annual growth. In 2008 'eco-industries' employed an estimated 3.4 million people across the EU (Ecorys et al., 2009, see also GHK et al. 2007). However, sustainable growth is not the exclusive domain of certain sectors. Rather, it has the potential to create new jobs and increase efficiency and productivity in every firm and sector across the whole economy.

Box 5.1: The impact of the recent financial and economic crisis

The latest recession was unusually severe, provoking dramatic falls in industrial production and employment. Industries producing durable consumer goods were hit harder: capital goods and intermediate goods suffered most with production losses of around 26% relative to EU pre-recession peaks (European Union Industrial Structure 2011). The sharp fall in industrial activity has led to deep job cuts. The reduction in GVA and employment has been particularly evident in the two biggest industrial sectors -manufacturing and construction. For example, manufacturing registered a drop of 15% in GVA and 4% in employment over the period 2007-2009 (for a set of 11 EU Member States for which figures are available, accounting for around half of total industrial employment in the EU-25). Patterns of employment decline appear consistent across sectors but are uneven between countries. Member States affected by housing bubbles or other macroeconomic imbalances suffered most in terms of output and, in particular, job losses (see chapter 1 of this report).

The incomplete data currently available show that declines in industrial GVA began to be felt in 2008 in most sectors, though growth was still seen in manufacturing of electrical and optical equipment, chemicals, rubber and plastics and machinery not elsewhere classified (NEC). In 2009 the impact of the crisis on industry was more significant, with declines gaining pace in most sectors. They were particularly sharp in industrial GVA in the electrical and optical equipment, basic and fabricated metals, machinery NEC, transport equipment and other non-metallic mineral sectors. These changes are evidence of both consumer and business purchases of equipment being postponed (electrical and optical, machinery NEC and transport sectors) and of the drying-up of demand from industry as a whole and the

construction sector (basic and fabricated metals and non-metallic minerals). In the case of the transport sector, the reaction is instructive as in many Member States there was a strong focus on scrapping and other schemes to support vehicle purchases.

In addition, many governments, both European and non-European, have emphasised the importance of a '*green* recovery' by investing in, for example, renewables and energy efficiency in their recovery packages (OECD, 2009). The total '*green*' part has been estimated to represent 10% of the EU's economic recovery plans (HSBC, 2010, see table 7 in annex for an overview of the stimulus plans adopted in the EU, USA, Japan, South Korea and China, their estimated 'green component' and thematic focus). However, this percentage is highly sensitive to how '*green* investments' in, for example, infrastructure, are defined and is difficult to interpret in terms of environmental impact (European Commission, 2009a). The aggregate spending on and stage of implementation of the 'green' elements in European Recovery Packages are currently under review by the European Commission. However, some examples of mid-term evaluations exist. Car scrapping schemes, for example, were carried out in 13 Member States to boost car sales and take fuel-inefficient vehicles off the roads. The total injection of capital adds up to 7.9 billion Euros and significant environmental benefits are expected, e.g. removing 1.06 million tones of CO2 and pulling down average emissions from the whole market to 145 g/km (IHS Global Insight, 2010).

5.3. Eco-performance of the EU Industry

This section analyses the main summaries of eco-performance and tries to draw the main findings together to form a coherent picture of EU industry's move to sustainability. Eco-performance and sustainability are assessed on the basis of the evidence available in the key areas of energy, greenhouse gas emissions, other emissions, resource use and water (see Annex I for the full list and a description of the indicators used). Sustainability is most closely associated with decoupling of production (and to a lesser extent consumption) from environmental impact. Two forms of decoupling, as levels of eco-performance, can be identified:

– Relative decoupling of resource utilisation (or production of harmful outputs) from economic activity: while overall utilisation of resources may increase, the intensity of use falls relative to the quantity of output produced.

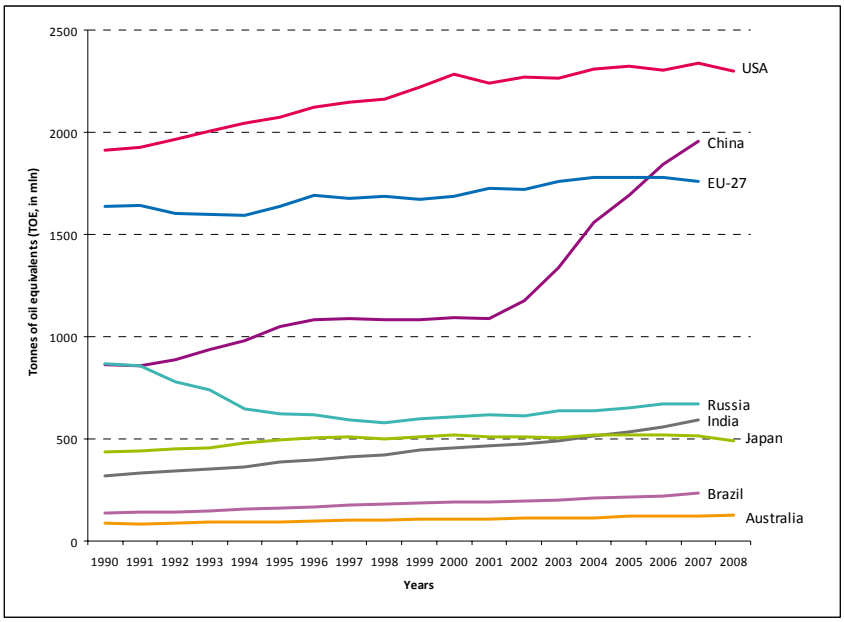
– Absolute decoupling of resource utilisation (or production of harmful outputs) from economic activity: the intensity of use of resources falls relative to output along with a reduction in the overall quantity of resources used.

5.3.1. Energy consumption and intensity

Whole economy

Figure 5.5 displays the overall final energy consumption for the major international economies. As can be seen, since 1990 there has been huge growth in energy consumption in China, particularly since 2001. The USA and India have also exhibited strong growth, whereas in the EU-27 energy consumption has grown slowly over the same period. Analysis shows that the main source of growth in energy use in the EU-27 over this period has been in the transport sector, with overall energy consumption in industry decreasing.

Figure 5.5 Change in final energy consumption in million toe from 1990 to 2008



Source: OECD Factbook 2010, toe = tonnes of oil equivalent.

Energy intensity trends (final energy consumption in toe relative to GDP at constant prices, see Annex I) show that in recent years the EU-27 has closed the gap with Japan, the leading (i.e. least energy-intensive) major economy. The USA and other countries such as Australia have been able to narrow the gap on the EU-27, but remain significantly more energy-intensive. In particular, looking at the relative improvement in percentage terms, the EU-27 outperforms these countries.

Industry

Energy is a critical input for industry. Changes in energy consumption, both headline and relative to output, are therefore important measures of eco-performance. The industrial energy intensity data presented in figure 5.6[74] show that *final energy consumption* (FEC) by industry in the EU-23[75] as a whole increased by 2.1%, while industrial GVA increased by 24.4%. The increase in FEC was higher in the EU-15, for a lower increase in GVA. An overall decline in FEC was recorded in the EU-12(-4)[76], whereas industrial GVA increased by 95%. This reflects a 'catch-up process', specifically the shift to more energy-efficient processes and less energy-intensive sectors in these countries.

Large differences in performance were observed between Member States, with Poland, for example, achieving 88% growth in industrial GVA and a 22% reduction in FEC, but Ireland recorded 157% growth in GVA and a 37% increase in FEC. In countries such as Ireland and

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74 This figure should be interpreted as follows: a high GVA growth in combination with low or negative growth in energy use can be considered efficient. Hence, further to the left along the horizontal axis and further up along the vertical axis is better in various terms. The 45 degree line marks the no change in energy intensity locus. The vertical distance from a given point to the 45 degree line gives an approximation to the percentage change in energy intensity (the exact percentage change is equal to this distance/ (1 + % change in GVA)).

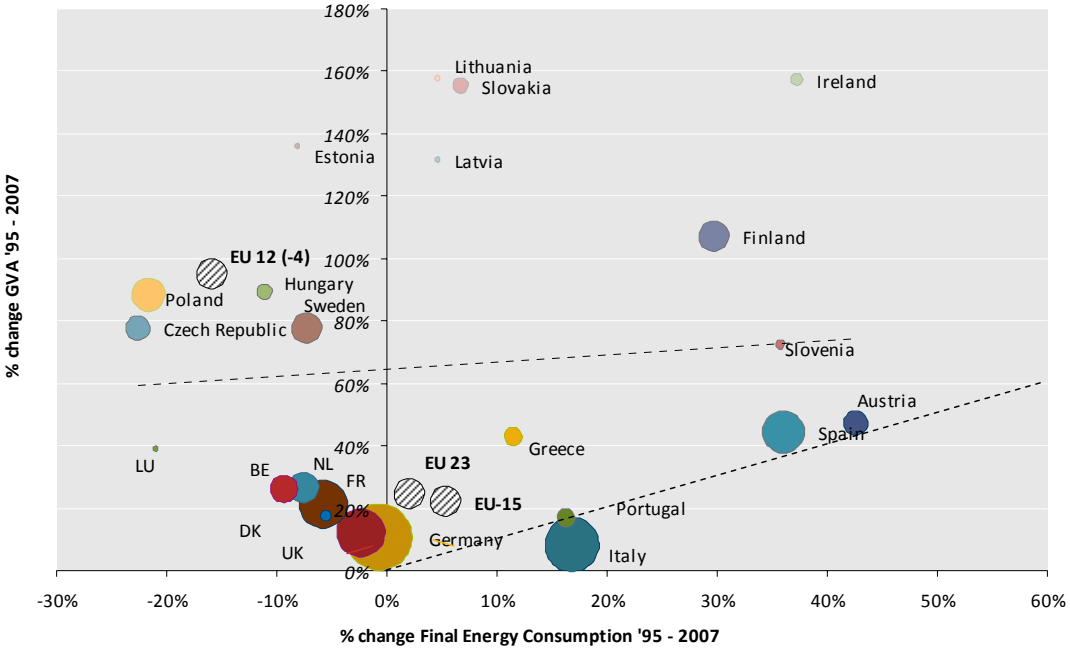
75 EU-27 – minus BG, RO, CY and MT, due to incomplete datasets.

76 EU-12 – minus BG, RO, CY and MT, due to incomplete datasets.

Spain, the large increase in final energy consumption is mostly due to the rapid growth of energy-intensive industries, across manufacturing and including construction. The Baltic region – plus Slovakia – achieved the largest increase in GVA without substantially increasing final energy consumption and, in the case of Estonia, even decreasing it.

The data at Member State level point to a decoupling of energy use by industry from GVA growth in every Member State except Italy. In ten Member States (AT, ES, IE, FI, SI, LT, SK, LV, EL and PT) this decoupling was relative, with GVA increasing faster than FEC. In the remaining twelve (DE, UK, NL, FR, BE, DK, LU, CZ, PL, HU, SE and EE) an absolute decoupling of FEC from GVA growth was evident.

Figure 5.6: Energy intensity of EU industry (manufacturing and construction, % change in final energy consumption versus % change in GVA), 1995 and 2007



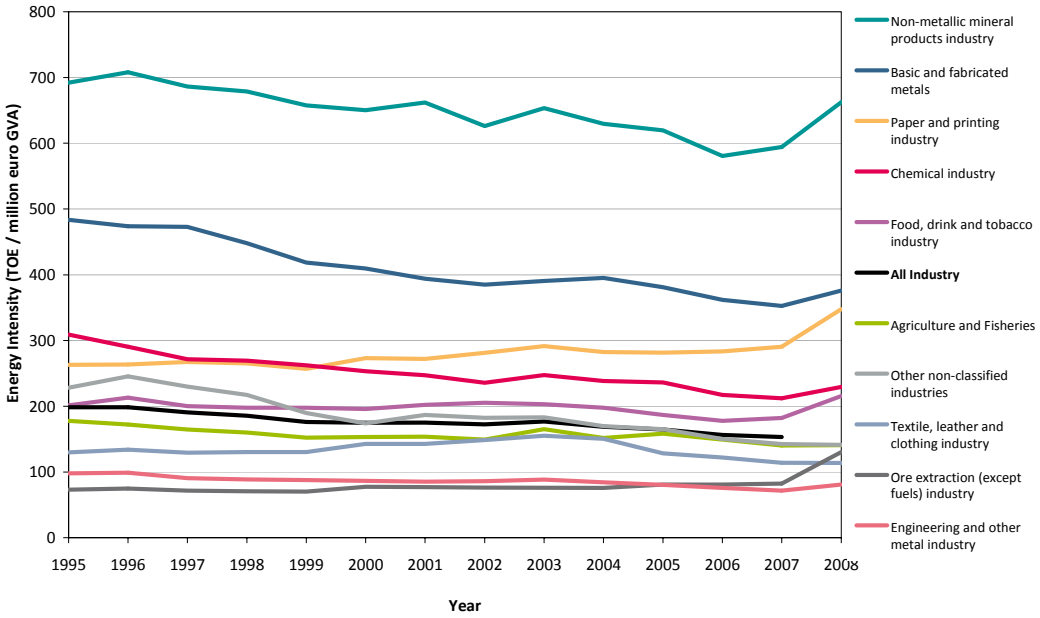
Notes: Bubble size represents relative industrial FEC in 2007. Dashed lines represent the trend of all data points and the 45 degree line one-to-one changes. Bulgaria and Romania are missing (because the latest EU KLEMS database release has no GVA data for these two countries). For Portugal, Poland and Slovenia the EU KLEMS database has GVA data until 2006 only. Therefore, for these three Member States the % change has been calculated over 1995-2006. EU-23=EU-27 – minus BG, RO, CY and MT; EU-12(-4)=EU12 – minus BG, RO, CY and MT.

Source: Eurostat (final energy consumption) and EU KLEMS database (GVA).

Energy intensity improved within most of the individual industrial sectors (see figure 5.7). Overall, the picture was favourable and some of the sectors with the highest initial energy intensity achieved some of the largest improvements. The basic and fabricated metals sector (i.e. the iron and steel and non-ferrous metals industries) saw an improvement of 22.2% from 1990 to 2008, with the downward trend continuing until 2007-2008 when a significant fall in GVA led to an increase in energy intensity. The chemical industry recorded a 25.7% improvement over the whole period, which has levelled off somewhat in recent years. The biggest improvement over the period, (38%), was achieved by the 'other non-classified

industries' (i.e. electrical and optical equipment and wood products), again a product of rapid increases in GVA. GVA stands out as the dominant variable in intensity trends, with the increases in intensity recorded in 2007-2008 a result of falls in GVA greater than the decline in energy consumption.

Figure 5.7: Energy intensity sector by sector (final energy consumption (in toe)/GVA in million euros (1995 constant prices)), 1995-2008

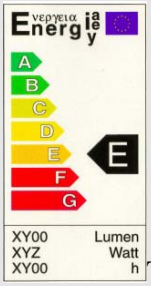


Source: Eurostat and EU KLEMS data (Ecorys calculations)

Changes in energy use and efficiency across sectors and their impact are affected by the fuel or energy mix used, choices of fuels and, within any given energy mix, by many factors, including local resource availability, energy prices and public policies. Public policies can promote energy efficiency and sustainable growth by means of a broad range of instruments (such as energy taxes and subsidies, regulations and standards, eco-designs, eco-labels, see section 5.5). Box 5.2 describes the specific case of mandatory energy labels for light bulbs in the EU which has produced significant economic and environmental benefits.

Box 5.2: Energy labelling for light bulbs: linking sustainable consumption, production and eco-innovation

Energy labelling is a mandatory requirement for light bulbs, cars, and most electronic appliances in the EU. These EU initiatives illustrate how consumer-oriented approaches to improve sustainable consumption and production can have far-reaching implications for the economic and eco-performance of industry. The regulatory energy-efficiency labelling scheme for light bulbs is an example of a labelling scheme with clear positive effects on both eco-performance (energy-efficiency improvements) and economic performance (higher value-added products and stimulating innovation). The labelling scheme has been primarily a regulatory initiative with the aim of informing consumers and supported and anticipated by industry.



The mandatory energy labelling scheme for light bulbs (under Energy Labelling Directive 92/75/EEC and Implementing Directive 98/11/EC on household lamps) is an example of a compulsory method for informing consumers and setting minimum thresholds the level of eco-performance of consumer products. Since December 2008, minimum energy-efficiency requirements for light bulbs are in force with the goal of phasing out incandescent bulbs by 2012. The energy label for light bulbs shows their energy efficiency level on a scale from G to A+++ plus the number of lumen and watts used, indicating the power of the light and the energy consumption per second. Compared with incandescent bulbs (levels E to G), compact fluorescent lamps (CFLs) (level A) can save up to 80% of energy for the same light output and have a service life six to fifteen times longer.

The development and market penetration of compact fluorescent lamps (CFLs) – the main sustainable alternative to incandescent light bulbs – has kept partly ahead of regulation. Sales of CFLs increased by 340% from 2003 to 2007 (Bertoldi and Atanasiu, 2009). Industry has taken on a proactive role in developing and marketing more sustainable lighting alternatives. Nonetheless, there seems to be consensus among policy makers, industry and consumer organisations that similar levels of energy efficiency would not have been achieved without these regulatory schemes, e.g. if the scheme had been voluntary[77]. This is mainly because consumers are concerned foremost about the quality (colour) of the light and price of the bulb and do not believe that they can make a bigger impact by buying energy-efficient appliances.

In general, awareness and willingness to act as a 'sustainable consumer' are increasing in the EU; more than 80% of Europeans believe that a product's environmental impact in general is a significant factor when deciding which product to buy (Eurobarometer, European Commission 2009b). However, when making a purchasing decision, a large majority of consumers consider quality and price more important than environmental impact. EU consumers see minimising waste and recycling as the ways in which they can have most influence on solving environmental problems, more so than by purchasing energy-efficient appliances or products that were produced using environmentally sustainable methods. Differences in consumer attitudes exist between Member States; for example, eco-labels play a larger role in purchasing decisions by consumers in Malta, Austria, Portugal and Italy than in the Czech Republic, Hungary, Estonia, Slovakia and Bulgaria.

Even though the general level of consumer recognition of the A-G energy label is high across Europe, ranging from 81% in Poland to 95% in the Netherlands, France and Denmark (Ipsos MORI, 2008), this can mainly be explained by the mandatory nature of the scheme. Consumer awareness of 'cost of ownership' arguments – i.e. that over the entire lifetime of the light bulb, energy saving costs can outweigh the initial higher purchasing price – is still assessed relatively low.

[77] See references for the list of interviews conducted.

Energy prices and policies or market conditions affecting their level or volatility, (such as taxes, subsidies, liberalised markets and competition) can also induce significant changes in industrial energy use and efficiency. For example, the relatively higher increase in gas prices against electricity prices over the last decade has been reflected by a shift in the relative industrial energy mix, from gas to electricity, in the majority of Member States.

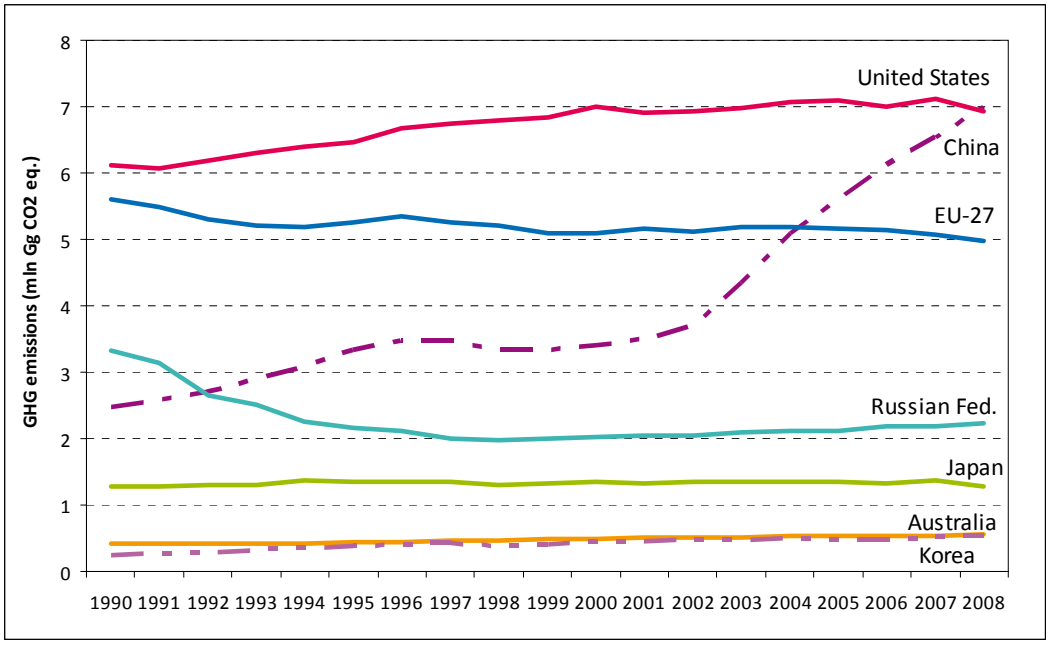
The way changes in energy use make an environmental impact is also affected by the energy mix in the country or industry concerned. Low-carbon (i.e. nuclear and renewable) energy sources play a leading role in this, as do factors such as fuel switching. The proportion of renewable energy in the energy mix in the EU increased from 13.8% in 2000 to 15.6% in 2008 (EEA, 2010, page 36) with improvements evident across almost every Member State, in line with policy goals on climate change. The EU as a whole remains ahead of Japan, the USA and many other countries on the use of renewable energy but countries such as China are also rapidly developing their technology and capacity.

5.3.2. Greenhouse gas (GHG) emissions and intensity

Whole economy

The environmental impact of changes in the energy mix is better reflected by changes in emissions. Mirroring changes in energy consumption, the biggest mover in global GHG emissions since 1990 has been China (see figure 5.8) which has surpassed the EU-27, and now also by most estimates the USA too, to become the world's biggest emitter. For both the EU and USA, the trends in total GHG emissions differ from final energy consumption, with the EU-27 recording a decrease in emissions while FEC was increasing and the USA also recording lower increases in emissions than FEC. This is a result of measures in these economies to promote use of renewable energy sources and energy efficient processes and to switch the fuel mix away from coal, the most carbon-intensive energy source.

Figure 5.8: Total GHG emissions in million Gg of CO2 equivalent, 1990-2008



Note: Data for China and Korea are based on CO_2 emissions data only, as CO_2 equivalent data are not reported to the UNFCCC by these two countries. Estimates suggest that CO_2 equivalent data would increase their emissions by approximately 8%, based on the proportions of the other countries.

Source: UNFCCC.

Analysing overall GHG trends within the EU-27, a marked difference emerges over time. In the early part of the period 1995-2000, significant reductions in GHG emissions were reported across the EU-12 countries, again tied to economic transition. The picture in the EU-15 at the same time was more mixed, with most countries decreasing emissions as more renewables came online and fuel mixes switched from coal to gas, but rapid economic expansion meaning that in countries such as Ireland, Portugal, Spain and Greece, GHG emissions also increased rapidly in this period. From 2001 on, this situation was reversed, with most of the EU-15 countries reducing emissions. At the same time, rapid economic growth in the EU-12 Member States increased their total emissions by 1.2% from 2001 to 2008. This increase was not universal, with Hungary, the Czech Republic and Slovakia managing to continue reducing their emissions.

Figure 5.9 presents GHG emissions at whole economy level against GVA changes in the same period. It reveals a variety of interesting findings: firstly, that the variation from the average trend is significant, demonstrating that there appears to be no strong correlation between changes in emissions and changes in GVA. While changes in GVA are likely to be a factor in emissions, the energy mix and transport both play a significant role at whole economy level.

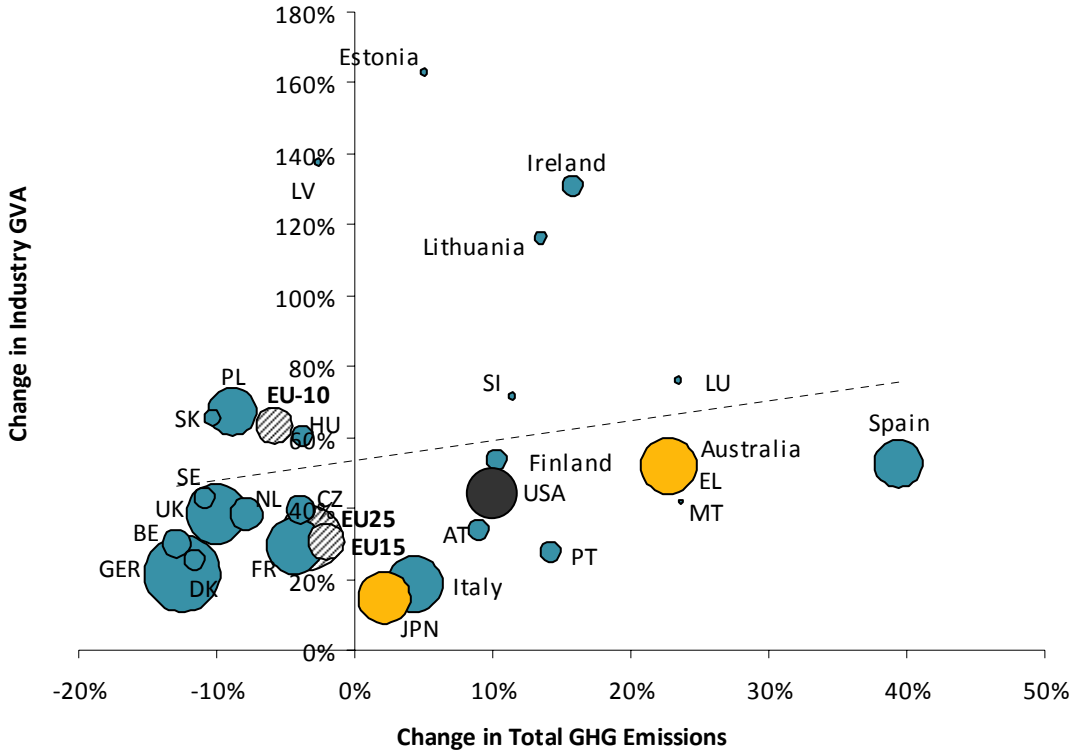
Secondly, 12 EU economies achieved an absolute decoupling of GHG emissions from GVA growth during this period. This is interesting, as it includes both EU-15 and EU-10 Member States, showing that EU-10 Member States are capable of a more sustainable economic transition in terms of emissions.

Thirdly, every country in the analysis achieved at least relative decoupling of economic growth from GHG emissions growth over the period. Various factors lie behind this,

including improved efficiency, cleaner power generation and more renewables in the energy mix. A further factor is the exporting or 'offshoring' of emissions: as heavy manufacturing is relocated outside these countries, domestic emissions decline, but the products, despite being produced offshore in places such as the BRIC (Brazil, Russia, India and China) countries, are still consumed in the EU and the developed world.

Finally, related to this, an international comparison of GHG emission intensity shows that the EU achieved the biggest proportional reductions and, similarly to energy intensity, is closing the gap on Japan. The USA and Australia lag behind in comparison. Since 1995 the EU has gained on Japan, while the USA and Australia have also closed on the EU.

Figure 5.9: Change in EU GHG emissions and GVA – Whole economy, i.e. all NACE rev. 1.1 sectors (GHG emissions (Gg CO2 equivalent)/GVA (in million EUR at 1995 constant prices), 1995-2007



Note: Bubble size relative to 2007 emissions, except for EU aggregates, US and Japan, which are set to uniform size for visual reasons.

Source: Ecorys based on UNFCCC and EU KLEMS data.

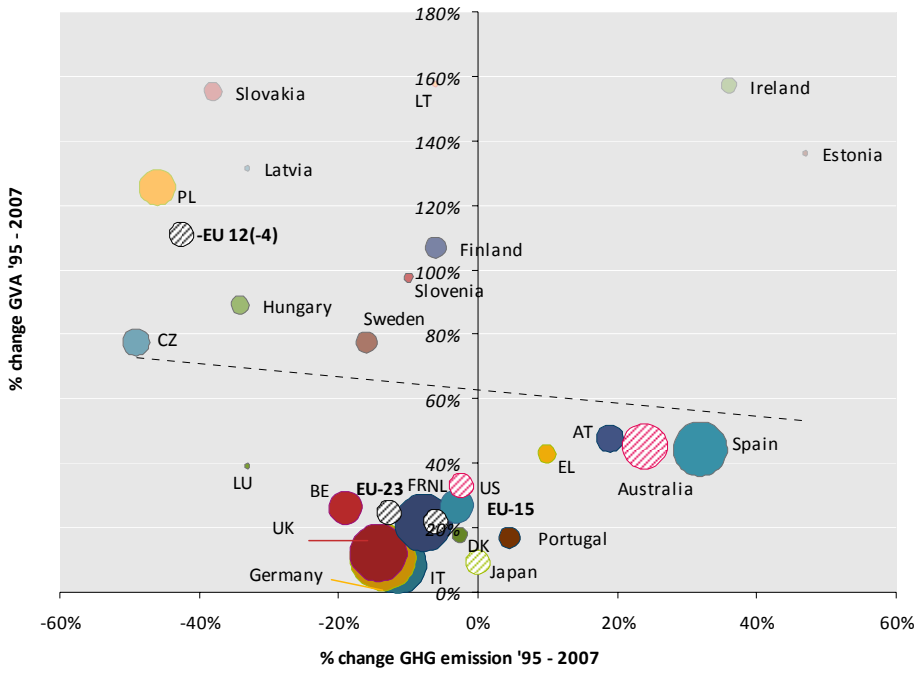
Industrial emissions

Focusing solely on the role of industry is difficult, as the emissions data reported to the UNFCCC are not directly aligned with the standard NACE industrial classifications and, consequently, GVA. This study matched the closest sectoral definition for industry in the emissions data – Manufacturing and construction emissions – to the appropriate economic sectors to form an analysis, but the match between the data sources is not perfect.

Figure 5.10 presents the trends in industrial GHG emissions for individual Member States against changes in GVA. This shows little clear correlation between changes in GVA and emissions from manufacturing and construction. GVA growth over the period was positive in every Member State, with 17 of the 23 for which data is available, achieving absolute decoupling of emissions from GVA. At the same time, six Member States – Spain, Ireland, Austria, Greece, Estonia and Portugal - saw emissions increase in this period. One conclusion is that the construction bubble in some of these six countries contributed disproportionately to emission increases per percentage point of growth. However, looking at GVA growth in just the construction sector, Lithuania (+146.1%), Slovakia (+99.2%) and Latvia (+293.9%) show growth rates at least as high as in these six countries and Portugal recorded only 6.5% growth in construction in this period. The construction sector is, therefore, unlikely to be the only explanatory factor.

The figure also gives an indication of the relative trends in emission intensity internationally. These show that over the full period the average EU emission reductions exceed those achieved in all non-EU countries. The USA has achieved absolute decoupling of emissions, but not to the same extent as in the EU. This reflects a long-term trend over the period for the USA to close the gap on the EU, although this is more a result of faster increases in industrial GVA than of emission reductions.

Figure 5.10: Change in GHG emissions from manufacturing and construction (UNFCCC) and GVA in the EU-23 (NACE rev. 1.1 D + F), 1995-2007



Note: Bubble size is relative to GHG emissions in 2007, except for EU aggregates, USA and Japan, which are set to uniform size for visual reasons.
GVA is measured in constant 1995 euros, using EU KLEMS industry-specific price deflators.
Countries omitted from the analysis due to missing data are: CY and MT (no GHG data) and BG and RO (no GVA data).

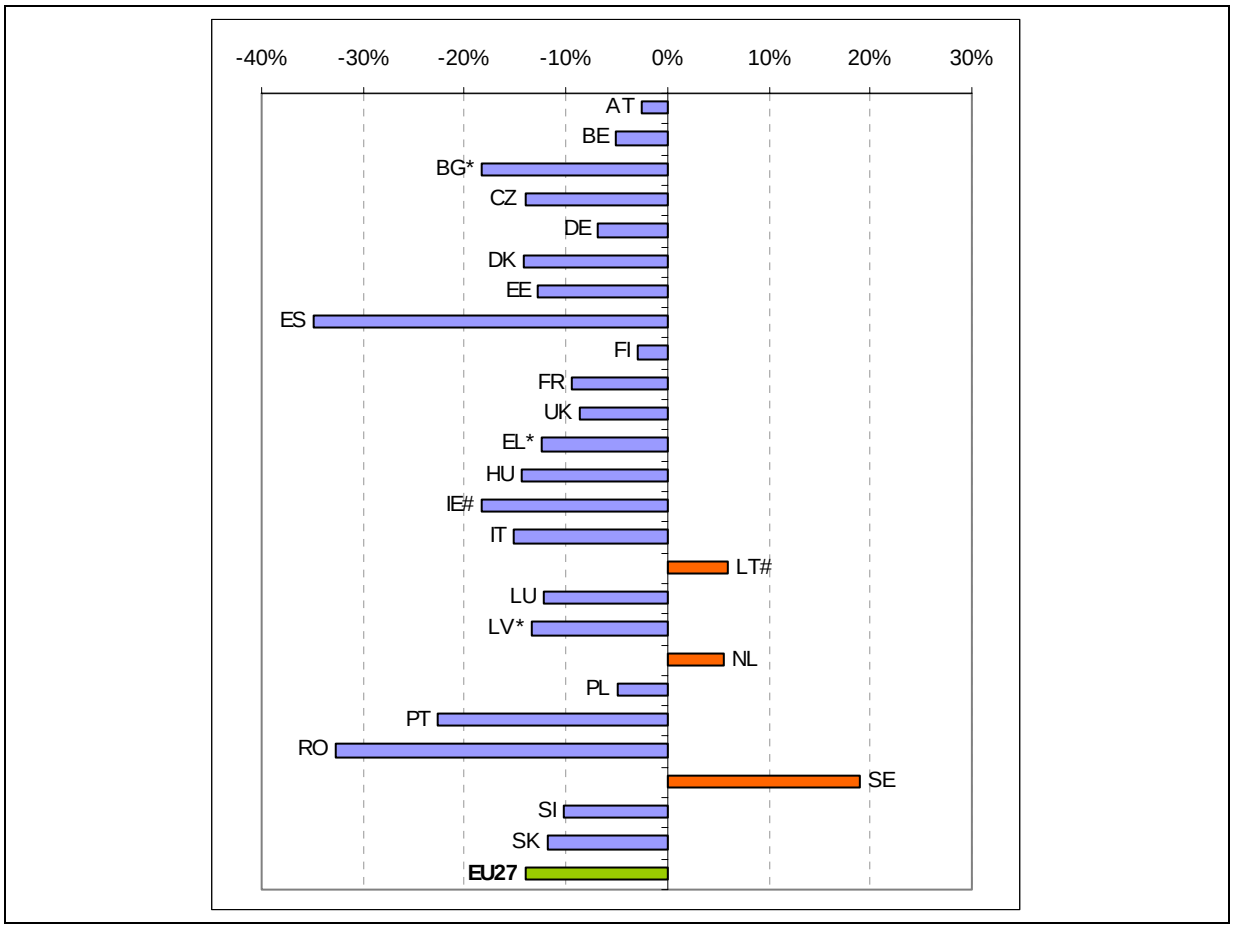
Source: Ecorys based on UNFCCC and EU KLEMS data.

Box 5.3: Sectoral emissions in the EU based on the CITL database

It is possible to form a more nuanced view of sectoral emissions in the EU by drawing on data from the CITL database, compiled as part of the EU emission trading scheme (ETS). This records and verifies emissions from the largest energy-generating and industrial installations across the EU, which generate around 40% of total EU-27 emissions. Data are available from 2005 to 2010, with 2009 and 2010 data still showing some variability in the quality in the data for specific sectors. Generally, the CITL data show a decline in emissions of 1% across all installations covered by the EU ETS between 2005 and 2008. At the same time, a 3.6% decline in overall EU-25 emissions was reported to the UNFCCC.

Going beyond 2007, the data from the CITL show that between 2007 and 2010 emissions declined by around 14% across the EU (see Figure 5.11), with particularly significant declines in Spain, Portugal and Romania. This is consistent with expectations, based on the impact of the financial crisis and contraction in economic activity in 2008 and 2009 in most Member States. Yet the decline was not felt everywhere, with three Member States – Sweden, the Netherlands and Lithuania – seeing emissions increase in this period. In Sweden the increase was tied to problems in the energy sector, with the shutdown of nuclear reactors increasing the demand for energy from gas-fuelled plants, combined with increased emissions from large chemical facilities and metal smelters. In Lithuania and the Netherlands the increases are a result of increased emissions from existing and new chemical installations and fuel refineries.

Figure 5.11 Change in EU-25 Member States' industrial GHG emissions, 2007-2010



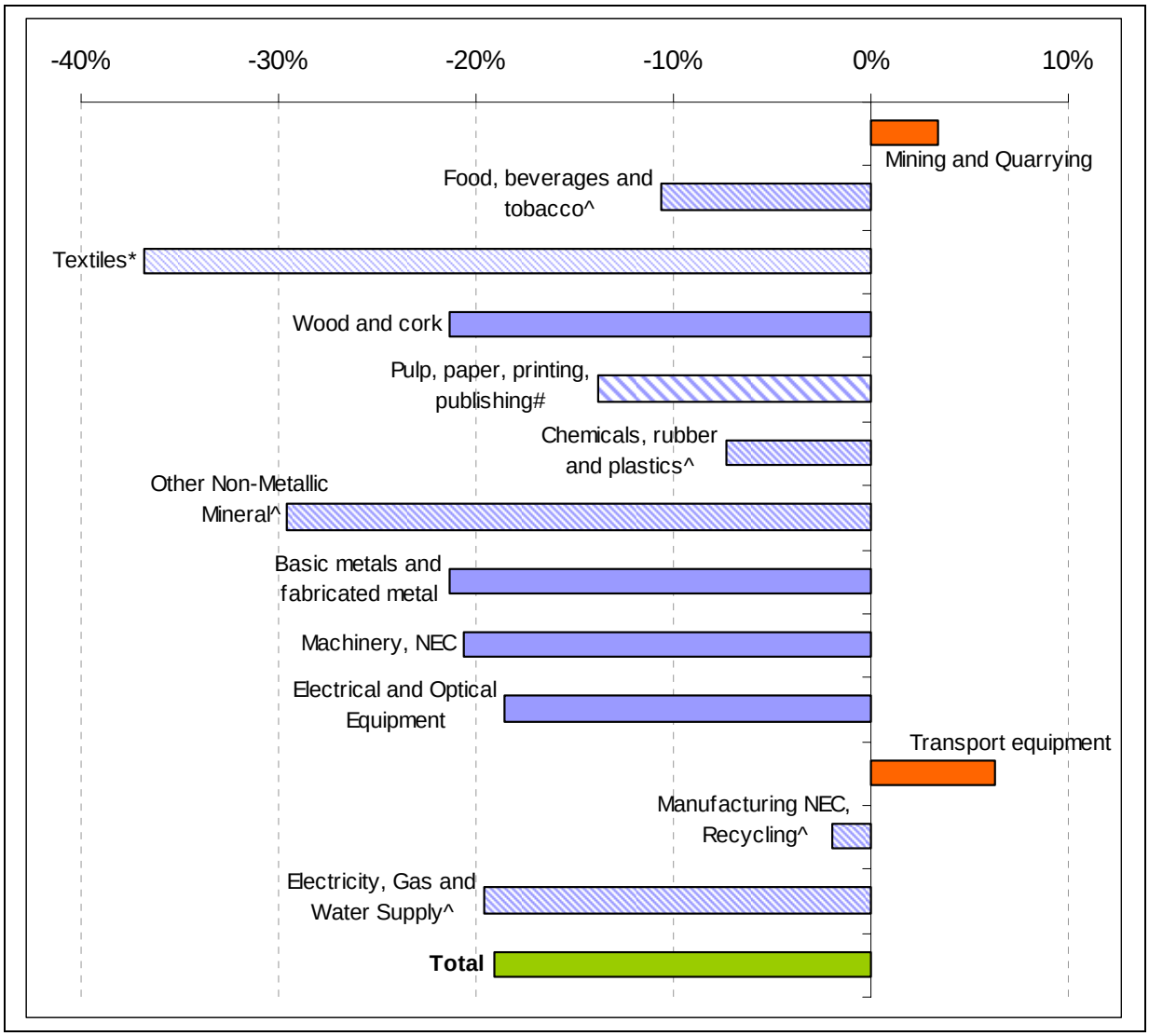
* - 2007-2009 data only – due to reporting gaps in 2010 data.

- Dataset for 2007-2010, but some concerns over completeness, with – estimates pointing to 5 to 10% potential additional emissions. This is based on an estimate of the emissions from installations that have not yet reported data or for which the data are still provisional, for 2008-2010. An assessment of potential additional emissions still to be reported has been made for all Member States in every year, based on emissions in the latest year from each installation. Only in Ireland and Lithuania does this estimate exceed 5% of total emissions in one or more year. In most Member States and years the proportion is less than 1% of the total.
Countries missing due to no or incomplete datasets: CY and MT.

Source: Ecorys based on CITL data (2009 and 2010 data provisional).

The CITL data also allow a more comprehensive examination of sectoral emissions over the same period, as shown in figure 5.12. This shows that EU industry under the ETS was able to achieve a 19% total reduction in emissions between 2007 and 2010, although a significant portion of this is likely to be related to the fall in economic activity. The biggest emitter by far is the electricity, gas and water supply sector, accounting for around 65% of all emissions under the EU ETS. The 19.6% decline in emissions from this sector is therefore a major contributor to the overall decline in emissions. The move to partial auctioning of EU ETS permits for the energy sector and continuing expansion of renewable energy are among the factors at work. Two sectors saw emissions increase in this period: mining and quarrying (+3.4%) and manufacture of transport equipment (+6.3%). Together these account for only 1.9% of total emissions. Increases in emissions are centred on the oil and gas extraction industries and a significant increase from a major German vehicle manufacturer.

Figure 5.12: Change in industrial GHG emissions in the EU-25, 2007-2010



* - Significant data concerns (estimated >5% of installations/emissions non-reported) in all years.
# - Data concerns in 2009 and 2010.
^ - Data concerns in 2010 figures.

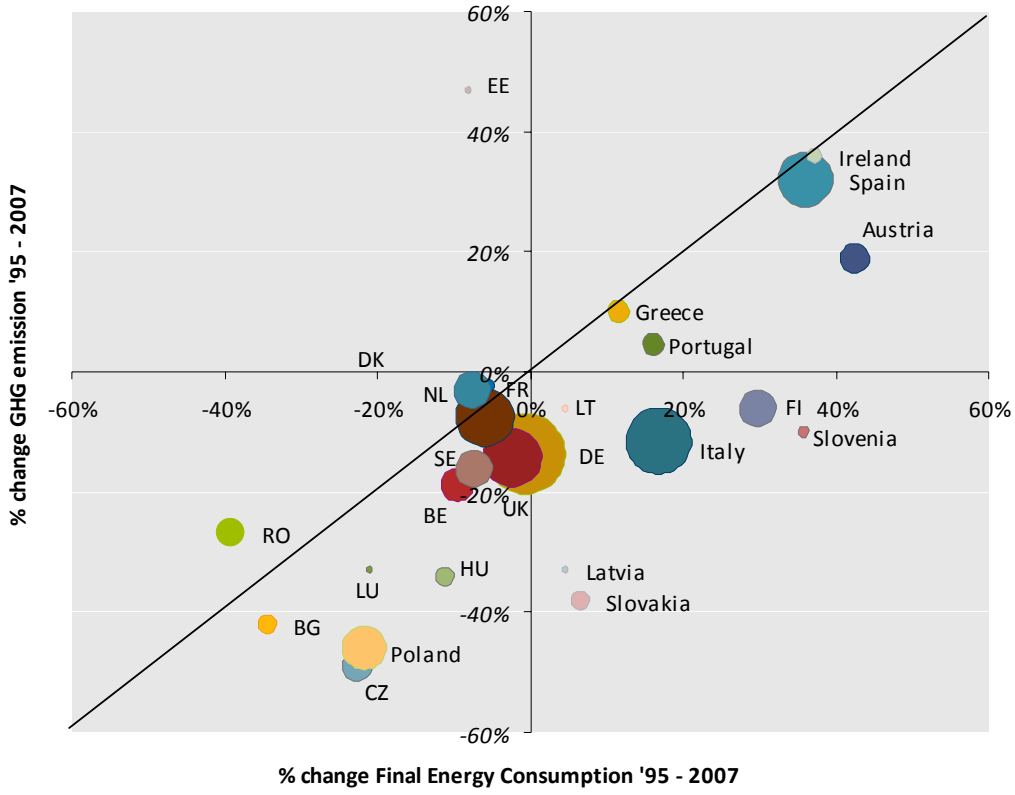
Note: In 2007, approximately 98.7% of total emissions were allocated to a specific sector: in 2010 92.9% were allocated.

Source: Ecorys based on CITL data, unless stated, all data estimated to be within 5% margin of error.

The role of the energy generation mix in determining emission levels and changes in emissions was mentioned earlier. Figure 5.13 presents the change in GHG emissions from industry against the changes in final energy consumption (FEC) by industry for the period 1995-2007. This demonstrates that in the EU-25 (EU-27 excluding CY, MT) FEC by industry remained largely unchanged, whereas emissions declined by 14%. This indicates an overall decarbonisation of the energy consumed by industry.

All but four Member States – indicates – are below the 45 degree line, indicating that most Member States were able to decouple industrial energy consumption from industrial emissions. In these four Member States, the recent changes suggest that the energy mix has become higher carbon, due to retirement of low-emission nuclear capacity and expansion of coal -or gas- fired plants. Equally, the nature of the data and the potential for differences in classifications[78] between the two indicators means the comparison might not be exact. Differences due to this could change the position as regards decoupling in these four countries. Five countries achieved only relative decoupling of industrial energy consumption from industrial emissions: Ireland, Spain, Portugal, Greece and Austria.

Figure 5.13: Change in industrial GHG emissions (manufacturing and construction) and final energy consumption by industry in the EU-25, 1995-2007



Note: Countries missing due to no or incomplete datasets: CY and MT (no industry-level GHG data).
Bubble size represents scale of FEC.
Source: Ecorys based on UNFCCC and Eurostat data.

78 The NACE rev 1.1. sector scope of both GHG emissions and FEC is not clearly defined, particularly in respect of FEC-related construction emissions.

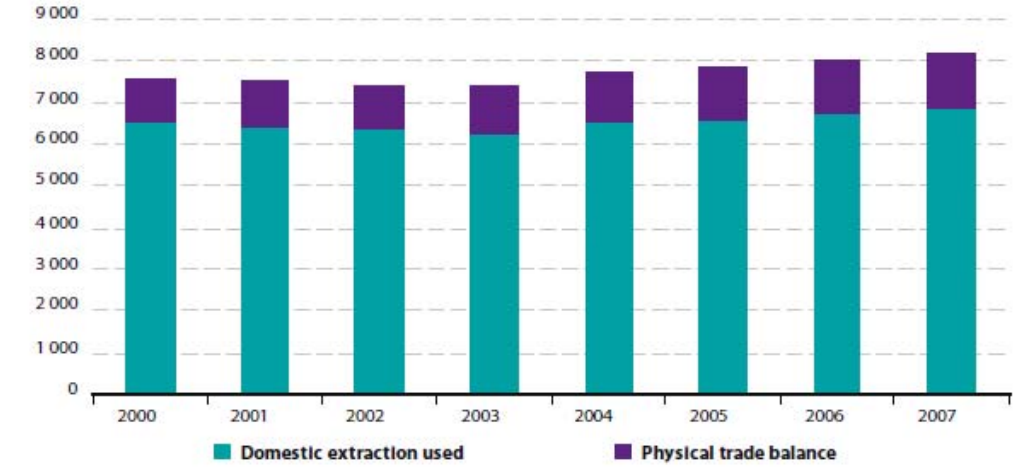
In summary, by most measures of performance with regard to emissions the EU outperforms the USA and is closing the gap on Japan. Emissions show a marked trend towards decoupling from GVA growth. In around half of the countries this trend is heading towards absolute decoupling. This trend is evident for emissions for the whole economy but also holds when the best available evidence for emissions from industry, manufacturing and construction, is considered. The best performers come from across the EU, with EU-12 Member States performing particularly well. Indeed, the weakest performers are found in the EU-15. The other EU-15 Member States generally report emission reductions of up to 20% combined with GVA growth rates of up to 40%.

5.3.3. Material flows and resource efficiency

The way in which industries use and dispose of raw materials is a critical component of their environmental impact and performance. . It is important to consider the impact of material flows in all lifecycle stages, namely: how raw materials are extracted (as this places environmental pressure on the locations from which they are sourced); how they are used (resource efficiency); how resources or materials are finally disposed of or reused.

Domestic material consumption (DMC) is a measure of the volume (in tonnes) of materials directly consumed in an economy. It is the sum of all materials extracted domestically plus the materials in physical imports, minus the materials in physical exports. As a volume measure, DMC does not differentiate between the type of material consumed, although it is important to note the differences between, for example, consuming one tonne of wood versus one tonne of mercury, as they obviously differ in mass density and the potential environmental implications of the latter are far more serious. Figure 5.14 shows that within the EU-27, DMC increased by 7.9% between 2000 and 2007.

Figure 5.14: Domestic material consumption (DMC) in the EU-27 by components (in million tonnes)

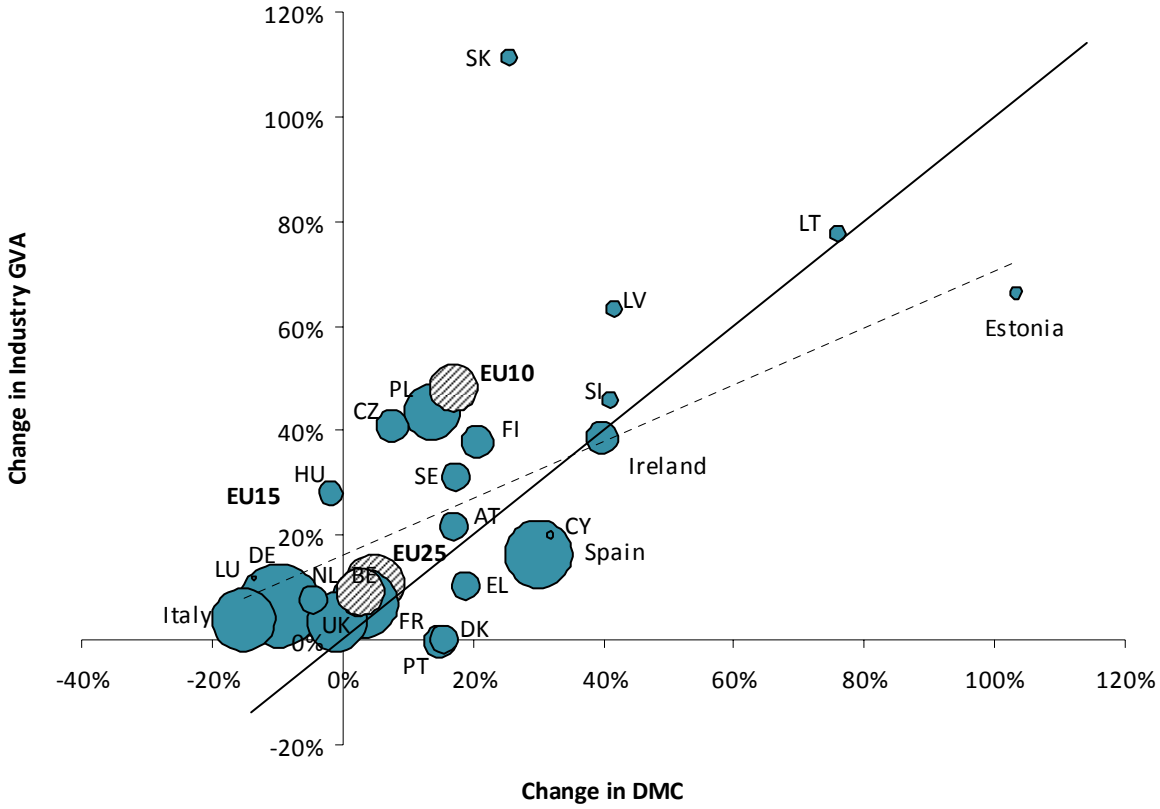


Source: Eurostat (env_ac_mfa)

Figure 5.15 presents an analysis of the change in DMC against the change in industrial GVA over the same period, though due to data limitations DMC is for the whole economy and not just industry. The figure shows, how in terms of material consumption, six economies - Italy, Germany, the UK, the Netherlands, Luxembourg and Hungary - all achieved what may be regarded, to some extent, as absolute decoupling, by reducing material consumption while

increasing industrial GVA. Eleven other – France, Poland, Czech Republic, Sweden, Austria, Belgium, Slovakia, Finland, Lithuania, Latvia, Slovenia –demonstrated what could be regarded as relative decoupling, with industrial GVA increasing faster than DMC in this period. In the other Member States below the 45 degree line – Spain, Greece, Denmark, Ireland, Estonia, Cyprus, Portugal and Malta – DMC grew faster than GVA, pointing to a reliance on resource use to fuel economic growth. In Spain and Ireland this is understood to be consistent with expansion in the construction sector with its high material needs (see figure 5.18).

Figure 5.15: Change in DMC and industrial GVA by Member State, 2000-2007

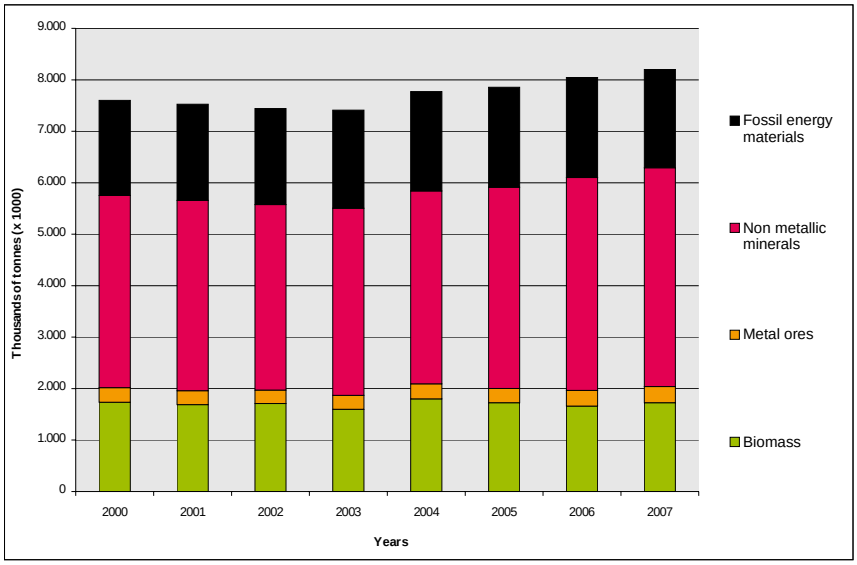


Note: Bubble size is relative to 2007 DMC, except for EU aggregates.

Source: Ecorys from Eurostat and EU KLEMS data.

Figure 5.16 presents DMC over the four main categories of material: fossil energy (carrier) materials, biomass, non-metallic minerals and metal ores. It shows that consumption of biomass declined by 0.4%, but metal ore consumption increased by over 10% and non-metallic mineral consumption by 13.9%. Fossil fuel consumption grew by 3.2%, in keeping with overall growth in FEC in the EU-27 over this period.

Figure 5.16: Domestic material consumption in the EU-27 by main material categories, 2000-2007



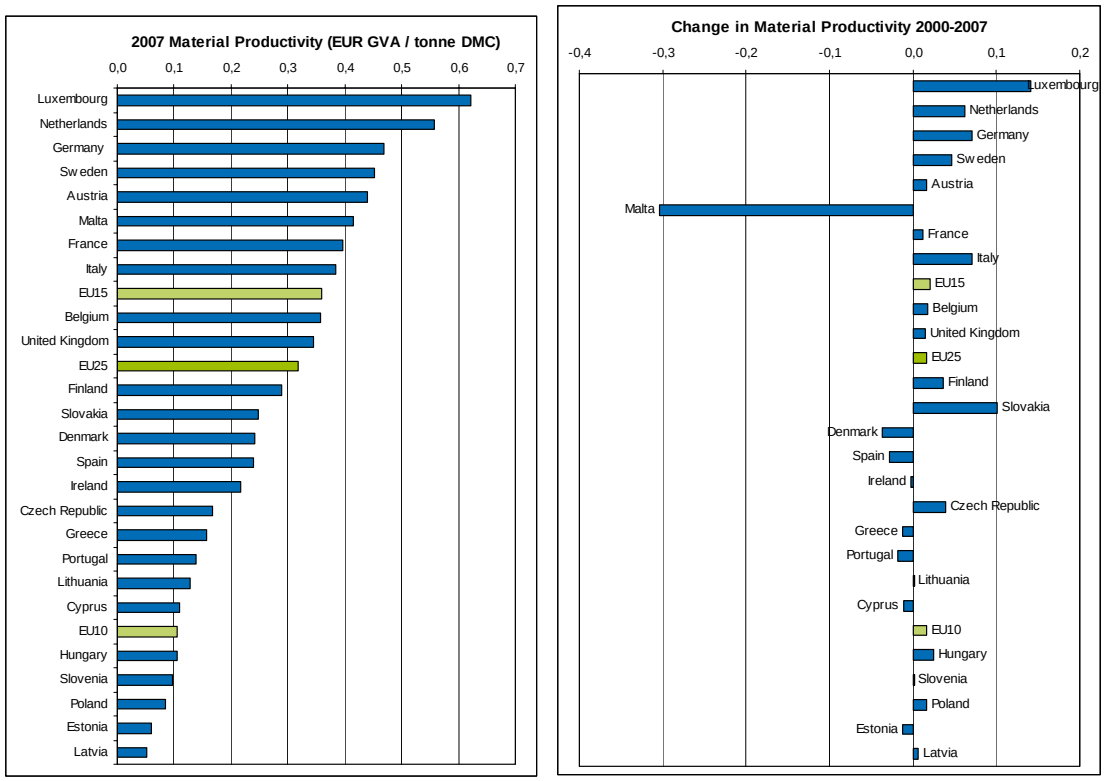
Source: Eurostat

Developing this further, figure 5.17 presents the material productivity for each Member State in 2007 as a factor of euros of GVA from industry, at 1995 constant prices, per tonne of DMC for the whole economy. Material productivity for the EU-25 was 0.32 euros of industrial GVA per tonne of DMC and improved by EUR 0.02 or 5.2% from 2000 to 2007. This small improvement provides evidence of a limited relative decoupling of industrial GVA from material use.

A distinct difference is evident between the EU-15 and EU-10 economies, with material productivity more than three times higher in the EU-15 (0.36) than in the EU-10 (0.10). The countries with the highest material productivity levels are Luxembourg, the Netherlands and Germany, broadly consistent with the data on DMC. Spain and Ireland rank among the countries with the lowest levels, again reflecting the role of the relatively high material consumption of the construction sector.

Eight Member States recorded a decline in material productivity – Malta, Denmark, Spain, Ireland, Greece, Portugal, Cyprus and Estonia – mainly a trend in the Member States with strong expansion in the construction sector, rather than a divide along EU-15 and EU-10 lines, as was evident in the changes in figure 5.15. The change in the EU-10 marked a relatively bigger increase in material productivity than that achieved in the EU-15. The biggest absolute increase in material productivity came in Luxembourg, the Netherlands, Germany, Italy, Sweden and Slovakia, each recording increases of 0.05 EUR or more over the period. The biggest relative increases in material productivity (greater than 20% over the period), came in Luxembourg, Italy, Slovakia, Czech Republic, Hungary and Poland, illustrating the catching up process in some of the EU10 countries.

Figure 5.17: Material productivity in the EU-25 in 2007 – Industrial GVA in EUR (1995 constant prices) per tonne of DMC in 2007 and change in material productivity, 2000-2007



Source: Ecorys based on Eurostat (DMC) and EU KLEMS (GVA) data.

5.3.4. Waste generation and treatment

The production process in industry creates waste at various stages. Examining trends in the volume of waste generated by industry provides insights into changes in the absolute and, by relating back to GVA, the relative impact of industry. The coverage and quality of waste data restrict the extent to which analysis is possible, as so far data have been collected for only 2004, 2006 and 2008 and are not directly comparable between industries.[79]

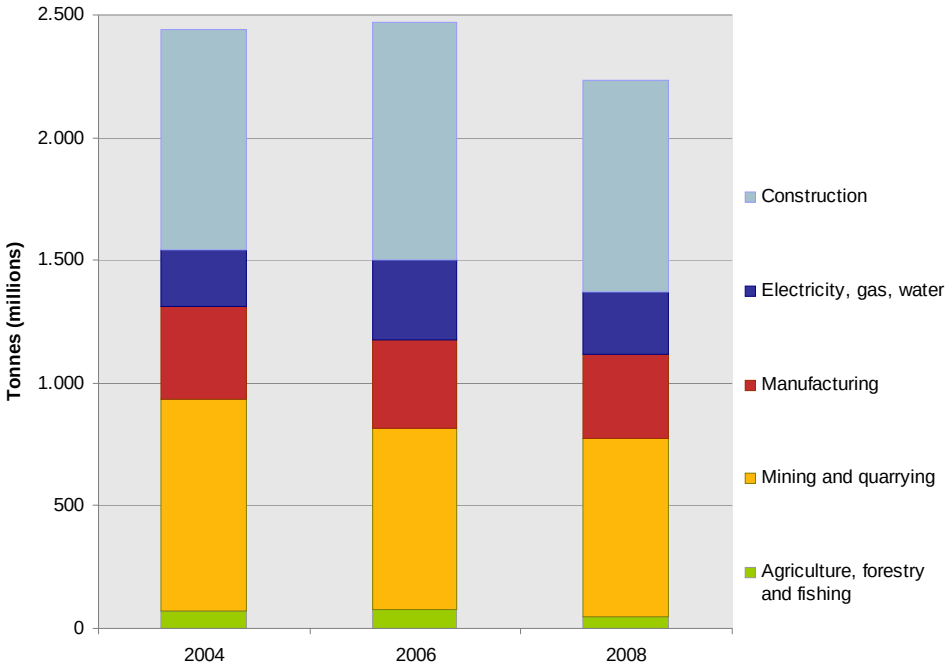
Total waste generation data for industry[80] in the EU-27 are presented in figure 5.18. This shows clearly that the two sectors that appear to generate the largest amount of waste are construction and mining and quarrying. The overall trend is interesting, with a 4.8% rise in the total from 2004 to 2006, fuelled by an increase in waste generation from the electricity, gas and water sector (+42.7%) and construction (+7.9%). Over the same period there were decreases in the volume of waste generated from mining and quarrying (-14.1%) and

79 The data are compiled on a NACE rev. 2 sectoral basis, which is not directly comparable with other data, such as GVA data from EU KLEMS, compiled on a NACE rev. 1.1 basis.

80 This is for NACE rev.2 categories A to F. While the category headers are similar to NACE rev.1.1, there are differences in their composition. Focusing solely on industrial sectors A to F covers 93 to 94% of waste generated across all NACE categories and 83.8% to 86.3% of all NACE category and household waste generated in this period across the whole EU27.

manufacturing (-5.2%). According to the same data source, from 2006 to 2008 there was a significant decline (-11%) in the volume of waste generated, with the biggest arising in agriculture (-41.4%) and electricity, gas and water (-20.8%).

Figure 5.18: Total waste generation by industry in the EU-27 (NACE rev.2 A-F), 2004-2008



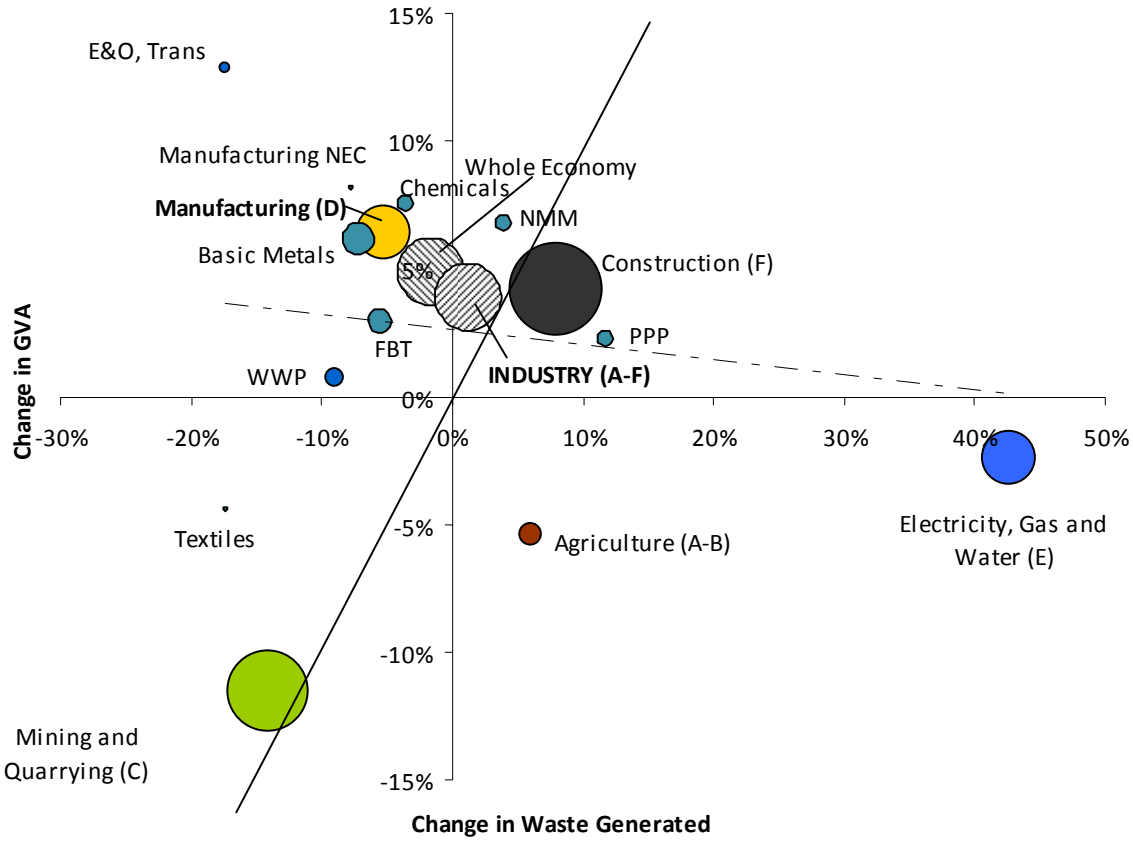
Source: Ecorys based on Eurostat data.

Figure 5.19 presents the change in waste generation by sector, against the change in GVA over the period 2004-2006.[81] This demonstrates an absolute decoupling of waste generation from GVA growth in this period for all sectors in the upper left quadrant, including manufacturing as a whole and electrical, optical and transport equipment, basic and fabricated metals, food, beverages and tobacco (FBT), chemicals and wood and wood products (WWP).

Relative decoupling, with generation of waste increasing at a slower rate than GVA, is evident in all but four of the other sectors. The four sectors that counter the trend are construction, agriculture, electricity, gas and water and paper and publishing. In each case the change in GVA was exceeded by the change in waste generated, apparently pointing to negative trends in eco-performance in these sectors. There is no clear explanation for the increase in waste generation in these sectors is not clear. Box 5.4 presents a brief assessment of the impact of the End-of-Life Vehicles Directive (which imposed binding targets for reuse, recovery and recycling) on the eco-performance of the automobile industry in the EU.

[81] GVA data are not yet available for 2008.

Figure 5.19: Change in total waste generation by industry (NACE rev. 2 A-F) and GVA in the EU-27, 2004-2006



Notes: Bubble size represents relative waste generated in the sector, except for whole economy and industry (A-F). E&O, Trans represents the combined totals for the electrical and optical and transport sectors.

Source: Ecorys based on Eurostat data.

Box 5.4: Measures to support sustainable performance in the EU automobile industry: an assessment of the ELV Directive

The End-of-Life Vehicles (ELV) Directive (EC, 2000a) was introduced in 2000 in order to achieve a number of environmental benefits (and is thus based on Article 192 of the Lisbon Treaty). It covers the **whole lifecycle of a vehicle**, including the design, re-use and recycling stages. Above all, it regulates a major sector of European industry that is facing considerable competition from around the world. This is perhaps why the Directive has attracted considerable attention, and at times criticism, from the different industries involved in the product chain.

The headline provisions of the Directive are its binding targets for re-use, recovery and recycling of ELVs. By 2006, 85% of the weight of each vehicle had to be either reused or recovered (e.g. bumpers, tyres, etc.) and 80% had to be reused or recycled. Moreover, these targets will rise to 95% and 85% respectively by 2015. Before the ELV Directive some countries had already managed to achieve high levels of reuse, recovery and recycling thanks to effective voluntary agreements with industry (for example, in Sweden and the Netherlands). However, this was not the case throughout the EU, which was one of the reasons for introducing the Directive.

The 2006 targets have been reached in nineteen Member States, though reporting has been problematic because of the different methods employed by the national authorities (EP, 2010). There is, however, some concern that the 2015 targets cannot be achieved because of the extra proportion that needs to be recovered or recycled, as every additional percentage point becomes more difficult. A large proportion of each ELV has significant value, which is why dismantling cars has long been a profitable business all over Europe. However, the parts of an ELV with less value make reuse and recycling less commercially attractive. By way of illustration, the average value of the ferrous metals in an ELV (steel and iron) is €128, whereas the plastic is worth only €1 (ARN Recycling).

The different industries in the automobile supply chain have been forced to make considerable changes in order to meet the requirements of the Directive. Significantly, the principle of *extended producer responsibility* has been introduced whereby manufacturers assume responsibility for the final use of their products, which had previously not been considered part of an industry's core business (Gerrard and Kandlikar, 2007). Some of the specific challenges which the EU industry has had to face are described below:

- Vehicles now need to be designed for recycling in addition to normal commercial considerations. Use of plastics is problematic, because of their low value and mixture of types, which makes them difficult, and therefore more expensive, to recycle. However, changing the design of a vehicle for recycling purposes can increase its weight which has a negative impact on energy efficiency and emission reduction efforts. In this regard the increasing use of aluminium is encouraging, since it is a light material with a high end value. Although it is expensive, use of aluminium could help to reinforce Europe's tradition of making quality cars. Even closer coordination between suppliers and manufacturers and the recycling industry is needed to make sure that the whole life cycle of the vehicle is taken into account. Some interesting and useful research was conducted with these different partners in the EU-funded LIRECAR ('Light and recyclable cars') project just after the Directive was introduced. More investment in similar research is needed to ensure that vehicles are designed for both the environment and recycling, while remaining competitive on price.

- Manufacturers and, consequently, their suppliers have also had to stop using four heavy metals (lead, cadmium, mercury and hexavalent chromium) which are damaging the environment. The industry has largely achieved this (ÖKO Institut, 2010) but at a considerable financial cost. These heavy metals were being gradually phased out by industry but future vehicles such as battery-powered or hydrogen cars will need other raw materials (European Commission, 2010e). To remain competitive, more resources have to be invested in **research for the future** (e.g. into long-term substitutes that do not rely on access to critical raw materials; see the previous chapter of this report), which should be given equal priority to regulation of cars designed today.

- The recycling industry has had to **innovate** in order to meet the targets set by the Directive, notably in use of post shredding technology (PST) that separates materials even further so that they can then be recycled or used for energy production. ARN Recycling recently completed a large plant in Tiel (Netherlands) with support from the automobile industry and new facilities have also been opened in Austria and Germany. Volkswagen, in partnership with the recycling company Sicon, has produced the first car that meets the recycling targets set in the Directive, mainly by means of investment in PST.

However, overall, industry has been expressing some concerns about whether imposing headline targets is the best strategy to create sustainable growth. This is illustrated by its much

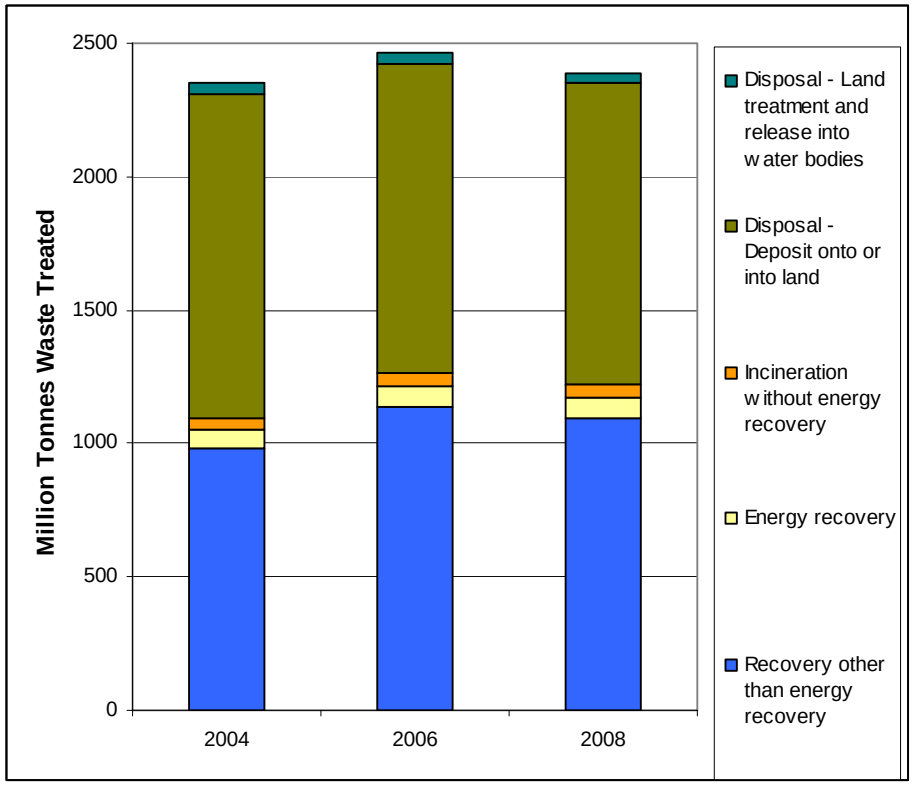
larger investment in R&D on emission reduction, fuel efficiency and energy consumption technologies (Gerrard and Kandlikar, 2007). The environmental benefits of the Directive have to be weighed against the costs and the need to concentrate on the future of a rapidly changing industry. Greater understanding of the **different stages of the supply chain** helps to ensure that the **whole lifecycle of the product** is taken into account. Legislation certainly has a role to play in this, but so do research and intra-industry cooperation. Consequently, the right combination and the establishment of well functioning markets for recycled materials are needed in order to create the conditions for sustainable growth.

Waste can have a significant environmental impact, particularly if it is hazardous or otherwise contaminated, but even simple biological waste can also be a significant source of GHG when disposed of in landfills. It is becoming increasingly important to view waste as a potential resource stream, rather than a problem that needs to be disposed of in the cheapest way possible.

Figure 5.20 illustrates the most recent trends in waste treatment across the EU-27, giving details of the process used to dispose of the waste. In keeping with the waste hierarchy of reduce, re-use, recycle, recover or dispose (in that order of preference), the waste treatment methods span the last three stages. Recovery other than energy recovery means recycling or other more environmentally friendly treatment of waste. Energy recovery means using waste to produce energy, typically by means of incineration, but also via other processes. The three other categories cover forms of disposal, from incineration without energy recovery to disposal of waste on land (landfill) or into water.

The total quantity of waste treated increased from 2004 to 2006 before falling from 2006 to 2008. Overall, from 2004 to 2008 the total volume of waste sent for treatment increased by 1.6% from 2 353 million tonnes to 2 391 million tonnes. Changes between the main treatment and disposal methods over the period were limited primarily to a move towards greater recycling in the 'recovery other than energy recovery' category, which increased its share of waste treatment from 41.7% to 45.7% between 2004 and 2008. At the same time, disposal of waste via landfill or 'deposit onto or into land' decreased from 51.9% to 47.3%. An increase in energy recovery from 3.1% to 3.4% was also recorded (see also chapter 4 of this report on waste stream recovery and recycling of non-energy materials).

Figure 5.20: Total waste treatment in the EU-27, 2004-2008



Source: Eurostat.

The waste treatment data do not allow sectoral analysis. Nevertheless, it is clear that the way in which waste can eventually be treated is a factor in how industrial processes enable or restrict the options by which products can be recycled or disposed of safely. If targets are to be met and the environmental impact reduced, it is important for industry to design products with cradle-to-cradle life-cycle processes in mind. Although not evident at macro level, several initiatives have been launched to increase resource efficiency, but they are still not widespread among all industry. Collection systems' bottlenecks and the lack of incentives to use recycled material are major barriers to enhancing the waste recycling markets.

The overall eco-performance of industry in terms of material and resource use is more mixed than for other environmental variables. With material consumption increasing as a whole, but at a slower rate than GVA growth, there is evidence of relative decoupling of the impact for the EU as a whole. At Member State level the picture is more mixed with only a few countries providing strong evidence of absolute decoupling of economic growth from material and resource use - Germany, Italy, the Netherlands and, to a lesser extent, the UK, Hungary and Luxembourg. A more worrying trend is that nine Member States (Spain, Greece, Denmark, Ireland, Slovenia, Estonia, Cyprus, Portugal and Malta) exhibit no decoupling of resource consumption from GVA growth, demonstrating that, in some Member States at least, efficient and sustainable resource use is some distance away.

Within industry there were more positive trends in most sectors, with waste generation being decoupled from GVA growth to some extent in all but three. Manufacturing as a whole and many of its sub-sectors exhibit absolute decoupling. Notably, there was relative decoupling in the construction sector, the biggest waste generator. The second biggest waste-generating sector, mining and quarrying, was among the poorest relative performers.

Positive eco-performance trends were exhibited in waste treatment in general, with energy recovery and recycling slowly displacing disposal to landfill. The role of policy in initiating this change should not be underestimated.

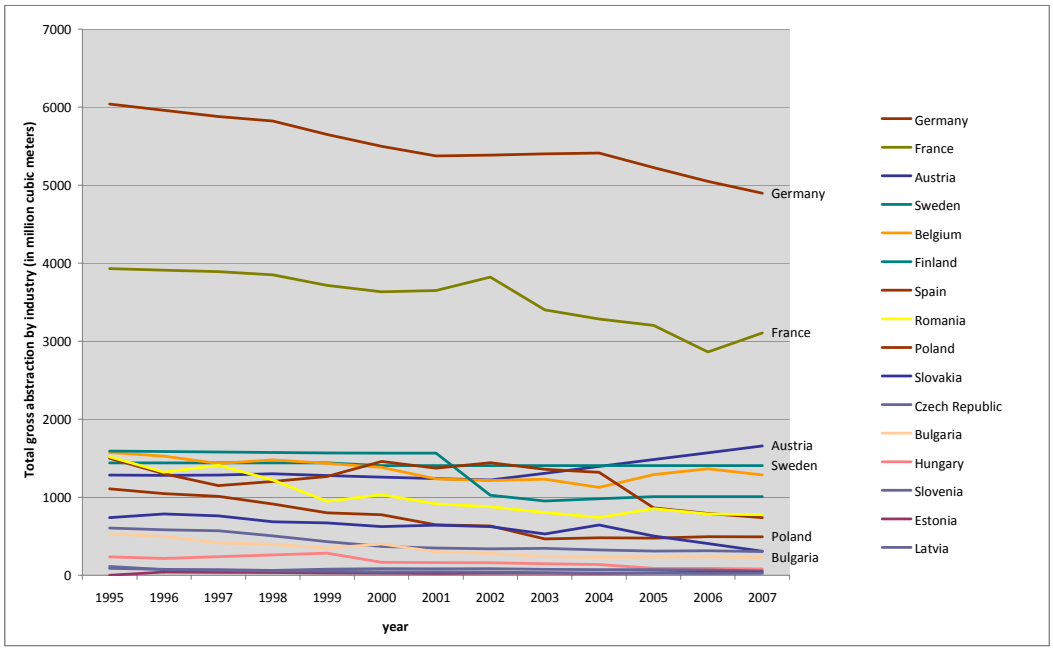
5.3.5. Water

Europe has abundant water resources, but they are not distributed evenly. In some regions water is becoming an increasingly precious and scarce resource. Therefore, efficient use and management of (waste)-water resources is important to prevent and/or adapt to water scarcity. The Water Framework Directive was designed to safeguard a sufficient supply of good-quality fresh surface water and groundwater within a sustainable, balanced and equitable water use scheme in each Member State (EC, 2000b).

The efficiency with which industry uses water is important, although agriculture and residential users are the largest sources of demand. Water is crucial to many industrial processes. It is therefore important to balance industrial needs against agricultural and domestic requirements, knowing that losses of water in the supply network are often substantial, particularly in Member States with severe water scarcity, as in southern Europe. Water has a number of other environmental impacts, including indirectly via the energy used in processing, supplying and treating it.

It is hard to draw robust conclusions on the eco-performance of industry in terms of water use (both as input and as destination for its emissions) as the data are weak and incomplete on a yearly and Member State basis. Comparing total water abstraction with abstraction for industry, the latter has fallen faster than total abstraction over the same period. Figure 5.21 provides some evidence of an absolute decoupling of industrial water abstraction from industrial GVA growth. A particular improvement is evident in Germany over the whole period. The one exception according to the available data is Austria, where water abstraction increased over the period. As regards water as destination for industrial emissions, see Box 5.5.

Figure 5.21: Water abstraction by EU manufacturing industry by Member State, 1995-2007

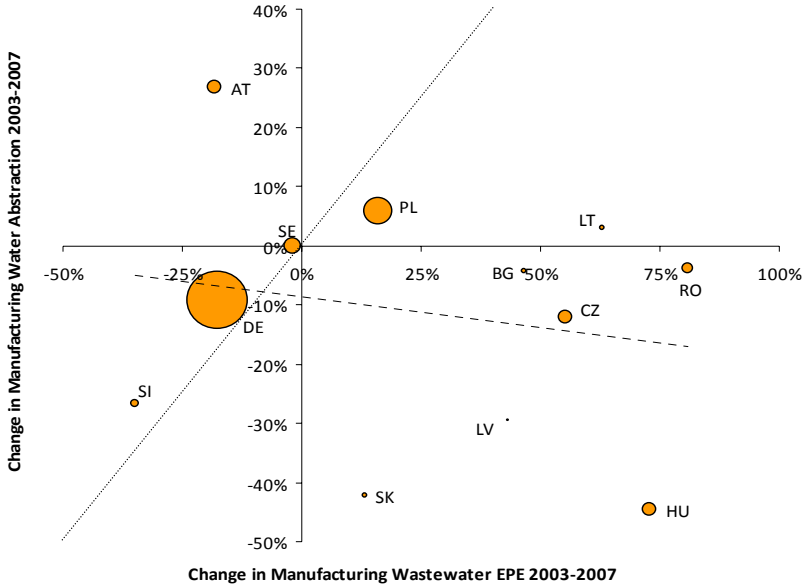


Note: Countries missing due to no or incomplete data: UK, MT, IE, LU, PT, FI, IT, NL, LT, DK and EL.
Source: Eurostat.

Box 5.5: Eco-expenditures on waste-water management

Wastewater management is a major item in industrial environmental protection expenditures (EPE), which is presented in section 5.4.2. In 2006, wastewater management accounted for 17% of public EPE. Figure 5.22 presents an analysis of the extent to which increased EPE on wastewater by manufacturing industry could lead to decreases in industrial water abstraction. It demonstrates that the correlation between the two variables could be weak: in general, EPE on wastewater has been increasing faster than water abstraction. In addition, aside from Poland and Lithuania, the five other Member States where EPE on wastewater by manufacturing industry increased, also saw their water abstraction for manufacturing decline. Austria saw the biggest increase in water abstraction. As mentioned previously, this was due to above-average growth in water intensive manufacturing sectors such as food, drink and tobacco and chemicals.

Figure 5.22: Change in EPE on wastewater and in water abstraction by manufacturing industry in selected Member States, 2003-2007

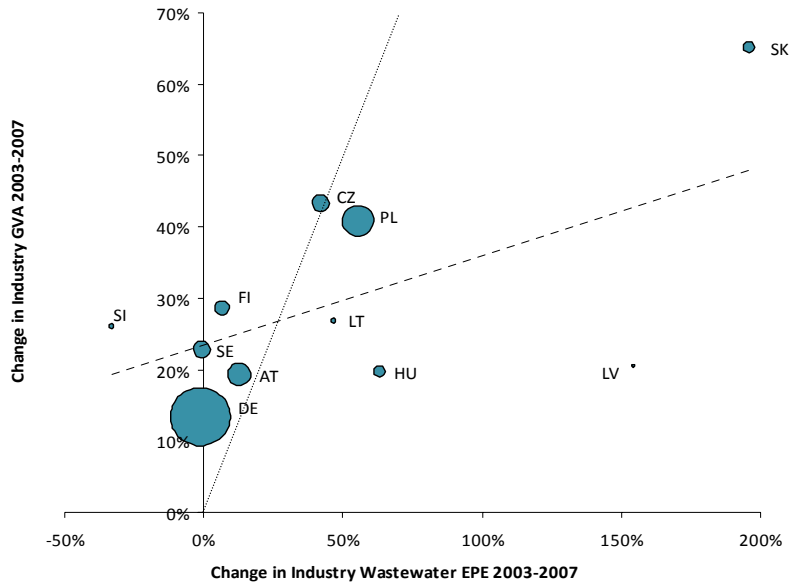


Note: Bubble size represents relative industrial EPE on wastewater in 2007. Member States missing due to incomplete data: BE, DK, IE, EE, EL, ES, FR, IT, CY, LU, MT, NL, FI, PT and UK.

Source: Eurostat data – Ecorys analysis.

As shown by figure 5.23 in general there appears to be a correlation between increased industrial GVA and increased industrial EPE on wastewater. This is strongest in newer Member States in Central and Eastern Europe, as a result of lower relative starting points than in Member States such as Germany and Sweden

Figure 5.23: Change in EPE on wastewater and GVA in industry in selected Member States, 2003-2007



Note: Bubble size represents relative industrial wastewater EPE in 2007. Member States missing due to incomplete data: BE, BG, DK, IE, EL, IT, EE, ES, FR, CY, LU, MT, NL, PT, RO and UK.

Source: Eurostat data – Ecorys analysis.

There are various other aspects affecting the sustainability of industry including its impact on land use, biodiversity and air pollution (see also subsection 5.4.3 and Box 5.8 below on environmental protection expenditures). Measures of these are of mixed quality. For air pollution there has been a significant improvement in industrial emissions in the last 10-20 years, closely following the trends in energy and GHG emissions as the emission source points are often the same. Since 1995 there have been falls of around 50% in particulates (PM10), which are responsible for human respiratory problems, and over 50% falls in nitrogen oxide (NOx), ammonia (NH4) and Sulphur dioxide (SO2), the main pollutants responsible for acid rain (Ecorys et al. 2011). Reductions in these emissions are continuing, although they have slowed since the early impetus given by EU air pollution legislation (see also Commission 2002).

5.3.6. Summary and tentative discussion on the impact of the recent crisis

The overall picture emerging of the eco-performance of EU industry is one of significant progress towards decoupling economic growth from environmental impact over the last two decades. The specific role played by industry within this setting is not always clear from the data, as it is not always possible to separate out which part of the changes is the result of growing efficiency in industry and which is due to other improvements. A case in point is that many of the most positive aspects of industry's eco-performance stem from improvements in emissions from the energy sector. However, the evidence points to these improvements being based on wider policy intervention in the energy generation sector, rather than on action taken by industry. While not all the improvement could be claimed by industry for these reasons, the evidence does support the view that on the whole industry has improved its eco-performance over the period covered and that these trends are continuing in most sectors and Member States. Policy has played a prominent role in many of these developments, particularly in improvements in emissions to air and in waste and resource efficiency.

Overall, there remains strong evidence of, at least, relative decoupling of GVA from environmental impact across the majority of industry, particularly in respect the cases of energy, GHG or other emissions and water use. Relative decoupling is also apparent in material consumption, but not to the same extent as in the other aspects. The evidence suggests that absolute decoupling is also taking place, with eco-performance improving in absolute terms, not just proportionally, while economic performance is also improving. This is most visible in the cases of energy use and emissions, but, as noted above, any absolute decoupling is the product of a variety of factors to which actions by industry alone makes only a small contribution.

Throughout the text references are made to the recent economic crisis. Unfortunately, however, 2007 is the latest year for which most indicators of industrial eco-performance are available. Nevertheless, whenever more recent observations are available, a steep decline in the eco-indicators over the last two years tends to be observed. These drops are likely to have been influenced by the dramatic fall in economic activity. The crisis is also the probable reason for the reductions in emissions and resource use in the short-term (European Commission, 2010f). Early estimates from the EEA (EEA, 2010) point to a:

- 5.5% drop in fossil fuel consumption (oil, coal and natural gas);
- 6.8% drop in GHG emissions compared with 2008, which implies a 17.3% reduction from 1990s levels;
- 12.7% drop in coal use;
- 8.3% increase in use of renewables;
- 11.6% reduction in emissions from sectors covered by the EU ETS.

On a global scale, however, the drop in GHG emissions was limited to 1.3%, which is significantly less than predicted at the dawn of the crisis (Friedlingstein et al., 2010).

There is a growing body of evidence showing a short-term (beneficial) impact on some of the indicators for sustainable growth. The medium and long-term impact is more difficult to estimate. As economies rebound emissions are expected to increase. Friedlingstein et al. (2010) suggests that if global GDP increases by 4.8% (as projected by the IMF in 2010) then carbon emissions would follow with a 3% increase, assuming that improvement trends for carbon intensity remain stable. With the recovery of the European economy (which experienced an uneven and fragile economic growth of 1.8% in 2010 and is projected to maintain the same growth rate in 2011, EC, 2011a), GHG emissions from the power sector and industry appear to have increased by 3.5% in 2010, as indicated by preliminary figures (DG CLIMA, 2011).

The scattered evidence and data presented in the previous paragraphs can provide a starting point for analysing the effects of the economic crisis on sustainable growth. Comprehensive analysis will, however, have to wait until data are published for 2008-2010 and the effects of the economic rebound are better known.

5.4. Eco-expenditure and eco-innovation

This section analyses the evidence on the levels of investment made in environmental protection and eco-innovation as a marker of mitigation efforts by industry and future decoupling. New "green" business models are also briefly discussed.

5.4.1. Eco-innovation

Eco-innovation is often regarded as pivotal for achieving sustainable growth (see, for example, Aghion et al. 2009a). According to the Eco-Innovation Observatory (EIO, 2010), '*eco-innovation is the introduction of any new or significantly improved product (good or service), process, organisational change or marketing solution that reduces the use of natural resources (including materials, energy, water and land) and decreases the release of harmful substances across the whole lifecycle*'.

Data on eco-innovation are relatively poor and researchers rely heavily on patent statistics (see e.g. Oltra et al., 2008, Dechezleprêtre et al., 2011, Johnstone et al., 2010), single case studies (Technopolis Group, 2008) or scattered surveys (Kemp, 2008). Using survey, patent and venture capital data, Aghion et al., (2009b) argue that the speed of eco-innovation in technologies is slow compared with other emerging technologies. The authors see some momentum but claim that support from tax rates on energy, the ETS and public spending on R&D is still too low and/or fragmented. Patent data are also used in case studies on the state of eco-innovation in particular countries. Dechezlêprete and Martin (2010), for example, look at how the UK performs in terms of eco-innovation by identifying 19 technologies they claim are 'clean'. The study singles out certain technologies (such as marine technologies) where the UK holds a comparative advantage.

This section examines the environmental benefits of innovation using micro-level and firm data from the Community Innovation Survey (CIS 2008) and a Eurobarometer study based on a survey of managers of European SMEs ('Attitude of European entrepreneurs towards eco-innovation', Flash Eurobarometer 315). CIS 2008 provides some insight into whether innovation generally leads to environmental benefits for firms, in addition to the perceived economic benefits.

Table 1 presents an overview of the environmental benefits reported by firms with innovation activities in CIS 2008. There are marked differences between countries but, overall, lower energy use is the most commonly reported benefit. This might be related to the fact that it is a general target relevant to every enterprise in every sector. Other prominent environmental benefits include 'Recycled waste, water or materials' and 'Reduced material use per unit of output'.

There clearly appear to be big differences between some countries. The countries with the highest percentage of innovating companies reporting environmental benefits are Ireland, Germany and Portugal. Environmental benefits are clearly less present in Bulgaria, Cyprus and Czech Republic. Up to two thirds of the Irish innovating companies report recycled waste, water or materials, whereas only 15% of the Bulgarian innovating companies report reduced energy use per unit of output in the form of production of goods or services. One notable finding is that the three best and three worst performing countries are each spread across the innovation typology groupings (innovation "leaders", "followers", "moderate innovators" and "catching-up countries", see the Innovation Union Scoreboard 2010). This provides some evidence that typologies for overall innovation may not be as appropriate for

the analysis in terms of environmental benefits of innovation. Looking at the underlying data, generally speaking, industry reports more environmental benefits than services.

Table 5.1: Percentage of enterprises with innovation activity reporting an environmental benefit, 2008 – Industry (without construction)

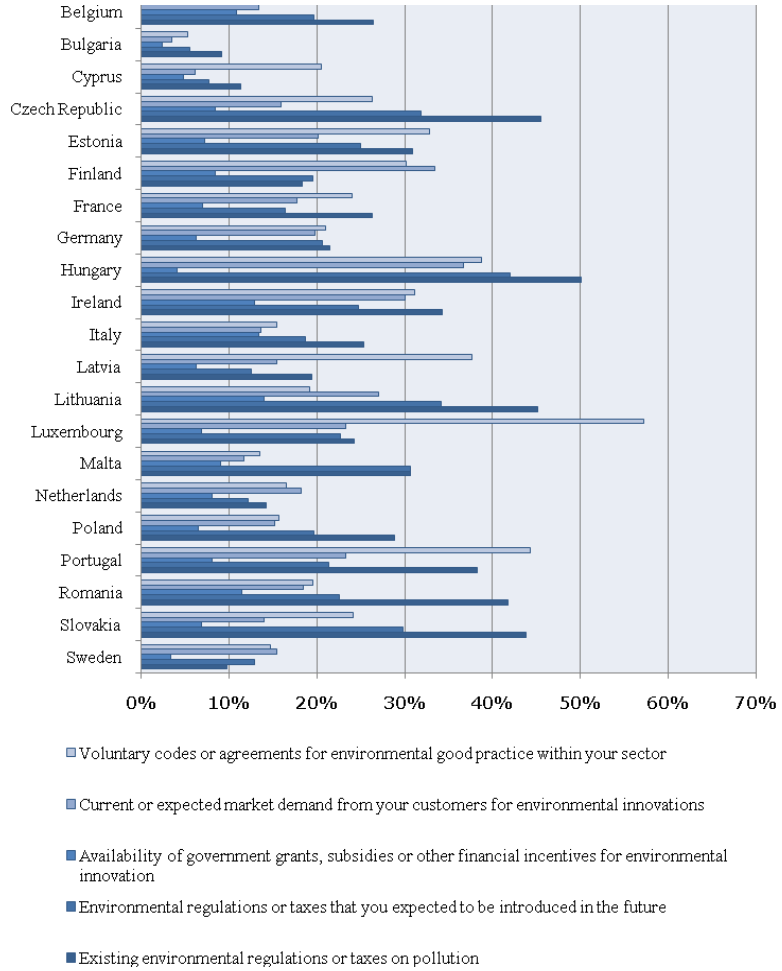
	Environmental benefits from production of goods or services within enterprise						Environmental benefits from after-sale use of goods or services by the end-user		
	Reduced material use per unit of output	Reduced energy use per unit of output	Reduced CO_2 'footprint' (total CO_2 production) by your enterprise	Replaced materials with less polluting or hazardous substitutes	Reduced soil, water, noise or air pollution	Recycled waste, water or materials	End-user benefits, reduced energy use	End-user benefits, reduced air, water, soil or noise pollution	End-user benefits, improved recycling of product after use
Austria	37%	39%	29%	34%	39%	32%	34%	26%	22%
Belgium	33%	40%	31%	30%	37%	44%	28%	23%	26%
Bulgaria	13%	15%	6%	10%	12%	9%	8%	8%	6%
Cyprus	16%	21%	13%	12%	21%	19%	8%	9%	8%
Czech Republic	37%	41%	20%	24%	32%	45%	34%	31%	30%
Estonia	26%	9%	14%	22%	9%	13%	18%	14%	13%
Finland	41%	38%	28%	29%	28%	40%	34%	23%	25%
France	30%	28%	18%	33%	29%	43%	23%	19%	23%
Germany	46%	54%	39%	31%	47%	48%	47%	37%	34%
Hungary	39%	44%	20%	37%	36%	29%	21%	20%	14%
Ireland	37%	43%	39%	40%	38%	66%	38%	29%	42%
Italy	16%	19%	15%	16%	28%	28%	24%	25%	24%
Latvia	21%	27%	10%	25%	36%	17%	24%	34%	11%
Lithuania	40%	42%	25%	33%	29%	26%	27%	21%	21%
Luxembourg	35%	39%	38%	38%	41%	61%	29%	29%	33%
Malta	32%	33%	14%	26%	22%	31%	18%	5%	14%
Netherlands	25%	29%	18%	30%	27%	31%	25%	20%	18%
Poland	31%	33%	19%	30%	35%	28%	28%	30%	19%
Portugal	42%	46%	33%	46%	54%	64%	40%	43%	45%
Romania	40%	41%	26%	26%	37%	37%	33%	33%	22%
Slovakia	27%	34%	12%	24%	29%	33%	31%	26%	25%
Sweden	32%	35%	24%	29%	27%	27%	30%	24%	20%

Source: CIS 2008 (IDEA Consult).

These findings are consistent with the analysis of eco-innovation in *Flash Eurobarometer 315*. According to *Eurobarometer*, about 42% of the enterprises that had introduced at least one type of eco-innovation in the last two years said that such innovations had led to a reduction in material use. Furthermore, comparing CIS data with *Flash Eurobarometer 315*, no direct correlation can be established between eco-innovation and reporting an environmental benefit, as the countries reporting the highest environmental benefits are not especially the ones reporting high investment in eco-innovation investments. According to *Flash Eurobarometer 315*, '*there are only six countries where more than 20% of respondents estimated that 30% of their innovation investments were eco-related (Sweden, Greece, Austria, Cyprus, Luxembourg and Poland')*. This list of countries clearly does not coincide with the countries reporting high percentages of environmental benefits (mainly Ireland, Germany and Portugal).

Figure 5.24 presents the CIS results on the motives for eco-innovation. These are instructive, as they show that firms' expenditure on environmental protection is primarily driven by compliance and regulation and that in every case grants, subsidies and financial incentives were the weakest motivation for environmental innovation.

Figure 5.24: Motives for environmental innovation (percentage of enterprises with innovation activity), 2008 - Industry (without construction)



Source: CIS 2008 (IDEA Consult).

Some reasons can be put forward to explain why government grants play a rather limited role in triggering environmental innovation: firstly, that the available grants do not provide a big enough incentive for European companies to invest in eco-innovation or, secondly, that companies are unable to gain easy access to these grants. The Eurobarometer survey found some evidence to support this latter point, stating that *'barriers related to financing and funds were very or somewhat serious barriers to an accelerated development and uptake of eco-innovation. For example, insufficient access to existing subsidies and fiscal incentives was considered a barrier by 6 in 10 respondents.'*

Figure 5.24 also reveals that in Belgium, Finland, Luxembourg and Portugal, companies tend to be relatively more proactive, introducing environmental innovations in response to current or expected market demand and because of voluntary agreements within their sector. This contrasts with other Member States (such as the Czech Republic, Lithuania, Malta, Romania and Slovakia) where firms report they mainly react to regulation (existing or expected). This may still reflect the implementation of the acquis as a driving force for innovation. The remaining countries have mixed profiles, with no clear dominant motive for environmental innovation. The Eurobarometer survey also corroborates these findings for SMEs. About two thirds of managers said that uncertain market demand was a barrier to faster take-up of eco-innovation in their company. This uncertainty would definitely play a role in defensive behaviour in eco-innovation, with firms unwilling to take a lead in market demand and voluntary agreements.

A detailed sectoral analysis reveals that firms in some sectors tend to be more responsive to one or even all the motives suggested for introducing an eco-innovation (such as electricity, gas, steam, air conditioning, water supply or waste management), but that, overall, existing regulation is the preponderant factor. See boxes 5.6 and 5.7 for two sectoral case studies.

Box 5.6: Industrial initiatives: the Marine Stewardship Council sustainable fishing labelling scheme

One example of a voluntary labelling scheme is the Marine Stewardship Council (MSC) sustainable fishing labelling scheme, which certifies and promotes well-managed marine wild-capture fisheries. MSC certification is based on third-party assessment of sustainable use of resources and the environmental effects of the activities from capture up until delivery on land. To date, 105 fisheries around the world have been MSC-certified, of which 39 are in Europe.

Since the MSC label was introduced in 2004, take-up has been strong. The total number of MSC-labelled seafood products available increased from an estimated 1 000 in January 2008 to 7 362 in September 2010 and approximately 8 200 in January 2011. The largest range of MSC-labelled fish products available is in Germany (2 018 products), the UK (791) and the Netherlands (727). In the Netherlands for example, MSC-labelled products are estimated to have a share of 19% of total wild-caught seafood products now available at retailers. In this case, consumers also consider various other factors (freshness, health benefits and price) to be more important than environmental impact (World Business Council for Sustainable Development, 2008 and Seafood Choices Alliance, 2007). Nonetheless, consumer

willingness to buy sustainable products seems to be slightly higher for food and fish than for other products.

Consumers have, however, not been the main drivers of take-up of the MSC label. Looking at the fisheries value chain, industry, civil society and retailers all play a central part. In 1997, the MSC was set up by a joint engagement of a food brand (Unilever) and a civil society organisation (WWF), in response to concerns about depletion of fish stocks (whether for reasons of environmental protection or as a company response to input supply insecurity). Retailers, although not the primary initiators, have been fast to take it up. Operating in a responsive, fast-moving segment in close interaction with consumers, retailers play a central role in the MSC scheme. Along the **value chain** of the fisheries, there has been more resistance to the MSC labelling scheme. For the fisheries economic considerations are the dominant driving factor and the label has been perceived by some as an additional cost burden (on top of fishery policies like quotas that influence this part of the value chain more directly) – even though, for some fisheries, more sustainable fishing methods have given rise to cost savings and economic benefits. For example, in a small fishery in the Netherlands, a switch to sustainable practices led to a saving of up to 70% in fuel expenses while catching higher quality fish and reducing the by-catch and debris. Nonetheless, in general, fisheries' move to MSC certification has been pushed primarily by the **next links along the value chain**, where brands have created demand for certified fish from the fisheries. More recently, fisheries that claimed to have been using sustainable practices before they receive certification have been using the MSC label as a way to increase their exposure to the markets and legitimise their good-quality practices (Potts, T. et al., 2011).

In short, both voluntary and mandatory (see Box 5.2) labelling schemes can be seen as successful examples of enhancing economic and environmental performance. In general, consumer awareness and responsiveness to eco-labels is increasing in the EU (see Box 5.2), even though price and quality remain the main factors in consumers' purchasing decisions. Consumers tend to associate fish products (food) more closely with sustainability than light bulbs (consumer electronics), possibly as a result of their more direct perception of scarcity and of the finite nature of natural resources. The voluntary MSC label has attained a high take-up rate, especially in some perceptive countries. The main drivers behind the high take-up rates for MSC have been food processors and food brands, along with retailers. Industry plays a crucial role as a driver for successful labelling and sustainable consumption and production. From the specific cases analysed, consumers seem to accept rather than drive more sustainable consumption and production.

Box 5.7: Industrial initiatives and new more sustainable business models: chemical leasing

This case study takes the perspective of the chemicals industry in the search for sustainable business models – models that can simultaneously have a positive impact on the competitive position of a sector or company (e.g. by means of 'green' brand positioning and /or cost reductions) and on the use of natural resources.

The considerable move by EU industry towards more sustainable chemistry over recent years has been mostly from within the chemical industry, driven by considerations such as resource efficiency, costs and the availability of raw materials. A strong focus has been placed on a *substitution approach*, i.e. replacing substances by other less hazardous substances that

achieve the same or better results and/or diminish resource input requirements. In addition to this trend of substitution and resource efficiency, a second (partly overlapping) line can be observed with a stronger focus on processes, i.e. a stronger *(risk) management approach* to chemicals, taking a more service-oriented approach to management of chemicals all along value chains and focusing on process optimisation. Chemicals suppliers have been induced to do so partly by regulatory requirements (such as REACH), partly by the need to regain market power on what have become buyers' markets. Users of chemicals are motivated by the increase in regulatory requirements, no longer fully matched by in house expertise, seeking to improve the performance of their production processes by having chemicals inputs more finely tuned to their technical requirements. This service-oriented approach, often encountered, either implicitly or under the name of outsourcing, is a new more sustainable way of manufacturing together with offering service packages for regular clients, application of lifecycle and supply chain assessments, resource efficiency, reduced waste, etc.

Chemical leasing (CL) is one clear example of such a service-oriented risk management approach. Broadly, CL is a concept in which a firm (the customer) that uses chemicals in its production process no longer purchases the chemicals, including taking responsibility for how they are handled, but purchases from the 'chemical operator' a service limited to the functions (performed by the chemicals) that are needed for the customer's production process. The ownership and associated responsibilities during the life cycle of the chemical remain with the chemical operator, i.e. the leasing company. This model shifts the producer's previous focus on increasing sales volume to increasing value-added and the per-unit performance of the chemical (see the following schematic representation of the incentives under CL).

Incentives under chemical leasing

CL is mainly a B2B (business to business) model suitable for specific applications. Typical applications in which this model is applied include: powder coating, solvents for cleaning, galvanisation, food processing, pest control, anti-fouling services, detergents for water purification and electroplating or lubricants for sugar production. Some of the ideas underlying the concept of CL have been applied for longer, or implicitly, for example in paint applications for the automobile industry. In the 1980s, General Motors (GM) was one of the first companies to recognise the opportunities offered by forming partnerships with chemicals suppliers. By transferring overall management of the chemicals to the supplier, GM cut its costs by 30% (Stoughton, M. and Votta, T., 2002). Since 2004, CL has been actively promoted, mainly by UNIDO, which established a definition of CL and a set of quality criteria.

In instances where CL is suitable, the improvements in economic and environmental performance can be considerable. Several applications suggest that the model can in some cases reduce the total chemicals input by 40 to 80% (Safechem, 2005). The optimisation of production and reduction of 'spoilage' may considerably reduce not only the environmental impact but also costs. The CL model 'divides' these gains between the players primarily involved: the chemical service supplier and the (business) customer. For example, a customer that 'outsources' high-performance cleaning for medical devices now pays per unit cleaned instead of for the chemicals and equipment to clean them. The total cost of cleaning the same number of devices for the customer becomes lower while, due to the more efficient resource input, the supplier now also obtains a higher price per unit of chemicals used. In practice, the value added by unit of chemicals used for cleaning has increased and this benefit is shared. Often, the equipment is also provided and managed by the lessor (chemical operator), thereby

transferring the associated investment costs and financial risks for the customer and including them in the overall service.

The main drivers behind sustainable chemistry and the trend to make chemical-related business processes more sustainable, including CL, are reduction of use of resources and the associated costs and input supply risks. However, the CL model has been limited to specific sectors and applications. Some companies have mentioned that issues regarding information transfer have complicated application (trust is an essential part of the CL model as the purchaser of the services needs to transfer information to the supplier so that the service can be performed). Its impact on the chemical industry as a whole is therefore (as yet) small. The model should nonetheless be seen as one positive example within a much broader range heading towards sustainable chemistry that illustrate industry's search for substitution and/or risk management models that fit companies striving to move to more sustainable business practices.

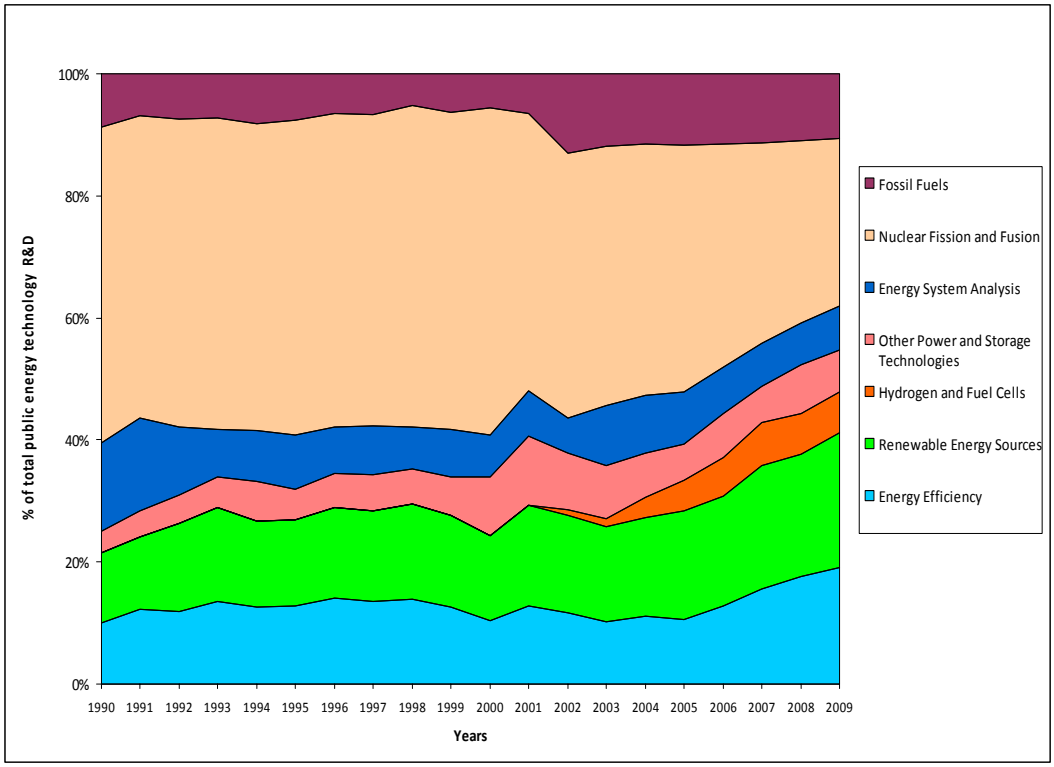
The drivers behind and barriers standing in the way of eco-innovation and specific policy measures to promote it have been analysed and proposed in the literature (see, for example, EIO, 2010). Aghion et al. (2009b) suggested combining a carbon price with high initial subsidies for R&D into clean-innovation. In a modelling exercise, Conte et al. (2010) addressed the market failure of low carbon prices to act as an incentive for eco-innovation, investigating different policy mixes and the design of policies which reallocate revenue from the carbon market to target "green" R&D in the short run and labour market support.

5.4.2. Eco-innovation and R&D on energy

Policy measures in the field of eco-innovation consist not only of regulating or encouraging adoption of existing technologies, as regards e.g. increasing energy efficiency or waste reduction. Discovery and development of new technologies are the cornerstone of sustained "*green" growth,* including future improvement of eco-performance in industry. Innovative technologies are costly in terms of investment, and often create new markets for their products, with all the uncertainties attached. Public support is therefore essential both for development of existing "*green"* technologies such as renewable energy technologies and to support new-born cutting-edge technologies such as hydrogen and fuel cells. The EU is a market leader in the development of many of these technologies (e.g. renewable energy generation, see for instance Box 3.2 in European Commission 2010f). This report does not focus on the economic case for financing these R&D projects. Studies analysing this problem are available (Conte et al., 2010).

Limited data are available on total "*green" R&D* expenditure. However, the International Energy Agency (IEA) provides data on public support to all types of energy-related R&D for a number of countries including the EU-15 and Hungary. Figure 5.25 clearly shows the increase in the relative share of public support allocated to "*green" R&D* into energy technology: from 22% in 1990 up to 48% in 2009. This was manly at the expense of nuclear fission and fusion R&D. It should be taken into account that, according to the IEA definitions, research into fossil fuels covers all research conducted in the domain of CO_2 capture and storage which, since 2003, accounts for about 10% of total fossil fuels research. Another notable feature is the higher share of public funding that hydrogen and fuel cells have secured since the European Initiatives for Growth were adopted in 2003 and the Fuel Cells and Hydrogen Joint Technology Initiative in 2008, both by the European Commission as part of the 7th Framework Programme (EC, 2008b).

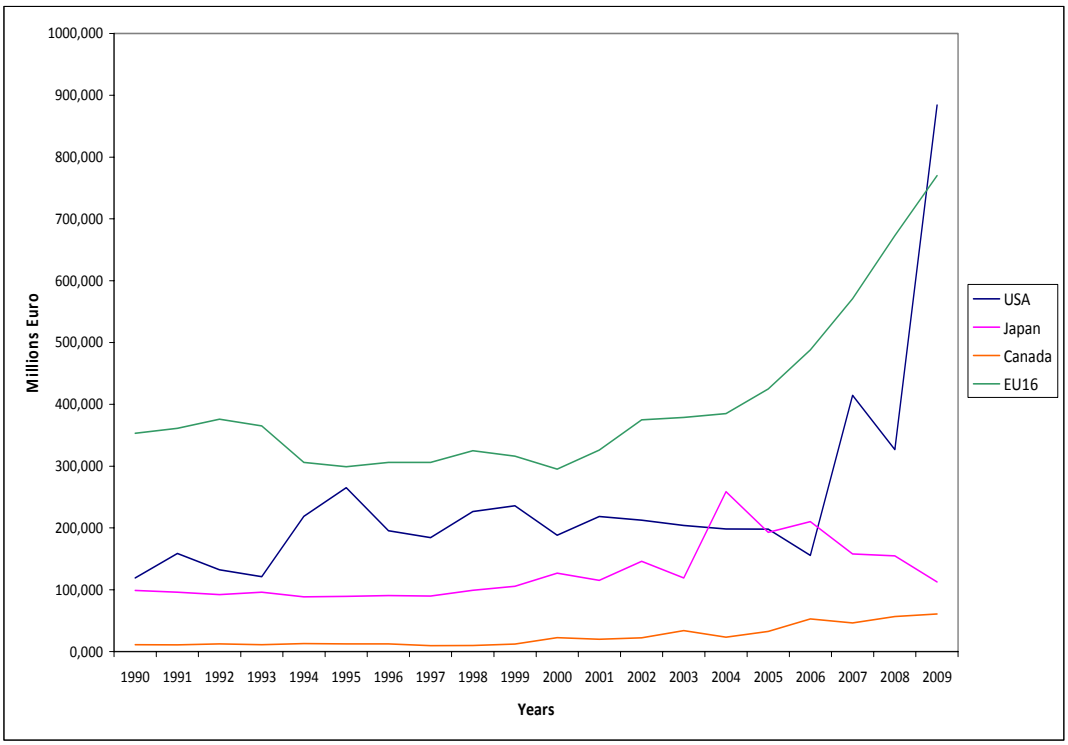
Figure 5.25: Relative share of public support to sub-fields of energy R&D in the EU-16



Source: own calculations based on IEA data. EU-16 is AT, BE, DK, FI, FR, DE, EL, HU, IE, IT, LU, the NL, PT, ES, SE and the UK. The original IEA data also include Switzerland, Turkey and Norway.

A comparison at international level can be made with other major players on the "*green" R&D* scene. The EU has always played a leading role in public funding of renewable energy research: in order to meet the 2020 targets for the shares of renewable energy in final energy consumption, substantial resources have been invested in further developing existing technologies. Looking at figure 5.26 public support for renewable energy R&D increased more than twofold between 2000 and 2009. However, the data do not include EU FP7 related spending, nor the part of the Emission Trading System allowances allocated to innovative renewables The USA doubled its funding in only one year, under the 2009 American Recovery and Reinvestment Act. It is not yet clear whether this increase is sustained by a long-term commitment, as it evidently appears to be in the case of the EU.

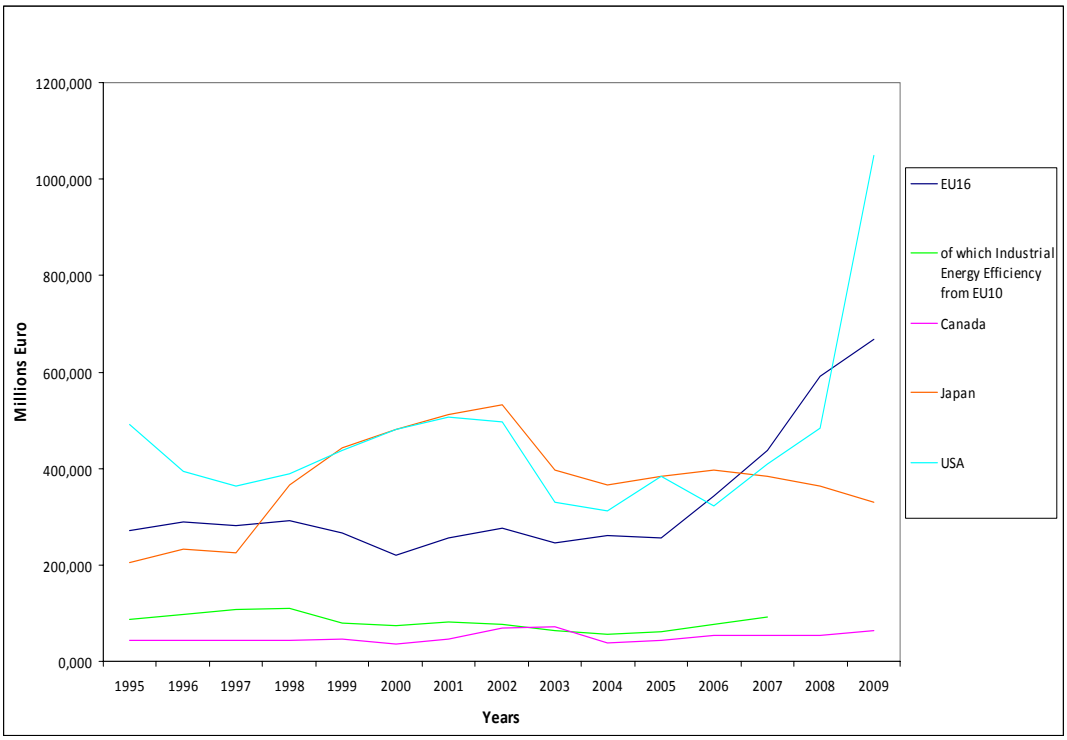
Figure 5.26: Public support for R&D into renewable energy resources, international comparison (2009 prices and exchange rates)



Source: own calculations based on IEA data. EU16 is AT, BE, DK, FI, FR, DE, EL, HU, IE, IT, LU, the NL, PT, ES, SE and the UK. The original IEA data also include Switzerland, Turkey and Norway.

Major eco-innovation can be achieved not only by conducting research into technologies based on renewable sources, but also by increasing the energy efficiency and environmental impact of existing technologies, production processes and techniques. Figure 5.27 shows that R&D on energy efficiency is also heavily funded in the EU, with a more than twofold increase between 2005 and 2009 (not counting FP7 related spending). Again, in the USA the Recovery Act was the single cause for the doubling of funds. With respect to industrial energy efficiency, disaggregated data are available for only a subset of countries (labelled as EU-10), which account for 70% of public funding of total R&D on energy efficiency.

Figure 5.27: Public support of energy efficiency (not only industrial) R&D (2009 prices and exchange rates)



Source: own calculations based on IEA data. EU16 is AT, BE, DK, FI, FR, DE, EL, HU, IE, IT, LU, the NL, PT, ES, SE and the UK. For industrial energy efficiency, EU10 is EU16 minus BE, EL, HU, IE, LU and the UK. The original IEA data also include Switzerland, Turkey and Norway.

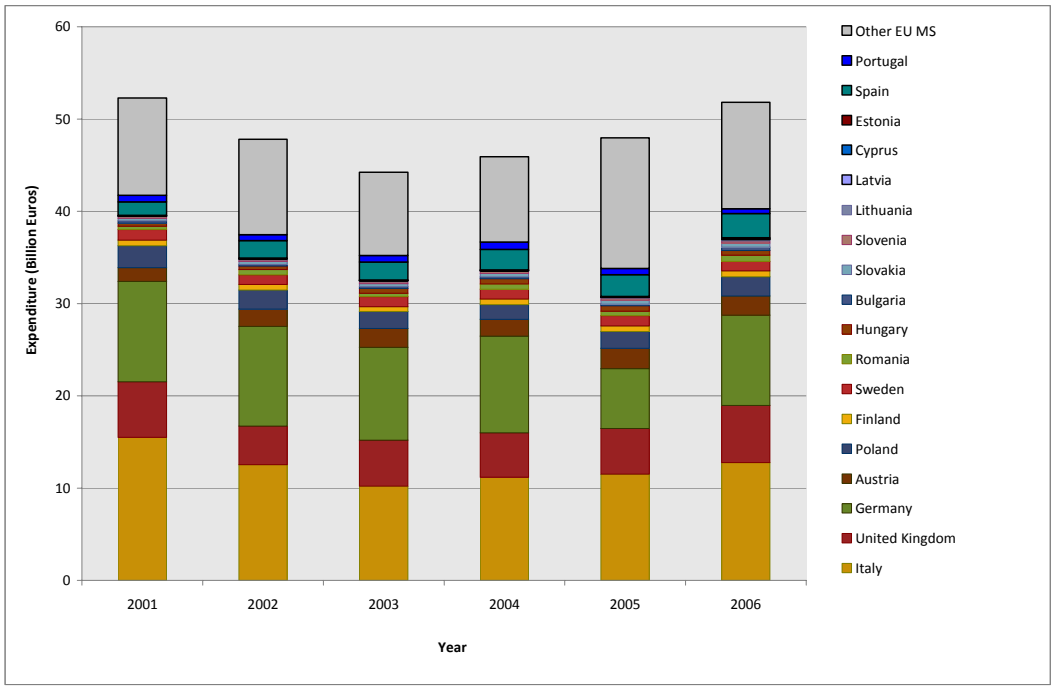
Box 5.1 above mentioned the importance that many governments put in "green" growth as a way out of the economic crisis. Figures 5.26 and 5.27 give a clear hint (for two sub-fields of research) of the considerable effort put in by the US in green recovery, leading to a noticeable change of pace concerning public support to green R&D; all of this as a part of a wider stimulus plan. However, it is not a coincidence that also many other major economies had stimuli plan that included a considerable "green" components (see Table 5.7 in annex for an overview of the stimulus measures adopted in the EU, USA, Japan, South Korea and China).

5.4.3. Environmental protection expenditures

Another key indicator of current endeavours to reduce the long-term environmental impact is environmental protection expenditures (EPE) by industries, which is the sum of investment and current expenditure on prevention, reduction and elimination of pollution resulting from production processes. Expenditure on environmental protection by industry within a Member State can give some insight into the level of consideration given to eco-performance (although, strictly speaking, not on the relative efficiency of these expenditures). As a proxy for sustainability, it encapsulates all industry's efforts to protect the environment, including pollution prevention, sustainable supply chains and biodiversity protection. In 2006, the combined EPE of all industries in the EU-25 added up to 50 billion euros, a 1% decrease compared with 2001, with a trough of 8 billion euros in between. However, as a percentage of GVA, industrial EPE fell from 2.8% in 2001 to less than 2.5% in 2006 (Eurostat, 2010).

Data fragmentation issues similar as those mentioned for water abstraction also arise with EPE, which limits the ability to draw robust conclusions on eco-performance. Figure 5.28 shows positive trends in EPE at EU-27 level in the most recent years for which data are available, particularly in EU-12 states. The decoupling trends seen in many EU-12 states could potentially be related to increased EPE, though the actual links to EPE are unclear. One final conclusion to be drawn from the data is that EPE expenditure by industry is highly variable, changing significantly from one year to the next.

Figure 5.28: Total environmental protection expenditure by industry (NACE A-E, excluding construction) in selected Member States, 2001-2006



Note: Countries included under 'Other EU MS' due to no or incomplete data: BE, DK, IE, EL, LU, MT and FR.

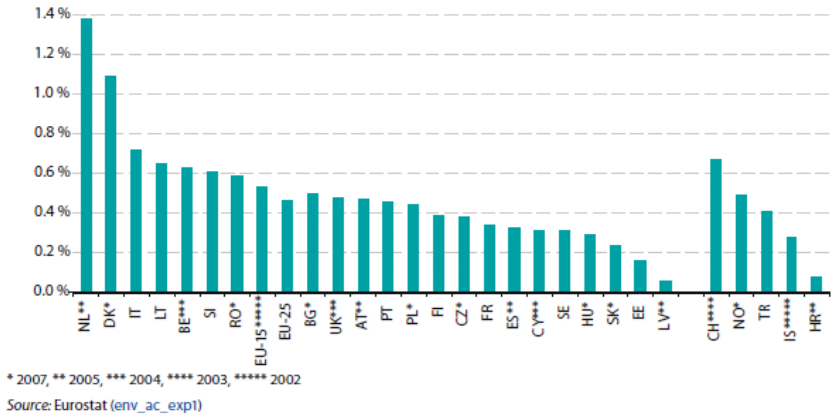
Source: Eurostat data – Ecorys analysis.

Box 5.8: Public-sector environmental protection expenditure

One proxy for identifying the amount of public investment in the environment is the 'public environmental protection expenditure' figure collected by Eurostat. In 2006 such investments – including current account expenses – broke down as follows: 40% to waste, 17% to waste water, 1% to air and 42% to other domains.

In the EU-25, most of this expenditure in 2006 went towards providing waste management services or to activities related to soil, biodiversity and landscape protection, protection against radiation and research and development. Spending was mostly related to current costs, rather than investments or subsidies/transfers.

Figure 5.29: Public-sector EPE investment and current expenditure by Member State (% of GDP, 2008 unless otherwise indicated)



Source: Eurostat 2010: Environmental statistics and account handbook.

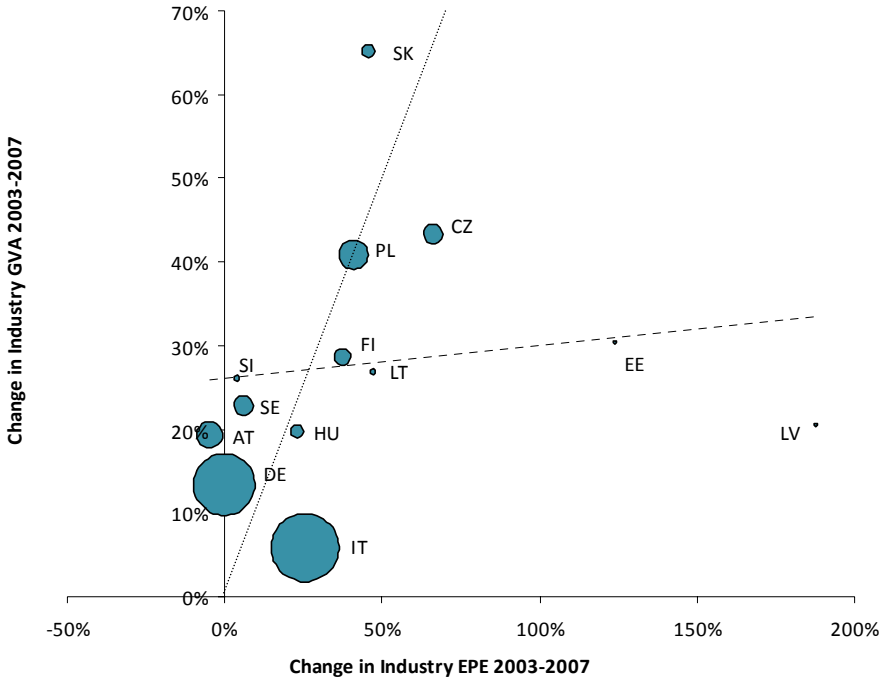
In most European countries, in 2006 the public sector spent between 0.2 and 0.6 % of GDP on environmental protection investments and current expenditure. In 2005, the Netherlands earmarked almost 1.4% of its GDP for this, but Latvia only 0.06 %.

By restricting the Member States taken into consideration to those that reported in both 2003 and 2007,[82] it is possible to draw a more detailed picture of the changes that have taken place in industrial EPE and to relate them back to changes in GVA. Figure 5.30 presents these changes for the Member States for which data are available. It shows a weak overall trend to increase industrial EPE as GVA increases, lending some support to the idea of a Kuznets curve for industrial EPE. The biggest increases in EPE were found in Member States in the Baltic region and Central Europe (CZ, SK and PL). Relative to GVA seven Member States (IT, HU, LT, FI, CZ, EE, and LV) increased their EPE by more than their industrial GVA increased. Member States known for having strong EPE records (DE, AT and SE) saw their EPE remain largely stable over the period.

These relationships hold broadly across the main industrial sectors (NACE rev. 1.1 A to E), with the exception of agriculture, forestry and fishing, where there appears to be no clear correlation between EPE and GVA, though this is likely to be a result of incomplete data.

82 These years were selected as they were the years when most Member States reported EPE data. They were chosen to maximise coverage and relevance.

Figure 5.30: Change in industrial EPE and industrial GVA (NACE A-E, excluding construction) in selected Member States, 2003-2007



Note: Bubble size represents relative industrial EPE expenditure in 2007.
Member States missing due to incomplete data: BE, BG, DK, IE, EL, ES, FR, CY, LU, MT, NL, PT, RO and UK.

Source: Eurostat data – Ecorys analysis.

5.5. Conclusions and policy implications

The analysis of major trends and developments has shown significant improvements in the eco-performance of European industry. However, there are also signs that efficiency increases slow down, as the higher the initial efficiency levels already are the more difficult it becomes to achieve further improvements. Adopting the right mix of policies, including the right measures and conditions to foster g*reen* R&D, eco-technologies and eco-innovation, is of paramount importance in this regard. Eco-performance improvements will be more easily sustained, environmental problems dealt with more efficiently and European firms may fully and more easily exploit new business opportunities and improve their competitiveness. This section discusses briefly the available mix of policy instruments in the light of their economic rationale and past experience.

5.5.1. Policy instruments for sustainable growth

Looking at the public policy instruments[83] currently in use to raise eco-performance and, at the same time, facilitate industry's transformation towards more sustainable methods of production and greater competitiveness shows that, at EU level, policy has, in the last decade

[83] For a more detailed account of these policy instruments see the background report to this study (ECORYS, 2011a).

or more, been focused on energy and on controlling GHG emissions. The findings in section 3 illustrate that these policies have contributed to an increase in energy efficiency and a significant reduction of both GHG and other emissions from energy generation.

To date there has been less focus on policies with an impact on resource efficiency and use of natural resources such as water and land. This has been changing in recent years, with an increase in the number of policy initiatives in this area and attention shifting towards sustainable consumption and production, "green" public procurement and, more recently, resource efficiency. The overall policy framework is currently weaker than for energy and related emissions and the performance on resource use appears to be much more mixed. The efforts to develop a stronger policy framework in this area should draw on the lessons learned from the implemented in the area of energy and emissions and their performance against expectations and theory.

The policy instruments available differ by government level: at EU level regulatory instruments are widespread and powerful; fiscal instruments are strongest at Member State level while subsidies are widespread at both Member State and subnational (regional and local) level. Each instrument has its advantages and disadvantages in relation to sustainable industrial growth and eco-performance.

Regulation

Overall, EU industry has shown that it tends to respond well to regulatory policy measures, when these are carefully designed and take a long-term perspective. Regulation tends to work well when it comes to performance targets, once these are anticipated and gradually introduced. The introduction of regulations on energy-efficient and incandescent light bulbs is one example of successful regulation of this type. However, standards which are over-ambitious and/or introduced too early run the risk of being counterproductive, as they sometimes induce disruptions. Furthermore, implementation can be unequal across the EU-27, thus affecting industry in one part of the EU more or earlier than in other locations.

Regulation is one of the primary drivers of eco-innovation activities in firms. In certain cases regulation can be the most cost-effective solution, particularly when carefully designed and enforced, allowing e.g. for a suitable level of freedom for business to innovate and in finding the best way to achieve given targets. Most EU firms, particularly SMEs, remain compliance driven rather than pro-active in pursuing eco-innovation.

However, direct regulation can be considered to be often less cost-effective than market-based instruments, as it tends to impose uniform rules, targets or constraints that do not necessarily take full account of the settings and competitive environment of industry. This has been a key factor in the growing use of market based instruments.

Market-based instruments

While there are concerns about the cost-effectiveness and competitiveness effects of regulatory measures there is also mixed evidence about the effectiveness of market-based instruments in the context of sustainable growth and eco-performance. Here a distinction can be made between *subsidies, tenders* and *grants* (‘bonus incentives’) on the one hand and *taxes, penalties* and *trading schemes* (‘malus incentives’*)* on the other hand.

‘Bonus incentives’ such as subsidies, tenders and grants may be necessary to induce industry learning curves, albeit they typically entail heavy budgetary costs. However, practical experience has been mixed. As regards subsidies supporting innovation the evidence suggests that grants and subsidies were among the least powerful motivators for adopting environmental innovations. At the same time, subsidy systems based on feed-in tariffs have proved very successful for deployment of onshore wind energy and photovoltaic energy, yet they are typically also expensive. Many feed-in tariff schemes have been scaled down in the light of the financial crisis and resulting pressures on public finances and the costs imposed on firms and households.

In principle, subsidies should be time-limited, addressing temporary rather than structural market failures. This time-horizon issue is also important for EU industry and long-term planning. EU industry urgent needs a stable long-term policy framework, to provide greater certainty for firms considering expensive long-term capital investment in technology. The time horizon of many public policy initiatives - especially subsidies and grants - is often too short and prone to fluctuations in terms of continuity, eligibility or funding. Investments in eco-innovation and clean energy technologies require longer time spans, in order to recoup such investments over periods of 10 to 20 years.

‘Malus incentives’ like taxes, penalties and trading schemes offer an alternative to ‘bonus incentives’. They send a direct signal that works through prices to influence market conditions and bring about the desired changes. By working through prices, tax instruments have an impact on both supply and demand, which can be an advantage over regulation. Taxes can have negative implications for competitiveness, but consumers and firms retain the flexibility on how to respond to increased prices and costs. Hence, from a welfare and environmental perspective, if targeted correctly, taxes can work in accordance with the polluter pays principle and to the overall benefit of society. Judging the level at which to set a tax is a complex matter and must take into account relative tax systems in other economies.

Sometimes an argument is raised that tax or tariff mechanisms are needed for imports produced in economies with weaker eco-performance. It is argued that it would have an effect equivalent to internalising the negative environmental externalities of these imports, thus levelling the playing field for EU-27 producers in their domestic markets, by imposing equivalent costs on all producers. Such a tariff would need to be graduated, depending on the eco-performance of industries or firms in the country of production. However, the practical and political feasibility of such a scheme is debatable, as is its compatibility with international trade agreements. Without a clear evidence base, it could open the door to unwarranted protectionism in international trade. It cannot be excluded as part of a wider package in case substantial ‘leakage’ effects from EU environmental policies are to be expected. ‘Softer’ alternatives to this involve international negotiations and persuasion and pressure to align environmental policies of the EU and other countries in view of adopting and implementing more sustainable production behaviour.

Permit trading schemes are favoured in some situations as the most economically efficient way of achieving eco-performance gains and for making the total environmental benefits known in advance, as caps are chosen by policy-makers. They can maximise the competitive benefits to firms that invest most heavily in sustainable practices, providing clear and continuing incentives to improve performance over time. Permit trading schemes are most effective for sustainability when the environmental impact can be easily monitored and verified, when firms can adequately bear the transaction costs, when a viable market can be

created and when a move is made towards full auctioning of permits. Where this is not the case, taxation and regulation may be better alternatives to permits.[84]

Voluntary agreements and information

Voluntary agreements (i.e. self-regulation) can be effective for both industry and policymakers. By anticipating changes in consumer demand industry can stay at the cutting edge and also mitigate the need for policy action and the associated costs and burdens. Experience from the MSC scheme suggests that such schemes tend to be used more widely when larger companies are involved, but can be more difficult to implement when many SMEs are concerned. Furthermore, they appear to be more effective for final product groups, where the interface with consumers is strong. One drawback of voluntary approaches is that their effectiveness in addressing environmental concerns will depend on the perceived benefits to the companies concerned. They could also reduce competition. Its effectiveness can also suffer from information asymmetries between governments and firms. Voluntary schemes can therefore be an effective instrument in certain circumstances where policy has been unable to act effectively and/or provides a framework for industry to go beyond compliance.

Information and communication can be useful in situations where information problems exist (e.g. in household energy consumption) or where enforcement costs are disproportionately high (e.g. small-scale emissions creating air pollution). This area is particularly important for consumer demand and consumer action to support improvements in eco-performance. The evidence clearly shows that price and performance (quality) remain the primary demands of consumers. Products offering higher eco-performance need to compete on these two fronts too and to offer something more.

As regards influencing consumer behaviour, it is important for the choice of instrument to take account of their understanding of the environmental benefit in question. Voluntary schemes relying on consumer action appear less effective when the environmental benefits are more abstract, as in the case of energy and emission reductions. However, the successful take-up of the MSC scheme and improvements in recycling efforts are examples where the physical link to the environment is clear for consumers and of how this has supported success in these areas. In these cases it is important that other instruments, such as regulation or taxes, are also employed.

5.5.2. Policy design and implementation

As regards policy design and implementation, a number of important factors must be considered and the findings of this work have significant implications. Whilst developing

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[84] The EU ETS is the prime example of this type of instrument in the EU. The performance of the ETS has been mixed and has illustrated both the pros and cons of a trading permit scheme. It has been successful in bringing the largest emitters of GHG into a compliance and reduction scheme, creating a viable market for permits and contributing to overall emission reductions. Yet the costs to firms of participating, i.e. the transaction costs, have been high, as they have learned to adapt to the market. This is a big barrier to introducing permit trading schemes that will have an impact on SMEs and large numbers of operators. There has also been contention about the over-allocation and free allocation of permits, creating both a weak cap and a weak market price and handing free income to polluters, a perverse incentive. To reap the full efficiency benefits of a permit trading system, it is essential to move towards a larger share of permits auctioned. With the ETS phase 2 and plans for phase 3 moving in this direction, this should become less of an issue.

such policies, there is a need for comprehensive and robust impact assessments, covering both economic and environmental aspects as well as administrative costs and burdens.

The EU's growing practice of impact assessment could be echoed more clearly in policy development at the level of Member States, regions and local authorities. This is particularly important for the competitiveness of EU industry, to ensure long-term predictability and that policy action remains proportionate to the environmental benefits that result. Absolute bans and limits can place significant burdens on producers, occasionally with high marginal costs for only small environmental gains, after most reductions have already been achieved. Duplication is also an issue: if industry is hit by multiple regulations on a single product or input material, this adds to the complexity and burdens of compliance, particularly for SMEs (Calogirou et al. 2010). Consideration must be given to how a particular policy fits into the wider framework and how compliance procedures could be integrated more effectively.

Ex-post evaluation and monitoring of policies and measures that promote economic and environmental performance are vital in order to learn lessons that can lead to design improvements during the policy lifetime and can also inform further developments. Particular attention needs to be paid to the mechanisms by which such policies influence EU industry and whether such policies are effectively doing what they intend to.

Complementarity and enforcement

Similar trends to those in EU policy are also found at Member State level in terms of the issues addressed, with over half of all the major policy initiatives identified at Member State level focusing on energy efficiency and climate change. The policy instruments used by Member States tend to include market-based instruments (taxes and subsidies) along with public investment and regulation and self-regulation. Analysis of the cross-section of policies at EU and other levels clearly showed that there are often tight links and complementarities between the policies on various levels both within the EU and also across Member States'. Care needs to be taken to ensure that policy measures are not duplicated, that overlaps and uneven implementation are minimised and that the scope for learning and sharing of best practice are exploited wherever possible to reduce the compliance burdens on EU industry.

The effectiveness of policy implementation is closely related to enforcement. Implementation of regulations matters for containing the general administrative burden. Evidence from the case studies found that lax enforcement can have a negative economic impact on companies that have complied with the regulation, creating undue competitive advantages for non-compliant firms, either from within or outside the EU.

Policy as a supporting framework

As a final point, policy should provide a predictable enabling framework for industry itself, creating the conditions for and supporting moves by industry towards eco-performance benefits. The examples of voluntary labelling schemes and chemical leasing (Boxes 5.6 and 5.7) show how industry initiatives can create significant incentives for resource-efficient behaviour, improving eco-performance. They illustrate the link between economic competitiveness and eco-performance. The current limited scope of these types of arrangements points to wider potential to deliver benefits in this way.

Establishing this link between economic benefits and eco-performance is difficult, as the impact of policy is uneven across industry. For the industry directly affected, policy-imposed

changes are initially felt to be negative. However, in many cases regulatory approaches can help creating a market for new eco-friendly products. The light bulbs (Box 5.2) is such an example, illustrating the engagement in the development of products with significant environmental benefits, whose purchase by consumers was facilitated by the energy labelling scheme. Overall, the case studies demonstrated that considering the effects on industry along the entire value chain is vital to securing competitive and sustainable industries.

Table 5.2: NACE rev. 1.1 classifications used in this report

Category	Sub-category
A and B – Agriculture, hunting, forestry and fishing	
C – Mining and quarrying	
D – Manufacturing	15-16 – Food, beverages and tobacco
	17-19 – Textiles, leather and footwear
	20 – Wood and products of wood and cork
	21-22 – Pulp, paper, printing and publishing
	23-25 – Chemicals, rubber, plastics and fuel
	26 – Other non-metallic minerals
	27-28 – Basic metals and other fabrication of metal
	29 – Machinery not elsewhere classified
	30-33 – Electrical and optical equipment
	34-35 – Transport equipment
	36-37 – Manufacturing not elsewhere classified and recycling
E – Electricity, gas and water	
F – Construction	

Indicators of eco-performance

– Energy consumption is one of the key areas for measuring the environmental impact of industry, though the impact itself is often indirect and based on the emissions into the air and water by energy generators. Energy efficiency is an important policy goal and route to decoupling. Final energy consumption and energy intensity indicators are reviewed to provide both a nominal and marginal view on eco-performance in this area.

– Greenhouse gas (GHG) emissions are the primary climate change impact associated with industry. They are closely related to energy use. Decoupling emissions from economic growth is among the most pressing drivers of sustainable production. The cumulative and global nature of emissions makes the total level of emissions important, but as it is not always clear if emissions have simply 'leaked' outside the EU it is important to consider emission intensity too.

– Other emissions into the air and water from industry can also have a significant environmental impact. This study considers the performance in terms of acidification potential – as a contributor to acid rain – and also of particulate emissions to the air (PM10) which can damage human health.

– Material flows and resource efficiency are essential components of environmental impact, both in the extractive (or harvesting) process and when it comes to their eventual disposal as waste. Indicators of these are vital to understand how process and product efficiency has changed and are especially important to the issue of decoupling. Various indicators relating to material consumption, use of inputs, productivity and waste treatment are reviewed.

– Water use is also considered as water is a key resource used during industrial production processes (e.g. as cooling water) and is also coming under increasing scrutiny as pressures on it mount from population growth and expected reductions in supply from rainfall due to climate change. Indicators on water abstraction are presented.

– Environmental protection expenditure (EPE) gives an indication of investment and expenditure on resource, energy and carbon efficiency and, as such, is a useful indicator to measure eco-performance.

– Eco-innovation provides insight into investments and "green" R&D with the objective of improving eco-performance. This is important as an indicator of industrial investment in current, but also towards future, eco-performance. It is a new and complex area to define and the relevant section reviews the major discussions around such an indicator before presenting findings. Each of the indicators listed above has been analysed on three different levels, determined by the data available. This approach has been used to capture the relevant effects at each level to help explain the changes observed. The first level taken into account is the international and EU-27 level, since an understanding of overall economic performance and eco-performance is needed in order to comment on the relative position and developments of the EU-27 against its international trade partners, between the Member States themselves and also intra-industry - between sectors.

Table 5.3: Entergy intensity of manufacturing plus construction (NACE rev. 1.1 D+F) by Member State in selected years
Industrial energy use in thousand toe per million EUR industrial GVA at 1995 prices

	1995			2000			2005			2008		
	GVA	FEC	EI	GVA	FEC	EI	GVA	FEC	EI	GVA	FEC	EI
Austria	42923	6199	0.14	51528	7019	0.14	55256	8367	0.15	62674	8831	0.14
Belgium	47368	13612	0.29	54395	15762	0.29	55959	13555	0.24	59341	12036	0.20
Czech Republic	15637	12450	0.80	18026	10077	0.56	22245	9762	0.44	27338	9112	0.33
Denmark	25801	3040	0.12	28031	2938	0.10	27212	2867	0.11	30125	2765	0.09
Estonia	674	836	1.24	905	571	0.63	1316	718	0.55	1863	770	0.41
Finland	24877	9989	0.40	36451	12046	0.33	43040	12082	0.28	54716	12451	0.23
France	238838	37119	0.16	269989	36887	0.14	284386	35728	0.13	288256	36334	0.13
Germany	491439	62002	0.13	504593	57896	0.11	504527	57436	0.11	553485	60436	0.11
Greece	14323	4114	0.29	16606	4445	0.27	17957	4143	0.23	19696	4238	0.22
Hungary	4862	3797	0.78	6759	3446	0.51	8339	3422	0.41	9217	3358	0.36
Ireland*	16929	1853	0.11	30852	2339	0.08	38969	2595	0.07	43550	2544	0.06
Italy	235029	36091	0.15	243321	39775	0.16	243363	41855	0.17	249078	36551	0.15
Latvia*	827	692	0.84	1094	571	0.52	1645	705	0.43	1915	724	0.38
Lithuania*	1822	1017	0.56	2312	780	0.34	3843	994	0.26	4694	1064	0.23
Luxembourg	2756	1214	0.44	3389	957	0.28	3798	940	0.25	3778	876	0.23
Netherlands	63055	14092	0.22	73543	14895	0.20	74702	14925	0.20	80671	13081	0.16
Poland	19931	22790	1.14	28111	18882	0.67	32436	16413	0.51	48615	16560	0.34
Portugal*	18591	4974	0.27	22547	6244	0.28	21770	5689	0.26	21740	5782	0.27
Slovakia	5546	4120	0.74	6208	3826	0.62	10519	4499	0.43	16733	4316	0.26
Slovenia	2712	1178	0.43	3544	1421	0.40	4304	1653	0.38	5416	1480	0.27
Spain	114414	20507	0.18	137995	25527	0.18	155750	31097	0.20	159863	26773	0.17
Sweden	40685	13820	0.34	53792	14290	0.27	65677	12628	0.19	75257	12292	0.16
UK	187742	35146	0.19	197453	38574	0.20	203479	36019	0.18	208100	32775	0.16
EU-23*	1616781	310652	0.19	1791446	319168	0.18	1880492	318092	0.17	2011750	317157	0.16
EU-15*	1564771	263772	0.17	1724486	279594	0.16	1795845	279926	0.16	1910188	277722	0.15
EU-12 - 4*	52010	46880	0.90	66960	39574	0.59	84647	38166	0.45	101562	39435	0.39

* Figures for 2007. EU-23 is EU-27 minus Bulgaria, Cyprus, Malta and Romania. EU-12 - 4 is EU-12 minus Bulgaria, Cyprus, Malta and Romania.

FEC = final energy consumption. EI = energy intensity, i.e. FEC/GVA.

Source: EU KLEMS, OECD STAN and Eurostat.

Table 5.4: Energy intensity of industries, for EU-25, in selected sectors and selected years
Energy use in thousand toe per million EUR GVA at 1995 constant prices

		1995			2000			2005			2008		
		GVA	**FEC**	**EI**	**GVA**	**FEC**	**EI**	**GVA**	**FEC**	**EI**	**GVA**	**FEC**	**EI**
A-B	Agriculture and fisheries	177 698	31 568	0.18	195 196	29 898	0.15	195 703	30 954	0.16	186 725	26 312	0.14
15-16	Food, drink and tobacco	150 772	30 383	0.20	156 421	30 622	0.20	162 818	30 400	0.19	135 024	29 103	0.22
17-19	Textiles, leather and clothing	81 044	10 522	0.13	75 604	10 780	0.14	61 877	7 951	0.13	55 258	6 276	0.11
21-22	Paper and printing	115 503	30 361	0.26	129 027	35 260	0.27	126 625	35 629	0.28	104 438	36 317	0.35
23-25	Chemicals	204 649	63 248	0.31	232 630	58 917	0.25	258 946	61 200	0.24	240 093	55 097	0.23
26	Non-metallic mineral products	60 965	42 195	0.69	67 081	43 638	0.65	70 480	43 664	0.62	64 801	42 944	0.66
27-28	Iron and steel and non-ferrous metals	171 166	82 756	0.48	190 610	78 088	0.41	196 602	74 911	0.38	189 365	71 191	0.38
20, 30-33	Other non-classified	170 907	39 000	0.23	236 040	41 044	0.17	276 612	45 642	0.17	316 928	44 838	0.14
29, 34-37	Engineering and other metals	299 723	29 318	0.10	339 082	29 293	0.09	366 824	29 522	0.08	356 581	28 918	0.08
C	Ore extraction (except fuels)	53 202	3 889	0.07	48 313	3 745	0.08	41 042	3 326	0.08	23 436	3 053	0.13

EU-25 is EU-27 minus Bulgaria and Romania.
Source: EU KLEMS, OECD STAN, Eurostat

Table 5.5: GHG emission intensity of manufacturing plus construction (NACE rev. 1.1 D+F) by Member State plus USA and Japan in Gg CO_2 eq. per million EUR GVA at 1995 constant prices

	1995			2000			2005			2008		
	GVA	GHG	Intensity	GVA	GHG	Intensity	GVA	GHG	Intensity	GVA	GHG	Intensity
Austria	42923	13593	0.32	51528	13864	0.27	55256	16143	0.29	62674	16161	0.26
Belgium	47368	32495	0.69	54395	32923	0.61	55959	27930	0.50	59341	26669	0.45
Czech Republic	15637	32964	2.11	18026	28364	1.57	22245	19093	0.86	27338	16097	0.59
Denmark	25801	6042	0.23	28031	6213	0.22	27212	5807	0.21	30125	5393	0.18
Estonia	674	794	1.18	905	569	0.63	1316	707	0.54	1863	985	0.53
Finland	24877	12138	0.49	36451	11937	0.33	43040	11331	0.26	54716	10783	0.20
France	238838	83843	0.35	269989	83371	0.31	284386	80714	0.28	288256	75660	0.26
Germany	491439	119473	0.24	504593	106797	0.21	504527	100793	0.20	553485	102505	0.19
Greece	14323	9274	0.65	16606	9785	0.59	17957	10227	0.57	19696	9303	0.47
Hungary	4862	10996	2.26	6759	8486	1.26	8339	8748	1.05	9217	7034	0.76
Ireland	16929	4318	0.26	30852	5588	0.18	38969	5743	0.15	5652	5548	0.98
Italy	235029	87637	0.37	243321	85323	0.35	243363	82174	0.34	249078	74372	0.30
Latvia*	827	1899	2.30	1094	1199	1.10	1645	1174	0.71	1915	1268	0.66
Lithuania*	1822	1532	0.84	2312	997	0.43	3843	1272	0.33	4694	1445	0.31
Luxembourg	2756	2726	0.99	3389	1755	0.52	3798	1718	0.45	3778	1630	0.43
Netherlands	63055	28728	0.46	73543	27142	0.37	74702	27374	0.37	80671	27586	0.34
Poland	19931	63286	3.18	28111	47968	1.71	32436	32469	1.00	48615	32624	0.67
Portugal*	18591	10292	0.55	22547	12030	0.53	21770	10973	0.50	21740	10769	0.50
Slovakia	5546	12354	2.23	6208	8525	1.37	10519	7367	0.70	16733	7869	0.47
Slovenia	2712	2615	0.96	3544	2269	0.64	4304	2486	0.58	5416	2305	0.43
Spain	114414	53350	0.47	137995	58480	0.42	155750	72355	0.46	159863	67722	0.42
Sweden	40685	13892	0.34	53792	12881	0.24	65677	11789	0.18	75257	10695	0.14
UK	187742	94035	0.50	197453	93581	0.47	203479	84354	0.41	208100	76891	0.37
EU-23*	1616781	698276	0.43	1791446	660049	0.37	1880492	622741	0.33	2019808	609758	0.30
EU-15	1564771	571835	0.37	1724486	561672	0.33	1795845	549427	0.31	1872434	521689	0.28
EU-12 - 4*	52010	126441	2.43	66960	98377	1.47	84647	73314	0.87	109619	72586	0.66
United States	1539230	868908	0.56	1925722	858514	0.45	1977696	831850	0.42	1453932	825210	0.57
Japan**	1190365	372521	0.31	1208958	379005	0.31	1257005	373523	0.30	1302371	375632	0.29

* Figures for 2007. ** Figures for 2006. EU-23 is EU-27 minus Bulgaria, Cyprus, Malta and Romania. EU-12 - 4 is EU-12 minus Bulgaria, Cyprus, Malta and Romania.

Source: UNFCCC, EU KLEMS, OECD STAN.

Table 5.6: Materials productivity by Member State per million EUR of industrial GVA (NACE rev. 1.1 A-F) at 1995 constant prices, per tonne of DMC for the whole economy in selected years

	2000			2003			2005			2006			2007	
	GVA	DMC	Productivity	GVA	DMC	Productivity	GVA	DMC	Productivity	GVA	DMC	Productivity	GVA	DMC
Belgium	64 911	190 785	0.34	63 519	183 609	0.35	65 344	190 137	0.34	68 100	195 814	0.35	69 956	195 684
Czech Rep.	23 384	182 901	0.13	23 523	178 430	0.13	28 169	187 906	0.15	30 783	193 804	0.16	32 946	196 649
Denmark	37 511	134 757	0.28	36 071	129 539	0.28	36 373	151 203	0.24	37 851	158 447	0.24	37 572	155 530
Germany	577 525	1 453 485	0.40	559 178	1 318 590	0.42	583 085	1 294 062	0.45	606 845	1 324 307	0.46	615 456	1 314 169
Estonia	1 351	18 766	0.07	1 637	30 030	0.05	1 892	28 267	0.07	2 072	31 538	0.07	2 247	38 170
Ireland	35 950	164 032	0.22	43 156	183 357	0.24	44 982	201 058	0.22	45 113	217 816	0.21	49 886	229 539
Greece	26 525	156 648	0.17	28 724	188 009	0.15	27 606	186 343	0.15	29 355	185 778	0.16	29 255	186 334
Spain	179 830	674 684	0.27	193 448	810 698	0.24	198 486	848 078	0.23	203 687	897 400	0.23	209 488	877 810
France	336 466	876 917	0.38	341 485	799 263	0.43	354 756	852 238	0.42	356 490	871 816	0.41	359 825	907 955
Italy	297 512	947 494	0.31	292 394	749 037	0.39	297 947	831 976	0.36	305 197	835 104	0.37	309 028	804 257
Cyprus	1 833	15 189	0.12	1 870	16 129	0.12	1 967	18 999	0.10	2 164	18 590	0.12	2 200	20 020
Latvia	1 557	34 293	0.05	1 930	35 672	0.05	2 231	43 046	0.05	2 395	45 506	0.05	2 539	48 594
Lithuania	3 493	27 638	0.13	4 629	40 536	0.11	5 333	41 181	0.13	5 702	41 351	0.14	6 207	48 613
Luxembourg	3 785	7 886	0.48	4 028	7 896	0.51	4 247	7 860	0.54	4 116	9 085	0.45	4 233	6 821
Hungary	8 963	111 703	0.08	9 802	125 713	0.08	11 277	165 919	0.07	11 604	138 310	0.08	11 472	109 684
Malta	1 008	1 405	0.72	911	1 511	0.60	886	1 836	0.48	917	2 108	0.44	925	2 233
Netherlands	95 397	192 689	0.50	94 190	174 735	0.54	98 078	182 109	0.54	99 725	178 117	0.56	102 727	184 299
Austria	62 158	147 165	0.42	64 594	155 671	0.41	67 513	171 951	0.39	70 793	175 304	0.40	75 593	172 154
Poland	38 994	564 980	0.07	39 890	515 314	0.08	44 225	558 071	0.08	48 678	572 096	0.09	55 919	642 107
Portugal	29 846	189 630	0.16	29 344	171 606	0.17	29 285	186 390	0.16	29 724	213 377	0.14	29 724	218 109
Slovenia	4 217	44 252	0.10	4 694	46 570	0.10	5 047	47 877	0.11	5 427	55 792	0.10	6 158	62 372
Slovakia	7 942	54 003	0.15	10 141	57 702	0.18	12 692	71 300	0.18	14 533	67 943	0.21	16 792	67 800
Finland	43 335	171 681	0.25	46 921	184 649	0.25	50 460	186 777	0.27	55 103	199 349	0.28	59 750	207 033
Sweden	63 292	156 165	0.41	67 679	155 072	0.44	75 936	181 040	0.42	80 975	163 726	0.49	82 901	183 453
UK	249 454	757 830	0.33	247 716	746 898	0.33	253 268	751 135	0.34	256 074	751 228	0.34	258 511	750 744
EU-27	2 196 241	7 597 803	0.29	2 211 476	7 406 528	0.30	2 301 088	7 848 070	0.29	2 373 423	8 041 963	0.30	2 431 309	8 200 293
EU-15	2 103 499	6 221 848	0.34	2 112 448	5 958 629	0.35	2 187 367	6 222 357	0.35	2 249 148	6 376 668	0.35	2 293 905	6 393 891
EU-10	92 742	1 055 130	0.09	99 028	1 047 607	0.09	113 720	1 164 402	0.10	124 276	1 167 038	0.11	137 404	1 236 242

Source: Eurostat, EU KLEMS. DMC = Domestic material consumption. Productivity is GVA/DMC.

Table 5.7 – Green components in economic stimulus packages, 2009

Country	Stimulus package	Total amount package, (period)	Amount green component, (%)	Focus themes
USA	American Recovery and Reinvestment Act, 2008; Emergency Economic Stabilization Act 2008; Green allocation in US Budget 2010.	USD 787 bln (10 years); USD 185 bln (10 years);	USD 94.1 bln (12%); USD 18.2 bln (10%); USD 4.9 bln	Renewables; Building energy efficiency
China	NDRC stimulus package 2008; Budget 2009.	USD 586 bln (2009-2010); USD 61.4 bln (2009);	USD 201 bln (34%); USD 15.6 bln (25%)	Energy efficiency (rail, grid); Waste & water
Japan	Measures to Support People's Daily Lives 2008; second stimulus plan 2009.	USD 486 bln (2009 onwards); USD 154 bln (2009 onwards).	USD 12.4 bln (3%); USD 23.6 bln (15%)	Building energy efficiency
South Korea	Green New Deal 2009 and subsequent Five Year Plan for Green Growth 2009	USD 76 bln bln (2009-2013);	USD 60 bln (79%);	Water & waste; Building energy efficiency
EU	Sum of stimulus packages from EU Member States and direct EU contribution.	USD 537 bln (mostly 2009-2010, some packages beyond)	USD 53.4 bln (10%)	Energy efficiency (building, rail, grid); Low carbon power (CCS)

Source: HSBC (2009), A Climate for Recovery – the colour of stimulus goes green, Feb 2009; and HSBC (2009), Building green recovery – governments allocate USD470bln – and counting…, May 2009 and HSBC (2010), Overview of global green stimulus spending, Feb 2010.

REFERENCES

Aghion, P., Henous, D. and Veugelers, R. (2009a), *No green growth without innovation*, Bruegel Policy Brief, Issue 2009/07, November 2009.

Aghion, P., Veugelers, R. and Serre, C. (2009b), *Cold start for the green innovation*, Bruegel Policy Contribution, Issue 2009/12, November 2009.

Bertoldi, P. and Atanasiu, B. (2009), *Electricity consumption and efficiency trends in European Union,* Status report 2009, JRC.

Calogirou, C. et al. (2010), *SMEs and the environment in the EU-27*, Planet SA and Danish Technological Institute, published by European Commission, DG Enterprise and Industry.

Canton, J., Labat, A. and Roodhuijzen, A. (2010), *An indicator-based assessment framework to identify country-specific challenges towards greener growth*, Economic Papers 401, European Commission, Economic and Financial Affairs Directorate-General.

Conte, A., Labat, A., Varga, J. and Zarnic, Z. (2010), What is the growth potential of green innovation? An assessment of EU climate policy options, Economic Papers 413, European Commission, Economic and Financial Affairs Directorate-General.

Dechezleprêtre, A., Glachant, M., Hascic, I., Johnstone, N. and Meniere, Y. (2011), Invention and Transfer of Climate Change Mitigation Technologies: A Global Analysis.Review of Environmental Economics and Policy (5)1,109-130.

Dechezleprêtre, A. and Martin, R. (2010), Low-carbon innovation in the UK: evidence from patent data, Policy paper, Grantham Research Institute on Climate Change and the Environment.

DG CLIMA (2011), Data from CITL: http://ec.europa.eu/clima/news/index_en.htm.

EC (2000a), Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles, Luxembourg.

EC (2000b), Directive 2000/60/EC — Framework for Community action in the field of water policy, Brussels.

EC (2003), Directive 2003/87/EC, Brussels.

EC (2008a), Directive 2008/1/EC, Brussels.

EC (2008b), Council Regulation (EC) No 521/2008, Brussels.

EC (2009a), Directive 2009/29/EC, Brussels.

EC (2009b), Directive 2009/31/EC, Brussels.

EC (2009c), Directive 2009/28/EC, Brussels.

EC (2010), Directive 2010/75/EU, Brussels.

Ecorys (2007), *Progress report on the European Union sustainable development strategy — Overview of Member States*, Study prepared for European Commission Secretariat-General.

Ecorys, Idea (2011a), *EU Industry in a Sustainable Growth Context: Instruments, innovation and Performance*, Report for the European Commission, DG Enterprise and Industry.

Ecorys (2011b), *Study on the Competitiveness of the European Companies and resource Efficiency*, Report for the European Commission, DG Enterprise and Industry.

Ecorys, CES IFO (2009), *Study on the competitiveness of the EU eco-industry*.

EEA (2010), The European environment: State and outlook 2010.

EIO (2010), Eco-innovation Observatory: Methodological report, Autumn 2010.

EP (2010), *End-of-life vehicles: Legal aspects, national practices and recommendations for future successful approach*, Brussels, European Parliament.

European Commission (2002), *European Competitiveness Report 2002,* Chapter 5: "Sustainable Development in the EU Manufacturing Industry Commission", Staff Working Paper, SEC(2002) 528.

European Commission (2007), *Progress report on the European Union sustainable development strategy*, Commission Staff Working Document, SEC(2007) 1416.

European Commission (2008), *Sustainable Consumption and Production and Sustainable Industrial policy Action Plan*, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2008)397.

European Commission (2009a) Non-paper *Green elements from Member States,* recovery plans.

European Commission, (2009b), Europeans' attitudes towards the issue of sustainable consumption and production, Flash Eurobarometer 256.

European Commission (2010a), *Europe 2020: A strategy for smart, sustainable and inclusive growth,* COM(2010) 2020 final.

European Commission (2010b), *An integrated industrial policy for the globalisation era — putting competitiveness and sustainability at centre stage*, COM(2010) 614.

European Commission (2010c), *Europe 2020 flagship initiative — Innovation Union*, COM(2010) 546.

European Commission (2010d), *A European strategy on clean and energy-efficient vehicles*, Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, Luxembourg.

European Commission (2010e), Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage: Background information and analysis.

European Commission (2010f), *European Competitiveness Report 2010,* Commission Staff Working Paper.

European Commission (2011a), European Economic Forecast, Spring 2011, European Economy 1/2011.

European Commission (2011b), A resource-efficient Europe — Flagship initiative under the Europe 2020 Strategy, COM(2011) 21.

Eurostat (2010), Environmental statistics and accounts in Europe, 2010 edition.

Friedlingstein, P., Houghton, R.A. et al. (2010), Update on CO_2 emissions, Nature Geoscience 3: 811-812.

Gerrard, J. and Kandlikar, M. (2007), Is European end-of-life vehicle legislation living up to expectations? Assessing the impact of the ELV Directive on 'green' innovation and vehicle recovery, Journal of Cleaner Production 15(1): 17-27.

GHK, Cambridge Econometrics, Institute of European Environmental Policy (2007), Links between the environment, economy and jobs, Study commissioned by DG Environment.

HSBC (2010), Overview of global green stimulus spending. HSBC Global Research.

HSBC (2009a), More green money on the table. HSBC Global Research.

HSBC (2009b), A climate for recovery – the colours of stimulus goes green. HSBC Global Research.

IEA (2011), World energy outlook 2010, International Energy Agency.

IHS Global Insight (2010), Assessment of the effectiveness of scrapping schemes for vehicles: Economic, environmental and safety impacts, Report prepared for European Commission DG Enterprise and Industry, March 2010.

IMF (2010), World economic outlook 2010 (WEO).Ipsos MORI (2008), Recognising A-G: Summary of results from cross-EU survey [online], available at: <http://www.anec.eu/attachments/ANEC-ENV-2008-G-040a.pdf> [accessed on 1 February 2011].

Johnstone, N., Hascic, I. and Kalamova, M. (2010), Environmental policy design characteristics and technological innovation: Evidence from patent data, OECD Environment Working Papers, No 16.

Kemp, R. (2008), Measuring eco-innovation, United Nations University (UNU) Research Brief No 1, 2008.

OECD (2009), Green growth: Overcoming the crisis and beyond.

OECD (2011), Green growth strategy synthesis report.

Öko-Institut (2010), End-of-Life Vehicle Directive 2000/53/EC, Annex II: Study on analysis of costs and environmental benefits of heavy metal ban, and proposal for better regulation, Freiburg.

Oltra, V., Kemp, R. and de Vries, F. (2008), Patents as a measure for eco-innovation, Report for MEI project, FP6.

Potts, T. et al. (2011), Sustainable seafood and ecolabelling: The Marine Stewardship Council, UK consumers and the UK fishing industry [online], UK: Scottish Association for Marine Science, Scottish Marine Institute, available at: <http://www.sams.ac.uk/sams-news/Media%20releases/research/departments/ecology/EECSAF%20Policy%20report%202011.pdf > [accessed on 24 January 2011].

Technopolis Group (2008), Final report on work package 6 of the SYSTEMATIC project: innovation leaders showcase, May 2008.

SAFECHEM (2005), Chemical leasing within the SAFECHEM business model [online], available at: <http://www.dow.com/safechem/eu/fr/about/chemical_leasing.htm> [accessed on 1 February 2011].

Seafood Choices Alliance (2007), The European marketplace for sustainable seafood, available at: <http://www.seafoodchoices.org/resources/documents/SCAEuroMPReport.pdf> [accessed on 1 February 2011].

Stoughton, M. and Votta, T. (2002), Implementing service-based chemical procurement: lessons and results, Massachusetts, Elsevier Science Ltd.

World Business Council for Sustainable Development (2008), Sustainable consumption facts and trends, from a business perspective.

Interviews – ELV case study:

ACEA, Association of European Car Manufacturers (Director of Environmental Policy).

Robert Bosch (Head of European Government and Political Relations).

Ford (Sustainability Manager).

EFR, Association of European Shredders (Environmental and Technical Officer).

European Commission, DG Environment (Unit C2).

Interviews – Eco-labelling case studies

Marine Stewardship Council (MSC), Deputy Director for Europe.

Dutch Retail Association, Director of Consumer Affairs and Quality.

IGLO (formerly part of Unilever and co-founder of MSC), Director of Sustainability and External Affairs.

OSRAM, Spokesperson on Trade Media.

European Consumers' Organisation (BEUC), Eco-Design Project Coordinator.

Philips, Vice-President — Sustainability, Government and Industry Affairs, Philips Lighting.

EkoFish B.V., General Manager.

Interviews – Chemical industry case study

CEFIC, Head of Trade Policy and Executive Director for the Programme Product Stewardship.

Dow Chemicals/SAFECHEM, Business Manager.

Umweltbundesamt (UBA), German Federal Environment Agency, International Chemicals Management, Sustainable Chemistry Officer.

UNIDO, Chemical Leasing Coordinator.

VCI, Director of Product Safety.

6. EU INDUSTRIAL POLICY AND GLOBAL COMPETITION: RECENT LESSONS AND WAY FORWARD

6.1. Introduction

The EU economy faces long-term structural challenges that necessitate a strategic response in order to meet the targets set out in the Europe 2020 strategy. Improving the performance of the EU economy, in particular maintaining and reinforcing the competitiveness of European industry (competitiveness is defined in Chapter 1, Box 1.1), forms an indispensible part of this response and requires close integration of all relevant policies. This applies first and foremost to the core EU policies that shape industrial competitiveness and their respective toolkits.

Nearly a decade ago, a European Commission report pointed to 'new challenges that emerge at an accelerating rate: new markets, new ways of doing business, new drivers of growth and of dynamic competition.'[85] Since then, the speed at which these challenges have materialised and their extent have exceeded all expectations. In essence, the macroeconomic trends reshaping the global economy have forced the EU to move away from an inward-looking focus on the Single Market to a broader and more global, resource-oriented perspective. The old order, in which the EU determined the pace and pattern of global growth and trade together with the US and Japan, has been irreversibly overturned by the emergence of an as yet unfinished power patchwork involving ever more players.

In addition, the economic and financial crisis has triggered a debate about the strength and sustainability of the institutional pillars on which the Western socioeconomic model rests. While it is by now clear that this crisis has only temporarily exacerbated weaknesses that already existed in the real economy, recent positive economic signals are no reason to return to business as usual. On the contrary, identifying these weaknesses and proposing practical solutions embedded within the EU's competitiveness policies is essential in order to ensure long-term industrial competitiveness.

In this context, not only industrial and competition policies but also trade, Single Market and other policies are indispensible. In fact, in parallel to the shift in focus towards external developments, the EU has undergone its biggest enlargement ever, resulting in an internal market of 500 million citizens. As a consequence, the Lisbon Treaty, which entered into force in December 2009, was designed to provide the enlarged EU-27 with a workable governance structure. It also reinforced the role of industrial policy at European level and prompted, in the context of the Europe 2020 strategy, a new industrial policy for the globalisation era (cf. section 6.3.2). These changes are of particular importance for the EU's competitiveness.

This chapter assesses the synergies between industrial policy and other competitiveness policies, in particular competition policy, building on an earlier analysis in 2002.[86] As such, the chapter is intended to contribute to the debate on the way ahead for the Europe 2020

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85 European Commission (2002), *2002 European Competitiveness Report,* Commission Staff Working Paper, SEC(2002) 528, p. 93.

86 Cf. European Commission (2002), *2002 European Competitiveness Report,* Commission Staff Working Paper, SEC(2002) 528.

strategy. In order to remain concrete and concise, it largely focuses on manufacturing industry.

Section 6.2 revisits the major developments over the last decade and explains the main challenges for the EU. Section 6.3 summarises the institutional and policy toolkit so far available to address these challenges. Section 6.4 then explores how the identified challenges result in practical problems for European industry at different stages of their production value chain. Section 6.5 suggests relevant solutions in the context of EU policy making, based on the existing legal framework and a reassessment of how it relates to the issues raised. Some concluding remarks in section 6.6 highlight the merits of a more integrated policy approach and complete the chapter.

6.2. Key challenges for the competitiveness of the EU economy

Three major developments have marked the last decade, each resulting in specific challenges for EU industry: enlargement to form the EU-27, globalisation with the resulting relative rise in importance of some EU trade partners, and the recent economic and financial crisis. Overall, their effects overlap and create a dynamically changing economic environment that forms the background for this chapter.

6.2.1. Exploiting the full potential of the enlarged internal market

The historically unprecedented enlargement from the EU-15 to first the EU-25 in 2004 and then the EU-27 in 2007 has triggered the most fundamental and visible change in the EU since the start of the millennium. It has enabled the new Member States to complete the adjustments they had already starting making to their political and economic systems and has resulted in a massive extension of the EU internal market. The EU now embraces about 500 million citizens and forms one of the most powerful economic blocs in the world.

The resulting dynamics have created new business opportunities and growth potential that is far from fully exploited. The old Member States have benefited from increased trade with and investment in the new Member States.[87] In turn, the new Member States have experienced significant growth financed by private investment and access to EU cohesion funds. Overall, trade integration has triggered a more efficient allocation of productive resources, had a positive effect on employment in the EU-27 and significantly improved the global competitiveness of European companies.

The relationship between the enlarged internal market and European industry is a mutually beneficial one. This was recently highlighted when the Commission presented its new industrial policy in 2010:

'Now more than ever, Europe needs industry and industry needs Europe. The Single Market, with 500 million consumers, 220 million workers and 20 million entrepreneurs, is a key instrument in achieving a competitive industrial Europe'. [88]

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87 European Commission (2009), *Five years of an enlarged EU – Economic achievements and challenges,* Communication from the Commission, COM(2009) 79, p. 2.

88 European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614.

In the past, the internal market has been the main driving force behind European economic growth, based on the freedom of movement of goods, persons, services and capital. Little by little, economic integration has provided companies in Europe with a domestic market that goes beyond national boundaries and a stimulating and competitive environment conducive to innovation and increased productivity.

However, despite all past successes, the shortcomings within the internal market and its unexploited opportunities remain major challenges holding back the EU's competitiveness. The smooth continuation of the integration process cannot be taken for granted and remains a formidable task, the more so in the face of future enlargements. It is a task that has not been made easier by the emergence of external challenges, in particular the recent economic and financial crisis and the pressures of globalisation, both of which will be discussed further below.

In order to exploit the full potential of the internal market, the Commission adopted on 13 April 2011 the Single Market Act. This proposes 12 levers to strengthen confidence, each featuring one key priority action and a number of additional actions to be implemented by the end of 2012, in time for the 20th anniversary of the Single Market. Actions include tasks particularly important from an industrial competitiveness perspective, such as ensuring access to finance for SMEs, improving the framework governing Intellectual Property Rights (IPRs), reforming standardisation policy, extending high-performance European infrastructure networks and modernising the rules governing public procurement.

Moreover, the challenge ahead is not limited to consolidating and deepening the integration of the internal market. While this is a prerequisite for improving competitiveness, addressing global challenges cannot be achieved by merely extrapolating intra-EU policies beyond Europe. Instead, all EU policies — and notably any attempt to preserve and enhance competitiveness — need to take into account that not all trade partners are market economies. Only a policy approach that takes into account the economic realities faced by European companies outside the EU can establish a powerful link between the Single Market and the rest of the world.

6.2.2. Creating a global level playing field with non-EU competitors

'Europe is the right level for thinking and action in terms of globalisation. Markets are global: Europe must defend its interests and values with greater confidence, in a spirit of reciprocity and mutual benefit. European policies must aim to ensure the greater convergence of rules and standards at international level.'[89]

Progressing at an accelerating speed over the last decade, globalisation has been reshaping the world economy. Newly emerging economies, spearheaded by the BRICs,[90] have established themselves as major economic powers. The main drivers behind this process include economic liberalisation inside these countries, the dismantling of regulatory and tariff barriers to trade between countries, and falling transport and communication costs resulting from better logistics and use of ICT.

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89 European Commission (2010), *Towards a Single Market Act, For a highly competitive social market economy, 50 proposals for improving our work, business and exchanges with one another*, Communication from the Commission, COM(2010) 608.

90 Brazil, Russia, India and China.

The emerging countries have significantly increased their share of output, raw material consumption, trade and capital stocks. The share in world GDP held by China, India and the ASEAN countries, for example, has risen by more than 60% over the last decade. Their share in world trade has increased by more than 50% and in world foreign direct investment (FDI) stocks by more than 15%.[91] China overtook Japan as the world's second largest economy in 2010, and is expected by many observers to become the largest economy within the next 20 years.[92]

Globalisation and the economic rise of Asia have led to important changes to the business context in which European companies operate, notably in the manufacturing sector:

- The newly emerging economies present ever more important markets for European products and thereby new business opportunities. European imports from and exports to newly emerging economies in Asia have doubled since 2000.

- Access to these markets, including access to public procurement, is crucial for the current and future world market position and profitability of European companies, including SMEs,[93] but remains difficult and often subject to restrictions unacceptable in and for market economies.

- The structure of European industry has changed profoundly. Competition especially from Asian companies has put intense pressure on European companies to move up the quality and innovation ladder.[94] Some EU industries have retrenched to niches of their former markets, while others have outsourced much of their production outside the EU. Examples include the textile/clothing industry, shipbuilding, and consumer electronics, joined over the last decade by the clean technology and semi-conductor industries.

- European companies face increasing competition for energy resources and non-energy raw materials (cf. Chapter 4.). China's imports of fuels and non-fuel commodities have both increased by 500 % over the last decade.[95] Prices of most raw materials have risen significantly, e.g. the UNCTAD composite price index for minerals, ores and metals has more than doubled since 2000. Key sectors in high technology are dependent on relatively rare raw materials (e.g. lithium for batteries or neodymium for wind turbines and electric cars) only mined outside the EU.[96]

One of the most important consequences of these developments has been a trend towards internationally ever more specialised and fragmented value chains.[97] In the last decade,

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91 All data are from UNCTADstat. The period is 2000 to 2009; the GDP share in constant prices/exchange rates (2000). The term 'world trade' combines imports and exports.

92 The BRIC countries are expected to account for 60% of world GDP by 2030 (EIM study on internationalisation of SMEs).

93 European Commission (2011), *Review of the 'Small Business Act' for Europe,* Communication from the Commission, COM(2011) 78.

94 Notably China has recently moved into the manufacturing of high-tech goods as well. India is particular strong in services such as IT or customer care.

95 UNCTADstat.

96 European Commission (2011), *Tackling the Challenges in Commodity Markets and on Raw Materials*, Communication from the Commission, COM(2011) 25.

97 Cf. European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614; and European Commission (2010), European Competitiveness Report 2010,

imports of intermediate goods in the EU (as a proxy for value chain fragmentation) have increased by more than 80%[98] and now amount to about 40% of world trade in manufactured non-fuel products.[99] Formerly vertically integrated companies are concentrating on specific steps of the value chain and are outsourcing many other activities. Making use of efficiency gains stemming from specialisation along value chains is an important factor for the competitiveness of European businesses but can create significant risks as well, linked to security of supplies.

The last decade also saw increasing FDI between the EU and the emerging countries. While European FDI in the developing world has continued to grow, there is a recent trend for increased FDI to flow in the other direction. This is partly the result of the revenues from the huge trade surpluses built up over the last years by certain countries, most importantly China. Furthermore, some companies from these countries have emerged as globally active multi-nationals and have started to acquire assets all over the world, including European companies.

Looking ahead, it seems fair to state that improving the ability of European enterprises to fully capitalise on the business opportunities offered by globalisation is one of the most fundamental challenges ahead, if not the most important. As the EU has recognised the need to maintain a strong, diversified and competitive industrial base,[100] it must ensure that its enterprises maintain and reinforce their international competitiveness. A particularly important element for achieving this objective is the creation of a global level playing field,[101] on which companies from around the world are able to compete on their respective commercial merits. This includes all dimensions of economic activity, be it access to inputs and markets, IPR protection, availability of business services or choice of an optimal distribution network.

A continuing challenge to the creation of such a global level playing field results from the fact that some of the new economic powers are emerging from a planned economy model and have started liberalising their internal and external economic activities rather recently. The role of the state in these countries differs substantially from the role of the state in Europe and other mature economies. This may bring about distortions due to strategic macro-economic policy choices, such as fixed exchange rates, or interventionist economic policy strategies. Moreover, distortions other than classical tariffs or straightforward subsidies have risen to the forefront over the last decade.[102]

Commission Staff Working Document SEC(2010) 1276, Accompanying Document to the Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, COM(2010) 614.

98 European Commission (2010), *European Competitiveness Report 2010,* Commission Staff Working Document SEC(2010) 1276, Accompanying Document to the Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, COM(2010) 614, p. 81; data are available for the period 1999 to 2008.

99 Figure for 2008; source: WTO International Trade Statistics 2009.

100 European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614.

101 European Commission (2010), EUROPE 2020, *A strategy for smart, sustainable and inclusive growth,* Communication from the Commission, COM(2010) 2020 p. 21; European Commission (2011), *Review of the 'Small Business Act' for Europe,* Communication from the Commission, COM(2011) 78, p. 14.

102 European Commission (2011), Trade and Investment Barriers Report 2011, *Engaging our strategic economic partners on improved market access: Priorities for action on breaking down barriers to trade*, Communication from the Commission, COM(2011) 114.

Box 6.1: Offsets and forced technology transfers

Offsets, notably in the form of forced technology transfers, are a particular interesting example of a non-classical distortion of the global level playing field. Offsets are a price a company is requested to pay to enter a foreign market or obtain a lucrative contract. The price can consist for example in the transfer of technology to a local partner. It can also be more indirect, such as an obligation to use a specific percentage of local inputs or to help local companies in selling a predetermined amount of goods within a specific timeframe. Designed to make up an economic shortfall for local firms and compensate for the backwardness of a developing country, they form part of firms' bids, and their impact on the competitiveness of the European firms concerned can but need not always be negative.

However, such offsets can present a policy dilemma. While the individual company may be willing to pay the price, a negative externality can arise for the sector as a whole, and there may be negative repercussions for policy objectives based on the European interest. The increased use of offsets in an ever greater number of different sectors could call for assessment of the need for a legal framework to govern them.

In this context, and in order to guide the subsequent discussion in this chapter of the more detailed issues involved, a number of fundamental observations apply:

First, creating a level playing field implies a realistic assessment and monitoring of distortions. It can also require bilateral or multilateral negotiations with economic policy makers in the countries concerned. Further, case-by-case interventions may be required to help European businesses as much as possible to overcome specific distortions.[103] This applies to the activities of EU companies abroad but also to the activities of non-EU companies within Europe.

Second, creating a global level playing field implies neither 'tit for tat' acts of protectionism nor subsidy races between countries. Consumers and tax payers would immediately lose from such an approach, and any short-term benefits for enterprises would be rapidly cancelled out by the longer-term loss of growth opportunities. A global level playing field can therefore only be built on the principle that distortions are minimised.

Third, creating a global level playing field also does not imply a lowering of safety, labour or environmental standards. Societal demand for such standards rises with income, and differences in current levels are primarily a function of different income levels, not of differing preferences. The economic growth observed in significant parts of the developing world therefore goes hand in hand with rising environmental, safety and labour standards. Efforts to create a global level playing field are facilitated by this trend. This is compatible with competition between regulatory regimes in terms of cost-effectiveness (and not lowest standards).

Finally, the role of EU policy makers is enhanced in this global environment. Creating a regulatory framework, in the EU and globally, to address the changed reality of a globalised economy requires significant resources and resourcefulness on the part of policy makers. Rules must fit the needs of globally active businesses and their stakeholders, and also take

[103] The EU maintains for example 30 'Market Access Teams' in its key export markets and also provides help for European companies that face IPR problems in China.

into account the ever increasing interdependence of companies working in global value chains. Policy makers can also have an important role in facilitating adaptation by enterprises and societies to the substantial economic realignments caused by globalisation.

6.2.3. Boosting the real economy in times of financial trouble and fiscal constraints

The recent economic and financial crisis was the most severe macroeconomic shock since the Great Depression in the 1930s and has had a significant long-term impact on the competitiveness of EU industry.

In the face of the economic crisis originating in the United States, the EU took timely and coordinated policy action to maintain the stability of financial markets in Europe and to avoid a credit crunch by ensuring continued access to finance for the real economy. A Temporary Framework for State Aid was adopted in October 2008 (Box 6.2). The Commission subsequently adopted the European Economic Recovery Plan in November 2008 to coordinate a pan-European fiscal stimulus of about 2% of EU GDP in order to boost demand and structural change towards sustainable growth.

Box 6.2: State aid during the crisis

The Commission approved specific crisis-related national state aid measures under exceptional temporary rules adopted in October 2008 in accordance with Article 107(3)(b) TFEU, with a view to remedying a 'serious disturbance in the economy of a Member State'.

1) Support for financial institutions

Between 1 October 2008 and 1 October 2010, the Commission adopted approximately 200 decisions on state aid measures for the financial sector, authorising, amending or prolonging 41 schemes and addressing with individual decisions the situation in more than 40 financial institutions, affecting 22 Member States.

In 2009, total state aid granted to the financial sector represented €351.7 billion, or 2.98% of EU27 GDP. However, not all of the approved aid has been used by the Member States concerned.

2) Support for the real economy

Between 17 December 2008 and 1 October 2010 the Commission approved 73 schemes under the Temporary Framework and 4 ad hoc aid measures, amounting to a total of €82.5 billion (0.7% of EU-27 GDP). The schemes comprised aid of up to €500000 per company, subsidised guarantee measures, schemes for subsidised loan interest, schemes offering reduced-interest loans to businesses investing in the production of green products, risk capital schemes and export credit schemes.

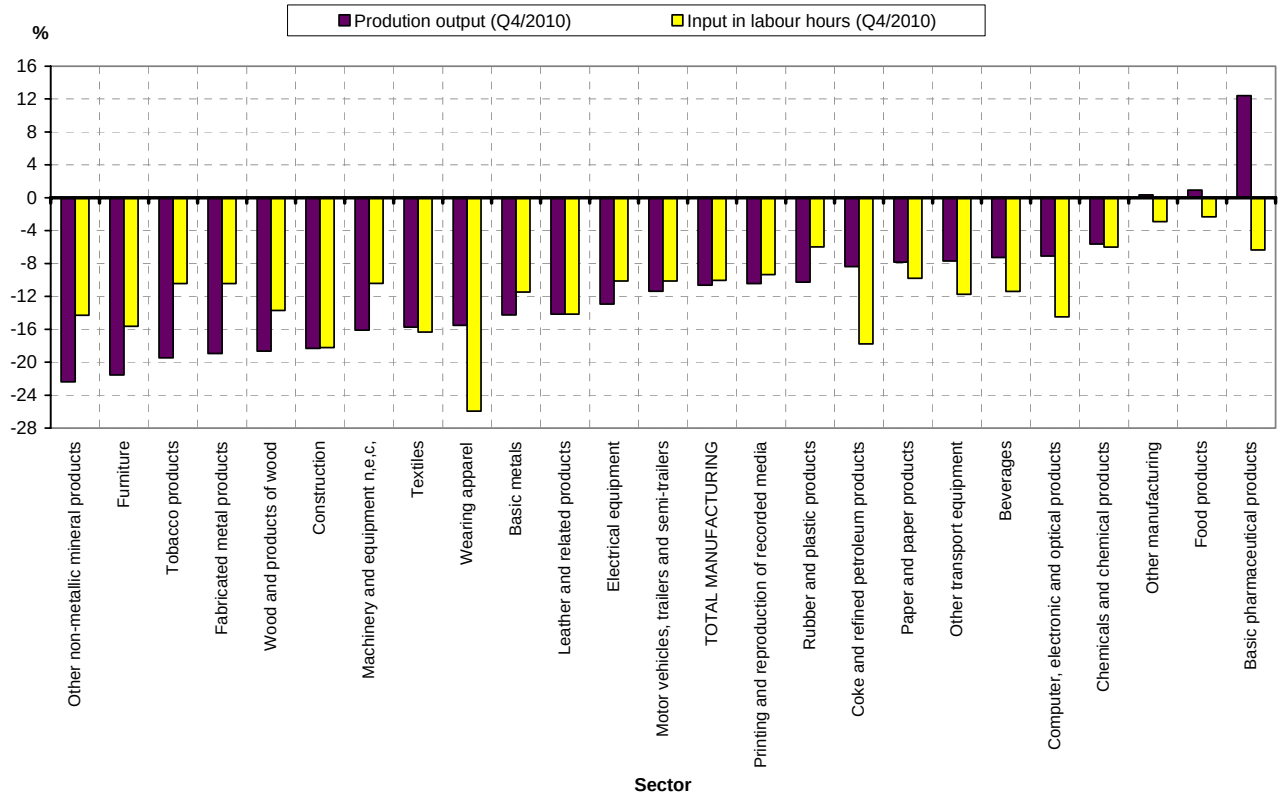
In 2009, the Commission approved measures under the Temporary Framework amounting to approximately €81.3 billion, including aid estimated at €2.2 billion, which represents 0.018% of EU27 GDP.

Source: State Aid Scoreboard — Report on State aid granted by the EU Member States- Autumn 2010 Update — 01.12.2010.

Due to the heavy reliance of European enterprises on bank credit and bank intermediation of savings, instability and lack of trust in the banking sector had an immediate impact on the financing of the real economy and on the level of consumption.[104] Credit restraints and reduced business and household demand had a particularly negative impact on those sectors already in need of structural adjustments, as for them access to finance had already been a bottleneck before the crisis.

By the end of 2008, production, demand, investment and trade inside the EU had decreased drastically, with manufacturing output falling by some 20 %. EU real GDP shrank by 4.2 % in 2009, the sharpest contraction in its history.[105] The crisis also had an immediate impact on the level of employment and bankruptcies, with social difficulties aggravating the economic downturn and negatively affecting private domestic demand. Since mid-2009, the EU economy has started to emerge from the recession.[106] Short-term economic data show a strong recovery in Europe, especially for industrial output. However, output remains below its former peak. Employment has also fallen significantly and manufacturing employment is on average some 10 % below its peak (see Figure 6.1).

Figure 6.1: Sectoral manufacturing output and employment developments



Note: Percentage change, latest data compared to the cyclical peak (Q1/2008), seasonally adjusted
Source: Eurostat

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104 Posen, A., Véron, N., (2009), *A Solution for Europe's Banking Problem*, Bruegel Policy Brief 2009/03. It also had an indirect impact on the valuation of the European corporate landscape, with banks representing 24 % of the aggregate market value of European listed companies among the world's 500 largest in mid-2007 and only 12 % in March 2009.

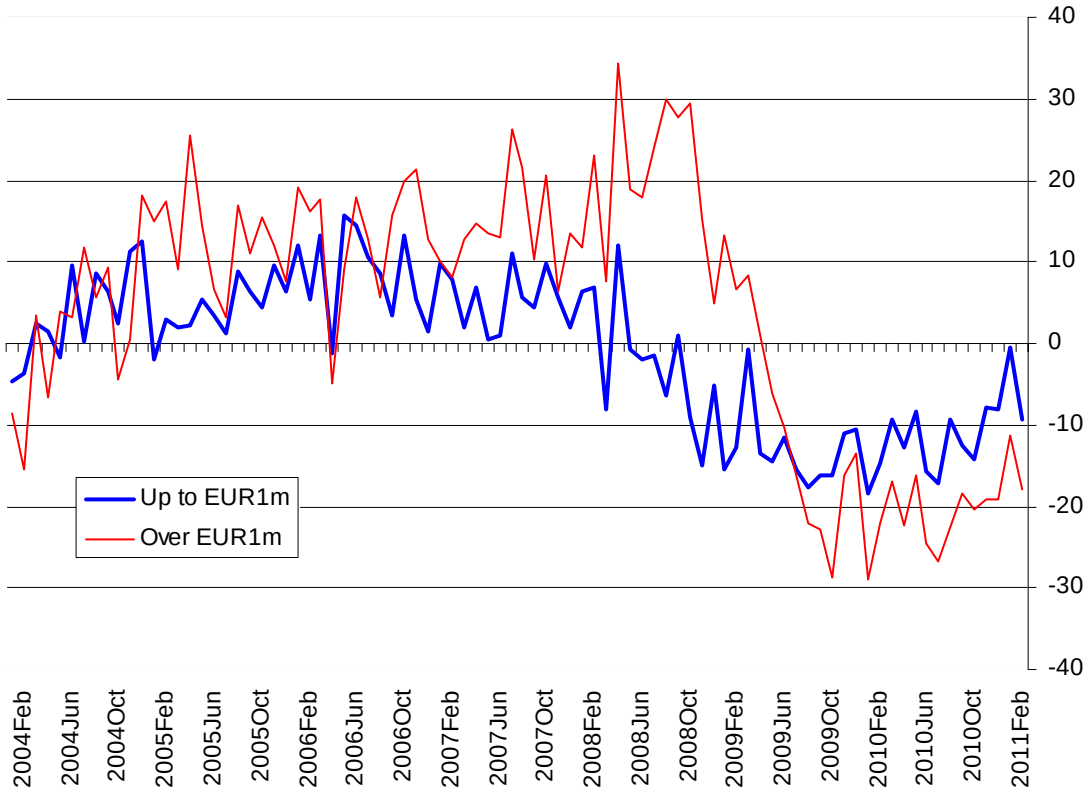
105 European Commission (2009), *Economic Crisis in Europe: Causes, Consequences and Responses*, European Economy 2009-7, DG Economic and Financial Affairs.

106 European Commission (2010) Monthly Note on Economic Recovery in Manufacturing, Construction and Services Industries, March 2010, DG Enterprise & Industry.

While the current economic outlook for production and growth is now positive, the real economy remains exposed to structural problems with access to finance, which has not returned to normal. The continued high risk aversion of financial institutions, the current uncertainties on the financial markets, the embryonic European venture capital market and ever tighter fiscal constraints together constitute a potentially lasting damaging consequence of the crisis on the EU's economic performance. Credit supply is in fact expected to be further affected by the introduction of the CRD IV guidelines.

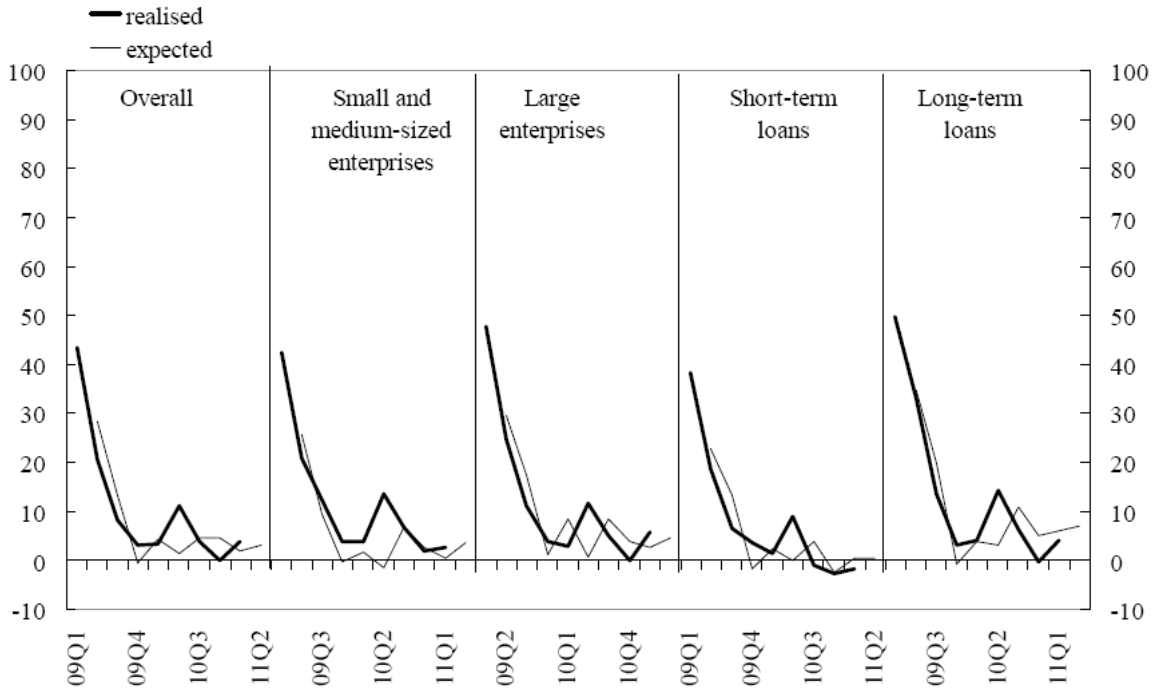
The crisis has in particular revealed the need for further restructuring and better supervision of the banking sector. The increasingly narrower scope for financial state intervention due to fiscal constraints adds to the problem. As a result, many companies in the real economy have been weakened by the crisis — not because they were uncompetitive, but because of the failure of financial service providers to play their supportive role. Some companies have thus reduced or delayed necessary investment or R&D&I expenditure, while others are barely able to survive due to lack of financing, making them vulnerable to any further cyclical change or take-overs. This will have a negative effect on both competition and the strength of Europe's industrial fabric. In particular, non-financial corporations, especially SMEs, are still facing difficulties. New loans to enterprises in the euro zone have continued to fall over the past months, and euro zone banks are still reporting a tightening of their credit standards for loans to enterprises (cf. Figure 6.2 and Figure 6.3).

Figure 6.2: Change in new loans below and above EUR 1 m — year-on-year change



Source: ECB

Figure 6.3: Changes in credit standards applied to the approval of loans or credit lines to enterprises (net percentage of banks reporting tightening credit standards)



Source: ECB Bank Lending Survey, April 2011

Overall, exposure of the European economy to lasting problems of access to finance forms one of the main challenges in the post-crisis context. The key task ahead is thus to restore trust and stability in the financial sector. A move towards more stability and responsibility in the financial system is already ongoing, through a series of important European initiatives to reform financial markets (e.g. corporate governance crisis resolution system, supervision of institutions, strengthening of capital requirements). These are indispensible for improving the system as a whole, as is the balanced restructuring of distressed banks.

A stable and business-oriented financing market is essential not only for daily operations but also for the longer-term investment needed for 'modernising Europe's industrial base and the infrastructure on which it relies'. This also implies 'more private capital for productive investments, in particular through venture capital markets' and, more generally, 'more resilient and efficient financial markets ensuring that they have the right incentives to finance the real economy and investment.'[107]

It is moreover essential to continue structural reforms in Member States, e.g. adjusting labour or pension systems, and to create 'incentive mechanisms encouraging all forms of sustainable investment or investment supporting a long-term strategy.'[108] Facing these short- to medium-term challenges will require innovative approaches, especially to address the fiscal situation

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107 European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614, point 3.2.

108 European Commission (2010), *Towards a Single Market Act, For a highly competitive social market economy, 50 proposals for improving our work, business and exchanges with one another*, Communication from the Commission, COM(2010) 608, point 1.4.

of many Member States, characterised by large structural deficits and high levels of public debt. The search for better efficiency in all policies will thus need to be placed high on the agenda.

6.3. Fostering strategic European interests

The challenges identified above have important implications for the EU policy framework. This is reflected in the modernisation of the EU's industrial policy with the specific objective of gaining leverage for global competition. The following section discusses the institutional framework where relevant from a competitiveness perspective.

6.3.1. The Lisbon Treaty and competitiveness

The enlargement of the EU required a new treaty to render governance of the EU-27 more operational. Decision-taking would otherwise have become increasingly difficult. In order to achieve better coordination, a clearer institutional structure and more effective governance, the Lisbon Treaty was signed on 13 December 2007 and entered into force on 1 December 2009 (Box 6.3).[109]

Box 6.3: The Lisbon Treaty

The Treaty of Lisbon amended the EU's two core treaties, the Treaty on European Union (i.e. the 'Maastricht Treaty') and the Treaty establishing the European Community (i.e. the 'Treaty of Rome'). The latter was renamed the Treaty on the Functioning of the European Union (TFEU). In addition, several Protocols and Declarations were attached to the Treaty.

All legal provisions relevant for competitiveness policies are contained in the TFEU. Industrial policy is a field where action at EU level serves to support, coordinate or supplement Member State actions, whereas establishing the competition rules necessary for the functioning of the internal market is an exclusive competence of the EU. Although there are three short references elsewhere in the TFEU,[110] the issue of competitiveness is essentially covered by Article 173 TFEU on industry, which establishes industrial policy as the main pillar of the EU's competitiveness policy.

Article 173 keeps the main elements of its predecessor, Article 157 EC.[111] In particular, it maintains the overall objective that

'[t]he Union and the Member States shall ensure that the conditions necessary for the competitiveness of the Union's industry exist.'

The article then lists more detailed industrial policy objectives, such as

- speeding up the adjustment of industry to structural changes;

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109 Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007, Official Journal C 306 of 17 December 2007.

110 Article 151 TFEU on social policy, Article 189 TFEU on space policy and Article 195 TFEU on tourism, cf. the consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union, Official Journal C 83 of 30.03.2010.

111 Cf. also European Commission (2002), *2002 European Competitiveness Report,* Commission Staff Working Paper, SEC(2002) 528, p. 82.

- creating a favourable business environment, particularly for SMEs; and
- fostering better exploitation of the 'industrial potential of policies of innovation, research and technological development'.

Any action by the EU and the Member States must be in accordance with a system of open and competitive markets. Moreover, Article 173 emphasises that industrial competitiveness has various dimensions. This has broad implications for the positioning of industrial policy in conjunction with other policies, such as R&D, innovation, competition and trade. It also implies that industrial policy is multifaceted, so that a single indicator will not suffice to measure competitiveness in a comprehensive and operational manner.[112]

In addition, Article 173 TFEU includes novel aspects that strengthen its relevance compared with Article 157 EC. Most importantly, Article 173(2) gives the Commission more scope to coordinate between EU level and Member States, for example by establishing guidelines and indicators, exchanging best practice or performing periodic monitoring and evaluation.[113] The conclusions adopted by the Competitiveness Council on 1 March 2010 reconfirm this widened room for manoeuvre.[114] Much of the subsequent discussion in this chapter serves to explain in greater detail how this opportunity can be grasped in practical terms.

With a view to other policies, Article 3(c) TFEU refers to competition policy as one of the EU's exclusive competences, to the extent necessary for the functioning of the internal market. Competition policy thus remains a vital element of any competitiveness policy strategy. As regards trade policy, the Lisbon Treaty introduced two major changes: a clarification of the EU's exclusive competence on all key aspects of trade policy and an increase in the European Parliament's powers vis-à-vis the Council. Concerning the EU's exclusive powers, the Lisbon Treaty explicitly refers not only to trade in goods but also to trade in services, trade-related IPRs and FDI.[115] By extending the competence for FDI without explicitly mentioning investment liberalisation or protection, the Lisbon Treaty has granted the EU an exclusive competence for investment protection. Any new policy is therefore not confined to granting access to trade partners and ensuring access for European companies to the markets of third countries, but can also ensure that these investments are duly protected. Multilateral fora and bilateral trade agreements could serve to advance this approach further.

6.3.2. A new industrial policy for the globalisation era

In the wake of the 1992 Single Market Programme, the EU pursued a horizontal[116] industrial policy aimed at improving the framework conditions necessary to ensure the flourishing of the newly constructed internal market. Strong competition policy was used to break down

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112 European Commission (2010), *Member States competitiveness performance and policies,* Commission Staff Working Document SEC(2010) 1272, Accompanying Document to the Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, COM(2010) 614.

113 Priollaud, F-X., Siritzky, D., (2010) *Le Traité de Lisbonne: commentaire, article par article, des nouveaux traits européens (TUE-TFUE)*, Paris, Documentation française, p. 284.

114 Council of the European Union (2010), *Council conclusions on the need for a new industrial policy,* 2999th Competitiveness Council meeting, Brussels, 1 March 2010, point 9.

115 De Gucht, K., *The implications of the Lisbon Treaty for EU Trade policy,* S&D seminar on EU Trade Policy, Oporto, 8 October 2010.

116 As opposed to vertical policies that target specific sectors.

remaining barriers. Interventionist economic policies were explicitly avoided as likely to be incompatible with the internal market.

As the Single Market has become an established reality, the importance of manufacturing industry in the EU economy has been increasingly recognised. In 2002, with a view to the upcoming enlargement, the Commission published a Communication on Industrial Policy in an Enlarged Europe,[117] which examined the future of EU industrial policy. It underlined the role of a competitive industry and emphasised three key factors influencing industrial competitiveness: knowledge, innovation and entrepreneurship. Two further Communications followed in 2003 and 2004.[118] [119]

In the context of the revised Lisbon Strategy,[120] the Communication on industrial policy in 2005 confirmed industrial policy as a key policy at EU level. The document set out an integrated approach to industrial policy, maintaining a horizontal non-interventionist approach to industrial policy that took full account of sectoral specificities. A detailed set of horizontal and sectoral policies were set out based upon a systematic screening of the opportunities and challenges facing 27 individual sectors of EU manufacturing industry. Key initiatives included a legislative simplification initiative, work on energy and environmental issues, international market access, and intellectual property enforcement, together with a series of High Level Groups, including CARS21 and LeaderSHIP, to review the future of certain sectors. A mid-term review in 2007 further extended and elaborated this policy approach, including working more closely with Member States. Overall, the new policy framework has served the EU well.

When the global business environment changed radically, as described above, the Commission designated industrial policy as one of the key flagship initiatives under the Europe 2020 Strategy, and adopted on 28 October 2010 a new Communication on 'An Integrated Industrial Policy for the Globalisation Era — Putting Competitiveness and Sustainability at the Centre Stage' (Box 6.4). Taking into account in particular the lessons learnt from the crisis, the Commission agreed on a fresh approach to industrial policy, which is to put EU economy on a dynamic growth path by strengthening EU competitiveness, providing growth and jobs, and enabling the transition to a low-carbon and resource-efficient economy. Most importantly, the Communication recognised the need for an outward-looking global perspective with competitiveness as the central element to help ensure consistency between all other policies targeting enterprises.

While it is built on past experience and continues some existing initiatives, this new industrial policy contains some novel elements that strengthen the Commission's role as the coordinator of national policies. On substance, emphasis is placed on the whole value chain, from access to raw materials to after-sales service, in recognition that any focus on solely one part of this chain is detrimental to enhancing the competitiveness of not only firms but the EU economy as a whole. At the same time, the EU has set itself a new strategic objective: maintaining a

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117 European Commission (2002), *Industrial Policy in an Enlarged Europe*, Communication from the Commission, COM(2002) 714.

118 European Commission (2003), *Some Key Issues in Europe's Competitiveness — Towards an Integrated Approach*, Communication from the Commission, COM(2003) 704.

119 European Commission (2004), *Fostering structural change: an industrial policy for an enlarged Europe,* Communication from the Commission, COM(2004) 274.

120 European Commission (2005), *Common Actions for Growth and Employment: The Community Lisbon Programme*, Communication from the Commission, COM(2005) 330.

strong, competitive and diversified industrial base in Europe. In particular, it aims to provide 'a strategic framework for a new integrated industrial policy that will stimulate economic recovery and jobs by ensuring a thriving world-class industrial base in the EU'.[121]

In order to promote a successful industrial policy, the new strategy requires that industrial policy is understood in a wider sense, focusing on all policies that have an impact on the cost, price and innovative competitiveness of industry and individual sectors, such as standardisation, innovation policies or policies targeting e.g. the innovation performance of individual sectors. It also entails consideration of the competitiveness effects of all other policy initiatives.

The key challenge ahead is to create a framework that accompanies firms through all phases of their life cycle and all stages of their activity. The framework is also intended to provide the right incentives for them to increase their competitiveness (this notion is further discussed in section 6.4). The primary responsibility for doing this rests on industry itself. Nonetheless, a modern industrial policy offers a toolbox that combines the rigour and consistency of horizontal principles with the flexibility of priority setting according to the specific needs of sectors.

In addition to these priorities, the Commission has started reporting on EU and Member State competitiveness, industrial policies and performance on an annual basis as part of the new TFEU provision for it to coordinate competitiveness policies.[122]

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121 European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614.

122 European Commission (2010), *Member States competitiveness performance and policies — 2010 edition*, Commission Staff Working Document, SEC(2010) 1272.

Box 6.4: The five key priorities of the October 2010 Industrial Policy Communication

Firstly, the Communication emphasises the need to deliver the right framework conditions for industry and ensure that EU policies all work together in the same direction. To achieve this, all important policy proposals impacting on industry — for example, new regulations for financial markets, environmental standards or new Single Market and competition legislation — should undergo a detailed assessment of their overall impact on industrial and sectoral competitiveness before implementation. This should guarantee a genuinely integrated industrial policy approach at EU level.

Secondly, the Communication stresses the role that the Single Market plays in fostering industry's competitiveness and the need to address its shortcomings. For example, the efficiency of the Single Market crucially depends on the quality and efficiency of the energy, transport and communications infrastructure. The related policies should therefore be considered integral parts of an integrated industrial policy approach. Also, the provision of business services is becoming ever more crucial for modern industry, and the Single Market needs to be modernised in this area.

Thirdly, as Europe needs to improve its ability to turn ideas into marketable goods and services, the Communication puts forward a new industrial innovation policy, to ensure that EU firms are first onto the market. In particular, it emphasises the role that Key Enabling Technologies (KETs) can play in ensuring continuing technological leadership by EU industry in both mature and emerging markets.

Fourthly, the Communication insists that European industry must take advantage of the new markets opened up by globalisation, and that it will only be able to do so if put on an equal footing with its global competitors. This requires greater efforts to identify and combat trade and investment barriers[123] and also beyond-the-border practices, such as subsidies in specific sectors. As access to raw materials is an increasingly strategic issue for Europe, the Communication announced a comprehensive strategy, subsequently presented by the Commission,[124] with a strong external dimension to ensure, in particular, that access is genuinely market-driven and that restrictions and constraints in third countries are removed.

Finally, industry must be accompanied in its transition to a low carbon resource efficient economy. Indeed, combating climate change and increasing resource efficiency should not be seen exclusively as a burden on companies, but also as an opportunity for sustainable growth and gaining competitive advantage. This implies in particular initiatives targeting energy-intensive industries – such as metals, chemicals, and paper and pulp – so that new low-carbon technologies can be developed and disseminated.

6.3.3. A European policy approach to serve strategic European interests

In line with the principle of subsidiarity, the appropriate level to design policy is the lowest that can effectively provide a solution for the problem at hand. Action at EU level is thus only justified where the target of such action comprises a significant part of the EU and where a

123 European Commission (2011), *Trade and Investment Barriers Report 2011*, Report from the Commission to the European Council, COM(2011) 114.

124 European Commission (2011), *Tackling the challenges in commodities markets and on raw materials,* Communication from the Commission, COM(2011) 25.

response only at a lower level would create risks of fragmentation, underperformance or inconsistency.

These conditions are met for a policy response towards the challenges discussed above:

- Globalisation affects all Member States, and the strategic response to it is a task with clear economies of scale. In the face of non-EU competitors with swiftly expanding home markets of a potential size much larger than that of any EU Member State, political and economic leverage can be higher at European level.

- There is a strong need to maintain the Single Market across an enlarged EU-27, a much less homogenous economic bloc than the earlier, smaller EU. In a number of sectors, manufacturing is concentrated in a minority of Member States, whereas resources, suppliers and markets encompass all of them. Maintaining and extending the Single Market benefits all businesses and consumers.

- Limited state finances in the wake of the economic and financial crisis call for pan-European solutions, including new ways of financing large-scale demonstration projects (as exemplified by Carbon Capture and Storage or KETs) and supporting infrastructure.

The Europe 2020 strategy provides the basis to implement such a European approach. As discussed in section 6.3.1, the TFEU provides new tools for the 'integrated industrial policy for the globalisation era' flagship to enhance competitiveness, for instance by strengthening the Commission's role as coordinator of national efforts. In this context, it is important as a starting point to clarify some concepts, notably 'European interest', 'strategic' at European level, and 'European company', to the extent relevant for an industrial policy context.

6.3.3.1. European interest

The notion of European interest figures in the TFEU only once, in Article 107(3)(b) on state aid. Financial support measures by Member States 'may be considered to be compatible with the internal market' if they constitute

'aid to promote the execution of an important project of common European interest or to remedy a serious disturbance in the economy of a Member State'.

However, the related term 'common interest' appears ten times. In particular, two subsequent provisions on state aid, Articles 107(3)(c) and (d), state that other forms of aid must not distort trade (and competition) to an extent 'contrary to the common interest'. A common European interest is thus recognised in the TFEU itself.

Beyond these references, the European interest also figures in secondary law:

- In the competition context, the conditions for considering '[a]id for R&D&I to promote the execution of an important project of common European interest' as compatible with the internal market are laid down in the 2006 R&D&I state aid framework.

- In another field, the notion already exists as well. In trade policy,[125] the 'Community interest' is defined on the basis of various interests taken as a whole, including the interests of domestic industry, users and consumers. It thus serves to combine diverse — and sometimes opposed — specific interests to arrive at the common good.

- The notion of European interest is used in EU transport or energy policy for establishing the right framework conditions and financial means to ensure the building or operating of efficient trans-border infrastructures. It can be extended to large research infrastructure projects, e.g. the ITER fusion energy demonstration project in Cadarache.

From the perspective of industrial competitiveness policy, a legitimate European interest could be assumed to exist where an action would benefit industrial competitiveness across national borders without its benefits being either limited to one Member State or the Member States implementing it or confined to the industry directly concerned, or where the implementation of a project or policy at Member State level would result in wasteful duplication of efforts (i.e. inefficient use of resources), would act against similar efforts in other Member States, or would not happen at all. Reasons for the latter include costs that exceed benefits at national level due to externalities, too large a project size or myopic behaviour, all of which is aggravated in the face of tighter fiscal constraints.

Factual developments underpin the need to rapidly fill the notion of European interest in the competitiveness context with content. The evolution of cross-border industry value chains is one of them. This was prominently highlighted in the 2010 Industrial Policy Communication:

'Delivering the new industrial policy calls for more effective European governance. The concepts of national sectors and national industries with little interaction with other sectors or the rest of the world are becoming less relevant. It is now increasingly important to identify strategic European industrial interests, and uncoordinated national policy responses must give way to coordinated, European policy responses.'[126]

The ongoing changes in the global configuration of industries and countries add a new dimension to the notion of European interest in the field of competitiveness policy. In some areas where the level playing field for all companies is distorted, and where Europe 2020 aims to 'maintain a strong, competitive and diversified industrial base', defining the European interest with regard to non-European trade partners could be done in a more pro-active way.

6.3.3.2. Strategic nature of such interests

The paragraphs above, including the quotation, refer to the concept of 'strategic' interests. Of course, a sector, company or activity is never strategic *per se* but can only be so in specific circumstances. Such circumstances can change over time. This explains why lists of strategic actors or activities differ, depending on their origin. Furthermore, many EU Member States have defined strategic sectors at national level, e.g. relating to national security, which have

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125 Council Regulation (EC) No 597/2009, of 11 June 2009 on protection against subsidised imports from countries not members of the European Community.

126 European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614.

then received specific support. This need not be in contradiction with EU law, notably on the free movement of capital.[127] However, such definitions can differ profoundly across the EU.

However, a European interest deemed to be strategic must be so at European and not national or sectoral level. The focus should be on criteria that are objective while flexible enough to cope with the relative nature of what is strategic at a given moment in a given context. Accordingly, two such criteria can be singled out: public policy relevance and indispensability for specific economic activities.

1. An activity and its driver — in many cases firms — are the more strategic the more they are indispensible to achieve an acknowledged public policy objective. An example is road safety. If the objective is to reduce the number of fatal accidents in passenger transport, on-board safety systems are essential. If it turns out that the number of producers of state-of-the-art technologies is very limited, any of them is strategically important — not per se, but in this specific context.

2. Many economic activities rely on specific inputs produced by innovative firms with cutting-edge technology and/or on time by highly specialised producers. Indispensible inputs, such as certain raw materials found in few countries, are another example. The less they can be substituted and the more disruptive for global, fine-tuned value chains their temporary non-availability would be, the more they are strategic. Examples here include lightweight, high-resistance materials or electric batteries in road transport or energy-saving propulsion systems in maritime transport.

When one considers these examples in greater detail, similarities become visible. Much of this looks unspectacular, and the companies concerned may in fact be small — and few. They can be prone to weaknesses, including the financial issues that SMEs often face, and can therefore be vulnerable to takeovers. Nevertheless, their strategic value far exceeds their absolute size because of their bottleneck function, not only for production as such but for public policy needs that depend on such production.

If the European interest is to enhance competitiveness, as outlined above, a systemic analysis of how to achieve this must continue to focus on the most strategic elements within the industrial fabric, including both large and small enterprises, whose removal from the market-driven economic system the EU promotes would have an appreciable effect on competitiveness across national borders.[128] This is the notion of 'strategic' pursued in the following sections.

6.3.3.3. European companies

These considerations lead to the third element of the EU competitiveness paradigm: European companies. While references to European companies abound and are pertinent in many industrial contexts, notably strategic contexts at national level (for instance in defence), a clear definition proves particularly difficult. Similar exercises in other countries, such as the US two decades ago, have proven equally difficult, but have ultimately contributed to a better understanding of how companies, regardless of their origin, can help to add value to specific regions of the world. The exercise here has to be understood in a similar vein as a starting point for discussion.

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127 Cf. Bertoncini and de Beaufort (2009).

128 As such, the concept obviously includes not only existing and fully active firms but new entrants.

Box 6.5: European companies

Many attempts to define a European enterprise have been made, leading so far to inconclusive results. It has sometimes been defined as a transnational group, in contrast with national companies from Member States or in contrast with third countries. The criteria used to define a European enterprise in economic terms have also been widely discussed: European shareholding, dominant market in Europe, added value created in Europe, headquarters, main production sites, R&D or jobs located in Europe. Some criteria used are identified in sociological terms, such as methods of governance, relations between shareholders and management, importance of employee participation in management, closeness to legal and institutional framework, etc. Debates are still ongoing but seem to add little value to the discussion in this chapter.

Despite these definitional ambiguities a more pragmatic approach would be to say that a company founded in Europe that has its R&D department, production sites and headquarters in Europe is obviously European, whereas a company where none of this applies equally clearly is not. The usual market reality lies in between and need not be further described in many (if not most) cases. For example, whether a producer of final products in a homogenous global market with low transport costs and no capacity constraints is European or not is at best of academic but not practical relevance.

At the same time, this would be an example of a firm that neither merits nor deserves public policy attention. The market reality is usually different. The more a company adds value to the European economy, the more it is entwined with European policies and the more it can become a vehicle for such policies. This is obvious in some contexts, such as employment. In fact, a widely recognised definition of 'competitiveness' includes jobs[129] and thus stresses this particular dimension of economic activity.

Even if one were to challenge the significance job creation might have for core competitiveness, companies that are strongly rooted in the European economy may produce a series of other beneficial effects in Europe. They often form part of innovation systems within Europe, in which proximity and local or regional spillovers are crucial and where distance matters when it comes to the success or not of such systems. Furthermore, they may be more familiar with the legal and socioeconomic system and the culture in Europe, which may reduce frictions and make it simpler for them to operate and for others to deal with them. Again, this is a success factor not to be underestimated, and is one which is too often absent in investors purely operating from outside the EU.

The objective of any definition of European companies is recognition of the simple fact that the policy of any jurisdiction is primarily targeted at the economic subjects living and operating in it. At the same time, there is a European interest in maintaining a strong presence of companies with strong roots in the European economy in a variety of strategic contexts, as industries or companies that exit the European market cannot return at short notice and without significant cost. In fact, both the time and cost are often prohibitive, and exacerbated by the loss of knowledge and support factors within the system.

[129] See Box 1 in Chapter 1 of this report.

6.4. Industrial competitiveness throughout the production value chain

The challenges defined in section 6.2 necessitate the design of a European response that takes into account the institutional framework and the policy principles presented in section 6.3. It is of paramount importance to base this response on the EU's strategic interests. As noted above, these strategic interests depend on the context. In what follows, in order to place the discussion within a more practical context, such interests are exemplified for different stages of the production value chain: access to resources, innovation, access to markets, and restructuring. Each stage is affected differently by the challenges, and each requires a different form of response. Overall, however, all these responses need to be coherent to optimise policy leverage at European level.

6.4.1. Access to resources

European companies can only thrive on the global market if they have reliable access to essential inputs. This particularly applies to raw materials, some of which are subject to trade restrictions, concentrated in few non-EU countries and prone to becoming the subject of strategic leveraging. As the 2010 Industrial Policy Communication put it, 'secure, affordable, reliable and undistorted access to raw materials is essential for industrial competitiveness, innovation, and jobs.' However, fluctuations in both quantities and prices render such access difficult. Increased prices for raw materials in principle reflect increased demand and signal relative scarcity. This is a normal and useful incentive in a market environment to search for alternatives and to increase efficiency (See Chapter 4.). At the same time, such price increases can be partly due to government intervention for strategic reasons, e.g. to give preference to domestic producers.

The response to this is threefold, as identified in the recent Raw Materials Communication:[130]

First, the availability of intra-EU resources should be stepped up. This starts with better knowledge and identification of the EU's indigenous resources, the development of technologies for intelligent mining, and the increased exchange of best practices between Member States in the area of land use planning and permitting of exploration and extraction.

Second, respect for multilateral rules should be enhanced through increased cooperation in global fora, such as the WTO, to address external supply problems, tackling trade barriers through dialogue but also through judicial action, where appropriate. Action at multilateral or bilateral level can also be taken in the development field in order to diversify access to raw materials by creating win-win situations.

Third, recycling (e.g. through 'urban mining') and technological substitution can reduce the pressure on access to a certain extent. In both cases, the concept of the sustainable use of natural resources is the driver of EU action.

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130 European Commission (2011), *Tackling the Challenges in Commodity Markets and on Raw Materials*, Communication from the Commission, COM(2011) 25.

Box 6.6 Critical raw materials

In order to develop priority actions, the Commission has identified a list of critical raw materials, based on the risk of a supply shortage in the next ten years and the importance for the whole value chain. In all, 14 such critical raw materials figure on this list: antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, platinum group metals, rare earths, tantalum and tungsten. These critical raw materials have or should become a core strategic dimension of industrial, trade, research and competition policies.

Strategies at firm level can complement these efforts. Long-term contracts are a particularly useful tool to steady prices and hedge risks. In specific circumstances, such contracts can become anti-competitive, for instance if resources are obtained from a dominant player on the basis of exclusive contracts that result in only minor quantities being available on the market each year, or in general if the long-term contracts lead to market foreclosure. The specific circumstances are now well-established in antitrust case law. In general, however, long-term contracts are often pro-competitive and work even better if their pricing is constrained by spot markets that cater to supplementary short-term needs.

Second, firms can reduce scope for strategic leverage by relying on several suppliers. This proves difficult at times, as bottlenecks emerge in complex supply chains. Moreover, many suppliers are small and prone to risks inherent in cyclical businesses. The financial crisis has exposed such problems and weakened parts of industrial supply chains, which has prompted responses that have not always been pro-competitive, e.g. takeovers that have privatised assets that had formerly been accessible to all buyers.

Recent events, such as the global repercussions of the Japan earthquake and tsunami, have added to these concerns and made supply chain management a number one priority for many global businesses. In fact, the old wisdom of the undisputedly beneficial effects of an enhanced global division of labour cannot be maintained any longer. Greater strategic state intervention, supply chain interruptions for an increasing number of reasons (e.g. natural disasters, piracy), and increasing market concentration are strong disruptive factors. Proximity starts to matter more, not only for innovation — where this principle has been long established — but also for access to resources as such.

6.4.2. Innovation

Maintaining and strengthening a competitive, low-carbon and resource-efficient industrial base in Europe depends upon an appropriately designed research and innovation policy. In particular, a pro-active industrial innovation policy is a key driver for efficiency gains in production processes and services, improved performance of products and the creation of new markets.[131]

Such a policy should take into account the specific research and innovation profile of each Member State and focus on their respective weaknesses. This would also promote convergence between the innovation performances of Member States. All new Member States

[131] European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage*, Communication from the Commission, COM(2010) 614.

are currently below the average EU innovation performance.[132] The difficulty of this situation has been compounded by the crisis, which has had a 'disproportionate impact on some less performing regions. Europe must avoid an "innovation divide" between the strongest innovating regions and the others'.[133] More efficient use of the Structural Funds and a more targeted approach, focused on the relative strengths of each region (the so-called 'smart specialisation approach'), together with cluster initiatives, could contribute to this objective.

More generally, the crisis has imposed tight fiscal constraints on national budgets, including those supporting research and innovation. This problem calls for a much better aligned effort from Member States and the Commission to pool resources and coordinate actions in order to optimise efficiency. Such a coordination or pooling strategy would also contribute to addressing the recent changes in global conditions and the competition from non-EU competitors, which are following a similar innovation path and which in many instances have already implemented a coherent research and innovation strategy.

In this context, a fundamental challenge for Europe is fragmentation. Research and innovation capacities in EU firms are numerous and of a high quality, but often small in size and fragmented along national and regional lines. This leads to duplication and overlap. Focusing on the European dimension and going beyond mere national initiatives is necessary, not only to overcome the scarcity of public resources, but also to acquire a recognised weight at global level. This necessitates the pooling of EU efforts, for example by increasing contributions to cross-European initiatives, such as European platforms, the Lead Market Initiative, public-private partnerships, innovation partnerships, Framework Programme support for collective projects of firms from several Member States, or other policy measures. Such policies all encourage cross-border convergence and synergies. They indeed serve to make strategic European interests a priority.

Within such a framework, it is of the utmost importance to help EU firms to become or remain innovation leaders. This includes efforts to ensure their goods or services are low-carbon and resource-efficient. Targeted efforts are for example needed to support the early uptake of KETs[134] (such as industrial biotechnology, advanced materials, nanotechnology, micro- and nano-electronics, photonics, and advanced manufacturing systems) to unleash their full beneficial impact in other industrial sectors. New initiatives to address societal challenges also need to be strongly encouraged, in the field of technology as well as in the field of services.

6.4.3. Access to markets

Access to resources and a strong innovation performance fail to deliver optimal results if access to markets, particularly outside the EU, is a problem. In fact, both the recovery from the crisis and some tendencies in the context of globalisation, where newly emerging competitors might bring forward infant industry arguments or implement other policies that favour their native companies, result in a significant risk of protectionism. European businesses are largely dependent on non-EU markets and integrated global value chains. In the future, the main growth potential for European businesses is expected to come from non-

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132 Innovation Union Scoreboard 2010: The Innovation Union's performance scoreboard for Research and Innovation (2011), ProInno Europe Report.

133 European Commission (2010), *Europe 2020 Flagship Initiative Innovation Union,* Communication from the Commission, COM(2010) 546.

134 Reference to 2009 COM.

EU markets. European companies can furthermore profit from geographical diversification to hedge against crises that are geographically limited or affect different world regions at different times. All of this means that the need to ensure fair access to markets worldwide is a key ingredient for EU policy in a globalised economy, the more so when Europe faces ever more competitive trading partners.

Access to the Single Market 'home base'

Deepening the Single Market plays an essential part in building and strengthening European companies' competitiveness and giving them a 'home base' to compete globally.[135] In the era of globalisation, however, deepening the Single Market goes hand in hand with opening it to the outside world. This opening to imports and investments from trading partners is crucial for economic growth within Europe. Competitive pressure on EU firms from non-EU businesses provides important incentives for them to remain innovative and rapidly adapt to global evolutions.

Access for European companies to foreign markets

The successful removal of tariff barriers to trade, achieved under multilateral and bilateral agreements, has significantly increased global trade. It has benefited EU businesses, helping them to recover from the crisis. While it is necessary to pursue these efforts, the focus has shifted to non-tariff and other 'behind the border' barriers[136] (offsets, burdensome customs procedures, discriminatory technical regulations, etc.). These obstacles are more difficult to identify and to remove. Furthermore, the crisis has unsurprisingly turned out to be a period of increased protectionism, precisely in the form of hidden or 'low intensity' barriers. Access to the Single Market, with its 500 million consumers, remains very attractive to foreign firms, so reciprocity is a highly efficient instrument for reducing non-tariff trade barriers.[137] The economic weight of the Single Market grants the EU considerable influence on regulatory issues in such a context. It also allows it to achieve leadership in standardisation and other policy fields where regulatory competition will increase.

Furthermore, European companies investing abroad need a secure legal framework for doing so. Their capital investments and also their technical know-how (especially in the form of IPR) need to be protected against arbitrary interventions by the government or lack of effective access to the courts or dispute settlement mechanisms. This is especially so for small and medium-sized enterprises, which find it particularly challenging to be active abroad.

Finally, distortions in international trade and investment can result from strategic macro-economic policy choices, such as fixed exchange rates. Exchange rates significantly influence the relative competitiveness of industries and enterprises from different countries. Solutions that aim to create a global level playing field must therefore address all aspects of the existing imbalances if they are to be effective.

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135 European Commission (2010), *Towards a Single Market Act, For a highly competitive social market economy, 50 proposals for improving our work, business and exchanges with one another*, Communication from the Commission, COM(2010) 608.

136 European Commission (2007), *Global Europe, A stronger Partnership to Deliver Market Access for European Exporters*, Communication from the Commission, COM(2007) 183.

137 Accordingly, the Agreement on Government Procurement (GPA), for instance, contains specific reciprocity clauses. http://www.wto.org/english/docs_e/legal_e/gpr-94_e.pdf.

6.4.4. Restructuring

The structural weaknesses of the EU economy exposed by the crisis cannot be ignored if the objective is to achieve medium- and long-term growth and secure jobs. Changes should aim, on the one hand, to ensure a transition to more sustainable and innovative production and/or new business models. On the other hand, they may be conceived to manage structural excess capacities or to accompany changes at firm level, ranging from 'engaging in new business models and products to definite market exit'.[138]

Although, in order to successfully compete, any firm and any sector must be ready to adjust, some sectors are more concerned by the need to find new business models or markets than others. These include, for instance, the automotive sector, the basic metals industries, mechanical and electrical engineering, shipbuilding or the printing industry.

First, it is essential to consider that restructuring processes constitute an inherent element of the life-cycle of each enterprise. Companies must constantly adjust their strategies to the changing environment and to their internal evolution. This being said, many firms have come into difficulties almost exclusively because of the crisis and the lingering difficult access to finance. For these firms, when facing adjustment needs the issue of access to finance becomes existential.

Second, restructuring concerns both firms and whole sectors. While the responsibility for restructuring is always considered as primarily that of firms themselves, the issue becomes more complex and sensitive when it comes to the restructuring of sectors. It might be worth offering sectors some space to collectively rethink their role and place in the global arena, in order to collectively contribute to their own restructuring processes and to ensure, if needed, the orderly winding down of businesses. This topic becomes even more complex, but certainly not less relevant, when considering the impact of restructuring on value chains. Decisions by single companies — or sectors — can substantially influence the competitiveness of other, related companies or sectors.

The overall sector dimension should also be taken into account in all public policies and decisions relating to firms. In the field of state aid, for example, decisions taken on aid for large investment projects on the basis of regional development considerations are already assessed with a view to the impact on the sector, if the beneficiary has more than a 25% market share or, should the market be underperforming, if the capacity increase resulting from the investment exceeds 5% of the consumption of the market. State aid rules also exclude certain sensitive sectors from regional state aid (for example the steel industry). Furthermore, aid schemes targeting specific sectors have to be notified individually. The assessment of these schemes takes into account the impact on the sector concerned.

For all types of company adjustment strategies, the EU policy approach should continue to be based on identifying and taking into account the pro-competitive effects of projects and initiatives on the EU market. Such pro-competitive effects in turn can contribute to increasing the competitiveness of the companies involved.

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138 'An integrated Industrial Policy for the globalisation era putting competitiveness and sustainability at Centre Stage'.

6.5. Implications for the interface between industrial policy and other competitiveness-related policies

Any reflections on the general principles governing a policy approach have their litmus test in their practical application. This reality check is all the more important — yet particularly difficult — if the issues addressed are new and complex, necessitating a careful balancing of objectives (such as free trade vs targeted intervention) the implications of which are not fully clear in advance. This certainly applies to the developments discussed in this chapter, which form a moving target and which are only now starting to draw the attention of both policy makers and the wider public.

What is certain in such a context is that individual policies aiming to enhance competitiveness, such as industrial and competition policies but also trade, internal market and other policies, need to engage in a well coordinated exploitation of policy synergies based on sound and joint analysis of socioeconomic developments, which by necessity starts with fact finding. The discussion of the industrial and competition policy interface in the 2002 Competitiveness Report pointed to the existence of such synergies and the merits of exploiting them. Events since then have reinforced this observation.

The subsequent discussion in this section therefore advances and deepens this discussion in the light of recent and expected future developments. Two principles apply:

1. This discussion is driven by practical examples of particular relevance at this moment in time. They should not be seen as a complete list of issues to be addressed but rather as typical examples. In fact, new manifestations of the challenges facing European industry materialise by the day, and any assessment of them needs to draw on the general tools discussed above and applied below in related fields.

2. The development of a consistent policy framework that addresses all challenges noted above has to be preceded by a sound analysis, including assessment of their likely impact on the main dimensions of European competitiveness. This will take time. In many instances, however, there is a need for swift and timely policy action, which in the absence of enhanced legal tools and instruments needs to build upon a reinterpretation and extension of the current framework. The following considerations therefore start from the legal status quo, which by no means excludes that bolder steps are considered and prepared in parallel.

6.5.1. Securing the strength of the European industrial value chain

The following remarks provide examples of how existing competition and trade policy instruments can be used and extended to continue safeguarding industrial competitiveness in the context of the challenges outlined above. The sub-section below starts with merger control and antitrust enforcement, whereas state aid rules are considered in a subsequent sub-section.

6.5.1.1. Applying merger control and antitrust enforcement to support industrial competitiveness

As discussed in section 6.3, the legislative framework evolves in line with broader socioeconomic developments. This also applies to competition rules, where European merger control and antitrust regimes have undergone significant changes over the last decade. The more economic approach to merger control, applied since the 2004 reforms and supplemented

by the 2008 round of guidance documents,[139] has resulted in a framework that is increasingly focused on the economic impact of concentrations on competition in the European Economic Area (EEA). The antitrust rulebook has been developed with a similar objective in mind and provides increasingly better guidance on the relevant economic considerations to companies, which since 2003 are responsible for self-assessing that their conduct is in line with these rules.

These improvements constitute a shift towards a more sophisticated assessment of economic reality. It also allows the Commission to contribute to competitiveness through a more sophisticated evaluation of notified mergers and acquisitions. Despite the fact that many of the more than 2000 mergers notified to the Commission since 2004 have touched upon crucial industries or transactions with far-reaching economic consequences, the Commission has managed, with 1835 clearances, 117 conditional clearances and only three prohibitions, to ensure that these transactions are fully in line with the EU's competitiveness objectives.[140] In fact, the Commission has not prohibited any merger with any industrial policy relevance since the 2004 Merger Regulation entered into force.

In this context, it should be stressed that European merger control policy has not prevented European companies from becoming champions on global markets. The Commission's practice rather shows the contrary. Prominent cases, including EADS, Glaxo/Smithkline, GdF/Suez and SAP/Sybase, not only demonstrate that there is no inevitable antagonism between the idea of allowing companies to fully benefit from the enlarged Single Market 'base camp' and the need to protect European consumers.[141] They also show that the European Commission, within and in accordance with existing EU competition rules, takes into account businesses' concerns about their competitiveness on markets outside the EU and the need for size in this regard — concerns that will become ever more pressing in the globalisation era — as 'Europe needs European champions that are able to grow on their own merits and to run with their legs in the global race.'[142]

The economic trends identified in the preceding sections and the dynamic character of the EU policy framework mean that decision making has to be constantly adapted. This does not necessarily require new rules; in fact, the current rules provide enough flexibility if properly interpreted.[143] It however calls for a vigilant eye for these new developments and a constant updating of the detailed application of the tools. For this reason, the Commission regularly assesses the effectiveness of its policy and enforcement tools in order to ensure that they

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139 The most important are the revised Merger Regulation No 139/2004 of 20 January 2004, the Horizontal Merger Guidelines (OJ 2004/C 31/03) of 05 February 2004, and the Non-Horizontal Merger Guidelines (OJ 2008/C 265/07) of 18 October 2008.

140 Figures are for the period between January 2005 to March 2011 (referrals to the Commission or to the Member States explain the difference in figures).

141 Speech by Vice-President Almunia on 28 September 2010 on 'The past and the future of merger control in the EU': http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/486&format=HTML&aged=1&language=EN&guiLanguage=en; further examples include Lufthansa/SN Brussels Airlines, Lufthansa/Austrian Airlines, Air France/KLM, EDF/British Energy and Carrefour/Promodès.

142 Mario Monti, *A New Strategy for the Single Market*, Report to the President of the European Commission, 09 May 2010.

143 The core of substantive EU merger secondary law/guidance dates from 2004 and 2008. An (albeit important) exception is the Market Definition Notice (OJ 97/C 372/03), which has not been revised since 1997.

reflect market realities and the latest economic learning and to take into account the interests and concerns voiced by industry.

A number of features in the application of EU merger control policy can be said to contribute to EU industrial competitiveness. The first concerns geographic market delineation or, more generally, the geographical scope of competitive constraints in evaluating mergers or market positions. At least as regards investment goods and intermediary products (less so for branded consumer goods), markets are becoming ever wider and falling transport costs coupled with better IT inter-linkages are increasingly facilitating global competition. In times of global integration, markets are becoming EEA-wide or wider. In this regard, the Commission is determined to maintain its current practice of assessing such developments as and when they materialise taking into account the specific facts of the case, e.g. by adequately taking rising competition from newly emerging countries into account (such as in the decision on Arsenal/DSP).

The massive increase in the division of labour on a global scale and the rise of globally distributed integrated value chains also require a special focus on the vertical relationships between companies. While this trend has proven, in essence, to be pro-competitive and to allow European enterprises to benefit from economies of specialisation, it has also added complexity and vulnerability to the environment that companies face. Again, it is primarily for companies to guard themselves against these risks (as exemplified by the recent trend to near-sourcing). The regulatory regime — merger control ex ante and antitrust ex post — will continue to face the task, among others, of preventing, respectively, the emergence of dominant positions in these value chains and the abuse of dominant positions or significant impediments to competition. The global reach of both policies (as the effect matters, not the location of companies) plays an important role if suppliers are concentrated outside the EU.[144]

In a more dynamic global environment, it may be increasingly relevant to evaluate the benefits and efficiencies brought by agreements and transactions. Where dynamic efficiencies can be expected to play a very prominent role, even though their evaluation is more difficult and requires more time, a pro-active approach is warranted. As regards specific merger efficiencies, the Commission will look at such efficiencies where the parties make such claims (it being understood that it is for the parties in such cases to provide the necessary evidence from the outset).

As detailed in section 6.2.2 above, the governments of some emerging economies have a much greater role in the economy than is customary in the EU. These non-market interventions present some challenges for applying merger and antitrust rules to cases in the extensive grey area between the public and private sectors. The instruments developed to take into account public sector links in the Member States or other market economies are therefore applied to a much wider spectrum of possible government interference (e.g. to establish the true ownership/control of enterprises in non-market economies). In merger control for instance, the Commission's 2008 Consolidated Jurisdictional Notice provides a framework for assessing state influence on undertakings. This has also been employed in practice in cases involving non-EU state governments (recent examples are the Bluestar/Elkem, DSM/Sinochem and Petrochina/Ineos mergers). Quite often, the problem in such cases is the difficulty of obtaining from those countries the information necessary to perform a thorough assessment.

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144 Global sourcing also presents the problem of how to take into account indirect sales in cartel cases.

The pressure to restructure and the benefits from doing so are multiplied in an open economy with rapid technological progress. Since restructuring, in terms of adaptation to both cyclical and structural changes, is primarily the responsibility of firms, the regulatory framework must allow them to act on their responsibility. Companies aiming to restructure via mergers or acquisitions will in many instances depend on approval under the merger control regime. Restructuring attempts that do not go as far as a merger and which instead are implemented via coordination between companies must be in line with the antitrust rules on cooperation between undertakings. For both merger control and antitrust action the toolbox is in place — in merger control for example the failing firm defence, the counterfactual defence, or the efficiency defence can be cited, while antitrust action has the specialisation Block Exemption Regulations and the guidelines on horizontal cooperation agreements. Recent merger cases have included very elaborate restructuring analysis and have clearly demonstrated that a return to profits via the creation of a monopoly goes beyond reasonableness (e.g. Olympic/Aegean). Companies that need to exchange information on past and present strategic data (for example demand or capacities) that can be crucial for the allocation of production to high-demand markets may benefit from the more detailed guidance given in the revised Horizontal Guidelines.

Finally, the intensified competition between economic areas also requires a continued focus on the cost of doing business in Europe. An effective regulatory regime, maintaining the competitiveness of European industry, by its very nature requires resources from companies involved in proceedings. The Commission's efforts to reduce the length of investigations (e.g. through the recent introduction of settlement procedures) and increase the transparency and predictability of enforcement can contribute to keeping Europe attractive as a place to invest. This is even more important if one considers that multiple jurisdictions all over the world often wait with their assessment of a transaction until they know the final position of the European Commission. The Commission, as one of the leading role models for competition policy worldwide, has a natural role to play in aligning substantive and procedural tools around the world and thereby tackling the problem of the ever increasing cost of multi-jurisdictional filings and preventing inconsistent demands on enterprises from different national competition authorities.

6.5.1.2. Making full use of policy toolkits in the global context

Monitoring and assessing the risks of disruption of production chains as well as establishing the balance between economies of scale, security of supply and technological leadership in a specific economic context is the primary responsibility of businesses. They are closest to the market and thus have the best available information. Moreover, they are the first to feel the consequences. And yet, the increasing involvement of states, in particular non-EU non-market economies that have their own approach to the delineation between private and public interests, creates an asymmetry that European industry on its own cannot handle.

Traditional forms of disruptive threats to the EU's industrial value chains are usually directly linked to distorted price competition. Current European trade defence instruments (anti-dumping, anti-subsidy and safeguard measures), designed in conformity with WTO rules, enable the European Commission to address most of these issues. However, in the context of the internationalisation of value chains and 'low intensity protectionism', new threats to the integrity of value chains have emerged. On top of the risks outlined above, the recent economic and financial crisis has demonstrated how exposed key suppliers, which are often SMEs, can become if access to finance deteriorates, which is often unconnected to individual economic performance. In fact, one lesson from the crisis is that many European

manufacturing sectors active in global value chains depend on the timely delivery of key inputs produced by a handful of relatively small suppliers, in some instances only one or two. In line with the concept developed in section 6.3.3, these can be considered as 'strategic', as they are often indispensible not only for a sector as a whole but for more than one single manufacturing activity. In addition, the products manufactured with their input have significance not only for applications in various sectors but also in specific public policy contexts.

Such strategic importance for the integrity of the European industrial fabric increasingly turns these companies into targets for acquisitions. From an industrial policy perspective, it is important to closely monitor and assess the consequences, the more so when public authorities in non-EU countries are involved in such transactions. For example, recent scientific research suggests that mergers and acquisitions by Chinese companies, which often are state-owned, are increasingly strategic, building upon the underlying principle of 'digesting rather than investing'.[145]

As a result, major EU competitors (including recently 'free trade' ones, such as Canada and Australia) have recently strengthened their policy toolkit to be able to prevent malpractices and better preserve national interests. Although some EU Member States have similar systems in place, the EU as a whole remains one of the most open economic blocs in the world. A careful and balanced analysis seems warranted to assess how to maintain this openness while taking into account the increasingly strategic dimension in global competition. This process would usefully build on input from and constant dialogue with European industry to flag risks. It could also involve a broader activation of existing frameworks, whether EU country teams abroad or information exchange mechanisms in the public realm.

As a complement, notably in the short run, existing instruments such as the Commission's merger control system can continue to be applied, either directly or through meaningful exploitation of unused opportunities, to provide a 'safety net' for takeovers that could potentially restrict competition, such as by blocking downstream access to an essential input or eliminating innovative 'mavericks' in a specific industry. In fact, merger control disallows such negative competitive effects unless sufficient clear-cut remedies are offered to offset them.

However, the EU merger control system is neutral as regards the origin of the merging parties and applies in the same way to EU and non-EU companies. It is firmly rooted in the idea that competitive market structures need to be maintained to benefit consumers and businesses. This neutrality ensures that the merger review process is transparent, manageable and predictable to the investing community. It is also in line with the EU's long-established commitment to openness to the rest of the world, and gives the EU a moral high ground in arguing for non-discriminatory treatment at international level regarding the outgoing investments of European companies in third countries. At the same time, though, the merger control system ensures that global mergers and acquisitions do not have any negative impact on prices, innovation and choice in Europe.

Addressing efficiently both traditional and 'innovative' forms of threats to the integrity of the EU's industrial value chains requires the EU to develop a stronger horizontal coordination of

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[145] E.g. Ping Deng (2009): 'Why do Chinese firms tend to acquire strategic assets in international expansion?', Journal of World Business 44 (2009) 74–84.

its various instruments and policies. A more in-depth articulation of competition, trade and industrial policies has to be developed, in order to ensure a coherent and consistent approach to the protection of industrial value chains. A particularly crucial issue for this horizontal approach is the conditions under which such protection is allowed. An example from the current regulations governing trade defence instruments is the 'Community interest test' to determine whether the implementation of planned measures is in the interest of European industries, users and consumers. Such a mechanism for a horizontal approach would be based on the concept of European interest, as defined in section 6.3.3.

6.5.2. Enhancing the scope, impact and timing of targeted state support

Industrial policy objectives that aim to enhance competitiveness are complemented by state aid control, which aims to safeguard the undistorted functioning of the Single Market, in particular in a period when Member States' room for manoeuvre is limited by fiscal constraints due to the economic and financial crisis. While existing instruments could be screened for unused potential, including procedural improvements, any extensions to the existing framework should be considered with care and based on the proper identification of well-demonstrated needs.

6.5.2.1. Timely and efficient state aid assessment in a global context

Business success first and foremost depends on entrepreneurial vision and its translation into viable business plans. State aid often provides an indispensible additional impetus to bridge specific phases in the development of new products and processes not otherwise accommodated by the market, but it remains a supplement to and not the *raison d'être* for economic activity.

In order to speed up the decision-making process and to address the time issue as such, which is a key dimension for competitiveness, especially in R&D&I projects, it is essential to continue improving the information flow between the Commission and stakeholders. Despite the best efforts of the Commission to minimise the time state aid decisions take, long delays — often caused by inefficient information flows outside the Commission — still occur, which may in certain cases be incompatible with the often urgent financing needs of enterprises. The recent procedural simplifications and the adoption of the Best Practices Code help to address such shortcomings, in particular through the generalisation of early prenotifications. Beyond helping to save time, this also serves to clarify the context of a project from the beginning and to establish a clear view of the rationale and impact of any aid needed for European companies.

It is also essential to raise stakeholders' awareness of the need for the Commission to have access to useful and updated data on markets and sectors, in particular if they have global dimensions. While the Commission can in most cases rely on its own resources, there are specific situations where cross-sector information is required and where the early supply of such data by Member States and companies can accelerate the assessment of a project.

The time needed for assessment could also be reduced by more dynamic cooperation between the Commission and Member States. At the same time, sustained advocacy activities whereby the Commission seeks to explain to stakeholders the possibilities offered by the state aid framework, to enable them to make the best use of the rules, can also contribute to further reducing the length of the assessment process, for instance in the field of R&D&I. In fact, as most of the state aid rules currently in force are the result of legislation adopted following the

2005 State Aid Action Plan, they have so far been applied for a relatively short period of time. Therefore, both companies and Member State authorities still need to gain broader experience and sufficient knowledge of the practical use of these rules.

6.5.2.2. Maintaining a strong and diversified industrial base in Europe

To achieve the objective of maintaining a competitive and diversified industrial base, which could in turn contribute to the smart, sustainable and inclusive growth target set by the Europe 2020 strategy, the EU has to ensure that firms find the appropriate business environment they need to grow and innovate, to carry out their activities or to change their business models and strategies. This forward-looking strategy requires that access to finance is improved for all types of companies in the value chain, with a view to adequately addressing their needs and projects.

Globalisation trends put pressure on Europe as a location for doing business, not only directly but also through a lack of important suppliers or raw materials. From an industrial competitiveness perspective, state aid policy contributes to addressing this challenge by recognising that a strong competitive market structure in Europe is an objective of common interest. In general, and as explained above, effective access to finance must be ensured in a continuous way. State aid often contributes to improving such access to finance, in particular when the market does not provide sufficient alternative means of finance, for example through venture capital funds. Moreover, access to finance can be relevant for specific activities, such as R&D&I, where market failures exist. In this field, there is a need to consolidate the Single Market, which forms the base camp for European companies, in order to decrease the innovation divide between poor and developed regions. In fact, in a context of rigid fiscal constraints in several Member States, it is important to improve the use of the Structural Funds for innovation priorities. The experience gained within the current programming period should usefully guide any initiative to improve the status quo.

Moreover, difficulties in access to finance could hamper the development of projects in technologies where Europe is leader or intends to invest to become one, such as KETs, referred to in the Industrial Competitiveness Communication. In addition, lack of financial resources could prevent exploration and development of the unused innovation potential in services, essential to address the many societal challenges faced by the EU. In both cases, well-targeted state support can compensate for financial markets that have turned overly risk-adverse.

6.5.2.3. Support for early adjustment processes and restructuring of European enterprises

While companies and sectors know best their needs for restructuring and are in principle responsible for these processes, wherever necessary and appropriate state aid could usefully support such processes in various ways. As mentioned in section 6.4.4, all companies at almost all stages of their business life constantly adjust their business strategies: some may already find themselves in structural difficulties, whereas others are in a stable situation but in transitional adjustment.

Independently of any difficulties, such companies may need, at one point in time, state support in order to accompany the transition or to address their structural problems and ensure and/or restore long-term viability, as the biggest problem for firms undergoing restructuring is access to finance.

One of the main challenges encountered by European firms is the simultaneous expansion of their potential markets and the emergence of global competitors covering increasingly larger parts of the value chain. This double trend puts pressure on European firms, which have to modernise, innovate and access new markets at the same time. The main challenge for many of them is size; hence, it could be beneficial to further explore the potential for cross-border cooperation between firms, research centres, and Member States, for example in relation to KETs.

European state aid policy can indirectly contribute, within its own logic, to the promotion of such cross-border initiatives. For instance in the field of R&D&I, the current rules already encourage cooperation beyond national frontiers through a higher aid intensity applicable to cross-border projects. This possibility has so far not been much used by Member States, since it is still culturally and politically difficult for national authorities to fund the costs of a project which is not entirely located within their territory. However, in the face of increased global competition, trans-border cooperation between firms has to be understood as a necessity not only for the success of a project but for pursuing the strategic European interest as a whole, including the interests of the territories of the Member States granting the aid. In this respect, it may also be noted that the state aid notion of a 'project of common European interest', provided for by Article 107(3)(b) TFEU and the 2006 Framework on State Aids to R&D&I, has so far rarely been used by Member States.

6.6. Conclusions

The last decade has witnessed the emergence of trends that will permanently transform the arena in which European industry operates. Within the EU, enlargement has unleashed a socioeconomic dynamic that provides firms with new opportunities and a strong base camp, but the Single Market is as yet unfinished. Outside the EU, globalisation has greatly widened potential markets, but also intensified competition and resulted in the emergence of major new players on a global scale, not all of which play by the market economy rule book. The economic and financial crisis has resulted in fiscal constraints that reduce leverage at Member State level. As discussed in detail above, these challenges necessitate the stepping up of efforts to enhance the competitiveness of European industry, which in turn requires a strategic European response that bundles resources from lower levels of decision-making.

This chapter started by enquiring how the relationship between the EU's set of competitiveness-related policies (exemplified by but not confined to the EU's industrial and competition policies, considered to be complementary in the 2002 Competitiveness Report) could be further improved in the light of 'new challenges that emerge at an accelerating rate: new markets, new ways of doing business, new drivers of growth and of dynamic competition.'[146] The response is clear: more than ever, the global nature of the main challenges requires full use and, where possible and appropriate, better integration of individual policies and a streamlining of concepts and existing instruments. The great questions Europe faces today necessitate a horizontal approach that applies consistent policy tools to specific questions. The preceding analysis has provided examples for such an approach, but the list is not complete and grows by the day.

Much of what can and should be done does not require a radical overhaul of the rules that govern the system. Instead, it calls for a pro-active approach that uses unexploited potential

[146] European Commission (2002), p. 93.

within the existing framework and only extends it where demonstrably necessary. Implementing a European strategy is a question of will, not ability. The tools are in place, as are the drivers, which beyond the political players consist of the most important facet of competitiveness: European firms, which in many fields are global leaders and benchmarks for excellence. A closer alignment between the real needs of enterprises at global level and the practical will to offer solutions at short notice is the main deliverable all competitiveness policies have to provide. This is precisely what a symbiosis of industrial dynamism, competition policy rigour and the global reach of trade policy can deliver.

References

Agreement on Government Procurement http://www.wto.org/english/docs_e/legal_e/gpr-94_e.pdf

Arnold & Porter LLP, (2009), *Will the Lisbon Treaty Have an Impact on Future EU Competition Policy?* Available at: http://www.martindale.com/members/Article_Atachment.aspx?od=113129&id=881322&filename=asr-881324.LisbonTreaty.pdf

V. De Beaufort and Y. Bertoncini (2009), "La protection des intérêts stratégiques dans l'Union européenne : une voie étroite ?", Note du Centre d Analyse et de Stratégie , Dec 2009, Issue N°161 http://www.cede-essec.fr/fr/pdf/travaux/protection-interets-strategiques-UE.pdf

Bourgeois, J., Duvernoy, Ch., Ehlermann, C-D., Louis, F. , Ratliff, J., Völcker, S.B., (2009), *The Lisbon Treaty the Next Steps Forward for Europe*,WilmerHale briefing note available at http://www.wilmerhale.com/the_lisbon_treaty_the_next_steps_forward_for_europe_12-03-2009/

Centre d'analyse stratégique, Note de Veille n°161 (décembre 2009), Analyse : *La protection des intérêts stratégiques dans l'Union européenne : une voie étroite ?* http://www.strategie.gouv.fr/IMG/pdf/NoteVeille161vf.pdf

Community Framework for State Aid for Research and Development and Innovation, (2006/C 323/01).

Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union, Official Journal C 83 of 30.3.2010.

Council of the European Union (2010), *Council conclusions on the need for a new industrial policy,* 2999th Competitiveness Council meeting, Brussels, 1 March 2010.

Council Regulation (EC) No 597/2009, of 11 June 2009 on protection against subsidised imports from countries not members of the European Community.

De Gucht, K., The implications of the Lisbon Treaty for EU Trade policy, S&D seminar on EU Trade Policy, Oporto, 8 October 2010.

European Commission (2002), *2002 European Competitiveness Report,* Commission Staff Working Paper, SEC(2002) 528.

European Commission (2002), *Industrial Policy in an Enlarged Europe***,** Communication from the Commission, COM(2002) 714.

European Commission (2003), *Some Key Issues in Europe's Competitiveness – Towards an Integrated Approach***,** Communication from the Commission, COM(2003) 704.

European Commission (2004), *Fostering structural change: an industrial policy for an enlarged Europe,* Communication from the Commission, COM(2004) 274.

European Commission (2005*), Common Actions for Growth and Employment: The Community Lisbon Programme***,** Communication from the Commission, COM(2005) 330.

European Commission (2007), *Global Europe, A stronger Partnership to Deliver Market Access for European Exporters***,** Communication from the Commission, COM(2007) 183.

European Commission (2009), Commission Staff Working Document SEC (2009) 177; Accompanying Document to the Communication from the Commission, *Five years of an enlarged EU– Economic achievements and challenges,* COM(2009) 79.

European Commission (2009), *Economic Crisis in Europe: Causes, Consequences and Responses*, European Economy 2009-7, DG Economic and Financial Affairs.

European Commission (2009), *Five years of an enlarged EU– Economic achievements and challenges,* Communication from the Commission, COM(2009) 79.

European Commission (2010) *Monthly Note on Economic Recovery in Manufacturing, Construction and Services1 Industries,* March 2010, DG Enterprise & Industry.

European Commission (2010), *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage***,** Communication from the Commission, COM(2010) 614.

European Commission (2010), *Annual Growth Survey, Annex 2, Macro-Economic Report***,** Communication from the Commission, COM(2010) 11.

European Commission (2010), *Europe 2020 Flagship Initiative Innovation Union,* Communication from the Commission, COM(2010) 546.

European Commission (2010), EUROPE 2020, *A strategy for smart, sustainable and inclusive growth,* Communication from the Commission, COM(2010) 2020.

European Commission (2010), *European Competitiveness Report 2010,* Commission Staff Working Document SEC (2010) 1276, Accompanying Document to the Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage***,** COM(2010) 614.

European Commission (2010), *Member States competitiveness performance and policies,* Commission Staff Working Document SEC (2010) 1272, Accompanying Document to the Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era Putting Competitiveness and Sustainability at Centre Stage***,** COM(2010) 614.

European Commission (2010), *Towards a Single Market Act, For a highly competitive social market economy, 50 proposals for improving our work, business and exchanges with one another***,** Communication from the Commission, COM(2010) 608.

European Commission (2011), *Review of the "Small Business Act" for Europe,* Communication from the Commission, COM(2011) 78.

European Commission (2011), *Tackling the Challenges in Commodity Markets and on Raw Materials***,** Communication from the Commission, COM(2011) 25.

European Commission (2011), Trade and Investment Barriers Report 2011, Engaging our strategic economic partners on improved market access: Priorities for action on breaking down barriers to trade**,** Communication from the Commission, COM(2011) 114.

Innovation Union Scoreboard 2010: The Innovation Union's performance scoreboard for Research and Innovation (2011), ProInno Europe Report.

Ping Deng, (2009), Why do Chinese firms tend to acquire strategic assets in international.

expansion?, Journal of World Business 44 (2009) 74–84.

Posen, A., Véron, N., (2009), A Solution for Europe's Banking Problem, Bruegel Policy Brief 2009/03

Priollaud, F-X., Siritzky, D., (2010), Le Traité de Lisbonne: commentaire, article par article, des nouveaux traits européens (TUE-TFUE), Paris, Documentation française.

Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, signed at Lisbon, 13 December 2007, Official Journal C 306 of 17 December 2007.

7. SECTORAL COMPETITIVENESS INDICATORS

Explanatory notes

Geographical coverage: all indicators in tables 7.1 to 7.8 refer to EU-27. The indicators in tables 7.9 and 7.10 refer to the individual Member States, EU-27, the US, Japan, Brazil, China, India and Russia.

Production index[147]: The production index is an index of final production in volume terms.

Labour productivity: this indicator is calculated by combining the indexes of production and number of persons employed or number of hours worked[148]. Therefore, this indicator measures final production per person of final production per hour worked.

Unit Labour Cost: it is calculated from the production index and the index of wages and salaries and measures labour cost per unit of production. "Wages and salaries" is defined (Eurostat) as "the total remuneration, in cash or in kind, payable to all persons counted on the payroll (including homeworkers), in return for work done during the accounting period, regardless of whether it is paid on the basis of working time, output or piecework and whether it is paid regularly wages and salaries do not include social contributions payable by the employer".

Relative Trade Balance: it is calculated, for sector "i", as (Xi-Mi)/(Xi+Mi), where Xi and Mi are EU-27 exports and imports of products of sector "i" to and from the rest of the World.

Revealed Comparative Advantage (RCA):

The RCA indicator for product "i" is defined as follows:

$$RCA_i = \frac{\frac{X_{EU,i}}{\sum_i X_{EU,i}}}{\frac{X_{W,i}}{\sum_i X_{W,i}}}$$

where: X=value of exports; the reference group ('W') is the EU-25 plus 38 other countries (see list below); the source used is the UN COMTRADE database. In the calculation of RCA, X_{EU} stands for exports to the rest of the world (excluding intra-EU trade) and X_W measures exports to the rest of the world by the countries in the reference group. The latter consists of the EU-25 plus the following countries: Afghanistan, Albania, Algeria, Angola, Argentina, Armenia, Australia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Belarus, Belize, Benin, Bhutan, Bolivia, Bosnia Herzegovina, Botswana, Brazil, Brunei, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Rep., Chad, Chile, China, China, Hong Kong SAR, China, Macao SAR, Colombia, Comoros, Congo, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Dem. People's Rep. of Korea, Dem. Rep. of the Congo, Djibouti, Dominican

147 The data are working-day adjusted for production.

148 The data are working-day adjusted for hours worked.

Rep., Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, Iceland, India, Indonesia, Iran, Iraq, Israel, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Lao People's Dem. Rep., Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Neth. Antilles, New Zealand, Nicaragua, Niger, Nigeria, Norway, Occ. Palestinian Terr., Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Qatar, Rep. of Korea, Rep. of Moldova, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Somalia,, South Africa, Sri Lanka, Sudan, Suriname, Swaziland, Switzerland, Syria, Tajikistan, TFYR of Macedonia, Thailand, Timor-Leste, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Arab Emirates, United Rep. of Tanzania, Uruguay, USA, Uzbekistan, Venezuela, Viet Nam, Yemen, Zambia, Zimbabwe.

For services, countries consist of EU-25 plus the following 75 countries: Albania, Algeria, Argentina, Armenia, Aruba, Australia, Azerbaijan, Bangladesh, Belarus, Bermuda, Bolivia, Bosnia & Herzegovina, Botswana, Brazil, Cambodia, Canada, Cape Verde, Chile, China,P.R.: Mainland, China,P.R.:Hong Kong, China,P.R.:Macao, Costa Rica, Croatia, Egypt, El Salvador, Ethiopia, The Gambia, Georgia, Guatemala, Guinea, Honduras, Iceland, India, Indonesia, Israel, Japan, Kazakhstan, Kenya, Republic of Korea, Kuwait, Kyrgyz Republic, Macedonia, Malaysia, Mauritius, Mexico, Moldova, Montenegro, Morocco, Mozambique, Namibia, New Caledonia, New Zealand, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Russian Federation, Saudi Arabia, Republic of Serbia, Seychelles, Singapore, South Africa, Sri Lanka Switzerland, Tanzania, Thailand, Tunisia, Turkey, Uganda, Ukraine, United States, Uruguay, Zambia.

Data sources: Tables 7.1 to 7.6 are based on Eurostat's indicators. Tables 7.7 to 7.9 are based on United Nations' COMTRADE. Table 7.10 is based on IMF, OECD and Eurostat data.

Table 7.1: EU-27 - Industry production index, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2005-2010
B	MINING AND QUARRYING	1,9	-2,3	-3,1	0,5	-3,2	-2,2	-6,4	-4,1	0,3	-4,0	-10,9	-0,8	-4,
C	MANUFACTURING	1,2	4,8	0,2	-0,3	0,4	2,7	1,7	4,9	4,2	-1,7	-14,8	7,6	-0,
C10	Manufacture of food products	1,2	1,2	1,2	1,9	0,2	2,2	2,4	1,5	2,0	-0,6	-1,0	2,4	0,
C11	Manufacture of beverages	6,1	-0,5	2,6	2,6	1,6	-2,5	1,3	4,2	1,5	-2,0	-2,6	-1,3	-0,
C12	Manufacture of tobacco products	-3,2	-8,6	-2,9	-0,9	-6,9	-6,4	-4,0	-4,9	2,3	-16,9	-3,0	-5,9	-5,
C13	Manufacture of textiles	-5,6	0,3	-3,1	-4,8	-3,4	-4,7	-3,8	-0,7	-1,3	-9,7	-17,4	8,5	-4,
C14	Manufacture of wearing apparel	-9,2	-5,4	-4,1	-10,7	-6,1	-4,9	-8,9	2,4	2,4	-3,4	-11,2	0,7	-2,
C15	Manufacture of leather and related products	-4,1	-2,2	-5,2	-7,5	-7,2	-11,4	-9,1	-1,8	-1,6	-7,6	-13,0	3,0	-4,
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3,3	6,9	-4,2	0,5	2,4	3,4	0,1	4,3	1,9	-8,7	-14,2	3,9	-2,
C17	Manufacture of paper and paper products	3,1	3,6	-2,3	3,4	1,7	3,2	-0,3	3,6	2,7	-3,5	-9,2	6,1	-0,
C18	Printing and reproduction of recorded media	2,4	0,9	-2,3	-0,1	-1,3	1,4	2,3	0,4	0,6	-2,5	-7,2	1,7	-1,
C19	Manufacture of coke and refined petroleum products	-4,8	4,7	0,4	-2,7	2,0	4,9	-0,8	1,6	-0,4	3,1	-7,8	0,2	-0,
C20	Manufacture of chemicals and chemical products	2,4	3,5	-0,9	2,7	-0,2	3,3	1,6	3,6	2,8	-3,2	-11,0	9,8	0,
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	8,5	5,2	10,4	8,9	5,3	-0,2	4,8	6,3	1,8	1,1	3,4	5,9	3,
C22	Manufacture of rubber and plastic products	2,1	5,0	-0,5	0,0	1,9	1,7	0,8	4,1	4,4	-4,4	-13,8	7,9	-0,
C23	Manufacture of other non-metallic mineral products	2,3	3,9	-0,6	-1,7	0,5	1,8	0,8	4,4	2,0	-6,7	-18,8	2,6	-3,
C24	Manufacture of basic metals	-3,8	4,1	-0,7	0,1	-0,5	4,9	-0,6	5,7	0,7	-2,7	-26,8	18,8	-2,
C25	Manufacture of fabricated metal products, except machinery and equipment	0,5	6,7	0,3	-0,5	0,8	2,6	1,6	5,0	5,9	-2,2	-22,2	7,4	-1,
C26	Manufacture of computer, electronic and optical products	5,0	12,7	-5,5	-6,6	1,5	7,7	4,6	10,1	11,4	2,6	-15,1	11,3	3,
C27	Manufacture of electrical equipment	2,3	9,5	-0,1	-3,0	-2,3	3,1	1,2	8,4	4,8	-0,1	-20,7	11,2	0,
C28	Manufacture of machinery and equipment n.e.c.	-1,9	6,0	1,4	-2,1	-0,8	4,1	4,0	8,4	8,4	2,0	-26,1	10,4	-0,
C29	Manufacture of motor vehicles, trailers and semi-trailers	3,6	7,0	2,3	0,8	2,0	5,2	1,8	3,1	6,2	-5,9	-24,2	21,1	-1,
C30	Manufacture of other transport equipment	-0,2	0,6	0,9	-4,1	1,4	0,9	2,7	9,1	3,9	4,7	-6,1	-2,8	1,
C31	Manufacture of furniture	3,2	1,6	-1,8	-4,5	-2,2	0,5	0,5	3,2	3,2	-4,2	-16,5	-0,9	-3,
C32	Other manufacturing	1,0	4,9	3,7	2,5	-0,8	1,7	1,2	5,0	2,1	-1,2	-5,9	8,0	1,
C33	Repair and installation of machinery and equipment	0,4	4,9	0,4	-3,7	-0,7	4,7	1,7	9,2	3,7	5,0	-8,9	3,8	2,
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	2,4	3,4	2,3	0,7	2,9	2,2	2,1	1,0	-0,7	0,1	-4,8	4,3	-0,
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F	CONSTRUCTION	4,2	4,0	0,5	1,1	1,8	0,8	1,9	3,6	2,0	-3,8	-8,5	-4,1	-2,

N/A: Data not available
Source: Eurostat

Table 7.2: EU-27 - Number of persons employed, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avera 2005-2
B	MINING AND QUARRYING	-8,0	-8,2	-3,3	-4,7	-4,5	-4,6	-3,2	-3,9	-3,5	-1,4	-3,7	-4,5	
C	MANUFACTURING	-1,8	-0,5	0,0	-2,0	-2,0	-1,9	-1,4	-0,7	0,5	-0,3	-7,1	-3,7	
C10	Manufacture of food products	-0,6	-0,6	-0,6	-0,9	-0,5	-1,2	0,0	-0,1	0,0	-0,1	-2,0	-0,5	
C11	Manufacture of beverages	N/A	N/A	-1,8	-1,2	-1,8	-1,4	-1,5	-1,4	-0,2	-1,2	-6,3	-1,6	
C12	Manufacture of tobacco products	-9,1	-3,7	-3,3	-0,4	-5,5	-5,3	-2,6	-1,5	-9,4	-8,0	-5,2	-5,5	
C13	Manufacture of textiles	-6,7	-3,6	-3,3	-5,1	-7,2	-6,2	-4,5	-5,9	-5,2	-6,4	-12,9	-5,3	
C14	Manufacture of wearing apparel	-3,9	-5,7	-3,3	-3,7	-4,0	-6,2	-7,7	-5,7	-5,6	-6,4	-12,8	-9,2	
C15	Manufacture of leather and related products	-6,5	-3,3	-1,1	-1,0	-4,4	-6,8	-5,8	-2,7	-3,1	-5,2	-12,0	-3,9	
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	-0,2	-0,8	-1,2	-1,8	-1,3	-1,4	-0,8	-0,8	0,9	-2,2	-12,1	-3,9	
C17	Manufacture of paper and paper products	-3,3	-1,5	-1,6	-1,0	-2,8	-1,6	-2,6	-2,6	-2,7	-2,0	-5,1	-2,6	
C18	Printing and reproduction of recorded media	-0,8	-0,6	-0,4	-2,2	-4,0	-1,9	-3,3	-1,6	0,0	-2,3	-7,0	-5,2	
C19	Manufacture of coke and refined petroleum products	-2,1	-1,3	-2,1	-3,0	-3,3	-2,1	-3,3	-3,5	1,3	-0,8	-2,7	-4,3	
C20	Manufacture of chemicals and chemical products	-2,8	-2,7	-0,8	-1,7	-2,6	-3,2	-2,1	-1,2	-0,6	-2,3	-4,6	-2,5	
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	N/A	N/A	2,0	2,3	-0,4	-2,8	-1,1	1,9	0,8	-2,1	-3,6	-0,8	
C22	Manufacture of rubber and plastic products	-0,8	2,4	0,9	-0,9	0,2	-0,1	-0,7	-0,8	1,6	0,5	-6,8	-1,2	
C23	Manufacture of other non-metallic mineral products	-2,1	-0,5	-0,7	-2,3	-2,7	-2,1	-1,0	-0,5	1,4	-2,0	-10,3	-5,4	
C24	Manufacture of basic metals	-3,5	-4,2	-0,3	-4,0	-3,2	-3,9	-1,1	-1,0	-0,4	-0,4	-8,2	-6,0	
C25	Manufacture of fabricated metal products, except machinery and equipment	0,1	0,9	0,8	-1,1	-1,2	0,1	-0,3	1,3	3,3	2,6	-8,2	-4,8	
C26	Manufacture of computer, electronic and optical products	-2,0	4,2	1,8	-5,9	-4,5	-2,9	-1,3	-0,8	1,1	-1,9	-8,4	-4,4	
C27	Manufacture of electrical equipment	-1,6	1,5	0,1	-3,9	-4,1	-1,3	-0,6	1,0	2,5	1,2	-8,1	-3,0	
C28	Manufacture of machinery and equipment n.e.c.	-2,6	-2,0	1,0	-1,4	-2,2	-2,4	-0,9	0,8	2,9	2,1	-5,6	-5,6	
C29	Manufacture of motor vehicles, trailers and semi-trailers	0,2	2,1	1,7	-1,0	-0,3	0,2	-0,8	-1,0	-0,2	0,9	-9,0	-2,6	
C30	Manufacture of other transport equipment	-2,2	-2,2	-0,3	-1,5	-2,7	-1,7	0,3	0,6	2,8	2,0	-2,8	-5,5	
C31	Manufacture of furniture	N/A	N/A	0,4	-3,3	-0,1	-2,5	-2,5	-1,1	0,3	-2,1	-9,0	-6,3	
C32	Other manufacturing	-1,8	-5,3	0,9	-1,6	-0,2	-1,0	-1,8	-0,3	0,3	0,2	-2,8	-1,1	
C33	Repair and installation of machinery and equipment	-1,8	-4,9	-0,1	-2,8	-2,4	-1,0	-0,5	0,3	0,4	3,8	-2,1	-3,5	
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	-3,3	-3,9	-2,9	-4,3	-4,3	-3,8	-2,5	-1,3	-1,5	-0,8	3,0	1,0	
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	-0,7	1,0	-1,4	-0,4	0,4	-0,8	-1,8	1,4	0,5	-0,5	0,4	-0,2	
F	CONSTRUCTION	1,1	-0,4	0,1	-0,5	0,6	1,4	2,5	4,1	4,9	-0,9	-7,6	-5,4	

N/A: Data not available

Table 7.3: EU-27 - Number of hours worked, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2005-2010
B	MINING AND QUARRYING	N/A	N/A	-3,0	-5,0	-6,1	-3,6	-3,2	-4,0	-2,8	-1,3	-4,6	-2,8	-3,1
C	MANUFACTURING	N/A	N/A	-1,2	-2,4	-2,4	-1,2	-1,6	-0,1	0,3	-0,7	-9,3	-0,7	-2,2
C10	Manufacture of food products	N/A	N/A	-1,2	-2,3	-1,8	-0,2	-0,7	0,2	-0,4	0,1	-2,8	0,2	-0,5
C11	Manufacture of beverages	N/A	N/A	-0,7	-3,8	-0,8	0,3	-2,9	-3,5	-0,7	-2,0	-4,8	-3,6	-2,9
C12	Manufacture of tobacco products	N/A	N/A	2,2	-2,5	-8,9	-5,9	-4,2	-5,6	-3,1	-9,5	-6,7	-2,6	-5,5
C13	Manufacture of textiles	N/A	N/A	-3,4	-4,7	-6,5	-5,6	-5,2	-5,0	-2,7	-5,6	-14,7	0,6	-5,6
C14	Manufacture of wearing apparel	N/A	N/A	-4,1	-3,5	-3,9	-3,8	-3,8	-3,9	-5,3	-6,5	-14,3	-8,4	-7,8
C15	Manufacture of leather and related products	N/A	N/A	-2,4	-3,4	-3,9	-3,8	-4,3	-1,2	-3,9	-5,8	-11,0	-0,6	-4,6
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	N/A	N/A	-3,8	-2,0	-1,9	-0,4	-1,4	0,0	0,0	-2,9	-12,8	-0,1	-3,3
C17	Manufacture of paper and paper products	N/A	N/A	-2,0	-2,3	-0,9	-1,8	-2,3	-1,4	-1,4	-3,5	-7,2	-1,1	-3,0
C18	Printing and reproduction of recorded media	N/A	N/A	-0,4	-3,7	-4,0	-3,3	-2,6	-0,4	0,2	-1,5	-5,5	-3,9	-2,3
C19	Manufacture of coke and refined petroleum products	N/A	N/A	-2,2	-4,2	-1,6	-0,4	-0,3	-3,4	1,1	2,6	-8,1	-3,0	-2,2
C20	Manufacture of chemicals and chemical products	N/A	N/A	-2,2	-2,6	-2,5	-1,9	-2,8	-1,4	-1,4	-1,8	-5,2	-0,7	-2,1
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	N/A	N/A	0,3	2,0	-0,1	-1,3	-1,8	0,0	0,4	-0,6	-3,6	-1,7	-1,1
C22	Manufacture of rubber and plastic products	N/A	N/A	0,0	-1,5	-1,3	0,0	-1,5	1,5	0,8	-0,5	-9,1	2,0	-1,2
C23	Manufacture of other non-metallic mineral products	N/A	N/A	-2,5	-3,2	-3,3	-1,3	-1,1	0,0	0,6	-2,5	-11,9	-1,1	-3,1
C24	Manufacture of basic metals	N/A	N/A	-2,2	-3,7	-5,0	-2,4	-2,1	-0,2	-0,4	-1,2	-12,6	0,3	-2,9
C25	Manufacture of fabricated metal products, except machinery and equipment	N/A	N/A	-0,6	-1,3	-1,8	-0,3	-0,8	1,5	2,5	3,2	-11,1	-0,1	-1,0
C26	Manufacture of computer, electronic and optical products	-1,2	3,6	0,2	-5,0	-4,0	-2,5	-1,7	-0,5	1,1	-1,1	-11,5	-2,5	-3,0
C27	Manufacture of electrical equipment	N/A	N/A	-1,1	-2,7	-3,7	-1,3	-1,8	2,3	1,7	1,0	-12,9	1,8	-1,4
C28	Manufacture of machinery and equipment n.e.c.	N/A	N/A	-0,6	-2,3	-2,4	-1,3	-1,2	1,5	2,8	1,2	-11,4	-1,1	-1,5
C29	Manufacture of motor vehicles, trailers and semi-trailers	N/A	N/A	0,5	-1,1	-0,9	0,5	-0,7	-1,0	0,7	-1,5	-14,1	4,0	-2,6
C30	Manufacture of other transport equipment	N/A	N/A	-1,1	-2,5	-2,2	-2,1	0,1	1,8	2,1	1,1	-3,8	-5,4	-0,9
C31	Manufacture of furniture	N/A	N/A	0,3	-4,4	-3,2	-1,4	-3,2	0,9	0,5	-3,1	-11,1	-3,2	-3,3
C32	Other manufacturing	N/A	N/A	-0,7	-2,2	-2,0	-0,4	-2,1	-0,2	0,9	-0,1	-4,6	0,4	-0,7
C33	Repair and installation of machinery and equipment	N/A	N/A	-2,5	-3,4	-3,7	-2,8	-0,8	1,5	-0,4	2,2	3,3	-4,3	0,4
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	N/A	N/A	-1,6	-4,8	-5,0	-2,9	-1,0	-1,9	-1,0	-0,5	2,6	1,2	0,1
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	N/A	N/A	-1,8	-1,3	-0,3	0,3	-3,4	-0,5	0,7	1,3	-1,3	0,1	0,0
F	CONSTRUCTION	1,5	1,8	-1,5	-3,1	-1,1	0,2	5,9	3,5	2,7	-1,6	-8,8	-6,9	-2,3

N/A: Data not available
Source: Eurostat

Table 7.4: EU-27 - Labour productivity per person employed, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2005-2010
B	MINING AND QUARRYING	10,7	6,4	0,2	5,5	1,3	2,5	-3,3	-0,3	3,9	-2,6	-7,4	3,8	-0,6
C	MANUFACTURING	3,0	5,3	0,2	1,7	2,4	4,7	3,1	5,7	3,7	-1,4	-8,3	11,7	2,1
C10	Manufacture of food products	1,8	1,8	1,9	2,9	0,7	3,4	2,4	1,7	2,0	-0,5	1,0	2,9	1,4
C11	Manufacture of beverages	N/A	N/A	4,5	3,9	3,5	-1,2	2,8	5,7	1,7	-0,8	3,9	0,3	2,1
C12	Manufacture of tobacco products	6,5	-5,1	0,4	-0,5	-1,4	-1,2	-1,5	-3,5	12,9	-9,7	2,3	-0,4	0,1
C13	Manufacture of textiles	1,2	4,1	0,2	0,3	4,1	1,6	0,7	5,5	4,1	-3,5	-5,1	14,6	2,9
C14	Manufacture of wearing apparel	-5,5	0,3	-0,8	-7,2	-2,1	1,4	-1,3	8,6	8,5	3,2	1,9	10,9	6,5
C15	Manufacture of leather and related products	2,5	1,1	-4,2	-6,6	-3,0	-4,9	-3,5	1,0	1,5	-2,5	-1,1	7,2	1,1
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3,5	7,8	-3,0	2,4	3,8	4,8	0,9	5,2	1,0	-6,7	-2,4	8,1	0,9
C17	Manufacture of paper and paper products	6,6	5,1	-0,7	4,4	4,7	4,8	2,4	6,3	5,5	-1,6	-4,3	9,0	2,9
C18	Printing and reproduction of recorded media	3,2	1,5	-1,9	2,1	2,8	3,4	5,8	2,1	0,6	-0,2	-0,3	7,3	1,9
C19	Manufacture of coke and refined petroleum products	-2,7	6,1	2,6	0,3	5,4	7,2	2,6	5,2	-1,7	4,0	-5,3	4,7	1,3
C20	Manufacture of chemicals and chemical products	5,4	6,4	-0,1	4,4	2,5	6,7	3,8	4,8	3,4	-0,9	-6,7	12,6	2,4
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	N/A	N/A	8,2	6,4	5,7	2,6	6,0	4,3	1,0	3,3	7,3	6,7	4,5
C22	Manufacture of rubber and plastic products	3,0	2,5	-1,4	0,9	1,7	1,8	1,5	4,9	2,8	-4,9	-7,5	9,2	0,7
C23	Manufacture of other non-metallic mineral products	4,5	4,4	0,1	0,7	3,2	3,9	1,8	5,0	0,6	-4,8	-9,5	8,5	-0,2
C24	Manufacture of basic metals	-0,3	8,7	-0,4	4,3	2,8	9,2	0,5	6,8	1,1	-2,3	-20,2	26,4	1,2
C25	Manufacture of fabricated metal products, except machinery and equipment	0,4	5,7	-0,5	0,6	2,0	2,5	1,9	3,6	2,5	-4,7	-15,3	12,8	-0,7
C26	Manufacture of computer, electronic and optical products	7,1	8,2	-7,1	-0,8	6,3	10,9	6,0	11,0	10,2	4,6	-7,3	16,5	6,7
C27	Manufacture of electrical equipment	4,0	7,8	-0,2	1,0	1,9	4,5	1,8	7,4	2,2	-1,3	-13,7	14,6	1,4
C28	Manufacture of machinery and equipment n.e.c.	0,7	8,1	0,4	-0,7	1,4	6,7	4,9	7,6	5,3	-0,1	-21,7	16,9	0,7
C29	Manufacture of motor vehicles, trailers and semi-trailers	3,4	4,8	0,6	1,8	2,3	5,0	2,7	4,1	6,4	-6,7	-16,7	24,4	1,4
C30	Manufacture of other transport equipment	2,0	2,9	1,2	-2,6	4,2	2,6	2,4	8,4	1,1	2,6	-3,4	2,8	2,2
C31	Manufacture of furniture	N/A	N/A	-2,2	-1,2	-2,1	3,1	3,1	4,4	2,9	-2,1	-8,3	5,7	0,4
C32	Other manufacturing	2,9	10,7	2,7	4,2	-0,6	2,8	3,1	5,3	1,8	-1,4	-3,1	9,2	2,3
C33	Repair and installation of machinery and equipment	2,2	10,3	0,5	-1,0	1,7	5,8	2,3	8,8	3,3	1,2	-6,9	7,6	2,6
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	5,9	7,6	5,3	5,3	7,5	6,2	4,7	2,3	0,8	0,9	-7,5	3,3	-0,1
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F	CONSTRUCTION	3,1	4,4	0,4	1,6	1,2	-0,6	-0,6	-0,5	-2,8	-2,9	-1,0	1,4	-1,2

N/A: Data not available
Source: Eurostat

Table 7.5: EU-27 - Labour productivity per hour worked, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2005-2010
B	MINING AND QUARRYING	N/A	N/A	-0,1	5,8	3,1	1,5	-3,3	-0,1	3,2	-2,7	-6,6	2,1	-0,9
C	MANUFACTURING	N/A	N/A	1,5	2,2	2,9	3,9	3,3	5,0	3,9	-1,0	-6,1	8,3	1,9
C10	Manufacture of food products	N/A	N/A	2,4	4,3	2,1	2,4	3,1	1,3	2,4	-0,7	1,8	2,2	1,4
C11	Manufacture of beverages	N/A	N/A	3,3	6,6	2,4	-2,8	4,3	7,9	2,2	0,0	2,3	2,3	2,9
C12	Manufacture of tobacco products	N/A	N/A	-5,0	1,6	2,2	-0,6	0,2	0,7	5,6	-8,1	4,0	-3,4	-0,4
C13	Manufacture of textiles	N/A	N/A	0,3	-0,1	3,3	1,0	1,5	4,5	1,5	-4,4	-3,1	7,8	1,2
C14	Manufacture of wearing apparel	N/A	N/A	0,0	-7,4	-2,3	-1,1	-5,3	6,6	8,1	3,4	3,6	9,9	6,3
C15	Manufacture of leather and related products	N/A	N/A	-2,9	-4,3	-3,5	-7,9	-5,0	-0,6	2,4	-1,9	-2,2	3,6	0,2
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	N/A	N/A	-0,5	2,5	4,4	3,8	1,5	4,3	1,9	-6,0	-1,6	4,0	0,5
C17	Manufacture of paper and paper products	N/A	N/A	-0,3	5,9	2,7	5,1	2,1	5,0	4,2	0,0	-2,2	7,3	2,8
C18	Printing and reproduction of recorded media	N/A	N/A	-2,0	3,8	2,8	4,8	5,0	0,8	0,4	-1,0	-1,8	5,8	0,8
C19	Manufacture of coke and refined petroleum products	N/A	N/A	2,6	1,6	3,7	5,3	-0,5	5,2	-1,5	0,5	0,3	3,3	1,5
C20	Manufacture of chemicals and chemical products	N/A	N/A	1,3	5,4	2,3	5,3	4,5	5,0	4,3	-1,4	-6,1	10,5	2,3
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	N/A	N/A	10,1	6,8	5,5	1,1	6,8	6,3	1,3	1,7	7,2	7,7	4,8
C22	Manufacture of rubber and plastic products	N/A	N/A	-0,5	1,5	3,3	1,7	2,3	2,6	3,6	-3,9	-5,1	5,8	0,5
C23	Manufacture of other non-metallic mineral products	N/A	N/A	1,9	1,5	3,9	3,1	1,9	4,4	1,4	-4,3	-7,8	3,7	-0,6
C24	Manufacture of basic metals	N/A	N/A	1,5	3,9	4,8	7,5	1,5	5,9	1,1	-1,5	-16,3	18,5	0,9
C25	Manufacture of fabricated metal products, except machinery and equipment	N/A	N/A	0,9	0,8	2,6	3,0	2,4	3,5	3,3	-5,2	-12,5	7,5	-1,0
C26	Manufacture of computer, electronic and optical products	6,2	8,8	-5,7	-1,7	5,8	10,5	6,4	10,7	10,2	3,8	-4,0	14,2	6,7
C27	Manufacture of electrical equipment	N/A	N/A	1,0	-0,3	1,4	4,5	3,1	6,0	3,0	-1,1	-8,9	9,2	1,4
C28	Manufacture of machinery and equipment n.e.c.	N/A	N/A	2,0	0,2	1,6	5,5	5,3	6,8	5,5	0,7	-16,6	11,6	1,1
C29	Manufacture of motor vehicles, trailers and semi-trailers	N/A	N/A	1,8	1,9	2,9	4,7	2,5	4,2	5,5	-4,4	-11,8	16,4	1,5
C30	Manufacture of other transport equipment	N/A	N/A	2,1	-1,6	3,7	3,1	2,6	7,1	1,8	3,6	-2,4	2,8	2,5
C31	Manufacture of furniture	N/A	N/A	-2,1	-0,1	1,0	2,0	3,8	2,3	2,7	-1,2	-6,1	2,4	0,0
C32	Other manufacturing	N/A	N/A	4,4	4,9	1,2	2,1	3,4	5,2	1,1	-1,1	-1,4	7,6	2,2
C33	Repair and installation of machinery and equipment	N/A	N/A	2,9	-0,3	3,1	7,7	2,5	7,6	4,2	2,8	-11,8	8,5	2,0
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	N/A	N/A	3,9	5,8	8,3	5,3	3,1	2,9	0,3	0,6	-7,2	3,1	-0,1
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
F	CONSTRUCTION	2,7	2,2	2,0	4,3	2,9	0,6	-3,8	0,1	-0,7	-2,2	0,3	3,0	0,1

N/A: Data not available
Source: Eurostat

Table 7.6: EU-27 - Unit labour cost, annual growth rate (%)

Code (NACE Rev. 2)	Sector	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average 2005-2010
B	MINING AND QUARRYING	-4,2	-2,8	8,2	-0,9	7,2	4,3	1,3	8,6	4,8	11,2	11,8	2,4	7
C	MANUFACTURING	1,4	-0,3	2,7	1,2	0,2	-1,4	-0,6	-2,4	-0,2	5,7	10,1	-6,8	1
C10	Manufacture of food products	1,5	-0,3	2,2	0,9	2,7	-0,7	-0,8	0,3	1,4	5,2	1,2	-0,3	1
C11	Manufacture of beverages	N/A	N/A	0,8	-1,7	2,3	3,9	-1,6	-4,1	0,9	5,0	1,7	-1,1	0
C12	Manufacture of tobacco products	5,0	10,5	5,8	1,0	8,2	8,5	5,7	6,7	-3,5	16,6	3,8	-1,2	4
C13	Manufacture of textiles	6,6	9,6	1,9	3,3	0,7	0,8	0,9	-2,5	0,8	9,0	5,7	-9,3	0
C14	Manufacture of wearing apparel	10,1	15,6	1,1	9,3	2,4	1,8	4,2	-3,6	-0,5	3,4	2,1	-5,3	-0
C15	Manufacture of leather and related products	4,7	15,4	9,2	7,4	4,3	9,3	6,0	4,6	4,9	10,3	4,8	-1,2	4
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	-0,8	-5,1	5,6	-0,7	-2,0	-0,7	0,9	-0,5	3,9	12,1	5,3	-5,3	2
C17	Manufacture of paper and paper products	-0,5	-0,4	5,0	-2,6	-1,8	-1,7	1,4	-3,3	-1,3	4,1	4,3	-5,2	-0
C18	Printing and reproduction of recorded media	0,2	3,7	5,4	0,3	-1,3	-1,1	-1,7	-0,6	0,7	4,8	1,9	-6,3	0
C19	Manufacture of coke and refined petroleum products	6,8	6,5	0,9	6,8	-4,8	-1,4	4,1	2,3	2,8	4,0	8,2	2,3	3
C20	Manufacture of chemicals and chemical products	-1,1	1,7	2,5	-1,9	1,7	-3,3	-0,6	-3,7	0,0	5,1	9,6	-8,9	0
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	N/A	N/A	-5,8	-2,8	-0,6	1,0	-3,1	-3,6	4,0	0,1	-3,6	-4,7	-1
C22	Manufacture of rubber and plastic products	1,3	-0,1	3,4	1,4	-0,2	0,6	0,2	-2,9	-0,8	7,9	8,4	-5,4	1
C23	Manufacture of other non-metallic mineral products	0,0	-2,4	2,1	2,8	0,2	-1,0	0,5	-1,8	2,4	9,3	12,7	-3,7	3
C24	Manufacture of basic metals	4,1	-2,2	-3,4	-1,4	0,4	-3,5	3,0	-2,4	3,5	6,1	23,1	-14,3	2
C25	Manufacture of fabricated metal products, except machinery and equipment	2,1	-4,7	3,9	1,8	-0,1	0,1	-0,1	-1,1	0,8	10,1	15,4	-7,1	3
C26	Manufacture of computer, electronic and optical products	-2,4	-0,1	11,8	3,6	-5,8	-7,4	-4,6	-8,7	-7,7	0,2	9,9	-11,8	-3
C27	Manufacture of electrical equipment	-0,4	-4,4	2,7	2,1	0,2	-1,3	-0,7	-4,2	0,6	5,0	13,1	-8,5	0
C28	Manufacture of machinery and equipment n.e.c.	3,9	-2,8	2,8	3,0	1,8	-1,9	-2,6	-3,7	-1,5	3,8	27,1	-9,0	2
C29	Manufacture of motor vehicles, trailers and semi-trailers	1,3	0,8	1,0	0,8	0,4	-2,8	-0,4	0,0	-5,4	9,1	16,2	-15,3	0
C30	Manufacture of other transport equipment	3,7	1,4	3,7	8,2	0,6	-1,4	0,3	-4,7	1,5	1,7	8,8	3,5	2
C31	Manufacture of furniture	N/A	N/A	5,5	4,6	-1,0	-1,3	0,1	-0,3	0,4	6,6	11,5	-3,5	2
C32	Other manufacturing	0,9	-11,0	0,7	-0,5	1,5	0,4	-1,3	-2,5	3,1	4,4	3,3	-5,8	0
C33	Repair and installation of machinery and equipment	2,1	-1,1	3,8	4,6	0,6	-3,0	0,5	-5,8	0,7	2,2	12,5	-7,2	0
D	ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY	-1,4	-1,5	-1,0	2,0	-1,6	-1,2	0,1	4,3	5,1	4,5	9,2	-1,9	4
E	WATER SUPPLY; SEWERAGE, WASTE MANAGEMENT AND REMEDIATION ACTIVITIES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/
F	CONSTRUCTION	-0,6	-3,8	3,5	2,5	0,2	1,2	6,0	2,6	7,3	7,8	2,4	-1,5	3

N/A: Data not available
Source: Eurostat

Table 7.7: EU-27 - Revealed comparative advantage index

Code (NACE Rev. 2)	Sector	2007	2008
C10	Manufacture of food products	1,20	1,12
C11	Manufacture of beverages	1,61	1,59
C12	Manufacture of tobacco products	1,52	1,55
C13	Manufacture of textiles	0,81	0,76
C14	Manufacture of wearing apparel	0,76	0,76
C15	Manufacture of leather and related products	0,96	0,91
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1,15	1,18
C17	Manufacture of paper and paper products	1,28	1,30
C18	Printing and reproduction of recorded media	1,20	1,62
C19	Manufacture of coke and refined petroleum products	0,84	0,84
C20	Manufacture of chemicals and chemical products	1,13	1,13
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	1,47	1,53
C22	Manufacture of rubber and plastic products	1,18	1,21
C23	Manufacture of other non-metallic mineral products	1,22	1,19
C24	Manufacture of basic metals	0,92	0,88
C25	Manufacture of fabricated metal products, except machinery and equipment	1,18	1,19
C26	Manufacture of computer, electronic and optical products	0,60	0,60
C27	Manufacture of electrical equipment	0,98	0,99
C28	Manufacture of machineryand equipment n.e.c.	1,14	1,18
C29	Manufacture of motor vehicles, trailers and semi-trailers	1,22	1,22
C30	Manufacture of other transport equipment	0,85	0,88
C31	Manufacture of furniture	1,27	1,24
C32	Other manufacturing	0,80	0,78

Note: there was a transition from NACE REV 1 to NACE REV 2, therefore the data are only available from 2007
Source : own calculations using Comtrade data

Table 7.8: EU-27 - Relative trade balance (X-M)/(X+M)

Code (NACE Rev. 2)	Sector	2007	2008	2009
C10	Manufacture of food products	-0,03	-0,03	-0,03
C11	Manufacture of beverages	0,21	0,20	0,20
C12	Manufacture of tobacco products	0,03	0,06	0,06
C13	Manufacture of textiles	-0,01	-0,01	-0,02
C14	Manufacture of wearing apparel	-0,19	-0,19	-0,21
C15	Manufacture of leather and related products	-0,07	-0,07	-0,08
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0,00	0,02	0,04
C17	Manufacture of paper and paper products	0,04	0,04	0,06
C18	Printing and reproduction of recorded media	0,08	0,05	0,04
C19	Manufacture of coke and refined petroleum products	-0,03	-0,01	-0,05
C20	Manufacture of chemicals and chemical products	0,03	0,03	0,05
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0,07	0,08	0,08
C22	Manufacture of rubber and plastic products	0,04	0,04	0,04
C23	Manufacture of other non-metallic mineral products	0,08	0,08	0,09
C24	Manufacture of basic metals	-0,06	-0,03	0,01
C25	Manufacture of fabricated metal products, except machinery and equipment	0,09	0,09	0,10
C26	Manufacture of computer, electronic and optical products	-0,11	-0,11	-0,11
C27	Manufacture of electrical equipment	0,07	0,08	0,08
C28	Manufacture of machineryand equipment n.e.c.	0,16	0,17	0,20
C29	Manufacture of motor vehicles, trailers and semi-trailers	0,06	0,08	0,08
C30	Manufacture of other transport equipment	0,13	0,11	0,11
C31	Manufacture of furniture	0,04	0,04	0,03
C32	Other manufacturing	-0,04	-0,04	-0,04

Note: there was a transition from NACE REV 1 to NACE REV 2, therefore the data are only available from 2007
Source : own calculations using Comtrade data

Table 7.9: RCA in manufacturing industries in 2009: EU countries, US, Japan and Brazil, China, India and Russia.

Table 7.9: Revealed comparative advantage index in manufacturing industries in 2009 - EU countries, Japan and Brazil, China, India and Russia.

	Food	Bevarages	Tobacco	Textiles	Clothing	Leather & footwear	Wood & wood products	Paper	Printing	Refined petroleum	Chemicals	Pharmaceuticals	Rubber & plastics	Non-metallic mineral products	Basic metals	Metal products	Computers, electronic & optical	Electrical equipment	Machinery	Motor vehicles	Other transport	Furniture	Other manufacturing
	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28	C29	C30	C31	C32
Austria	0,92	2,06	0,85	0,71	0,55	0,75	4,45	2,23	1,30	0,26	0,50	1,33	1,36	1,41	1,24	1,99	0,41	1,34	1,47	1,27	0,71	1,42	0,78
Belgium	1,35	1,08	0,98	0,87	0,78	1,02	0,83	0,97	7,21	1,07	2,10	3,40	1,06	1,13	1,04	0,72	0,22	0,43	0,68	1,16	0,24	0,60	1,12
Bulgaria	1,45	0,94	3,10	1,37	3,70	1,31	1,56	0,42	0,29	2,61	0,56	0,69	0,82	2,18	2,82	0,66	0,30	1,11	0,72	0,29	0,34	1,39	0,33
Cyprus	2,06	1,43	34,64	0,11	0,54	0,42	0,24	0,40	0,23	0,00	0,53	4,53	0,37	0,39	0,37	0,63	0,92	0,30	0,55	0,33	1,52	0,80	2,69
Czech Rep.	0,47	0,74	1,54	0,93	0,38	0,39	1,53	1,04	1,32	0,17	0,50	0,28	1,70	1,83	0,67	2,01	0,98	1,51	1,15	2,18	0,51	1,49	0,78
Denmark	3,08	0,77	1,86	0,73	1,52	0,79	1,31	0,69	0,99	0,73	0,62	1,28	1,18	1,50	0,35	1,57	0,49	1,18	1,53	0,33	0,61	2,75	0,86
Estonia	1,23	2,08	0,45	1,49	1,12	0,65	8,16	0,78	0,01	3,48	0,68	0,10	1,31	1,60	0,42	1,90	0,39	1,42	0,65	1,13	0,29	3,00	0,54
Finland	0,33	0,51	0,02	0,23	0,16	0,26	4,79	8,57	0,75	1,49	0,58	0,44	0,86	0,78	1,19	0,97	0,78	1,51	1,57	0,36	1,30	0,29	0,49
France	1,18	3,93	0,59	0,60	0,72	1,05	0,66	1,05	1,15	0,58	1,33	1,70	1,12	0,98	0,76	0,92	0,43	0,92	0,88	1,22	3,23	0,66	0,76
Germany	0,78	0,66	1,80	0,54	0,51	0,38	0,87	1,24	2,43	0,29	1,05	1,33	1,29	1,03	0,77	1,24	0,54	1,17	1,62	1,77	1,35	0,85	0,64
Greece	2,70	1,81	5,69	1,75	2,12	0,71	0,56	0,73	1,47	2,10	0,90	1,65	1,25	2,57	1,96	1,01	0,25	0,78	0,40	0,11	1,18	0,36	0,39
Hungary	0,84	0,40	0,02	0,33	0,30	0,52	0,82	0,87	0,15	0,36	0,52	0,85	1,22	1,17	0,31	0,76	1,75	1,72	0,79	1,87	0,16	0,98	0,26
Ireland	1,25	1,62	0,40	0,08	0,07	0,06	0,35	0,10	0,00	0,15	3,38	6,27	0,28	0,22	0,05	0,20	0,88	0,22	0,29	0,04	0,39	0,09	1,44
Italy	0,93	2,12	0,02	1,38	1,59	3,01	0,53	1,01	1,25	0,72	0,68	0,91	1,36	2,02	0,98	1,73	0,20	1,13	1,90	0,74	0,95	2,55	0,95
Latvia	1,61	4,15	3,35	1,15	1,24	0,37	18,34	0,78	0,65	0,70	0,60	1,12	0,87	1,59	1,43	1,43	0,43	0,59	0,60	0,75	0,50	2,77	0,55
Lithuania	2,02	1,17	5,65	1,14	1,42	0,33	3,36	0,85	1,00	4,93	1,35	0,37	1,18	0,77	0,23	1,00	0,23	0,51	0,52	0,68	0,51	6,01	0,38
Luxembourg	0,92	0,88	6,33	2,05	0,38	0,44	2,13	2,37	0,21	0,02	0,52	0,16	3,72	2,56	4,04	1,11	0,33	0,67	0,84	0,73	1,18	0,11	0,25
Malta	0,63	0,21	1,32	1,19	0,36	0,16	0,05	0,02	1,74	0,09	0,33	2,10	1,46	0,42	0,04	0,40	2,55	1,70	0,39	0,04	0,81	0,35	1,97
Netherlands	2,11	1,44	5,36	0,49	0,57	0,66	0,31	0,92	0,73	2,03	1,63	0,83	0,82	0,48	0,58	0,75	1,14	0,54	1,00	0,36	0,41	0,40	0,83
Poland	1,41	0,47	4,77	0,62	0,72	0,36	2,40	1,55	0,48	0,43	0,65	0,27	1,68	1,54	0,86	1,70	0,66	1,29	0,56	2,03	1,09	4,98	0,30
Portugal	1,17	3,76	5,30	1,98	2,24	3,30	4,51	2,61	0,99	0,63	0,62	0,34	1,83	3,55	0,60	2,02	0,31	0,98	0,52	1,45	0,14	2,62	0,30
Romania	0,33	0,23	5,93	1,13	2,53	2,81	3,98	0,29	0,04	1,29	0,44	0,30	1,38	0,53	0,88	0,97	0,50	1,40	0,76	1,99	1,54	3,90	0,30
Slovakia	0,46	0,51	0,00	0,40	0,49	1,22	1,79	1,33	0,63	0,89	0,39	0,15	1,28	1,15	1,14	1,57	1,40	0,98	0,61	2,35	0,27	1,72	0,29
Slovenia	0,59	0,59	0,00	0,69	0,44	0,64	3,19	1,85	0,19	0,34	0,81	2,04	1,64	1,54	0,90	1,88	0,23	2,05	0,99	1,84	0,33	3,09	0,49
Spain	1,60	2,22	0,33	0,84	1,22	1,35	0,88	1,29	0,46	0,53	1,06	1,21	1,21	2,21	1,02	1,16	0,21	0,89	0,70	2,43	1,04	0,85	0,38
Sweden	0,53	0,91	0,24	0,33	0,32	0,21	3,98	5,68	0,14	1,30	0,73	1,53	0,91	0,64	1,04	1,01	0,76	1,12	1,27	0,97	0,40	1,62	0,54
United Kingdom	0,70	3,32	0,93	0,53	0,60	0,46	0,19	0,76	1,10	1,30	1,36	2,33	0,92	0,73	0,74	0,79	0,70	0,71	1,08	1,15	1,49	0,38	1,09
EU-27	1,10	1,62	1,60	0,69	0,76	0,91	1,18	1,34	1,79	0,77	1,16	1,54	1,18	1,18	0,82	1,16	0,57	0,98	1,18	1,30	1,15	1,20	0,75
USA	0,91	0,66	0,29	0,53	0,15	0,21	0,58	1,19	0,67	1,04	1,46	1,13	1,03	0,70	0,71	0,91	1,03	0,89	1,37	0,96	0,50	0,46	1,59
Japan	0,09	0,06	0,08	0,48	0,02	0,03	0,02	0,26	0,20	0,41	1,00	0,18	1,08	0,94	1,25	0,67	1,18	1,12	1,65	2,13	1,51	0,14	0,46
Brazil	5,09	0,12	0,61	0,45	0,05	1,96	2,05	2,77	0,24	0,69	0,97	0,32	0,75	1,10	1,91	0,83	0,14	0,56	0,67	0,95	1,38	0,69	0,19
China	0,37	0,09	0,15	2,52	2,75	2,56	0,96	0,37	0,15	0,26	0,44	0,20	0,91	1,37	0,46	1,27	1,87	1,42	0,72	0,22	0,76	2,01	1,11
India	1,03	0,09	0,50	2,86	2,46	1,36	0,12	0,21	1,05	3,18	0,93	0,85	0,54	0,79	1,10	0,82	0,25	0,42	0,43	0,34	1,00	0,28	5,88
Russia	0,66	0,37	1,69	0,08	0,02	0,11	3,82	1,08	0,09	9,03	1,33	0,06	0,31	0,64	3,89	0,37	0,12	0,24	0,24	0,15	0,52	0,22	0,05

Source: Own calculations using COMTRADE data

Table 7.10: Revealed comparative advantage index in service industries in 2009 - EU countries, US, Japan and Brazil, China, India and Russia.

	Communication	Computer and information	Construction	Finance	Insurance	Other business services	Personal, cultural and recreational	Transportation	Travel
Austria	1,17	0,63	0,88	0,26	0,94	1,08	0,45	0,80	1,52
Belgium	2,00	0,91	0,63	0,52	0,68	1,61	0,67	0,97	0,54
Bulgaria	1,30	0,40	2,02	0,07	0,82	0,37	0,70	0,73	2,31
Cyprus	0,40	0,26	0,34	2,79	0,35	0,71	0,40	1,34	0,77
Czech Republic	0,82	0,84	0,58	0,03	0,26	0,86	0,46	1,51	1,07
Denmark	0,47	0,56	0,24	0,16	0,35	0,77	0,73	2,17	0,47
Estonia	1,30	0,51	1,17	0,15	0,08	0,62	0,21	1,93	0,77
Finland	0,57	4,92	1,75	0,21	0,31	1,93	0,03	0,00	0,52
France	1,12	0,16	1,41	0,17	0,20	0,80	1,01	1,37	1,26
Germany	0,73	0,92	1,62	0,59	0,80	1,12	0,41	1,39	0,55
Greece	0,30	0,12	0,23	0,04	0,33	0,14	0,33	2,36	1,10
Hungary	0,91	0,93	0,66	0,12	0,04	0,95	4,49	1,16	1,15
Ireland	0,33	6,54	0,00	1,21	5,15	1,30	0,00	0,00	0,24
Italy	0,61	0,12	0,85	0,87	0,50	1,06	0,93	0,85	1,49
Latvia	1,06	0,55	0,32	0,86	0,30	0,61	0,22	1,81	0,80
Lithuania	1,11	0,18	0,59	0,14	0,00	0,30	0,37	1,97	1,25
Luxembourg	2,22	0,30	0,26	7,86	2,26	0,51	1,60	0,19	0,29
Malta	0,58	0,33	0,00	0,83	0,60	1,11	18,12	0,47	1,14
Netherlands	2,08	1,20	1,14	0,20	0,28	1,48	0,83	1,02	0,61
Poland	0,90	0,52	1,74	0,19	0,04	1,01	0,44	1,07	1,32
Portugal	1,20	0,27	1,05	0,12	0,28	0,79	1,24	0,91	1,83
Romania	3,62	1,73	1,77	0,24	0,22	1,14	0,72	1,07	0,54
Slovak Republic	1,40	0,78	0,67	0,67	0,50	0,56	0,77	1,08	1,60
Slovenia	1,85	0,44	1,53	0,08	0,63	0,72	0,75	0,88	1,78
Spain	0,69	0,84	1,15	0,50	0,65	0,95	1,24	0,52	1,86
Sweden	1,46	2,11	0,32	0,32	0,81	1,60	0,86	0,63	0,80
United Kingdom	1,36	0,85	0,36	3,15	2,21	1,26	1,26	0,51	0,57
EU-27	1,07	1,09	0,90	1,12	1,07	1,07	0,88	0,97	0,90
USA	0,99	0,58	0,58	1,89	1,60	0,91	3,17	0,57	1,32
Japan	0,20	0,11	3,03	0,47	0,27	1,23	0,11	1,65	0,32
Brazil	0,55	0,14	0,02	0,80	0,61	2,11	0,28	0,55	0,87
China	0,32	0,72	2,06	0,04	0,44	1,18	0,06	1,10	1,10
India	0,56	7,74	0,27	0,45	0,64	0,53	0,44	0,77	0,47
Russia	1,32	0,53	2,65	0,34	0,46	1,08	0,76	1,08	0,97

Source: IMF, OECD

ANNEX

LIST OF BACKGROUND STUDIES TO THE EUROPEAN COMPETITIVENESS REPORT 2011

Some parts of the European Competitiveness Report 2011 are based on, or use, material prepared by a consortium led by WIFO, the Austrian institute for economic Research:

Chapter 1 – "Crisis, recovery and the role of innovation" was written by Jorge Durán and benefitted from research assistance by Giorgos Alaveras and from contributions by Mats Marcusson. Comments and suggestions are acknowledged to João Libório, Maya Jollès and Ágnes Magai. Statistical assistance is acknowledged to Luigi Cipriani.

Chapter 2 – "Convergence of knowledge intensive sectors and the EU's external competitiveness" was coordinated by Mats Marcusson and is based on the background study "Convergence of knowledge intensive sectors and the EU's external competitiveness" by Sabine Biege (2), Martin Borowiecki (1), Bernhard Dachs (1), Joseph Francois (4), Doris Hanzl (4), Johan Hauknes (3), Angela Jäger (2), Mark Knell (3), Gunther Lay (2), Olga Pindyuk (4), Doris Schartinger (1) and Robert Stehrer (4).

(1) AIT, Austrian Institute of Technology.
(2) ISI, Fraunhofer Institute for Systems and Innovation Research.
(3)NIFU STEP, Norwegian Institute for Studies in Innovation, Research and Education.
(4) wiiw, Vienna Institute for International Economic Studies.

Chapter 3 – "European Competitiveness in Space Manufacturing and Operations" is based on the background study "Competitiveness of the European Space sector" by Robert Piers, Dick Mans, Konstantina Laparidou, Koen Berden, Afke Mulder, Jurgen Vermeulen and Sophie Willems (*Ecorys Rotterdam*).

Chapter 4 – "Access to non-energy raw materials and the competitiveness of EU industry" was coordinated by Ágnes Magai and is based on the background study "Access to non-energy industrial raw materials and the competitiveness of EU industry" by Valentijn Bilsen, Sjouke Beemsterboer, Ruslan Lukach, Elissavet Lykogianni, Pieter Staelens, Miriam Van Hoed, Jan Wynen (all from *IDEA Consult*) and Andreas Unterstaller (*Ecorys Brussels)*

Chapter 5 – "EU Industry in a Sustainable Growth Context" was coordinated by João Libório and is based on the background study "EU Industry in a Sustainable Growth Context" by Koen Rademaekers, Koen Berden, Jan Maarten de Vet, Matthew Smith, Jeron Van de Laan, Afke Mulder (all from *ECORYS*) and Elissavet Lykogianni and Miriam Van Hoed (both from *IDEA Consult*).

Chapter 6 – "EU Industrial Policy and Global Competition: Recent Lessons and Way Forward" was coordinated by Joachim Schwerin and co-drafted by Adriana Czechowska, Torsten Frey, Joachim Schwerin, Edouard Simon, Kamila Skowyra and Marie-Laure Wyss (all from *DG ENTR, Unit B2*). The chapter has substantially benefited from comments and suggestions from Chris Allen, Petar Angelov, Manfred Bergmann, Maya Jollès, João Libório and Konstantin Pashev.