

Industry as a growth engine in the global economy

Final Report

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List of Abbreviations

BPS	Basis Points
BRICS	Brazil, Russia, India, China and South Africa
CEE	Central and Eastern Europe
CEPII	Centre d'études prospectives et d'informations internationales
CEPS	Centre for European Policy Studies
CP	Competitiveness Proofing
CSR	Corporate Social Responsibility
DG	Directorate General
ECSC	European Coal and Steel Community
ECHA	European Chemicals Agency
EFIGE	European Firms in a Global Economy (Bruegel-UniCredit data set)
EP	European Parliament
ETS	Emissions Trading System
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GVCs	Global Value Chains
IA	Impact Assessments
ICT	Information and Communications Technology
IDI	ICT Development Index
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IW	Institut der deutschen Wirtschaft Köln
KET	Key Enabling Technologies
NUTS	Nomenclature des unités territoriales statistiques
OECD	Organisation for Economic Co-operation and Development
PRODY	Income/Productivity Level
R&D	Research and Technological Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
REFIT	Regulatory Fitness and Performance Programme
RXS	Relative Export Share

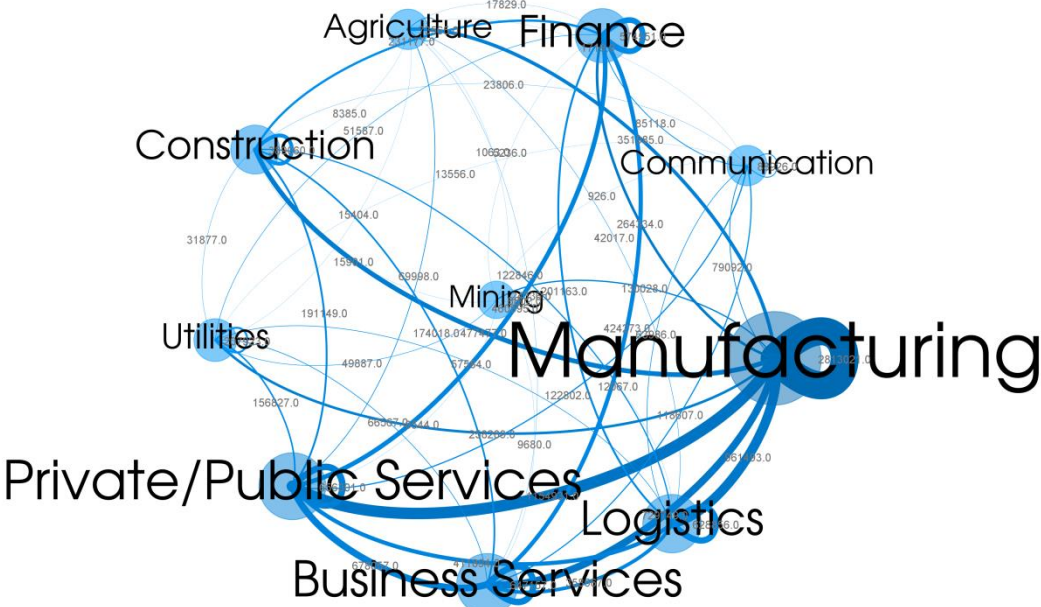
SASP	Single Authorisation for Simplified Procedures
SHVC	Substances of Very High Concern
SMEs	Small and Medium-sized Enterprises
STEM	Science, Technology, Engineering and Mathematics
TFP	Total Factor Productivity
TIVA	Trade in Value Added (OECD-WTO joint project)
VA	Value Added
WIOD	World Input-Output Database
WTO	World Trade Organization

Executive summary

Industry – the backbone of the economy

Industry¹ is the backbone of the economy. Due to strong spillover effects to other sectors, manufacturing is significantly more important to the overall economy than it is often given credit for. The following findings vividly illustrate the relevance of industry in various dimensions.

Figure 0-1: EU production network illustrated by intermediate inputs (2011)



Source: own illustration, graph made with Gephi.

¹ Industry is defined throughout the study in a narrow sense as the manufacturing sector. Thus, the terms industry and manufacturing are used synonymously.

Industry features as an economic hub to the economy because it offers an important market for suppliers from other sectors, as highlighted in Figure 0-1:

- The function of industry as a hub for the economy is underlined by the fact that the manufacturing sector accounts for 49 per cent of intermediate input transactions in the EU economy, while its share in total value added (VA) and employment amounts to 15 and 14 per cent, respectively (Figure 0-2).²

Figure 0-2: Manufacturing's share in the total economy in various dimensions

in per cent



Source: Eurostat (2013), OECD (2013), WIOD (2013), WTO (2013), own calculations

- Business services as well as other non-industry sectors strongly benefit from industry's demands in the course of upstream and downstream value chains. In fact, for every one euro of manufacturing output in the EU, 34 cents of input comes from other supply sectors.
- The symbiosis of industry and other sectors on the input level can be termed "Joint Production".³ This deep and mutually productive integration, particularly with the service sector, renders the traditional dichotomy and antagonism between industry and services obsolete.

² Industry's share in VA would be nearly 18 per cent (Figure 0-2) if prices in industry had risen to the same degree as in the total economy. Instead, industry's productivity advantage mentioned below and international competition mainly explains why industrial prices have increased at a considerably slower pace than in the overall economy. As a result of the lower price dynamic, industry contributes to rising real incomes.

³ "Joint Production" is measured in terms of net intermediate input transactions among different sectors.

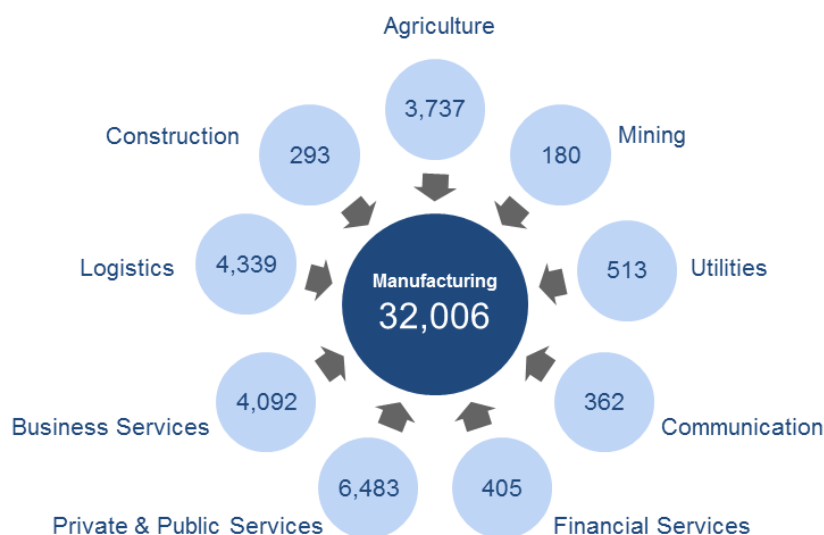
- Combined with this “Joint Production”, the relevance of industry is considerably higher than it is often given credit for. In the EU, this “Combined Sector” accounts for 24.3 per cent of VA in the total economy (Figure 0-2) compared to a world average of 20.8 per cent. Furthermore, the share of the “Combined Sector” remained more or less constant between 2005 and 2011 in the EU.
- In Europe in particular, the manufacturing sector is a major hub for the organisation of value chains. While “Joint Production” accounts for only 3.7 per cent of total VA in the world on average, its share in the EU is considerably higher at 8.5 per cent.

Due to this interconnectedness, industry generates strong positive spillovers to other sectors:

- Industry exerts higher multiplier effects on the total economy than other sectors. In fact, every unit of additional demand in the manufacturing sector generates 1.68 units of additional output in the total economy.
- Regarding employment, while manufacturing directly provides 32 million jobs in the EU, more than 20 million jobs indirectly depend on industry in related supply sectors (Figure 0-3).
- Thus, a vibrant and thriving industry in Europe will also benefit the economy overall.

Figure 0-3: Direct and indirect employment in the manufacturing sector (2012)

in 1,000 persons



Source: Eurostat (2013), WIOD (2013), own calculations.

Industry fosters important growth factors

- Manufacturing businesses account for a significant share of research. With a share of 15 per cent of VA in the total economy, industry is responsible for 65 per cent of research and technological development (R&D) expenditure and for 49 per cent of innovation expenditure (Figure 0-2). Large manufacturing firms' innovation intensity is twice as high as in large companies in other sectors.
- Industry relies heavily on employees with STEM (science, technology, engineering and mathematics) skills. These qualifications are considered particularly important when it comes to innovative capacity required to develop more efficient production processes. Moreover, STEM skills and practical experience are necessary throughout manufacturing firms to generate new, better and more marketable products.
- Industrial businesses are a motor for internationalisation (Figure 0-2). In the EU, they are responsible for 76 per cent of merchandise exports and 57 per cent of total exports (including service exports). In addition, the EU boasts a world export market share in manufacturing of 42 per cent.
- EU industry is strongly integrated into global value chains (GVCs) with particularly intense cross-border intermediate linkages among EU countries.
- The above factors enable the manufacturing sector to be more productive than other sectors. In industry, an hour of work generates nearly €32 of VA, a productivity level that is about 15 per cent higher than the average in all sectors.⁴
- As a result, manufacturing provides a large number of high-quality jobs that offer higher wages and better income prospects than many other sectors. While industry concentrates on employees who have completed secondary education, industrial wages are above average in every skill class.

Industry is a growth driver

- Considering the relevance of industry for the above-mentioned growth drivers, it comes as no surprise that a strong industrial base goes hand in hand with higher economic growth and technical progress.
- In countries with an above-average specialisation in industry,⁵ the growth of Gross Domestic Product (GDP) has been stronger since 2000 (+149 per cent on average in euro terms) than in the comparison group of countries with below-average specialisation (+35 per cent on

⁴ This calculation for all sectors excludes the real estate sector where price bubbles distort the picture.

⁵ Included are the 50 most industrialised countries; industrial-oriented countries are defined as having a manufacturing share of VA above the world average (17.4 per cent in 2012).

average). The same is true for the European Union but at a lower level: the industry-oriented Member States⁶ grow by 43 per cent, the comparison group by 38 per cent.

- Moreover, when the industry share (in the total economy VA) increases by one percentage point, total factor productivity (a measure for technical progress) rises on average by 0.28 per cent (Stöllinger et al. (2013)).

Due to these beneficial spillover effects, a renaissance of industry would also have an important social dimension: it can help Europe to get out of the current crisis and reduce the burden of excessive unemployment in many parts of the EU.

Apart from this outstanding macroeconomic relevance, industry offers solutions to societal challenges. The innovative and creative capacities of manufacturing businesses are essential to tackle many future challenges, e.g. population growth in emerging economies or dwindling natural resources.

Challenges and opportunities for EU industry

However, despite this huge potential and the disproportionate relevance of industry for the total economy, the manufacturing sector has come under pressure from various angles in recent years.

From an economic perspective, challenges for EU industry have arisen due to important megatrends: tertiarisation (increasing relevance of services), globalisation and knowledge intensification. They comprise, for example, a shift in global demand from goods to services, more intense competition from emerging markets, and challenges for low-skilled jobs/sectors from technology-driven rationalisation.

However, these megatrends also provide opportunities to increase the competitiveness of manufacturing and thus to tackle the challenges (see below). In addition, future global demand patterns will tend to favour manufactured goods, in particular investment goods. Huge global trends – such as ageing, urbanisation and climate change – improve business prospects in fields like life sciences, transport infrastructure and environmental technologies.

Additional challenges for industry have been induced by policies. This is indicated by the IW Competitiveness Index, which focuses on factors that are important for the competitiveness of manufacturing businesses.

The index makes it possible to gauge the quality of the policy and economic frameworks for the 50 most important developed and emerging countries.⁷ Strikingly, on average the EU lies behind relevant competitors in all applicable competitiveness fields. However, a considerable divergence between EU regions/countries has been identified. While North-Western Europe on average scores significantly better than the group of other developed economies outside the EU, Southern and Eastern Europe lag

⁶ European Member States with a manufacturing share of VA above 15.2 per cent.

⁷ It measures the position of the 50 most important developed and emerging countries (EU-27 states, OECD and BRICS countries) using 60 relevant indicators clustered around the areas of government and governance, infrastructure, human capital, innovation, labour relations, energy and raw materials, capital markets, cost, market and customers, value chains and economic openness.

behind. Furthermore, these two latter EU regions already lag behind South Korea and China, both of which have improved their competitiveness frameworks considerably over time.

The EU strategy in the energy and environmental field has also affected the international competitiveness of EU industry in recent years. The lack of progress towards an international climate agreement has challenged the frontrunning strategy of the EU in combating climate change. Moreover, the discovery of large shale gas reserves has led to a renaissance of the United States as a manufacturing production location. While worthy in themselves, these developments tend to erode the international level playing field for EU industry. In addition, incentives for production dislocation have increased and established value chains in the EU have become endangered.

These various challenges have exerted significant pressure on EU industry. As a result, the industrial share in total VA in the EU has declined to 15 per cent on average. However, the manufacturing sector is a growing market globally in absolute terms and thus continues to offer opportunities. The worldwide gross VA increased from €5.9 trillion (2000) to €8.4 trillion (2012); in the EU, it increased from €1.5 trillion to €1.8 trillion.

The way forward

In view of these challenges and opportunities, the renaissance of EU industrial policy after the financial crisis is most welcome. This is also true for the new EU goals to increase the manufacturing share in total VA to 20 per cent by 2020. While this target appears highly ambitious, it rightly provides a clear direction and anchor for future EU industrial policy. To get there, the main aim is to increase industrial competitiveness in a broad and encompassing sense.

Key success factors for businesses and industrial competitiveness

Improving industrial competitiveness and growth across Europe is not going to be easy. It is mainly the task of businesses to achieve this aim. This necessitates not only increasing cost efficiency and staying ahead of competitors by innovating and upgrading, but also requires EU industry to better differentiate and adapt their product portfolios in accordance with changing demand patterns.

These objectives are demanding, therefore more enterprises in the EU should actively use the success factors offered by the above-mentioned economic megatrends: industry-service integration, internationalisation (exports, global sourcing and international production) and R&D activities. The strategies have been widely shown to be closely connected to business success and industrial competitiveness in this and many other studies.

For example, service integration helps to improve cost competitiveness, and internationalisation and R&D activities improve growth perspectives on the business, sectoral and economic level.

The paradigm for the EU: “Moving Forward Together in Europe”

To better exploit these success factors, EU businesses should increasingly follow the concept of “Moving Forward Together in Europe” – the paradigm for the EU pointed out in this study. It essentially requires better use of the potential of cooperation and integration in value chains across firms, sectors

and national borders. This increasing interconnectedness will be key for the revitalisation of EU industry. It will foster better utilisation of the above-mentioned success factors. Competitiveness of EU manufacturing can thus be reinforced from the very core.

The paradigm's main dimensions comprise:

- progressive cooperation between industry and services along the domestic and EU value chains and also in hybrid business models;
- strong intra-industrial linked networks, including energy- and material-intensive sectors, which are needed in the EU;
- increasing integration in international value chains via industrial hub sectors to target customers all over the world and to use the efficiency potential of labour sharing across borders; and
- more cooperation on R&D activities and innovation along the value chain and increasingly in a cross-border context, both within the EU and internationally.

The paradigm for the EU also extends to the cooperative potential of the internet to manage value chains (across firms, sectors and borders) with completely new digital production systems. As distance and borders matter much less in this new digital production world, all EU Member States can benefit. In fact, Europe has the opportunity to take a leading role in developing internet-based networking solutions for industrial production.

Beneficial effects of cooperation and value chain integration

This study provides ample empirical and qualitative evidence to prove the beneficial effects of more cooperation and value chain integration. For example:

- The integration of services in industrial processes and goods offers important potential to differentiate and upgrade manufacturing products. Therefore, hybrid business models (which combine goods and services) can be shown to be particularly successful.
- Integration in GVCs clearly strengthens productivity, competitiveness and export success at the country level. Despite an increasing share of foreign inputs in EU industrial exports, in absolute terms the manufacturing VA contained in these exports has greatly increased. Obviously, the exploitation of international value chains has enhanced industrial competitiveness and could thus considerably boost EU industrial exports.
- Cooperation in R&D and innovation has been widely shown to foster innovation in the economic literature. As a result, research-oriented cooperation improves business performance in terms of employment, turnover and return.

Potential for cooperation between smaller and larger players

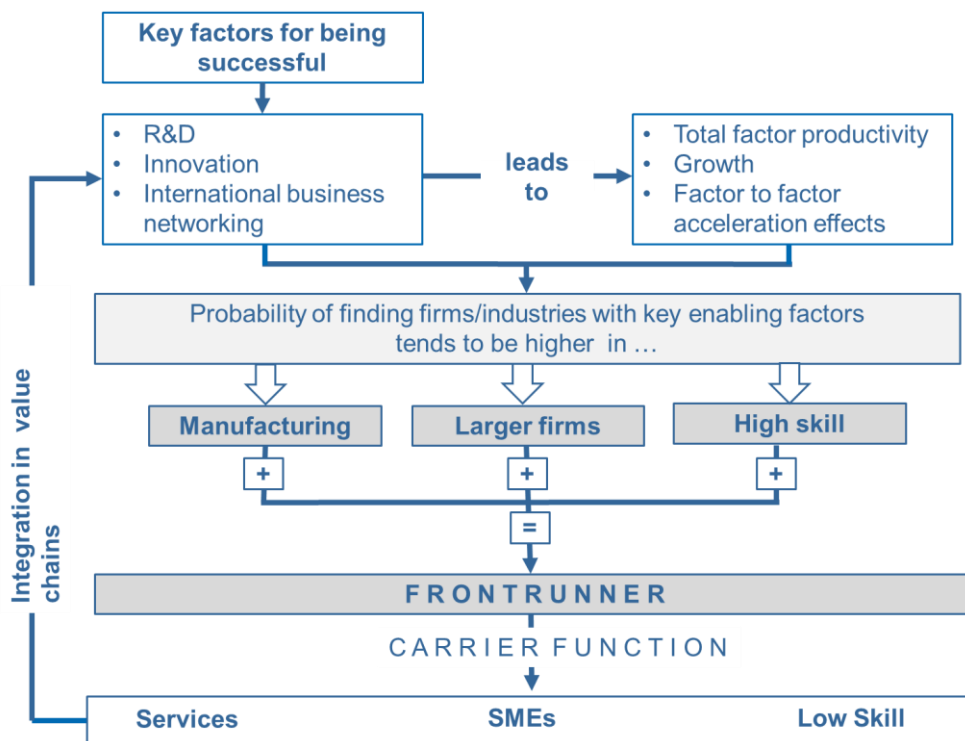
These opportunities for cooperation and integration are particularly relevant for small and medium-sized enterprises (SMEs) in Europe. Primarily due to a lack of scale effects, SMEs tend to lag behind larger firms, especially in exploiting the success factors of internationalisation and innovation. To

better use this potential, the existing sound symbiosis in the EU between smaller and larger firms should be further extended to benefit all participants.

In particular, large global frontrunners are prime examples of how companies can exploit the above-mentioned success factors. They are innovative, experienced in international markets and know the needs of global customers (cp. Figure 0-4) but they also rely on specialised input providers. Thus, frontrunners have an important carrier function because they offer platforms for other firms to integrate in international value chains. As a result, domestically oriented SMEs and service providers also have the chance to tailor their products to better suit world demand and benefit from global growth.

Industrial value chains increasingly cross internal EU borders, supporting linkages between smaller and larger EU countries. This growing cooperation and integration offers the opportunity to better connect industrial hub countries with other countries offering different specialisations, which will be to the benefit of all Member States. The EU market offers the ideal platform to integrate efficient industrial and service suppliers in one EU country with industrial frontrunners in other EU countries. In this respect, this study has demonstrated that a 10 per cent increase in total exports of goods from Germany, France or the UK already leads to a 9 to 11 per cent rise in exports of intermediate goods from EU partners to Germany, France or the UK.

Figure 0-4: Carrier function of frontrunners



Source: own illustration.

Moreover, SMEs can significantly enhance their innovation capacity by cooperating along the value chain or in networks with research institutions. Furthermore, SMEs would disproportionately benefit from larger innovation networks in the EU. In fact, this study demonstrates a large potential in this respect. By using patent statistics, it shows that innovation networks are much less developed than production networks in the EU. This is particularly true for larger EU countries, though is also evident for smaller ones.

However, this new world of ever closer integration across Europe needs active engagement. On the business side, there are important preconditions for companies to become part of cooperation networks or international value chains: to be efficient and reliable as well as to display a suitable specialisation and technological readiness.

The policy challenge: Enabling business to “Move Forward Together”

On the policy side, a new EU Industrial Compact can help to unlock the potential of industry and enable EU companies to “Move Forward Together in Europe”. In this respect, enabling does not necessarily mean fostering single sectors and businesses; it is more important to provide a business- and innovation-friendly economic framework. Concerning the IW Competitiveness Index, the responsibility lies mainly in the realm of Member States to improve those policy areas identified as lagging behind.

Regarding the EU overall, much is achieved if policies on the EU (and Member State) level do not unnecessarily burden firms with regulatory costs and administrative problems. Particularly regarding the renewed industrial policy focus – despite intensive proclamations of EU institutions – there is still a significant lack of implementation. Industrial competitiveness and the need to sustain existing and thriving value chains are still too often compromised by EU policy initiatives.

This is particularly relevant regarding the energy and environmental field. Repeatedly, inconsistencies regarding EU competencies – comparing the energy/climate/environment fields with industrial policy – have contributed to an erosion of the international level playing field for many industrial businesses. Looking forward, the new EU Industrial Compact should better balance industrial competitiveness needs with other objectives of EU policymaking.

In addition, industrial policy has to heed the paradigm of cooperation and integration pointed out in this study. The economic framework provided by the EU (and Member States) should enable ever more companies to become sufficiently attractive to join forces with the frontrunners.

1 Introduction

The potential: Industry is the economy's backbone

Industry is the backbone of the economy and features as an economic hub. Industry is defined throughout the study in a narrow sense as the manufacturing sector. Due to strong spillovers to other sectors, manufacturing is more important to the overall economy than it is generally given credit for. In particular, the deep and mutually productive integration with the service sector renders the traditional dichotomy and antagonism between industry and services obsolete. Service providers profit from industry's thriving demand and manufacturing businesses increasingly need the dynamic service sector as a source of tailored high-quality and cost-efficient inputs. Thus, a thriving Joint Production sector has emerged involving manufacturing companies and providers of business-related services.

The role of industry as the economy's backbone is further highlighted by the central role the manufacturing sector plays with regard to important growth drivers. In fact, industry is a key driver of productivity growth, which has a direct effect on rising economic welfare. Furthermore, the manufacturing sector accounts for a significantly larger share of R&D and STEM employees than its share in VA or employment of the overall economy would suggest, with innovation and highly qualified employees being key drivers of technical progress and growth. Due to these beneficial spillover effects, a renaissance of industry would also have an important social dimension: it can help Europe to get out of the current crisis and reduce the burden of excessive unemployment in many parts of the EU.

Industry also offers solutions to societal challenges. The innovative and creative capacities of manufacturing businesses are essential for tackling – and profiting from – the large global demand trends of our time, be it globalisation, digitisation, urbanisation, ageing, sustainability, etc.

This study will elaborate on the wide array of potential that industry offers for both the economy and society (chapter 2).

External challenges: Obstacles for industry success

Despite these positive perspectives, industrial production in the EU has had to face significant uphill challenges in recent times, which have contributed to a decline in industry's share of total production (see chapter 3).

- The current economic crisis has led to a severe burden for many manufacturing businesses and uncovered deeper problems such as an erosion of international cost competitiveness and weak productivity growth. As a result, financial markets in Europe are still fragmented and access to credit is restricted in several countries, thus hampering the urgently needed economic recovery.
- The EU strategy in the energy and environmental field has affected the international competitiveness of EU industry in recent years. The discovery of large shale gas reserves has led to the renaissance of US-based manufacturing with relatively low energy costs. The lack of progress towards an international climate agreement has challenged the frontrunning strategy of the EU in combating climate change and reducing CO₂ emissions relatively rapidly compared with other parts of the world. While worthy in themselves, some of these developments tend to erode

the international level playing field, increase the incentives for dislocation of industrial production and, in part, endanger established value chains in the EU (see chapter 6.4).

- The rise of China and other emerging markets has been an additional challenge for some time. The upgrading and export success of these newcomers particularly affects EU manufacturing businesses specialising in lower- and medium-technology as well as smaller SMEs which are not integrated into international value chains.

Against this background, the renewed EU-level focus on the relevance of industry is welcome. Since deindustrialisation is a sustained process, putting forward the overall objective to reindustrialise Europe is extremely timely. While the new EU target – to raise the industry share in VA from 15 to 20 per cent of the total economy – appears highly ambitious, it rightly provides a clear direction and anchor for future EU industrial policy.

The paradigm: “Moving Forward Together in Europe”

Businesses themselves should be primarily responsible for adapting their product portfolio to demand patterns, seizing export opportunities in thriving markets, cooperating productively on innovation and integrating into international value chains or business networks. This study shows extensively (in chapter 4) that these activities are pivotal for entrepreneurial success. It also points out the central role and exemplary function that international business frontrunners play in this context.

Moreover, this analysis is based on the new paradigm that businesses in Europe will increasingly have to work together to be successful in the future.

- Innovation and adjusting product portfolios to meet demand increasingly requires cooperation in various dimensions: within networks and clusters as well as with customers and input suppliers. To be successful, innovation and products have to be tailored to customers' needs and have to take advantage of the specialised know-how of the suppliers in the ever more complex value chain.
- Moreover, internationalisation and cross-border value chain integration carry large potential in several respects (see also chapter 4). These strategies are needed to make the supply potential of EU companies (of all sizes) meet the global demands. In addition, labour sharing and specialisation within international value chains contribute to cost efficiency and thus competitiveness.

The “Moving Forward Together in Europe” paradigm has various dimensions, including:

- progressive integration of industry and services along the domestic and EU value chains and also in hybrid business models;
- strong intra-industrial linked networks, including energy- and resource-intensive sectors, which are needed in the EU;
- integration in international value chains to target customers all over the world and to use the efficiency potentials of labour sharing across borders; and
- more cooperation on R&D activities and innovations along the value chain and increasingly in a cross-border context within the EU and internationally.

Frontrunners and Hidden Champions⁸ have an important carrier function for more domestically oriented companies, particularly SMEs. The former are experienced in international markets and know the needs of global customers but they also increasingly rely on specialised providers of inputs.

Value chains should and will increasingly cross EU borders. In this respect, internationalisation also widens choices and raises efficiency via increased competition intensity. This rising cross-border cooperation and integration offers the opportunity to bind industrial hub countries together with countries with different specialisations for the benefit of all participants. The Single Market offers the ideal platform to integrate efficient industrial and service suppliers in one country with industrial frontrunners and Hidden Champions in other countries.

However, this new world of closer integration across Europe is no panacea. Frontrunners are choosy. There are important preconditions for companies to become part of cooperation networks or international value chains: to be efficient and reliable as well as to display a suitable specialisation and technological readiness. Again, to achieve these characteristics is mainly a task for businesses themselves.

The policy challenge: The new EU Industrial Compact as an enabler for business success and cooperation

The new EU Industrial Compact can help to unlock the potential of industry and to enable EU companies to “be successful and move forward together in Europe”. In this respect, enabling does not necessarily mean to foster single sectors and businesses; it is more important to provide a business- and innovation-friendly economic framework. Policy game changers are highlighted in chapter 6.2.

Much is achieved if policies on the EU (and Member State) level do not unnecessarily burden firms with regulatory and administrative costs. Particularly regarding the renewed industrial policy focus – despite intensive proclamations from EU institutions – there is still a significant lack of implementation. Industrial competitiveness and the need to sustain existing and thriving value chains continue to be compromised by EU policy initiatives. This is particularly relevant regarding the changes in the energy and environmental field. Repeatedly, inconsistencies regarding EU competencies – comparing the energy/climate/environment fields with industrial policy – have contributed to an erosion of the international level playing field for many industrial businesses.

Looking ahead, the new EU Industrial Compact should not only better balance industrial competitiveness with other objectives of EU policymaking but also industrial policy has to heed the new paradigm of cooperation and integration developed in this study. The economic framework provided by the EU (and Member States) should enable more and more companies to become sufficiently attractive to join forces with the frontrunners. Policy avenues to facilitate “Moving Forward Together in Europe” include, for example, offering platforms for cooperation in innovation and cross-border value chain integration, opening markets and enhancing cross-border infrastructure.

The result of more companies cooperating in R&D and integrating into international value chains will be a more efficient, innovative and competitive industry in the EU. This is also the aim of the old

⁸ Hidden Champions are (often unknown) SMEs that are world market leaders in product niches.

paradigm of industrial policy. The new paradigm, however, has several advantages: it enhances innovation opportunities, better carries along domestically oriented SMEs, and exploits international value chains to make EU supply better meet world demand. Thus, by using the huge potential of cooperation and value chains, competitiveness of EU industry will be further advanced and reinforced.

Outline of the study

A brief outline explains the storyline of this study:

- Chapter 2 demonstrates that several global demand trends offer important opportunities to manufacturing on a worldwide scale. The technology-oriented manufacturing sector is well positioned to find solutions to the implied societal challenges.
- Chapter 3 describes the economic challenges that EU industry had to face and which contributed to industry's declining share in the total economy. It concludes that de-industrialisation appears to have gone too far in several EU countries.
- Chapter 4 builds the core of this study and elaborates on the key role industry plays for the economy. It is organised according to the three economic megatrends and points out the potential they offer for businesses to become more successful and competitive. What is more, it develops – for each megatrend – how the paradigm of “Moving Forward Together in Europe” can foster competitiveness and economic performance.
- Chapter 5 is based on the IW Competitiveness Index and highlights the strengths and weaknesses of the policy and economic framework conditions for industrial businesses in Europe. It demonstrates that in the EU overall and particularly in some regions and Member States areas for policy improvement exist.
- Chapter 6 shows the way forward. Departing from a summary of the preceding chapters, it points out the game changers for EU policy in a general context. After a brief description of the renaissance of EU industrial policy, several positive examples of EU policy initiatives are briefly described. Subsequently, shortcomings of EU policies are pointed out and areas for improvements identified to build a reliable and robust new EU Industrial Compact.

2 Industrial solutions for worldwide challenges

Worldwide, industry is a US\$10 trillion [€7.8 trillion] market.⁹ The wider industrial sector – including the building sector and energy suppliers – accounts for US\$13 trillion [€10.1 trillion] in VA. There are two main reasons why industrial products are needed and why industry therefore has a future in Europe:

- Emerging countries will continue the catching-up process, i.e. reduce the income gap towards developed economies. The faster these countries grow, the larger these markets will become, including industrial products from Europe. In the manufacturing sector, developed countries today generate a VA of approximately US\$5,200 [€4,047] per capita while the emerging countries achieve only about a quarter of this value. If they caught up in per capita VA, an additional market volume of around €15 trillion would be created. This shows the enormous growth potential of industry through the catching up of emerging countries.
- It is only possible to overcome various social challenges – from the growing world population to climate change – with technology and thus with industrial solutions.

In the following sections, these two lines of demand-side development will be explained in more detail.

Vibrant emerging markets

Since the turn of the millennium, emerging markets have economically decoupled from the advanced economies and a strong and sustainable convergence between the “poor” and “rich” world has gained momentum. This process is driven by more vibrant economic growth in emerging and developing countries (Figure 2-1). Thus, they become more dynamic drivers of the world economy. Their share of the total world GDP has almost doubled from 20 per cent on average in the 1980s and 1990s to 38 per cent in 2013. The EU has gained from this evolution by increasing their exports to these countries.

At the same time, emerging and developing countries have also driven global demand for manufactured and particularly for investment goods. In fact, global investment activities have shifted towards the (partly very populous) emerging and developing countries. Annual capital formation in the emerging and developing world skyrocketed from US\$1,700 billion [€1,807 billion] in 2002 to an estimated level of almost US\$9,300 billion [€7,237 billion] in 2013. Due to this giant investment boom, half of all global investments nowadays take place in emerging and developing countries. Looking ahead, catching-up countries will further become the centre of global capital formation. Nonetheless, the ongoing necessity to modernise and stay competitive will also drive demand for manufactured goods in advanced economies. Modern technological knowledge finds its way into modern production processes only by investment in and the application of new capital goods. This explains why countries with a relatively strong focus on the production of investment goods have recently performed quite well with external trade and manufacturing production (Grömling (2013)).

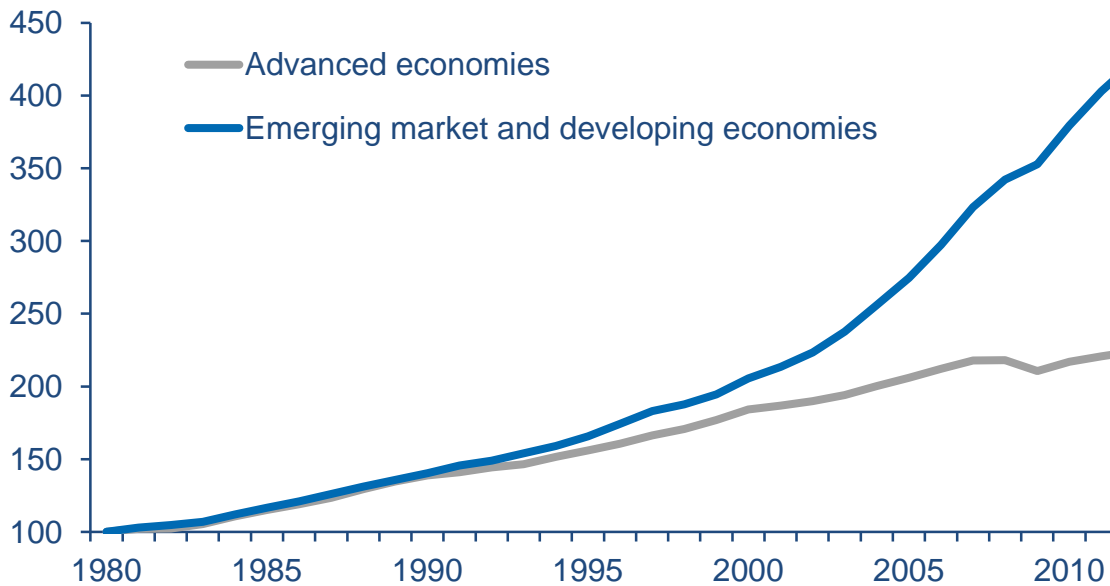
The catching up of emerging markets and the global demand for investment goods have obviously favoured manufacturing-oriented economies in the last decade. Looking ahead, there is good reason for an ongoing economic dynamic in emerging and developing markets.

⁹ VA of the manufacturing sector for the 50 leading industrial countries.

These confident perspectives for a growing demand for manufactured goods can be based on several long-term trends (Grömling and Hass (2009); Westkämper (2013)).

Figure 2-1: Growth of real GDP (1980–2010)

1980 = 100



Source: IMF (2013), own calculations.

Growing world population

The growing world population will benefit global demand. According to the latest projections by the United Nations (UN (2013)), the world population will increase from 7 billion people in 2013 to 9.5 billion in 2050. Almost the entire increase will be allotted to the current emerging and developing countries, particularly in Asia and Africa. The number of older people will triple to 2 billion in 2050 on a global scale. Against this background, world-market-oriented companies have good opportunities to expand their business and production. In particular, companies that focus on the rising demands of ageing populations will benefit. This is expected to be the case for firms in pharmaceutical, biotechnological and medical engineering sectors. Global construction companies and their numerous suppliers as well as machinery- and equipment-producing firms will benefit from increasing infrastructure investments driven by the demand of growing populations in currently poorly equipped countries.

Urbanisation

The structure of the world population will not only shift towards emerging and developing countries but the distribution of the world population will also shift from rural to urban areas. While in 1950 almost three-quarters of the world's population lived in rural areas, in 2008 for the first time in human history one half lived in urban areas. Between 2010 and 2050, the number of urbanites will almost double from 3.3 to 6.4 billion (UN (2013)). What does that mean? The insufficient traffic and transport infrastructure in many megacities cannot cope with the expected overcrowding; huge investments are necessary to avoid collapse – not only in transport infrastructure but also in the broad field of supply and removal facilities; and the relevant products and solutions will most often need to originate from the manufacturing sector.

Scarce resources

Despite the current moderate global dynamics, crude oil prices – as a showcase for resource prices – have remained high. Similar tendencies can be seen with other raw materials. In combination with the growing world population, this requires large adjustment burdens, but also offers huge opportunities. This holds true for the development and production of technologies to save or to substitute non-renewable resources with renewable ones like agricultural raw materials. For instance, the car industry and its suppliers in a variety of sectors have the potential to utilise innovative mobility concepts. Furthermore, the construction sector and the building materials industries might benefit from scarce resources, e.g. by an increasing necessity for energetic reconstruction.

Climate change

According to the Intergovernmental Panel on Climate Change (IPCC), the surface temperature on Earth will increase in the coming decades. Pronounced regional impairments are likely. These challenges might be greater in less developed countries where populations are growing and natural resources are scarce. Some regions might face an accumulation of adjustment burdens. This calls for a broad palette of solutions. The machine-building and electrical industries are drivers in developing environmental technologies. The chemical and pharmaceutical industries can also contribute to adjusting to climate changes while the energy industry faces a global window of opportunity.

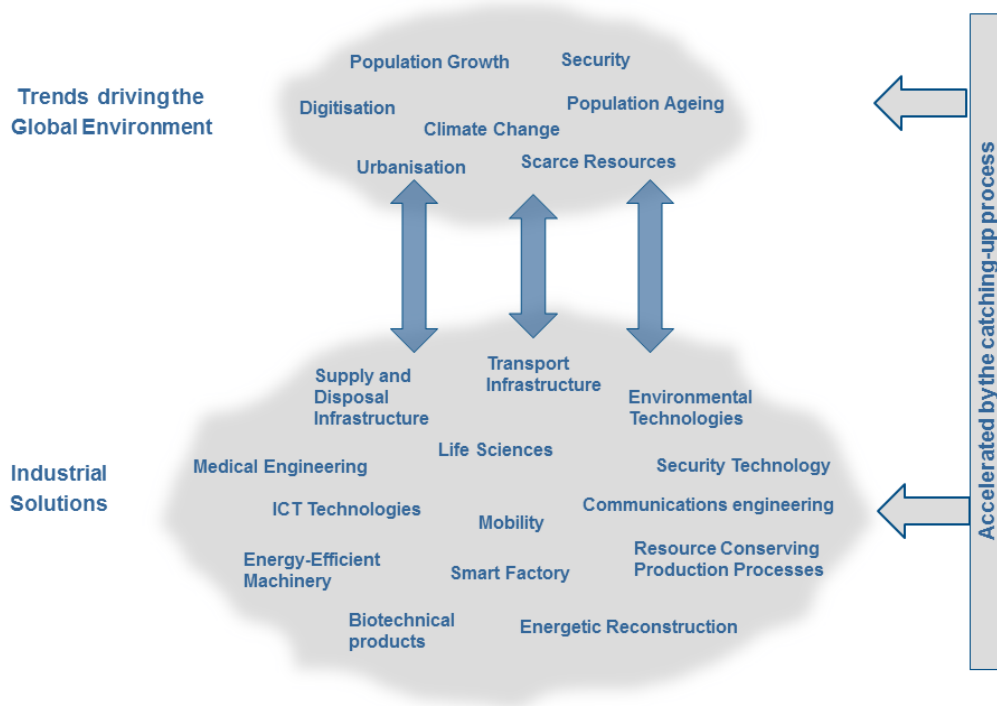
Digitisation

Digitisation is a global trend which strongly influences the behaviour of firms, consumers and state administrations. Today, the networking of people through social media or the linkage and control of production processes through Information and Communications Technology (ICT) are vital parts of modern society and business. Internet technologies in recent years have provided the decisive impulse. New concepts like smart factories or smart grid solutions are not possible without these technologies. The markets in these areas are growing significantly. Friedrich et al. (2013) have estimated that in 2011 worldwide digitisation contributed US\$193 trillion [€139 trillion] to GDP and created six million new jobs.

Security

Crime, terrorism, natural catastrophes, epidemics, cyber criminality – the list of dangers for life and limb is long. In the future, a variety of product innovations and accompanying services will be in great demand to serve the manifold security needs of the people. Because of the various sectoral crossovers, it is not clear which manufacturing and service industries will benefit. Using the example of natural catastrophes and health care, the chemical and pharmaceutical industries will play an important role.

Figure 2-2: Global trends and industrial solutions



Source: Grömling and Hass (2009), own illustration.

The aforementioned trends (Figure 2-2) will shape the future economic environment. On the one hand they represent considerable challenges while on the other hand they open huge opportunities for businesses, particularly from the manufacturing sector. A growing and urbanising global population has to deal with decreasing resources and climate change. Only manufacturing innovations and solutions will be able to tackle these adjustment burdens. However, it is not just the manufacturing sector that is relevant and responsible for our future welfare. In chapter 4, we illustrate clearly that

combinations of manufactured goods and accompanying services have been and will remain the road to success in the future.

In view of the opportunities for manufacturing pointed out here, the next chapter will show that industry has also had to face economic challenges which have contributed to a declining relative share of industry in the economy over time.

3 European industry: Back to 20 per cent

Public perception of structural change is often characterised by a constant downsizing of industry. That is only true in relative terms; in absolute numbers demand for and supply of manufactured goods have increased enormously over the last few decades. However, the increase of manufacturing output has been outpaced by service production and there are some good economic reasons for the long-term increase of the service sector share in total demand and final output.

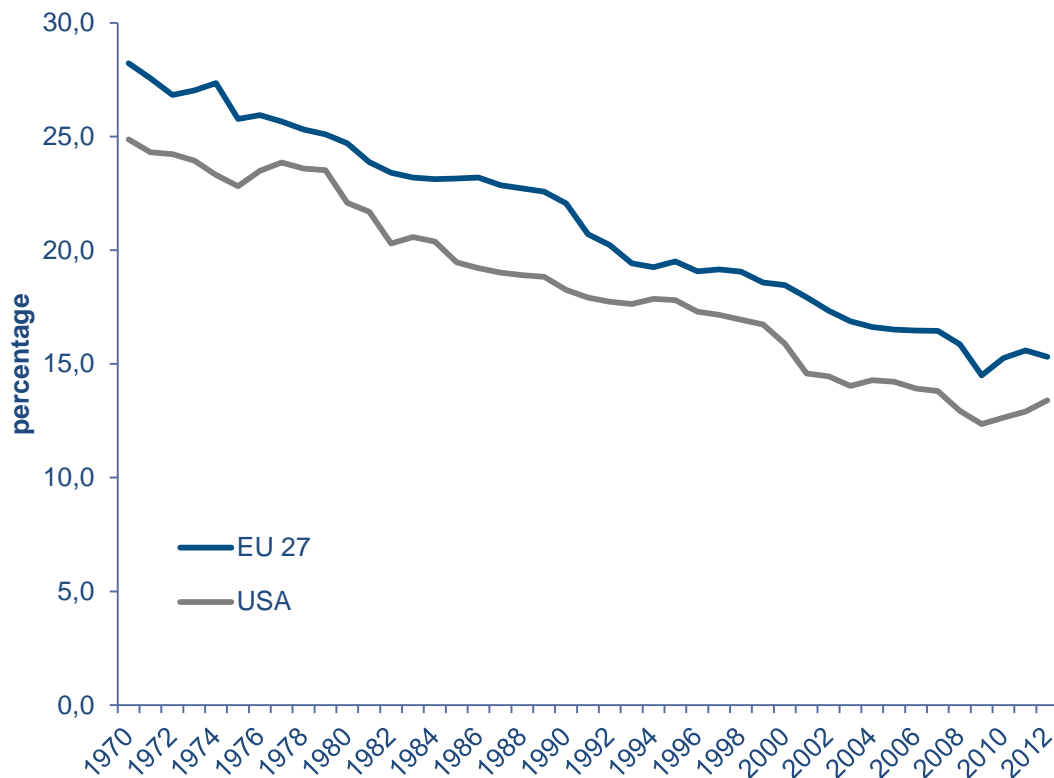
In a market economy, changes in the production structure of a country are also brought about by changing consumer demand. Early studies on the structural change reckoned that the demand for services increases disproportionately with rising income. The growing importance of the services sector is therefore also a prosperity-related phenomenon. If people's basic needs are largely met, then their interest in high-quality services in the areas of travel, housing, insurance or culture, for example, will increase. In addition, today's consumers demand a range of associated services whenever they buy certain products (see chapter 4.1). As our society becomes ever more complex, knowledge- or skill-intensive services also play an important role at the consumer level. The communication sector is a good example for this development. Furthermore, demographic change is another factor that is bound to increase private household demand for services. As the average age of populations rises, services such as health care are becoming much more relevant to households. A striking structural change at the consumer level can be seen in all advanced economies over the last two decades: consumer spending by private households on services jumped considerably in share, while spending on goods dropped.

Europe has a long history of manufacturing, which has influenced culture, welfare and social development in various ways. Industry can be seen as the backbone of the economy, contributing more than other sectors to research and development, innovation, exports and productivity growth. These growth drivers have made Europe one of the most progressive and prosperous regions in the world.

However, this positive view of manufacturing is somehow qualified by a declining industrial share in the total economy in the EU. In fact, deindustrialisation is a sustained global trend, equally manifest in Europe and elsewhere. In Europe, the share of manufacturing in total VA has declined to only 15 per cent; however, this is not a uniform trend and there are differences between countries and regions, which will be discussed in the following sections. At present, the societal importance of manufacturing is receiving improved recognition. Therefore it is positive that the EU has established the goal to increase the manufacturing share to 20 per cent.

Figure 3-1: Manufacturing's share of total VA (1970–2012)

in per cent



Source: AMECO (2013), OECD (2013), own calculations.

Figure 3-1 shows the decline of manufacturing's share of VA in the EU-27 from 1970 onwards. A very similar development can be observed in other developed countries. For example, in the US this share dropped from 25 per cent to around 13 per cent over the same period. The decline in the importance of industry is even more evident when looking into the employment figures.

Reasons for the decreasing share of manufacturing can be found not only on the demand, but also on the supply side. In this respect, a higher level of productivity in manufacturing than in the overall economy features as the main factor. A higher productivity level implies that industry needs less factor inputs (capital and labour) to produce one unit of output. This effect diminishes industry's employment share in the total economy compared to what it would be if the productivity of manufacturing merely reached the overall economy's average.

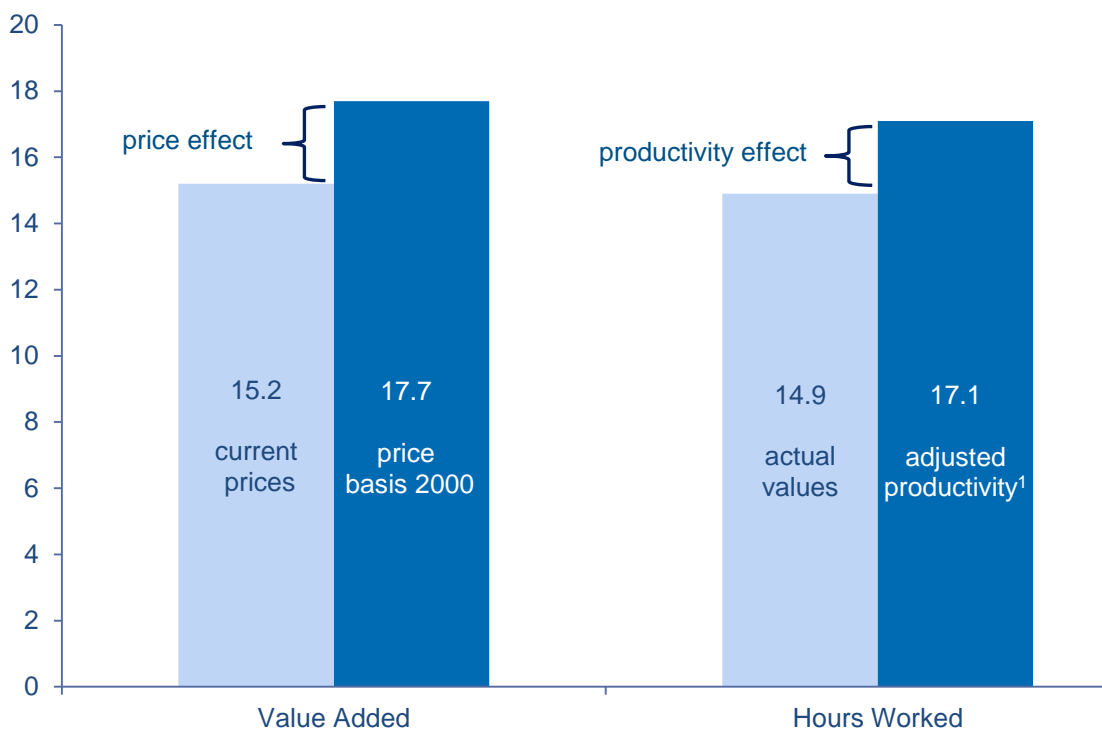
This effect can be illustrated by calculating a virtual industrial employment share, measured in working hours (see Figure 3-2), where the actual industrial VA is converted to the (virtual) employment level by using the overall economy's productivity level. As a result, the virtual employment share amounts to 17.1 per cent of total employment compared to the actual share of 14.9 per cent in 2012. The difference illustrates the effect of the differing productivity levels.

A second supply-side factor needs to be mentioned which contributes to the lower industrial share in VA: prices for manufacturing goods tend to increase more slowly compared to services. One important reason for this is due to relatively stronger competitive pressures in industry where more goods are traded internationally. Therefore, industrial businesses tend to pass on part of their productivity advantages to lower prices for industrial goods.

This effect is also depicted in Figure 3-2 by displaying a virtual industrial share of VA in the total economy (which is commonly determined by including price developments). This virtual share can be calculated by assuming that industrial goods prices remained constant for example compared to the year 2000 instead of having fallen compared to the overall price development since then. As a result of the constant price basis of the year 2000, the virtual industrial share of VA would have reached 17.1 per cent of the total economy instead of an actual share of 15.2 in 2012. In sum, industry has to some degree become a victim of its own success, as the higher level of productivity leads to lower shares in VA and employment.

Figure 3-2: Manufacturing's share of different economic activities in 2012

in per cent

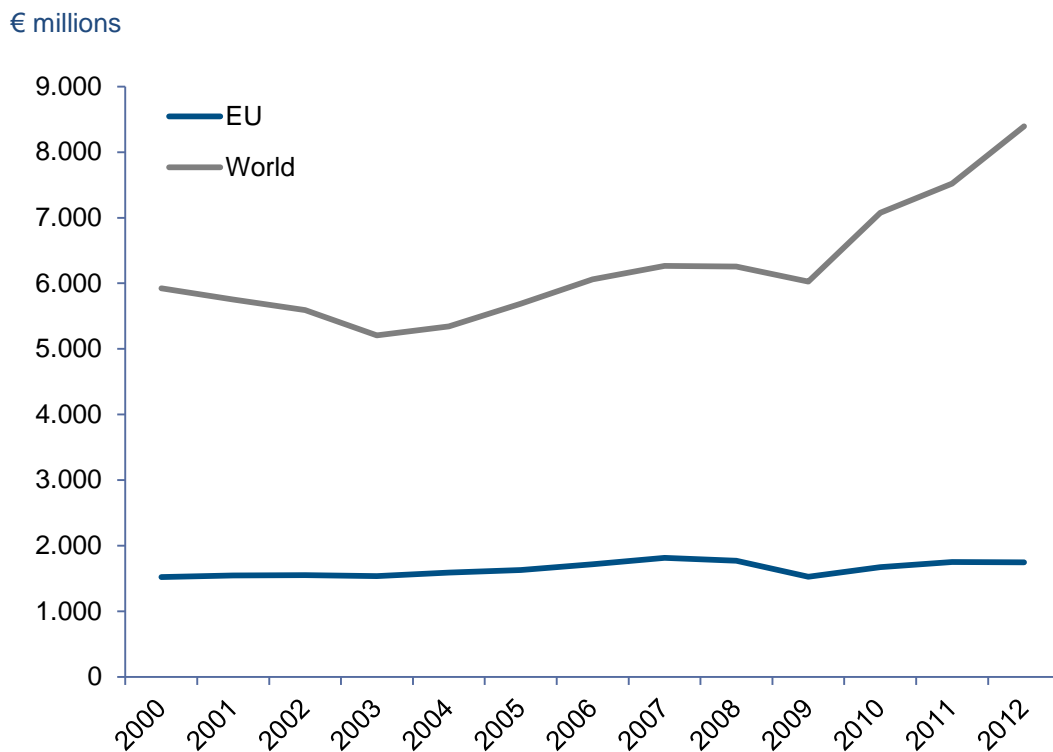


¹ The labour productivity is measured without distortion effects caused by the real estate sector.

Source: Eurostat (2013), own calculations.

However, despite falling industrial shares, the manufacturing sector is a growing market globally in absolute terms (Figure 3-3). The worldwide VA increased from €5.9 trillion (2000) to €8.4 trillion (2012) with EU growth from €1.5 trillion to €1.8 trillion. This positive finding does not apply to employment, however. In the EU, 6 million manufacturing jobs were lost between 2000 and 2012, when employment declined from 38 to 32 million people.

Figure 3-3: Growth of manufacturing's VA (2000–2012)



Source: UN (2013), OECD (2013), Eurostat (2013), own calculations.

In the following section, the main traces of the deindustrialisation trend will be described by putting the developments in the EU and its Member States in a global context. Afterwards, it will be pointed out that manufacturing nevertheless remains very important for the overall economy as a driver of growth and technical progress.

The structural change in Europe can only be understood in the context of the rapid rise in manufacturing VA in certain emerging countries. This can be illustrated by comparing different groups of developed and emerging countries (Table 3-1).¹⁰

¹⁰ This comparison includes 50 countries which represent around 95 per cent of VA in the manufacturing sector.

Table 3-1: Manufacturing's share of VA by regions, 2000 and 2012

	Manufacturing's share of total VA			Share of world manufacturing's VA		
	2000	2012	2000–2012	2000	2012	2000–2012
European Union	18.5	15.2	-3.3	25.7	20.8	-4.9
Other developed countries	18.0	15.1	-2.9	58.8	41.7	-17.1
Asian emerging countries	31.1	28.9	-2.2	9.6	27.5	17.9
Other emerging countries	17.9	15.4	-2.5	5.9	9.9	4.0
Total	18.9	17.4	-1.5	100	100	

Definition of country groups in appendix.

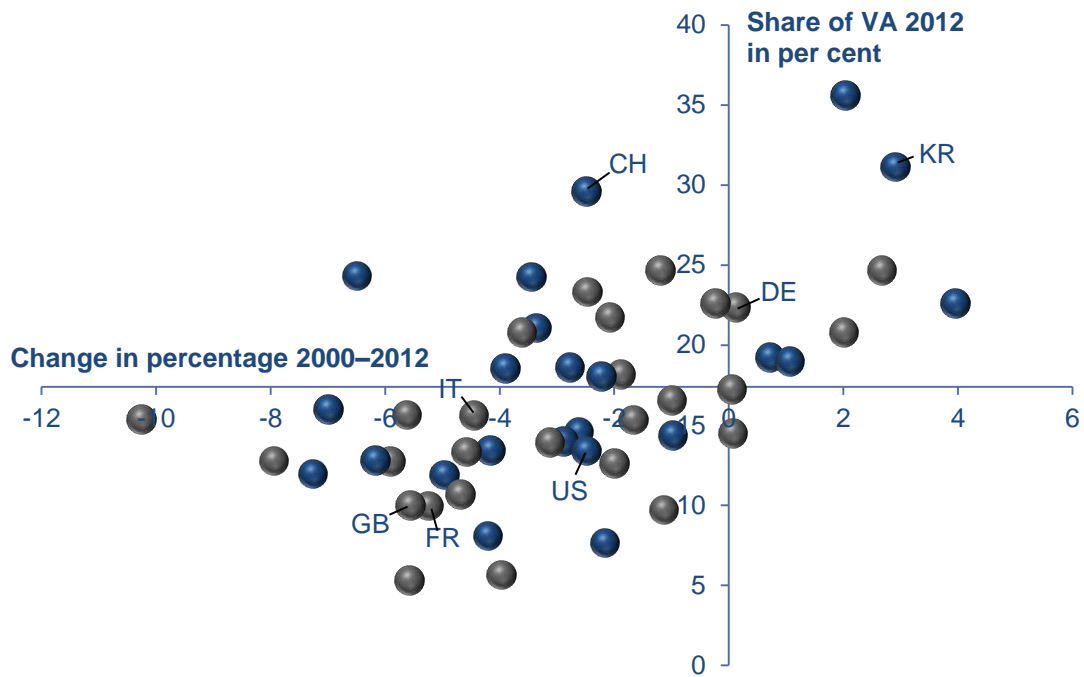
Source: UN (2013), OECD (2013), Eurostat (2013), own calculations.

The above table highlights three important phenomena:

- Deindustrialisation is a worldwide phenomenon. The share of manufacturing's VA in the total economy has declined on a global scale and in all regions.
- The decrease is particularly pronounced in the EU (-3.3 percentage points from 2000 to 2012). This is also reflected in the EU's declining share in worldwide manufacturing VA (-4.9 percentage points).
- Asian emerging markets, however, have become more important industrial players. In 2000 they accounted for 9.6 per cent and for 27.5 per cent of the worldwide manufacturing VA in 2012. In particular, China has contributed to this shift, with its share rising from around 7 per cent (2000) to almost 23 per cent (2012). China is now the world's largest industrialised country producing a VA of US\$2.45 trillion [€1.91 trillion] compared to US\$2.25 trillion [€1.75 trillion] in the EU.

Although it is widespread, deindustrialisation is not a fully encompassing phenomenon. This is shown in Figure 3-4, which plots the level of industry share in VA of the total economy for each country on the y-axis and the change of this share between 2000 and 2012 on the x-axis. In ten out of 50 countries included in our analysis, a share increase can be discerned. With the exception of South Korea, Switzerland and Germany, these are all emerging economies from Asia and Central and Eastern Europe (CEE) – countries that are still in an earlier phase in the secular trend of deindustrialisation. The other major industrial EU countries (France, Italy, Netherlands, Spain and the United Kingdom) as well as the US have displayed a decreasing relevance of manufacturing. That said, the US has seen reindustrialisation in the last two years due to increasing competitiveness because of low prices for energy, oil and gas which aid energy-intensive industries.

Figure 3-4: Manufacturing's share of VA and changes over time

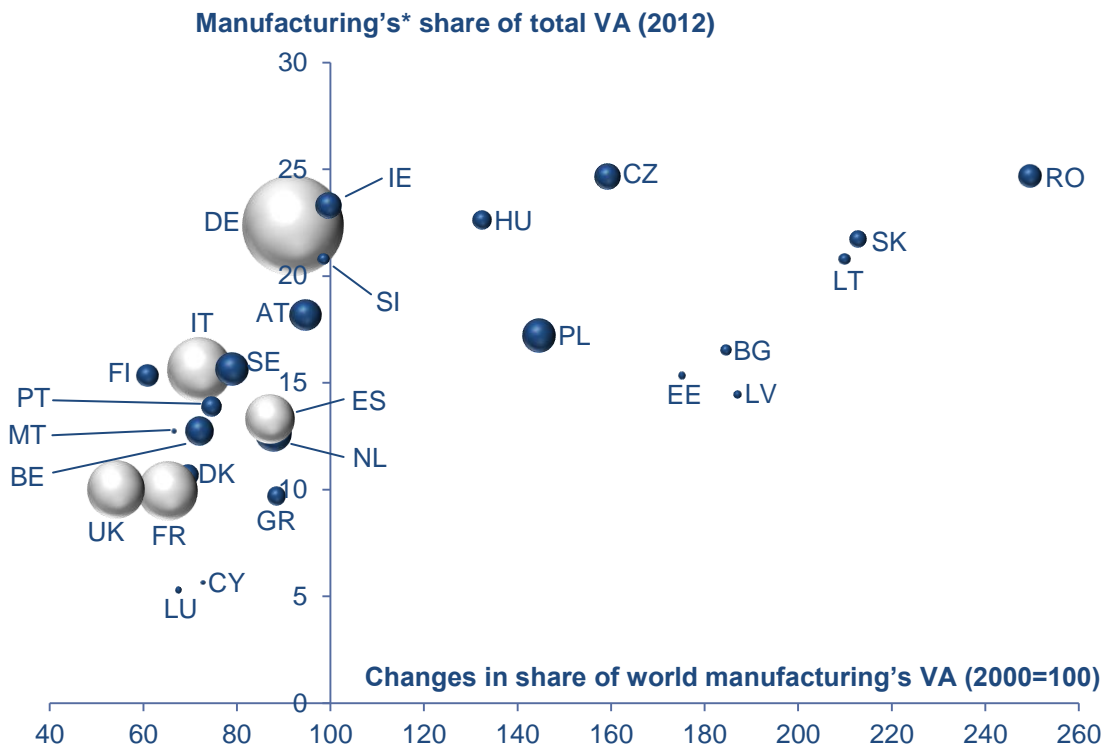


The EU-27 countries are shown in grey.

Source: UN (2013), OECD (2013), Eurostat (2013), own calculations.

Figure 3-5 offers a closer look at individual EU Member States by depicting three different dimensions: the manufacturing share of VA of the total economy within a country on the y-axis; the change of a country's share in worldwide industrial VA (measured as an index 2000=100) on the x-axis; and the country's share in worldwide industrial VA as the size of the bubble.

Figure 3-5: European manufacturing – View from three aspects



*Scale of bubbles corresponds to the world market share of manufacturing.

Source: UN (2013), OECD (2013), Eurostat (2013), own calculations.

Two main findings are important:

- The large difference between larger and smaller EU countries becomes obvious. The share in worldwide VA in 2012 among the large EU countries ranges from 6.4 per cent in Germany to 1.5 per cent in Spain.
- Looking at the change of the share in worldwide industrial VA, the majority of EU countries have had to accept declines. This is particularly true for the UK (with a share decline of -46 per cent), France (-35 per cent) and Italy (-28 per cent). In contrast, most EU countries from CEE have improved their share of world manufacturing's VA since 2000.

These findings are somewhat concerning because industry positively contributes to economic growth and technical progress, as the following empirical evidence highlights:

- In countries with an above-average specialisation in industry,¹¹ the growth of GDP has been stronger since 2000 (+149 per cent on average in euro terms) than in the comparison group of countries with below-average specialisation (+35 per cent on average). The same is true for the European Union but at a lower level: the industry-oriented Member States¹² grow by 43 per cent, the comparison group by 38 per cent.
- The Human Development Index¹³ (a broad concept to measure welfare in countries) developed better in countries with above-average industry orientation (+8.2 per cent on average) than in the comparison group (+5.3 per cent on average) from 2000 to 2012. Similar results apply in the European Union: 6.1 per cent for industry-oriented Member States and 4.5 per cent for others.
- Industry is a driver of technical progress: if the industry share in the total economy VA increases by one percentage point, total factor productivity (a measure for technical progress) rises on average by 0.28 per cent (Stöllinger et al. (2013)).

In this context, it appears that deindustrialisation in the EU and particularly in several Member States might have progressed too far. The following chapter provides additional evidence that the manufacturing sector is the backbone of an economy and features as an important driver of research and development, innovation, exports and income.

¹¹ Included are the 50 most industrialised countries; industrial-orientated countries are defined as having a manufacturing share of VA above the world average (17.4 per cent in 2012).

¹² European Member states with a manufacturing share of VA above 15.2 per cent.

¹³ The HDI is a new way of measuring a nation's welfare by combining indicators of life expectancy, educational attainment and income. The index is provided by the United Nations.

4 Manufacturing – growth engine in a connected world

As pointed out in the preceding chapter, the importance of industry should not merely be judged by its direct contribution to the total VA. Instead, industry is not only an important growth driver but also a shaper of its environment in an increasingly connected and rapidly changing world. The ongoing process of global structural change is driven by the following three megatrends, which also affect and challenge EU industry:

- tertiarisation (increasing relevance of services);
- globalisation; and
- knowledge intensification.

Industrial businesses have long-term experience of integrating these trends in their strategies and thus seizing the new opportunities the megatrends offer.

Figure 4-1 demonstrates the main characteristics of each megatrend. In addition, the inner grey rectangle shows that businesses increasingly interact and cooperate in the framework of these megatrends:

- increasing service integration;
- expanding joint production;
- deeper GVCs;
- growing innovation networks;
- interconnecting digitisation of production; and
- sustaining intra-industrial value chains.

These new opportunities for integration and networking on the firm level are the focus of this study and form the basis of the new paradigm of cooperation developed here. It will be illustrated that industry plays a vital role as a hub of the joint industry-service sector, as an organiser of connected value chains and as the source of knowledge and innovations. Additionally, the importance for frontrunners will be highlighted.

Overall, the importance of the manufacturing sector is much greater than its own share of total VA, because industry plays a leading role in the creation of knowledge due to its high R&D and innovation activities combined with above-average internationalisation.

Three arguments can illustrate this. With a share of VA of 15 per cent, the manufacturing sector in the EU accounts for

- 65 per cent of R&D expenditure;
- 57 per cent of exports (including services); and
- 49 per cent of all expenditure on innovation.

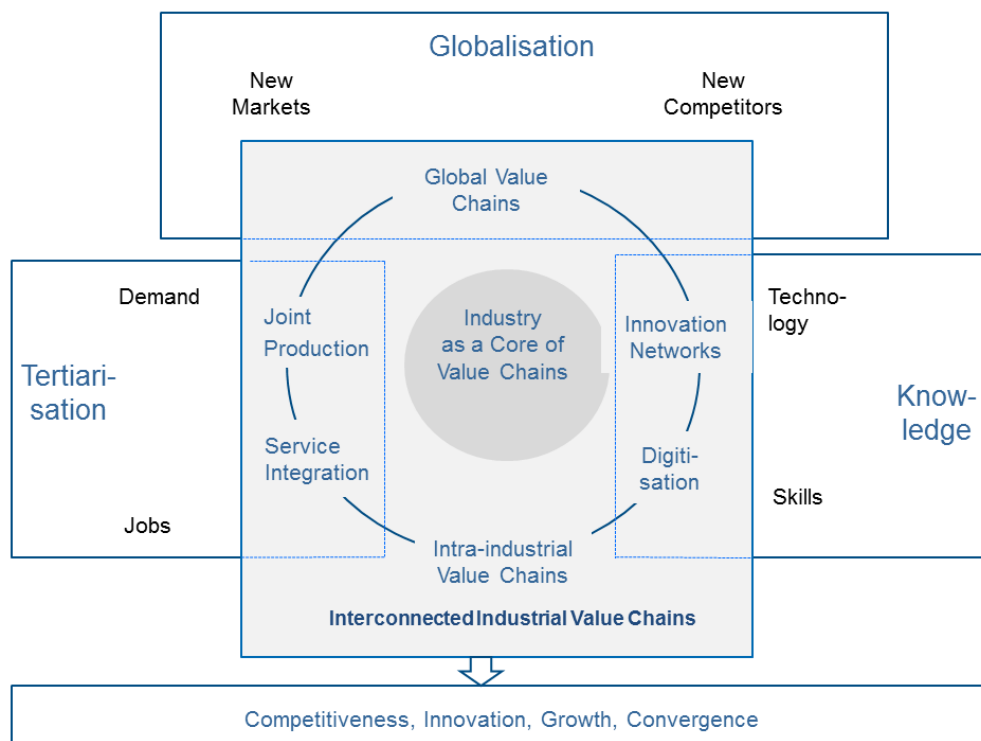
These and other positive contributions of the manufacturing sector for the overall economy are explained in more detail below.

Outline of chapter 4

This chapter is organised according to the megatrends depicted in Figure 4-1 and mainly focuses on the opportunities offered for businesses and industry to increase competitiveness and performance. Moreover, the key elements of the “Moving Forward Together in Europe” paradigm are developed.

- Chapter 4.1 on tertiarisation concentrates on the intensive linkages in domestic value chains between industry and services (and other sectors). The function of industry as a hub for the economy, which generates important economic spillovers to other sectors, is highlighted. Also the relevance of intra-industrial linkages particularly with energy-intensive material suppliers is explained.
- Chapter 4.2 on globalisation demonstrates industry’s key role as a driver of internationalisation and particularly as an export engine. Moreover, manufacturing is central as a platform for integration in GVCs. These global activities together with increasing and upgrading products can contribute to meeting the challenges of globalisation, mainly in the form of rising import competition as the chapter shows in more detail.
- Chapter 4.3 on knowledge intensification points out the decisive role of industry for research and innovation and thus as a driver of economic progress. Moreover the key role of cooperation for innovation in networks and the potential to extend cross-country networks is highlighted.

Figure 4-1: Megatrends in the world economy



Source: own illustration.

4.1 Industrial hubs and service integration

The tertiarisation of the economy, i.e. a growing relevance of services in general, is a significant megatrend not only in the European Union but also worldwide (Figure 4-1). A major reason for this phenomenon is the shift in demand towards service products (see chapter 3). As a result, the service sector's share of total VA and employment have been constantly growing. This effect is intensified by higher productivity gains in manufacturing. Furthermore, service activities in industrial companies increase relative to pure manufacturing activities. Fewer workers are involved in classic industrial production activities.

However, the deindustrialisation process is often overstated. Manufacturing is more relevant for the economy than its share in total VA suggests. In this chapter, the key message that industry and services become even more integrated is illustrated with different facts. Our analysis highlights the function of manufacturing as the hub of the economy, i.e. the organisational core of value chains which integrates intermediates from other sectors into its products.

The most important message is that industry should not be seen as a single branch, but as a “Joint Industry Service Sector”.

4.1.1 Industry spillovers to the total economy

Industry plays a vital role in value chains, is an important market for suppliers from other sectors and creates significant spillovers to other sectors. This is illustrated in this subsection by explaining

- how industry serves as a market for other sectors;
- that this role of industry is particularly important for SMEs from the service sector;
- that industry and other sectors (mainly services) are cooperating in “Joint Production” and that a “Combined Sector” of industry and “Joint Production” should be looked at to evaluate the true relevance of industry;
- that due to this symbiosis between industry and other sectors, manufacturing generates significant multiplier effects for other sectors; and
- how industry as a hub is also strongly linked to other sectors across borders in Europe.

Methodological remarks

At the outset, some methodological remarks are useful. Industry's role as a hub for the economy can be illustrated by input-output tables. To understand the following remarks and figures, it is helpful to know which components of manufacturing output are included:

Imported intermediates from manufacturing and other sectors supplied to manufacturing
 + domestic intermediates from manufacturing and other sectors supplied to manufacturing
 = **overall intermediate inputs** of manufacturing
 + taxes, subsidies, etc.
 + **VA** of manufacturing
 = **output** of manufacturing

In this study, the WIOD (World Input-Output Database) is used. The WIOD provides data for 40 countries and 38 sectors (intermediate inputs, VA, exports, imports as well as wage bills, working

hours, investments) for the years 1995 to 2011.¹⁴ Thereby, national and cross-border value chains and production networks can be illustrated. Furthermore, spillover effects and multipliers can be calculated in a consistent way.

Service integration

Due to an exchange of intermediates, the manufacturing sector is closely linked to other sectors. This can be demonstrated by several analyses based on input-output tables:

- In 2011,¹⁵ each euro output for the manufacturing sector in the EU-27¹⁶ contained 34 cents for intermediates from other sectors. Another 35 cents came from intermediates from other parts of the manufacturing sector. The remaining share of VA is about 27 cents¹⁷ per euro.
- The share of suppliers of intermediates from other sectors has increased: in 2000 it was 32 cents.

Industry also sells goods and services from other sectors. This is the first significant integration function of the manufacturing sector. A more detailed analysis shows that these supplies mainly come from the service sector. For that purpose, the 35 sectors of the input-output tables are classified in ten groups.

- Each euro's worth of production in the manufacturing sector contains 26 cents from intermediates in the service sector and 9 cents from other sectors such as construction or agriculture. This highlights the connection of the manufacturing sector particularly to the service sector.
- The share of services in industrial products has increased slightly: in 2000 the share amounted to around 23 cents, in 1995 around 22 cents.

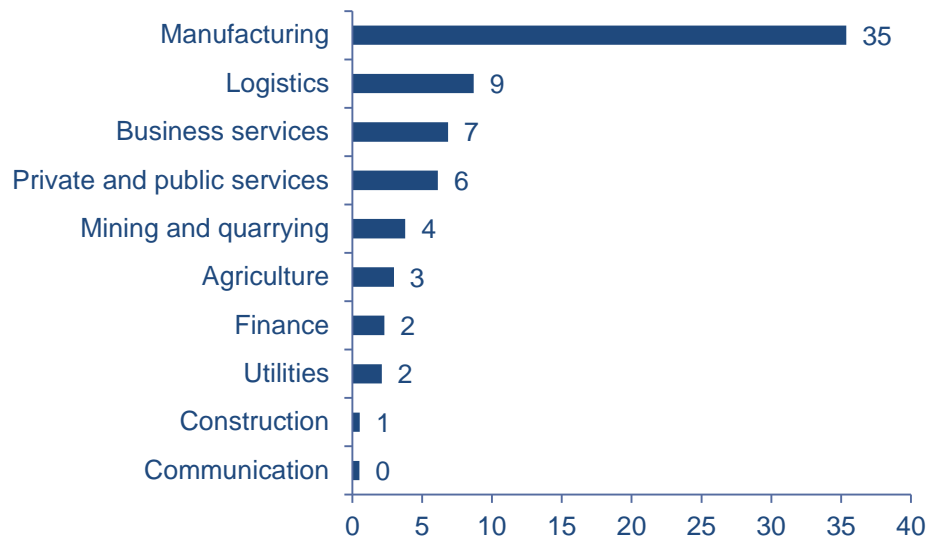
¹⁴ The WIOD has been developed and made available in the course of an EU research project headed by Marcel P. Timmer (University of Groningen). These data tables have been constructed in a clear conceptual framework on the basis of officially published input-output tables in conjunction with national accounts and international trade statistics. In addition, the WIOD provides data on labour and capital inputs and pollution indicators at the industry level that can be used in conjunction with enlarging the scope of possible applications. The WIOD is very useful because for the first time data are available in a matrix structure of countries and sectors on a consistent and timely basis. The newest data for 2011 have been available since mid-November 2013. Additional information is available in Timmer et al. (2012) or at <http://www.wiod.org>.

¹⁵ These results are calculated based on the world input-output database.

¹⁶ The weighted averages of all Member States are presented as EU-27 values; effects of trade within the EU-27 are included.

¹⁷ Four cents of every euro's production value is spread over taxes, subsidies and statistical adjustments.

Figure 4-2: Intermediate input share for one unit of manufacturing production (2011)



In per cent, missing shares to 100 per cent are own VA (27 per cent) and taxes, subsidies and statistical adjustments (4 per cent).

Source: WIOD (2013), own calculations.

The role of SMEs

An efficient economy needs a good mix between SMEs and larger companies. SMEs are often referred to as the backbone of the economy because they significantly contribute to industrial value chains. Before going into detail, some core data about the importance of industrial SMEs are provided. SMEs are companies with up to 249 employees, which corresponds to the EU's official definition (Table 4-1).

- In the manufacturing sector, 99.2 per cent of companies in the EU-27 belong to the group of SMEs.
- Industrial SMEs account for 59 per cent of employees, 45 per cent of VA and 39 per cent of sales in manufacturing.
- Within the group of SMEs across all sectors, 10 per cent belong to the manufacturing sector but account for 21 per cent of the VA of all SMEs. This highlights the importance of industrial SMEs.

Table 4-1: Key facts about SMEs in the European industry (2012)

in per cent

	SMEs' total share in the manufacturing sector	Manufacturing's share of total SMEs
Firms	99.2	10.3
Employment	59.2	21.1
VA	45.4	21.4
Gross investments	43.7	16.7
Turnover	39.1	19.5
Wages and salaries	45.9	23.1

Source: ECORYS (2013).

By connecting the data on SMEs and the WIOD input-output tables, the relevance of SMEs in the value chain of the manufacturing sector can be illustrated. In 2011 the EU manufacturing sector generated a production value of US\$9.45 trillion; SMEs and larger companies (LE), each amount for around US\$4 trillion, more than 40 per cent of the total production value, respectively. The additional share of almost 15 per cent originates from intermediates from non-EU countries (11 per cent) and taxes, subsidies, etc. (4 per cent).

Figure 4-3 explains how these figures have been calculated.

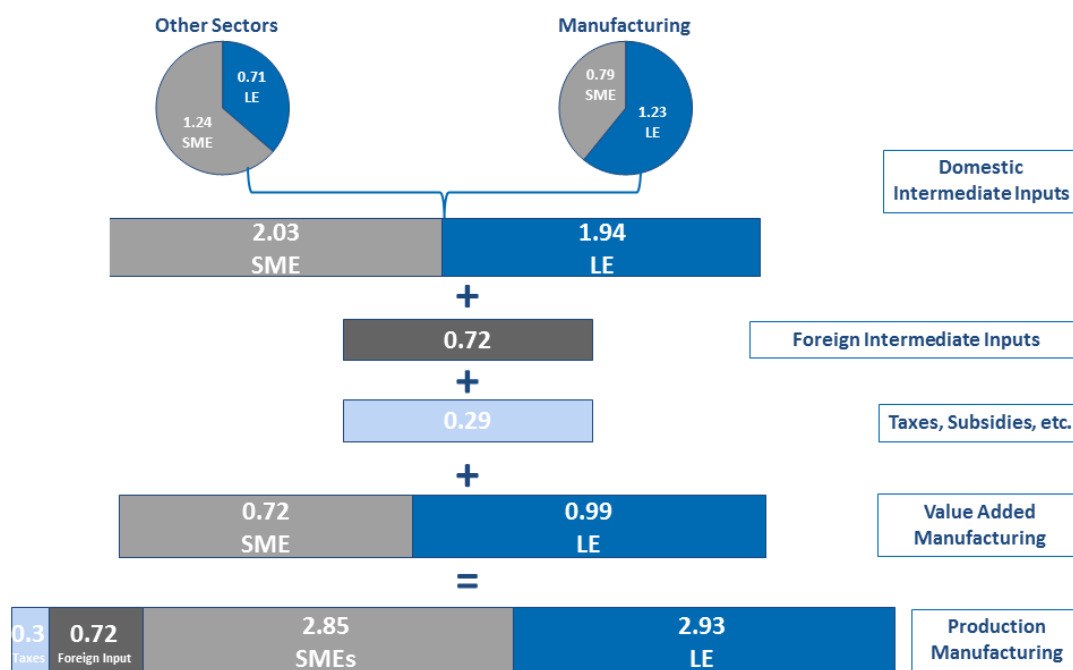
- The lowest main bar shows the above result that US\$3.96 trillion (42 per cent) of manufacturing output is generated by SMEs. Moreover, it displays how the manufacturing output can be subdivided into its two main components: intermediate goods (upper main bar) and VA (middle main bar).
- Regarding the upper main bar of intermediate inputs to manufacturing, the distribution between SMEs and larger enterprises can be derived from the WIOD and the official enterprise size statistics. This has to be done separately for supplies from other sectors and from manufacturing (according to the circles on top).
- The other domestic sectors (upper left circle) provide the manufacturing sector with intermediates amounting to US\$2.71 trillion. Almost 64 per cent or US\$1.72 trillion originate from SMEs. This demonstrates the importance of the manufacturing sector, especially for smaller service companies.
- In manufacturing (the upper right circle) the above-mentioned SMEs' sales share of 39 per cent is relevant and leads to a value of US\$1.1 trillion (of overall US\$2.81 trillion of intermediates supplied by manufacturing to manufacturing).

- In the upper middle bar, the absolute amounts supplied by SMEs and LEs are brought together, respectively from the above circles.
- The middle main bar relies on the above-mentioned information that SMEs contribute 45 per cent to manufacturing VA.
- Eventually all bars (including minor bars) are added up to US\$9.45 trillion and display the SMEs' share of 43 per cent overall.

In summary, SMEs “serve” about more than two-fifths of the industrial value chains. It is particularly noteworthy that industry has an important integrating function for SMEs from the service sector which form the main part of the upper left circle. Since 2005 SMEs share on industrial value chains has been constant even though the foreign share in the output has risen from 8 per cent (2005) to 11 per cent (2011).

Figure 4-3: Shares of industrial value chains by firm size

in € trillions



Source: WIOD (2013); ECORYS (2013), own calculations.

Joint Production

The exchanges between the manufacturing sector and other sectors run in both directions. However, the EU manufacturing sector buys more intermediates than it sells. On balance, industry is therefore an important market for others in the EU and creates important spillover effects to the overall economy.

This balance of purchases and sales of intermediates can be called “Joint Production”¹⁸ because it is the VA that the manufacturing sector and the group of other sectors produce together (Table 4-2):

- Adding up the contribution of the EU manufacturing sector (15.8 per cent) and the share of VA created through Joint Production (8.5 per cent), industry contributes 24.3 per cent to the total VA (2011). This is higher than the world average (20.8 per cent) and also significantly higher than the equivalent in other developed countries (17.0 per cent).
- The relevance of Joint Production is significantly larger in the EU than in other regions. On average, the VA contribution of the 50 analysed leading developed countries is 3.7 per cent.

These results demonstrate that the importance of industry is underestimated when (as is usually the case) only the manufacturing share of VA is looked at. Especially in Europe, the manufacturing sector is a major hub for the organisation of value chains. Moreover, these insights highlight that the often suggested traditional antagonism between industry and services is no longer relevant.

However, it should be remembered that it is not obvious which sector is more important in initiating this integrated production. This is why the term “Joint Industry Service Sector” or “Joint Production” will be used in the current report.

¹⁸ Manufacturing’s purchases of intermediate inputs from other sectors minus their sales of intermediate inputs to other sectors in per cent of total VA; only considers domestic production.

Table 4-2: Manufacturing sector's contribution to VA (2011)

in per cent

	Joint Production	Manufacturing's share of VA	Total
European Union	8.5	15.8	24.3
Other developed countries	2.1	14.9	17.0
Asian emerging countries	-0.5	31.8	31.3
Other emerging countries	3.8	14.8	18.5
Total	3.7	17.1	20.8

Source: WIOD (2013), own calculations.

A closer look at the individual EU countries shows significant differences in Joint Production (Figure 4-4):

- In EU Member States with an above-average industry specialisation, Joint Production is relatively more important: the Czech Republic, Slovakia and Hungary in particular display a much higher share.
- Adding up the share of manufacturing and “Joint Production sector” in total VA, four EU Member States reach a level above 30 per cent.

Figure 4-4: Manufacturing and Joint Production sector¹ – share of VA (2011)

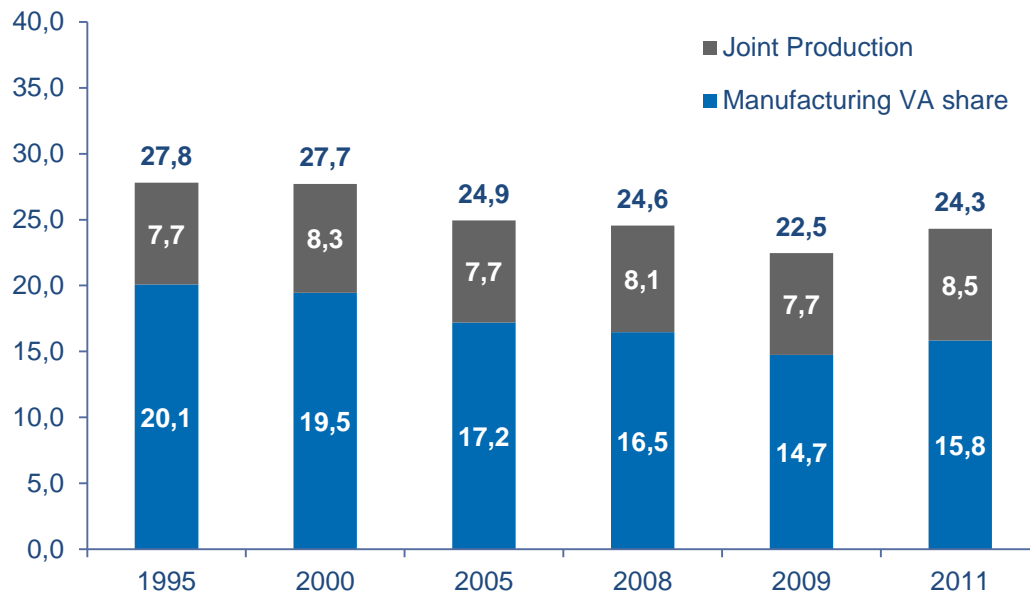


¹Joint Production: Manufacturing's purchases of intermediate inputs from other sectors minus their sales of intermediate inputs to other sectors in per cent of total VA; only considers domestic production.

Source: WIOD (2013), own calculations.

The manufacturing industry's share of total VA (Figure 4-5) has recovered from the economic crisis in 2009. The share of the "Joint Industry Service Sector" in the total economy is back up to a level equal to 2008. This is mainly due to the increase in Joint Production (service integration effect), which is at the highest level measured in the six reference years. Its share of the impact of manufacturing increased from 28 per cent in 1995 to 35 per cent in 2011.

Figure 4-5: Manufacturing and Joint Production sector¹ – share of VA (1995–2011)



¹Joint Production: Manufacturing's purchases of intermediate inputs from other sectors minus their sales of intermediate inputs to other sectors in per cent of total VA; only considers domestic production. Shares of total EU-27 VA in per cent.

Source: WIOD (2013), own calculations.

Multiplier effects on production

The positive effects the manufacturing sector generates for the total economy can also be illustrated by multiplier effects. They measure the change in total output of the economy for each additional unit of demand for the products of a specific sector:

- For each one per cent increase in the demand for manufacturing products (domestic demand or export) created in all EU Member States, the average total domestic output of all Member States increases by 1.68 per cent.
- This leverage effect is only 1.57 per cent in other sectors such as the service sector.
- The multiplier effects are slightly higher in economies outside the EU-27. In particular this applies to the group of Asian emerging countries, which is not surprising due to their high degree of industrialisation. But a second argument is important, too: in countries with a higher level of internationalisation of products, this multiplier effect is lower because a higher part of the production effect is generated abroad. Indeed, the degree of internationalisation is lower in Asian emerging countries than in the EU-27.

Table 4-3: Multiplier effects (2011)

	Manufacturing sector	Other sectors
EU-27	1.68	1.57
Other developed countries	1.94	1.57
Asian emerging countries	2.77	1.98
Total	1.94	1.62

Multiplier effect: Growth of total domestic output, which is initiated by the growth of demand by one unit in the manufacturing sector (other sector).

Source: WIOD (2013), own calculations.

Multiplier effects on employment

Based on the “Combined Sector” view, manufacturing also has a significantly better employment record than when viewed on its own. Using input-output tables, employees creating intermediate inputs (e.g. business services, mining) for the manufacturing sector can be calculated. Without the manufacturing sector, these jobs would not exist. For example, the business services, logistics and utilities industries delivered nearly one-fifth of their output in 2011 to the manufacturing sector.

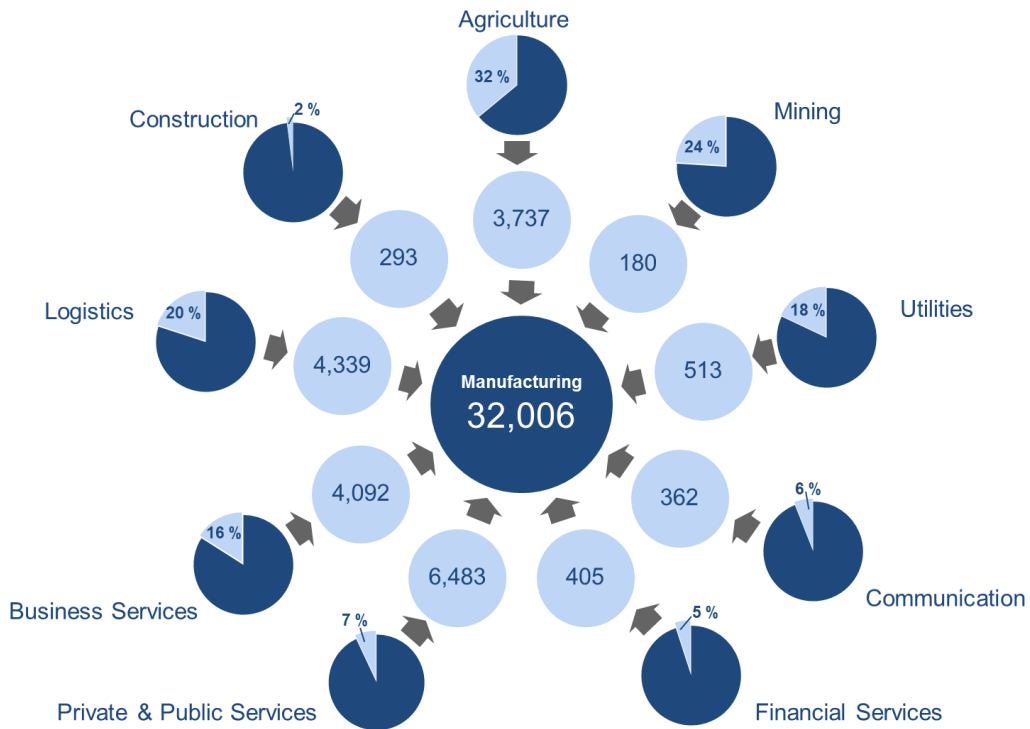
To evaluate this number we first take the share of intermediate products these supply sectors sell to the manufacturing industry. Employees are allocated proportionally by turnover shares which are delivered to the manufacturing sector. For example: the agriculture sector sells 32 per cent of its total output or turnover to the manufacturing sector. Accordingly, 32 per cent of employees in the agricultural sector are allocated to the manufacturing sector; this is called indirect employment. Figure 4-6 shows the employment effects of nine sectors:¹⁹

- Around 32 million people are employed in the manufacturing sector. In the EU Member States 20.4 million jobs depend on deliveries from other sectors to the manufacturing sector, of which the public and private service sector has the largest share with 6.5 million employees. Thus, approximately 52 million jobs in the EU depend directly or indirectly on industry.
- This number has declined due to the deindustrialisation of the economy: in 2000, 61 million jobs were directly or indirectly connected to manufacturing.

¹⁹ The sales structure is taken from the input-output tables for 2011. The employment data are from 2012.

Figure 4-6: Direct and indirect employment in the manufacturing sector (2012)

in 1,000 employees



Source: Eurostat (2013), WIOD (2013), own calculations.

These three perspectives (Joint Production, multipliers and associated employees) illustrate the role of the manufacturing sector as the hub of the economy creating dynamic spillover effects. As a result, it is also important for the overall economy that the EU industrial sector is stabilised. However, the service sector also accounts for several positive impulse effects for this “Joint Industry Service Sector”.

European production network

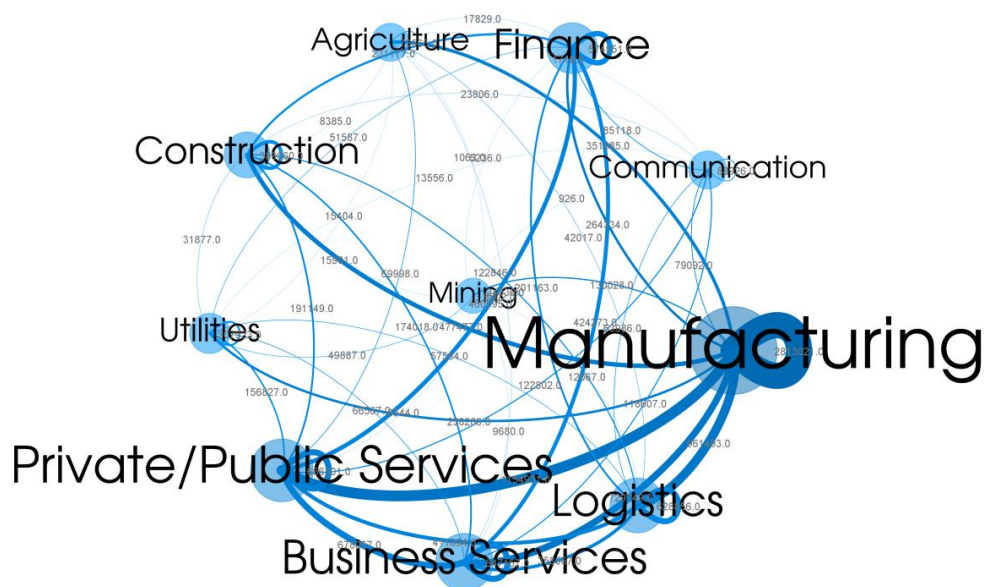
Figure 4-7 demonstrates how intensively industry in Europe is linked via intermediates with other sector groups (taking into account all deliveries and purchases of intermediates within the EU-27). The size of the knots illustrates the amounts (true to scale) of all procured and supplied intermediates for each sector. The intermediate flows between the sector groups are represented by the connecting lines.

The following results stand out:

- The manufacturing sector features as the core of the European production network. Industry is involved in 48 per cent of all intermediates' flows.
- Manufacturing is also involved in three of the five highest-volume exchange relations. This applies to the intermediate linkages with the public/private, logistics and business services sectors.
- Several other sectors (construction, agriculture, utilities) are also closely connected to industry.

The manufacturing sector in Europe accounts for 15 per cent of the total VA and 28 per cent of the total production. Figure 4-7 vividly illustrates the particular importance of industry as the core of EU value chains.

Figure 4-7: EU production network illustrated by intermediate inputs (2011)



Source: WIOD (2013), own illustration, made with Gephi.

4.1.2 Service integration potential

This subsection explains and provides evidence that the industry-service integration is beneficial for all participants.²⁰ It has two main dimensions. First, on the sectoral level, traditional outsourcing implies that industrial firms purchase intermediates which they have previously produced themselves from other sectors. Financial reasons or specialisation advantages are the main reasons for this. Second, service activities are increasingly integrated into industrial products in order to develop and produce innovative products tailored to customers' needs. These products can be termed "hybrid products" because they simultaneously combine elements from services and industrial products. This mix offers consumers a new product. Increasing numbers of manufacturing firms are shifting from pure manufacturing to a combination of manufacturing and services (Wise and Baumgartner (1999)). There are several examples of this phenomenon:

- Integrated services in cars: More and more service functions for communication, entertainment, navigation or safety are integrated in cars. In this way the car is upgraded and the result is a modified product with new features. The focus here is mainly on embedded software, i.e. on the fusion of software and hardware components into new products.
- Performance guarantees: Industry no longer only provides pure industrial products as the value chains are extended through upstream and downstream services and are then sold in this package. A manufacturer of machinery not only provides the machine but at the same time also guarantees that the machine fulfils certain properties (e.g. downtime minimisation). To ensure this, the machine builder – or a partner company – also offers maintenance, spare parts management, continuous development and optimisation of the system as an integrated service.
- Contracting models: The adoption of services by industrial companies can go so far that the utility or output is sold rather than the machinery. One example is the provision of compressed air for industrial manufacturing processes. The company no longer buys compression but rather the provision on demand through the producer of compressors. In these contracting models, the manufacturer of an industrial product also offers a complex service and is responsible for all risks.

This list can easily be extended (Bruegel (2013)). The transfer of sales activities through the producers of textiles, the adoption of production activities through logistics companies or the provision of mobility through car-sharing systems are further examples.

Due to lack of data and statistics, this important trend is difficult to illustrate with empirical facts. The official statistics at the sectoral level are not useful because these aspects can only be analysed at the company level. A limited number of case studies indicate that the implementation of service-based concepts is becoming a global business trend. In the literature, this trend has been described as "product-service-systems", "servitisation"²¹ or "tertiarisation of production".

²⁰ See Bruegel (2013), p. 103: "[...] services have taken on greater importance for manufacturing competitiveness; manufacturing exports include significant VA in service industries. [...] The value of manufactured products increasingly reflects service inputs because services play a crucial role as 'enablers' of GVCs."

²¹ Bruegel (2013), p. 27 describes this trend as "servitisation" of manufacturing and the blurring of the boundary between industry and services.

Only a few large-scale empirical studies exist that are based on enterprise surveys. Two examples clearly show that service integration is a successful strategy:

- Lay et al. (2010) show that most manufacturing companies offer some kind of services along the value chain. In a sample of nearly 2,000 European manufacturing companies, over 85 per cent appeared on the market as service providers. The offering of services as a core competence remains the exception.²² On average, 16 per cent of their turnover was generated by services. Seven percentage points were generated as a direct invoice. Nine percentage points were already included in the price of the final goods. These results indicate a relatively low level of maturity within the service strategy of the companies. Most of the services are still product-oriented, like the customisation of product installation and maintenance. More than two-thirds of the surveyed companies reported such service activities. Using regression analysis, the service infusion of a certain company increases significantly with the level of customisation, the share of new products and the importance of services for the business model of the company.
- A study for Germany (IW Consult (2011)) indicates that manufacturing companies with a long value chain are more successful than those with a shorter value chain. The length of the value chain is measured by the number of upstream and downstream services²³ offered in addition to the industrial products from the company itself or from partners. The measured success (in terms of turnover, employment and return) increases with the number of integrated services. Companies with these hybrid business models are more international, innovative and invest more in research and development.

These findings also apply to SMEs. Hybrid business models in particular give small and medium-sized companies the opportunity to participate as an equal partner directly with their specific products in long supply chains. The study also illustrates that so far only a minority of the companies (16 per cent) actively participate in long supply chains. This proportion is expected to increase to 20 per cent in the next few years. Hybrid business models create unique selling points and also provide the opportunity for companies to distance themselves from competitors, especially from those from less developed countries.

In summary, industry and services tend to merge more and more to the benefit of both sides (Bruegel (2013)). Service providers profit from higher sales, and manufacturing businesses take advantage of specialised and efficient intermediate service inputs. In addition, hybrid business models create unique selling features that allow the highly advanced developed European countries to succeed in the global market. The important high command of complexity can be seen as the core competence. Also, SMEs can integrate into these value chains and seize the opportunity to access highly attractive markets.

²² A study by Neely (2008) reports a share of 35 per cent.

²³ These include companies that offer at least 12 out of 20 upstream or downstream services. The results are robust to changes of this limit.

4.1.3 Intra-industrial value chains

Exchange relations exist not only between the manufacturing sector and other sectors but also within the manufacturing sector. Functional specialisations of individual sectors in the value chain are common, especially in the manufacturing sector. Therefore, a successful economic area is characterised by a well-diversified economic structure and thus a long, deep and far-reaching value chain. This also applies to raw material- and energy-intensive sectors that provide indispensable intermediates to other manufacturing subsectors.²⁴ An international comparison shows that the value chains of the EU-27 countries are more specialised and less diversified.

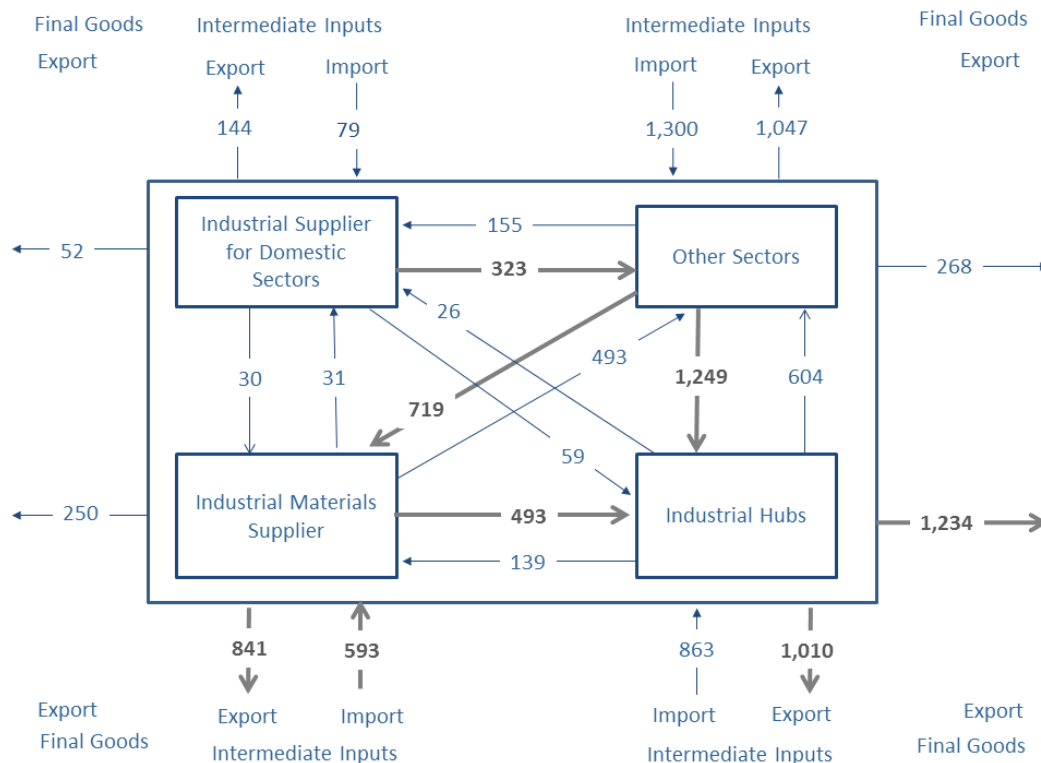
Functional specialisation in the value chain

One way of illustrating the task division in the value chain is the typification of the different sectors according to their functions in the intermediates' network and foreign trade. This study identifies four types of functional specialisations mainly within the manufacturing sector. These four groups are depicted in Figure 4-8. Inside the box, the domestic exchange of intermediates between the different sectors is illustrated. Outside the box, the corresponding exports and imports for the EU-27 in 2011 are shown. Above-average functional specialisation is highlighted with red arrows and numbers.

²⁴ A case study for Germany (IW, (2012)), based on enterprise survey data, shows that energy-intensive industries are essential in the value chain because they provide important contributions to innovation in other sectors.

Figure 4-8: Supply interrelations of the functional value chain (2011)

EU-27, € billions; grey arrows show above-average specialisations



Source: WIOD (2013), own calculations.

- Industrial hubs:** These hubs buy more intermediates from other sectors than they sell, especially from the service sector. They are mainly responsible for the integration of services into industrial products (service integration). Moreover, the export activities of these industrial hub sectors (regarding final goods) are far above the average level. In most of the EU-27 countries, this includes the following sectors: transport equipment, machinery, electrical and optical equipment, food and beverages, and textile products. They accounted for €1,014 billion in VA for the EU-27 in 2011.

Industrial hubs play a vital role as export platforms and are essential to giving domestic-oriented sectors indirect access to foreign markets. This bridging function is especially important for SMEs.

- **Industrial materials suppliers:** This group provides industrial hubs with industrial materials and intermediates. It is particularly integrated in trade with intermediates and is responsible for global sourcing and thus the supply of raw material-related intermediates. It also has the function of service integration. This includes the sectors' basic metals and fabricated metal and in most countries rubber and plastic products. The chemical sector has a dual role.²⁵ In countries with a strong industry core, like CEE countries, Germany, Austria and Finland, these sectors account for very high shares of VA in the manufacturing sector. Their VA in the EU-27 is €629 billion.

Industrial materials suppliers are essential parts of the value chain, particularly for industrial hubs and thus form a thriving export activity within the manufacturing sector. As industrial materials suppliers are, generally, very raw material-, energy- and emission-intensive, the sector is particularly susceptible to higher energy costs and environmental regulations.

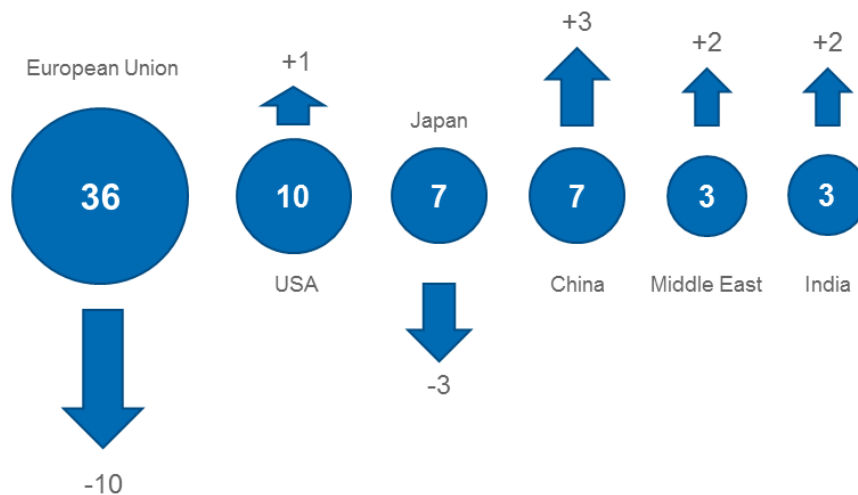
- **Industrial suppliers for domestic sectors:** Their main customers are firms outside the manufacturing sector, mainly services or the construction industry. They are more focused on domestic value chains. These include products from the non-metallic minerals, pulp, paper, printing and publishing sectors. In some Member States, these sectors also play a quantitatively outstanding role, for example in the UK, Spain and Portugal. The EU-27 VA totals €166 billion.
- **Other sectors:** These include all industries outside the manufacturing sector, mainly service firms that provide intermediate inputs for industrial hubs and industrial materials suppliers. The sector accounts for €9,615 billion in VA.

The importance of the industrial materials suppliers has been underlined by a recent study from the International Energy Agency (IEA (2013)). Because of shifts in the local prices for gas and other energy resources, a main shift in the market shares of energy-intensive industries is expected. The IEA forecasts increasing differences in energy prices in regions around the world.

Europe is one of the areas with disadvantages in this field. Experts have calculated that the export share in energy-intensive products is expected to decline until 2035 by 10 percentage points from 36 per cent in 2011 (Figure 4-9). This is due to the price effects caused by conveyor techniques like fracking or the use of unconventional gas or oil sources. The report stresses the importance of energy prices for competitiveness, especially for chemical, steel, aluminium, cement, glass and paper industries.

²⁵ In most countries it fulfils criteria for an industrial hub as well as for a materials supplier. Depending on which part is more predominant, chemicals can be assigned to one or the other group.

Figure 4-9: Export shares of energy-intensive goods (2011–2035)



Note: Circles resemble the export share in 2011. The arrows show the expected changes for 2035 in percentage points.

Source: IEA (2013).

Diversification

An important requirement for long domestic value chains – and thus for a broadly based and successful economy – is a diversified industrial structure. This structure can be measured in comparison to the average sectoral structure of the world economy, as illustrated in the WIOD database. The diversification²⁶ is relatively high (low), if the sectoral structure of a country is similar (dissimilar) to that of the world average.

- Europe has, considering all sectors, a less diversified economic structure than other advanced developed countries. Asian emerging economies have a very low degree of diversification. This is the reflection of a strong concentration on industry.
- Within the manufacturing sector, the EU-27 region is less diversified than other regions. This is especially obvious in comparison to the United States. The EU-27 countries are much more specialised concerning industrial hubs and industrial materials suppliers than their competitors outside the EU. Countries with a well-diversified industrial structure are Spain, France, Belgium and the UK. Highly specialised are the Baltic States, Romania, Ireland and Italy.

²⁶ Measured by the sum of the deviations of the VA shares of the sectors of a country from the world average.

Table 4-4: Diversification index (2011)

index values

	Total economy	Manufacturing sector
EU-27	4.11	2.07
Other developed countries	2.91	1.87
United States	2.68	1.76
Asian emerging countries	5.79	1.72
Rest of world (RoW)	3.23	1.46

Index = sum of the deviations of the VA shares of the sectors of a country relative to the world average. Smaller index values indicate a higher degree of diversification.

Source: WIOD (2013), own calculations.

A high degree of diversification does not necessary imply a high level of competitiveness. Countries with high specialisation in few industries are more dependent on importing the necessary supplies for their value chains. This becomes a risk when these value chains, due to a lack of efficient supply, move abroad.

4.1.4 Regional clusters and networks

Industry's relevance for other sectors can also be demonstrated with regard to regional clusters. Moreover, this subsection draws together empirical evidence on the geographical concentration of regional clusters and thus shows that there are important opportunities to better integrate regions with low industrial density into value chains in order to strengthen the paradigm of "Moving Forward Together in Europe".

In the global economy, interest is growing in new organisational structures of economies with the following features: they should be sufficiently flexible to respond to market changes and, at the same time, solid enough to take on cooperative projects. In fact, an increasing amount of statistical evidence indicates a positive relationship between the presence of clusters and the prosperity of regional economies (Delgado et al. (2012); Ketels (2012)). A cluster is defined as geographic concentration of interconnected companies and institutions working in a common industry (Porter (1998)). In addition, clusters encompass an array of collaborating and competing services and providers that create a

specialised infrastructure, which supports the cluster's industry. Finally, clusters draw upon a shared talent pool of specialised skilled labour. The works of Michael E. Porter first on industrial clusters and then on regional clusters in particular describe the tight relationships between cluster participation and the competitiveness of firms and industries (Porter (1990; 1998)). As clusters and networks can play a vital role in adapting to the new competition in the globalised economy, they are also an important topic of this study.

A regional cluster can be broadly characterised by the following features. It consists of a group of geographically co-located firms and related economic actors involving suppliers, customers, related services, research facilities and universities. These are engaged in economic activities in a set of related industries, connected through externalities, spillover effects and other types of linkages. The involved companies and institutions develop specialised expertise, services, resources, suppliers and skills. Cooperation is common but not always the rule. It could focus either on broader competitiveness upgrading or on specific projects (European Commission (2012)). Porter's famous Diamond Model consists of four elements that interact with each other: sector-related business strategies and structures; supply factors, especially in the form of branch-related human capital; demand conditions; and further (related) industries and services.

Spatial proximity and agglomeration is seen as an essential factor for development of innovation. Clusters offer a fertile environment for SMEs to innovate and develop linkages with large companies and international partners. Thus, clusters and networks are increasingly seen as catalysts for accelerating industrial transformation and for developing new regional competitive advantages, speeding up the creation of firms and jobs and thereby contributing to growth and prosperity (European Commission (2012)). Evidence, for example for Germany and the United States, explicitly shows that regional sectoral clusters provide for better development of employment and VA than in the same sectors of the overall economy's average (Delgado (2012)). The European Commission has addressed the role of industrial clusters in economic development and has launched a cluster-based innovation strategy (COM (2008) 652 final; ECPG (2010)).

Localisation of important manufacturing clusters in Europe

To analyse location of regional manufacturing clusters, we evaluated data from the European Cluster Observatory.²⁷ Regarding the future regulatory fundamentals of manufacturing in Europe, there are some crucial clusters like IT, business services, education and knowledge creation, heavy machinery, medical devices, aerospace or automotive which could strengthen the location of industry in Europe. The analysed segment groups of the metal and electrical clusters include most of the highly innovative sectors of manufacturing. At the same time, they include all key technologies defined by the EU Commission, which will be the major growth drivers in Europe over the coming decades (see High-Level Expert Group (2011)).²⁸

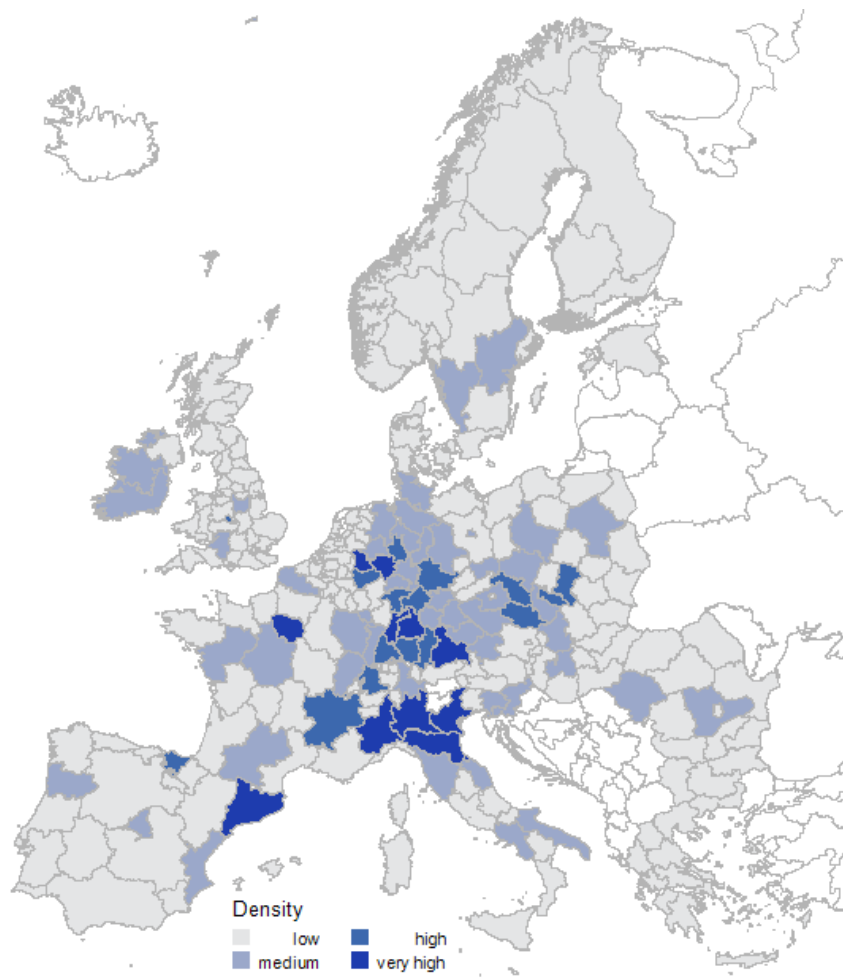
²⁷ The European Cluster Observatory is an online platform that provides a single access point to information and analysis of clusters and cluster policy in Europe. Launched in 2007, the Observatory offers a range of services providing data and analysis on clusters and competitiveness, a cluster library, and a classroom for cluster education.

²⁸ These key technologies are micro- and nano-electronics, semiconductor, photonic (lighting technology, laser and solar technology), nanotechnology, advanced materials, advanced production equipment, resp. advanced manufacturing systems and (industrial) biotechnology.

Figure 4-10 shows the regional cluster of the metal and electrical industries in a broader sense (aerospace, automotive, metal manufacturing, production technology, heavy machinery, instruments, lighting and electrical equipment) and their localisation and distribution over European regions (based on NUTS-2 regions) measured by the proportion of persons employed in metal and electrical industries in the respective region of the total number of persons employed in this region.

Manufacturing is concentrated in the centre of Europe. Thus, we find large clusters in Arnsberg, Catalonia, Düsseldorf, Emilia Romagna, Île-de-France, Karlsruhe, Lombardy, Piedmont, Stuttgart, Upper Bavaria and Veneto. There are large distances to the next smaller regional clusters, which are located in the Czech Republic, France, Ireland, Italy, Germany, Poland, Romania and Slovakia. Industrial density is considerably lower in many more peripheral European regions. However, there are several exceptions, for example in Apulia and Campania in Italy, Mazowieckie province in Poland, the regions in the north of Portugal, Sud-Muntenia and Vest in Romania, the Basque Country, the Valencian Community and Community of Madrid in Spain, and Östra Mellansverige and Västsverige in Sweden.

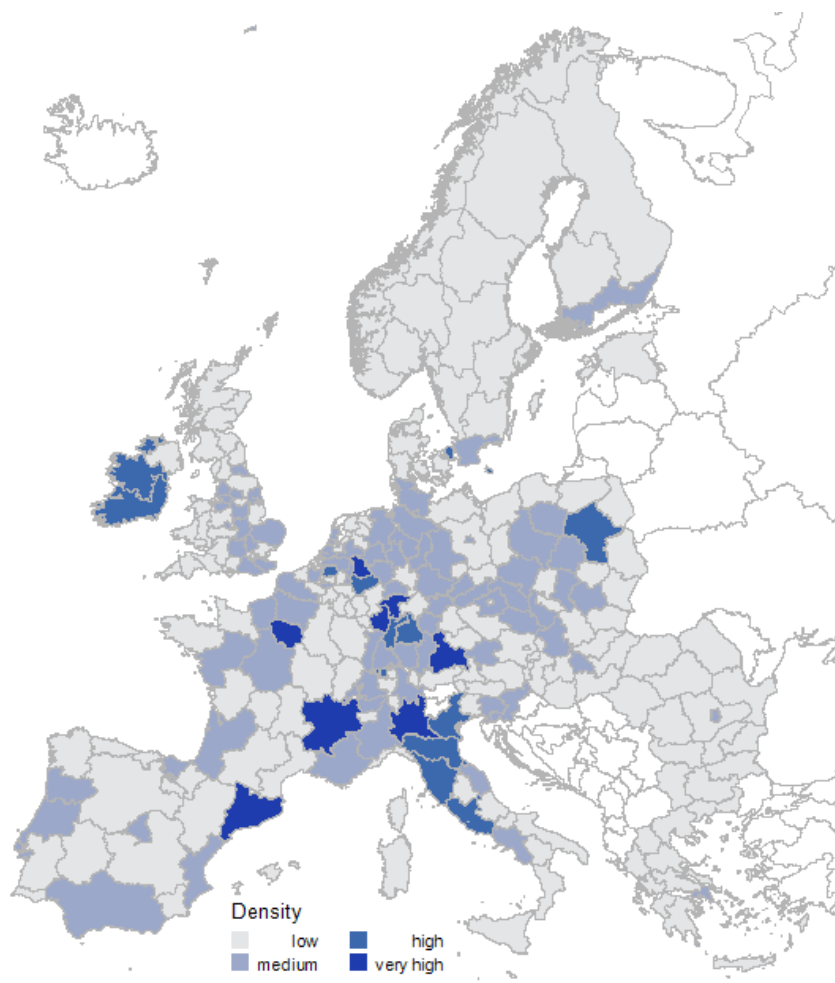
Figure 4-10: Regional clusters of the metal and electrical industries (2011)



Source: European Cluster Observatory (2013), own calculations.

In the same way we analysed the segment groups of the chemical industry cluster, which include chemical products, pharmaceuticals and plastics. The chemical industry is concentrated in the centre of Europe too, but less so in the outermost regions. Thus, we find corresponding large clusters in Catalonia, Darmstadt, Düsseldorf, Île-de-France, Rhône-Alpes, Piedmont, Rhine-Hesse-Palatinate and Upper Bavaria. Other important cluster regions, with at least a high density of employees in the chemical industry, are Antwerp in Belgium, Hovedstaden in Denmark, Cologne, Karlsruhe and Stuttgart in Germany, Ireland, Emilia Romagna, Lazio Veneto and Tuscany in Italy and Mazowieckie province in Poland.

Figure 4-11: Regional clusters of the chemical industry (2011)



Source: European Cluster Observatory (2013), own calculations.

The weaker concentration of clusters in the more peripheral EU regions shows that these regions should be better connected with regions of higher concentration via networks and trade to strengthen their innovation and R&D activities. Closer cooperation of cluster companies in the centre of Europe

and those on the European periphery would lead to positive spillovers in peripheral regions and therefore promote European cohesion. For this, it is necessary to encourage competitiveness and innovative capacities of companies in peripheral regions in order to become part of interregional or cross-border clusters in the future.

Regarding the changes in employment shares in manufacturing between 2005 and 2010 at the NUTS-2 level, a positive development of employment shares can be seen in many German regions, Île-de-France, Cumbria (UK), Western and Central Slovakia, as well as in the Peloponnese region and West Macedonia. In these regions, clusters of manufacturing should benefit from this development, too, while in other regions the weaker development could affect the future development of manufacturing clusters. Overall, this figure shows that the regional cluster seems to be declining. This could become a problem for the process of European re-industrialisation.

4.2 Industry-driven globalisation

Globalisation – the second megatrend (see Figure 4-1) – has been relevant for decades and continues to be so. This chapter highlights the opportunities and challenges of the increasing economic interconnectedness with a particular focus on the integration in GVCs, which are an important facet of the “Moving Forward Together” paradigm of this study.

This subsection highlights industry’s key role as a driver of internationalisation and particularly as an export engine. Moreover, manufacturing is central as a platform for the integration in GVCs. These global activities together with increasing and upgrading products can contribute to meeting the challenges of globalisation, mainly in the form of rising import competition as this section demonstrates in more detail.

Drivers of globalisation

The main drivers of globalisation comprise technical progress in communication technologies, declining transport costs, trade liberalisation, the opening of Eastern Europe and a strong increase in the economic performance in emerging countries. Globalisation opens new possibilities but also leads to challenges for developed countries. Manufacturing businesses are core globalisation players and thus are well placed to seize the new opportunities it presents. Industry is also pivotal to solving its challenges.

There are several indicators that highlight ongoing globalisation:

- Currently, 14.9 per cent of the VA in the EU²⁹ (2011) depends on foreign demand, while this was 10 per cent in 1995 and 12 per cent in 2000 (Foster et al. (2013)).
- The manufacturing sector is more affected by growing globalisation. About 30 per cent of the VA of the manufacturing sector is generated by foreign demand from outside the EU (Table 4-5).³⁰ Overall, the effects in the service sector (average 9.3 per cent) are significantly lower

²⁹ The equivalent employment share is 11.6 per cent.

³⁰ These induced effects are calculated from the WIOD with multiplier models. The special feature is that the domestic VA content of the external demand was calculated. For the methodology, see Timmer (2012). For the calculations, see Foster et al. (2013). Similar information can be calculated for the years 1995 to 2009 with the TIVA data set (OECD and WTO (2013)).

than in the manufacturing industry. The dependence on foreign demand has increased in each sector since 2000.

- However, globalisation is not a one-way street and also entails challenges. Higher competition from abroad implies an increasing import penetration of foreign suppliers in almost every EU country. In the EU, the import penetration ratio in manufacturing increased from 24.3 per cent in 2000 to 29.2 per cent in 2009.

The crucial new aspect is the growing importance of GVCs, which is one of the networking aspects illustrated in Figure 4-1. The globalisation of value chains means, in particular, a globalisation of production with increasing:

- importance of cross-border procurement;
- fragmentation of production;
- length of value chains; and
- foreign shares of VA in production and exports.

Empirical studies show that companies improve their competitiveness through integration into GVCs and are thus able to benefit from comparative advantages in all regions of the world. This especially applies to the international price competitiveness through procurement in regions with lower cost levels. On the opposite side, there is a hollowing out effect because each unit of production includes more and more foreign VA. These dampening effects can only be compensated or even overcompensated for through growth with corresponding volume effects. It seems that this has been successfully achieved in the EU. The sectors that are highly integrated into international value chains have performed better, as is shown below.

The effects of GVCs cannot be illustrated on the basis of traditional external trade statistics. Therefore input-output tables are necessary to show the trade with intermediate goods and to provide the basis for calculations of domestic shares of VA which are included in exports. For this, two new international databases and analysis capabilities, WIOD³¹ and TIVA³², are used. Thus, data from 1995 to 2011 can be used, which has only been available since mid-November 2013.

³¹ World Input-Output Database, providing time-series of world input-output tables for forty countries worldwide and a model for the RoW, covering the period from 1995 to 2011. Thirty-five sectors are included. The tables provide data as a basis for calculating the VA content of domestic production and exports.

³² The OECD-WTO TIVA database considers the VA by each country in the production of goods and services that are consumed worldwide. It presents indicators for 57 economies (including all OECD countries, Brazil, China, India, Indonesia, the Russian Federation and South Africa) covering the years 1995, 2000, 2005, 2008 and 2009 and broken down by 18 industries. Indicators include decomposition of gross exports by industry into their domestic and foreign content, the services content of gross exports by exporting industry (broken down by foreign/domestic origin), bilateral trade balances based on flows of VA embodied in domestic final demand and intermediate imports embodied in exports.

Table 4-5: Induced VA by foreign demand¹ (2000 and 2011)

EU-27; in per cent of the sectoral GDP

Sectors/products	2000	2011
Agriculture	10.0	12.1
Mining/quarrying	22.6	25.5
Food/textiles/leather	14.1	16.4
Industrial materials suppliers²	27.8	34.1
Industrial hubs³	32.4	36.4
Industrial suppliers for domestic sectors⁴	18.3	20.3
Utilities	9.4	10.8
Construction	2.2	2.8
Logistics	16.9	19.6
Communication	9.4	10.5
Finance	6.3	7.9
Business services	17.2	18.5
Private/public services	4.5	3.6
Total	11.6	14.9

¹ Effects only due to foreign demand from outside the EU-27.

² Chemicals, rubber/plastics, basic metals/fabricated metals, coke/refined petroleum.

³ Machinery, transport equipment, electrical/optical equipment.

⁴ Non-metallic minerals, wood/wood products, pulp/paper/printing/publishing.

Source: WIOD (2013), Forster et al. (2013); own calculations.

In the following sections, three aspects of globalisation are discussed:

- new markets due to the growth of emerging countries;
- GVCs offering new opportunities for the internationalisation of production; and
- new competitors in emerging countries which force the developed countries to adapt their products and strategies in an upgrading process.

Industry – as a gateway to the world and as the main source of innovation – is the key for developed countries to make the best out of these aspects, also by acting as an export platform for other sectors, particularly services. Large manufacturing companies play an essential role in the EU as globalisation players. These aspects are further illustrated in the following sections.

4.2.1 Export engine industry

Since the turn of the millennium, world GDP has increased by US\$39.6 trillion [€30.8 trillion] (World Bank (2013)) while world trade has grown by US\$14.5 trillion [€11.4 trillion] in volume terms.³³ Only companies, industries and economies with international activities can benefit from these growing foreign markets. This subsection provides broad evidence for industry's role as an export motor and platform for service and other sectors to reach global markets.

Export-oriented industry

Industry is highly and disproportionately involved and active in international activities. In the EU-27, the manufacturing sector accounts for 57 per cent of all exports although its share of VA amounts to just over 15 per cent (Table 4-6). These export shares are even higher in Asian emerging countries. There are large differences among EU countries. In Slovakia or the Czech Republic, the manufacturing sector is responsible for more than three-quarters of all exports. In Member States like the Netherlands, Finland, Spain and in particular the United Kingdom, this rate is already below 50 per cent.

A different result is presented when looking at the domestic VA contained in exports in the EU-27. The share of manufacturing goods in this export-induced domestic VA was only 36.6 per cent in 2011 (Stöllinger et al. (2013)). This is much lower than the share of manufacturing goods in gross exports (57 per cent), because gross exports of manufacturing goods also contain foreign intermediate inputs and inputs from the domestic service sector. This insight provides an additional indication that manufacturing is a hub for the integration of services and foreign inputs.

Table 4-6: Export share of manufacturing goods in total trade, 2000 and 2012

in per cent

	2000	2012
EU-27	66	57
Other developed countries	63	53
Asian emerging countries	71	76
Other emerging countries	37	28
Total	64	57

Source: WTO (2013), own calculations.

³³ US\$-euro exchange rate 2012.

Also, the export intensity – measured as exports to VA – is significantly higher in the manufacturing sector than in other sectors. In 2012, this export rate amounted to 195 per cent in the manufacturing sector while in other sectors it was only 26 per cent. In accordance with the global trend, a strong increase in export rates can also be observed in the EU. In 2000 the export ratio stood at 144 per cent for manufacturing and 17 per cent for other sectors.

Looking at the change in foreign trade structures, a deindustrialisation trend can be observed (see also chapter 3). In 2000, the export share of the manufacturing sector in the EU still accounted for two-thirds. This implies a decrease of nine percentage points in just 12 years where the beneficiaries were the service exports. Their share of all exports from the EU-27 increased from 18 per cent (2000) to 25 per cent (2012). This trend cannot be observed worldwide;³⁴ this tertiarisation of foreign trade is a feature of the EU.

Industry platform for exports

However, the manufacturing sector remains an important platform for the export of services. Analysis based on the TIVA data shows that industrial exports of the EU-27 contain about 35 per cent of VA from service sectors – in 2000, this was only around 32 per cent. This is considerably more than the global average (31 per cent in 2009).³⁵

The services contained in the industrial exports can be examined more closely with the WIOD (Figure 4-12).

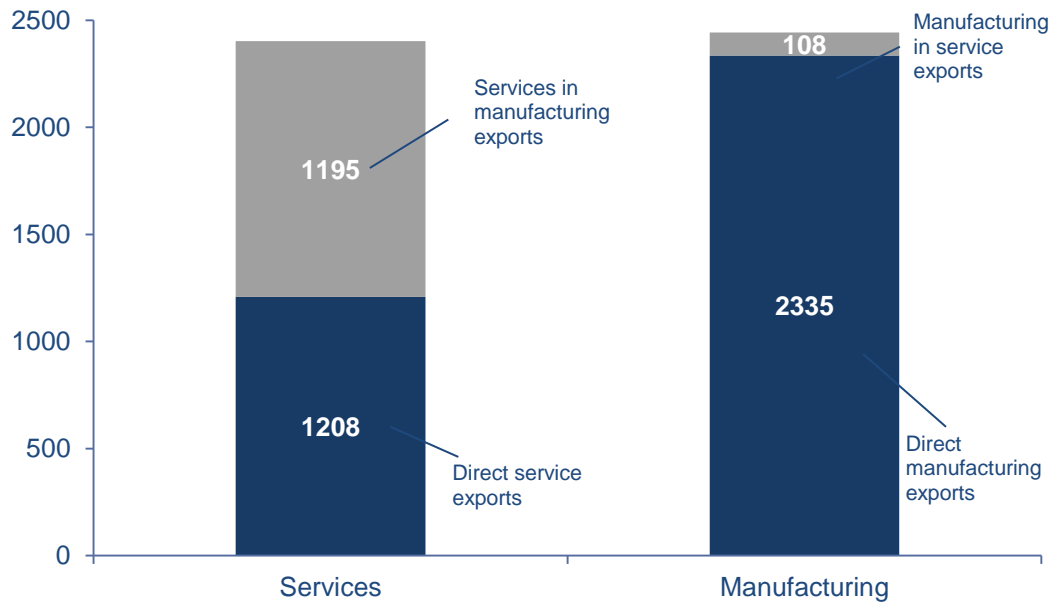
- In 2011 the manufacturing sector indirectly exported services worth €1,200 billion, which amounted to nearly 50 per cent of all service exports.
- The service sector's carrier function is much smaller. Manufacturing goods indirectly exported by the service sector amounted to only €108 billion.

³⁴ There the merchandise exports increased more outside the manufacturing sector.

³⁵ Total exports of the EU-27 contain a service share of around 51 per cent (2009), which is higher than the international average (almost 43 per cent).

Figure 4-12: Direct and indirect exports of services¹ in the EU-27 (2011)

€ billions



¹ Including agriculture, mining and construction, and utilities.

Source: WIOD (2013), own calculations.

Thus, manufacturing is central for service companies' (indirect) access to international markets. In particular, SMEs profit from this carrier function, which are over-represented in the service sectors. For these companies the supply of intermediates to large manufacturing companies is an important opportunity to gain access to international markets.

Foreign trade is dominated primarily by large companies. For this uncontested "stylised fact", only limited empirical evidence is available in official statistics. In the United States, for example, the ten largest companies account for 20 per cent of the manufacturing sector's exports and the 50 largest companies account for 40 per cent (OECD (2013)). Additional evidence can be found in survey results. Examples are the EFIGE data set³⁶ for European companies and the IW Future Panel³⁷ for German companies.

³⁶ The EU-EFIGE/Bruegel-UniCredit data set (in short the EFIGE data set) combines measures of firms' international activities (e.g. exports, outsourcing, FDI, imports) with quantitative and qualitative information on about 150 items including R&D and innovation, labour organisation, financing and organisational activities, and pricing behaviour. Data consist of a representative sample (at the country level for the manufacturing industry) of almost 15,000 surveyed firms (over ten employees) in seven European economies (Austria, France, Germany, Hungary, Italy, Spain, United Kingdom). The data were collected in 2010, covering the years from 2007 to 2009. Special questions related to the behaviour of firms during the crisis were also included in the survey.

³⁷ The IW Future panel is a survey panel covering 8,000 to 9,000 German firms from manufacturing, construction, utilities, logistics and business services. It deals with questions concerning the company's strategy for globalisation, innovation and other success factors three times a year.

- The EFIGE data set contains almost 15,000 industrial companies from seven European countries (AT, HU, FR, GER, IT, ES, UK). Twenty-nine per cent of these countries are not internationalised (zero mode) and 32 per cent only very weakly because they only import or export (single mode). One-third of the companies import and export (dual mode) and only around 5 per cent (triple mode) also produce abroad. The average firm size increases continuously from the zero-mode company (33 employees) to the triple-mode company (276 employees). Only 10 per cent of the companies are responsible for about 87 per cent of all trade flows. These companies have a significantly above-average company size.
- The analyses of the IW Future Panel for Germany show a similar finding. The foreign activities as well as the intensities increase with the size of the company (Table 4-7).

Table 4-7: Internationalisation activity and intensity in Germany (2010)

in per cent

	Small	Medium	Medium-large	Large	Total
Share of firms with activity in...					
Exports	31.0	42.3	56.6	73.6	59.5
Production	10.3	12.4	18.9	47.7	31.5
Employees	7.7	11.3	19.6	51.6	33.0
R&D	3.0	3.5	7.1	18.1	11.6
Share of cross-border activities in...					
Exports¹	9.1	11.2	18.1	32.3	23.1
Production	4.0	4.3	5.1	13.8	9.3
Employees	1.5	1.9	4.2	17.8	10.4
R&D	1.8	1.7	2.8	7.3	4.8

Only manufacturing, construction, utilities and industry-related services (including logistics).

Small: 0 to 9 employees; medium: 10 to 49 employees; medium-large: 50 to 249 employees; large: 250 or more employees.

¹ Share of exports in turnover.

Source: IW Consult (2011).

This below-average internationalisation of SMEs can be seen as a structural problem in all EU Member States. A greater internationalisation of these smaller companies is necessary, especially since empirical studies show that companies with international strategies and activities are more successful than others. The successful indirect integration in export value chains of manufacturing and large companies can only be part of the solution.

With its large export-oriented industry, the EU actively benefits from growing global markets. Moreover, it allows for the use of economies of scale in the production of industrial goods. Particularly for highly specialised producers, the domestic market is too narrow to make use of large-scale effects. However, a greater focus on exports can also involve risks, mainly the vulnerability to larger economic global crises.

The export model contains a second potential structural risk. There is a latent trend that production follows demand and companies eventually produce where consumers are located. The reasons for this are the need for companies to be close to the market, but can also derive from political pressure for local content requirements. Consequently, long and stable EU value chains are important. The same is true for global sourcing strategies that do not necessarily require production abroad. Moreover, policymakers have to keep in mind the latent dislocation incentive when they design policies which could make EU production considerably more costly or less attractive.

4.2.2 Potential of global value chain integration

Globalisation not only offers access to growing global markets, but also new possibilities on the production side. Companies can optimise their value chains through global sourcing and/or production abroad. For each operational activity, the world's best location, using comparative advantages, can be found. Despite higher transaction costs and the need to control very complex structures, companies can thus lower their overall costs and improve their competitiveness. As shown below (Figure 4-13), this is a precondition for thriving domestic production and EU exports. Also, from the point of view of the entire economy – and despite the shift of VA abroad – a gain in competitiveness is possible, which can result in higher exports and domestic production.

The following section highlights two important aspects:

- the EU-27 is highly integrated in GVCs; and
- the integration in GVCs improves competitiveness and has overall positive effects.³⁸

In the following section the most important concepts and results concerning GVCs are presented:

- global sourcing;
- fragmentation;
- foreign VA content; and
- hubs and network effects.

³⁸ Regressions in several studies point out the importance of GVC integration for the productivity, competitiveness and export success of the respective countries. Increasing intermediates' imports have positive effects on productivity (Ethier (1982)) and on export success (Feng et al. (2012); Lo Turco and Maggioni (2011)). Ruigrok and Wagner (2004) give an overview of several studies concerning the link between competitiveness and internationalisation and find that both measures are positively correlated; see OECD (2013a, 2013b).

Importance of global sourcing

Global sourcing means procuring intermediate inputs from foreign countries. The EU is using this opportunity more and more. In the manufacturing sector, the rate of imported intermediates of the EU Member States is 25.2 per cent of the production value (Table 4-8). In this ratio, (intra-EU) intermediate imports from other EU countries are included. In other words, each euro output contains around 25 cents supplied from abroad. The worldwide average is 17 cents.³⁹ Global sourcing is therefore more significant in the EU than in other developed countries.⁴⁰ In the United States, Japan and China the corresponding rates are considerably lower.

However, concerning sourcing strategies, EU industry is very concentrated in the European market as it receives most of its intermediate imports from other EU countries. The share in global sourcing from regions outside the EU is approximately at the level of the United States or China. South Korea is significantly more integrated into international value chains. Similar results can be found for the exports of intermediates.

In summary, European industry is strongly involved in international procurement processes.

³⁹ Average of the 42 countries, which are included in the WIOD database.

⁴⁰ Analysis by the OECD (2013) shows that outsourcing and offshoring in the context of GVCs help to make countries more competitive and improve their export specialisation. GVCs positively affect the international specialisation of countries by expanding their sourcing possibilities both within the domestic economy and abroad. This greater use of intermediates helps countries to increase their VA in export activities. The researchers found significant positive effects of outsourcing and offshoring on the export competitiveness of countries.

Table 4-8: Ratio of intermediate inputs in manufacturing

in per cent of production

	Imports of intermediates	Exports of intermediates	Trade ¹ with intermediates
2011			
EU-27	25.2	29.4	54.6
EU outside²	10.8	11.4	22.2
US	14.9	12.9	27.0
Korea	21.3	23.2	44.9
Japan	10.1	13.1	23.1
China	9.5	7.6	17.1
World	16.6	16.7	33.3
2000			
EU-27	19.7	23.8	43.6
EU outside	7.8	8.7	16.4
US	9.3	8.8	18.2
Korea	17.8	16.8	34.5
Japan	5.2	8.2	13.4
China	8.1	6.4	14.5
World	14.1	14.9	29.0

¹ Sum of imports and exports.

² Trade of EU Member States with countries outside EU-27.

Source: WIOD (2013), own calculations.

What is more important is highlighting the differences and developments:

- The manufacturing sector is highly responsible for trade in intermediate inputs. It accounts for 66 per cent of total intermediate exports (2011) and 57 per cent of imports.
- The intensity of trade with intermediates is growing. Between 2000 and 2011 all relevant rates increased.
- There are major differences within the European Union. The Southern Member States (Italy, Spain, Portugal, Greece, Malta and Cyprus) are less involved in global sourcing. Their entire trade volume of intermediates is 41 per cent, 14 percentage points less than the other EU countries.
- Over half of the integration of industry into the global economy runs through the trade with intermediates. Over 56 per cent of the EU Member States' imports and exports are intermediate exports.

- The sectors are differently integrated into international sourcing processes. In chemicals, transport, electrical and optical equipment sectors, the rates of foreign intermediate inputs in total output are at 28 per cent; sectors like food, beverages and tobacco are at 14 per cent.

In summary, industry in Europe strongly contributes to global sourcing. This aspect is also important for sustaining international price competitiveness because European firms can use the most cost-efficient sources for intermediate inputs worldwide.

Fragmentation

A significant development of the global sourcing in value chains is the decomposition into multi-level sub-processes. The individual parts are produced where comparative advantages exist regarding costs, skills, access to technology, access to raw materials and market proximity of each country. In the course of such a global strategy, parts of a final product are increasingly exported or imported multiple times to and fro. A good example is the production of smartphones. The technology and concept are created, for example, in the United States and key components come from Korea, Taiwan, Germany and France. The assembly takes place in China while the marketing, design and sales strategy are defined in the United States.

The intensity of fragmentation can be measured by the share of re-exported intermediate inputs in total intermediate imports:⁴¹

- Half of the EU's intermediate imports are re-exported, i.e. integrated in a multi-level global value chain. This ratio is higher than the international average and the United States and Japan in particular. Fragmentation can especially be found in Korea and China.
- There are major differences between sectors. In Europe the highest level of re-exports can be observed in the transport equipment sector (Table 4-9).
- Fragmentation has increased: this re-export rate was 41 per cent in the EU in 1995 and 50 per cent in 2009.⁴²
- Not all EU Member States are integrated into these GVCs to the same extent. The re-export rate in the Southern Member States is only 35 per cent, 20 percentage points less than the average of other Member States.

The increase in fragmentation is both a challenge and opportunity for European manufacturing. To handle these complex international sourcing processes, the firms need highly developed management capacities, but firms that are able to manage that challenge can successfully use all of the advantages from international sourcing.

⁴¹ A similar measure is the length of the value chain in certain countries and sectors. It is approximated by the weighted share of foreign VA inputs in the output of the sector. A study by the OECD (2013a) shows that the length of value chains in European manufacturing industries is on an average level. However, the EU-27 as a whole has a relatively low integration in GVCs outside the Union.

⁴² The rate is expected to have grown after 2009, because the slump, triggered by the global crisis, reduced the re-exporting activities of imported inputs.

**Table 4-9: Re-exported intermediates as a per cent of total intermediate imports
(2009)**

	EU	US	Korea	Japan	China
Food/beverage/tobacco	33	10	17	5	32
Textiles/leather/footwear	52	14	50	15	81
Wood/paper/printing	38	12	35	12	49
Chemicals/non-metallic mineral products	47	18	58	22	49
Basic metals/fabricated metal products	58	27	62	39	52
Machinery	53	19	55	32	49
Electrical and optical equipment	56	23	76	41	73
Transport equipment	60	20	54	38	38
Other manufacturing	30	8	37	22	49
Total	50	18	60	28	57

Source: WIOD (2013), TIVA (2013), own calculations.

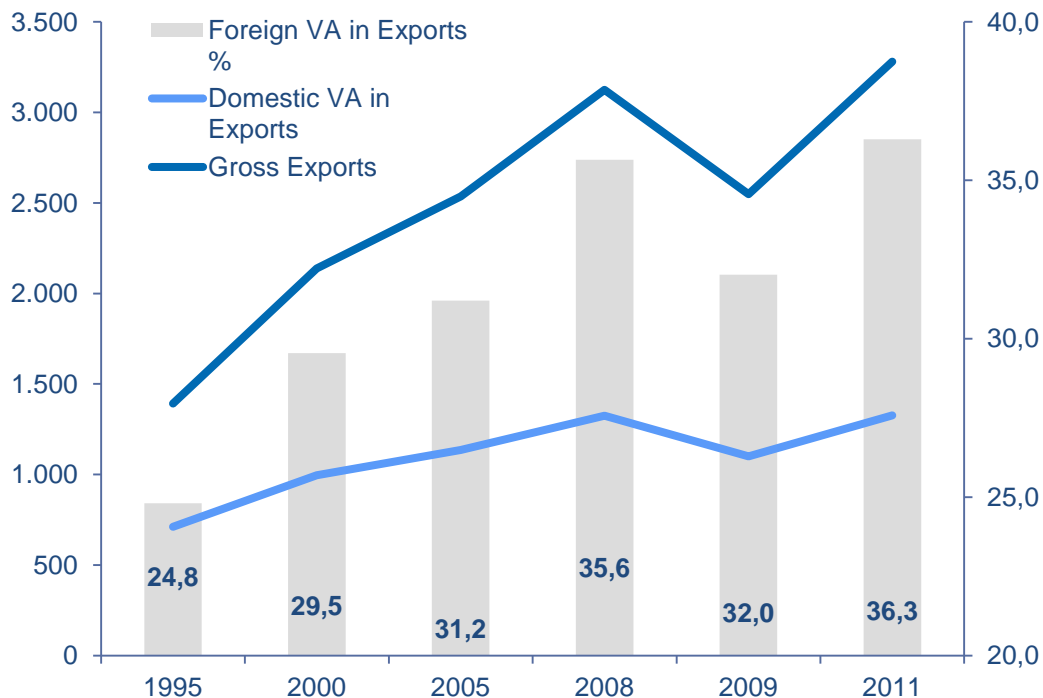
Foreign VA content

The increase in the relevance of GVCs leads to a decreasing share of domestic VA in exports. Vice versa, the share of foreign VA in European exports has increased from 29.5 per cent (2000) to 36.3 per cent in 2011.⁴³ This share is higher in the European manufacturing sector than in other regions. This increase shows the specific hollowing out effect, which means that the domestic share in VA of each export unit has declined. But this effect is overcompensated by a quantity effect. The export measured in VA terms has increased by 101 per cent from 2000 to 2011. This is lower than the increase in gross exports (131 per cent), but shows that in total there are no tendencies for hollowing out effects in European manufacturing. Figure 4-13 demonstrates this trend. Also the economic crisis dip in 2009 can clearly be observed.

⁴³ Measured in vertical specialisation.

Figure 4-13: Gross exports and exports in VA (1995–2011)

EU-27 manufacturing in € billion ⁴⁴



Source: TIVA (2013), WIOD (2013), own calculations.

There are similar results for China and other developed countries. The foreign shares in exports are increasing. The exports, measured in domestic VA, (in US\$) are also increasing. This shows that there are no tendencies for hollowing out effects.

According to Feenstra and Hanson (1996) and De Backer and Yamano (2012), aggregate indicators based on input-output tables show that the share of externally sourced intermediates in production (i.e. outsourcing) and the share of imported intermediates in total intermediates (i.e. offshoring) increased in the European Union and in most EU Member States between 1995 and 2009. Furthermore, Miroudot and De Backer (2013) have shown that the number of production stages that a product or service goes through before it reaches the final customer has increased over the past two decades and that most of this increase is explained by the international part of the value chain.

Hubs

The previous analysis shows that globalisation is a far extended trend and that all nations are highly integrated in GVCs. But foreign trade is still dominated by intra-regional relationships. Regional hubs

⁴⁴ Values from the TIVA data set differ slightly from the values of the WIOD database. Domestic VA in exports approximated for 2011.

are already centred in geographic regions like Europe, North America and Asia where most of the circulation of imports and exports happens (Table 4-10). Sixty-three per cent of the domestic VA in manufacturing exports is sent to other European countries. Interdependencies can also be found, to a lesser degree, in North America and Asia. These trade networks are centred on the big local economies.

Similar results can be presented by the length of the value chain. The length of the value chain is measured by the share of imports and exports included in GVCs measured by the GVCs' length of the respective partner. The average European country has more than 50 per cent of its exports integrated in GVCs (see Bruegel (2013)). Looking at the EU as one economy, only 30 per cent of its exports are part of GVCs. This illustrates the strong regional economic network in the EU.

Table 4-10: Share of exported domestic VA in manufacturing (2009)

in per cent

	Europe	NAFTA	Asia	RoW
Europe	63	9	9	19
NAFTA	21	40	20	19
Asia	20	23	37	20
RoW	32	17	22	29

Source: TIVA (2013), own calculations.

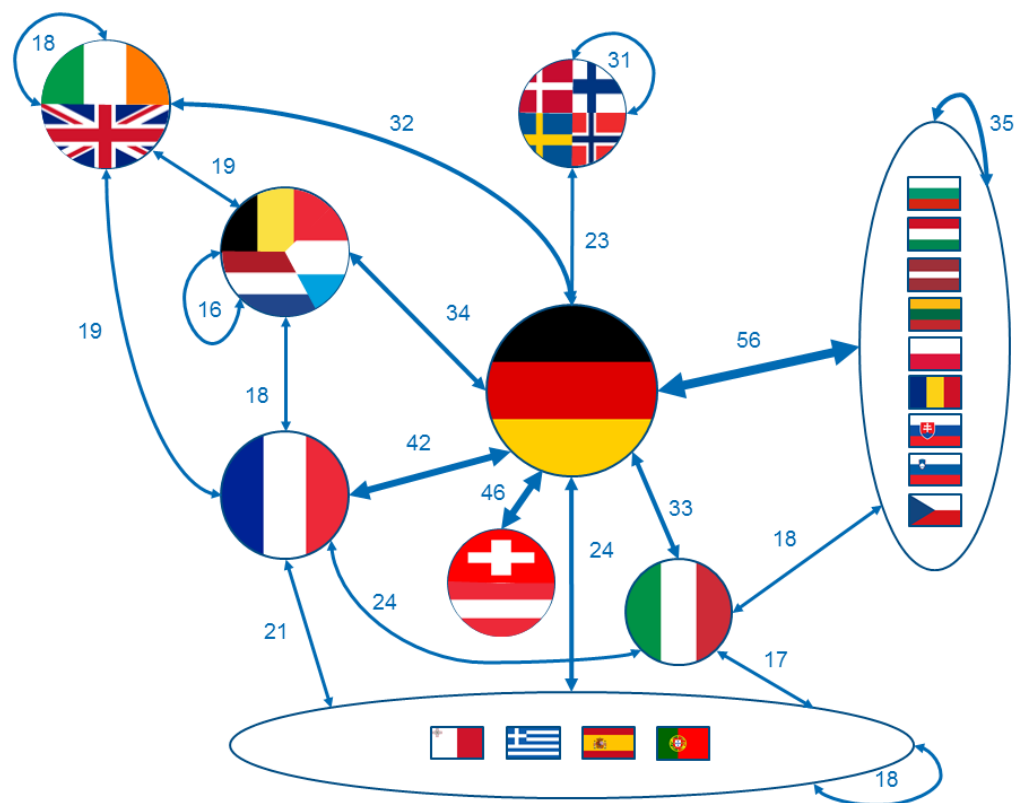
Similar structures can be found in Asia where the value chain is centred around China and, to a lesser degree, Japan and Korea. The implied high volume of VA in regionally centred imports and exports shows the advanced networked production in Europe and Asia compared to North America and other economies around the world. In Europe, a higher percentage of these inputs belongs to other countries of the same geographic region. As a result, European companies are more dependent on the industrial competitiveness in the whole region than other businesses around the world. This insight has to be heeded by policymakers.

The structure of the European hub

Looking deeper into the European regional hub, it turns out that the German economy – mainly due to its size – stands at the centre of the system (see Figure 4-14). This becomes obvious by looking at the domestic VA in manufacturing exports relative to the total output of the manufacturing sector. For each of the clustered countries, Germany is among the top two export targets for the respective manufacturing sector. Overall, Germany is the destination for 24 per cent of the domestic VA in manufacturing exports for all countries in Europe.

Figure 4-14: Main European trade routes in manufacturing

sum of domestic VA in imports and exports 2009 in € billion



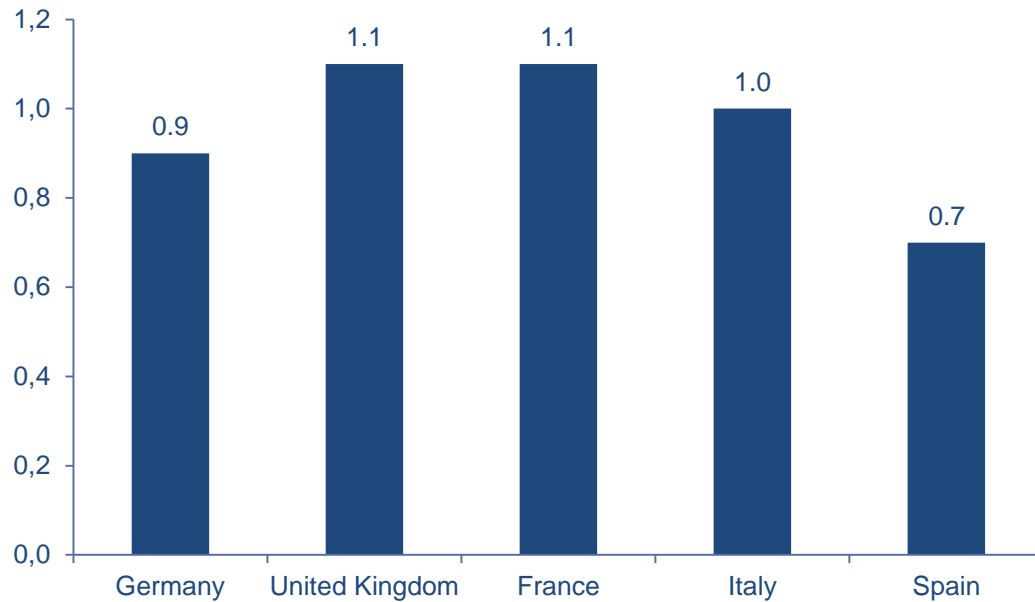
Only sums that exceed 1.5 times the rectangular distribution of values.

Source: TIVA (2013), own calculations.

Other economies benefit from the export-oriented strategy of Germany as the centre of the European hub by delivering (and receiving) intermediate inputs and thus by indirectly connecting to global markets. Thus, with rising German exports, EU partners also benefit from higher exports of intermediate inputs to Germany. This relationship has been tested within a complex panel analysis.⁴⁵ It shows that a 10 per cent increase in German total goods exports goes hand in hand with a 9 per cent rise of intermediate goods exports of EU countries to Germany. Figure 4-15 displays the so-called elasticity for the case that German exports rise by 1 per cent. For four other large European economies it also shows similar and partly higher results, which are also statistically significant. This result again shows that EU countries are already connected with each other to a considerable degree.

⁴⁵ The conventional gravity equation has been estimated for the intermediates' imports of these countries from other EU Member States. Besides the usual gravity variables, barriers to trade and market size, the lagged merchandise exports of the particular country have been used as an explanatory variable. Barriers to trade were approximated by the geographical distance reported by CEPII. For the market size, the sum of nominal GDP has been used with data stemming from Eurostat. The analysis is based on quarterly data between 1999 and 2013. The variables are represented in logarithms and the time series were tested for non-stationarity using the Im-Pesaran-Shin test. The Hausmann specification test was applied and fixed effects were added where necessary. The standard errors are robust for heteroskedasticity and adjusted for cluster effects.

Figure 4-15: Export elasticity of intermediates' imports from other EU countries (1999–2013)



An elasticity of 0.9 implies in the case of Germany that a 10 per cent rise of German total goods exports coincides with a 9 per cent increase of intermediate goods exports from Germany's EU partners.

Calculations based on quarterly data between 1999 and 2013.

Source: Eurostat (2012), CEPII (2012), own calculations.

Production networks

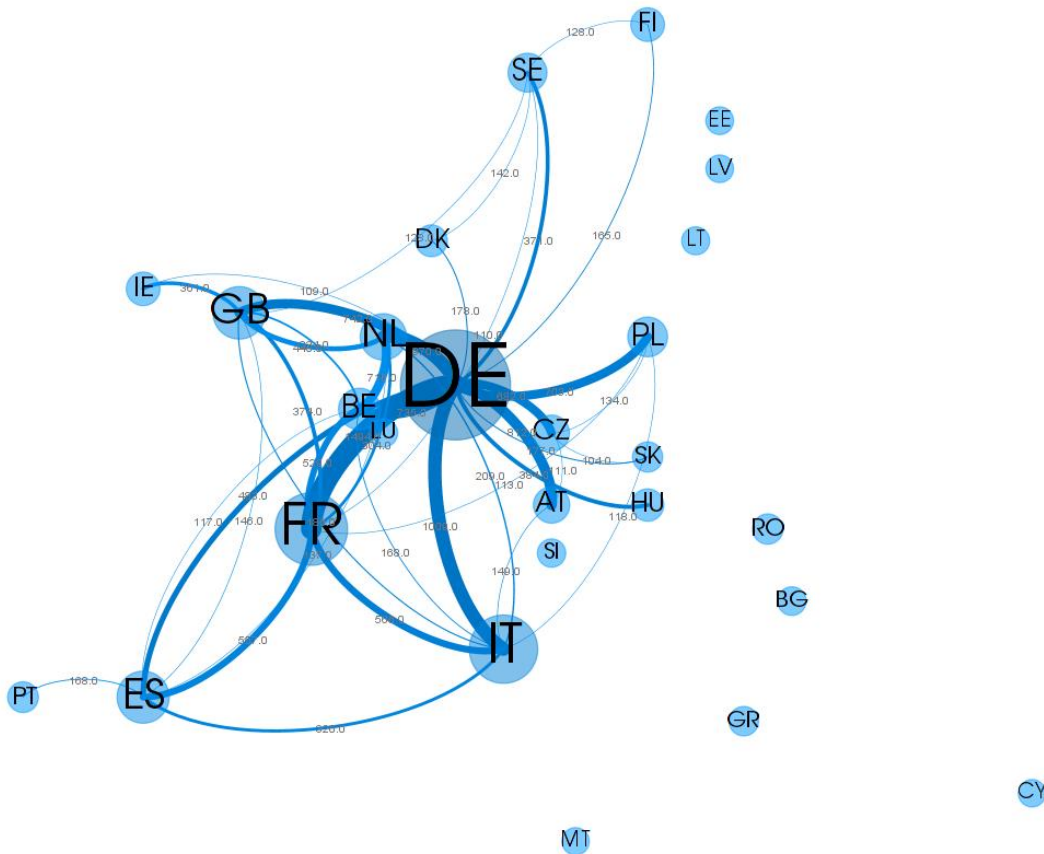
The previous remarks clearly demonstrate that European industry is highly connected on an intra-regional level. Figure 4-16 visualises this European hub, based on the volume of cross-border intermediate linkages. The size of the knots indicates a country's share of intermediates' trade within the EU and the strength of the lines represents the level of bilateral exchange relations:

- Measured by the absolute size, Germany lies in the middle of the European production network (largely because it is the largest EU country and is situated in the geographic centre of the EU). France, Italy, United Kingdom and Spain are also large knots in the network. The largest bilateral exchange volumes can be observed for Germany with France, Italy and the Netherlands.
- However, in relative terms, a different picture emerges. Nearly all major countries (Germany, United Kingdom, Italy and Spain) are involved in intra-EU intermediate trade to a lesser degree than their respective shares of VA in the EU would suggest. France is an exception and relatively strongly integrated in the European production networks.
- Smaller countries are relatively highly integrated, especially countries with a geographical proximity to Germany (Austria, Belgium, Poland, Hungary, the Czech Republic and Slovakia). Less intensely integrated are the Baltic States, Romania, Greece and Portugal. Here lies a considerable integration potential for the future.

All in all, the EU production network is well developed and shows that cooperation and value chain integration already exists. However, important potentials exist to strengthen the ties among EU partners. This holds generally, and is relevant for the larger countries and for countries at the EU periphery. The establishment of new and the strengthening of already existing connections and (decentralised) hubs should be an objective of European industrial policy.

Figure 4-16: Intermediate input networks in European manufacturing (2011)

in US\$



Production network: Volume of imports of intermediate goods between two EU countries.

Source: WIOD (2013), own calculations, graph made with Gephi.

Review and conclusions

The integration of GVCs is an important factor for economic competitiveness and a decisive part of the “Moving Forward Together in Europe” paradigm. This is demonstrated by various regression analyses which show a positive relation between export competitiveness and the degree of integration in GVCs (Bruegel (2013)). Companies can benefit from comparative advantages of all the countries integrated in the value chain. To keep the VA alongside the GVC in the local economy, the country has to be attractive for global investors to finance the requirements for value-intensive activities. In fact, countries with a greater presence of Foreign Direct Investment (FDI), relative to the size of their economies, tend to have a higher level of participation in GVCs and generate relatively more domestic VA from trade. The significant recent decline of FDI in the European Union (United Nations (2013)) is

thus a problematic development because it could hamper the participation rate in GVCs and in turn damage the competitiveness of the manufacturing sector in the medium term.

However, previous research by van Baal and Lichtblau (2012) points out that other success factors like innovation and research activities have to be used and promoted by companies to be more successful than their competitors. These findings are in line with results from the OECD (2013a), which state that innovation and research activities provide a sustained source for comparative advantages that foster the inclusion in GVCs. This way SMEs that are mainly connected to other regional companies as well as local service suppliers can effectively be integrated in the GVCs.

4.2.3 Industry meets competitive challenges

Industry is not only the gateway to the world but also the part of the economy with the greatest exposure to international competition. The competition, for example, between Europe and China is much stronger in the manufacturing than in the service sector. However, manufacturing businesses strive to successfully cope with these challenges by focusing on growing world markets with innovative products and a sophisticated strategy of upgrading.

This subsection first provides evidence for the rise of international competitive pressures for EU industry and subsequently points out that manufacturing businesses play a key role in tackling these challenges, e.g. by being present in foreign markets or upgrading products.

Import penetration and competition in world markets

The intensity of international competition can be measured by different indicators. First, import penetration indicates the share of imports in the domestic final consumption:

- On average in the EU Member States, the import penetration ratio⁴⁶ is 29 per cent (2011) in the manufacturing sector; in other sectors of the economy, this share of goods from abroad in final consumption is only 1.4 per cent.
- This ratio has risen worldwide, which is another indication of an increasing interdependence on the global economy.
- The import penetration ratio with countries outside the EU-27 is 18.5 per cent for the manufacturing sector. While roughly the same prevails in the United States, this ratio is only half as high in South Korea and Japan. In China, the import share is just around 3 per cent.

Another indicator of international competition, the development of world export market shares can be used where significant shifts have occurred since the turn of the century (Table 4-11). China in particular has emerged as a major competitor:

- The world market share⁴⁷ of the EU-27 countries' manufacturing sector exports declined from 47 per cent (2000) to 42 per cent (2012).

⁴⁶ Import penetration ratio = $100 \times (\text{imports} - \text{exports} + \text{domestic production})$.

⁴⁷ Similar to Chapter 3, the 50 main industrial countries are included in this analysis for comparability reasons.

- The decline in export market shares in other developed countries is even more obvious: since 2000, these countries have lost around 10 percentage points.
- The winners are the Asian emerging countries. Their share in world exports rose from 10 per cent to over 23 per cent. This effect is mainly due to China. The market share increased from 5.2 per cent (2000) to 18.5 per cent (2012).

Table 4-11: World export market shares in manufacturing, 2000 and 2012

in per cent

	2000	2012
EU-27	47.0	42.1
Other developed countries	40.3	30.6
Asian emerging countries	10.0	23.2
Other emerging countries	2.6	4.1
Total	100.0	100.0

Source: WTO (2013), own calculations.

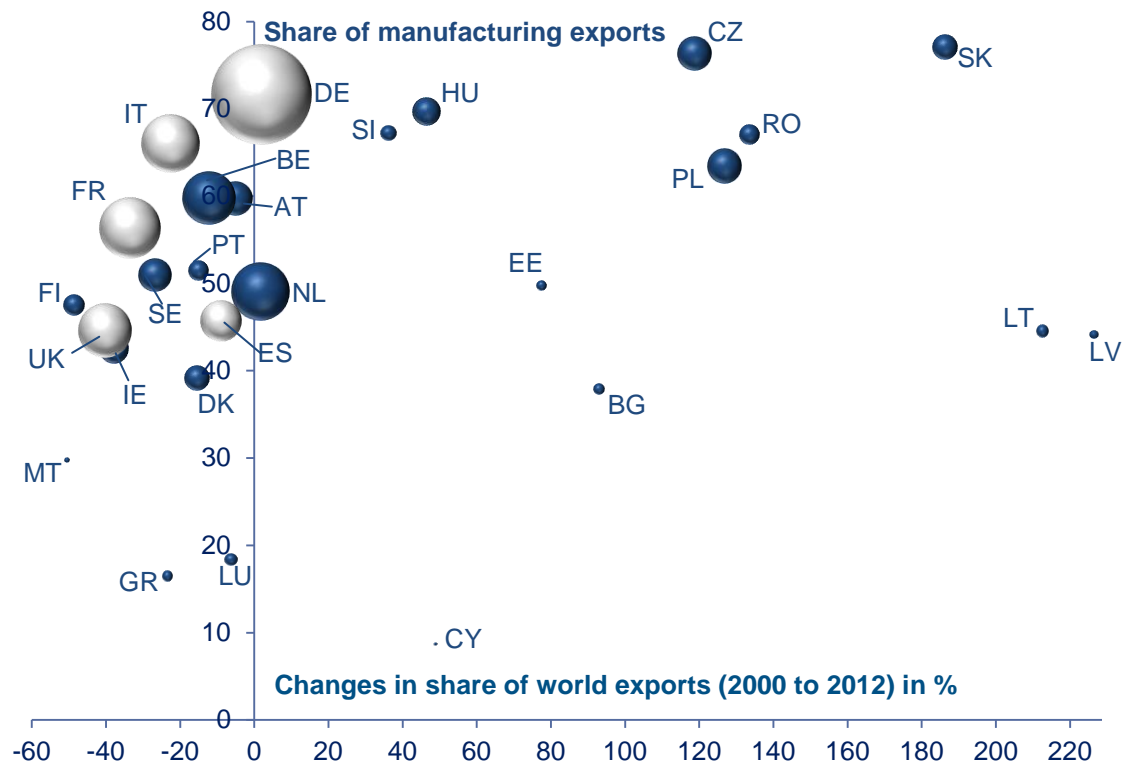
There are several differences within the groups. In the group of developed countries outside the EU, South Korea needs to be considered: the South Korean world market share has increased from 3.6 per cent to 4.4 per cent; it is one of the few major developed countries with rising export shares; and it is also becoming one of the main competitors for European industry.

There are also big differences (Figure 4-17) within the European Union. All CEE countries increased their world market shares, most obviously Lithuania, Latvia and Slovakia. Overall, this again is proof that these countries succeeded in their integration into the global economy and that the catching-up process has been successful. Among the EU-15 Member States, only Germany and the Netherlands expanded their market shares in the manufacturing sector's exports. Other large countries (UK, IT, FR, ES) recorded significant share losses.

There is no obvious relation between the level of export parts of the industry in each country and changes in the world market shares. However, there is a clear relationship between the extent of orientation towards industry as well as deindustrialisation on the one side and changes in the global export shares on the other. Countries with a rather high and stable share of industry also performed better on world export markets.

Figure 4-17: The European position in world manufacturing trade (2012)

in per cent



The size of the bubbles corresponds to the world market share of manufacturing exports.

Source: WTO (2013), own calculations.

Behind this development of world trade shares are structural changes that will remain important. Industrial businesses tackle these challenges in several different ways and thus increase their business success and also the competitiveness of European industry. These success strategies include:

- presence in emerging markets;
- technology intensity of foreign trade; and
- differentiation and upgrading.

Presence in emerging markets

Being present in fast-growing markets is necessary to benefit from foreign trade. These growing markets are the emerging countries. Global exports to these countries grew between 2000 and 2011 roughly twice as fast as exports to traditional developed countries.

EU Member States have maintained their market position in traditional developed countries and have even expanded their position in emerging countries outside of Europe. This is illustrated by the results presented in Table 4-12. Values greater than one indicate an improvement of the market position in the period from 2000 to 2011 in the certain region. Europe's position is significantly better than the position of the United States and Japan. An even better development can be observed for Korea and China; China was able to significantly improve its market share in almost all regions.⁴⁸

However, these positive findings do not apply to all EU Member States. From 2000 to 2011 particularly Southern Member States but also United Kingdom, France and Finland have only made below-average gains from growing markets in emerging countries. Countries from CEE, Germany, the Netherlands and Austria were able to take advantage of these new growing markets.

Table 4-12: Development of relative market position in different regions (2000–2011)

Development of market share in exports in the different regions

	Developed countries	CEE	South-East Asia/China	Other emerging countries	RoW
EU-27	1.01	0.92	1.19	1.08	0.57
United States	0.42	0.71	0.48	0.39	0.71
Japan	0.16	0.93	0.61	0.81	0.49
Korea	0.75	3.39	1.44	1.84	1.18
China	5.11	4.17	0.81	6.92	4.29

Values greater (smaller) than one indicate an improvement (worsening) of the market position.

Source: OECD (2013), own calculations.

Raising technology intensity

Although focusing on fast-growing markets is important to meet the challenge of rising international competition, it is also essential to consider technology intensiveness. The higher the products' technology content, the easier the creation of competitive advantages, especially over low-wage countries.

Concerning exports, European industry specialises in medium- and high-technology products. The share of exports in this technology segment is 48 per cent, which is higher than the average share

⁴⁸ The different participation in the growth of South East Asia and China is hardly surprising because China is a part of this region and the "China-effect" of the other countries is not taken into account.

over all the technology segments (43 per cent). This is shown by the positive values in the RXS indicator, which is a measure for the relative market share.⁴⁹ The profile of specialisation has changed since 2000. The changes in the RXS values show a shift towards the products in the technology-intensive sectors. Overall this clearly demonstrates an upgrading of the European export structure. This development can be observed in all regions of the EU; however, the specialisation on lower technology remains relatively high in Southern Europe. Their world market share in low-tech goods is still 8.5 per cent compared to an average share of 6.6 per cent over all technologies.

The EU Member States, the United States, Japan and Korea show an export specialisation that is typical for advanced industrial countries. They all have negative RXS values in the low-tech sector. This is different in emerging economies which specialise in these goods. In 2011, the same also applied to China; however, China has a dual structure because it is also highly specialised in the high-tech sectors. This figure can be qualified by the fact that China features as an assembler of many ICT products (which are categorised as high-tech products) and thus imports many intermediate components for these goods.

Even more interesting are the changes in export specialisation. EU countries – led by the manufacturing sector – managed to increase their specialisation in high- and medium-tech goods (see Table 4-13). The remarkable performance of South Korea and China in this respect is an additional indicator of the rising competition from both of these emerging countries. However, this phenomenon cannot be observed in every emerging country, with many still primarily specialising in the low-technology sector. Nevertheless, the challenge for EU countries will remain largely to continue the shift towards higher technology intensity. Industry will remain an essential enabler in this respect.

⁴⁹ RXS is defined as the log of the ratio between the world market share in the specific technology segment and the world market share for all technologies of the country multiplied by 100.

Table 4-13: Export market share by technologies

	High-tech	Medium-high	Medium-low	Low-tech
World market share 2011 (per cent)				
EU-27	38.5	47.9	39.9	41.4
United States	13.2	11.2	9.1	7.3
Japan	5.6	9.6	6.1	1.2
Korea	5.1	4.7	6.6	1.1
China	21.4	10.6	11.4	21.1
RXS¹ 2011				
EU-27	-10.7	11.2	-7.1	-3.4
United States	24.0	7.4	-13.7	-35.3
Japan	-11.2	41.9	-2.2	-165.9
Korea	13.4	3.9	38.4	-140.3
China	34.1	-36.3	-28.7	32.7
Changes in RXS from 2000 to 2011 (percentage points)				
EU-27	7.9	3.3	-12.9	-5.7
United States	-11.5	7.5	22.2	3.7
Japan	-31.2	9.7	23.1	-6.9
Korea	-18.5	36.2	7.0	-109.5
China	48.3	25.4	-19.4	-39.9

¹ RXS is defined as the log of the ratio between the world market share in the specific technology segment and the world market share for all technologies of the country multiplied by 100.

Source: OECD (2013), own calculations.

Upgrading and sophistication of exports

Another precondition to stay ahead of competitors from emerging markets is to upgrade the overall product portfolio and to achieve sufficient differentiation. To improve competitive advantages, small changes and improvements through learning by doing can be as important as new innovations (Baldwin (2011)). A broader and diversified industry as well as a high degree of manufacturing employees' technical finesse are important stepping stones to achieving a heterogeneous product portfolio.

Hausmann et al. (2005, 2007, 2011) have developed a method that measures the sophistication of exports and thereby the degree of upgrading. They showed that some traded goods are associated with higher productivity levels than others and that countries that latch on to higher productivity goods will perform better. Therefore, they developed a quantitative index that ranks traded goods in terms of their implied productivity. They constructed this measure by taking a weighted average of the per capita GDPs of the countries exporting a product, where the weights reflect the revealed comparative advantage of each country in that product. So for each product, they generate an associated income/productivity level (which they call PRODY). All in all, the PRODY index approximates the “revealed” technology content of a product by a weighted average of the GDP per capita of the countries that export it, where the weights are the exporters’ RCA⁵⁰ indices for that product. Intuitively, PRODY describes the income level associated with a product, giving relatively more weight to countries with a revealed comparative advantage in that product, independent of export volumes.

This PRODY index is very different between sectors and countries. It is particularly high in mechanical engineering, chemistry and transport equipment. Less pronounced is this product differentiation index regarding export goods in the fields of agriculture, wood, textiles and leather. When looking at individual countries, Japan, Finland, Germany, United Kingdom and the United States have a very high PRODY index and thus highly differentiated export goods. For 36 countries, data from 1995 to 2011 is available (Table 4-14). The weighted average for 1995 is equal to 100 in order to better demonstrate the differences of level and development:

- The EU countries have an above-average differentiation in their export products. The United States and Japan display even higher degrees of differentiation, while South Korea and China have significantly lower levels.
- In the EU, the degree of differentiation has increased by 6 per cent compared to 1995. However, South Korea and China have caught up significantly in this respect, which is indicated by the index’s high growth rates for both countries.

⁵⁰ This is a ratio of product K 's share in country i 's exports to its share in world trade.

Table 4-14: PRODY index (1995–2011)

changes in per cent

	1995	2011	Change
EU-23	108	115	6.0
United States	110	118	7.5
Japan	127	131	3.5
Korea	92	108	16.4
China	79	101	26.8
World¹	100 ²	109	9.1

The PRODY index is a measure for the sophistication of exports. For details see Hausmann et al. (2005, 2007).

¹ Data for 36 countries included.

² Weighted PRODY index for 36 countries (origin value 12,177) = 100.

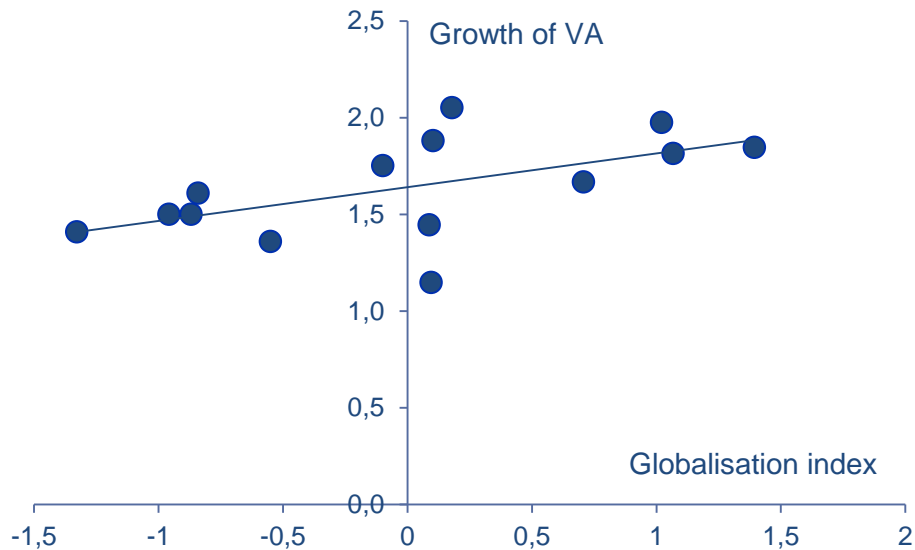
Source: Data taken from Foster et al. (2013), own calculations.

Empirical studies show how important this export sophistication is. With a multiple regression analysis, Foster et al. (2013) demonstrate that countries with a more sophisticated export structure tend to grow faster. Upgrading a country's product mix for exports has a positive effect. This is one of the main starting points for the European industry to improve and defend its position on the world markets against emerging competitors, particularly from South-East Asia.

Conclusion

Various studies show positive effects of globalisation on growth, productivity and other economic factors (OECD (2013a, b), IMF (2013a)). These key results can be illustrated by a simple figure (Figure 4-18) for the EU-27. There is a positive correlation between the growth in VA of manufacturing sectors and the integration changes in GVCs.

Figure 4-18: Globalisation and growth in European manufacturing (2000–2011)



Globalisation index: Standardised values for changes (2000 to 2011) in intermediate import ratios, foreign VA included in exports and PRODY index, measured at industry-sector level.

Source: WIOD (2013), Foster et al. (2013), own calculations.

4.3 Innovation networks and knowledge intensification

For many decades, the third megatrend of knowledge intensification has shaped structural change (see Figure 4-1). This section highlights the importance of innovation and skills for business success and economic performance as well as the extraordinary relevance of industry for innovation. Moreover, it particularly focuses on the relevance of cooperation for innovation as part of the “Moving Forward Together in Europe” paradigm.

Without innovation, R&D or well-trained professional companies can barely compete in the international markets. New products and processes are indispensable for keeping competitive advantages in higher-technology fields, developing them further and remaining cost-efficient in this upgrading process. Only if Europe succeeds in these respects will it achieve sufficiently high growth of productivity and thus of income. Being more expensive implies the need to remain better than competitors. This aim can only be achieved with technology, know-how and professionals. As a driver of innovation and knowledge intensification, industry contributes to meeting this challenge to an above-average extent.

Furthermore, ICT will play a crucial role in the future economic growth. Digitisation has emerged in recent years as a key economic driver that accelerates growth and facilitates job creation.⁵¹ From 2000 until 2012, the growth of ICT capital services contributed approximately 0.5 percentage points to the GDP growth of the EU-27 (The Conference Board (2013)). The average GDP growth was 1.25 per cent.⁵²

As a general purpose and cross-section technology (Kretschmer (2012)), ICT has enormous influence on most parts of the economy and offers opportunities for productivity increases. It facilitates communication and the creation of new knowledge through more efficient processes of collaboration and information processing. The cause of the digitisation trend is the rapid progress of computer technology, especially microprocessors, software, storage media and transmission capacities. The internet economy currently accounts for 3.8 per cent of GDP in the EU-27 (2010).⁵³ About US\$615 billion [€479 billion] can be attributed to this sector. This share will rise to 5.7 per cent in 2016, which equates to a contribution to GDP of US\$1.1 trillion [€0.86 trillion] (BCG (2012)).

ICT is increasingly relevant for manufacturing since knowledge has become more important to industrial processes. Faster information processing allows for new ways of communication with suppliers or arranging distribution systems. Digitisation enables the modification of production processes by cutting innovation cycles short. Moreover, issues like big data, IT security, Industry 4.0 and upskilling play a crucial role. Currently, platforms to organise and process the enormous data streams are still lacking, which creates a major challenge for companies.

4.3.1 Industry as a driver of progress

Manufacturing is becoming more and more technology-oriented. Thus, industry can be recognised as one of the key drivers for progress around the world and in the European Union. Moreover, innovation strategies are a key success factor to meeting the competitive challenges of the three economic megatrends.

The following subsections will underline these aspects regarding:

- research and development;
- innovation;
- skills (including STEM skills); and
- productivity (and wages).

⁵¹ Many studies show a positive relationship between economic growth and the increasing digitisation. In 2011, digitisation provided a US\$193 billion [€139 billion] boost to world economic output and created six million jobs (Friedrich et al. (2013)). Other studies highlight the significantly positive effects of ICT investments on productivity (Jorgenson and Timmer (2011), Inklaar et al. (2005)). For example, the European Commission calculated a 31 per cent contribution of ICT to labour productivity from 2003 to 2007 (European Commission (2010)).

⁵² Hence ICT investments are responsible for about 37.5 per cent of the GDP growth in the EU-27, which amounts roughly to €600 billion.

⁵³ In the OECD Declaration for the Future of the Internet Economy, the internet economy is defined as covering “the full range of our economic, social and cultural activities supported by the Internet and related information and communications technologies” (OECD, 2008).

Research and development

The manufacturing sector is not only a main factor for global economic development, but it is also the main source of R&D expenditure in most European countries. It combines to account for nearly two-thirds of the European R&D expenditure. Other global competitors like the United States, Japan and South Korea have an even higher share than the average European economy (Table 4-15). For each of the observed countries, the R&D intensity⁵⁴ of manufacturing is multiple times the value of the whole economy. The intensity in China is still lower than in other developed countries, but R&D expenditure is rising much faster than the VA.

Table 4-15: R&D expenditure and intensity (2008–2010)

in per cent

	Manufacturing's share of total R&D expenditure	R&D intensity total¹	R&D intensity manufacturing¹
EU	65.3	1.41	6.09
United States	69.1	2.0	10.9
Japan	87.1	2.6	11.9
Korea	87.5	2.97	9.03
China	85.2	1.08	2.94

¹R&D expenditure in per cent of VA.

Data shows averages for the years 2008 to 2010.

Source: OECD (2013), own calculations.

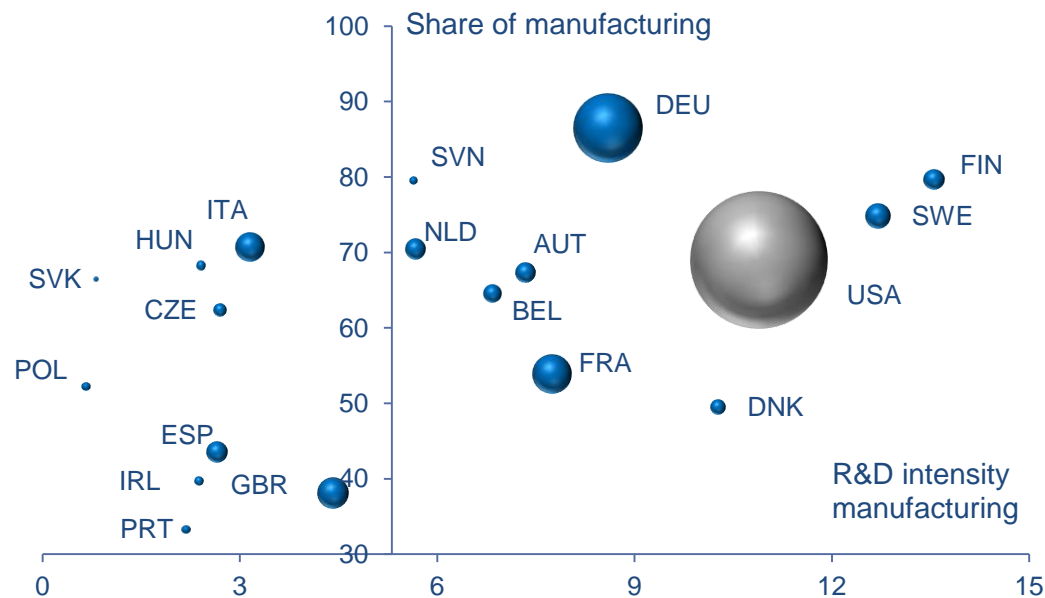
Looking at the individual EU Member States, a positive correlation between R&D intensity and share of R&D expenditure in manufacturing can be observed (Figure 4-19). Nearly all of the economies with an above-average R&D intensity have a share of manufacturing R&D investment above 50 per cent.

A critical point for the future of European manufacturing is that all of the Southern countries have a relatively low R&D intensity. Since a high technology level is a main enabler for VA and employment growth in manufacturing, this could seriously hamper the evolution of the manufacturing sector in Southern Europe.

⁵⁴ R&D expenditure as a share of GDP.

Figure 4-19: R&D intensity, volume and share of manufacturing (2008–2010)

in per cent



Data shows averages for the years 2008 to 2010; size of bubbles shows the total R&D expenditure.

Source: OECD (2013), own calculations.

A second perception of the figure above is the high volume of R&D expenditure in the US economy. All of the European countries combined only equal around 60 per cent of the US investments. European companies must increase their efforts to cooperate and combine the potential of their individual industries to keep up with the large global players in R&D.

Innovation

The building of transnational cooperation is even more important considering the results of the analysis of the innovation activities in the European Union (Table 4-16). It shows that there are large differences between the level of innovation depending on the size of the enterprises, the economic sector and the networking activities.

The manufacturing sector is far more innovative related to all relevant branches of the economy. Regarding the level of cooperation, the difference between the manufacturing sector and other sectors of the economy is the lowest whereas the other indicators show high differences between the sectors, regardless of the size of the enterprises. It becomes obvious that innovation plays an important role in the manufacturing sector. There are clear results (Table 4-16):

- With respect to all indicators (innovation intensity, innovator rate, R&D activity rate, turnover shares from innovative products, share of cooperation) the manufacturing performance is higher than in the total economy.
- There are huge differences between SMEs and larger firms in the manufacturing sector and the total economy.

For example, the share of turnover from large enterprises' innovative products (10.5 per cent) is nearly twice as much as SMEs' turnover (5.4 per cent). In terms of cooperation, the difference between SMEs and large enterprises is much greater: large enterprises (53.7 per cent) cooperate more than twice as much as SMEs (23.6 per cent).

Table 4-16: Innovation indicators by firm size and sector (2010)

in per cent

Enterprises		Innovation intensity ¹	Innovator rate ²	R&D rate ³	Share of turnover from innovative products ⁴	Cooperation ⁵
Total	Manufacturing	3.4	64.0	54.8	11.8	26.1
	All sectors	1.9	52.9	48.8	8.6	25.6
SMEs	Manufacturing	2.5	60.1	52.7	7.6	23.7
	All sectors	1.7	49.9	47.4	5.4	23.6
Large	Manufacturing	3.9	84.3	79.8	14.3	57.4
	All sectors	1.9	76.9	69.5	10.5	53.7

¹ Expenditure in innovation related to total turnover of innovative enterprises.

² Share of product- and/or process-innovative enterprises, and organisational or marketing innovation.

³ Enterprises engaged in in-house R&D activities in relation to all product- and/or process-innovative enterprises.

⁴ Share of turnover of product-innovative enterprises from new or significantly improved products.

⁵ Share of product- and/or process-innovative enterprises, and organisational or marketing innovation engaged in any type of cooperation.

Source: Eurostat (2013), own calculations.

This importance has increased in the past years. An indicator for this is the dynamic development of the innovator rate, which rose by about 20.1 per cent between 2008⁵⁵ and 2010 in the manufacturing sector, whereas the growth in all relevant branches was lower in this period (18.6 per cent). However,

⁵⁵ Due to missing data for earlier years it is not possible to analyse the dynamics of the innovator rate for the longer term.

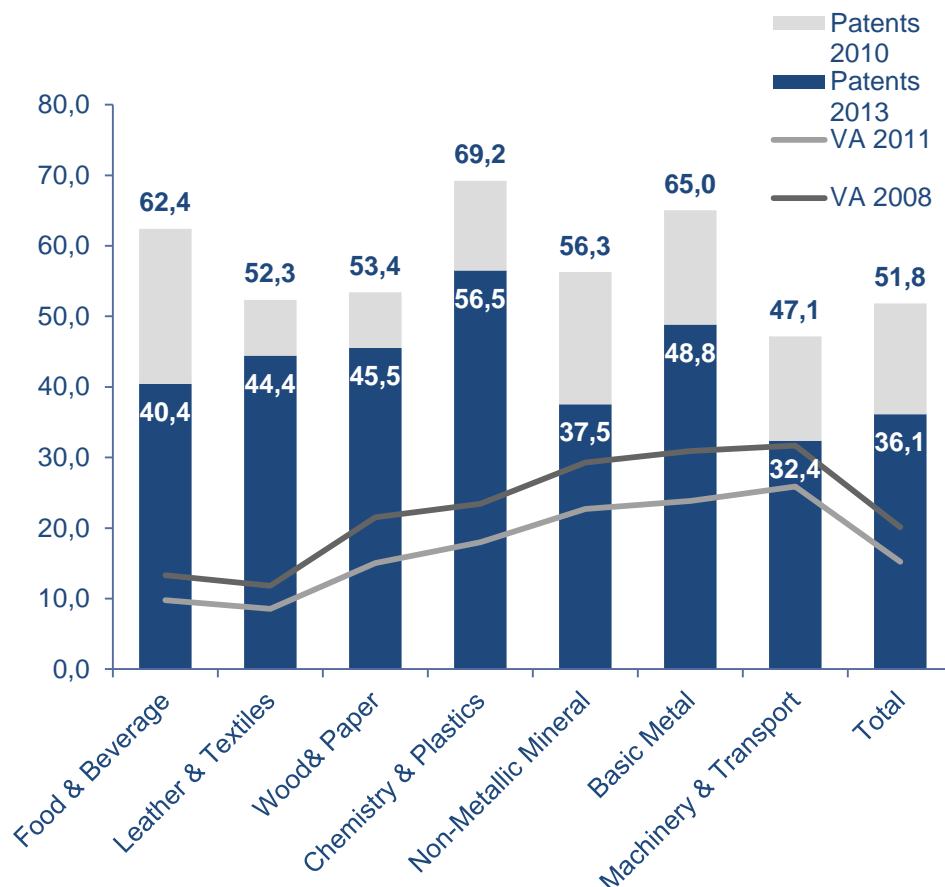
the development of the innovator rate in SMEs has developed more dynamically than in large enterprises. While the innovator rate in SMEs grew by 18.6 per cent between 2008 and 2010, the growth in large enterprises was 5.0 per cent.

International patents comparison⁵⁶

There is no data on the global level of innovations; however, the number of patents can be used as a measure for innovation activities. Europe's share in applications for new patents is much higher than its respective share in VA in the different manufacturing sectors (Figure 4-20). In 2010, Europe's share of total manufacturing patents exceeded 50 per cent. In 2013 this share is down to 36.1 per cent. The decrease in patents is slightly stronger than the decrease in the share of global VA in manufacturing. This finding is not constant for all the observed sectors. The wood and paper sector had a stronger decline in VA than in patent applications. In contrast the machinery and transport sector had a relatively small reduction in the share of global VA compared to the share of patents.

Figure 4-20: Europe's share in patents and VA by industry

in per cent



Source: Stadlbauer (2013), WIOD (2013), own calculations.

⁵⁶ Patent data are taken from Stadlbauer (2013).

Skills

Highly skilled employees are essential for companies to be competitive and innovative and to make economies successful in the global market. In the EU-27, almost a fifth of jobs in the manufacturing sector can be attributed to the high-skilled sector. Across all skill classes, industry offers very attractive high-quality jobs, as measured by the wage level.

Worldwide, an upskilling process – one of the main global economic megatrends – has been underway for some time already. To describe this phenomenon, the WIOD can be used. It provides employment data for three skill groups (high, medium, low) for 40 countries. Skill groups are classified according to the formal qualifications of employees.⁵⁷ The following findings highlight the upskilling trend:

- On a global scale, the share of total hours worked by highly skilled employees in the overall economy increased from 8.5 per cent (1995) to 12.5 per cent (2009). At the same time, low-skilled employment has become less important with a share decline from 57.6 per cent (1995) to 50 per cent (2009). The same structural changes can also be observed in the global manufacturing sector and in all regions. Upskilling obviously is a worldwide phenomenon.
- Likewise, in the manufacturing sector of the EU-27 a significant upskilling process can be observed with a 37 per cent increase of working hours of high-skilled employees between 1995 and 2009. This led to a high-skill share (of working hours) of 18 per cent in the EU. The intensity of upskilling in the manufacturing sector is about as strong as in the overall economy; in both areas the share of low-skill employment declined by about 10 percentage points.
- Upskilling proceeds similarly in all regions of Europe. However, high-skill shares in Southern Europe (15 per cent) and Eastern Europe (11 per cent) are lower than the EU average. Nevertheless, these countries have caught up rapidly in this respect.

Table 4-17 illustrates the skill structure for the EU-27 by sectors:

- The manufacturing sector displays a below-average high-skill share (18 per cent) compared to the overall economy (26 per cent). Correspondingly, the medium- and low-skill classes are relatively more important. However, the below-average overall skill intensity of the manufacturing sector can be qualified (see below).
- Larger high-skill shares can be found in the finance sector (44 per cent) and in business-related services (43 per cent). The private and public services area also displays higher rates because it includes the entire education sector.

⁵⁷ For the definition and explanation of the data sources see Erumban et al. (2012).

Table 4-17: Share of hours worked by skill intensity 2009

in per cent

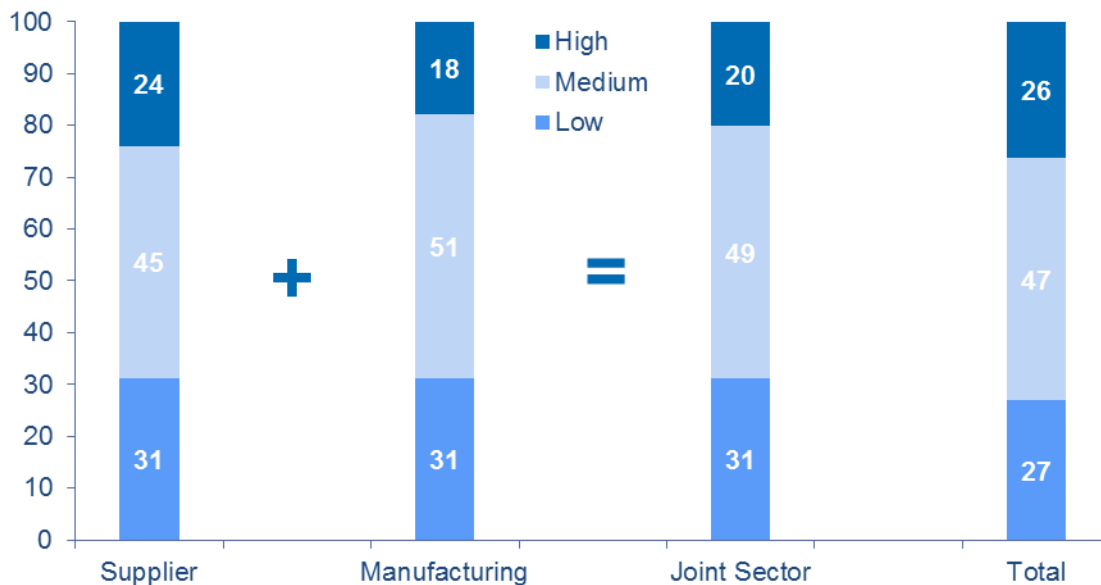
EU-27	High	Medium	Low	High	Medium	Low
	Share of hours worked			Change 1995/2009		
Agriculture	7.0	36.9	56.1	32.8	-25.7	-39.0
Mining	14.6	53.0	32.4	-23.0	-45.2	-56.6
Manufacturing	17.9	50.9	31,1	36.9	-11.3	-38.9
Utilities	27.7	55.1	17,2	30.7	-23.1	-48.8
Construction	11.7	50.5	37.8	43.8	22.0	-1.1
Logistics	16.5	54.5	29.0	77.9	14.1	-16.3
Communication	18.1	54.2	27.7	98.6	0.0	-31.6
Finance	43.7	46.0	10.3	80.9	-2.1	-30.6
Business Services	43.0	40.7	16.3	114.8	63.1	23.6
Public/Private Services	31.7	45.3	23.0	57.2	18.5	-15.2
Total	26.3	46.8	26.9	63.7	8.8	-23.1

Source: WIOD (2013), own calculations.

Strikingly, manufacturing sector suppliers are more skill-intensive than industry itself. This applies especially to the important area of business services. Figure 4-21 demonstrates this. The first pillar illustrates the skill structure of the manufacturing sector in the EU-27. The second pillar shows the skill structure of the suppliers, which is calculated on the basis of the sales shares of each supplying sector to manufacturing. The suppliers display an average high-skill share of 24 per cent, compared with 18 per cent in the industry itself (the low-skill shares are identical at 31 per cent). The structure of the “Joint sector”, i.e. of the industry suppliers’ network, is therefore similar to the overall economic average (third and fourth pillar in the figure). Overall, the manufacturing sector also has an integration function for high-skill employment.

Figure 4-21: Share of skill intensity by sector in the EU-27

in per cent of all skills (2009)



Supplier: Skills are allocated proportionally by turnover of shares which are delivered to the manufacturing sector.

Calculated on the basis of working hours of employees with different skill levels.

Source: WIOD (2013), own calculations.

The finding of a below-average skill intensity in the manufacturing sector is based solely on formal educational statistics, which has certain weaknesses:

- Formal qualifications need not represent the factual skill level. This is particularly true for the high share of medium skills in industry which generally represent secondary education levels.
- Skills continuously acquired by experience and by training on the job are not taken into account. This disadvantage is likely to be particularly important in the technology-intensive manufacturing sector.
- On-the-job skills (and thus labour productivity) are also improved when jobs are accompanied by high levels of capital equipment and an efficient business organisation. These effects should be taken into account.
- A good proxy for these effects is the wage level. In fact, in all skill classes, the hourly wage in manufacturing is above the overall economy average and also above the wage level in most other sectors (Table 4-18).

- These positive wage differentials are particularly pronounced in Western and Northern Member States. In the CEE countries, the hourly wages in manufacturing are lower than in the overall economy in all skill classes. In the Southern Member States, above-average manufacturing wages can be found in the medium- and low-skill area. In the high-skill area the opposite is true.

In summary, the EU manufacturing sector overall offers above-average wages in all skill classes. Industry thus provides attractive and high-quality jobs.

Table 4-18: Labour compensation per hour worked in the EU by skill level

in € (2009)

	High	Medium	Low
Agriculture	17.33	9.03	6.10
Mining/Quarrying	34.06	17.32	12.54
Manufacturing	35.24	19.70	14.47
Utilities	38.02	22.90	17.28
Construction	26.88	16.94	13.98
Logistics	28.67	18.03	15.74
Communication	28.14	17.38	16.46
Finance	32.47	23.61	19.06
Business Services	30.68	18.60	15.36
Public/Private Services	26.03	16.38	13.42
Total	28.46	17.42	13.26

Figures in larger font are where labour compensation is higher than in the manufacturing sector.

Source: WIOD (2013), own calculations.

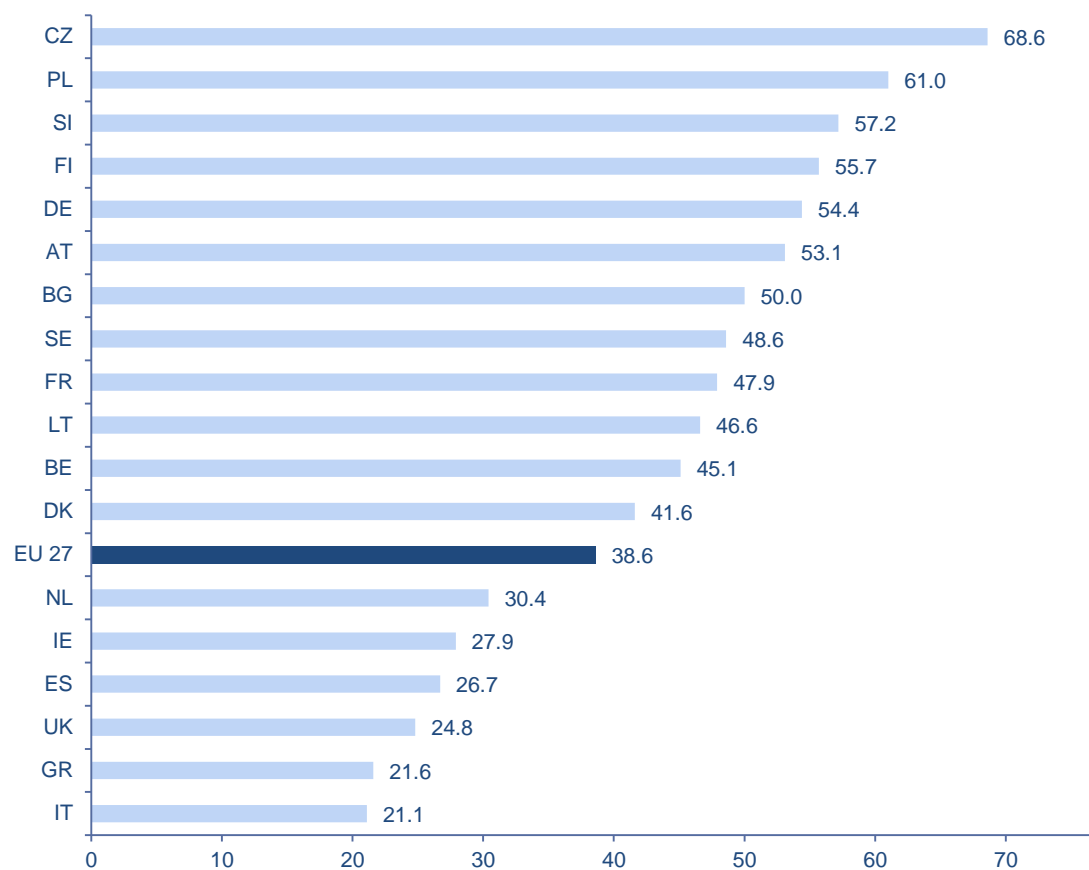
Regarding the skill structure in industry, it is particularly important to take technology-related skills into account. In this respect, STEM qualifications stand for skills in science, technology, engineering and mathematics. These skills play a crucial role in the development of high-technology products, one of the strengths of European industry. STEM employees not only work in fields like production, research or product development, but also in management. In fact, the combination of market-oriented knowledge and technological know-how is a key requirement for the development of innovation and also marketable products.

STEM employment shares in the manufacturing sector are higher than in the overall economy:

- Evaluations of Eurostat’s labour force survey data show that 39 per cent of all employees in the EU-27 belong to the field of “Science and Engineering”.
- This is significantly more than in the overall economy (22 per cent).
- The STEM shares in manufacturing vary considerably among Member States. While the Czech Republic has a STEM rate of 69 per cent, in Italy (21 per cent), the United Kingdom (25 per cent) and in Spain (27 per cent), for example, the shares are much lower.

Figure 4-22: Share of STEM skills employed in manufacturing

in per cent of all skills (2009)



Source: Eurostat (2013b).

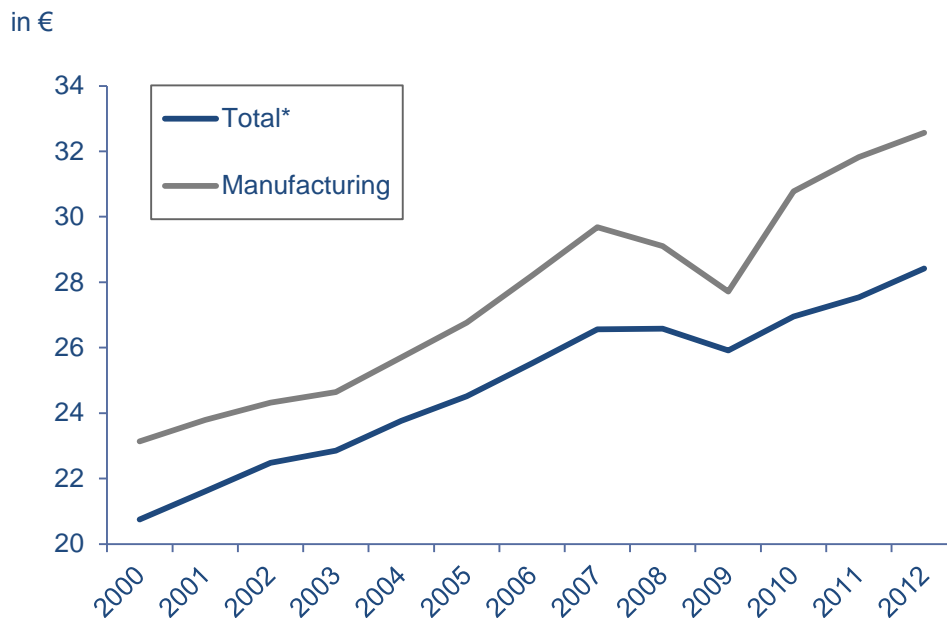
Productivity

The high rate of R&D investment and innovation leads to the assumption that manufacturing has high values in productivity. As increases in productivity lead to higher loans and a total increase in welfare, the manufacturing sector is especially important for the welfare of each country.

Productivity is often measured by labour productivity, which is VA per hour worked. Labour productivity in most European Member States is significantly higher in manufacturing than in the whole economy. Figure 4-23 shows the difference in labour productivity between manufacturing and the total economy minus the real estate sector.⁵⁸ Consequently, supporting the manufacturing sector is one way to increase total welfare in the European economies.

The ratio between labour productivity of manufacturing in relation to the productivity of the whole economy (without real estate) is positive for most of the European countries. In Ireland, productivity of manufacturing is about twice as high as the economy overall. Some other countries with a high ratio are Austria, Finland, Germany, Lithuania and Romania; some smaller countries have low manufacturing productivity in relation to the productivity of the total economy, for instance, Luxembourg, Estonia and Cyprus.

Figure 4-23: Labour productivity EU-27



* without real estate.

Labour productivity: VA per hour worked.

Source: Eurostat (2013), own calculations.

The higher level of productivity in manufacturing is especially true for large enterprises. The output per employee is €76,008 for manufacturing companies with at least 250 employees. Large enterprises in other sectors have a value that is nearly €20,000 less.

The differences between small and medium-sized enterprises are much smaller. Referring to the differences in innovation, cooperation and R&D it is much more difficult for SMEs to transfer the costs

⁵⁸ The real estate sector is intentionally left out because increases in VA in this sector do not reflect an increase in productivity but an increase in market prices due to high demand for property.

of innovation processes to increases in the prices of their products. The latitude created by the increase in productivity due to innovation processes is mostly consumed by the competition in the sector.

SMEs play a crucial role in the European manufacturing industry. In the EU-27, 99.2 per cent of all enterprises in this sector employ a workforce of fewer than 250 employees. They account for nearly half of the VA.

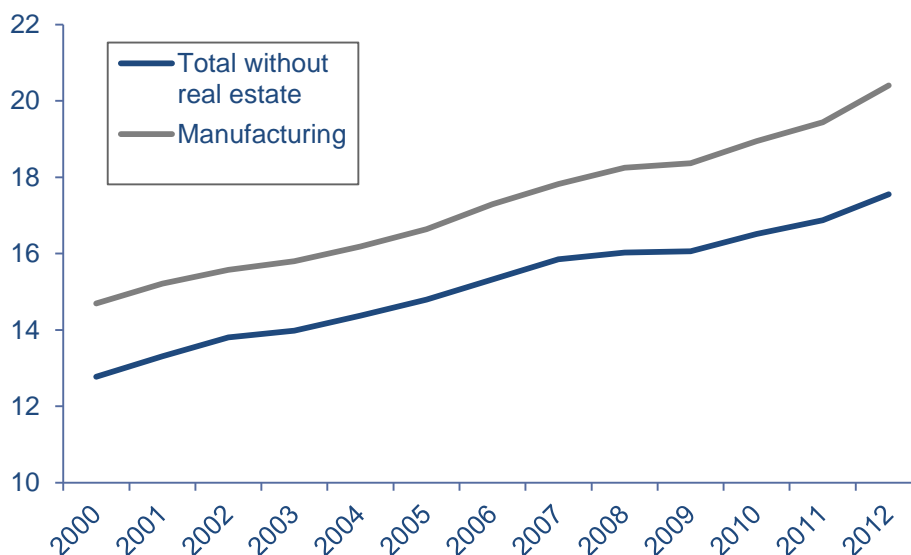
This fact leads to the insight that SMEs are less productive than bigger enterprises. Analysing the VA per employed person, there is a huge gap between SMEs and large firms. While SMEs in the EU-27 generate around €44,000 VA per employee, bigger enterprises earn €76,000. That is, SMEs account for less than 60 per cent of the productivity of bigger enterprises. This gap is more pronounced in big countries than small countries, largely due to economies of scale for large enterprises in big countries.

Wages

Productivity correlates with the level of wages therefore we can expect higher wages in the manufacturing sector. The data confirm this hypothesis. The average payment per hour is nearly €3 more in manufacturing than in the whole economy⁵⁹ (Figure 4-24). This gap has been constant over the last decade.

Figure 4-24: Wages per hour EU-27

in €



Source: Eurostat (2013), own calculations.

⁵⁹ Without real estate.

For SMEs, this gap is much smaller. SMEs pay approximately €22,000 per employee on average in the manufacturing sector and €20,000 in other sectors. However, bigger manufacturing enterprises are in the position to pay wages of €38,000 per employee.

The magnitude of these effects is somehow different across certain Member States. For Germany, the results are very strong while other countries show weaker or no effects. The tendencies for Europe as a whole remain the same for all of the above-mentioned aspects.

Table 4-19: Structural differences between SMEs and large enterprises (2012)

in per cent

	Big countries*	Small countries*	EU-27
Share of SMEs	99.2	98.9	99.2
SME productivity gap	42.9	34.7	42.7
SME wage gap	41.8	25.7	41.4

Big countries: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Spain, Sweden, United Kingdom.

Small countries: Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Slovakia, Slovenia.

Shares and gaps in per cent; productivity and wages/salaries in euros.

Productivity gap: Difference in VA per employee between larger firms and SMEs.

Wage gap: Difference in wages and salaries per employee between larger firms and SMEs.

Source: ECORYS (2013), own calculations.

In big European countries, the productivity and wage gaps are more pronounced than in small countries (Table 4-19). Economies of scale in big countries are one reason for this. Also, the wage gap in smaller countries is much smaller than the productivity gap. In the big countries, the gaps are almost the same. This means that in smaller countries, SMEs' wages are relatively higher compared with their productivity than in bigger economies.

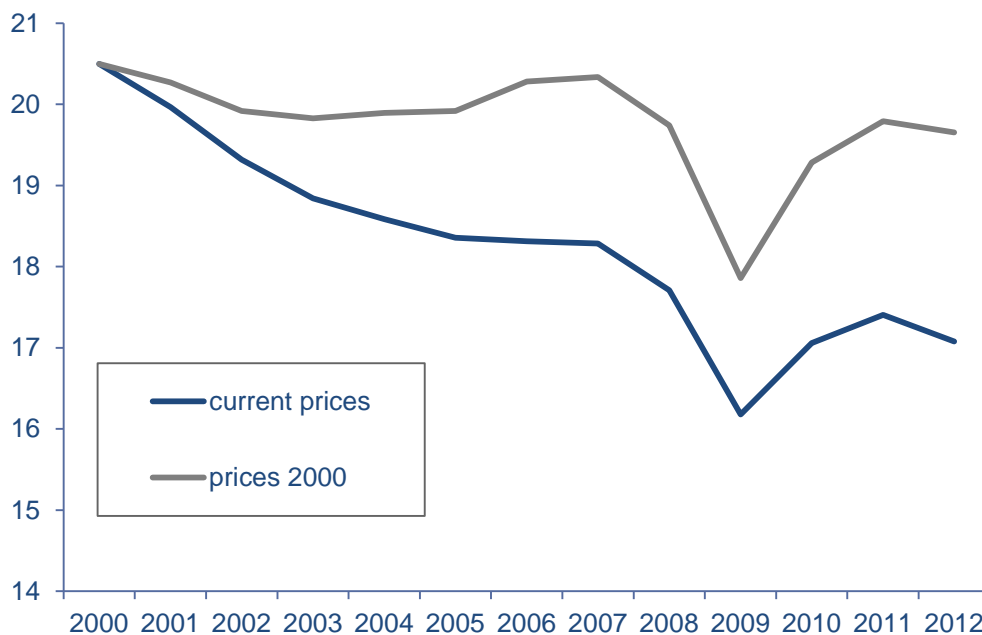
Price effects

The manufacturing sector is more productive than the non-manufacturing sector. Large manufacturing firms in particular achieve significantly higher productivity than large firms in other sectors. The better use of economies of scale and higher innovation intensities are the main reasons for this gap.

The manufacturing sector's higher productivity is shifted, at least in part, to customers in prices. This effect is due to the high level of competition for manufacturing goods in the global market compared with other sectors. The price indices for industrial goods develop at a slower pace relative to non-manufacturing prices, which creates an indirect income effect induced by the manufacturing sector. This can be measured by the comparison of VA shares in nominal and constant price levels (Figure 4-25). Looking at GDP volume, the decline in the share of manufacturing has been much smaller. The difference between the higher value share in constant prices and the share in nominal prices is the price effect.

Figure 4-25: Manufacturing's share of GDP in different concepts

in per cent



Source: Eurostat (2013), own calculations.

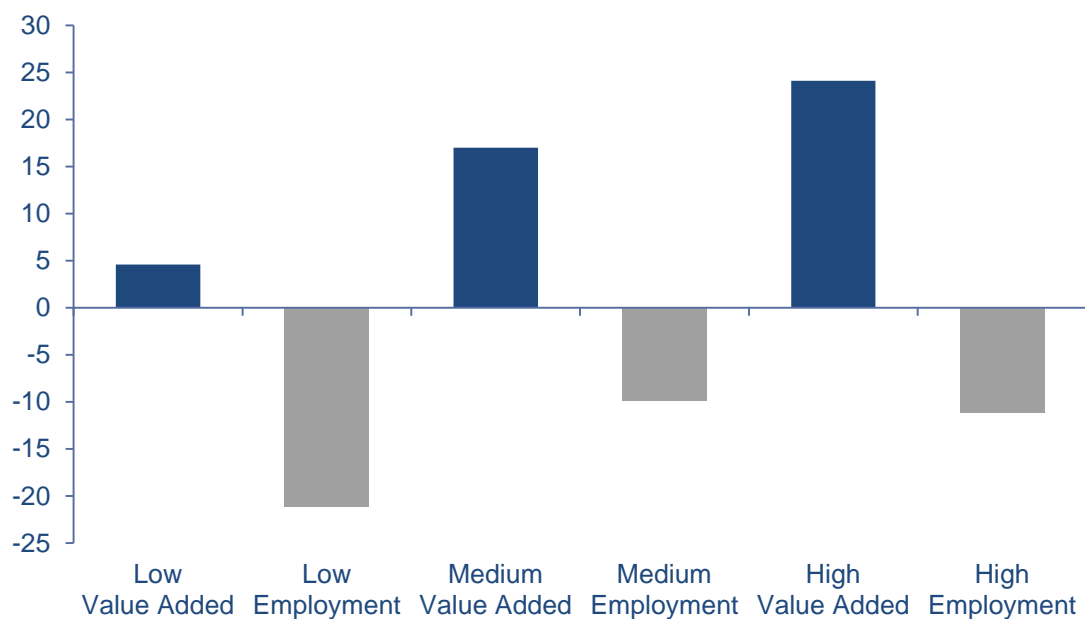
Conclusions

There is empirical evidence that investment in knowledge-based capital is an important source of competitiveness (Bruegel (2013)). The same results can be observed by looking at the growth rates of the different knowledge-intensive sectors in manufacturing.

In Europe, technology- and knowledge-intensive sectors develop with above-average rates compared to other sectors (Figure 4-26). VA in these sectors increased by 24 per cent from 2000 to 2012; in low-tech industries, this figure was only about 5 per cent. The economic collapse was very pronounced in advanced-technology sectors in 2009. This demonstrates how important a stable international environment is, especially for these industries.

Figure 4-26: VA and employment growth in the EU-27 by technology intensity

changes 2000 to 2012*



*Employment data up to 2011

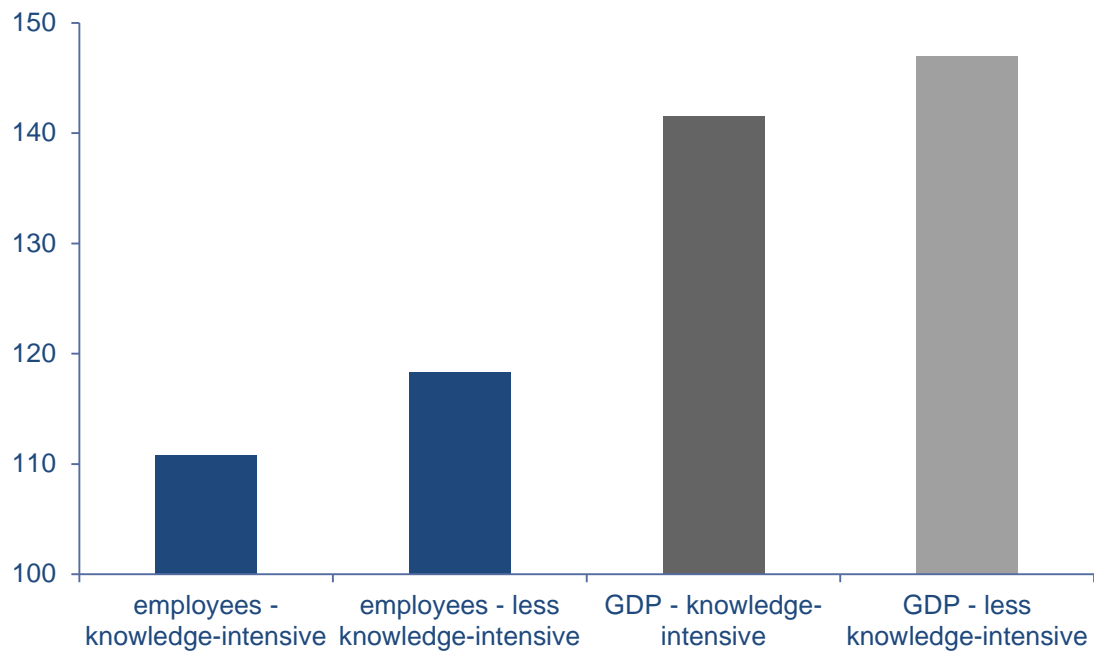
Source: Eurostat (2013), own calculations

In Europe, industry has lost employment in all technology classes though the declines have been much more pronounced in the low-tech sector. This development is also the result of higher productivity growth in industry, driven by technology and often the result of labour-saving technical progress. Overall, however, innovation and technical progress have not – as was often feared in the past – led to a permanent employment decline in the economy.

It is obvious that the manufacturing sector – at least directly – over time tends to contribute less to employment in the EU. This is especially true for the low-skilled area. However, new employment opportunities continue to be created in the service sector, where in several parts knowledge intensification and thus productivity growth are less pronounced. In this process of structural change, employees who lost their (e.g. low-skilled) job in industry can find new employment in the service sector. In fact, that is exactly what has happened in the EU (Figure 4-27).

Figure 4-27: EU-27 VA and employment growth in services by knowledge intensity (2011)

2000=100



Source: Eurostat (2013), own calculations.

In the less knowledge-intensive service sector, employment increased faster than in the knowledge-intensive service sector. This is a completely different picture compared to the manufacturing sector. Low-skilled jobs in the service sector are needed to compensate job losses in the low-skilled manufacturing sector. Many of these low-skilled jobs are less technology intensive and – as they are often local and personalised – also less prone to globalisation pressures like import competition. In this respect, the low-skilled sector is an important complement to high- and medium-technology industries.

4.3.2 Innovation networks

Innovation and R&D are success factors that enable companies to gain competitive advantages. New products or improved industrial processes require innovations which are based on businesses' R&D activities. Chapter 4.3.1 has illustrated that the manufacturing sector is much more innovation intensive and R&D intensive than other sectors. This section analyses the question of whether cooperation between companies or with research institutions positively affects innovation and research activities. An additional aim is to identify innovation networks in Europe.

Success through cooperation

Many arguments support the notion that cooperation positively influences innovation activities:

- Products and processes are becoming increasingly complex and require skills in a growing number of knowledge and technology fields. A network of several companies can access required knowledge resources more easily.
- Innovations are often very market-oriented and modify products and processes only in small but customer-specific steps. Therefore, a deep knowledge of the market is necessary. Innovations along the value chain together with suppliers and customers facilitate this knowledge generation.
- Innovations also require the development of new technology fields or procedures, which can be facilitated by cooperation with universities and research institutions.
- Some innovation projects require such large investments that only a group of companies can raise the required amounts.

These arguments are particularly relevant for SMEs because they can usually only draw from a limited knowledge and skill base.

In addition to these qualitative statements, several empirical studies show that cooperation has a positive impact on R&D or innovation activities.

- Abramovsky et al. (2005) find a positive relation between cooperative R&D activities and knowledge spillovers for manufacturing companies in the observed European countries.
- Bullinger et al. (2009) show that a high degree of cooperation leads to a high level of innovativeness.
- The difference in the connection between cooperation and innovation across European Member States has been observed by Rammer and Hünermund (2013).
- Freel and Harrison (2005) point out the importance of cooperation for innovation in SMEs in United Kingdom . Zeng et al. (2010) find similar results for small enterprises in China.
- Weiers (2013) even proclaims the “Idea Economy”, with the division of the labour in innovation processes, as the dominant strategy for innovation processes.

Against this backdrop it is actually surprising that only a few companies cooperate when it comes to innovations;⁶⁰

- Just around a quarter of all innovative SMEs in the EU are part of a network and cooperate on innovations.
- Among larger innovative companies this share reaches 57 per cent.
- The differences between the manufacturing sector and other sectors regarding cooperation are as pronounced as other indicators for research and innovation activities.

⁶⁰ These results are based on an analysis of the European Innovation Panel with data for 2010 (Eurostat, (2013)).

European innovation networks⁶¹

These findings lead to the second question of whether there are sufficiently developed innovation networks in the EU. Patent data are a good alternative to the European Innovation Panel which does not provide the necessary means for such a venture. The patent statistics reveal the interrelations between technology fields, sectors and countries. Thus, the structure of European innovation networks can be measured. The central result of this evaluation shows that patent networks are not as developed as production networks in Europe. As a result, we identify a field for political action to strengthen innovation networks.

For this analysis we use economica Vienna's patent database, which combines and evaluates national and international patent databases. Patent data have several advantages:

- they are strictly defined regarding companies and countries;
- related technology fields (and related sectoral networks) can be identified by taking multiple registrations of patents in different technology (IPC) classes into account; and
- geographical technology clusters can be found by analysing patents which were registered by inventors from different countries.

Industry linkages

Figure 4-28 illustrates the linkages within the manufacturing sector of the EU-27, based on an evaluation of multiple registrations of patents in different technology classes (including double counting of patent links):⁶²

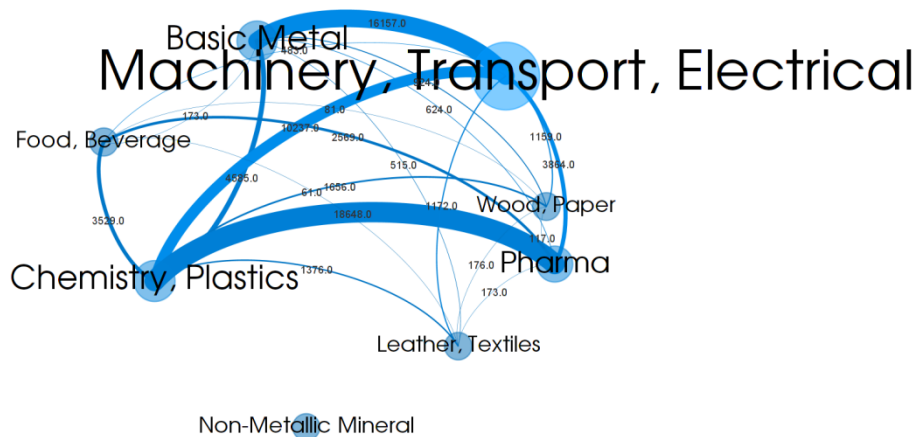
- The strongest links are revealed for the aggregated group of chemicals and related products (chemicals, plastics, crude oil, coke and petroleum products). This group accounts for 58 per cent of all linkages. Particularly intense are the linkages of this group with the pharmaceutical sector.
- The machinery, transport, electrical and optical equipment group features as the second largest patent knot. With a VA share of over 30 per cent, this core group accounts for around 46 per cent of all patents within the EU's manufacturing sector.
- The essential relevance of the resource-intensive sector, basic metals and fabricated metal products, also becomes obvious. This sector is closely linked to the machinery, transport, electrical and optical equipment groups and chemicals and related products.
- Less involved are the areas of food and beverage or non-metallic minerals. They are more linked to the construction sector.

⁶¹ Patent data were delivered, analysed and prepared by Stadlbauer (2013).

⁶² The data refer to the period from October 2010 to September 2013 and are based on an aggregated industry level with eight industry groups.

Figure 4-28: Cross-border patent networks

from October 2010 to September 2013



Graph made with Gephi.

Source: Stadlbauer (2013).

These results confirm once again how strong the sectors within the manufacturing sector are integrated in intra-industrial networks where they strengthen each other.

Country linkages

Since cooperation in R&D or innovation is a success factor, the question arises about how large and intensive European knowledge networks are. To answer this question, again patent data are used based on registrations from at least two EU countries for the period from October 2012 to September 2013.

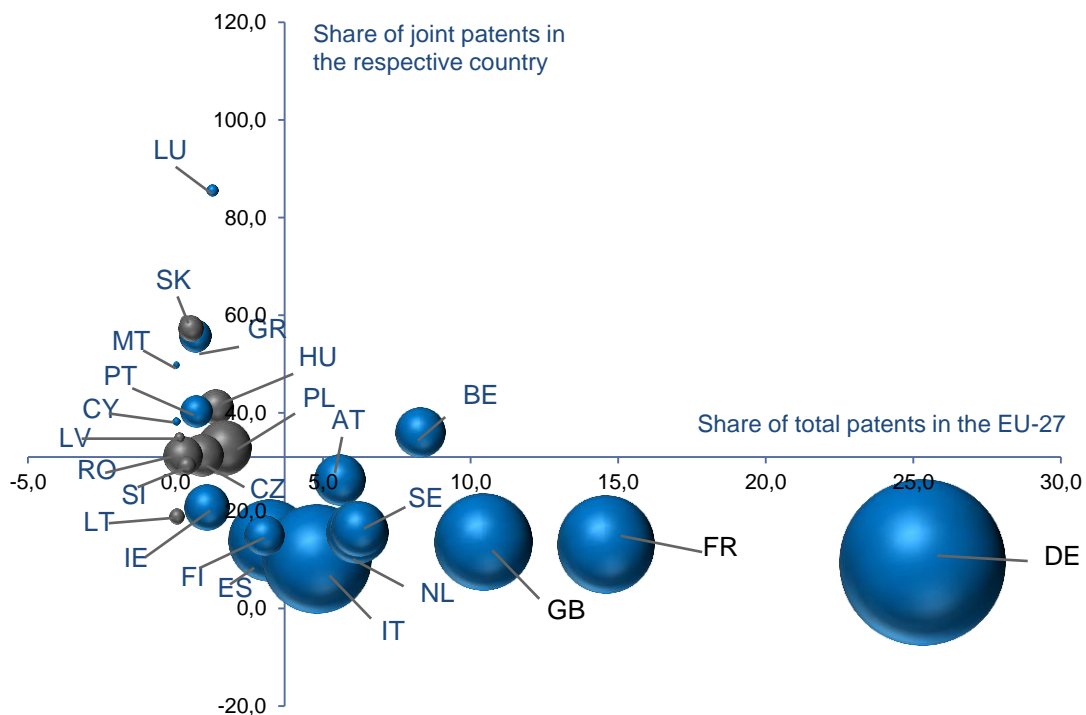
About 14 per cent of the patents in the EU-27 are joint patents. However, there are significant differences between the countries (Figure 4-29).

- EU countries (mainly larger ones) with a high proportion of European patents often do not have any form of cooperation with other European partners. In Germany, only 9.2 per cent of all patents are registered with at least one European partner; in France, the rate is 13.3 per cent.
- In smaller European countries, the cross-border cooperation rates are significantly higher. Here the rates are between 30 and 50 per cent, sometimes even higher.

- The countries of CEE also display above-average rates in joint patents.

This illustrates the importance and the potential of increased intra-European cooperation in innovation and research. Even if smaller EU economies and CEE countries are already involved in patent cooperation above the wider EU average, this is rarely the case in large economies.

Figure 4-29: Share of patents in the EU-27 and in joint patents in manufacturing



Size of bubbles refers to VA in manufacturing.

Source: Stadlbauer (2013), own calculations.

The cross-border innovation intensity of EU countries can be measured by comparing country shares of patents with country shares of VA. On this basis, joint innovation intensity is relatively low in Italy, Germany and Spain. Particularly high values are found for Belgium, France, Sweden and Austria.

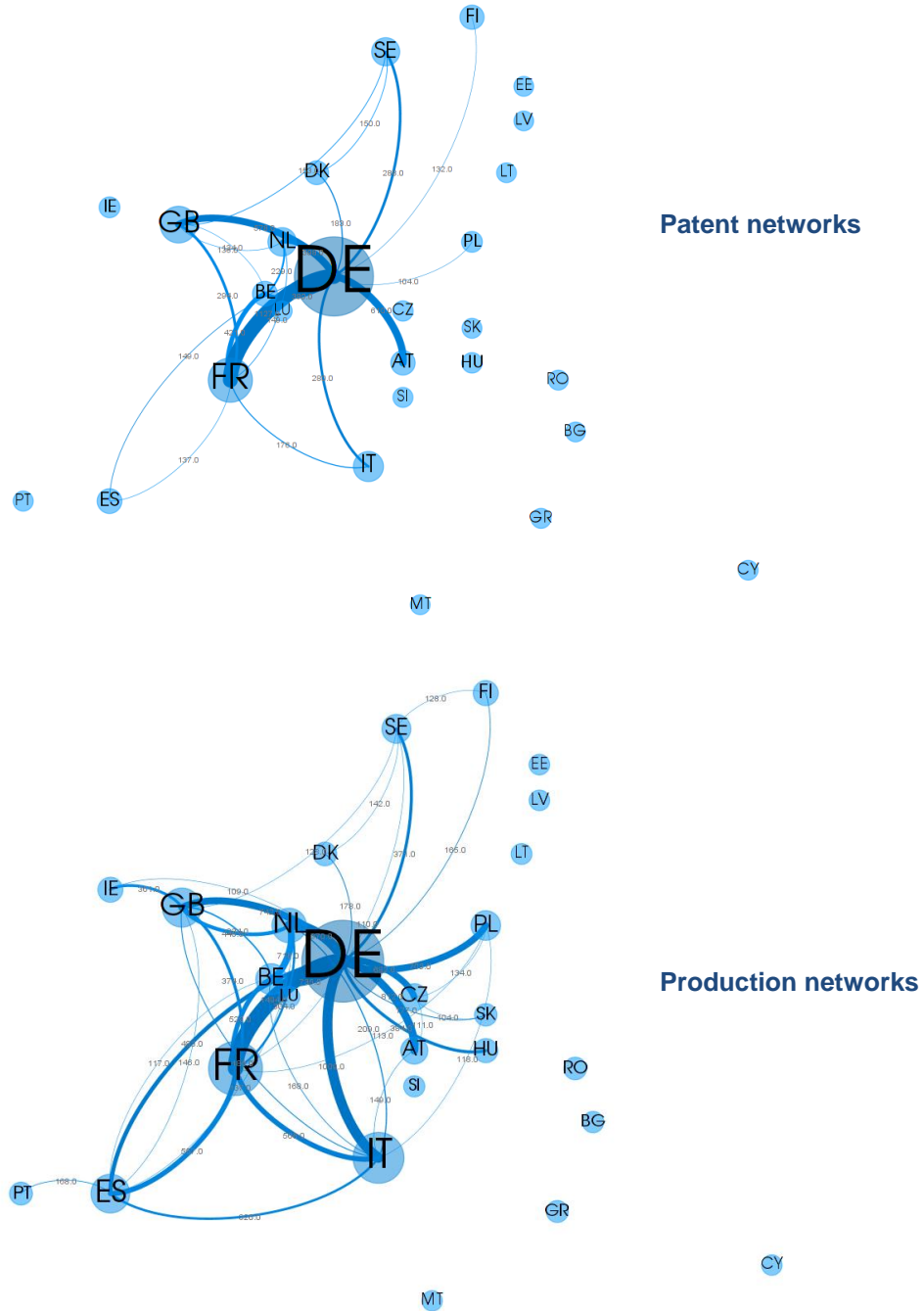
From the previous analysis an important hypothesis can be derived:

- Europe has large potential for enhanced cooperation in research and innovation.
- While smaller countries are relatively more involved in patent networks than larger Member States, significant potential still exists for them to increase cross-border cooperation in innovation.

To test these hypotheses, a benchmark is necessary. For this purpose, patent networks are compared to networks of intermediate inputs in manufacturing (Figure 4-30). Integration intensities are characterised by the thickness of the respective lines. For better comparability, the values for the intermediate inputs are normalised to the values of the patents.

- Figure 4-30 demonstrates that networks in intermediate inputs (production networks) are much more pronounced than the respective innovation networks in the EU. In manufacturing, only about 14 per cent of all patents were joint patents, while 31 per cent of the normalised intermediate inputs of individual EU countries originate from other EU countries on average.
- In Southern, Central and Eastern Europe, patent networks are particularly underdeveloped. Member States in CEE are integrated with a share of 14 per cent in intermediate inputs, but only with a share of 5.6 per cent in cross-border patent networks. Similar relations can be found in Southern Europe.
- While the large economies of Italy, France and Germany are the main players in production networks, regarding patent networks Italy is relatively less connected while United Kingdom, Austria and Sweden are relatively more.
- Geographical proximity plays an important role for patent networks. For example, Slovakia has developed relatively many patents in cooperation with Austria, Germany and the Czech Republic.

Figure 4-30: Patent and intermediate input networks in European manufacturing



Values for intermediate inputs normed at the level of patents.

Patent networks: Patents with at least two applicants from different EU countries.

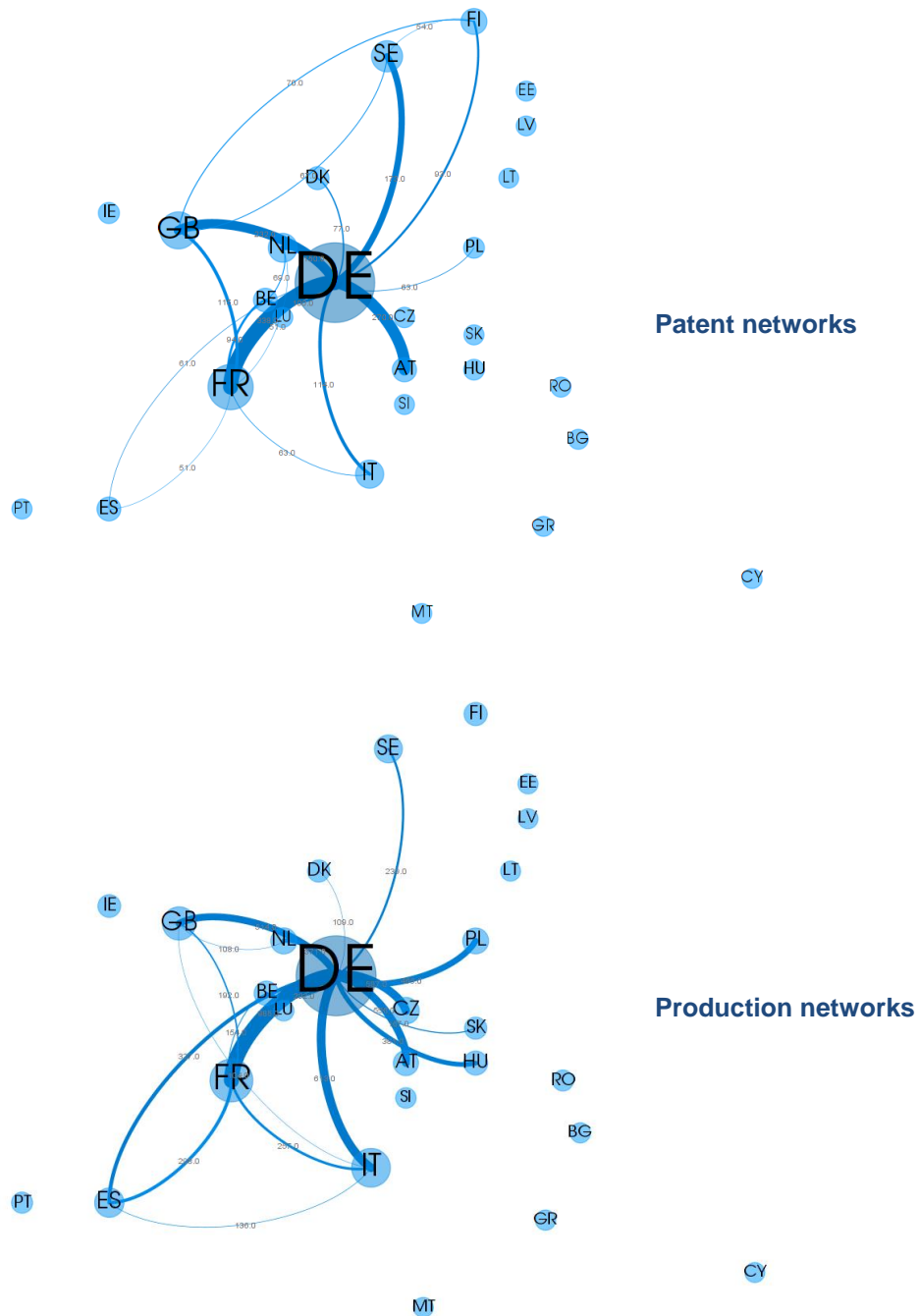
Production networks: Volume of imports of intermediate goods between two EU countries.

Graph made with Gephi.

Source: Stadlbauer (2013), WIOD (2013), own calculations.

Looking at the transport equipment sector, the intermediate input linkages are even more pronounced than in manufacturing in the EU-27 (Figure 4-31). About 34 per cent of all normalised intermediate inputs come from other European countries. At the same time, only 11 per cent of the patents are joint patents. Thus, the divergence between production and innovation networks is even larger in transport equipment compared to manufacturing overall.

Figure 4-31: Patent networks in European transport equipment



Values for intermediate inputs normed at the level of patents.

Patent networks: Patents with at least two applicants from different EU countries.

Production networks: Volume of imports of intermediate goods between two EU countries.

Graph made with Gephi.

Source: Economic (2013), WIOD (2013), own calculations.

Conclusions

Supporting evidence could be found for the above-mentioned hypotheses:

- The comparison of production and innovation networks supports the notion that patent cooperation is relatively underdeveloped. Thus, there is an untapped potential regarding cooperation in knowledge-intensive projects (innovation, R&D) in Europe.
- Smaller EU countries rely more on these networks than larger ones. However, the comparison between production and innovation networks for Member States from Southern and Eastern Europe indicates that cross-border patent cooperation could and should be increased here as well.

Additional main findings can be highlighted:

- Research cooperation among businesses clearly fosters innovation success.
- Manufacturing also displays strong intra-industrial linkages in innovation.
- Resource-intensive sectors play an essential role for industrial hub sectors in this respect.

4.4 Carrier function of frontrunners

Companies can hardly evade the megatrends that come along with structural change (tertiarisation, globalisation, knowledge intensification). Successful are those who actively shape this change and see this transformation as an opportunity. The ability to do so depends on key factors. This qualification is highly developed in companies that:

- promote research and development;
- are highly innovative;
- have a broad-based international business; and
- participate in networks.

Companies with these characteristics have significant advantages. Through differentiation and upgrading strategies, companies can create advantages over the international competition in order to be prepared for new competitors from emerging countries. This is also one key finding of our previous analysis.

Several evaluations from the IW Future Panel confirm these results for Germany. These analyses have examined the influence of three characteristics (research and development, innovation and internationalisation) on the success of companies from the fields of industry and business-related services.⁶³

⁶³ The finance sector and public/private services are not included in this analysis. Considering these sectors, the difference between manufacturing and other sectors as well as between smaller companies and larger companies would be even more significant; see IW Consult (2008 and 2009).

The success is measured as an index of sales and employment development and the net profit margin figures (Baal and Lichtblau (2012)):

- Regression analyses for the years 2007 to 2009 show that companies that are characterised by all three features are more successful than the group that does not show such characteristics.
- Companies with only two of the characteristics developed better than average. However, only one success factor is not enough to contrast with the comparison group.

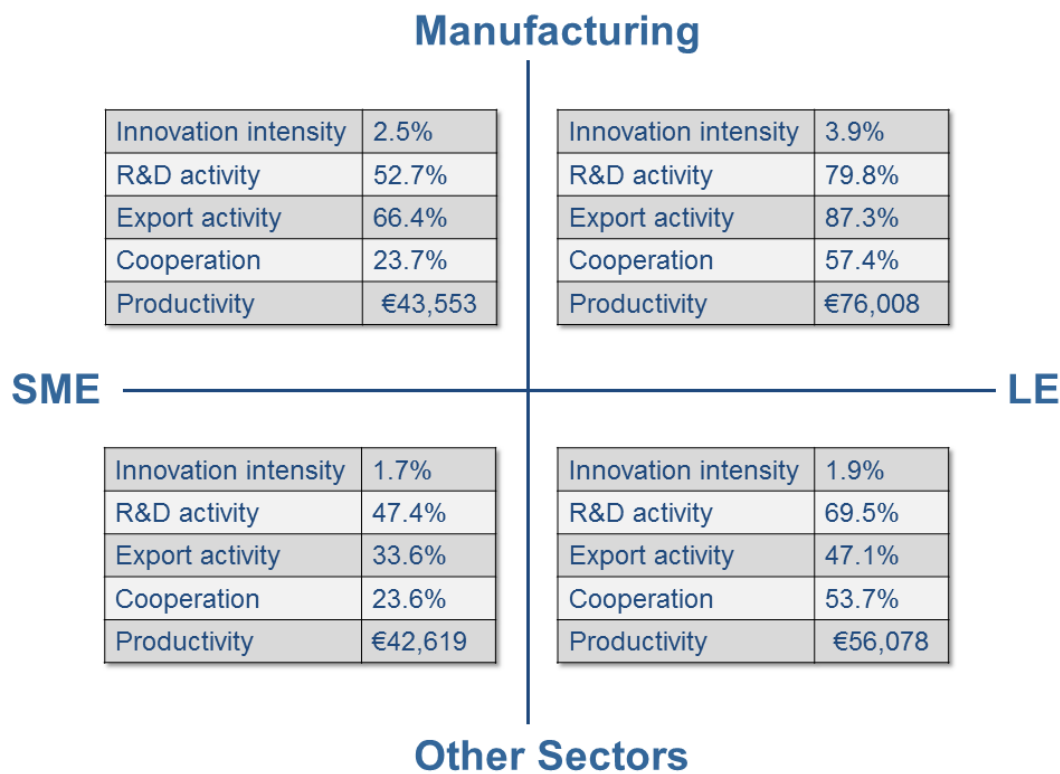
A previous study (IW Consult (2008, 2009)) has come to similar conclusions but has also pointed out that these findings apply regardless of the company size. SMEs are also more successful within their group if they are internationally active and promote R&D and innovation. Furthermore, the involvement in networks in the areas of innovation and R&D has been identified as a factor of success (IW Consult (2009)). The crucial aspect is that these key factors are not equally distributed and that they are to be found only in a small group of companies. It is more likely to find companies with these characteristics:

- in the manufacturing sector;
- in larger companies; and
- in skill-intensive companies.

There are several indications for this:

- Findings from the previous analysis can be used to show that in large companies from the manufacturing sector, the characteristics of R&D, innovation, international business and cooperation are more pronounced than in other reference groups. The productivity is also significantly higher. Figure 4-32 provides an overview of the results.
- The analyses for Germany illustrate that only about 20 per cent of the companies meet the three characteristics (R&D, innovation, exports) at the same time. This proportion is higher in larger companies (34 per cent) than in SMEs (16 per cent) and in the manufacturing sector (24 per cent) compared with other sectors (18 per cent).
- Studies from Austria about frontrunner companies provide similar results (Haidingen et al. (2009); Berger et al. (2013)). The studies have concluded that export rates and R&D expenditure increase with the size of the company. If R&D expenditure is higher than zero and if the export rate is higher than 60 per cent, only one per cent of companies in Austria fulfil the conditions of being a frontrunner. These few large companies generate 6 per cent of all employment and about 9 per cent of the total VA in Austria. They are also responsible for two-fifths of exports and R&D expenditure. These frontrunners can often be regarded as technology and market leaders. The enormous increase in the export rate in Austria in the last 15 years can mainly be attributed to the small group of frontrunners (Berger et al., 2013, p. 32), thus they play a key role in value chains.
- Some further evidence is derived by Bruegel (2012): internationally active firms are bigger, have higher turnovers, have large capital stocks and higher TFP. More complex activities are chosen by firms that have TFPs above already quite high thresholds. In other words, size matters more for relatively less complex international activities.

Figure 4-32: Distribution of key enabling factors by sector and firm size



Innovation intensity: Innovation expenditure in % of total turnover 2010.

R&D activity ratio: Firms with R&D activities in % of all innovative firms 2010.

Export activity: Firms with exports in % of all firms 2010 (only includes industrial and industrial-related services sectors; data for Germany).

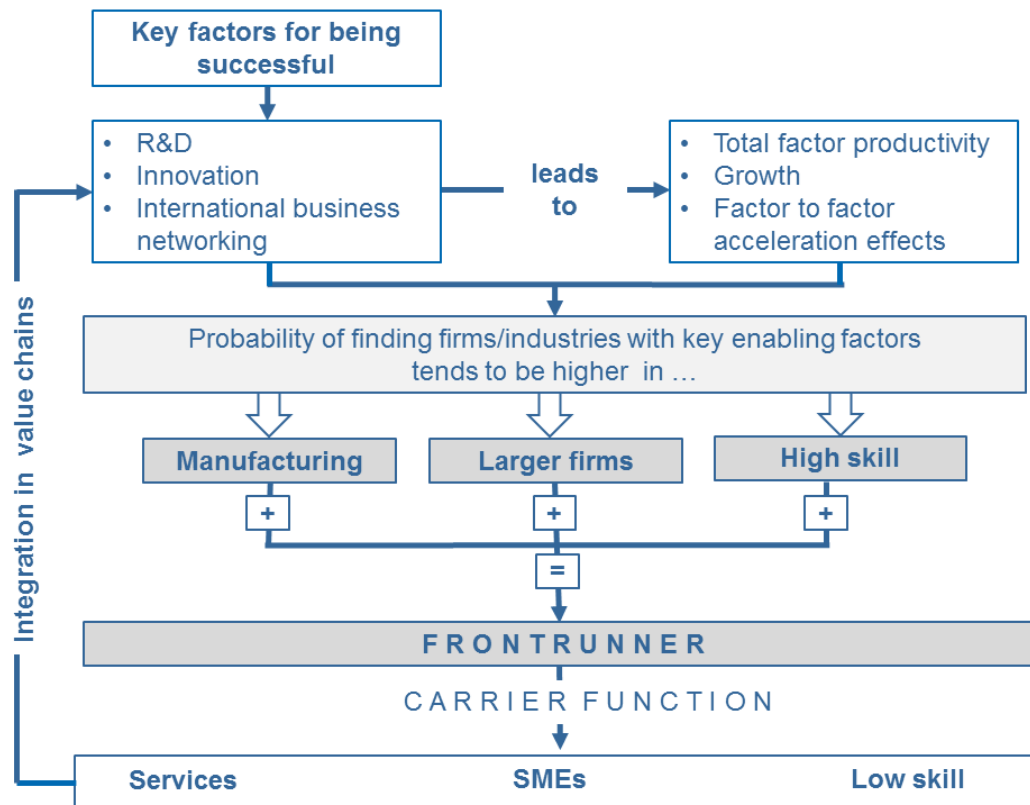
Cooperation: Firms cooperating in innovation activities in % of all innovative firms 2010.

Productivity: VA per employee, 2012 in euros.

Source: Eurostat (2013), OECD (2013), ECORYS (2013), own calculations.

These results confirm that a relatively small group of companies offers these success factors. The probability of finding them in large, skill-intensive manufacturing companies is clearly higher. This does not mean that there are no such companies in the group of SMEs, but they are only rarely represented in this group. There are several reasons for this, which lie in the specific diseconomies of scale (economies of scale, financial strength, access to capital markets, etc.). What needs to be mentioned again is that the results from Germany indicate that small companies are also highly successful when they spend money on R&D, promote internationalisation and innovation strategies and when they strongly participate in networks. The results are summarised in Figure 4-32.

Figure 4-33: Carrier function of frontrunners



Source: own illustration.

Previous analyses have demonstrated that there are intensive national and international intermediate linkages between industry and other service sectors and within industry. The manufacturing sector is in several ways a carrier function. It can be assumed that SMEs in particular and companies with a below-average skill intensity benefit from these intermediate linkages.

It is further assumed that especially frontrunners within the manufacturing sector carry out this carrier function.⁶⁴ This way they indirectly integrate SMEs, the service sector and the low-skilled area in international value chains. Therefore, industrial policy has two functions. It should:

- increase the ability for R&D, innovation and internationalisation strategies in SMEs; and
- strengthen the carrier function of frontrunners in order to integrate a larger share of SMEs in these networks.

If both can be realised, the existing value chains would be strengthened and new SME-based networks **could develop**.

⁶⁴ To check this valid assumption, a European-wide analysis at company level would be necessary, which would require a respective business panel survey to be built.

4.5 The relevance of industry for the economy

Industry features as a hub for the economy

- Industry is the backbone of the production network in Europe. It is involved in nearly half of all intermediate input transactions among all sectors of the economy. Non-manufacturing sectors strongly benefit from industry's demands in the course of upstream and downstream value chains.
- The symbiosis of industry and other sectors on the input level can be termed "Joint Production". In the EU, the "Combined Sector" (which consists of industry and "Joint Production") accounts for 24.3 per cent of VA in the total economy (Figure 4-34) compared to a world average of 20.8 per cent. What is more, the share of the "Combined Sector" has remained more or less constant between 2005 and 2011 in the EU.
- In Europe in particular, the manufacturing sector is a major hub for the organisation of value chains. While "Joint Production" accounts for only 3.7 per cent of total VA in the world on average, its share in the EU is considerably higher at 8.5 per cent and has increased since 2005 from 7.7 per cent.

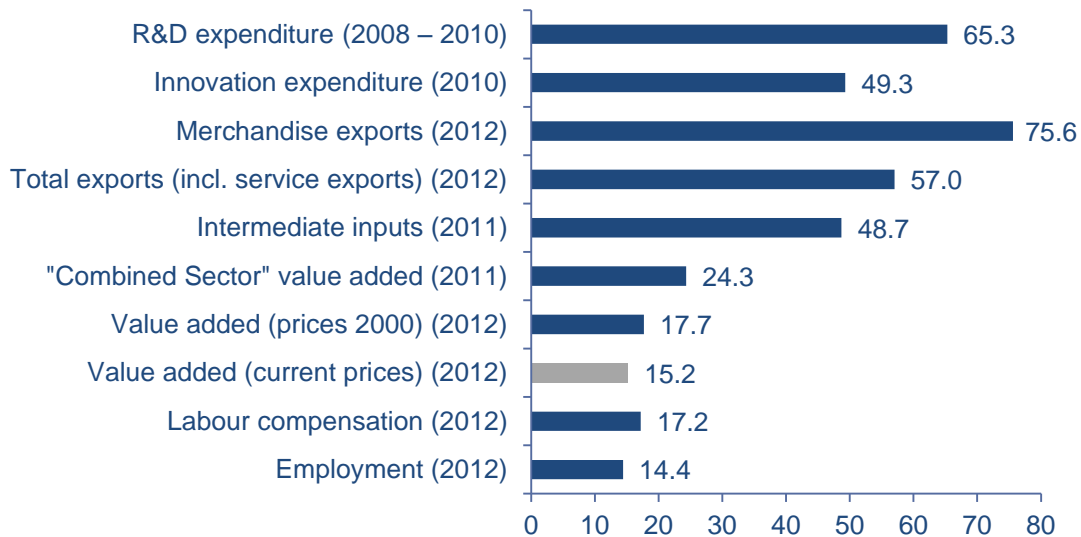
Industry also fosters important growth factors

- Manufacturing businesses account for a very high share of research. With a share of 15 per cent of VA in the total economy, industry is responsible for nearly two-thirds of R&D expenditure and for nearly half of innovation expenditure.
- Industry's R&D intensity⁶⁵ stands at 6.1 per cent, far above the average for the total economy of 1.1 per cent.
- Industrial businesses are a motor for internationalisation (Figure 4-34). In the EU, they are responsible for 76 per cent of merchandise exports and 57 per cent of total exports (including service exports). In addition, the EU boasts a world export market share in manufacturing of 42 per cent.
- The above factors enable the manufacturing sector to be more productive than other sectors. In industry, an hour of work generates nearly 32 euros of VA, a productivity level that is about 15 per cent higher than the average in all sectors (28 euros).
- As a result, manufacturing provides a large number of high-quality jobs that offer higher wages and better income prospects than many other sectors. This is true for every skill class.

⁶⁵ R&D expenditure related to VA.

Figure 4-34: Manufacturing's share in the total economy in various dimensions

in per cent



Source: Eurostat (2013), OECD (2013), WIOD (2013), WTO (2013), own calculations.

4.5.1 Success factors meet competitive challenges

Industry's impressive performance has to be evaluated taking into account the significant challenges for manufacturing which originate from structural change and economic megatrends:

- tertiarisation (increasing relevance of services), for example implying a shift in global demand from goods to services;
- globalisation, for example leading to more intense competition from emerging markets; and
- knowledge intensification, challenging low-skilled jobs/sectors in the course of technology-driven rationalisation.

However, these megatrends also provide potential to increase the competitiveness of manufacturing and thus to tackle these challenges. They offer new opportunities for integration and cooperation along value chains, across borders and in innovation networks. Thus, businesses and economies can reap the productivity benefits from increased labour sharing and from a better pooling of knowledge and core competencies.

The relevance and benefits of this increased focus on more cooperation and integration is illustrated in Table 4-20:

- The left-hand column lists the challenges and requirements that are needed to tackle the pressures from structural change and rising international competition.
- The three columns on the right display success factors for businesses that the three megatrends offer: service integration, internationalisation (exports, global sourcing and international production), and investments in R&D and skills.
- In the centre, the crosses indicate how far the respective success factors contribute to meeting the competitive challenges.
- Finally, the line on the bottom shows how the new paradigm of “Moving Forward Together” can support and enhance the use and benefits of the success factors.

Table 4-20: How cooperation contributes to meeting competitive challenges

Challenges (raise competitiveness)	Success factors to meet the challenges		
	and to seize the opportunities of the megatrends...		
	Tertiarisation	Globalisation	Knowledge intensification
	Service integration	Internationalisation	Investment in R&D and skills
Increase cost and process efficiency	x	x	x
Stay/get ahead of competitors			
Innovative products		(x)	x
Upgrading	(x)	(x)	x
Make supply meet demand			
Tailor products to (and benefit from) foreign demand		x	(x)
Product differentiation	x		x
Customer orientation	x	x	(x)
Relevance of “Moving Forward Together” for the respective success factor	Cooperation along the value chain and hybrid business models	More integration of SMEs in EU and GVCs (to connect via frontrunners to foreign demand)	Cooperation for innovation

Source: own illustration.

Chapter 4 has highlighted the aspects referred to in Table 4-20 and has also provided ample evidence for their relevance, as the following summary section highlights.

4.5.2 Service integration

Why service integration is a success factor

- Service integration is a strategic instrument to improving competitiveness and business performance.
- The integration of services in industrial processes and goods offers important potential to differentiate and upgrade manufacturing products. Therefore, hybrid business models (which combine goods and services) have been empirically shown to be particularly successful.
- Concentrating business activities on core competencies features as another important success factor. For manufacturing firms, this often entails buying (rather than making) certain products and services from specialised suppliers. This outsourcing can contribute to improving industry's cost efficiency.

The role of industry: Hub for service integration

- Business services, logistics as well as other non-industry sectors strongly benefit from industry's demands in the course of upstream and downstream value chains.
- In fact, for every euro of manufacturing output in the EU, 34 cents of input comes from other supply sectors.
- This is why industry exerts higher multiplier effects to the benefit of the total economy than other sectors. In fact, every unit of additional demand in the manufacturing sector generates 1.68 units of additional output in the total economy.

Why the cooperation strategy of “Moving Forward Together” is important

- Combining industrial products with service features allows businesses to better meet customer demands for problem solving (instead of merely offering products). With this strategy, businesses can shift from competing on prices to competing on quality and problem solving.
- SMEs are already relatively well connected to value chains, as has been demonstrated above. This clearly demonstrates the relevance of cooperation along value chains.
- SMEs from the service sector particularly rely on the platform function of the manufacturing sector. In fact, they account for 18 per cent of industrial output. However, there is considerable potential to increase the mutually beneficial symbiosis between industry and services.

4.5.3 Internationalisation and integration in GVCs

Why internationalisation and GVC integration are success factors

- Internationalisation and integration in GVCs also foster business success and competitiveness.

- Internationalisation allows businesses to seize the opportunities of global markets, to access new customers and to diversify demand for their products across various world regions (see Table 4-20).
- It has been empirically proven that companies improve their cost competitiveness through integration into GVCs. They thus benefit from comparative cost advantages in all regions of the world. Also within Europe, firms can reap this potential in view of the cost differences between EU regions.
- Integration in GVCs also strengthens productivity, competitiveness and export success at the country and sectoral level, as has been widely shown by empirical studies.

The role of industry: Driver of internationalisation and export platform

- Industry plays a vital role in seizing the opportunities of internationalisation and integration in GVCs.
- The EU manufacturing sector is intensely integrated into the global economy. About 30 per cent of manufacturing VA is generated by foreign demand from outside the EU. This compares to 15 per cent in the overall EU economy.⁶⁶ Moreover, industry's global integration has increased since 2000.
- EU manufacturing boasts a world export market share of 42 per cent. This share has, however, declined since 2000 due to the immense export success of China and other emerging markets.
- Industry remains an export platform for other sectors and particularly for services. About half of the exports from non-manufacturing sectors in the EU are industrial exports.

Why the cooperation strategy of “Moving Forward Together” is important

Manufacturing businesses are key players in GVCs in the course of FDI and offshoring

- The relevance of global sourcing has increased. About a quarter of manufacturing output in the EU consists of foreign intermediate inputs (2011) compared to a fifth in 2000.
- The share of foreign inputs in EU industrial exports has increased from 24 per cent in 1995 to 36 per cent in 2011. However, in absolute terms the manufacturing VA contained in these exports has greatly increased. Obviously, the exploitation of GVCs has enhanced industrial competitiveness and could thus considerably boost EU industrial exports.
- The trends of fragmentation and offshoring of production processes also involve outward processing strategies. Countries with cost advantages import certain intermediate parts, further enhance and then re-export them. In fact, the share of re-exported intermediate goods rose from 41 per cent in 1995 to 50 per cent in 2009 in Europe. This indicator for the intensity of value chain integration is higher in the EU than the global average.

⁶⁶ The equivalent employment share is 11.6 per cent.

- Even though global trade is concentrated in regional hubs (Europe, NAFTA, Asia), no hub is characterised by such strong intra-regional trade linkages in intermediate products as Europe. Nevertheless, this potential can be even further enhanced.

The carrier function of frontrunners

- Large global frontrunners are prime examples of how companies can exploit the above-mentioned success factors. They are innovative, experienced in international markets and know the needs of global customers, but they also rely on specialised input providers.
- Thus, frontrunners have an important carrier function because they offer platforms for other firms to integrate in international value chains. As a result, domestically oriented SMEs and service providers also have the chance to tailor their products to better suit world demand and benefit from global growth.
- This offers important opportunities for SMEs, which are much less globally oriented than larger firms, to better exploit the success factor of internationalisation.

4.5.4 Knowledge intensification

Why innovation and knowledge are key success factors

- Without innovation and highly skilled professionals, companies, sectors and economies can barely compete in global markets. To meet the competitive challenge of emerging economies, upgrading strategies as well as innovative products and more cost-efficient production processes are indispensable (Table 4-20).
- In fact, R&D and innovation activities feature as key success factors for businesses and sectors. For example, VA grew by 24 per cent in the high-tech sectors between 2000 and 2012 but by only 5 per cent in low-tech sectors.
- More generally, knowledge and innovation are one of the key motors for productivity and economic growth as a wide array of empirical studies have proved. The same is true for digitisation.

The role of industry: Key innovation driver and centre for STEM qualifications

Industry is also an important economic hub for research and innovation

- As pointed out above, manufacturing is mainly responsible for R&D and innovation expenditure in the total economy.
- Moreover, R&D intensities are significantly higher in industry compared to the overall economy. For example, in large manufacturing firms innovation intensity is twice as high as in large companies in other sectors.
- In an international comparison of research and innovation performance, the position of EU manufacturing displays more strengths than weaknesses. While important competitors (e.g. USA, Japan, South Korea) invest more in R&D (relative to GDP), the global share of Europe in

new patent applications is much higher than its respective share in VA. In the period between September 2012 and September 2013, EU manufacturing accounted for 36 per cent of global patents. However, this share has declined since 2010 (when it had reached 50 per cent), probably mainly due to the weakness in investment in the course of the euro debt crisis.

Industry needs to foster high skills and STEM qualifications

- In the EU-27's manufacturing sector, a significant upskilling process can be observed by a 37 per cent increase of working hours of high-skilled employees (measured by formal qualifications) between 1995 and 2009. This has led to a high-skill share (of working hours) of 18 per cent in the EU, which is lower than in the overall economy.
- However, formal qualifications need not represent the factual skill level because skills continuously acquired by experience and by training on the job are not taken into account. This disadvantage is likely to be particularly important in the technology-intensive manufacturing sector. In fact, in all skill classes, the hourly wage in manufacturing – a proxy for the effective skill level – is above the overall economy average and also above the wage level in most other sectors.
- In manufacturing, it is particularly important to take technology-related skills into account. STEM skills play a crucial role in the development of high-technology products. Therefore, STEM employment shares in the manufacturing sector are higher than in the overall economy.

Why the cooperation strategy of “Moving Forward Together” is important

- The economic literature has shown that cooperation in R&D and innovation fosters further innovation. As a result, research-oriented cooperation improves business performance in terms of employment, turnover and return. However, there is a huge unused potential in the EU in this respect.
- Around a quarter of all innovative SMEs in the EU cooperate on innovation in networks; this more than doubles for larger innovative companies at 57 per cent.
- Innovation networks in the EU are much less developed than production networks in the EU, as shown by patent statistics. This is particularly true for larger and more peripheral EU countries.

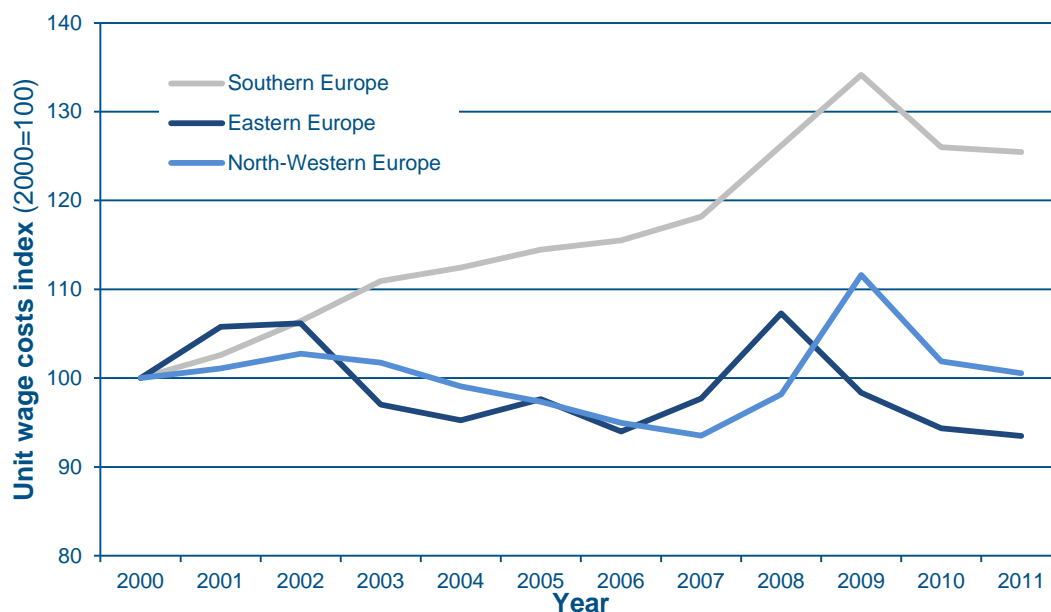
5 Competitiveness in a global context

Chapters 3 and 4 have illustrated that the performance of EU manufacturing displays strengths and weaknesses compared to other global competitors. To answer the question about which factors contribute to this outcome, chapter 5 focuses particularly on the economic framework conditions that can be targeted by policymakers (or industrial partners). Correspondingly, factors influencing the competitiveness of EU manufacturing are brought to the fore in the following sections.

Often, competitiveness is understood as international price competitiveness, which can be measured by unit labour costs in manufacturing. Figure 5-1 shows the divergent development of this indicator in different EU regions since 2000: in Southern Europe, rising unit labour costs can be observed, whereas in CEE countries a more or less stable development can be seen over the last ten years.

In parallel to the implied loss of international price competitiveness, several Southern European countries had accumulated large current account deficits before the crisis. Afterwards, they had to regain price competitiveness by means of internal devaluations, which led to long and deep recessions.⁶⁷ Thus, it appears reasonable to take the development of unit labour costs into account when measuring manufacturing competitiveness (particularly of Eurozone members).

Figure 5-1: Unit labour costs in manufacturing



Source: IW Consult (2013); Eurostat (2013), OECD (2013), departments of labour for several countries (2013).

⁶⁷ The decrease in unit labour costs visible in the figure can in part be explained by an increase in productivity, which however is due to lay-offs and plant closures.

However, competitiveness can also be understood as a much broader concept (see IW Köln (2012)).⁶⁸ In this view, it incorporates those economic and policy factors that influence the competitiveness of businesses and the investment conditions that determine the economic success of a given country in terms of productivity, growth and welfare. This wider horizon is captured by the IW Competitiveness Index. The IW index was developed in the context of a national research project, which was contracted by the German Federal Ministry of Economics and Technology in 2012 (see appendix). It measures the position of the 50 most important developed and emerging countries (EU-27 states, OECD and BRICS countries) using 60 relevant indicators clustered around the areas of government and governance, infrastructure, human capital, innovation, labour relations, energy and raw materials, capital market, cost, market and customers, value chains and economic openness.

The index particularly takes into account indicators that have an impact on the competitiveness of manufacturing, while other renowned competitiveness indexes have a broader approach and target the overall economy.⁶⁹ To this end, an industry-specific relevance ranking of the above-mentioned policy areas has been derived from a comprehensive business survey. This ranking, which has been tested and adjusted by means of an econometric analysis, serves as a basis for the calculations of the IW index.⁷⁰ It covers the time period from 1995 up to the present and makes it possible to gauge the quality of the policy and economic frameworks in each of the 50 countries. Furthermore, the index provides a background about the conditions for manufacturing in the EU and their development. The index is normalised by setting the average score of the 50 countries to a level of 100.

The overall comparison of competitiveness conditions for enterprises shows that developed countries still rank considerably better than emerging countries in the IW Competitiveness Index (see Figure 5-2 and Table 5-1). This concerns, in particular, North-Western Europe, the United States, Japan and other developed countries. The main advantages of these regions are stable regulatory frameworks and modern infrastructure. The countries of Southern and Eastern Europe display a lagging performance and have been overtaken by South Korea and China in the meantime. On average, the EU-27 falls behind other developed countries, such as the United States, Japan and even South Korea.

From the dynamic point of view, the emerging economies are catching up quickly: China (119) and South Korea (110) in particular show high values. The lagging performance of Southern Europe – and also the United States – becomes obvious with index values of 88 and 83 respectively. CEE countries have dynamic scores of around 100, which is broadly in line with other developed countries, Asian emerging countries and other emerging countries.

⁶⁸ This index was designed for the German Federal Ministry of Economics and Technology in 2012.

⁶⁹ Refer to Global Competitiveness Index of the World Economic Forum or the IMD World Competitiveness Yearbook of the Institute for Management Development for more details.

⁷⁰ Calculations are documented in the Annex of this study.

Table 5-1: Results of IW Competitiveness Index 2013

index values

	Level	Dynamic
EU-27	102	98
Southern EU	87	87
Eastern EU	84	100
North-Western EU	127	101
Other developed countries	117	103
Asian emerging countries	81	103
Other emerging countries	70	102
Results for selected countries		
United States	133	83
Japan	130	99
South Korea	108	110
China	93	119

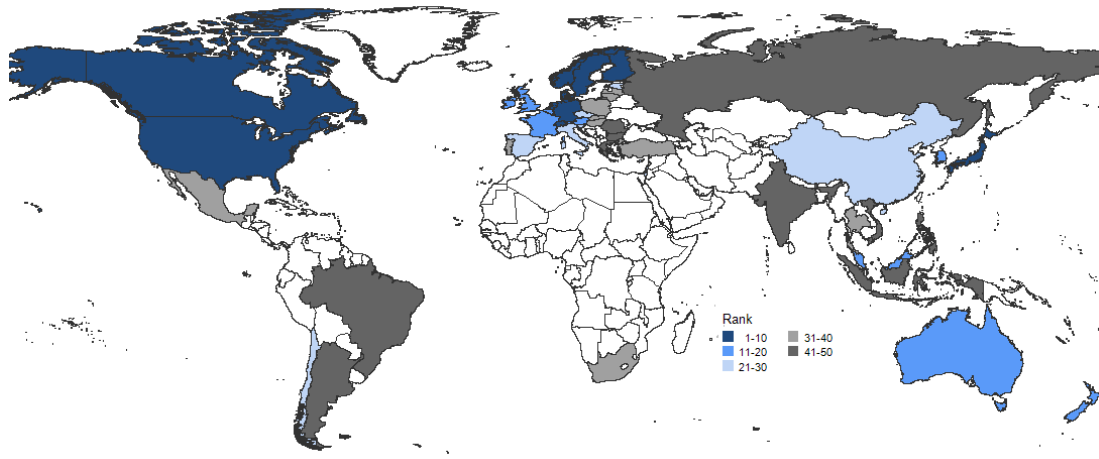
Note: Normalised index by setting the average score of the 50 countries to a level of 100.

Source: own calculations.

The level results of the IW Competitiveness Index for 50 countries in the world in 2013 are visualised in the following world map. The best conditions for the manufacturing industry are to be found in Northern America, Western and Northern Europe, Eastern Asia and Australia.

Figure 5-2: IW Competitiveness Index

Level view



Source: IW Consult 2013.

From the dynamic point of view we get a different picture: countries such as Brazil, Bulgaria, Chile, China, Turkey and Mexico are catching up, whereas other countries like the United States, New Zealand, the United Kingdom and some states in Eastern⁷¹ and Southern⁷² Europe are losing ground. Furthermore, other countries display relatively high values in the level and dynamic view, like many countries of North-Western⁷³ Europe.

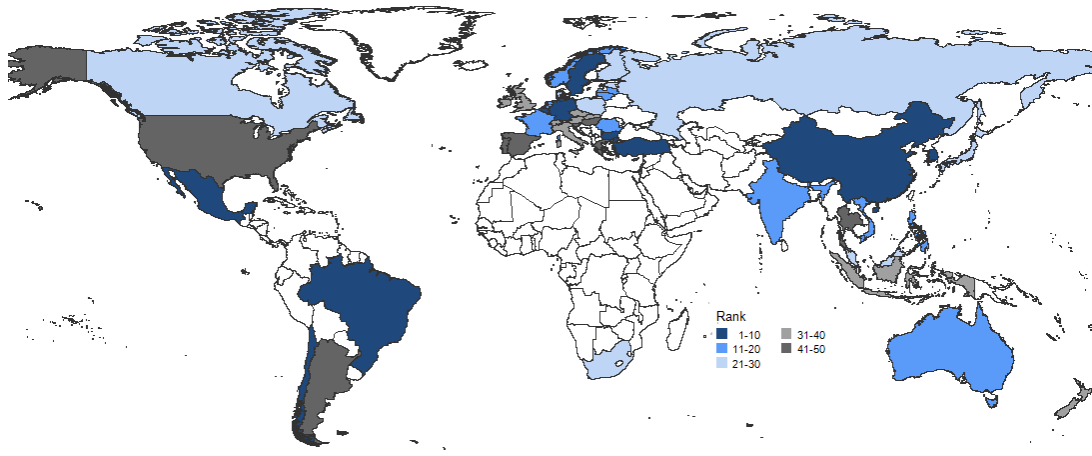
⁷¹ These countries include: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

⁷² These countries include: Cyprus, Greece, Italy, Malta, Spain and Portugal.

⁷³ These countries include: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden and the United Kingdom.

Figure 5-3: IW Competitiveness Index

Dynamic view



Source: IW Consult 2013.

What are the reasons for these findings? A closer look reveals that emerging countries still suffer from significantly worse conditions in the areas of governance, infrastructure and innovation as well as education and capital markets. In these fields, North-Western Europe, the United States, Japan, South Korea and other developed countries boast great strengths (see Table 5-2). In general, the EU-27 displays values slightly above 100, which is the average over all 50 analysed countries, with the exception of the costs and resources fields. The lagging performance of Southern Europe can be attributed largely to backlogs in innovation, education, markets, costs and especially capital markets. Eastern Europe is characterised by lags in areas like governance, infrastructure, innovation, markets, resources and capital markets.

Table 5-2: IW Competitiveness Index 2013 – the level view

	Total	Gover- nance	Infra- structure	Inno- vation	Edu- cation	Resour- ces	Capital markets	Costs	Market
EU-27	102	109	108	105	104	93	104	88	98
Southern Europe	87	92	102	89	77	96	53	82	87
Eastern Europe	84	88	71	76	98	86	89	104	71
North- Western Europe	127	137	146	140	125	99	145	76	129
Other developed countries	117	123	122	118	117	110	123	100	114
Asian emerging countries	81	55	58	72	81	99	70	143	100
Other emerging countries	70	49	53	63	58	112	59	114	77
United States	133	136	144	132	123	128	149	109	136
Japan	130	124	147	148	147	105	124	82	141
South Korea	108	115	137	138	78	90	107	112	109
China	93	47	92	84	86	136	121	121	107

Source: IW Consult (2013).

In addition, the following table shows the results for Member States with a high performance broken down to policy areas covered. Several countries, particularly from North-Western Europe, score high in many areas, with the exception of costs, where mostly Member States from Eastern Europe display advantages.

Table 5-3: IW Competitiveness Index 2013 – the level view of Member States

	High performer
Governance	AT, BE, DK, EE, FI, FR, UK, DE, IE, LU, NL, SE
Infrastructure	AT, BE, DK, FI, FR, GB, DE, IT, LU, NL, SE
Innovation	AT, BE, DK, FI, FR, UK, DE, IE, LU, NL, SE
Education	AT, CZ, DK, EE, FI, DE, IE, LT, LU, NL, SE
Resources	AT, CY, DK, ES, UK, DE, GR, IE, LU, NL
Capital markets	AT, BE, CZ, DK, EE, FI, FR, UK, DE, LU, NL, SK, SE
Costs	BG, CY, CZ, EE, HU, LV, LT, PL, PT, RO, SI
Market and customers	AT, BE, DK, FI, FR, UK, DE, IE, IT, LU, NL, SE

A high performer is a country that has an index value above 105 because the index is calibrated on the world average (World = 100). The other Member States are assigned to the group of middle and lagging performers.

Source: IW Consult, 2013.

The dynamic view of the IW Competitiveness Index highlights a more differentiated picture. Member States mostly from Eastern Europe score as high performers, but also some countries from North-Western and Southern Europe have caught up in some policy areas. Nevertheless, it is worth remembering that China and South Korea are outstanding performers in the dynamic ranking.

Table 5-4: IW Competitiveness Index 2013 – the dynamic view of Member States

	High performer
Governance	BG, DK, EE, LV, LT, MT, PL, RO, SI, SK, SE
Infrastructure	AT, BE, BG, DK, ES, FI, FR, UK, DE, LU, NL, SE
Innovation	AT, BE, CY, EE, GR, IE, LU, MT, NL, PT, SI
Education	BE, BG, FI, FR, DE, GR, IE, IT, LT, MT, NL, SE
Resources	BG, CZ, ES, EE, DE, LV, LU, PL, SK
Capital markets	BE, BG, CZ, DK, EE, LT, PL, RO, SVK, SL, SE
Costs	BG, DK, UK, HU, NL, PT, RO
Market and customers	AT, BE, BG, UK, DE, IT, LU, MT, NED, PL, SK, SE

Source: IW Consult, 2013.

6 The way forward

Based on the preceding analysis, this chapter describes the way forward and also takes policy considerations into account. Of central interest are the following questions:

- What lessons for the future can be drawn from the preceding analysis?
- What are the requirements for a future EU policy?
- How adequate is the EU industrial policy?
- What are the most relevant shortcomings of the EU policy?

Before providing answers to these questions, the main findings of the preceding analysis are briefly recalled and potentials for the future highlighted.

6.1 Lessons learnt and potentials for the future

Industry is of high importance for the overall economy because it is a hub for value chains and for Joint Production with other connected sectors. Because of industry's far above-average internationalisation, R&D expenditure and innovation activities, manufacturing is perfectly suited to the function of being a hub. Industry's overall positive economic impact is further underlined with a view to its high spillover and multiplication effects as well as its disproportional contribution to productivity and wage growth. Manufacturing therefore offers well-paid and high-quality jobs.

Challenges and opportunities

Future global demand patterns will favour manufactured goods, in particular investment goods. Huge global demand trends such as population growth in emerging regions, urbanisation, climate change and dwindling natural resources represent giant burdens on the one hand, while on the other, only manufacturing innovations and solutions – in fields like transport infrastructure, environmental technologies and life sciences – can tackle these challenges.

Also the economic megatrends on the supply side – tertiarisation (increasing relevance of services), globalisation and knowledge intensification – pose challenges for EU industry. They comprise, for example, a shift in global demand from goods to services, more intense competition from emerging markets, and challenges from technology-driven rationalisation for skilled jobs/sectors. However, these megatrends also offer opportunities to increase the competitiveness of manufacturing and thus to tackle the challenges.

Despite these potentials, not all EU regions are sufficiently competitive and attractive in terms of their economic framework conditions. In all relevant policy fields, the EU on average lies behind relevant competitors, as shown in chapter 5. Moreover, a considerable policy divergence between EU regions/countries has been identified. These policy weaknesses have contributed to the declining share of industry in total VA in many EU countries.

In parallel, Europe has suffered from economic divergence in recent years. However, the potentials of manufacturing can be exploited to restart the convergence process in Europe. Industry can thus provide an integrative force for the EU.

Key success factors and the new paradigm of “Moving Forward Together”

It has been shown that key success factors for businesses are closely connected to the economic megatrends. These success factors build on exploiting the potentials of increasing:

- industry-service integration;
- internationalisation (exports, global sourcing and international production); and
- use of the skilled knowledge base in the EU by means of R&D and training.

As a central finding, this study points out a new paradigm of “Moving Forward Together in Europe”. It essentially suggests better use of the potential of cooperation and integration in value chains across firms, sectors and national borders. This increasing interconnectedness will be key for the revitalisation of EU industry. It will foster the better utilisation of the above-mentioned success factors. Competitiveness of EU manufacturing can thus be reinforced from the very core.

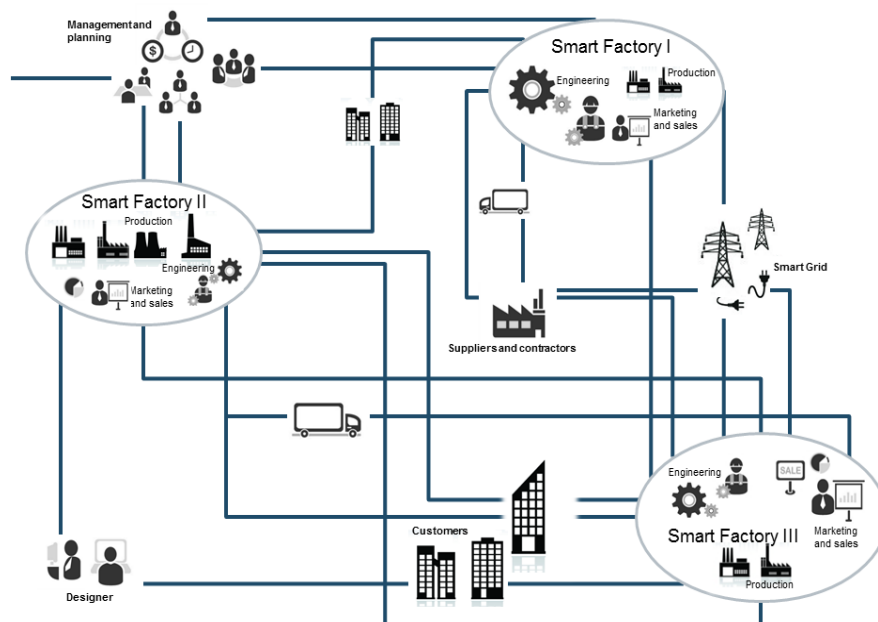
The new paradigm’s main dimensions comprise:

- progressive integration of industry and services along the domestic and EU value chains and also in hybrid business models;
- strong intra-industrial linked networks, including energy- and resource-intensive sectors, which are needed in the EU;
- increasing integration in international value chains to target customers all over the world and to use the efficiency potential of labour sharing across borders; and
- more cooperation on R&D activities and innovations along the value chain and increasingly in a cross-border context both within the EU and internationally.

The new paradigm also extends to the cooperative potential of the internet to manage value chains (across firms, sectors and borders) with completely new digital production systems. Industry 4.0 – i.e. ICT-driven network production – is the key concept in this respect (see box). As distance and borders matter much less in this new digital production world, all EU Member States can benefit. In fact, Europe has the opportunity to take a leading role in developing internet-based networking solutions for industrial production.

The potential of Industry 4.0

Industry 4.0 describes the convergence of the physical world and the virtual world based on the internet and enhanced data-processing technology. This internet of everything can radically change the way companies interact with customers and run their value chains. IBM predicts that one trillion devices will be connected to the internet by 2015 (IBM (2012)). In the manufacturing environment, Industry 4.0 comprises smart machines, storage systems and production facilities capable of autonomously exchanging information, triggering actions and controlling each other independently (smart factories). The key features of Industry 4.0 are comprehensive and dense GVC networks and a new dimension of machine-to-machine and human-to-machine interactions.



Source: Trumpf AG; own illustration.

This development holds two main advantages:

- **Flexibility:** Industry 4.0 enables dynamic real-time configuration of business processes relating to time, quality, price and eco-friendliness. Manufacturing processes can be changed more easily at short notice; temporary shortages (e.g. due to supply issues) can be better dealt with; engineering processes can be made more agile. Industry 4.0 renders it possible to produce small volumes and still profit. Thus, enterprises can better tailor products to customers' requirements.
- **Efficiency and productivity:** Industry 4.0 enables an increase in productivity because business processes and supply chains can be continuously optimised. It also becomes possible to steer production processes in a smarter way to save energy and resources.

Potential for cooperation between smaller and larger players

These opportunities for cooperation and integration are particularly relevant for SMEs in Europe that lag behind larger firms, especially in exploiting the success factors of internationalisation and innovation. To better use these potentials, the existing sound symbiosis in the EU between smaller and larger firms – which benefits all participants – can be further extended. In particular, large global frontrunners offer opportunities for SMEs to integrate in international value chains. Thus, domestically oriented SMEs also have the chance to tailor their products better to benefit from growing world demand. Moreover, the innovation capacities of SMEs can be significantly enhanced by taking part in cooperation for innovation along value chains as well as in networks with research institutions.

Value chains should and will increasingly cross EU borders, further binding together smaller and larger EU countries. This increasing cooperation and integration offers the opportunity to bind industrial hub countries together with countries with different specialisations to the benefit of all participants. The EU market offers the ideal platform to integrate efficient industrial and service suppliers in one EU country with industrial frontrunners and Hidden Champions in other EU countries.

How to get there: Mainly the task of businesses

However, this new world of ever closer integration and higher competitiveness across Europe is not going to be easy. It is mainly the task of businesses to get there by:

- increasing cost efficiency;
- staying ahead of competitors by innovating and upgrading;
- seizing the opportunities of thriving global markets; and
- differentiating and adapting the product portfolio in accordance with changing demand patterns.

To achieve these aims, more enterprises should actively use the success factors offered by the economic megatrends: service integration, internationalisation and R&D activities. Moreover, they should increasingly strive to follow the concept of “Moving Forward Together in Europe”, particularly by seizing the opportunities of integrating in:

- domestic value chains with industrial hub sectors;
- cross-border EU value chains with global frontrunners; and
- R&D networks in the EU.

However, there are important preconditions for companies to join the frontrunners and become part of cooperation and value chains: to be efficient and reliable as well as to display a suitable specialisation and technological readiness.

6.2 Policy game changers: Requirements for future EU policy

Policymakers can help to unlock the potential of industry and enable EU companies to “Move Forward Together in Europe”. In this respect, enabling does not (necessarily) mean fostering single sectors and businesses; it is more important to provide a business- and innovation-friendly economic framework.

How can policymakers in the EU (and Member States) enable manufacturing businesses to better achieve these challenges? Important general requirements for future EU policy can be arranged into three categories:

- enabling deeper cross-border value chain integration;
- avoiding unnecessary burdens for industrial competitiveness; and
- improving economic framework conditions and tackling identified economic policy weaknesses.

6.2.1 Enabling deeper cross-border value chain integration

EU industrial policy has to heed the new paradigm of cooperation and integration developed in this study. The economic framework provided by the EU (and Member States) should enable more and more companies to become sufficiently attractive to join forces with the frontrunners. Policy avenues to facilitate “Moving Forward Together in Europe” lead in three main directions:

- Creating cross-border connection points: Cross-border activities, particularly for SMEs, can be increased by offering platforms (including virtual platforms) and best practice information. Thus cooperation on innovation in networks and clusters can be fostered as well as creating better connections to GVCs and frontrunners.
- Reducing cross-border restrictions: Access to foreign markets and other EU markets needs to be facilitated by further eliminating unnecessary tariffs, particularly non-tariff barriers such as regulations, which unduly discriminate against foreign suppliers. Moreover, it is important to further reduce the remaining barriers in the EU’s internal market to enable the free movement of workers and innovative knowledge.
- Enhancing cross-border infrastructure: European transnational infrastructure needs to be expanded in transport, broadband and energy.

The results of more companies cooperating in R&D and integrating into international value chains will be a more efficient, innovative and competitive industry in the EU. This is also the aim of the old paradigm of industrial policy. The new paradigm, however, has several advantages. It enhances innovation opportunities, better carries along domestically oriented SMEs, and exploits international value chains to make EU supply better meet world demand. Thus, by using the huge potential of cooperation and value chains, EU industry competitiveness will be further advanced and reinforced.

6.2.2 Avoiding unnecessary burdens for industrial competitiveness

Much is achieved if policies at the EU (and Member State) level do not unnecessarily burden firms with regulatory costs and overly complex administrative rules. Despite the renewed industrial policy focus of the EU, industrial competitiveness is still too often compromised by EU policy initiatives.

This is particularly relevant regarding the energy and environmental field mentioned in the introduction of this study. Repeatedly, a misallocation of EU competencies – comparing the energy/climate/environment fields with industrial policy – has contributed to an erosion of the international level playing field for industrial businesses in the EU.

In addition, the EU tends to occasionally claim responsibility for policy issues where the subsidiarity principle would suggest sole responsibility of Member States. Also in this respect, industrial companies and particularly SMEs might be burdened with significant administrative or adjustment costs.

6.2.3 Improving economic framework conditions

More generally, policymakers should provide a stable and business-friendly institutional economic framework to enable entrepreneurs to thrive and be innovative. This applies to businesses from all sectors, but exists mainly in the realm of Member States.

The IW Competitiveness Index (see chapter 5) highlights strengths and reveals weaknesses of the EU compared to other developed countries. On a broad scale of areas, the EU-27's policy weaknesses are uncovered on average. A closer inspection, however, shows considerable divergences among Member States with certain EU regions/countries displaying a lagging performance. It is therefore mainly the responsibility of individual Member States to target the respective policy shortcomings. A priority of reforms can be derived from the IW Competitiveness Index, which also highlights the policy conditions that manufacturing businesses deem most important. In this ranking, the topic of energy/raw materials ranks first, followed by policy issues like governance and infrastructure.

On top of this, policymakers should make EU markets more competitive and flexible in order to generally improve the framework conditions for innovation and upgrading and thus for growth and employment. A higher intensity of competition is a main driver of innovation, efficiency and competitiveness. It also makes sure that businesses best serve the needs of people and customers. A higher cost efficiency and customer orientation of input suppliers to manufacturing will also help industry to remain internationally competitive. More competition accelerates economic progress but also structural change. It should thus be accompanied by an upgrading of skills and more flexible markets. More concretely, entry barriers to product markets should be reduced and labour markets reformed under the prerogative of "flexicurity". Furthermore, access to finance needs to be reliable and sufficiently broad to facilitate investment and the reallocation of resources.

EU policies can support Member States in setting the right framework conditions. This particularly refers to raising the intensity of competition in EU markets, which can be achieved by reducing cross-border entry barriers and regulations that unduly favour incumbents in certain markets. Moreover, the European Semester and Country Specific Recommendations should be used (and strengthened) to bring about the required reforms at the Member State level. Last but not least, the EU can disseminate best practices in a wide range of policy fields so that Member States can learn from one another about how to best encourage innovation, upgrading and competitiveness.

6.3 How adequate is EU industrial policy?

In the preceding chapter, general requirements for economic policymaking were derived. While chapter 5 has already provided a general evaluation of strengths and weaknesses of *Member State* policies, this and the following subsection focus on *EU industrial* policy. After a brief overview, positive initiatives are briefly highlighted, followed by a critical evaluation of shortcomings (section 6.4).

6.3.1 EU industrial policy – a brief overview

Industrial policy has a long tradition in the EU, as illustrated by the following milestones:

- As early as 1952 a basis was created for a supra-national industrial policy with the European Community for Coal and Steel (ECSC). The Treaty provided for various interventionist tools in order to shape the Member States' steel industry.
- In 1986, the foundation for industrial policy was created with the Single European Act in the context of the European Community.
- The next step followed in 1992 with the so-called Treaty of Maastricht when industrial policy got its own title (XIII). According to the new Article 130, "the community and the Member States shall ensure that the conditions necessary for the competitiveness of the Community's industry exist".

However, from the 1990s to 2010 only limited political weight was placed on industrial policy as the manufacturing sector was somewhat left on the sidelines. This reverse was mostly due to the ongoing deindustrialisation trend and the impression that certain service sectors provided better growth opportunities. After the financial and euro debt crisis, however, industrial policy has experienced a renaissance and a kind of rediscovery of industry took place in political circles.

In fact, industrial policy is one of seven flagship initiatives in the context of the Europe 2020 Strategy launched in 2010 by the European Commission (COM (2010) 614 final). Remarkably, the European Commission wrote in October 2012: "The political attention on industry is grounded in the realisation that a strong industrial base is essential for a wealthy and economically successful Europe" (COM (2012) 582). The Commission now intends to stop the process of deindustrialisation and reverse it. The share of manufacturing in GDP shall rise again to 20 per cent by 2020 having declined to around 15 per cent.

The current arsenal of the EU's industrial policy consists of horizontal and vertical or sector-specific measures. In fact, EU industrial policy has always been characterised by a dualism of liberal und interventionist elements. In 1970, the Commission's strategy for industrial development⁷⁴ was based, on the one hand, on the promotion of industrial champions and innovations, e.g. by technological forecasting, while on the other hand, the memorandum advocated the completion of the Single Market. However, in 1990 a Commission Report (COM (90) 556 final) rejected an interventionist industrial policy to promote targeted industries. Instead, it clearly favoured a horizontal approach based on three axes: maintaining a favourable business environment, implementing a positive approach to adjustment and maintaining an open approach to markets. However, sectoral policies were not completely absent at the EU level in the so-called "New Industrial Policy" from the 1990s to 2010 (Bruegel (2013)). With its new Communication on industrial policy from 2010 and particularly from 2012, the European Commission has introduced a "fresh approach", which has a significantly stronger vertical element (COM (2010) 614 final, 4).

Horizontal measures comprise strengthening the Single Market including competition policy, improvement of infrastructure, standardisation, enforcing intellectual property rights, improving access to finance for businesses, labour market policy, and education and training policies. Additionally all policy proposals that have a significant effect on industry shall undergo a thorough analysis for their impact on competitiveness. This includes new climate change or environmental legislation. According

⁷⁴ Memorandum "The Community's Industrial Policy" (COM (70) 100).

to the European Commission, the internal market is a key tool to achieve a highly competitive social market economy.

The *vertical dimension* of the EU's industrial policy contains various sector-specific instruments. The Commission has identified six fast-growing areas for priority action (COM (2012) 582): advanced manufacturing technologies for clean production; bio-based industries; sustainable industrial and construction policy and raw materials; clean vehicles and vessels; smart grids; and key enabling technologies (KETs). KETs comprise micro- and nano-electronics, advanced materials, industrial biotechnology, photonics, nanotechnology and advanced manufacturing systems.

6.3.2 Positive EU policy initiatives

While vertical strategies carry a certain risk of policy failure (as the market generally knows where future business potential is going), many of the horizontal measures clearly go in the right direction. However, important shortcomings remain in EU (industrial) policymaking and are addressed in section 6.4. Nevertheless, several positive examples for mainly horizontal measures are highlighted in this subsection with a focus on policy initiatives relevant to our narrative of "Moving Forward Together in Europe".

The **Global Europe** trade initiative of 2006 and the Commission's 2010 Communication "Trade, Growth, and World Affairs"⁷⁵ have set EU trade policy on a more active footing. They have strengthened the policy momentum to further open international markets for EU exporters. Due to the demise of WTO negotiations and the current Doha World Trade Round, the EU has set a significantly stronger focus on bilateral trade agreements. As a result, access to attractive (large and/or fast-growing) foreign markets has been considerably increased and is currently being negotiated. Particular focus is on emerging markets in Asia and, recently, also on highly developed countries like the United States, Japan and Canada. Moreover, trade topics have been tackled that go beyond the current WTO realm, like investment, public procurement, non-tariff and regulatory barriers, and intellectual property rights.

Furthermore, the **Market Access Strategy** is continuously used to identify and tackle current trade barriers of all kinds across the world. These initiatives support industrial competitiveness because they facilitate the internationalisation of EU companies and their increased integration into GVCs. In addition, with lower trade barriers for imports into the EU, competition intensity is increased (and thus competitive challenges for EU firms in their home market).

The **EU's Raw Materials Initiative** of 2008 (COM (2008) 699 final) is intended to secure access for EU firms to essential resources in three dimensions: in the global market; through better access to primary resources in the EU; and by raising the resource use, efficiency and recycling. Focusing on global markets, the EU has actively used the WTO dispute settlement to ensure the application of existing trade rules, e.g. concerning China's export restrictions for rare minerals and various raw materials. DG Trade also aims to improve international trade rules to increase trade disciplines for raw material exports on the multilateral and bilateral level. For example, bilateral trade agreements with

⁷⁵ See European Commission (2006), http://trade.ec.europa.eu/doclib/docs/2006/october/tradoc_130376.pdf and European Commission (2010), http://trade.ec.europa.eu/doclib/docs/2010/november/tradoc_146955.pdf.

Colombia, Peru and Central America include prohibitions of export duties with only limited exceptions. Moreover, the EU has developed raw material policy dialogues, for example with Argentina, China, Greenland, Russia and the United States. Secured access to raw materials is key for industrial competitiveness and also for sustaining existing value chains in the EU.

The **Innovation Union** (COM (2010) 546 final) comprises a (more) strategic and encompassing innovation framework in the EU to promote R&D investment and innovation. Within this concept, **Horizon 2020** – the EU Framework Programme for Research and Innovation – is the key financing instrument in the period 2014–2020. It provides funds, e.g. for top-level research initiatives and key technologies, simplifies innovation funding by combining three former programmes, and particularly intends to enable companies to better bridge the gap between research and the market.

Moreover, the **European Research Area** (ERA) – initiated originally in 2000 and due to be completed in 2014 – has the objective of enabling businesses and research institutions to better cooperate and move across borders, which is particularly relevant in the context of this study.

The **Services Directive** (2006/123/EC) also intends to foster economic integration in the service sector where many regulatory barriers still prevent a fully functioning internal market. Based on the Single Market Strategy in 2000 and on the originally proposed Directive of 2004 (relying on the country of origin principle) the revised Services Directive (now based on the principle of the freedom of service providers) is a significant step forward towards the elimination of barriers in the trade of EU services. This initiative, which has until now been partly implemented at the Member State level, is highly important in our context, because industry relies on cooperation with service integration and cost-efficient service suppliers.

Concerning the **internal market in energy**, the EU took several wide-ranging initiatives in order to foster competition in energy in the past, for example, the Directive on the internal market in electricity in 1996 and the Acceleration Directive due to implementation problems in 2003. The last major initiative, the **Third Energy Package** of 2009 (in force since 2011), intends to further increase competition in gas and electricity markets and consists of two directives and three regulations. It focuses on unbundling energy supply and distribution networks as well as on the independence of national energy regulatory bodies. These partly implemented initiatives have, *inter alia*, led to a rising price convergence in wholesale electricity markets. As energy supply has to be secure and affordable, making progress in the EU internal energy market is of vital relevance for industrial competitiveness and value chains.

The Commission's proposal of 2011 for a **Connecting Europe Facility** (COM (2011) 665 final) bundles important elements of improved cross-border infrastructure. It had foresight to very significantly increase EU funds to €50 billion (prices in 2011) for the new Multiannual Financial Framework 2014–2020 for these objectives to be distributed as follows:

- €32 billion to build missing links and remove bottlenecks in cross-border transport infrastructure (including €10 billion ring-fenced in the Cohesion Fund for transport projects);
- €9 billion to support investment in fast and very fast broadband networks and pan-European digital services which were to be leveraged by other private and public money; and

- €9 billion for trans-European energy infrastructure, e.g. for network bottlenecks and better interconnections to improve the security of supply and the possibility to transport renewable energy in a cost-effective manner across the EU.

This initiative is of high relevance to the concept of “Moving Forward Together in Europe” as cross-border value chains in goods, services and ICT essentially rely on sufficient transnational infrastructure.

The Commission’s initiative on **smart regulation** (COM (2010) 543) intends to ensure that EU policies/laws bring the greatest possible benefits in the most effective way, especially by reducing unnecessary regulatory burdens. Particularly the needs of SMEs should be taken into account:

- Concerning existing legislation and regulation, an Action Programme for Reducing Administrative Burdens reduced the administrative burden, which stemmed from 40 legal acts and 32 additional acts, by 25 per cent by 2012. Furthermore, the REFIT Programme (on regulatory fitness and performance) systematically reviews EU legislation. In a recent Communication (COM (2013) 685), the Commission outlined where it will take further action to simplify, revise, withdraw or evaluate EU laws.
- Regarding new legislation/regulations planned by the Commission, Impact Assessments (IAs) of economic, social and environmental effects feature as a main instrument to ensure the intended smartness. IAs are generally accompanied by stakeholder consultations, which are published online. Competitiveness Proofing (CP) is a relatively new instrument in the context of IAs. They are intended to implement the request of the Industrial Policy Flagship Communication of the Commission to “... ensure that all policy proposals with a significant effect on industry undergo a thorough analysis for their impacts on competitiveness”.

Reducing the regulatory burden for businesses is essential to securing industrial competitiveness and also enabling SMEs to be more successful in integrating in international value chains.

6.4 Shortcomings of existing EU policies

As pointed out in the previous subsection, many EU initiatives are heading in the right direction. However, there are also important shortcomings in the policy arena:

- On the level of Member States, industrial policies are often uncoordinated which can lead to inconsistencies. This aspect is, however, not the focus of this study.
- Many generally positive EU initiatives lack consequent implementation on the EU level (chapter 6.4.1). This particularly pertains to the promising instruments of IAs and CP which have not been used with sufficient rigour.
- EU policies can also lead to counterproductive inconsistencies and negative effects on industrial competitiveness (chapter 6.4.2).

6.4.1 Lack of implementation at the EU level

Reduction of funds for Connecting Europe Facility and Horizon 2020

The Connecting Europe Facility initiative is very important for cross-border internationalisation and value chain integration in the EU. Thus, it is all the more disappointing that the political agreement on the Multiannual Financial Framework 2014–2020 foresees significant cuts of more than €20 billion (or around 40 per cent) for this initiative compared to the originally very ambitious Commission proposal.⁷⁶

- Proposed funds for transport infrastructure (including funds channelled via the cohesion fund) have been reduced from €32 billion to €23 billion over the allocation period.
- Funds assigned for the trans-EU energy network have been cut from €9 billion to €5 billion.
- Particularly severe reductions are foreseen for cross-border broadband infrastructure where only €1 billion will be available (down from €9 billion).

Also, the financing for innovation suffers from very unfortunate cuts as the budget allocation for Horizon 2020 has been reduced from €80 billion to €70 billion compared to the Commission proposal.

Single Market

Services Directive

The Services Directive's impact on growth could triple (from 0.8 to 2.4 per cent of GDP) if Member States ambitiously reduce service restrictions as far as the five best EU countries per sector, which is close to full elimination of barriers covered by the Directive.⁷⁷ However, the implementation of the Services Directive has been delayed by Member States. As a result, the divergence of prices for services among EU countries is significantly larger than for goods.⁷⁸ This is a clear indication of the limited integration of national service markets in the EU.

Remaining obligations concern, for example:

- access barriers to many professions, such as special requirements for qualifications, or for legal forms of companies. Around 800 professions are regulated across the EU, of which three-quarters are regulated in more than one Member State. The regulation intensity varies considerably among Member States and affects up to 386 occupations;⁷⁹ and
- other remaining barriers for foreign service suppliers concern economic needs tests, duplicated regulations, lack of single points of contact and uncertainty about the application of regulations.

From a sectoral perspective, implementation of the Services Directive obligations by Member States is particularly low for business services (Figure 6-1), where the share of abolished restrictions tend to be lowest (e.g. accountants, legal services, architects, tax advisors, engineers). This shortcoming is also relevant for the manufacturing industry as inputs from business services are often rendered overly costly.

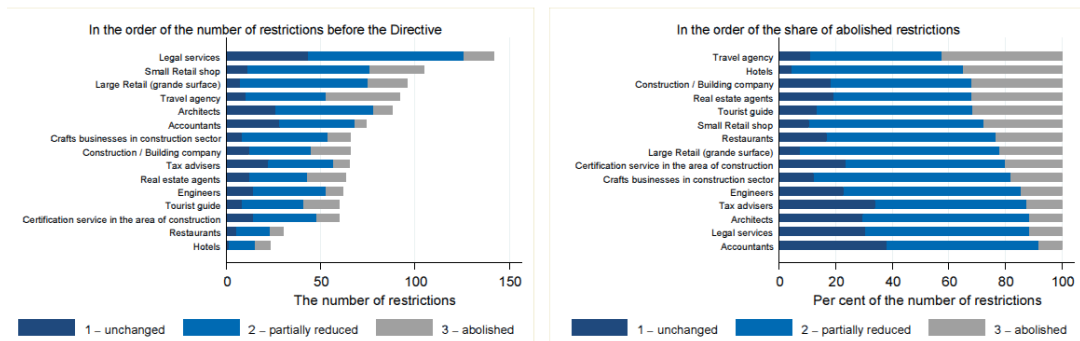
⁷⁶ The following dedicated amounts are measured in 2011's prices. It should be born in mind that infrastructure expenditure will be higher in the new MFF for 2014–2020 compared to the former MFF.

⁷⁷ See Monteagudo et al. (2012).

⁷⁸ See Busch (2012).

⁷⁹ This number is relevant for the Czech Republic; for further details see http://ec.europa.eu/internal_market/qualifications/regprof/index.cfm.

Figure 6-1: All restrictions across sectors in the EU



Source: Monteagudo et al. (2012).

Moreover, the Services Directive does not apply to several important sectors. Excluded are, for example, financial services, temporary work agency services, traffic and port services, e-commerce and services provided by notaries and bailiffs. In the case of temporary work agencies, significant barriers remain for cross-border placement of temporary workers, e.g. requirements and delays of permits, diversity of regulations.

Energy

Regarding the internal energy market, despite significant EU initiatives such as the Third Energy Package (see chapter on game changers), implementation of important directives by Member States is still being delayed and remains incomplete. Indicators for a resulting lack of competition in the EU's internal and national energy markets are:

- a high level of concentration in many electricity markets, where in eight Member States the incumbent company still controls over 80 per cent of the electricity generation; and
- large electricity retail price differences remain (of up to 40 per cent between neighbouring countries) despite energy being a homogeneous and tradable good.

Further barriers comprise price regulations (in 14 Member States) which are in part responsible for the large price differences. Overall, prices for energy tend to be overly high in many Member States, which is of particular relevance for the competitiveness of manufacturing businesses that rely on energy as an important input.

Digital Single Market

There is also important economic potential in fostering a Digital Single Market in the EU. However, apart from the lack of investment in cross-country broadband connections, many regulatory barriers exist, several of which are currently being tackled by the EU Council. For example, there is a lack of EU-wide regulatory frameworks for data protection, big data and cloud computing. Moreover, the EU telecommunication markets remain partially fragmented and intra-EU e-commerce trade is hampered

by diverging regulatory schemes (or interpretations), e.g. concerning VAT regimes, online identification and consumer law.

Worker mobility is rather limited in the EU

Only 3 per cent of employees in EU countries came from another Member State in 2011. The reasons comprise not only language and cultural barriers but also policy-related impediments, such as the lack of fully implementing or effectively enforcing the existing rights to free movement of employees by Member States. This mainly concerns problems with the recognition of professional or vocational qualifications. In spite of a Directive which streamlined 15 different regulations, for the majority of occupations the administrative recognition process is burdensome and long.

Smart regulation

REFIT Programme

REFIT (the regulatory fitness check for existing regulations and proposals) has been listed, generally, as a positive example of EU policymaking in chapter 6.3.2 (Positive EU policy initiatives). However, the implementation at the EU level still lacks decisiveness, rigour and sufficient detail.

This also pertains to the recent Communication of the Commission from October 2, 2013 on REFIT (COM (2013) 685 final). Particularly, the list of proposals to be withdrawn appears arbitrary. Moreover, the list is incomplete. Several proposals can be deemed redundant due to a lack of EU competency or high administrative cost burdens, which have resulted in a blockage in the Council.⁸⁰ Several examples illustrate this:

Maternity leave

The Commission's proposal for a change of the 1992 Maternity Leave Directive suggests an extension of maternity leave from 14 to 18 weeks. On top of this, the European Parliament proposed an extension to 20 weeks and at least two weeks' fully paid paternity leave. The proposal has been resisted and blocked by Member States since 2010 due to severe doubts about the EU's competency in this field and also due to a potentially implied significant cost burden. For these reasons, a withdrawal of the proposal is overdue and it is disappointing that it is not included in the list.

Antidiscrimination Directive

The Commission's proposal for a fifth Antidiscrimination Directive (COM (2008) 426 final) exemplifies how the EU oversteps its competencies and neglects the subsidiarity principle. Furthermore, the Commission has attempted to harmonise national antidiscrimination rules after several Member States "gold plated" former regulations in this field, i.e. implemented them over-ambitiously. As the Council blocked this proposal, it should be withdrawn.

Lack of formal involvement of European Parliament (EP) and Council in REFIT objectives

In addition, it appears problematic that the EP and the Council are not sufficiently involved in the aim of REFIT to streamline EU regulation and reduce the administrative burden, particularly for SMEs. Thus, it cannot be guaranteed that EU rules identified as problematic by the Commission will not be

⁸⁰ However, there are also reasonable proposals from a business point of view which have been blocked in the Council. This relates to the proposal to create a new legal company form in the EU (SPE – Societas Privata Europaeae) to reduce regulatory burdens and to facilitate cross-border activities of SMEs. Thus, the withdrawal of the European Private Company Statute (SPE) is counterproductive to fostering the internationalisation of SMEs.

aggravated regarding their detrimental impact on industrial competitiveness when they are redrafted by the EP and the Council.

IAs

IAs of the Commission's proposals are indispensable so this instrument should be used as effectively as possible. However, there are a number of problems with the existing IA practice.

Lack of sufficient analysis of resulting cost burdens

First, several IAs have significantly underestimated the implied cost burden of new regulatory initiatives.

- The implementation costs of Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) for the chemical industry have turned out to be significantly higher than originally envisaged. A review study of REACH by CSES (2012)⁸¹ estimated the costs to the chemical industry for the registration period up to 2011 to be around €2.1 billion. This is nearly as high as the €2.3 billion that the Commission expected in its extended IA in October 2003 for the whole registration period of up to 15 years (SEC (2003) 1171/3).
- A recent proposal by the Commission in April 2013 (COM (2013) 207) intends to make CSR (corporate social responsibility) reporting obligatory for companies with more than 500 employees, more than €20 million on the total balance sheet or more than €40 million net turnover. The respective IA (SWD (2013) 127 final) estimated the related administrative costs to amount to between €600 and €4,300 annually. However, it neglected the fact that auditing is mandatory because the required CSR information shall be part of the management report which has to be audited in full. According to the Institute of German Auditors (IDW, 2012)⁸² obligatory auditing would "significantly increase the accounting and auditing costs". Thus, the "cost of external verification ... would by far exceed the benefits of the addressees of the management report". The cost burden would be particularly relevant for relatively small companies with between 500 and 1,000 employees.

Lack of unbiased interpretation of results

The Energy Efficiency Directive (2012/27/EU) to be transposed into national law by June 2014 includes an indicative but absolute 20 per cent reduction target for primary energy consumption in the EU. This approach was chosen in spite of a percentage goal being problematic for countries that achieved considerable efficiency gains earlier on. Moreover, an absolute target (instead of target related to the level of GDP) can become an implicit impediment for growth and thus also for reducing unemployment, which is currently excessively high in several EU countries.

Apart from this general criticism, the interpretation of the results obtained by the respective IA is debatable (SEC (2011) 779 final). The IA found (small) negative implications for consumption and exports in 2020 of the chosen alternative A3 of the IA – the 20 per cent indicative reduction target (IA, Table 3, p. 28). A (small) positive impact on GDP in 2020 is expected, but this will only result from higher investment expenditure, which is costly for businesses.

⁸¹ CSES (2012), Interim Evaluation: Functioning of the European Chemical Market after the Introduction of REACH, p. III.

⁸² IDW Position Paper on Directive Proposal COM (2013) 207 dated June 10, 2013.

The interpretation of these results is remarkable as it mirrors a recurring argument of the Commission in similar contexts. The IA qualifies the negative short-term impact of higher energy prices on exports and consumption. It claims that in the medium to longer term, exporters will profit from first-mover advantages due to their improved energy efficiency and that the energy bills will decrease again due to lower energy consumption.

However, this argument can be fundamentally criticised because it ignores the fact that only a limited number of sectors which produce new energy-efficient electrical devices will be able to reap first-mover advantages. A large number of remaining sectors which have to bear higher production costs would have to cope with competitive disadvantages unless major global competitors also raise the energy-efficiency standards to a similar level in the EU. Whether and when this happens is still unclear as of today. The argument also fails to look at the short- to medium-term structural change, which is necessary to reach medium-term adjustment, which is likely to further increase unemployment for a prolonged period.

Lack of consequences

The Energy Efficiency Directive (2012/27/EU) represents a case in point where insufficient consequences were considered after problematic findings of an IA.

- First, the indicative reduction target of 20 per cent – policy alternative A3 in the IA – was chosen, notwithstanding the above-mentioned (small) negative implications for consumption and exports in 2020 (IA, Table 3, p. 28).
- Second, the IA came to the conclusion that energy-efficiency potential is limited in the business sector and is larger in the household sector. The Directive focuses more on industry by introducing regulations which should lead to further energy savings,⁸³ while the household sector, e.g. the energy efficiency of buildings, is targeted only to a limited extent relative to its potential. Depending on the implementation by Member States, this will likely lead to inefficient and overly costly abatement efforts as the burden of energy-efficiency increases will probably rely to a disproportional extent on industry where the potential for further energy savings are limited.

Lack of rigour and objectivity in CP

The new instrument of CP is potentially very important for providing more substance, rigour and reliability of IAs of the Commission's proposals in terms of their impact on industrial competitiveness. However, CPs have not been used on a sufficiently broad scale up to now (the Commission has published only six CPs on the relevant internet site⁸⁴). Moreover, several other weaknesses can be listed:

- there is a lack of explanation and justification about when a CP is deemed necessary or not;

⁸³ Article 7 (1–8) postulates that energy suppliers have to reduce their energy supply by 1.5 per cent each year. They will very likely concentrate on low abatement cost potential in the household sector, e.g. by offering financial incentives to households to buy energy-efficient products. The resulting cost increases for energy suppliers would then be shifted to electricity prices. This would further decrease the competitiveness, particularly of energy-intensive industries. Article 7 (9) opens an alternative to this approach, but has to be notified until December 2013 and might still imply an (albeit smaller) yearly reduction target for energy suppliers.

⁸⁴ See http://ec.europa.eu/enterprise/policies/smart-regulation/impact-assessment/competitiveness-proofing/index_en.htm.

- industrial competitiveness does not stand on an equal footing with other objectives. Instead of assuring the right balance, the CP gives clear priority to the main objective of a proposal. It is merely intended to limit potentially negative effects on industry. The Commission explicitly states that the CP “is not an instrument ... to compromise the overall core objective of the policy proposal”;⁸⁵ and
- as with the IAs, it is not always transparent how exactly the CP feeds into the final decision, particularly when an alternative is chosen which is not the most industry-friendly. Again, more explanation and justification is needed in the framework of a comply-or-explain approach.

Furthermore, from a methodological point of view, it appears to be unclear if the Commission uses a balanced and objective evaluation approach. Instead, there are indications that potential disadvantages to industrial competitiveness are underrated. This can be illustrated with the CP for the Directive setting a CO₂ limit for car fleets in 2020 (SWD (2012) 213 final).

In the part of the CP focusing on the impact on consumer prices for cars (p. 59), it mentions that the implementation of the 2020 target in the EU will increase costs of manufacturing vehicles, but no number (or range of numbers) and no qualitative indication about the severity of this increase is provided.⁸⁶ Instead, it is vaguely hinted at by saying that “a multitude” of other price-driving factors “tend to have a downward effect on the price of cars” (p. 59). However, in terms of competitiveness, many of these price drivers will be relevant outside the EU as well, so that the consumer price increase due to the 2020 CO₂ reduction target tends to remain as a cost disadvantage on the world market.

The part of the CP dealing explicitly with the impact on international competitiveness (p. 65) postulates without any differentiation that “advanced...environmental policy stimulates innovation which in the longer term improves the competitiveness of the region / country”. Moreover it is claimed, with reference to a figure (p. 23 of part I of the CP), that “CO₂ standards in different markets are rapidly converging” and that “non-EU manufacturers have to achieve quite similar CO₂ emission values on their home markets”. The CO₂ standard for 2020 in Japan is depicted as “close to the EU target”, but for South Korea the report mentions that the 2015 target is still in the proposal phase and no 2020 target has been set. Other countries are not mentioned in this part of the CP. Based on the initial hypotheses and on the above reference to the comparative CO₂ standards, it can be concluded that “EU regulation does not place EU manufacturers in a disadvantageous position in markets outside the EU”. Instead, it is stated: “The fact that EU legislation is still slightly ahead of targets in other countries might even give them [EU manufacturers] an advantage in other markets with CO₂ legislation”.

This analysis can be criticised from several angles.

- The postulated hypothesis at the outset is debatable. As pointed out above, the focus on the long term neglects potentially negative implications on growth and employment in the short term. Moreover, if highly environmentally friendly (but relatively costly) products do not meet demand in other countries, this cannot be regarded as an improvement of competitiveness.

⁸⁵ See http://ec.europa.eu/enterprise/policies/smart-regulation/impact-assessment/competitiveness-proofing/index_en.htm.

⁸⁶ A study quantifies the cost burden to amount to around €2,700 (RWTH (2013)).

- A closer look at the figure on page 23 of the CP reveals that CO₂ standards are not rapidly converging and that even the Japanese target of 105 gCO₂/km for 2020 is more than 10 per cent higher than the EU target of 95 gCO₂/km. Furthermore, the CP does not mention two important competitors, the United States and China, where 2020 targets are significantly above the EU level at 121 and 117 gCO₂/km, respectively.
- The CP provides no explicit IA on international competitiveness for the phase during which EU standards remain significantly higher than other regions of the world. Even if Japan, South Korea, the United States and China adopted similar CO₂ standards to the EU for 2025, a discussion about the resulting effects on EU manufacturers in the meantime would have been needed. It does not suffice to claim that in the long term (doubtful) competitiveness gains should materialise. Instead, it would have been necessary to analyse, as a minimum, how a higher price/efficiency combination of EU cars would be accepted in important non-EU markets. Moreover, the danger that EU production is further relocated to the large non-EU countries should have been mentioned and estimated as far as possible.

Overall, the CP for the Directive setting a CO₂ limit for car fleets in 2020 displays very significant shortcomings.

Summary of general criticism of IAs and CP

Overall, there is a solid indication that IAs and also the new CPs suffer from a lack of economic soundness and objectivity. Several cases have been identified where costs were incompletely assessed or significantly underestimated. Moreover, the interpretation of results did not appear to be sufficiently balanced. Particularly, potential advantages of a regulation tended to be overplayed and drawbacks relating to cost burdens and competitiveness disadvantages were played down in the cases depicted here. It is highly unfortunate that the opportunity to put the competitiveness check on a sounder economic footing is not sufficiently used as regards the new CP.

In view of these severe shortcomings, it appears questionable that the Commission drafts the IAs on its own. An “independent” Impact Assessment Board of the Commission, which should exert central quality control, is obviously no improvement. It is working under the authority of the Commission President, is chaired by the Deputy Secretary General responsible for Better Regulation and its members are high-level officials who are appointed in a personal capacity based on their expert knowledge. Effectively, however, there are no functioning control mechanisms to ensure an encompassing and objective cost analysis and an unbiased evaluation of results. Moreover, it is not always guaranteed that proposals that will have detrimental impacts on costs and competitiveness are withdrawn or sufficiently altered.

6.4.2 Policy inconsistencies and counterproductive initiatives

Mismatch of EU competencies regarding industrial policy

As chapter 5 has focused on weaknesses/shortcomings (and strengths) of economic policies at the Member State level, this chapter focuses solely on EU policies. Several examples are highlighted where EU policies are either inconsistent with each other or where they significantly impede the global level playing field, i.e. the international competitiveness of EU businesses.

The latter problem can easily arise due to an institutional mismatch of EU competencies. While the EU has relatively far-reaching competencies in the energy/climate/environment field, its powers regarding industrial policy are more limited. Thus, the (open) question can be raised whether industrial competitiveness issues are not structurally disadvantaged at the EU level. This is all the more relevant from a political economy point of view, since existing bureaucracies continuously tend to prove their relevance by putting forward new initiatives. For example, the implementation of the very complex and demanding REACH regulation is still ongoing (see below for the implied far-reaching consequences for the chemical industry in the EU). However, the need for businesses to adapt and rely on a stable economic framework in the nearer future is eroded by new EU plans for additional regulatory changes.

Inconsistent interaction of existing instruments

European Union Greenhouse Gas Emission Trading Scheme (ETS) and other instruments in climate and energy policy

There is a lack of consistency among various instruments of climate and energy policy at the EU and Member State level. Activities to avoid dangerous climate change, to foster renewable energy use and to increase energy efficiency are mainly based on:

- ETS (established by Directive 2003/87/EC amended by 2009/29/EC);
- minimum taxation levels of energy products and electricity (Directive 2003/96/EC, Annex I);
- the Energy Efficiency Directive (2012/27/EU); and
- a variety of instruments at the Member State level, particularly subsidy schemes for renewable energies.

These various instruments interfere with each other, which can be illustrated in a stylised way.⁸⁷ If an ETS with an effectively enforced emission cap exists, additional climate protection instruments will not further reduce carbon dioxide emissions within the reach of the ETS, and will only influence the allowance price. For example, an emissions tax on industrial activities which is also included in the ETS (as a subsector) incites the respective companies to further reduce their emissions. The same applies to a subsidy scheme for a subsector of the ETS which, for example, supports the use of renewable energy or incentivises low-emission energy-generating technologies. If sufficiently high, such taxes or subsidies decrease the demand for emission allowances, so that *ceteris paribus* the emission allowance price falls. However, as the emission cap remains the same, other subsectors can increase their emissions or reduce their reduction efforts.

Such interference of instruments can have detrimental consequences:

- If economic activities that are part of an ETS are also targeted by emission taxes or subsidies, overall abatement efforts will be inefficient. These activities will strongly reduce emissions with relatively high marginal abatement costs. Additionally, activities under the ETS not covered by taxes or subsidies will be able to emit more and will have – due to the lower emission price – relatively low abatement costs.

⁸⁷ The ETS Directive does not propose concrete requirements regarding the link between the ETS and other existing instruments. Annex III only prescribes that the National Allocation plans “shall be consistent with other Community legislative and policy instruments”. For a more systematic depiction of these interactions, see Heilmann (2005), Böhringer et al. (2005) and Walz (2005).

- If certain industries are covered by both the ETS and other taxes which lead to emission reductions, there will be no overall effect on emissions within the ETS, but a potentially substantial additional cost burden for the respective companies.

VAT legislation

EU legislation which allows for differences and varying interpretations of VAT rules leads to administrative complexity and can thus discourage SMEs from engaging in intra-EU trade. This contravenes the intention to further stimulate the internationalisation of SMEs and to foster their increased integration into international value chains. Moreover, the discretionary powers of Member States regarding VAT rules and their interpretations cause unnecessary administrative costs (such as consultancy costs).

For example, significant differences are prevalent concerning VAT registration requirements, VAT declarations (lack of a uniform declaration in the EU), rules for application of the 0 per cent rate for intra-EU supplies, interpretations regarding warehousing/storage of goods, and the understanding of VAT import rules regarding “deduction of input tax”. Additionally, business organisations report large problems concerning Single Authorisation for Simplified Procedures (SASP) and Centralised Clearance based on national requirements, especially in the area of VAT.

E-customs

There is an inconsistency whereby the European Commission wants to move towards e-customs (paperless returns, etc.) but at the same time EU legislation requires paper-based documents.

Erosion of the level playing field in international competition

REACH

The objective of REACH to increase the monitoring of and reduce potential health risks from chemical substances is certainly very valid. Nevertheless, the encompassing approach taken by the EU significantly threatens the competitiveness of EU businesses. In the EU, much stricter regulatory obligations are relevant to register and document chemical substances compared to other world regions.

In most non-EU countries, only a limited range of chemicals need to be registered with and/or are monitored by public authorities. In contrast, EU firms have to register almost all substances individually in an expensive administrative process with the European Chemicals Agency (ECHA). These costs are not just one-off, but if new information/research on individual substances is available, companies have to undergo part of the costly registration process again. The administrative burden is particularly severe for SMEs that only produce relatively small amounts of chemicals because there are substantial fixed costs for registering each substance.

As a result of the higher than expected registration cost (see section on IA), EU firms suffer from disadvantages in international competitiveness for a wide range of products, particularly on the world market. Within the EU, foreign exporters of chemical substances to the EU also have to undergo the registration procedure. However, foreign exporters of finished or semi-finished products into the EU do not. Thus, EU firms fabricating these products are at a competitive disadvantage in the EU market vis-à-vis these foreign companies. The cost disadvantage has been clearly recognised in a review of REACH published by the Commission in February 2013 (SWD (2013) 25 final, p. 132), mainly for homogeneous products. Based on a large business survey, the companies found it too early to make

substantial conclusions about the impact of REACH on their competitiveness. However, the report states that the “financial situation of most firms was reported to be negatively affected” and that profit margins were reduced. Moreover, individual cases of relocation were mentioned.

Additionally, there is the danger that important substances for the chemical value chain are no longer produced due to lack of profitability in the EU and certain very important and highly reactive substances (SVHCs – Substances of Very High Concern) could be banned by public authorities through the authorisation procedure of REACH. This causes legal uncertainty and significant impediments for investment projects where SVHCs are important for the production process.

EU climate policy

Further examples for competitive cost disadvantages relate to EU climate policy, which is relatively ambitious in international comparison. Two cases in point are only mentioned in passing here: the attempt to integrate air traffic in the ETS and the restrictions of CO₂ emissions for car fleets where the Commission proposed a reduction target for 2020 which is considerably stricter than in the United States and China (see above).

The cumulated cost burden of EU policies for aluminium firms

A recent study by CEPS has examined the cumulated cost burden of EU policies with a focus on aluminium companies.⁸⁸ As the aluminium industry is very energy-intensive, it is particularly exposed to EU policies that contribute to a rise in energy costs. Primary aluminium producers that rely on buying electricity on the market⁸⁹ are exposed not only to environmental policy (including REACH) but also to costs related to energy policy and to the ETS. According to the CEPS study, cumulated regulatory costs of these various policies amounted on average to 12 per cent of production costs between 2002 and 2012 in an intermediate scenario. Of this huge cost burden, 47 per cent is accounted for by costs related to energy policies and 45 per cent by indirect costs from the ETS. Except in two years (2006 and 2007) these costs exceeded profits, sometimes by a wide margin.

This immense regulatory cost burden contributes significantly to a large competitive disadvantage on the global market for EU aluminium firms relying on the electricity market. Their business costs per tonne of aluminium amounted to US\$2,229 [€1,735] in 2012, while aluminium firms in the US incurred costs of US\$1,944 [€1,513] and in China of US\$1,922 [€1,496]. The cost differential to the US and China is thus 15 per cent and 16 per cent respectively.

International competitiveness in non-EU markets

The above-mentioned examples of EU policies refer to increases of production costs for EU firms, which can result in their goods being more expensive than products from international competitors. Apart from this, some EU policies force or incentivise firms to make their products more energy-efficient. These products tend to be more expensive than conventional ones, but provide for energy cost savings and environmental quality advantages. This is suitable for economies with relatively high energy prices and relatively high preferences for environmental quality. However, these preconditions do not prevail in many countries worldwide. Thus, these energy-efficient and environmentally friendly

⁸⁸ CEPS (2012).

⁸⁹ The study distinguishes another subsample of aluminium plants which benefit from long-term electricity contracts and self-generation of electricity and therefore have lower cumulated costs. However, the long-term contracts will expire within the next five years for most plants. Therefore, only the subsample of firms that have to purchase electricity on the market is considered here.

products are hard to sell on the world market on a large scale. EU firms that intend to export successfully therefore have to offer different products for the EU market compared with non-EU markets with substantially different preferences. This can impede the exploitation of economies of scale and make products relatively more expensive.

Moreover, as a direct consequence there is greater incentive to relocate production to those foreign markets where less energy-efficient and cheaper products are in demand. According to the theory of multinational firms,⁹⁰ economies of scale are an important determinant (besides transport costs) for the choice of the home market as the production location and export platform for a certain product. Relocation of production to the destination country is more likely if transport costs are high (distance is long) and if economies of scale are of limited relevance. Thus, if the exploitation of economies of scale is rendered impossible due to regulatory norms (which lead to significantly different products for home and foreign markets) the dislocation of production becomes significantly more attractive. A decrease of investment would be very detrimental to the short- and long-term growth prospects in the EU.

⁹⁰ See the seminal knowledge-capital model of Markusen (2002).

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Appendix

Methodology of IW Competitiveness Index

Based on regression analyses with fixed effects models, we examined the success of manufacturing by measuring the share of VA of manufacturing and the percentage growth of VA relative to the previous year. We identified around 60 indicators with evidence of a statistically significant relationship to success of manufacturing (such as Index of Economic Freedom of the World, Worldwide Governance Indicators, GDP, labour costs, export rate, energy consumption, public expenditure on education, taxation of individuals, share of broadband customers and density of physicians).

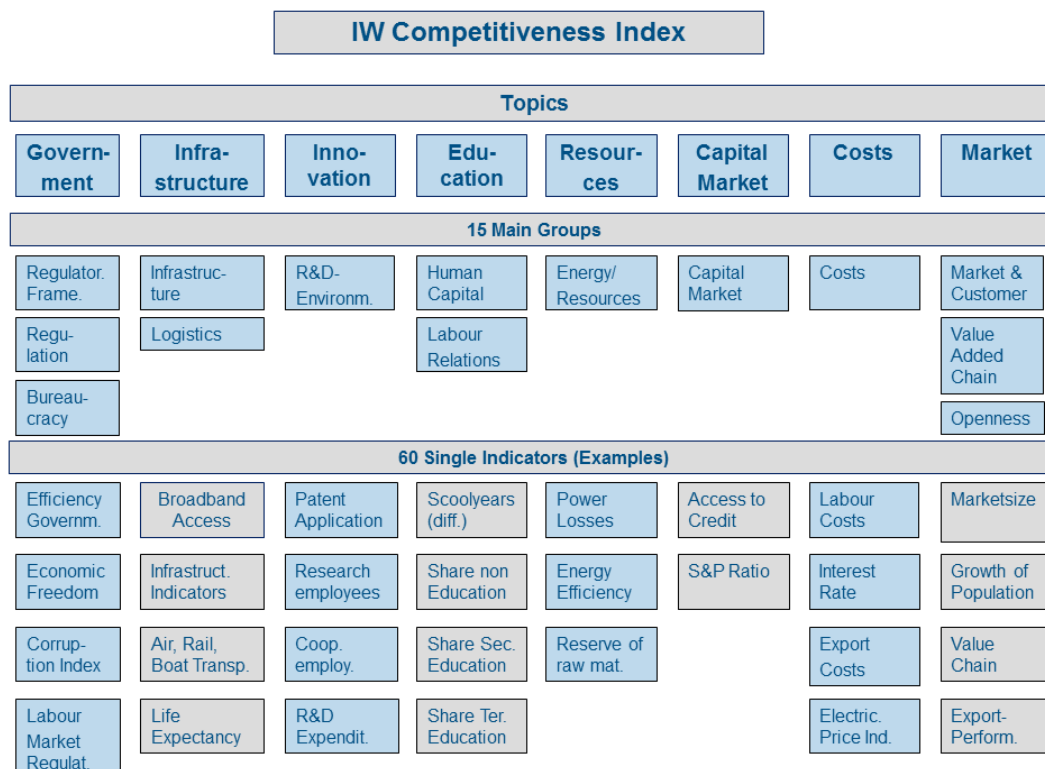
The IW Competitiveness Index of Industrial Competitiveness is based on 60 single indicators which are assigned to 15 main groups;⁹¹ the main groups are summarised in eight thematic areas (government, infrastructure, innovation, education, resources, capital market, costs and markets). The overall Index of Industrial Competitiveness is a weighted average of main groups. The weights were determined by conducting an empirical analysis of German companies with IW Business Survey Data.

In this empirical analysis, 2,200 German companies from industry and industry-related services had to evaluate the relevance of 71 singular location indicators for investment decisions in practice. Based on these results, we derived weights for calculating the Index of Competitiveness in the major industrial countries.

Figure A I shows a diagrammatic drawing of the structure of the IW index.

⁹¹ The main group, “government funding”, is not incorporated in the index calculation due to lack of data. This reduces the number of main groups from 15 to 14.

Figure A I: IW Competitiveness Index



Source: IW Consult (2013).

To derive weights for calculating the Competitiveness Index in different countries, we used calculated relevance quotas for 15 main groups. The weights are based on survey panel data in which companies were questioned on the relevance of several location and competitiveness factors.

The weights result from the share of relevance quota of a topic and the sum of relevance quotas of all topics. The weights add up to 100. The two major topics (energy/resources and regulatory framework) account for 25 per cent of weighting points. There is no difference between manufacturing and services. The results correspond in their structure to calculated relevance quotas.

Table A I shows the results, differentiated according to manufacturing and services, as well as terms of extreme values and average values.

Table A I: Weightings of main groups

per cent; differentiated by sectors and evaluation method

	Terms of extreme values		Terms of average values	
	Industry	Services	Industry	Services
Energy/resources	13.1	12.4	8.5	8.1
Regulatory framework	12.2	13.2	8.4	8.9
Infrastructure	8.3	10.6	7.3	7.7
Human capital	8.1	8.2	7.2	7.2
Bureaucracy	7.7	7.8	7.5	7.6
Labour relations	7.3	6.7	7.4	7.1
Market and customer	7.2	7.8	7.5	7.9
Innovation environment	7.1	5.1	7.0	6.4
Capital markets	6.5	6.7	6.5	6.9
Costs	5.6	5.4	6.9	6.9
Openness/foreign trade	5.4	3.7	6.4	5.3
VA chains	5.3	4.1	6.7	6.0
Government funding	2.3	3.0	4.7	5.0
Air/rail/boat transport	1.9	3.3	3.7	4.5
Regulation	1.9	2.0	4.1	4.5
Standard deviation	3.2	3.4	1.4	1.3

Source: IW Future Panel survey (2012).

Definition of country groups

EU-27: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom.

Other developed countries: Australia, Canada, Chile, Israel, Japan, Mexico, New Zealand, Norway, South Korea, Switzerland, Turkey, United States.

Asian emerging countries: China, Indonesia, Malaysia, Philippines, Thailand, Vietnam.

Other emerging countries: Argentina, Brazil, India, Russia, South Africa.