The EU Mechanical Engineering – Success in Global Markets Drives Growth

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Mechanical engineering has been acknowledged by European policy makers as a crucial pebble in the mosaic of competitiveness. Numerous studies have been commissioned by the European Commission and member states' governments. One of the more recent studies, the EnginEurope report was concluded just before the financial crisis shattered the global economy. The latest project, the *Study on the Competitiveness of the EU Mechanical Engineering Industry* (henceforth ME), which was also commissioned by the European Commission, was led by the Munich-based Ifo Institute.[1] Cambridge Econometrics and the Dansk Technological Institute were also members of the project team. The study was carried out in the context of the framework contract on Sectoral Competitiveness Studies (ENTR/06/054) over the time period of 2007 to 2011. This study aimed to contribute to the initiatives of the European Commission to strengthen the performance of the EU ME in international competition. This is in line with the Commission Communication of 3 March 2010 on objectives to be reached by 2020[2] and the 'Communication on a New Industrial Policy' – published in October 2010 – as a guideline for policy options and recommendations.

The strong performance of the EU ME was primarily driven by its unique product programme that meets the needs of globalization. The access of EU manufacturers to large and high-growth emerging markets has stimulated growth and contained the negative effects of the financial and state debt crisis, in spite of some weaknesses in price competitiveness. The long-term prospects are bright, although cyclical fluctuations in demand will remain a challenge to firms. Temporary setbacks should not affect the long-term confidence in the competitiveness of the EU ME. The companies should strive for opportunities in overseas markets. This calls for a strengthening of their foothold in these markets *via* foreign direct investment. Companies also need to factor the requirements of overseas clients into innovation in goods and services.

Comparative advantages of EU mechanical engineering

ME as one the EU's major branches

ME is one of the major branches of manufacturing in the EU27, with a share of around 9.1 percent of all production in manufacturing industries. Compared to other industries, ME firms are characterized by a relatively high manufacturing depth. This is mainly due to three factors: predominant small-batch and single-item production, high qualification requirements in manufacturing departments, and the need for close communication between manufacturing, engineering and design departments. As a result, the share of ME's value added of total manufacturing is higher than that of production, reaching around 11.5 percent. The higher share of value added is also reflected in employment, which also accounts for a similar share of total manufacturing (Table 1).

EU ME's growth in productivity is, on average, much higher than that of total EU manufacturing. Only during the financial crisis, when ME was hit harder than other industries, did productivity break down. This is a typical cyclical pattern inherent to the nature of this industry, and output growth was below productivity growth for most of the period under consideration. For ME, as well as for total manufacturing, output growth was not sufficient to prevent job losses.

* Ifo Institute. This article has been produced using the content of the Study on the Competitiveness of the EU Mechanical Engineering Industry with the permission of the European Commission. The views expressed here are those of the author and do not necessarily reflect the opinion of the European Commission.

[1] This study can be found at http://ec.europa.eu/enterprise/sectors/mechanical/files/competitiveness/comp-mech-eng-2012-frep_en.pdf.

[2] European Commission (2010), *Europe 2020 – A European Strategy for Smart, Sustainable and Inclusive Growth,* Brussels, 3 March.

Table 1

Key figures for EU27 in mechanical engineering

Sector	Indicator	2010		Annual average growth rate in % 1995–00	2000–05	2005–08	2008–10
Manufacturing	Production, in current prices	bn €	5,885	5.3	2.1	6.7	– 5.2
ME[1)]			502	4.0	2.3	10.4	– 8.4
Manufacturing	Gross value added, in 2010 prices	bn €	1,504.0	2.1	0.0	1.5	– 5.2
ME[1)]			157.5	2.4	0.3	6.0	– 9.3
Manufacturing	Employees	1,000	30,063	– 0.6	– 1.3	– 0.3	– 4.8
ME[1)]			2,901	– 1.6	– 2.2	1.8	– 4.8
Manufacturing	Productivity[2)]	1,000 €	50.0	2.7	1.3	1.8	– 0.4
ME[1)]			54.3	4.0	2.6	4.1	– 4.7

[1)] ME = mechanical engineering. [2)] Value added per capita and annum at 2010 prices.

Sources: Eurostat; Cambridge Econometrics; Ifo Institute.

ME is vital for the EU's current account balance

The EU ME is not only one of the most important providers of jobs within the EU, but also contributes significantly to a sound current account balance of the EU27. In foreign trade with manufactured goods the EU shows a noteworthy deficit. In 2010 extra-EU exports only amounted to 1,343.9 billion euros, whereas imports reached 1,500.6 billion euros. For ME however, exports amounted to 200.4 billion euros, with imports of 81.2 billion euros. In 2010 the trade deficit for total manufactured goods had reached 156.7 billion euros. Without the surplus created by ME, it would have been more than three quarters higher and would have reached 275.9 billion euros. Over the period under consideration, the EU ME's trade surplus nearly tripled and more than compensated for the growing deficits in trade with manufactured goods. ME has become more important for the EU27's current account balance.

A global heavyweight among major competing economies

The most important competing economies for the EU ME are Japan, China and the United States. The EU ME is by far the largest industry as compared to the United States and Japan, which only accounted for

Table 2

Key figures on the economic performance of major competing economies in mechanical engineering

2010[1)]			EU27	USA	% EU	Japan	% EU	China	% EU
Output [2)]	Current prices	bn €	502.1	221.6	44.1	151.9	30.3	480.6	95.7
Value added	Constant prices	bn €	157.5	103.0	65.4	66.2	42.0	161.4	102.5
Employees	Numbers	1,000	2,900.5	1,130	39.0	684.6	23.6	6,113	210.8
Labour productivity	Value added per employee[3)]	€	54,290	91,125	167.8	96,700	178.1	26,399	48.6
Labour costs	Per employee	€	33,243	39,815	119.8	32,420	97.5	3,700	11.1
Gross operating	Share of value added	%	38.8	56.3	145.2	66.5	171.5	86.0	221.8
Unit-labour costs[5)]	Labour costs per output unit	€/€	0.61	0.44	71.4	0.34	54.8	0.14	22.9

[1)] 2010 prices and exchange rates; [2)] Turnover /production; [3)] At constant prices; [4)] (Value added-wages)/value added); 5) value added at constant prices per 1 € labour costs.

Sources: Eurostat; National Statistical Offices; Cambridge Econometrics; Ifo Institute.

65.4 percent and 42.0 percent respectively of the EU ME's value added in 2010. However, the Chinese ME has caught up rapidly over the past decade and – as measured by value added – is now on a par with the EU (Table 2).

Between 2000 and 2010 the ME's outputs in the United States, Japan, and the EU changed at annual average rates of – 1.1 percent, – 3.3 percent, and 1.0 percent respectively. To a certain extent, the industry's relatively favourable development in the EU is caused by stimulating domestic demand. However, trade analysis reveals that the EU also performed better in international trade.

ME employment development has been better than that of manufacturing as a whole

Over the period 2000–2010, overall employment for the ME declined by 2.6 percent in the United States, 3.3 percent in Japan, and 1.5 percent in the EU. This development cannot be attributed entirely to the global economic crisis and the slump in 2009. In fact, employment only grew in the period 2005 up to 2008 in the United States and the EU. EU ME employment development has been better than for manufacturing overall, despite the fact that ME was hit harder by the crisis than most other EU-industries.

The Chinese ME has enjoyed breath-taking growth over the past decade. By 2010 total output had reached 480.6 billion euros. As measured by the value added, the Chinese ME had already overtaken the EU in 2010, amounting to 102.2 percent of the EU's output level. Between 2000 and 2010 the workforce grew by an annual average rate of 5.8 percent by up to 6.1 million employees, which is more than double the EU figure.

Poor performance in price competitiveness is a burden

The EU ME-industry faces a major productivity challenge

An investigation into the performance of the major competing economies in ME revealed major differences in performance (labour productivity defined as value added per employee), which can be taken as an indication for price competitiveness. Japan is in the lead in terms of labour productivity, closely followed by the United States. Third in this ranking is the EU27, but at a much lower level. This could be caused by heterogeneity within the EU, which includes member states with substandard economic performance. However, intra-EU regional differentiation discloses that none of the member states comes close to the United States or Japan. For the EU countries under investigation, Germany shows the highest labour productivity at a level of around 70,000 euros, still over 20 percent below the US ME's labour productivity (Table 2).

Like labour productivity, wages vary among competing economies. The US ME is in the lead, with wages per employee that are around 20 percent above the EU average. Despite its much higher labour productivity, Japan's wages are close to those of the EU. China lags far behind, with wages of 11 percent of the EU average.

The economic performance and profitability of the ME industries under investigation was assessed using the gross-operating rate (GOR) and unit-labour costs (ULC). The EU is lagging behind its competitors in terms of the GOR – the share of value added that remains to pay for other input factors and profits once labour costs have been deduced. The GORs for the United States and Japan exceed those of the EU by 45 percent and 72 percent respectively. The Chinese GOR is more than double as high. For the ULC the picture is quite similar.

The major reason for the EU ME's poor performance in indicators for price competitiveness lies in its high wages compared to its low labour productivity. This result is widely-known and not limited to ME. For many years it has raised concerns and led to initiatives taken by the European Commission, as well as national governments, aimed at catching up with the United States in terms of productivity.

Resilience during the crisis has improved the EU's ME relative position

The analysis of its economic performance has disclosed that the EU ME's labour productivity grew more strongly over the period under investigation than that of the United States, while Japanese labour productivity declined. For the whole period under investigation, EU ME's labour productivity grew at an average yearly rate of 1.5 percent, whereas the United States reached just 0.8 percent. The EU lead stems from a less dramatic breakdown during the global crisis in 2009. For the period 2000 and 2008 the United States was leading development at an annual

Table 3

Changes in the mechanical engineering industry's price competitiveness

Sector	Indicator	2010[1]		Annual average change rate in %		
				2000–05	2005–08	2008–10
EU27						
Labour productivity	Value added per capita[2]	€	54,290	2.6	4.1	– 4.7
Labour costs	Per employee	€	33,243	3.1	3.7	1.9
Gross operating rate[3]	Share of value added	%	38.8%	– 0.6	0.5	– 8.6
Unit-labour costs[4]	Labour costs per output unit	€ / €	0.61	0.5	– 0.5	6.9
USA						
Labour productivity	Value added per capita[2]	€	91,125	5.5	0.3	– 9.3
Labour costs	Per employee	€	39,815	3.7	1.8	– 8.5
Gross operating rate[3]	Share of value added	%	56.3%	1.4	0.1	0.6
Unit-labour costs[4]	Labour costs per output unit	€ / €	0.44	– 1.7	1.5	0.9
Japan						
Labour productivity	Value added per capita[2]	€	96,700	1.7	1.6	– 6.0
Labour costs	Per employee	€	32,420	0.5	– 2.4	– 3.0
Gross operating rate[3]	Share of value added	%	66.5%	0.1	2.1	– 1.5
Unit-labour costs[4]	Labour costs per output unit	€ / €	0.34	– 1.2	– 3.9	3.1
China						
Labour productivity	Value added per capita[2]	€	26,399	10.2	19.0	9.2
Labour costs	Per employee	€	3,700	16.1	17.6	11.6
Gross operating rate[3]	Share of value added	%	86.0%	– 0.7	0.2	– 0.4
Unit-labour costs[4]	Labour costs per output unit	€ / €	0.14	5.3	– 1.2	2.3

[1] 2010 prices and exchange rates; [2] At constant prices; [3] (Value added – wages)/value added; [4] Value added at constant prices per 1 € labour costs.

Sources: Eurostat; National Statistical Offices; Cambridge Econometrics; Ifo Institute.

rate of 3.5 percent, whereas the EU ME's labour productivity increased by 3.2 percent yearly (Table 3).

Rising labour costs put EU ME's gross operating rates under pressure

Nevertheless, wages in the EU ME grew between 2000 and 2010 at an annual rate of 3.0 percent, a much higher rate than that of the US ME at 0.6 percent. The gap was caused by different labour market regimes and collective wage contract agreements. Until 2008, wage increases in both regions followed a similar pace. During the crisis, US wages per capita fell, whereas EU wages did not stop growing. The EU ME's price competitiveness worsened dramatically and did not fully recover until mid-2011, while Japan's price competitiveness was improved only by shrinking wages per capita. Rigid labour market regulation is considered a threat to industries in a volatile market environment such as ME.

New member states will face growing competition from China

Chinese ME's labour productivity grew in the period 2000–2010 at an average rate of over 10 percent per annum, reaching around half of the EU27's level. Current Chinese labour productivity levels are comparable to those in Poland, the Czech Republic and Slovakia, whereas labour costs in these new member states are much higher. This gives Chinese enterprises an edge and challenges these (new) member states that

are more focused on production than on R&D, design and marketing. They will therefore experience growing competition from China.

Impressive performance in international trade

EU ME exports amount to 15 percent of all exports from manufactured goods

As already mentioned, EU ME contributes to a noteworthy surplus in foreign trade, thereby reducing the large deficit in trade with all other manufactured goods. The extra-EU exports of ME amounted to 200.4 billion euros in 2010. This accounts for around 15 percent of total manufactured goods, a much higher share than ME's weight of total manufacturing's output. This underscores the EU ME's strong dependency on global markets. The EU ME's exports grew at an annual average rate of 5.8 percent between 2000 and 2010, whereas the exports of non-ME goods only increased at a rate of 5.2 percent.

US and Japanese shares in global trade have fallen drastically

The EU's share in global trade with ME products amounted to 37.2 percent in 2010, corresponding to 539.0 billion euros, which was roughly 3 percent above its share in 2000. Compared with major competing economies, the EU ME has performed very well. This development contrasts with the performance of the United States and Japan, which both lost global trade shares. The US share fell from 25.6 to 17.4 percent and the Japanese share fell from 21.3 percent to 15.6 percent. Over the period under investigation China was the outstanding winner. Its share in global trade was only 3 percent in 2000, but had soared to 13.0 percent by 2010. The comparison of the EU with its most important competing nations underscores the strength of its ME enterprises – well-established suppliers in the global market – that have successfully expanded their trade shares despite the fact that emerging competitors have tapped into the market.

Developed industrial nations can keep up comparative advantage in ME

Although the United States and Japan have lost shares in global trade with ME products, ME has remained of outstanding importance in limiting the EU's deficit in foreign trade with non-ME products. Analysis in foreign trade shows that both the United States and Japan command comparative advantages in ME by specializing in ME products. It is noteworthy that the United States, a country leading in ICT

Table 4

EU machinery trade with major competing economies' important sales markets

Destination	Mechanical engineering EU exports to …			Total manufacturing EU exports to …		
	bn €	Share[1)]	Performance[2)]	bn €	Share[1)]	Performance[2)]
Major competing economies						
USA	27.3	34.2	+	240.3	16.8	–
Japan	4.2	22.0	+	43.8	8.5	–
China	28.0	37.2	+	75.3	10.9	=
Major sales markets						
MENA	17.7	69.2	–	111.9	43.2	–
Russia	14.1	92.7	=	86.3	53.7	=
Turkey	8.1	76.6	+	61.1	43.8	–
South Korea	7.6	41.5	+	27.9	10.3	=
India	7.0	57.3	–	34.8	12.9	–
Brazil	6.9	50.0	+	31.1	22.9	–
Taiwan	4.2	37.4	+	14.7	19.0	+
Australia	4.2	31.9	=	26.7	19.3	=
Canada	3.7	15.2	+	26.5	9.1	=
Mexico	3.6	20.0	+	21.4	9.6	=
Indonesia	1.6	15.0	–	6.4	6.2	–

[1)] Of the destination country's imports in %. [2)] For the period 2000 to 2010 the EU's import share was growing (+), about stable (=), declining (–).

Sources: Eurostat; National Statistical Offices; Cambridge Econometrics; Ifo Institute.

technologies, boasts comparative advantages in related ME products. By the same token, Japan, a leading economy in both ICT technology and the automotive industry, also shows comparative advantages in such ME products. This finding supports the assumption that ME is an industry with comparative advantages for developed industrial nations, even in the era of globalization. Indeed, the strong international performance of ME enterprises has turned out to be an asset for the EU in the globalized economy.

At the cutting edge of technology

EU ahead of US and Japan in terms of research intensity

ME is one of the core EU industries, not only in terms of its size, but also in terms of its performance in international technological competition. The 'innovation intensity', as measured by innovation expenditure as a share of total sales, shows the EU ME's strong position compared with major competing economies in two respects: the EU ME's innovation intensity is higher than that of its US and Japanese competitors. Moreover, the EU ME's innovation intensity is higher than the average value for of all EU industries. For Japan and the United States the comparison of ME with their national industries discloses a below average innovation intensity. This is a clear indication of the EU ME's comparative advantage in international competition and its lead in terms of R&D.

The EU ME is particularly strong in mechanical technologies and material sciences

The EU ME commands an outstanding position in international technology competition, particularly in mechanical technologies. This position is less outstanding in some advanced technologies supplied by upstream industries, above all in electronics and opto-electronic components, an area in which the EU had to struggle to catch up to the state-of-the-art technology in the United States and Japan. Although the EU has caught up, a certain dependency on deliveries remains, particularly from Japan.

In material sciences the EU is a global leader, be it in nano-technologies, carbon-fibre-reinforced polymer (CFRP) etc. In CFRP, the EU commands a strong global position. This can be attributed to know-how in different technologies and the ability of EU companies to co-operate in multidisciplinary projects. In particular, the EU strength in manufacturing technologies provided by ME, for instance by manufacturers of textile machinery, gives the EU an edge over competitors from Japan and the United States. A widespread dissemination of CFRP applications beyond aerospace will be strongly dependent on process innovation towards greater automation.

ME as an enabler for a range of other sectors

ME boosts resource efficiency across economic sectors

The supply of ME is not only of importance for all manufacturing industries, but also for agriculture, mining, construction and even the service sector. ME has been characterized as 'the enabling industry'. This means that it supplies machinery and equipment, as well as process know-how, to all its client industries, enabling them to produce their goods and services with an optimized use of input factors of an extraordinary quality. For some time policy makers placed great emphasis on resource efficiency to reduce the impact of economic activity on the environment. Resource efficiency has always been a focus of ME. Over the past decade ME companies' permanent product and process innovations contributed much to CO_2 emission avoidance by their clients investing in the latest available technology. This know-how will become an even more persuasive factor in making purchasing decisions when natural resources become even scarcer.

ME-firms become full-value suppliers

One of the long-term tendencies of ME enterprises has been their specialization in certain market segments and their focus on clients with specific needs. Simultaneously, ME firms strive for an expansion of their product programmes to become full-value suppliers, i.e. to offer all the products and services a client could ask for. This has increased the importance of system engineering and provided a broader focus on product, as well as process innovation. The integration of diverse technologies and the co-operation of technicians from different disciplines have been perceived as strengths of the EU ME. These abilities are well-suited to give EU companies an edge in view of global competition and growing price pressure.

Beyond system engineering, a range of pre- and after-sales-services are offered by ME enterprises. Most of these services are technical, closely related to physical

products delivered to clients. Other services offered to clients go far beyond the technological competency of ME firms, such as the financing of clients' purchases, the operation of plants and production sites for clients, contracting etc. These services create new business opportunities for ME firms. Even though these services do not present a noteworthy share of total supply in some ME market segments, they have been offered successfully and have become relevant for the design of new business models. On average, for total ME, the share of services lies between 10 percent and 15 percent. Surveys carried out by industry stakeholders show that services have been growing stronger than the output of physical products.

This development into full-value providers has certain implications for the performance of the EU ME. Firstly, the comparative advantages of the EU ME with its qualified staff experienced in cross-disciplinary cooperation and its knowledge of process technology is a unique feature that differentiates the EU ME's supply from that of competing emerging economies. Secondly, these services present additional value added and create new workplaces for highly qualified staff. These services are well-suited to compensate to a certain extent for relocation-driven losses of low-value added production. Thirdly, even totally new business areas can be accessed such as Build-Own-Transfer (BOT) and contracting. Fourthly, these new business areas are less dependent on highly volatile investment cycles, therefore reducing the cyclicality of ME's business activity.

Structural changes and value chains

Strong ties with upstream and downstream industries have both pros and cons

ME is not only characterized by an intra-industrial, but also by an inter-industrial division of labour. Upstream linkages to metal industries, electrical engineering, the electronics industry etc. call for a good industrial infrastructure as a prerequisite for a competitive ME. It is a less 'mobile' industry than, for instance ICT, with its longstanding tradition of global production networks for the exploitation of low-wage supply. ME has always exploited the advantages of the broad industrial infrastructure in Europe. This has not changed even though global networks have been created to build on comparative advantages in other regions and to improve access to remote markets.

Likewise, downstream linkages are also important to the competitiveness of ME. Close ties to client industries and their specific needs have help to turn the EU ME into a global leader in manufacturing technologies. However, loss of capacity, such as in the production of textiles and clothes in Europe, has also led to a loss in related global dominance and technology and production for the ME manufacturers concerned.

Since the late 1980s ME has evolved from less integrated national industries towards a pan-European ME industry. The transition and economic integration of the new member states economies has largely been concluded. However, the integration of the EU ME and its cohesion has been challenged by volatile macroeconomic developments in certain (southern) member states over the past decade. The financial and subsequent public finance crises have brought the problems to light. The ME industries of the member states concerned have suffered losses of competitiveness.

EU ME industry has undergone consolidation

ME is an industry characterised by smaller family owned companies that typically have between 500 and 2,000 employees. Most of them do not fall under the EU definition of a SME (up to 200 employees). Recent decades have seen consolidation in the EU ME. Companies have merged or been taken over by others. Medium-sized groups have been created that exist alongside the typical medium-sized, family held and independent companies. These groups' advantages lie in the combination of smaller firms' flexibility with larger firms' potential to access global sales markets and to carry out larger research projects. Moreover, they can allocate the necessary resources to shoulder the increasing administrative burden created by requests from clients and growing regulation. This development has strengthened the competitiveness of the EU ME in an era of globalization and larger markets.

The free circulation of products in the EU single market has tightened competitive pressure on smaller manufacturing firms that specialize in niche markets. Market shares are being taken over by larger competitors that try to fully exploit their growth potential within the EU. In some of these market segments the very small industrial enterprises will have to put their business models to the test and decide if they can continue to run their own manufacturing facilities. Better

opportunities could be provided in the handicraft market, where services such as the installation, maintenance and repair of machinery require regional proximity to clients, as for instance in the market for heating, ventilation and air conditioning.

The value chains within the EU ME have been adjusted to reflect the opportunities provided by globalization. Suppliers within a value chain feel growing competition in bidding processes from non-EU competitors. A growing number of clients are asking for a price/performance-ratio based on international tender procedures. If suppliers cannot meet these requirements, they have to relocate or to quit their role in a value chain. There are examples of clients supporting their suppliers' decision to relocate or following suit to overseas locations. Such initiatives can be of mutual interest and strengthen the EU ME.

In some areas, there is a trend towards client companies focusing their business activities on system integration. This provides opportunities for suppliers to become subsystem manufacturers and integrators. Companies that can allocate the necessary technological and financial resources will benefit from this development if they can build on sufficient management know-how. These companies are less exposed to international price competition than those with a lack of resources.

Asian production sites can help the EU ME industry to remain competitive

Asia has become an important region for the EU ME. Production locations owned by EU firms and Asian manufacturers have become an integral part of the EU ME value chain. Asian deliveries primarily consist of large batch, medium-tech products, whereas in Europe small batch production and customization as a share of total output is growing. This division of labour between Asia and Europe provides European manufacturers with opportunities to remain price competitive in medium-tech serial production. They do not leave market segments that – not by margins – but by volume are of crucial strategic importance and could otherwise be used as a gateway by emerging competitors. Competitors from low-wage countries could more easily enter machinery markets and cause cut-throat competition by permanent upgrading. EU ME firms use locations in low-wage countries outside the EU to control the lower end of their product programme abroad and in the domestic market.

The on-going structural change of the EU ME in the face of increasing globalization is driven by specialization in comparative advantages. Workplaces have been lost in low-value added areas and new opportunities have been created for more qualified labour. All in all, the competitiveness of the EU ME compared to the United States and Japan can be evaluated as strong with regard to the employment record and performance in international trade. However, losses in low-wage labour have not been fully compensated for by new opportunities. In particular, production locations in the new member states are endangered by competition from Asia. The comparatively rigid labour markets and collective wage agreement systems could contribute to a less dynamic structural adjustment of the EU ME to global needs.

Prospects are bright

Economic growth potential

The ME's future growth potential is assessed on the basis of projections for the EU27, the United States, Japan and the BRIC countries by the IMF's World Economic Outlook for the medium-term and by Goldman Sachs for the long-term. The growth momentum of the BRIC countries, above all China, will cause a shift of economic activity away from Europe to Asia.

Total production by the ME of the seven analysed countries and the EU27 will grow from 527 billion euros in 2010 to 928 billion euros in 2025, equalling an annual average rate of 3.8 percent. Although all individual countries and the EU27 look able to grow, China will clearly dominate the world output of mechanical engineering products by 2025.

However, this growth scenario derives the development of the ME sector only from domestic GDP development, and does not consider the special importance of trade for this sector. For the EU27, around 40 percent of growth in ME can be accounted for by trade-induced demand. Therefore a second 'trade-adjusted' scenario is derived whereby 60 percent of the growth is generated domestically, whereas the remainder is generated by increased demand in the world market. Using this second scenario, the EU27 would be able to achieve a market size of 232 billion euros by 2025, compared to the predicted market size of 204.7 billion euros stemming from the base scenario.

Table 5
Expected development of mechanical engineering output by selected countries (trade-adjusted scenario)

	Value added in bn €[1)]					
	2000	2005	2010	2015[1)]	2020[3)]	2025[3)]
Brazil	11.0	13.2	14.2	18.8	22.6	27.2
China	28.2	58.4	161.4	248.0	329.4	410.1
India	6.3	8.4	12.8	19.3	26.0	34.4
Japan	89.7	96.2	66.2	75.4	81.0	86.3
Russia	9.8	10.8	12.1	14.9	17.6	20.8
USA	123.7	124.5	103.0	115.5	129.7	144.9
EU27	158.0	160.8	157.5	178.3	193.2	204.7
EU27 with trade				183.5	208.4	232.0

[1)] 2010 prices and exchange rates. [2)] Based on GDP forecasts from IMF. [3)] Based on GDP forecasts from Goldman Sachs.

Source: Own calculations.

In the long run, growth rates in other BRIC countries may well exceed those of China

When looking at expected growth rates, a more diverse picture emerges. Although China is clearly leading in terms of growth rates from 2000-2015, those of other BRIC countries will reach similar, or even higher levels in the period thereafter. Japan, the United States and the EU27 are expected to have significantly lower growth rates throughout the whole period of analysis. Growth rates for the EU27 differ between the baseline scenario and the scenario including trade by around 1 percent.

Productivity development

The long-term trend in productivity development – a prerequisite for longer-term competitiveness – suggests a stable growth rate. Current developments fall into line with the long-term trend from 1995 to 2008. Average annual growth rates in productivity are 2.0 percent and 3.5 percent for manufacturing and ME respectively. As these growth rates were very stable for over a decade in the pre-crisis period, it is assumed that productivity will continue to grow at these growth rates after the recovery from the crisis.

Using these growth rates, EU27 productivity can be expected to grow significantly throughout the forecast period until 2020. Labour productivity in mechanical engineering is expected to reach 67,400 euros in 2015, up from 54,300 euros in 2010. By 2020 EU27 labour productivity has the potential to increase to 79,900 euros.[3]

[3] All productivity measures are reported in constant 2010 euro per employee.

Table 6
Projected growth rates in mechanical engineering (trade-adjusted scenario)

	Annual average growth rate in %				
	2000–05	2005–10	2010–15[1)]	2015–20[1,2)]	2020–25[2)]
Brazil	3.8	1.4	5.8	3.8	3.7
China	15.7	22.5	9.0	5.8	4.5
India	6.0	8.7	8.7	6.1	5.7
Japan	1.4	– 7.2	2.6	1.4	1.3
Russia	1.9	2.2	4.3	3.4	3.4
USA	0.1	– 3.7	2.3	2.4	2.2
EU27	0.3	– 0.4	2.5	1.6	1.2
EU27 with trade			3.1	2.6	2.2

[1)] Based on GDP forecasts from IMF. [2)] Based on GDP forecasts from Goldman Sachs.

Source: Own calculations.

Employment implications

Having formed expectations about growth of the ME sector and about developments in labour productivity, it is possible through triangulation to form expectations about development in employment. Such projections are made by multiplying existing employment with growth projections of gross value added (GVA) and dividing by growth projections of productivity. As expected, GVA growth rates in the EU27 manufacturing sector are consistently below the expected increase in productivity, and declining employment is expected. Projected ME employment is expected to shrink to 2.8 million employees in 2015 and to 2.5 million employees in 2020, which represents a significant decline compared to the 2.9 million employees in 2010. Using the more optimistic EU27 growth scenario that includes trade-induced growth as a basis for calculations, reductions in employment level would be more moderate: by 2015 employment would be 2.9 million and in 2020 2.7 million people would be employed in mechanical engineering.

Success in global markets is needed to secure jobs ...

Although the mechanical engineering sector is expected to achieve consistent absolute growth in the following years, this growth is probably not strong enough to more than compensate for growth in labour productivity, leading to a net loss in employment. The evolution of EU ME must be valued against a background of expectations that domestic demand will be dampened for several years by urgent measures to overcome the public debt and private banking crisis. Without success in global markets and stimulation by growth in emerging economies, the ME's perspectives would be worse.

... and success primarily means further penetration in emerging markets

Both of these development paths highlight the importance of ME's global alignment. Strong growth can only be generated if EU companies are successful in emerging economies' markets. These countries do not only provide opportunities for growth, but also for the exploitation of scale effects, a decisive factor for companies' long-term competitiveness. The EU ME's success in foreign markets over the past decade was impressive and underscores that companies do have the products needed for the industrialization of emerging economies. They are at the cutting edge of technology and have always been market leaders in the supply of resource efficient processes. In this respect, the EU ME is not only an enabling industry in the domestic market, but also in global markets. Its success in the latter markets will be decisive and will require a strong focus on third countries' needs in products systems and services. In the trade-adjusted scenario, the prospects for the EU ME are better than for total EU27 GDP. The growth momentum for the period under consideration is higher. However, due to the wealth created by significant increases in labour productivity, some losses in the labour market cannot be avoided.