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# The Importance of Sales Engineers in Germany, Europe and the United States

submitted by

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Verena Cassandra Koch

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## Supplementary Notes

All figures have been rounded.

Investigation period mainly relate to the year 2014, with exception of input rates and some manufacturing shares of the GDP. They differ from 2000 to 2013.

The term GDP (Gross Domestic Product) defines the real GDP in this thesis. The real GDP stands for the GDP at constant prices to compare countries and their profitability without price fluctuations. It is also known as GDP at market prices.

## List of Abbreviations

| | |
|---|---|
| AASE | Academic Association of Sales Engineering |
| AT | Austria |
| CEFIC | The European Chemical Industry Council |
| CIA | Chemical Industries Association |
| DE | Germany |
| FMMI | Fachverband Maschinen und Metallwaren Industrie |
| FR | France |
| GDP | Gross Domestic Product |
| ICCA | International Council of Chemical Associations |
| ifo Schnelldienst | Information und Forschung Schnelldienst |
| IT | Italy |
| SEs | Sales Engineers |
| UK | United Kingdom |
| VCI | Verband der deutschen Industrie |
| VDMA | Verband Deutscher Maschinen- und Anlagenbau |
| ZVEI | Zentralverband der deutschen Elektro- und Elektronikindustrie |

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# 1 Introduction

> *"If there is any one secret of success, it lies in the ability to get the other person's point of view and see things from that person's angle as well as from your own." – Henry Ford*

The enclosed quotation of Henry Ford [1], American industrialist and innovator (1863-1947) [2], reflects the comprehensive thinking of sales engineers. Thereby they act as a link between company and customer, they generate the optimum solution for the client under the best achievable technical and economic conditions. It follows that sales engineers pursue the objectives of their customers and also of their company.

This characteristic makes sales engineers unique in the industry and the reason why they are important for the economy of a country is constituted in this bachelor thesis. Global economic powers are analyzed to compare the different dimensions of sales engineers in the respective country. The results underscore the significance to promote this kind of profession. So far, it did not seem relevant at social and political level to support researches on technical sales, because the training was seen as central task of companies. The reason lies in the history of the technical sales: for a long time, there was no university education for sales engineers in Germany [3]. The first study of course was established 30 years ago [4]. It follows that companies had to undertake this function. However, enterprises only focus on professional development than on research, because they are practical-based. Consequently, the training as a sales engineer is still expandable, increasing the professionalization of the technical sales in companies.

This contributes to pursuing the goal to show the current significance of sales engineers and that their potentials are continuously improvable by an intensive analysis of further sales knowledge. Another objective is to show the importance with the help of the correlation between sales engineers and the industry. The reason is that they are decisive in selling technical products to their clients and this means that sales engineers are able to be constituted arithmetically in form of their reached turnover. Hence, the aim is to calculate the turnover of sales engineers in each selected country worldwide to present plastically their significant role. This leads to the usage of measurable numerical variables to describe the

interdependency between sales engineers, industry and economy of a country. Ergo, mainly quantitative studies are used as a method to investigate the dimensions of sales engineers in the economy. Especially, statistics and data support the calculations in a transparent manner.

Furthermore, the importance of sales engineers is expanded to an international level to compare the global economic powers like Germany and the USA to each other in regard to industrial, economic and sales-oriented differences.

## 2 Description of a Sales Engineer

"Sales engineers (SEs) sell technical products to [industrial] companies. […] They propose technical and economic realizable solutions, which give the customer and the own company the maximum benefit." [5][1] The quotation of Ludger Schneider-Störmann shows the special feature of sales engineering. It combines the thinking of a perfect technical arrangement with a target-oriented economic functioning [6]. This means that the essence of the general engineering and business administration is integrated to the sales engineering with an additional communicative-psychological thinking.

The technical knowledge is decisive for sales engineers to understand the company's complex products to establish an individual product structure for specific clients' requirements. This means that "[...] in most cases the product cannot be taken from shelf, but is adapted to the needs of the customer. In order to keep the cost of the products low, possible technical solutions need to be evaluated against cost. This is the reason for the required strong technical background of sales engineers – they have to find out the needs of the customer and propose solutions, which are functional and cost effective. […]" [7]

According to the quotation of Henry Ford in the introduction, "[s]ales engineers have basically two activity fields in their work. The first of course is the work with the customers as described above. The second is inside the own company. Sales engineers have to orient the own company to develop solutions. Often new solutions need new production equipment. If Sales Engineers jump from application to application, the company will have high investment cost. It is largely preferable that Sales Engineers explore new applications and evaluate them how beneficial they may be and then concentrate upon contacting as many customers for this application as possible. This concentration will result in a higher probability of sales success and reduced cost of operations, thus boosting the profits of the company. " [7]

It follows those sales engineers also need to improve the company's structure to make the sales process more efficient and profitable, because one of their major aims is to sell successfully technical products. Ergo, their turnover plays normally a great role, representing a measurable unit to show the success of a sales

[1] Author's translation from the German

engineer, because each of them is responsible for his own achieved turnover of every period. Consequently, the turnover is generally decisive for the company to generate profit, to be competitive and to be able to show their success to public.

# 3 The Correlation between Sales Engineers and Industry

In order to show the importance of sales engineers in various countries in the world, their turnovers are calculated to utilize them as a measuring unit. The sales engineers' turnover describes the connection with industry and economy. Sales engineers act in industrial branches and sell technical products, which are added to end-products by the value added chain. This means that these industrial products form the basis for implementation in further products of several technical and economic branches and services, because sales engineers sell their products across different sectors. Consequently, sales engineers contribute to the gross value added. "Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs." [8] Inputs in form of technical products need to be subtracted to avoid double counting, because the input is already contained in production value of end-products. The production value describes the profit of the total output. It is defined as:

"Net production value = economic turnover + changes in inventories of own products and self-created assets" [9][2]

It is included in the calculation of the GDP (Gross Domestic Product) that table 3-1 contains:

| Production Value | |
|---|---|
| - | Inputs |
| = | Value added |
| + | Taxes less subsidies |
| = | GDP |

**TABLE 3-1: GDP CALCULATION**

(Source: Own Illustration, Destatis [10])

The GDP is a measurement for economic performance that quantifies all homemade produced goods and services [10]. It follows that sales engineers contribute to the GDP by their integrated sold products as well. For this reason, the Gross Domestic Product is utilized as arithmetic unit in form of the turnover of industrial sectors to use it as starting point for the sales engineers' turnover calculation to reckon backwards from end-product sale to technical product sale.

[2] Author's translation from the German

To focus on the most relevant factors, the four largest industry sectors with the highest turnovers and most represented sales engineers are integrated into the calculation. Among them are automotive, mechanical, electrical and electronic and chemical industries.

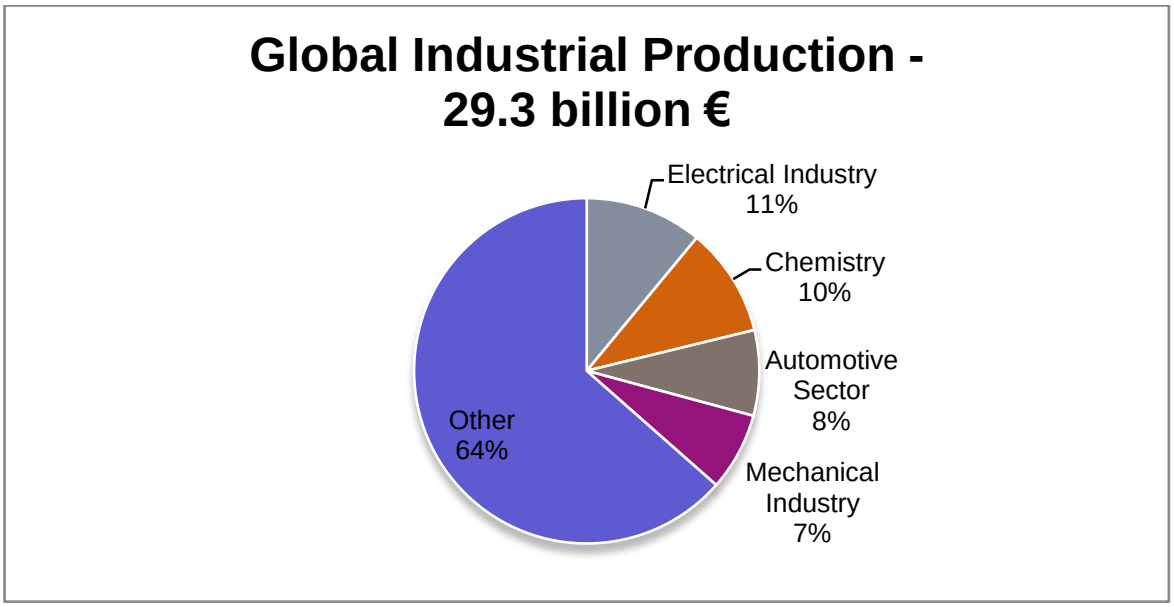



**FIGURE 3-1: INDUSTRIAL PRODUCTION WORLDWIDE 2010**

(Source: Own illustration, ZVEI [11])

Figure 3-1 gives information about the global industry shares and the most important sectors. The electrical industry forms the largest sector of the global production share, with nearly one quarter. The chemical sector comes second, with 10% of the global output. This is followed by the automotive sector, with 8%, and finally mechanical engineering on the fourth position. Moreover, the global ranking of these four sectors have not changed in the last ten years [11]. Consequently, these four industries are used to reflect the GDP in different categories to show differences between sectors and countries in relation to sales engineers.

# 4 The Importance of Sales Engineers in Germany

The first objective is to prove the high importance of sales engineers in Germany with the help of statistics and data. As mentioned before, the aim is to calculate their achieved turnover to use it as a measurement for their importance.

## 4.1 Economic data of Germany

Germany possesses a high technology performance, high-qualified specialist and a high international activity [12]. The combination of these strong facts serves as basis for the economic power of Germany. It reaches the highest GDP in Europe as shown in the following table.

| **Data sheet: Germany (2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 1st position |
| **Ranking of GDP worldwide** | 4th position |
| **GDP** | 2915 billion € |
| **Export total** | 1135 billion € |
| **Import total** | 915 billion € |
| **Balance of Trade** | 220 billion € |

**TABLE 4-1: GERMANY'S PROFILE**

(Source: Own illustration, Statista [13], Statis. Bundesamt [14], Eurostat [15]/ [16])

Referring to table 4-1, the GDP amounted to 2915 billion € in the year 2014. Germany is the most profitable country in comparison to other countries in Europe. Furthermore, the industry is an important part for the German profitability; the share of manufacturing industries represented 22.3 % of the gross value added. In comparison to other EU countries, the average of industrial share was 15.3 % in 2014 [17]. The German industry possesses nearly one quarter of the value added and reflects its influence in form of the most profitable branches like automotive and mechanical sector.

Moreover, Germany shows its export power by the total export valued at 1135 billion €. Ergo, around 40% of the GDP is gained in foreign countries. It

follows that Germany's profitability is connected to its high competitive position in international trade as well [18].

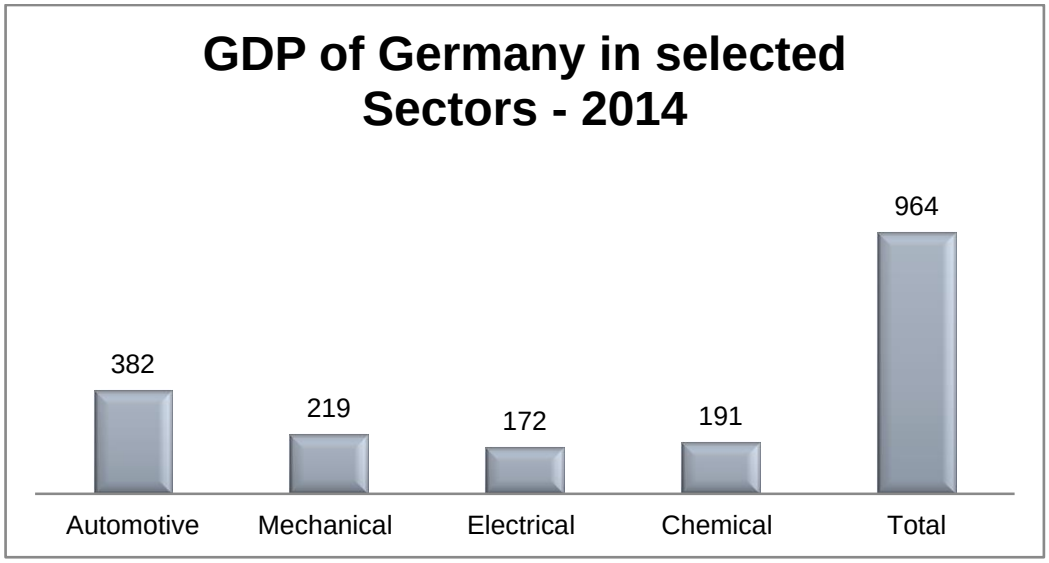



**FIGURE 4-1: TURNOVERS OF THE FOUR LARGEST INDUSTRIAL BRANCHES IN BILLION €, GERMANY**

(Source: Own illustration, Statista [19]/ [20]/ [21], VCI [22])

Figure 4-1 shows the GDP, categorized in turnovers of the four largest sectors, where technical products are used as input factor. It represents the automotive sector as the largest industry of Germany by turnover of 382 billion €, being nearly twice as high as mechanical engineering. Furthermore, it is the greatest automotive market of Europe [23]. Mechanical sector represents the second position with 219 billion € turnover. On third place is the chemical industry valued at 191 billion € and on the last position the electrical sector with 172 billion € turnover. Furthermore, Germany corresponds to the biggest chemistry nations in the world, measured by the share of the global turnover of chemicals and comes in third place, after the USA [22].

In total, the branches reached about 964 billion € in the year 2014. This is around one-third of the German GDP and shows thereby the importance of these four industry sectors.

## 4.2 Sales Engineers' Turnover

The sales engineers' turnover represents the turnover of technical products in the B2B sector. So often, these industrial goods are represented as input factors, which are part of the value added. This correlation of input products and value added forms the industry term [24]. Consequently, the input belongs to the most important factors in the industry. By its function as an integral part for products of various industrial and economic branches and services, the sale of inputs generates synergy effects. This means that sales engineers strengthen the importance of industrial products for the GDP by selling technical products across several sectors. In other words, the industry value works as "hub function" [24]; it can regulate the distribution and the production of required products and transfer them to different sectors. Particularly, specific manufacturing branches purchase high amounts of intermediate inputs to use them for their own production and are described as "Organizers of the industrial value added chain" [12]. This includes automotive, mechanical and chemical industry. These branches represent the hub function. They supply their products across all industries and are specialized in end products [12]. It follows that they are highly integrated in value added chains by sales of sales engineers and present an important role for the GDP with the help of their great share of end consumer markets.

Calculation procedure:

The connection between technical products and inputs is utilized to create an analog formula for the sales engineers' turnover calculation. To calculate the sales engineers' turnover, the turnover of technical products is necessary. However, only the total turnover of each industry branch is given and the aim is to calculate the share of the technical products, which are sold to B2B clients.

Consequently, the input rate was used as reference value, because it describes the share of input products on end-products, which are contained in the production value. In other words, it would present "the value added depth" and "its share of intermediate inputs on the turnover" [25].

**EQUATION 1: INPUT RATE**

$$input\ rate = \frac{input}{production\ value(output)} * 100$$

(Source: Own illustration, DIW Berlin [26])

The input rate describes the percentage of input products, which the production value contains after further processing. With the help of this rate, the share of input to output products is transferred analog to the share of turnover of technical products to turnover of end-products.

It follows:

**EQUATION 2: SALES ENGINEERS' TURNOVER FORMULA**

$$\boldsymbol{sales\ engineers' turnover\ rate} = \frac{\boldsymbol{turnover\ of\ technical\ products}}{\boldsymbol{total\ turnover}}$$

$$= \frac{turnover\ of\ sales\ engineers}{total\ turnover}$$

$$\boldsymbol{turnover\ of\ sales\ engineers} = \boldsymbol{SEs' turnover\ rate} * \boldsymbol{total\ turnover}$$

Ergo, the input rate formula can be transferred to the sales engineers' turnover rate to calculate their sales on the basis of the given turnovers of each industry sector and the sales engineers' rates are adapted to the given input rates of each branch.

The average input rate of German industry was 69.8 % in the year 2011 [27]. In the last 20 years, the input rate has raised continuously, which resulted from increasing interdependencies [24]. Vertical ranges of manufacture of companies will be lower and the manufacturers of input products are becoming more important [24]. This means the production and usage of technical products is becoming more relevant as well and this is why the input rate grows. Furthermore, this condition describes the high significance of sales engineers, because they are responsible for the sale of these industrial goods. Nevertheless, the input rate has moved between 60 and 69 % in the last 10 years [28], so there have not been any major changes and a current input rate is not decisive for the calculation of the sales engineers' turnover. Consequently, the average rate of 2011 can be used as a rough guide for the calculation of rates of sales engineers' turnover of each

branch. Every sector produces another type of a product which is sold to different customer groups. However, only B2B clients are in focus of sales engineers and for this reason the input rate helps to subtract the turnover of end-products. Ergo, there are different input rates for every industry sector due to various proportions of B2B and B2C clients.

| Sector | Sales Engineers' Rate (SEs' rate)[3] |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |

**TABLE 4-2: RATES OF SALES ENGINEERS' TURNOVER OF GERMAN SECTORS**

(Source: Own illustration, Ifo Schnelldienst [29], VCI [22])

The different rates, which table 4-2 contains, result from their share of the sale of technical products. This means that the lower the share of end-products for end-consumers in these sectors, the higher the rate of sales engineers. Consequently, it is not possible to accept every given input rate of the respective sector without modification, because it is important to differentiate between the types of end products. For example, the mechanical sector possesses the largest sales engineers' rate of 100 %, because of its pure B2B concentration. Machines and engines are the end products of this industry branch and are normally sold completely by sales engineers. This was the reason to choose 100 % as share, because no private consumer spending exists in this branch.

[3] Author's modification

Moreover, the chemical industry has a high share of products for B2B clients as figure 4-2 illustrates.

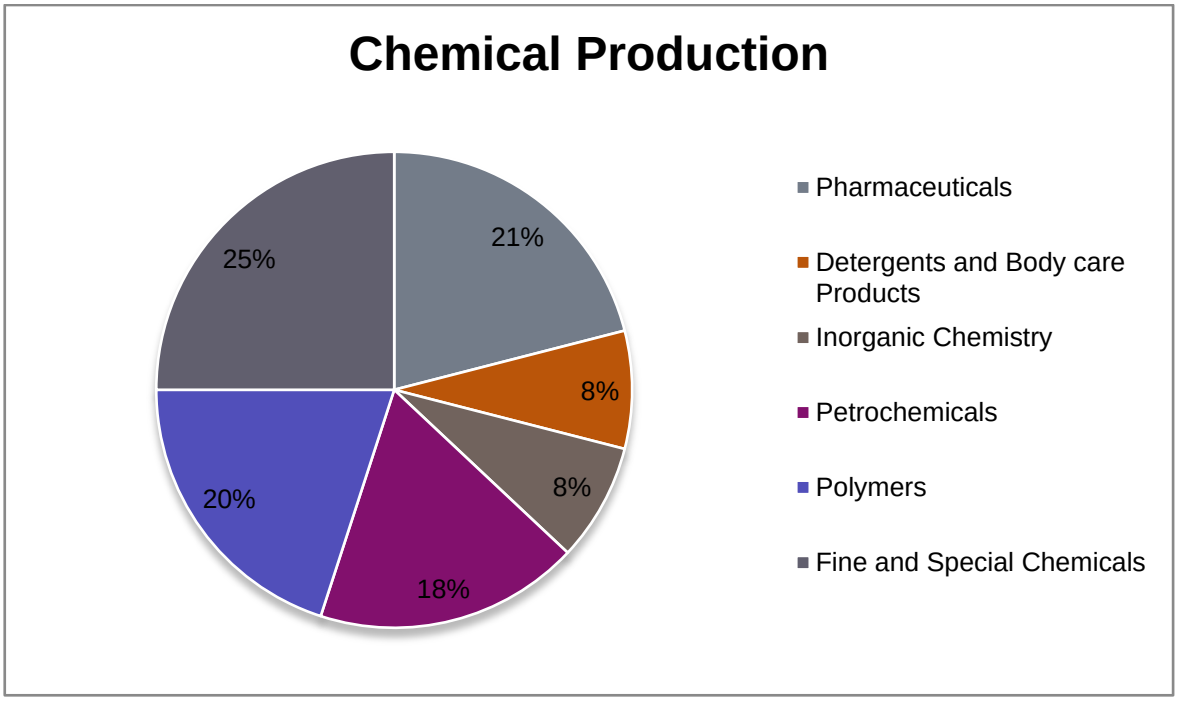



**FIGURE 4-2: SHARE OF CHEMICAL PRODUCTS, 2014**

(Source: Own illustration, VCI [22])

Most of the chemical products accord to input factors for plastic processors, automotive and packaging industry. Only around 20% [22] become end products for end consumers like detergents, body care and a share of pharmaceutical products. Consequently, the sales engineers' share amounts to 80% of the chemical industry turnover.

A lower input rate exists in electrical and electronic industry, according to figure 4-3.

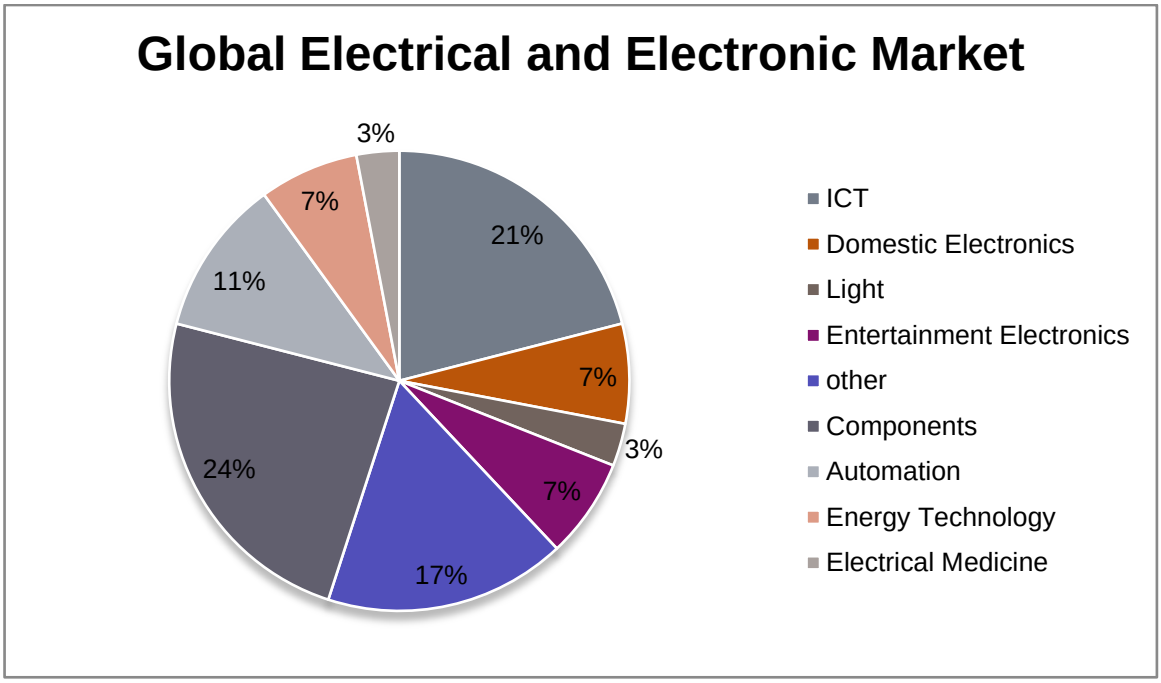



**FIGURE 4-3: PRODUCT RANGE OF ELECTRICAL AND ELECTRONIC MARKET WORLDWIDE OF 2011**

(Source: Own illustration, ZVEI [30])

Referring to the pie chart 4-3, the general electrical and electronic market has at least a technical product share of 50%; this includes electrical medicine, energy technology, automation, components, some amount of others, ICT and light. Consequently, an assumed share of sales engineers' turnover of 50% will be taken.

After creating the respective rates of sales engineers, their turnovers are calculated with the respective given total turnovers of each sector.

Formula: [4]

$$sales\ engineers'turnover = SEs'\ rate * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 382\ billion\ € \approx 229\ billion\ €$$

[4] See equation 2

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 219\ billion\ € = 219\ billion\ €$$

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 172\ billion\ € = 86\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 191\ billion\ € \approx 153\ billion\ €$$

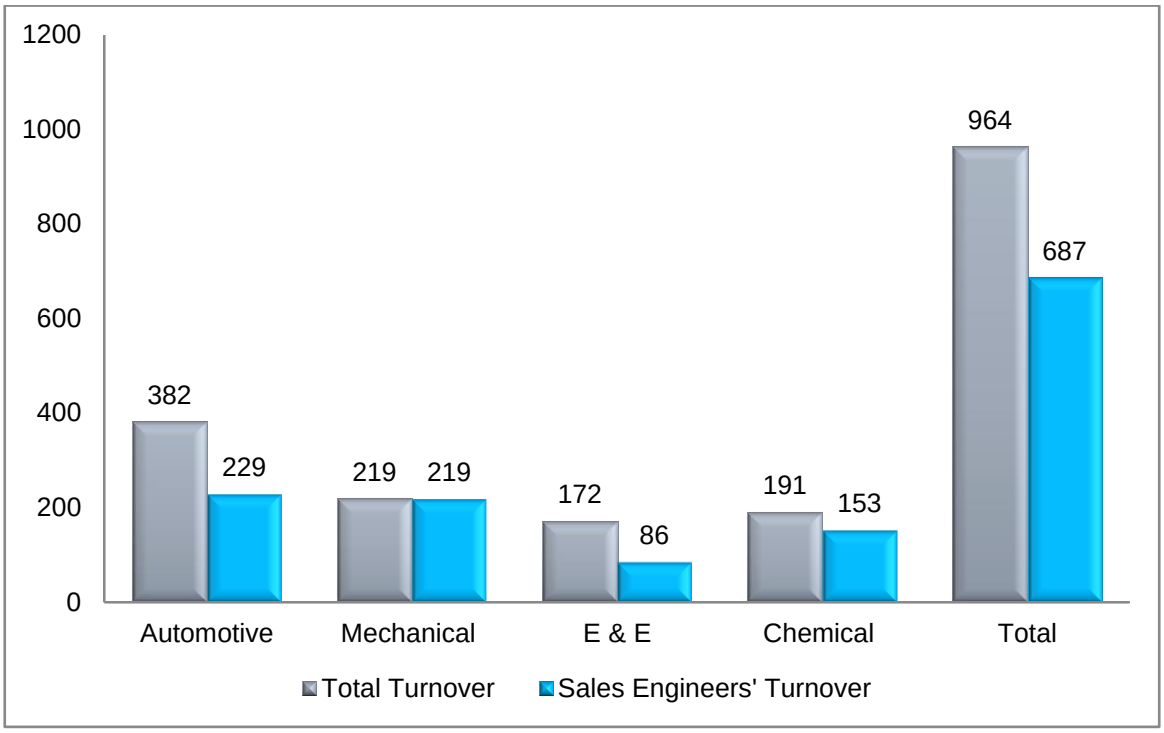



**FIGURE 4-4: COMPARISON OF SECTOR TURNOVER AND SALES ENGINEERS' TURNOVER OF 2014 IN BILLION €**

(Source: Own illustration)

The figure 4-4 shows the total turnover of the selected industry sectors and the respective share of sales engineers. This comparison demonstrates the high influence of sales engineers in the industry. More than two-third of the total turnover is provided by sales engineers due to the sale of the technical products. So, they are the basis for a successful turnover of end products, which influence the GDP.

In sum, the sales engineers' turnover counts up to 687 billion euros of the four selected sectors and forms 71% of the total turnover and 24% of the GDP.

Summed up, these four industry branches are responsible for 33% of the GDP with a turnover of 964 billion € and thereof 24% are achieved by sales engineers. Consequently, only 9% turnover in these four sectors is done by end-consumers.

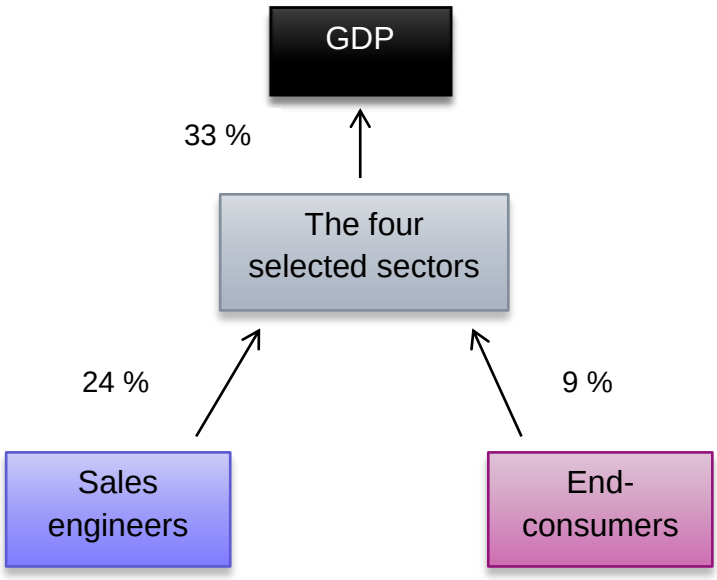



**FIGURE 4-5: CORRELATION BETWEEN SALES ENGINEERS, END CONSUMERS AND GDP**

All in all, sales engineers have a great importance in Germany by achieving turnover by technical products, which are added to the GDP with 24 %.

## 4.3 Germany's International Trade

The export rate shows how important export is for Germany's GDP [31].

**EQUATION 3: EXPORT RATE**

$$export\ rate = \frac{exports}{GDP} * 100$$

$$= \frac{1135}{2915} * 100 = 39\ \%$$

The equation shows that 39 % of the GDP is obtained by international trade with foreign customers. It reflects as well Germany's international competitive ability of manufacturing sector, because the four largest industry sectors represent a high share of the total export, which is illustrated by figure 4-6.

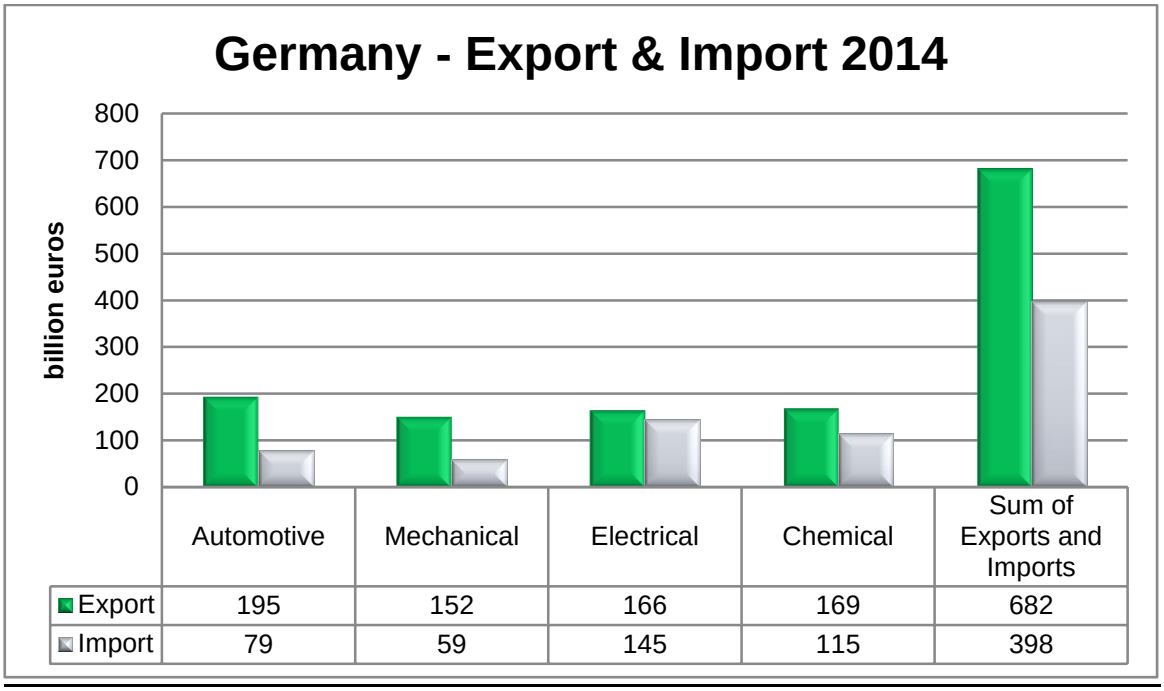



**FIGURE 4-6: GERMANY'S EXPORT AND IMPORT VALUES OF THE FOUR SECTORS IN BILLION €**

(Source: Own illustration, Statista [32], [33], [34], [35], [36])

The four sectors demonstrate a share of 60 % of the total export of Germany with 682 billion €, according to figure 4-6. Ergo, the relative largest industry branches have a strong concentration on sale abroad, whereby the GDP profits. In 2014 the biggest exporter was the automotive industry with 195 billion € and had the best balance of trade. The chemical and electrical sectors have similar export values of 169 and 166 billion €. In addition, the balance trade between the four sectors is in each case positive, showing an export surplus.

Sales Engineer's Share of Export

To calculate the foreign turnover of sales engineers, the sales engineers' rates are utilized to differentiate between sale of technical products and sale of end-products for end-consumers:

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion € |
|---|---|---|---|
| **Automotive** | 195 | 60 % | 117 |
| **Mechanical** | 152 | 100 % | 152 |
| **Electrical** | 166 | 50 % | 83 |
| **Chemical** | 169 | 80 % | 135 |
| **Total** | 682 | | 487 |

**TABLE 4-3: GERMAN SALES ENGINEERS' FOREIGN TURNOVER**

The same sales engineers' rates are assumed for international trade, according to the division of end- and technical, which are listed in the pie charts previously. Analog to the total turnover calculation of each branch in Germany, the sales engineers' foreign turnover amounts to 71 % as well with 487 billion euros. These are 43 % of the total exports in Germany. It follows that sales engineers are selling nearly half of the entire exported products to foreign customers. Their share is normally higher, if further industries are added to the calculation.

| **Sales Engineers' Foreign Turnover of the four selected sectors** | **487** |
|---|---|
| Total Export of Germany | 1124 |
| Export of remaining industry sectors | 1124 – 487 = 637 |
| SEs' share of remaining sectors (30 %) | 190 |
| **Total SEs' Foreign Turnover** | **487 + 190 = 677** |
| Relation to Total Export | 60 % |

**TABLE 4-4: EXTENDED CONSIDERATION OF SALES ENGINEERS' FOREIGN TURNOVER OF GERMANY**

The difference of the total export and the calculated sales engineers' share of the four selected sectors amounts to 637 billion €. This value presents the rest of the exported goods. 30 % of the remaining amount constitutes the share of sales engineers' foreign turnover. Normally, the sales engineers' rate is adapted to the average input rate of 69 %, but in this case it is necessary to deduct a reduction value, because of considering branches, which are not strongly sales technical oriented.

Ergo, the amount will rise from around 500 to 700 billion euros and will present 60 % of the whole exports, if further important technical export goods are included.

## 4.4 Sales Engineering Potentials in Germany

This sales engineering position within and outside the country can be improved by better educated sales engineers. The formation as sales engineer is not mature at all. Researches for sales knowledge about e.g. rhetoric, intercultural communication, leading of sales conversations and analysis about customer characteristics are very important for a professional working.

If these factors were increasingly investigated, the education of sales engineers would be improved and would lead to advancement in the whole sales process in companies.

The first potential would be cost saving. The contact task of sales engineers to acquire new and potential clients could work more efficiently, if they had necessary psychological and strategical knowledge about customer conversations and well

judgement about not potential customers to save energy and efforts of unsuccessful attempts. Furthermore, according to the previous second chapter, sales engineers could concentrate upon promising and strategic customers. This means that the company would focus only on their specialized application and sales engineers would contact the fitting potential customers. This concentration would reduce operations, investment and working costs of estimated 5 %. That means that sales engineers would be able to invest this saved time for further potential clients and to work target-oriented.

In technical sales the producing company has to build up experience for each industry sector or each application. On top the company has to get the required equipment to serve all the applications requirements. Machines, measuring equipment, automatization equipment and the related expertise have to be acquired and build up for each industry sector. Seen the large investment it becomes very expensive if the sales engineers hop from one industry sector to the next without exploiting it completely.

Ergo, it should be possible to achieve a higher turnover by better trained sales engineers. Furthermore, the education should focus on international actions as well. Foreign languages and cultural experiences are already part of the degree courses of sales engineering. This means that international business is another aspect of improvement. Business relations to foreign countries with the adaptation of different mentalities and handling of customers in foreign languages would be strengthened. Ergo, the export volume could be increased by estimated 5 % by better educated sales engineers.

It follows: $5\ \%\ of\ SEs'\ foreign\ turnover = 487\ billion\ € * 0{,}05 \approx 24\ billion\ €$

If the training was improved for sales engineering students, the turnover of exporting companies in Germany could be increased potentially by 24 billion € and operational costs could be minimized by 5 %.

## 4.5 Results of Germany

| Sales Engineers‘ Turnover | |
|---|---|
| **SEs‘ turnover of the four sectors** | 687 billion € |
| **SEs’ share of the four sectors** | 71 % |
| **SEs’ share of the GDP with the four sectors** | 24 % |

| Sales Engineers’ Turnover in Export Market | |
|---|---|
| **SEs’ foreign turnover of the four sectors** | 487 billion € |
| **SEs’ share of the Export values of the four sectors** | 71 % |
| **SEs’ share of the total Export with the four sectors** | 43 % |

**TABLE 4-5: SALES ENGINEERS’ TURNOVERS IN GERMANY**

All in all, sales engineers in Germany generate nearly three-quarter of the turnover of the four largest industry sectors worldwide. This is around one quarter of the entire GDP. Consequently, they cover a great share alone with these selected sectors. Their foreign turnover contributes a higher share to the total export value with 43 %.

# 5 The Importance of Sales Engineers in Europe

This chapter includes five more European countries. Among them are economic powers like the United Kingdom, France and Italy, which come behind Germany, measured in terms of the GDP. Additionally, Finland and Austria were included, because of their large GDP per capita and high engagement in the education of sales engineers. These two countries are members of the AASE (Academic Association of Sales Engineering), just like Germany and France [37]. This association forms a global network of academic representatives that focuses on researches, professionalization and public relations for higher education of sales engineering [37].

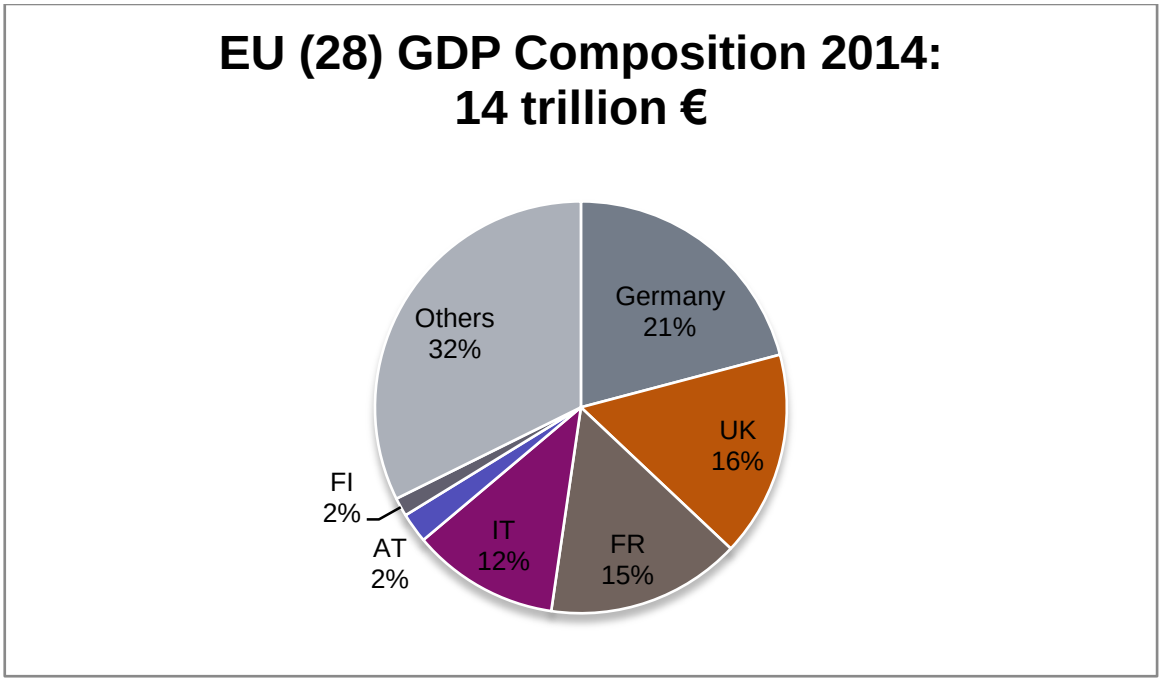



**FIGURE 5-1: GDP OF EU SEGMENTED IN SIX COUNTRIES, 2014**

(Source: Own illustration, Eurostat [15])

Referring to figure 5-1, the strongest economic powers in Europe may be identified as Germany, the United Kingdom, France and Italy. Including Finland and Austria, they account for two-third of the entire EU GDP. Their economic and industrial connection related to the importance of sales engineers is described in the following. Furthermore, differences of sales engineers' influence between Germany and other European countries are analyzed.

## 5.1 United Kingdom

### 5.1.1 Economic Data of UK

The second economic power of Europe is presented by the United Kingdom.

| **Data sheet:** United Kingdom **(2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 2nd Position |
| **Ranking of GDP worldwide** | 5th Position |
| **GDP** | 2253 billion € |
| **Export total** | 380 billion € |
| **Import total** | 520 billion € |
| **Balance of Trade** | -140 billion € |

**TABLE 5-1: UNITED KINGDOM'S PROFILE**

(Source: Own illustration, Statista [13], statistisches Bundesamt [14], Eurostat [15]/ [16])

UK has the highest GDP in Europe of 2253 billion € after Germany (23 % less), according to table 5-1. However, the main difference is demonstrated by the export value. Germany ships goods and services abroad three times more than the UK. Furthermore, the imported merchandises exceeded the exported goods in 2014. This shows UK's dependency on foreign products in relation to the GDP.

In addition, the GDP is marked by a high share of 80 % service sector [38]. This strong growth of service branch has a consequence of loss of growth of industry in the UK. The manufacturing contributes less in the UK to the profitability than in Germany. The share of manufacturing industries represented 9.4 % of the gross value added in the year 2014 [17]**.** It follows that industrial sectors of UK have a below-average input in comparison to other EU countries (15 %). The amount of the turnovers of the four selected industrial branches can confirm these circumstances in the UK (see figure 5-2).

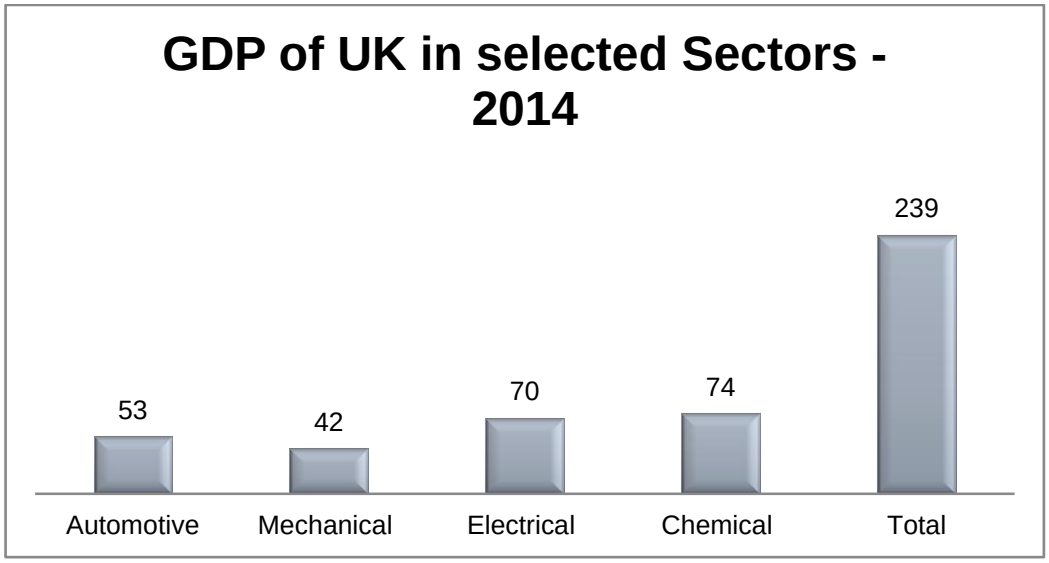



**FIGURE 5-2: TURNOVER OF THE FOUR INDUSTRIES IN UK IN BILLION €**

(Source: Own illustration, Statista [39]/ [40], ZVEI [41], CIA [42][5])

As figure 5-2 illustrates, the largest turnover of 74 billion € was generated by chemical sales in 2014. In comparison to Germany, every turnover of each branch is only one quarter or the half of the German sectors. The electrical branch valued at 70 billion € turnover. The automotive sector is defined as 53 billion € turnover and on the last position is mechanical engineering with 42 billion €. In total the four main sectors achieved 239 billion €, which is 11 % of the GDP.

However, development potentials exist in the automotive industry, because of promotion in electro mobility. Consumer demand is rising for hybrids and establishment of ultra-low emission zone in London strengthens the market potential for electric vehicles [43]. Furthermore, the government promote purchases of electric vehicles with 5.000£ (6.668€) and similar components like charging stations for increasing ecological driving [43]. Thereby, the UK wants to boost its automotive sector. This condition supports the profitability of the chemical sector, because of chemical supply parts for the automotive industry.

[5] Chemical sector converted: GBP-EURO = 1.28482, 12 Feb 2016

### 5.1.2 Sales Engineers' Turnover in the UK

Like Germany, the UK possesses the same industrial and economic interdependencies in relation to input factors. Input products are necessary for the manufacturing of end-products. This means given input rates of industry sectors were modified to represent the rate of technical products. The objective is to calculate the share of sold technical products by sales engineers. The input rates give information about the respective country conditions in relation to industrial value added.[6]

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 30 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| Ø | 65 % |

**TABLE 5-2: SALES ENGINEERS' TURNOVER RATE IN THE UK**

(Source: Own illustration, Die Welt [44], VCI [22])

The automotive sector produces only 30 % of its components inland. This means that British sales engineers are just able to sell 30 % of technical products to B2B clients. In comparison, German automotive industry uses 60 % input products by German suppliers. This difference reflects the extendable industry production in the UK. If they expanded their own supply chain, they could save 4 billion £ turnover [44].

The other three sales engineers' rates were adopted of the German rates, because they have the same conditions. Mechanical Engineering produces only goods for B2B clients, consequently sales engineers have a share of 100 % of the sale. The technical product rate of the global electrical and chemical market amounts to 50 % and 80 %.

The average sales engineers' turnover rate is 65 %, which fits to the average input rate of 63 % of the UK [45]. Ergo, the adapted sales engineers' rates can be used as basis for the next calculation.

[6] Further explanation in chapter 4.2

The turnover of sales engineers for each branch of the UK was calculated with the modified input rate equation.

Formula:[7]

$$sales\ engineers'turnover = SEs'rate * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.3 * 53\ billion\ € \approx 16\ billion\ €$$

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 42\ billion\ € = 42\ billion\ €$$

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 70\ billion\ € = 35\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 74\ billion\ € \approx 59\ billion\ €$$

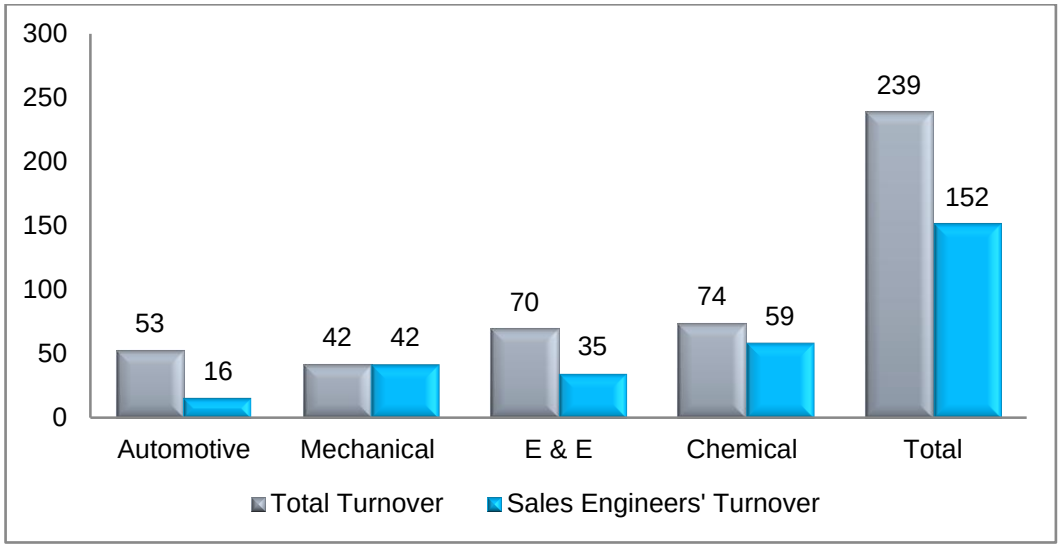



**FIGURE 5-3: SALES ENGINEERS' TURNOVER OF SELECTED INDUSTRY SECTORS IN THE UK IN BILLION EUROS**

The highest share is holding the chemical industry with 59 billion €. Furthermore, the total sales engineers' turnover in the UK amounted to 152 billion € in 2014. These are 64 % of the total turnover of the four selected sectors. It follows that the

[7] See equation 2

British percentage share of sales engineers is very similar to the German share without considering the amount of turnovers. Otherwise, the German sales engineers' turnover is the fourfold of the British. These four industry branches have a share of 11 % of the British GDP and the sales engineers generate sale of 7 %. This means that although the industry is not as large as in Germany, sales engineers still represent a significant part of the value added of the UK.

### 5.1.3 The UK's international trade

To demonstrate at first the importance of exported goods in the UK the export rate is calculated:

$$export\ rate^{8} = \frac{380}{2253} * 100 = 17\ \%$$

Export has a share of 17 % of the GDP. The cause is connected with the industrial conditions as reported with the help of the several turnovers of the four sectors.

Furthermore, it means that UK depends on supplied goods abroad to add them to its own production, because the own production is not strong enough.

Represented by the import rate[31]:

$$import\ rate\ = \frac{imports}{GDP} * 100$$

$$= \frac{520}{2253} * 100 = 23\ \%$$

The import rate exceeds the export rate with 5 %. Ergo, some input factors are not produced in the UK and are supplied by other countries.

[8] Equation 3

This negative balance trade is reflected by the four selected sectors partly as well:

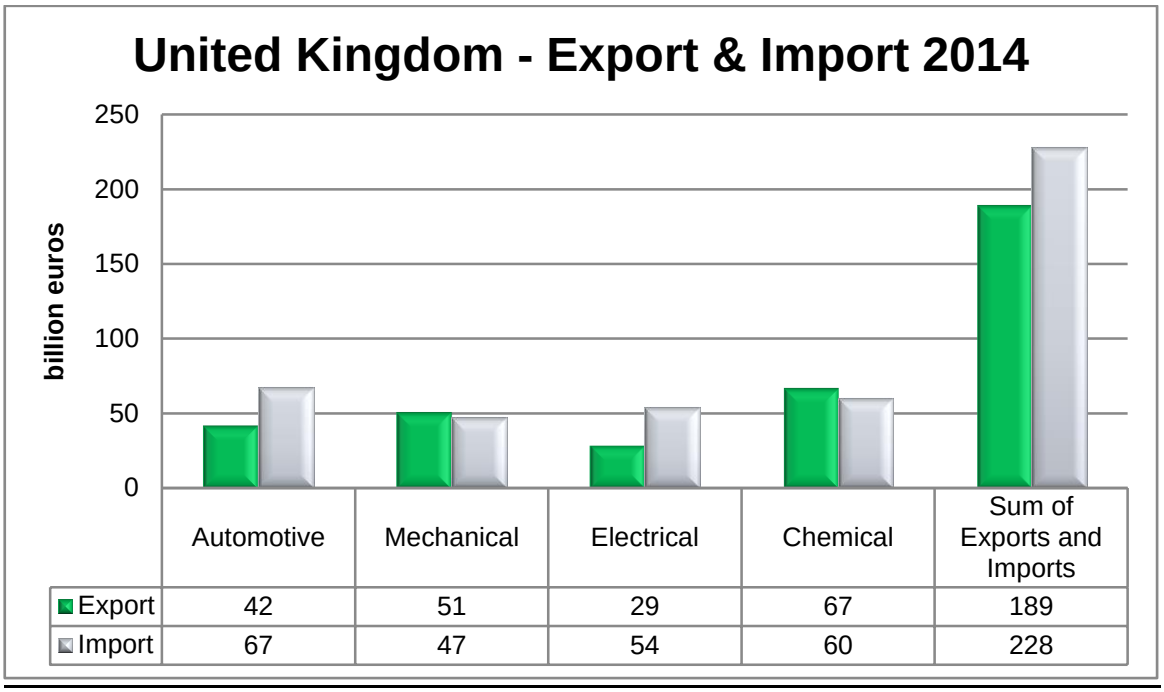



**FIGURE 5-4: EXPORT AND IMPORT OF SELECTED SECTORS IN BILLION € IN UK[9]**

(Source: Own illustration, globalEDGE [46], Statista [47], CIA [42])

Automotive, mechanical and electrical industries have a lower export value towards their imported amount. Only the chemical sector shows a good balanced trade. In total, these sectors have an export value of around 190 billion €, which is 50 % of the total export. Ergo, these four industries are still important for international trade.

[9] Chemical export and import, mechanical export and import: converted GBP-EURO = 1.28482, 12 Feb 2016
Automotive and electrical exports and imports: converted: USD-EURO = 0.8884, 12 Feb 2016

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion € |
|---|---|---|---|
| **Automotive** | 42 | 30 % | 13 |
| **Mechanical** | 51 | 100 % | 51 |
| **Electrical** | 29 | 50 % | 15 |
| **Chemical** | 67 | 80 % | 54 |
| **Total** | 189 | | 133 |

**TABLE 5-3: SALES ENGINEERS' FOREIGN TURNOVER OF UK**

Sales engineers sell around 70 % of the exported goods of automotive, mechanical, electrical and chemical sector. Consequently, they have a greater share of 6 % in international trade than in the domestic market. Additionally, the sales engineers' share of total exports amounts to 35 %.

| | |
|---|---|
| **Sales Engineers' Foreign Turnover** | **133** |
| Total Export of UK | 380 |
| Export of remaining sectors | 380 – 133 = 247 |
| SE's share of remaining sectors (30 %) | 74 |
| **Total SEs' Foreign Turnover** | **133 + 74 = 207** |
| Relation to total Export | 55 % |

**TABLE 5-4: EXPANDED VIEW ON SALES ENGINEERS' FOREIGN TURNOVER IN UK**

If further industries are counted to the sales engineers' foreign turnover, their amount of 133 billion € will rise to 207 billion €. This normally means that the share of sales engineers will be much higher, if every industry branch were included. Then the turnover would amount to 55 % of the whole export, instead of 35 %.

This condition reflects the important role of foreign trade. It is not sufficient to concentrate on the domestic market to stay profitable; it is necessary to use international customer contacts to expand the share of produced goods. To reach the goal for an improved international network establishment, better educated sales engineers could effectively support the sales and customer process.

### 5.1.4 Sales Engineering Potentials in the UK

As referred to the sales potential in Germany, the UK possesses the same chances for improvement of sales process by an enhanced training of sales engineers.[10] Consequently, the similar potentials would exist of 5 % minimizing operational costs and 5 % growth of foreign turnover by exported goods. For the UK follows:

$$5\ \%\ of\ SEs'\ foreign\ turnover = 133\ billion\ € * 0{,}05 \approx 7\ billion\ €$$

It would be possible to generate 7 billion € more turnover with exported products by better trained sales engineers. This means that the depth of training is still expandable and can influence the profitability of the country positively.

[10] Detailed description in chapter 4.4

### 5.1.5 Results of the UK

| Sales Engineers‘ Turnover | |
|---|---|
| **Sales Engineers‘ turnover of the four sectors** | 152 billion € |
| **SEs’ share of the four sectors** | 64 % |
| **SEs’ share of the GDP with the four sectors** | 7 % |

| Sales Engineers’ Turnover in Export Market | |
|---|---|
| **SEs’ foreign turnover** | 133 billion € |
| **SEs’ share of Exports of the four sectors** | 70 % |
| **SEs’ share of the total Export with the four sectors** | 35 % |

**TABLE 5-5: SALES ENGINEERS’ FIGURES IN UK**

UK’s importance of industry has declined due to stronger growth of service sector and decrease of competitive ability in international trade, but this loss could be improved by better trained sales engineers. Currently, they have a share of 64 % of the GDP and 35 % of the total export. With an improved training especially with international competence, they would be able to suggest an international competitiveness with an increase of export volumes of 5 %.

## 5.2 France

### 5.2.1 Economic Data of France

The third country analysis is about France, the third largest economic power in Europe.

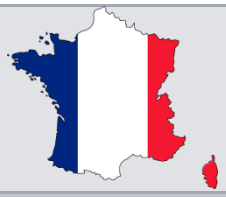
| **Data sheet:** France **(2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 3rd position |
| **Ranking of GDP worldwide** | 6th position |
| **GDP** | 2132 billion € |
| **Export total** | 438 billion € |
| **Import total** | 510 billion € |
| **Balance of Trade** | - 72 billion € |

**TABLE 5-6: FRANCE'S PROFILE**

(Source: Own illustration, Statista [13], statistisches Bundesamt [14], Eurostat [15]/ [16])

In regard to table 5-6, it follows that France is a member of the ten largest national economies worldwide with a real GDP of 2132 billion euros (27 % less than Germany and 5 % less than the United Kingdom). Also France possesses a below-average value of manufacturing industries of EU countries valued at 11.4 % [17], because of stronger growth of service sector and deterioration of competitiveness, which is shown by the negative balance of trade. Nevertheless, the share of industrial sector is 2 % higher than in the UK. Though, this circumstance is reflected in the turnovers of the four industry sectors.

Exports and imports are similar to the UK and form only a quarter of the GDP. Balance trade shows an import surplus. It follows that France depends relatively on foreign products just like the UK.

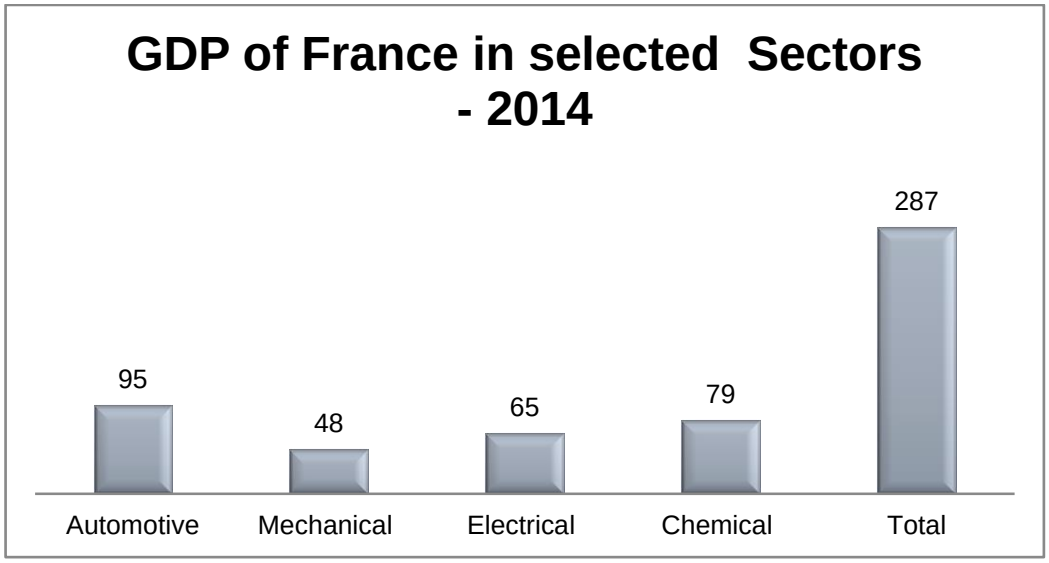



**FIGURE 5-5: TURNOVERS OF INDUSTRY SECTORS IN FRANCE IN BILLION €**[11] [12]

(Source: Own illustration, Statista [48]/ [49]/ [50]/ [51], GTAI [52])

For France, automotive and chemical industries are the sectors with the largest turnovers of 95 and 79 billion €, according to figure 5-5. The automotive sector is promoted for buying electrical vehicles like in the United Kingdom to increase the turnover [53] Forecasts indicate a 3 % till 5 % growth for the year 2015. The chemical industry owns increases of 2.9 % last year and potentials for larger export values, because of pharmacy products [53]. Mechanical engineering is on fourth position with 48 billion €. In sum they achieve 287 billion €. This is 44 % more than in the UK and 70 % less than in Germany.

Nevertheless, the selected sectors form around 14 % of the French GDP. This shows a greater reference on service sector than on industry performance, similar to the UK.

[11] Automotive sector: converted USD-EURO = 0.8884, 12 February 2016
[12] Turnover of the electrical sector is based on forecast in source [51]

### 5.2.2 Sales Engineers' Turnover in France

France had an average input rate of 69 % in the year 2000 [45]. Ergo, it shows a comparable value to Germany. This means the average of sales engineers' turnover rates is adapted to 70 %, referring to table 5-7.[13]

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| Ø | 72.5 % |

**TABLE 5-7: SALES ENGINEERS' TURNOVER RATE OF FRANCE**

The automotive sector had a similar input rate of 76 % in the year 1999 [26]. Analog it is expected that it had a similar development in 17 years like Germany did and can be presented as around 60 %. The other three rates were explained in the previous chapters already.

Based on the input rate equation, the sales engineers' share of each turnover of each branch was calculated:

Formula:

$$sales\ engineers'turnover = SEs' * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 95\ billion\ € \approx 57\ billion\ €$$

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 48\ billion\ € = 48\ billion\ €$$

[13] Further explanations in chapter 4.2

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 65\ billion\ € \approx 33\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 79\ billion\ € \approx 63\ billion\ €$$

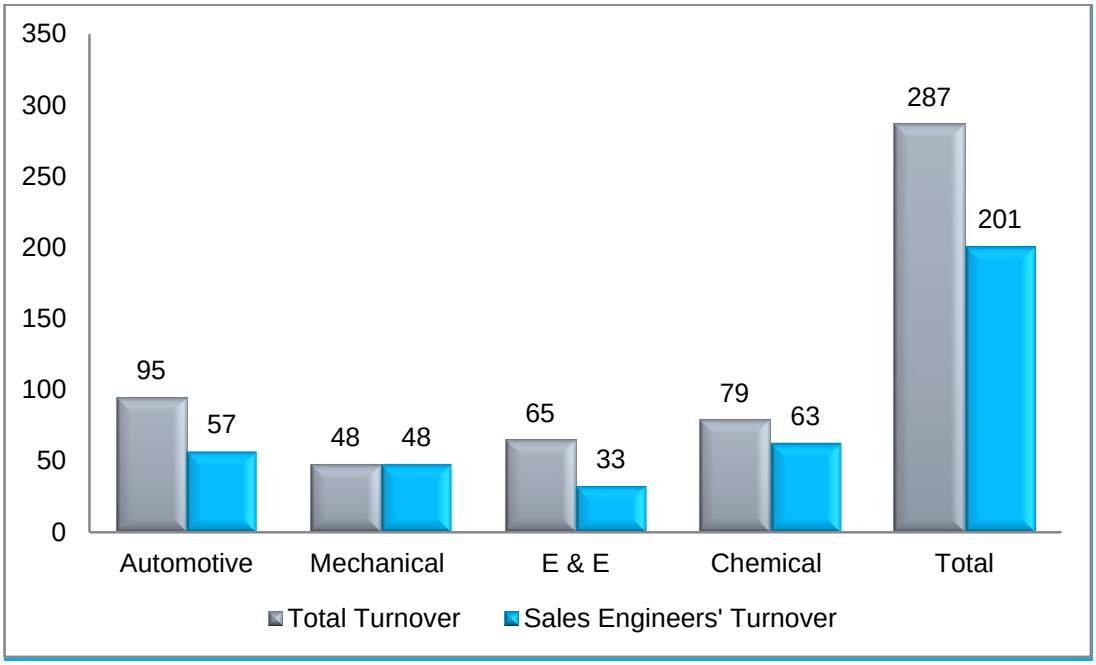



**FIGURE 5-6: SALES ENGINEERS' TURNOVER OF FRANCE IN BILLION €**

As can be seen from figure 5-6 the largest sales engineers' turnover is made by chemical sales of 63 billion €. In sum they generated 201 billion € turnover in these four sectors in 2014. This is 70 % of the total turnover of the selected industries and 9 % of the GDP. Concentrated on the manufacturing sectors, sales engineers make the largest part of the total turnover in comparison with end-consumers of 30 % share. Thus, the industry does not constitute a great part of France's GDP, the share of sales engineers' turnover is a lower value than in Germany, but the percentage is in a similar high level. The four sectors present 13 % of the GDP with 287 billion €. Consequently, only 4 % of the total turnover was achieved by end-consumer demand with these four sectors and 9 % by sales engineers.

### 5.2.3 France's International Trade

Considering the international trade, export and import values set in relation to the GDP:

$$export\ rate = \frac{438}{2132} * 100 = 21\ \%$$

The export rate gives information about the importance of exported goods in the respective country. France achieves 21 % export rate, which shows a moderate relation to the GDP.

$$import\ rate = \frac{imports}{GDP} * 100$$

$$= \frac{510}{2132} * 100 = 24\ \%$$

The import rate is with 24 % only slightly higher than the export rate. All in all, the international interdependency is not as high as in Germany. The export rate amounts the double of France.

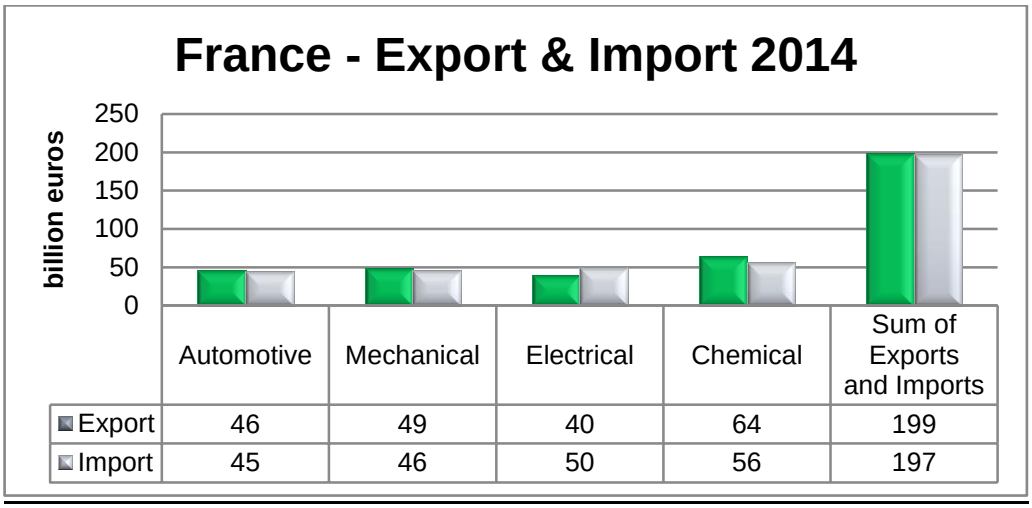



**FIGURE 5-7: EXPORT AND IMPORT VALUES OF THE FOUR SECTORS OF FRANCE IN BILLION €[14]**

(Source: Own illustration, globalEDGE [54], Aiche [55])

As figure 5-7 illustrates, the chemical industry is the top export sector of France with 64 billion €. Then comes the mechanical engineering export of 49 billion €. A balanced trade was reached in automotive, mechanical and chemical branch, but

[14] All figures converted: US-EURO = 0.8884

with just a slight difference. In total the four selected sectors achieved 199 billion € in 2014, accounting for 45 % of the total export value.

The foreign turnover of sales engineers is calculated by created sales engineers' rates and given export values of each branch.

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion € |
|---|---|---|---|
| **Automotive** | 46 | 60 % | 28 |
| **Mechanical** | 49 | 100 % | 49 |
| **Electrical** | 40 | 50 % | 20 |
| **Chemical** | 64 | 80 % | 51 |
| **Total** | 199 | | 148 |

**TABLE 5-8: SALES ENGINEERS' SHARE OF EXPORT**

They achieve 148 billion € with foreign customers, which represents 74 % of the total export value of the four sectors. In comparison to the total export of France, sales engineers sell around 34 % of all exported goods. These international relations are very similar to those in the UK and Germany, but German sales engineers have a greater share of the total export.

If further sectors are included in the consideration of sales engineers' foreign turnover, their amount will raise, which is demonstrated in table 5-9.

| **Sales Engineers' Foreign Turnover** | **148** |
|---|---|
| Total Export of France | 438 |
| Export of remaining sectors | 438 – 148 = 290 |
| SE's share of remaining sectors (30 %) | 87 |
| **Total SEs' Foreign Turnover** | **148 + 87 = 235** |
| Relation to total Export | 54 % |

**TABLE 5-9: CALCULATION OF TOTAL SALES ENGINEERS' FOREIGN TURNOVER OF FRANCE**

Table 5-9 shows the total foreign turnover of sales engineers, considering the entire manufacturing sector. The four greatest industry sectors constitute 34 % foreign turnover by sales engineers, but normally their share of the total export is much higher. If remaining sectors are taken into account, the total share of sales engineers' foreign sales will correspond to 54 %. Consequently, sales engineers are normally responsible for more than half of the exported technical products of France.

### 5.2.4 Sales Engineering Potentials in France

With assumptions, explained in the previous chapter of Germany[15] that countries would have chances of improvements in national and international trade with better educated sales engineers, follows that sales potentials could exist in form of:

- reduction of operational costs of estimated 5 %
- increase of export volumes, generating approximated 5 % higher foreign turnover:

  ➔ $5\,\%\ of\ SEs' foreign\ turnover = 148\ billion\,€ * 0.05 \approx 7\ billion\,€$

It would be possible to achieve with foreign customers an increase of export volumes of 5 %, which would be 7 billion € more turnover for French exporting companies.

[15] Detailed description in chapter 4.4

### 5.2.5 Results of France

| Sales Engineers‘ Turnover | |
|---|---|
| **SEs‘ turnover** | 201 billion € |
| **SEs’ share of the four sectors** | 70 % |
| **SEs’ share of the GDP with the four sectors** | 9 % |

| Sales Engineers’ Turnover in Export Market | |
|---|---|
| **SEs’ foreign turnover** | 148 billion € |
| **SEs’ share of Exports of the four sectors** | 74 % |
| **SEs’ share of the total Export with the four sectors** | 34 % |

**TABLE 5-10: SUMMARY OF SALES ENGINEERS’ FIGURES IN FRANCE**

## 5.3 Italy

### 5.3.1 Economic Data of Italy

According to table 5-11, Italy's economy ranks fourth in Europe and eighth worldwide, measured in terms of the GDP.

| **Data sheet:** Italy **(2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 4th position |
| **Ranking of GDP worldwide** | 8th position |
| **GDP** | 1614 billion € |
| **Export total** | 398 billion € |
| **Import total** | 355 billion € |
| **Balance of Trade** | 43 billion € |

**TABLE 5-11: ITALY'S PROFILE**

(Source: Own illustration, Statista [13], statistisches Bundesamt [14], Eurostat [15]/ [16])

In 2014, Italy's GDP had a value of 1614 billion €. Germany's GDP was 55 % higher. Nevertheless, the share of manufacturing sector amounted to 15.6 % in Italy in 2011 [18]. This means that the country corresponds to the average industry share of EU countries and additionally exceeds the United Kingdom and France. Its balance of trade is marked positive with 43 billion €, which demonstrates a better competitive position than the UK and France, based on the export surplus.

The industry share of value added is reflected by the following turnovers of the four selected industry sectors.

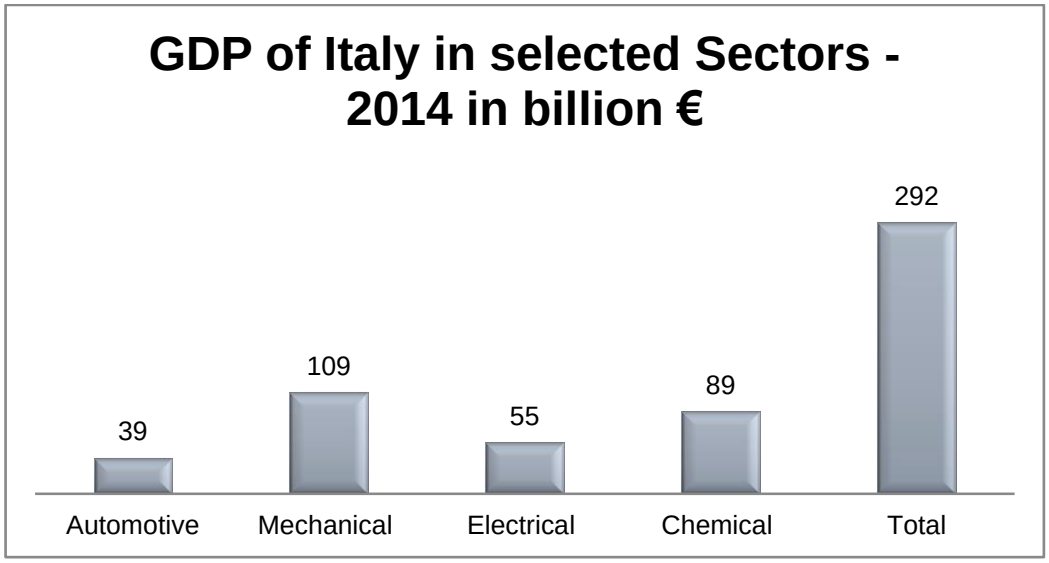



**FIGURE 5-8: TURNOVERS OF INDUSTRY SECTORS OF ITALY[16]**

(Source: Own illustration, Statista [56], VDMA [57], GTAI [58]/ [59])

The bar chart 5-8 highlights Italy's strength in the mechanical sector. It contributes the highest share of 109 billion € to the GDP, accounting for 42 % of the turnover in sum. Furthermore, Italy's chemical industry valued at 89 billion € belongs to the largest markets in Europe. The electrical industry comes up after in third position with 55 billion € turnover. The automotive sector makes up a smaller part of the general manufacturing sector than Germany or France automotive sale. Though, the turnover in sum of 292 billion € has a similar amount like France (287 billion €) and reflects one quarter of Germany's turnover of the four industry branches. Moreover, it accounts for 18 % of the GDP.

[16] Automotive turnover: converted USD-EURO = 0.8884

### 5.3.2 Sales Engineers' Turnover in Italy

To calculate the turnover generated by sales engineers in these four industry branches, the sales engineers' rates are created, adapted to the average input rate of 70.9 % in Italy in 2000 [45]. The input rate helps determine the share of sold technical products on the total turnover of end products.[17]

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| Ø | 72.5 % |

**TABLE 5-12: SALES ENGINEERS' TURNOVER RATES IN ITALY**

The average input rate in Italy is very similar to the German and the French. All have a value about 70 %. It follows that the sales engineers' rates in Italy can be adopted by Germany and France.

Based on the created rates, including in table 5-12, the sales engineers' turnovers of each sector are calculated with the modified input rate equation.

Formula:

$$sales\ engineers'turnover = SEs'\ rate * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 39\ billion\ € \approx 23\ billion\ €$$

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 109\ billion\ € = 109\ billion\ €$$

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 55\ billion\ € = 28\ billion\ €$$

[17] Further explanations chapter 4.2

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 89\ billion\ € \approx 71\ billion\ €$$

All results are summarized in the following bar chart, compared with the initial value.

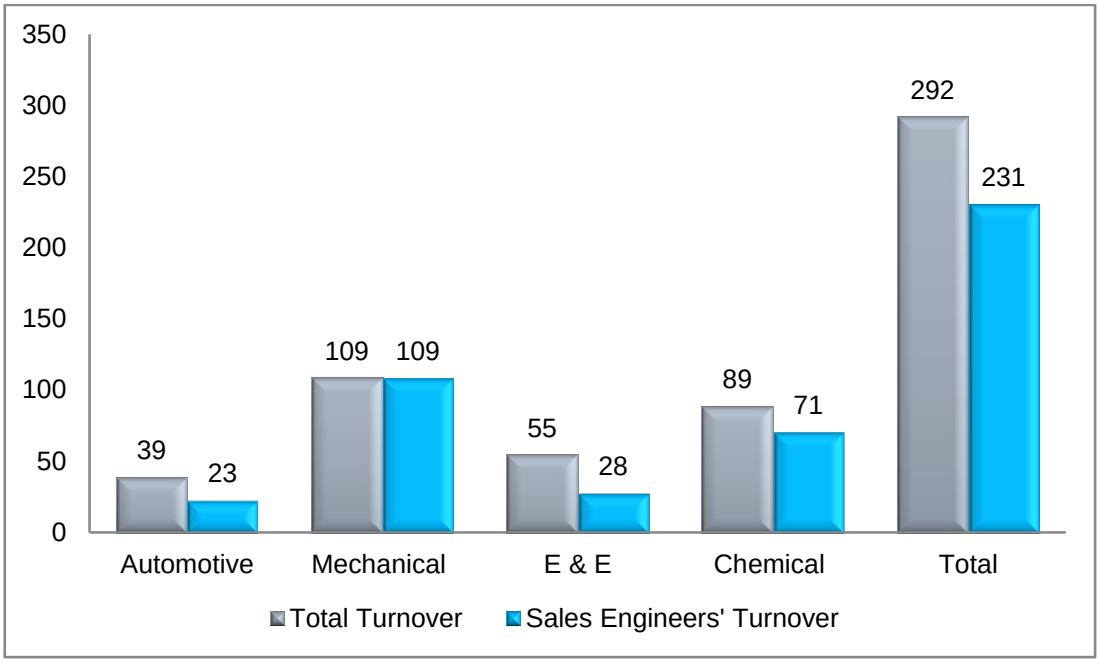



**FIGURE 5-9: SALES ENGINEERS' TURNOVERS IN ITALY IN BILLION €**

As the figure 5-9 illustrates, sales engineers made 231 billion € turnover in automotive, mechanical, electrical and chemical industries in the year 2014. Consequently, they are responsible for 79 % of the total turnover. Further, Italy's sales engineers have a greater share than the German (71 %). But they still differentiate from the share of the GDP. With 231 billion €, sales engineers in Italy achieve around 14 % of the GDP. This is 8 % less than in Germany, but still a high percentage share of the GDP. It follows that the importance of sales engineers is very high for the industry in Italy. Only a 4 % turnover is obtained by end-consumers with end-products in these four sectors, because the share of these industries amounts to 18 % of the GDP and 14 % is made by sales engineers.

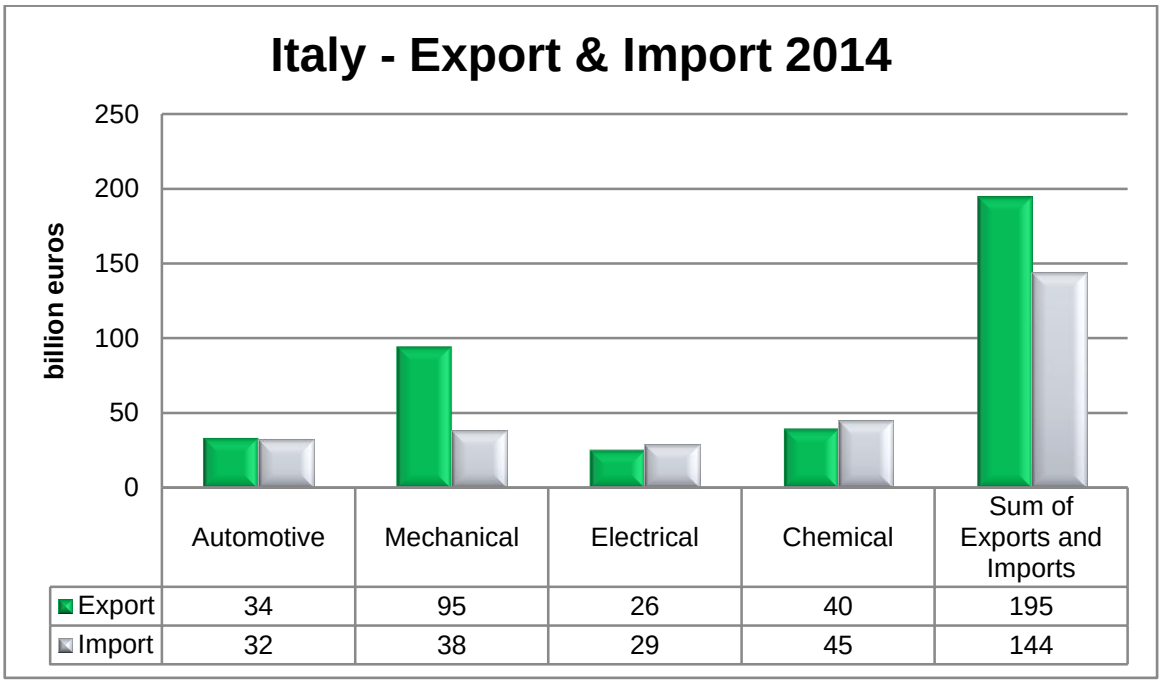
### 5.3.3 Italy's International Trade

The balance of trade was already mentioned before and showed a positive export surplus. This means that foreign demand exceeds foreign supply. To evaluate the competitiveness and integration in international trade, the export rate is calculated.

$$export\ rate = \frac{exports}{GDP} * 100$$

$$= \frac{398}{1614} * 100 = 25\ \%$$

One quarter of the GDP is achieved by exported goods of Italy. In comparison with the other listed EU countries, Italy exported more products than France and the UK in relation to the GDP, but still 15 % less than Germany.




| | Automotive | Mechanical | Electrical | Chemical | Sum of Exports and Imports |
|---|---|---|---|---|---|
| Export | 34 | 95 | 26 | 40 | 195 |
| Import | 32 | 38 | 29 | 45 | 144 |

**FIGURE 5-10: EXPORT AND IMPORT VALUES OF THE FOUR SELECTED SECTORS IN BILLION €, ITALY 2014[18]**

(Source: Own illustration, globalEDGE [60])

Referring to figure 5-10, the mechanical sector presents itself as the strongest export power at 95 billion €, accounting for 50 % of the export values in sum. The chemical industry follows with a 40 billion € export value. The electrical and the automotive industries possess similar export sales of around 30 billion €. Only the chemical and electrical sectors have a minimal import surplus. In total, they

[18] All figures converted: USD-EURO = 0.8884

generated a 195 billion € export of goods in 2014, making up 49 % of the total export of Italy.

Sales engineers' share of the export values is calculated in the following table.

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion € |
|---|---|---|---|
| **Automotive** | 34 | 60 % | 20 |
| **Mechanical** | 95 | 100 % | 95 |
| **Electrical** | 26 | 50 % | 13 |
| **Chemical** | 40 | 80 % | 32 |
| **Total** | 195 | | 160 |

**TABLE 5-13: CALCULATION OF SALES ENGINEERS' FOREIGN TURNOVER OF ITALY**

Sales engineers reached a foreign turnover of 160 billion € with exported goods of the four selected sectors in the year 2014. This is 82 % of the four export values in sum. Furthermore, the percentage share is higher than in Germany, the UK and France. Compared with the total export of Italy, sales engineers make up 40 %. So the sales engineers' percentage share of the total export is comparable with the French. Nevertheless, Germany's percentage share is slightly higher with 43 %.

If further sectors were included in the consideration of sales engineers' foreign turnover, their amount would raise, which is demonstrated in the following table 5-14.

| **Sales Engineers' Foreign Turnover** | **160** |
|---|---|
| Total Export of Italy | 398 |
| Export of remaining sectors | 398 – 160 = 238 |
| SE's share of remaining sectors (30 %) | 71 |
| **Total SEs' Foreign Turnover** | **160 + 71 = 231** |
| Relation to total Export | 58 % |

**TABLE 5-14: TOTAL SALES ENGINEERS' FOREIGN TURNOVER IN ITALY CONSIDERING ALL SECTORS**

The remaining sectors reached an export value of 238 billion € and around 30% is made by sales engineers. It follows that 71 billion € is additionally included in the sales engineers' foreign turnover. This counts up to 231 billion € total sales engineers' foreign turnover in Italy that makes up 58 % of the total export. Summarized, their share will be normally more than half of the total export value if every industry sector is included.

This means in total that sales engineers in Italy make about 80 % of the total turnover and 40 % of the foreign turnover with exported goods of the four selected sectors, but their share is normally much higher with considering every sector. Consequently, they are responsible for the largest part of sale to achieve a profitable national and international trade.

### 5.3.4 Sales Engineering Potentials in Italy

Considering outlooks of potential improvements by better trained sales engineers, possible financial outcomes are calculated related to Italy's conditions. A better training could be achieved by research activities for sales knowledge. Explanations for the link between sales improvements and financial aspects were already listed in the chapter 4.4 about Germany.

With better trained sales engineers, it would be possible to save around 5 % of operating costs. This means that unnecessary efforts of acquisition and negotiations could be minimized and this would save time which could be invested in target-oriented actions. Furthermore, Italy would have an opportunity to increase foreign sales by estimated 5 %.

It follows: $5\ \%\ of\ SEs'\ foreign\ turnover = 160\ billion\ € * 0.05\ =\ 8\ billion\ €$

Ergo, Italy's exporting companies could expand their volumes and generate an 8 billion € higher foreign turnover.

### 5.3.5 Results of Italy

| Sales Engineers' Turnover | |
|---|---|
| **SEs' turnover** | 231 billion € |
| **SEs' share of the four sectors** | 79 % |
| **SEs' share of the GDP with the four sectors** | 14 % |

| Sales Engineers' Turnover in Export Market | |
|---|---|
| **SEs' foreign turnover** | 160 billion € |
| **SEs' share of exports of the four sectors** | 82 % |
| **SEs' share of the total Export with the four sectors** | 40 % |

**TABLE 5-15: SUMMARY OF SALES ENGINEERS' FIGURES IN ITALY**

## 5.4 Austria

### 5.4.1 Economic Data of Austria

Austria corresponds to the wealthiest EU countries with a GDP per capita of 38,500 €, compared with Germany's 35,800 € [61].

| **Data sheet:** Austria **(2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 10$^{th}$ position |
| **Ranking of GDP worldwide** | 27$^{th}$ position |
| **GDP** | 329 billion € |
| **Export total** | 128.1 billion € |
| **Import total** | 129.8 billion € |
| **Balance of Trade** | - 1.7 billion € |

**TABLE 5-16: AUSTRIA'S PROFILE**

(Source: Own illustration, Statista [13], statistisches Bundesamt [14], Eurostat [15], Statistik Austria [62])

Referring to table 5-16, the real GDP amounted to 329 billion € in the year 2014 and formed the tenth position of countries in the EU. The manufacturing sectors account for 18 % [18] of the GDP. Consequently, the industry has a greater influence in Austria than in the UK, France and Italy. This can be seen in the following figures of the four largest industries.

The export and import values have just a slight difference of -1.7 billion €. It follows that there is no large outweigh position.

The GDP is shown in form of the four largest industry sectors worldwide: automotive, mechanical, electrical and electronic and chemical and pharmaceutical branch to analyze the importance of sales engineers in the most relevant industries.

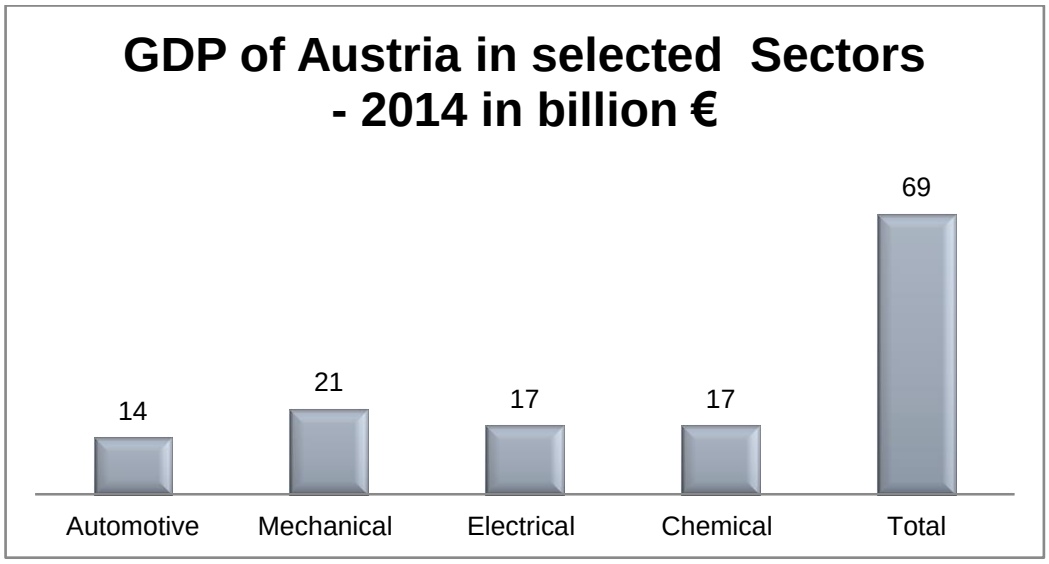



**FIGURE 5-11: TURNOVERS OF INDUSTRY SECTORS OF AUSTRIA**

(Source: Own illustration, Statista [63]/ [64], Advantage Austria [65]/ [66])

According to figure 5-11, Austria's four sectors had comparable values of around 20 billion € in 2014. The mechanical engineering has the highest turnover with 21 billion €, closely followed by the electrical and the chemical industry, making up 17 billion € turnover in each case. On fourth position comes the automotive sector with a 14 billion € turnover.

In sum, they reached a 69 billion € turnover in 2014. Ergo, the GDP consists of 21 % of turnover of automotive, mechanical, electrical and chemical products. This means that Austria's industry branches have a greater share on the GDP than in the UK, France or Italy. Germany has a share of around 30 % in comparison.

### 5.4.2 Sales Engineers' Turnover in Austria

Using the given turnovers, the sales engineers' share is calculated with the assumed sales engineers' rates for each sector. The input rate of Austria supports the modification of the sales engineers' rates. In the year 2010 the input rate amounted to 70.1 %. It was calculated with:

$$input\ rate = \frac{input}{production\ value}$$

$$input\ rate = \frac{3227}{4605} * 100 \approx 70.1\ \%$$ (Source: Statistik Austria [67])

Consequently, the same modified rates from Germany, France and Italy can be adopted, because each of them possesses the similar average input rate of around 70 %.[19]

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| Ø | 72.5 % |

**TABLE 5-17: SALES ENGINEERS' TURNOVER RATES IN AUSTRIA**

With the help of the adapted equation of input rate, the turnover of sales engineers in Austria of each sector is calculated.

Formula:

$$sales\ engineers'turnover = SEs'rate * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 14\ billion\ € \approx 8\ billion\ €$$

[19] Further explanations in chapter 4.2

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 21\ billion\ € = 21\ billion\ €$$

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 17\ billion\ € = 9\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 17\ billion\ € \approx 14\ billion\ €$$

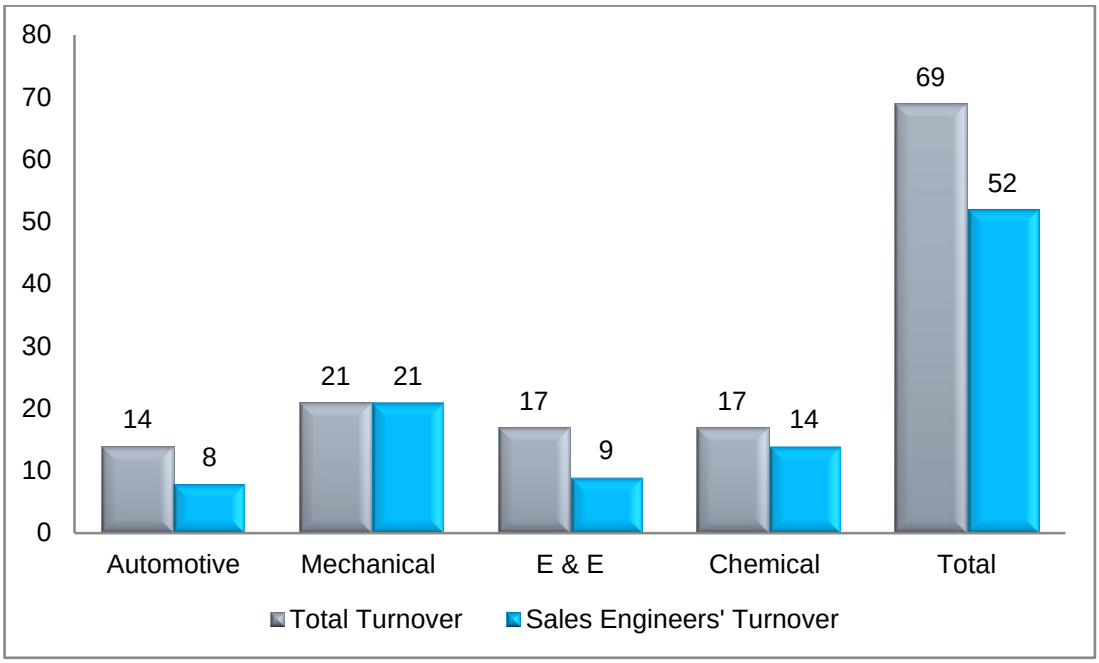



**FIGURE 5-12: COMPARISON SALES ENGINEERS' AND SECTOR TURNOVER IN BILLION €, AUSTRIA 2014**

As figure 5-12 illustrates, the largest sales engineers' turnover of 21 billion € is generated by mechanical engineering. In sum, they made a 52 billion € turnover in 2014, which is 75 % of the total amount and 16 % of the GDP. In comparison with the other listed EU countries, sales engineers in Austria have the greatest influence on the profitability of the country (share of the GDP) after the German. These conditions are related to the total industry share of the GDP. If the manufacturing share moved in below-average values compared with other EU countries, the sales engineers' share of the GDP would also be lower than in countries with higher manufacturing share.

### 5.4.3 Austria's International Trade

For the analysis of international conditions in Austria, the export rate is calculated to show its importance between exported products and GDP.

$$export\ rate = \frac{exports}{GDP} * 100$$

$$= \frac{134}{329} * 100 = 41\ \%$$

The export rate of Austria amounts to 41 %, presenting a good competitive position. Sold products to foreign partners are important for the profitability of Austria. Nearly half of its GDP is supported by export. Germany's export rate is only a bit higher with 43 %. Additionally, the other mentioned countries have an export share of around 20 %. Ergo, Austria corresponds to the most exporting countries in the EU. However, its import value is very similar to their export value, thus Austria depends on foreign products as well.

Nevertheless, sales engineers are decisive for the international sales of technical products in Austria to reach the high share of exported goods. Their share is calculated in the following.

At first, the export of the four largest industries is illustrated by figure 5-13.

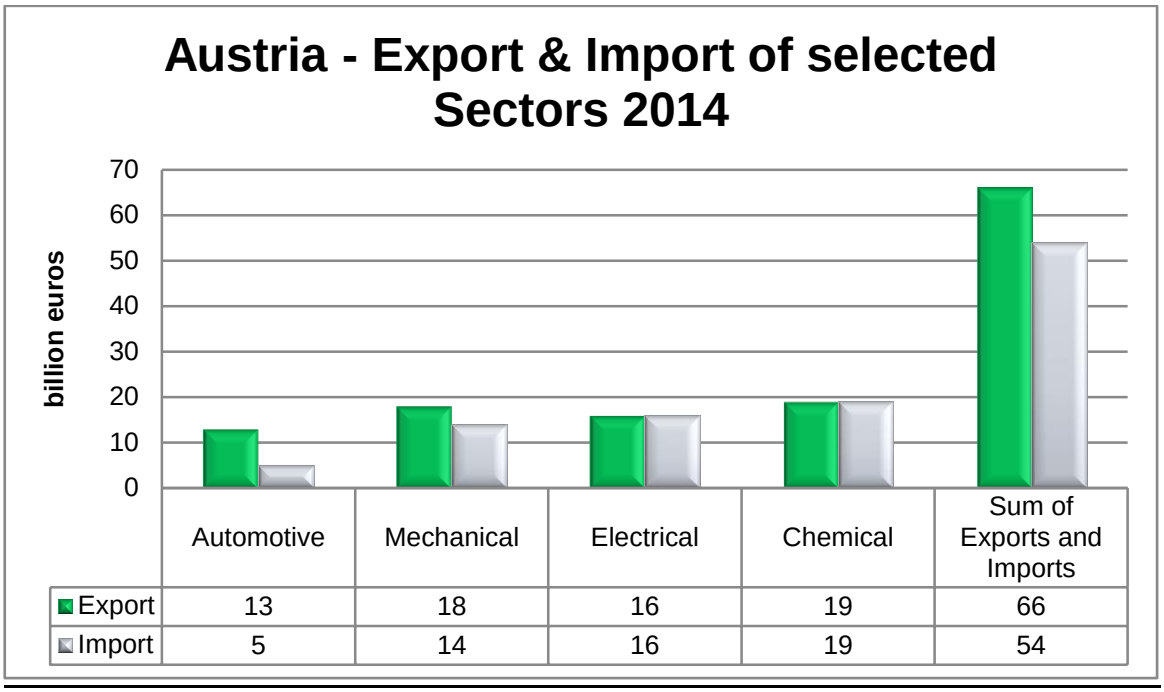



**FIGURE 5-13: COMPARISON OF INTERNATIONAL TRADE VALUES OF THE FOUR SECTORS IN AUSTRIA IN BILLION €, 2014**[20]

(Source: Own illustration, Fahrzeugindustrie Österreichs [68], GTAI [69], FMMI [70], globalEDGE [71], Advantage Austria [66])

As the figure 5-13 shows, every sector has a positive balanced trade. The chemical and the electrical industry branch have the smallest differences. The export of chemical products is the largest with 19 billion €, closely followed by the mechanical engineering, amounting to 18 billion € export value. The other two branches reach again similar values of around 15 billion € in average, whereby the automotive sector comes in fourth position with 13 billion € of exported goods. In total, they generated an export value of 66 billion € in 2014, accounting for 49 % of the total export of Austria.

With these given figures, the foreign turnover with exported goods of sales engineers is calculated. Likewise, the created sales engineers' rates are used for the calculation of the share of the export.

[20] Electrical sector exports and imports converted: USD-EURO = 0.8884

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion €[21] |
|---|---|---|---|
| **Automotive** | 13 | 60 % | 8 |
| **Mechanical** | 18 | 100 % | 18 |
| **Electrical** | 16 | 50 % | 8 |
| **Chemical** | 19 | 80 % | 15 |
| **Total** | 66 | | 49 |

**TABLE 5-18: SALES ENGINEERS' FOREIGN TURNOVER OF SELECTED SECTORS, AUSTRIA 2014**

In sum, sales engineers make a 49 billion € turnover with exported technical products in the selected sectors, making up 74 % of the total export amount. The major part is sold by sales engineers and the rest of 26 % is purchased by foreign end-consumers. Furthermore, 49 billion € sales engineers' foreign turnover makes up 37 % of the total export of Austria.

All in all, sales engineers in Austria generate yearly around 52 billion € turnover in domestic markets and 49 billion € in foreign markets.

[21] All results are rounded up

So far only the largest sectors were considered, but if the remaining industries are added to the calculation of sales engineers' foreign turnover, their share will raise as well.

| **Sales Engineers' Foreign Turnover** | **49** |
|---|---|
| Total Export of Austria | 134 |
| Export of remaining sectors | 134 – 49 = 85 |
| SE's share of remaining sectors (30 %) | 26 |
| **Total SEs' Foreign Turnover** | **49 + 26 = 75** |
| Relation to total Export | 56 % |

**TABLE 5-19: TOTAL SALES ENGINEERS' FOREIGN TURNOVER CONSIDERING TOTAL SECTORS, AUSTRIA**

The result is that sales engineers normally will have a share of 56 % of the total export value of Austria, if every industry branch is included. This is an increase of nearly 20 %.

Moreover, these high percentage shares reflect the high importance of sales engineers. Especially in Austria the values are very high.

### 5.4.4 Sales Engineering Potentials in Austria

The demonstrated conditions of sales engineers in domestic and international markets accord to the current education situation. Although, sales knowledge is not completely researched, the dimensions of sales engineers' actions are strong. These conditions could be increased by an improved content of studying for different sales skills.[22]

With better trained sales engineers in the industry, a 5 % of operational cost reduction is estimated and a further 5 % approximated increase of sales of international goods.

It follows: $5\ \%\ of\ SEs'\ foreign\ turnover = 49\ billion\ € * 0.05 \approx 2\ billion\ €$

With a more efficient sales process, it would be possible to invest unnecessary actions in further potential customers. Additionally, with specially trained sales

[22] Detailed description in chapter 4.4

engineers, the international relationships could be strengthened to improve export volumes of 5 %, which would mean 2 billion € more foreign turnover for exporting companies in Austria.

### 5.4.5 Results of Austria

| Sales Engineers' Turnover | |
|---|---|
| **SEs' turnover** | 52 billion € |
| **SEs' share of the four sectors** | 75 % |
| **SEs' share of the GDP with the four sectors** | 16 % |

| Sales Engineers' Turnover in Export Market | |
|---|---|
| **SEs' foreign turnover** | 49 billion € |
| **SEs' share of exports of the four sectors** | 74 % |
| **SEs' share of the total Export with the four sectors** | 37 % |

**TABLE 5-20: SUMMARY OF SALES ENGINEERS' FIGURES IN AUSTRIA**

## 5.5 Finland

### 5.5.1 Economic Data of Finland

Finland belongs to the most innovative countries in Europe. Nevertheless, it ranks in middle measured at GDP value.

| **Data sheet:** Finland **(2014)** |  |
|---|---|
| **Ranking of GDP in Europe** | 12th position |
| **Ranking of GDP worldwide** | 39th position |
| **GDP** | 204 billion € |
| **Export total** | 56 billion € |
| **Import total** | 58 billion € |
| **Balance of Trade** | - 2 billion € |

**TABLE 5-21: FINLAND'S PROFILE**

(Source: Own illustration, Statista [13], statistisches Bundesamt [14], Auswärtiges Amt [72], Eurostat [16])

In 2014, Finland had a real GDP of 204 billion €. Its economy did not recover from the economic crisis (2008-2014) [72]. Furthermore, the sustaining negative balance of trade is not beneficial for the GDP development. This economic situation is reflected by its GDP ranking as the 12th position of Europe and 39th position worldwide. Nevertheless, it had a GDP per capita of 37,350 € [72] in 2014 and belongs to the wealthiest EU countries, apart from Austria and Germany.

The manufacturing sectors accounted for 17 % of the GDP in 2014 [73]. Consequently, the industry share is higher in Italy, Austria and Germany than in Finland. Focused on Western Europe, Finland had the biggest decrease of 10 % from 2000 to 2012. In comparison, the UK, Italy and France had a reduction of around 5 % manufacturing share of the GDP.

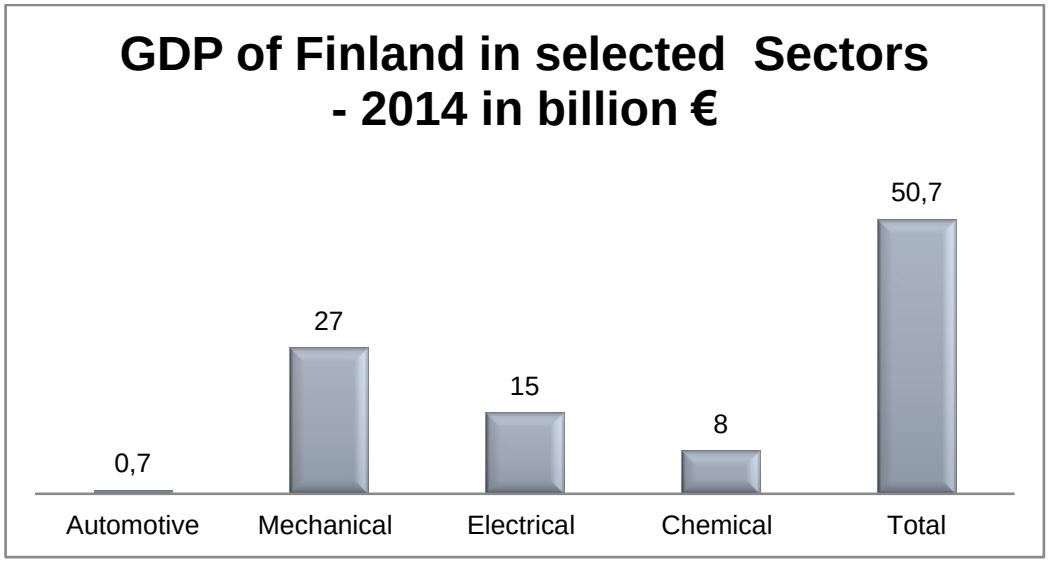



**FIGURE 5-14: TURNOVERS OF THE FOUR LARGEST INDUSTRIES IN FINLAND**

(Source: Own illustration, Statista [74], Technology Industries [75], CEFIC [76], GTAI [77][23])

As figure 5-14 illustrates, the real GDP of Finland is represented in form of the four industry sectors. The biggest industry branch is the mechanical sector, making up 27 billion € turnover. Second position forms electrical industry with 15 billion € turnover. The chemical sector defines the third place, valued at 8 billion €. On the last position is the automotive industry, amounting around 700 million €. Ergo, the motor vehicle sector gives the lowest input for the value added in comparison with the other listed EU countries. In sum, the four sectors achieved 50.7 billion € in 2014, presenting 25 % of the GDP.

[23] Chemical turnover is based on value of [76] and was calculated for 2014 with [77]

### 5.5.2 Sales Engineers' Turnover in Finland

The input rate of Finland amounted to 70.5 % in 2000 [45], presenting the share of technical products in relation to the output value. It follows that the industrial products have the same share of the production value compared with Germany, France, Italy and Austria. Consequently, the same sales engineers' rates apply for Finland as well.[24]

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| ∅ | 72.5 % |

**TABLE 5-22: SALES ENGINEERS' TURNOVER RATES IN FINLAND**

The sales engineers' turnover rates of table 5-22 are inserted in the sales engineers' turnover equation:

Formula:

$$sales\ engineers'turnover = SEs' * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 0{,}7\ billion\ € \approx 0{,}42\ billion\ €$$

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 27\ billion\ € = 27\ billion\ €$$

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 15\ billion\ \approx 8\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 8\ billion\ € \approx 6\ billion\ €$$

[24] Further explanations in chapter 4.2

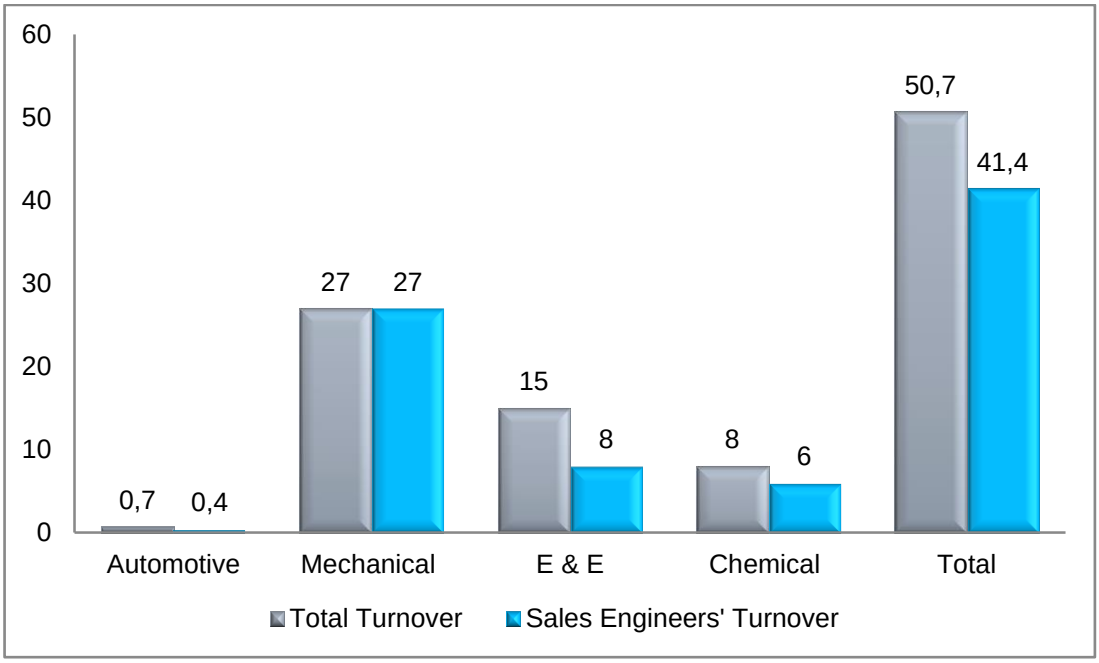



**FIGURE 5-15: TURNOVER OF SALES ENGINEERS, FINLAND 2014**

Referring to figure 5-15, sales engineers have the largest share by far in the mechanical sector valued at 27 billion €. The electrical and the chemical industries have a similar sales engineers' turnover of 8 and 6 billion €. In sum, they reached a 41 billion € turnover in these four sectors, making up 82 % of the turnovers in sum and 20 % of the GDP.

### 5.5.3 Finland's International Trade

Considering the international influence on the GDP, the export rate is calculated.

$$export\ rate = \frac{exports}{GDP} * 100$$

$$= \frac{56}{204} * 100 = 27\ \%$$

From the result follows that exported goods are important for the economic power of Finland in form of 27 %. The amount of the export rate is comparable with the French and the Italian one. Germany and Austria have a greater export importance of around 40 %.

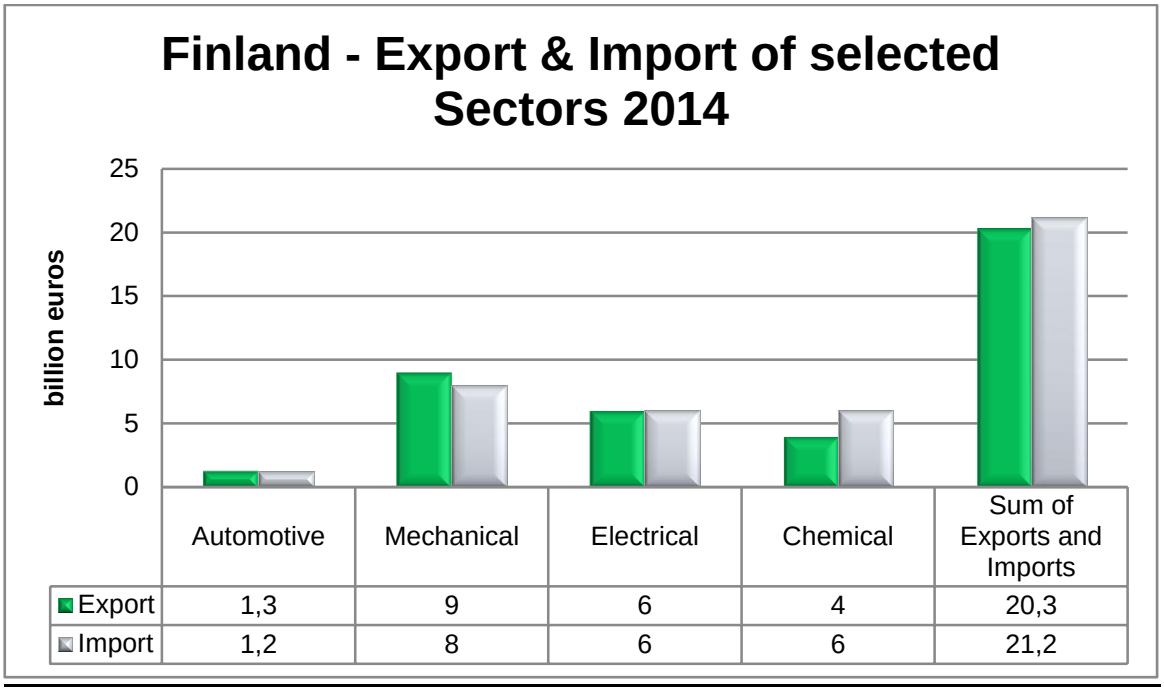



**FIGURE 5-16: FINLAND'S EXPORTED AND IMPORTED GOODS OF SELECTED SECTORS IN BILLION €, 2014[25]**

(Source: Own illustration, World's Top Exports [78], GTAI [79], globalEDGE [80])

As can be seen from figure 5-16, the automotive sector has the lowest export value that means it depends on imported components. The mechanical engineering contributes also with the export the highest share in comparison to the other three sectors. Furthermore, the chemical industry has a slightly higher import value than export value. In sum, Finland exported goods at a value of 20 billion € in 2014, making up 36 % of the total export.

[25] Automotive export, mechanical export and import, electrical export and import, chemical export and import: converted USD-EURO = 0.8884

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion €[26] |
|---|---|---|---|
| **Automotive** | 1.3 | 60 % | 0.8 |
| **Mechanical** | 9 | 100 % | 9 |
| **Electrical** | 6 | 50 % | 3 |
| **Chemical** | 4 | 80 % | 3 |
| **Total** | 20.3 | | 15.8 |

**TABLE 5-23: SALES ENGINEERS' FOREIGN TURNOVER WITH EXPORTED GOODS OF FINLAND**

The sales engineers' share of the export values is calculated with the help of the created sales engineers' rates. The result is that sales engineers gained around 16 billion € turnover with exported technical products of the four industry branches. This is 78 % of the total export of the listed sectors and 29 % of the whole export of Finland.

But the share will grow, if all industry sectors are included in the calculation.

| **Sales Engineers' Foreign Turnover** | **16** |
|---|---|
| Total Export of Finland | 56 |
| Export of remaining sectors | 56 – 16 = 40 |
| SE's share of remaining sectors (30 %) | 12 |
| **Total SEs' Foreign Turnover** | **16 + 12 = 28** |
| Relation to total Export | 50 % |

**TABLE 5-24: SALES ENGINEERS' TOTAL FOREIGN TURNOVER IN FINLAND**

The remaining sectors reach an export value of 40 billion €. The share of sales engineers is assumed 30% of the remaining industries, making up 12 billion € export value. In total, sales engineers have a foreign turnover of 28 billion € in Finland and presents 50 % of the whole export volume instead of 29 % considering only the export of the four main sectors.

[26] All results are rounded up

### 5.5.4 Sales Engineering Potentials in Finland

A further outlook is given by possible sales engineering potentials as explained in the previous chapter 4.4. With an intensive research, study of sales engineering should achieve a more professional work.

Ergo, sales engineering potentials exist in minimizing operating and working costs by approximated 5 % and increasing the sales volumes by estimated 5 %. This means that better trained sales engineers could use among others their international customer knowledge to improve export volumes.

It follows: $5\ \%\ of\ SEs'\ foreign\ turnover = 16\ billion\ € * 0.05 \approx 1\ billion\ €$

Consequently, with a better international handling of clients, the export volumes could be increased to gain a 5 % more foreign turnover with exported products, which would be 1 billion €.

### 5.5.5 Results of Finland

| Sales Engineers' Turnover | |
|---|---|
| **SEs' turnover** | 41 billion € |
| **SEs' share of the sectors** | 82 % |
| **SEs' share of the GDP with the four sectors** | 20 % |

| Sales Engineers' Turnover in Export Market | |
|---|---|
| **SEs' foreign turnover** | 16 billion € |
| **SEs' share of exports of the four sectors** | 78 % |
| **SEs' share of the total Export with the four sectors** | 29 % |

**TABLE 5-25: SUMMARY OF SALES ENGINEERS' FIGURES IN FINLAND**

## 5.6 Summary of Europe

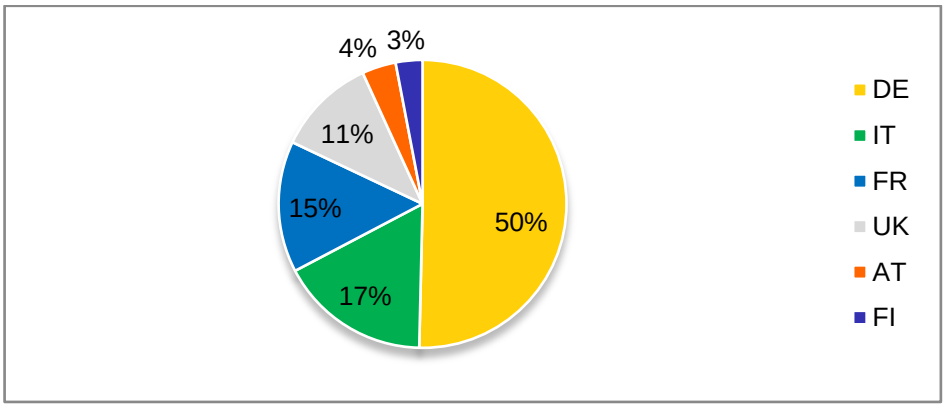



**FIGURE 5-17: THE TURNOVER OF SALES ENGINEERS CATEGORIZED IN THE SELECTED EUROPEAN COUNTRIES, 1.37 TRILLION € IN SUM**

According to figure 5-17, the highest turnover of sales engineers is reached in Germany, presenting the sum of turnovers of the five remaining countries. Italy comes in second position with a 17 % share, followed by France, the UK, Austria and finally Finland. The ranking is similar to the ranking measured in terms of the GDP, but Italy and France overtake the UK with regard to the sales engineers' turnover. All in all, sales engineers generate about 1.37 trillion € turnover in the six European countries with the four largest industry branches.

| Rank (measured In terms of GDP share) | Country | Share of the GDP in % | Share of the four industries in % |
|---|---|---|---|
| 1 | Germany | 24 | 71 |
| 2 | Finland | 20 | 82 |
| 3 | Austria | 16 | 75 |
| 4 | Italy | 14 | 79 |
| 5 | France | 9 | 70 |
| 6 | UK | 7 | 64 |

**TABLE 5-26: RANKING OF EUROPEAN COUNTRIES BY SALES ENGINEERS' SHARE OF THE GDP**

Table 5-26 illustrates the ranking of the six selected European countries in term of the GDP share of sales engineers. Sales engineers in Germany represent the first place with a 24 % share. Consequently, they generate the highest turnover and the largest share of the GDP in comparison with the other five countries. Finland comes in second position with a sales engineers' share of 20 % of the GDP, although their amount of sales engineers' turnover is the lowest in comparison, but the share of the four industries is the largest with 82 %. Also sales engineers in Austria contribute a high share of the GDP with 16 %. It follows that Finland and

Austria profit by the high sales engineers' share of industry sectors to become one of the wealthiest countries in Europe, measured in terms of the GDP per capita.

Additionally, some of the economic powers of Europe - Italy, France and the UK - represent the bottom positions. But Italy has the second largest share of the four sectors with 79 %. Consequently, sales engineers have a high percentage of sold industrial products in Europe, moving from 64 % to 82 % and show an average of about 74 %. Countries with a high industry level have a large sales engineers' share of the GDP as well and service sector oriented countries like the UK and France possess a lower percentage related to the GDP.

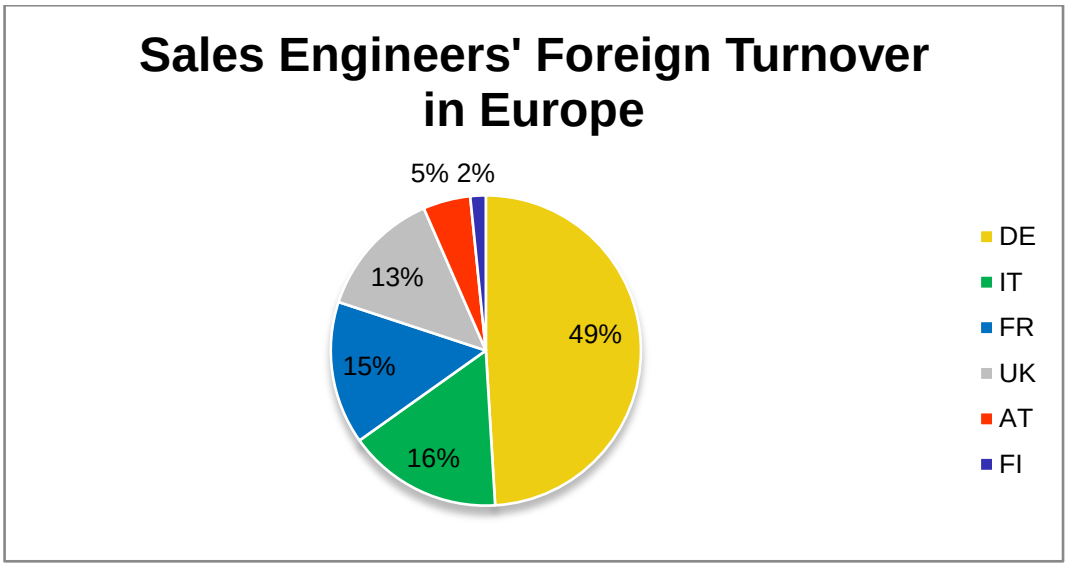



**FIGURE 5-18: FOREIGN TURNOVER OF SALES ENGINEERS IN SELECTED EUROPEAN COUNTRIES: 991 BILLION €**

Referring to figure 5-18, the sales engineers in the six listed European countries made a 991 billion € turnover with exported technical products in 2014. The ranking by the amount of foreign turnover is the same like the ranking for the turnover in domestic markets (figure 5-17).

| Rank (measured In terms of export value share) | Country | Share of the export value in % | Share of the four industries in % |
|---|---|---|---|
| 1 | Germany | 43 | 71 |
| 2 | Italy | 40 | 82 |
| 3 | Austria | 37 | 74 |
| 4 | UK | 35 | 70 |
| 4 | France | 34 | 74 |
| 6 | Finland | 29 | 78 |

**TABLE 5-27: RANKING BY SHARE OF THE EXPORT VALUE OF EUROPEAN COUNTRIES**

Table 5-27 shows that sales engineers in the economic powers of Europe – Germany and Italy contribute nearly half of the export value. The remaining countries have similar shares around one-third of the respective total export.

# 6 The Importance of Sales Engineers in the United States

The USA corresponds to the major economic powers worldwide with 22 % of the real GDP. Germany defines the fourth place with a share of 4 % [14]

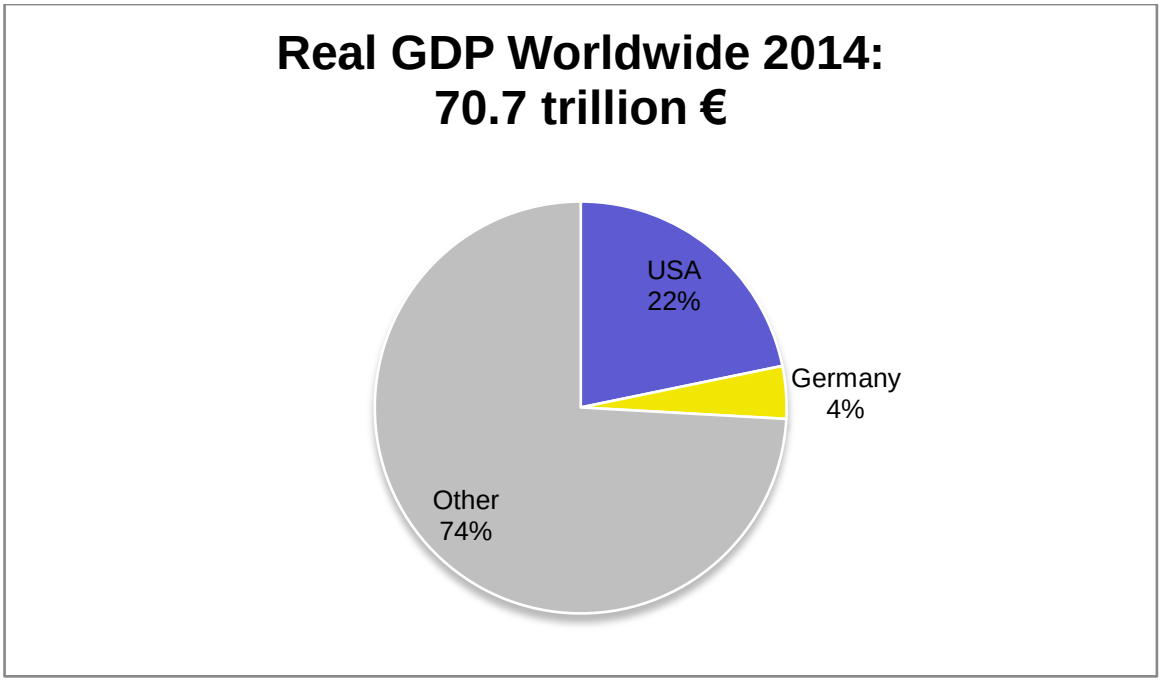



**FIGURE 6-1: SHARE OF ECONOMIC POWERS WORLDWIDE ON REAL GDP AT MARKET PRICES**[27]

(Source: Own illustration, Statista [81])

According to figure 6-1, the USA and Germany constitute more than one quarter of the global GDP, which was valued at 70.7 billion € [81] in 2014. The USA comprises 15.4 trillion €.

[27] Converted from USD-EURO = 0.8884, 12 Feb 2016

## 6.1 The USA

### 6.1.1 Economic Data of the United States

| **Data sheet:** USA **(2014)** |  |
|---|---|
| **Ranking of GDP worldwide** | 1st position |
| **GDP** | 15,412 billion € |
| **Export total** | 1439 billion € |
| **Import total** | 2084 billion € |
| **Balance of Trade** | - 645 billion € |

**TABLE 6-1: USA'S PROFILE**[28]

(Source: Own illustration, stat. Bundesamt [14]/ [82])

Referring to table 6-1, the USA is the largest economic power worldwide, represented by its real GDP value of 15.4 trillion €. Its Gross Domestic Product consists of nearly 80 % of service sector and around 20 % of industry sector [83], including 12 % manufacturing industries [73]. It follows that the share of industry turnover has a lower value than the average manufacturing share of 15 % in the EU countries. Also the negative balance of trade of -645 billion € shows a moderate export power of products and a dependency on imported foreign goods.

[28] All figures converted USD-EURO = 0.8884, 12 Feb 2016

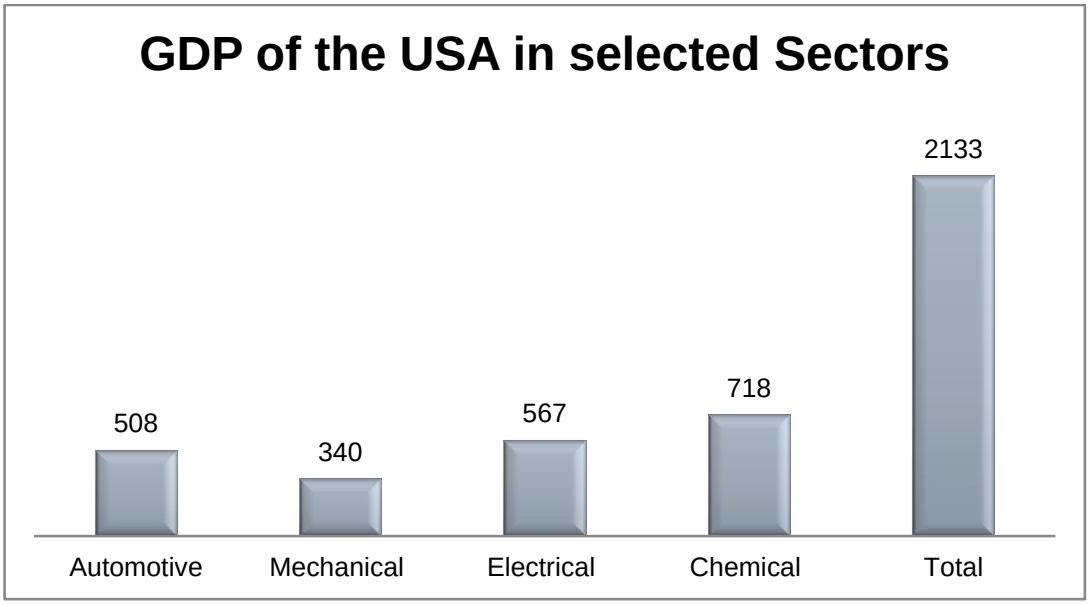



**FIGURE 6-2: TURNOVERS OF LARGEST INDUSTRIES OF THE USA IN BILLION €, 2014**[29]

(Source: Own illustration, Automotive News [84], VDMA [57], ZVEI [41], GTAI [85])

The figure 6-2 shows the greatest turnover of 718 billion €, which is made by the sale of chemical products. The United States represent the second largest chemical market leader worldwide after China [76]. Likewise, the American electrical and mechanical markets come in the second global position. In addition, the electrical and automotive sectors generate a turnover about 500 and 560 billion €. China is market leader when it comes to the automotive branch with higher sales volumes than the US, but the USA generates a larger turnover by higher prices per car [84]. Consequently, the USA has the most profitable automotive sector worldwide.

The last link forms the mechanical engineering with 340 billion € turnover. In sum, the four industries reached 2.1 trillion € or 14 % of the GDP in value terms. Furthermore, it amounts to three-quarter of Germany's GDP.

[29] Automotive turnover converted: USD-EURO = 0.8884

### 6.1.2 Sales Engineers' Turnover in the USA

Calculating the turnover of sales engineers, the US American rates related to the total output value, need to be created. They are oriented on the relation of input and output turnover.[30] So the input rate functions as reference point. The input rate of the United States amounted to 64.4 % in 2000 [45]. However, it is expected that the input rate has increased a little in the previous 16 years, as shown with Germany's development. For this reason, the adapted sales engineers' rates from Germany and other EU countries can be adopted for the USA. Every average input rate of each country moves in the same level about 70 %.

| Sector | Sales Engineers' Rate |
|---|---|
| **Automotive** | 60 % |
| **Mechanical** | 100 % |
| **Electrical and Electronic** | 50 % |
| **Chemical** | 80 % |
| Ø | 72.5 % |

**TABLE 6-2: US SALES ENGINEERS' RATES**

Every sector possesses its own sales engineers' rate, adapted on its product distribution between technical and end products. Only technical products are sold by sales engineers. It follows that the sales engineers' rate also describes the share of technical products within an industrial branch.

The turnover of sales engineers in calculated with the modified equation of the input rate.

Formula:

$$sales\ engineers'turnover = SEs' * total\ turnover$$

Automotive Industry:

$$sales\ engineers'turnover_1 = 0.6 * 508\ billion\ € \approx 305\ billion\ €$$

Mechanical Industry:

$$sales\ engineers'turnover_2 = 1.0 * 340\ billion\ € = 340\ billion\ €$$

[30] Further explanations in the chapter 4.2

Electrical and Electronic Industry:

$$sales\ engineers'turnover_3 = 0.5 * 567\ billion\ € \approx 284\ billion\ €$$

Chemical and Pharmaceutical Industry:

$$sales\ engineers'turnover_4 = 0.8 * 718\ billion\ € \approx 574\ billion\ €$$

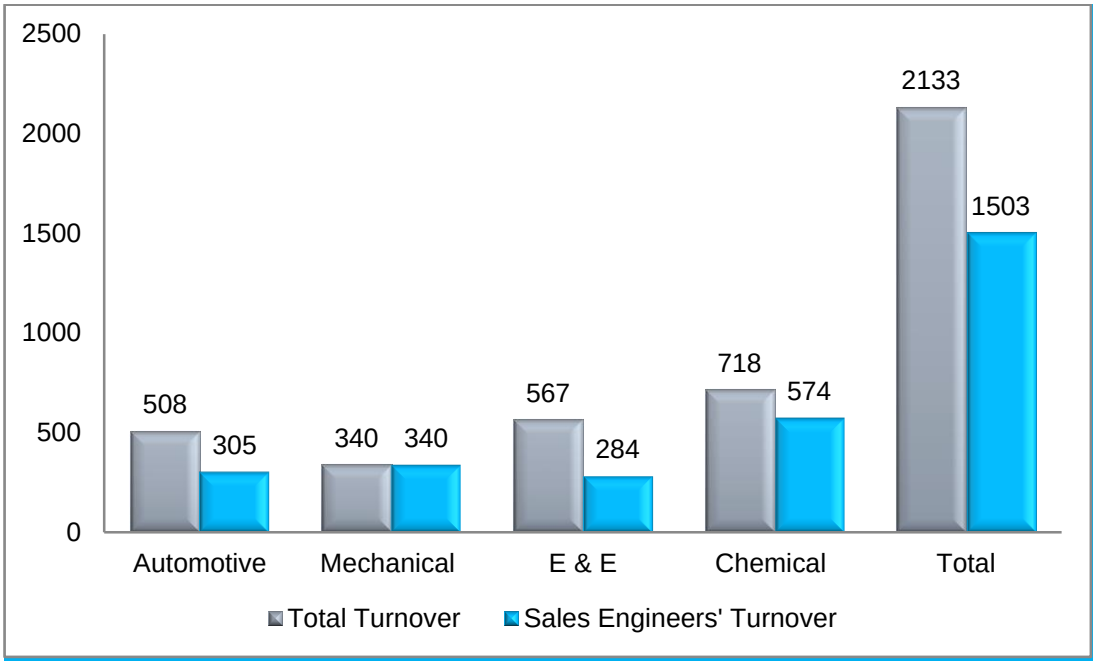



**FIGURE 6-3: SALES ENGINEERS' TURNOVER OF THE FOUR SELECTED INDUSTRIES IN THE USA IN BILLION €, 2014**

As can be seen from figure 6-3, sales engineers in the United States reached around 1.5 trillion € turnover in the four listed industry sectors in 2014, making up 71 % of the four turnovers in sum. The technical sale of chemical products makes up about one-third of the total turnover, with 574 billion €. In addition, sales engineers account for 10 % of the GDP, considering only sales engineers of these four sectors. The amount of the share of the GDP is related to the general lower impact of manufacturing sector in the US (14 % of the GDP) than in some listed countries. Though, sales engineers generate a large turnover with 10 % share of the GDP resulted in 1.5 trillion €.

### 6.1.3 The USA's International Trade

To evaluate the international economic power of the United States, the export rate is calculated at first to consider the relation between export and the GDP.

$$export\ rate = \frac{exports}{GDP} * 100$$

$$= \frac{1.4}{15.4} * 100 \approx 9\ \%$$

The result shows a less affecting role of the export value related to the development of the GDP. Export volumes are very moderate in comparison to the sales volumes within the country. The USA has the lowest export rate of 9 % of all mentioned countries, but it possesses the second largest total export value worldwide, ranked after China.

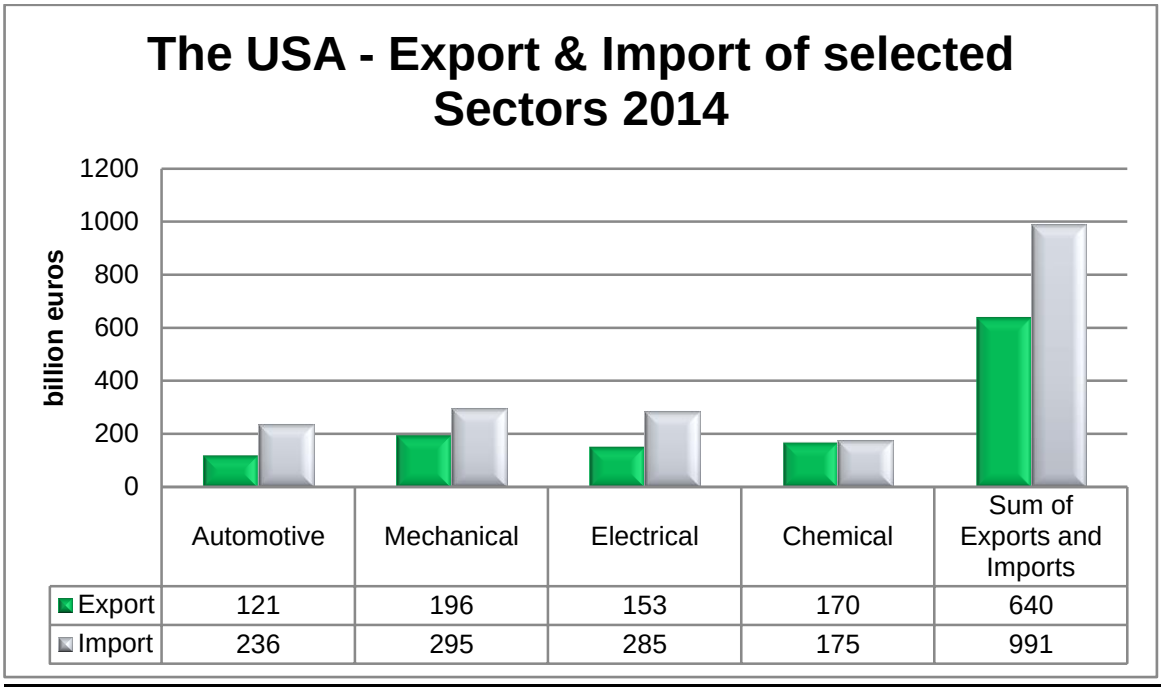



**FIGURE 6-4: EXPORT AND IMPORT VALUES OF THE FOUR INDUSTRIES, THE USA IN BILLION €[31]**

(Source: Own illustration, globalEDGE [86], Statista [87]/ [88])

Referring to figure 6-4, the four industries represent the negative balance of trade of the USA with their respective import surplus. In sum, the import value of 991 billion € make up 50 % more than the export value of 640 billion €.

[31] All figures converted: USD-EURO = 0.8884

The mechanical engineering is the largest export sector of the four, accounting for 196 billion €, although it has the lowest domestic turnover as described in figure 6-2. Furthermore, the chemical sector as greatest market comes in second position as export power of 170 billion €. In total the sectors reach 44 % of the total export of US.

The foreign turnover of sales engineers is calculated with the four export values and the sales engineers' rates.

| Sector | Export Value in billion € | SEs' rate | Sales Engineers' foreign turnover in billion €[32] |
|---|---|---|---|
| **Automotive** | 121 | 60 % | 73 |
| **Mechanical** | 196 | 100 % | 196 |
| **Electrical** | 153 | 50 % | 77 |
| **Chemical** | 170 | 80 % | 136 |
| **Total** | 640 | | 482 |

**TABLE 6-3: FOREIGN TURNOVER OF SALES ENGINEERS OF THE USA IN BILLION €, 2014**

In 2014, sales engineers generated a 482 billion € turnover with exported products, showing in table 6-3, and contributed 75 % of the total export value of the four industry sectors. Furthermore, sales engineers of these selected branches account for 33 % of the entire export of the US.

[32] All results are rounded up

To expand the consideration, the export values of the remaining sectors are included to calculate the total foreign turnover of sales engineers'.

| **Sales Engineers' Foreign Turnover** | **482** |
|---|---|
| Total Export of the USA | 1439 |
| Export of remaining sectors | 1439 – 482 = 957 |
| SE's share of remaining sectors (30 %) | 287 |
| **Total SEs' Foreign Turnover** | **482 + 287 = 769** |
| Relation to total Export | 53 % |

**TABLE 6-4: FURTHER OUTLOOK WITH REMAINING SECTORS, USA IN BILLION €**

The foreign turnover of sales engineers is not only based on the four selected industries. If remaining sectors are considered in the calculation of the sales engineers' foreign turnover, their share of the total export of US will increase about 20 %. Consequently, sales engineers have a domestic influence on the GDP of 10 % and on the export of 33 % up to 53 %.

### 6.1.4 Sales Engineering Potentials in the USA

As referred in the description in chapter 4.4 about Germany, financial potentials will exist if the training of sales engineers is improved. This will result in estimated 5 % less operating costs by a more efficient and target-oriented sales process. Additionally, international sales competence could increase export volumes to reach an approximated 5 % higher foreign turnover.

For the USA follows: $5\ \%\ of\ SEs'foreign\ turnover$

$$= 482\ billion\ € * 0.05 = 24\ billion\ €$$

Ergo, exporting companies could achieve a 24 billion € more turnover by sold exported technical products if sales engineers received a more intensive training.

### 6.1.5 Results of the USA

| Sales Engineers' Turnover | |
|---|---|
| **SEs' turnover** | 1.5 trillion € |
| **SEs' share of the four sectors** | 71 % |
| **SEs' share of the GDP with the four sectors** | 10 % |

| Sales Engineers' Turnover in Export Market | |
|---|---|
| **SEs' foreign turnover** | 482 billion € |
| **SEs' share of exports of the four sectors** | 75 % |
| **SEs' share of the total Export with the four sectors** | 33 % |

**TABLE 6-5: SUMMARY OF SALES ENGINEERS' FIGURES IN THE USA**

## 6.2 Summary of the selected Countries Worldwide

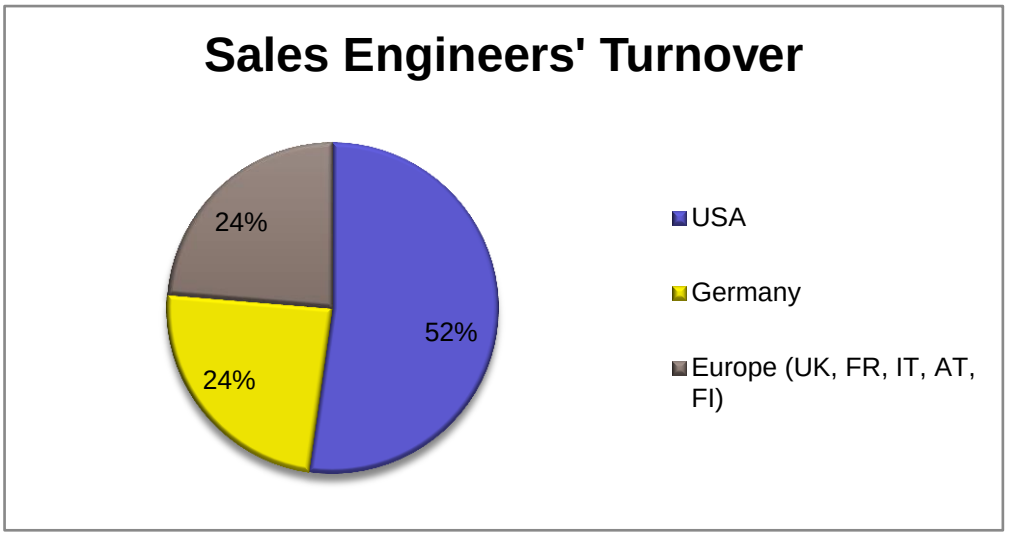



**FIGURE 6-5: TURNOVER OF SALES ENGINEERS WORLDWIDE: 2.9 TRILLION €**

Figure 6-11 shows the total turnovers of sales engineers which are generated in the automotive, mechanical, electrical and chemical industry and categorized by country. In sum, their total turnover resulted in 2.9 trillion € in 2014. Sales engineers in the USA contribute the largest turnover that amounts to more than the half of the total sum. Germany and the remaining European countries have similar sales engineers' shares of 24 %. The ranking of the sales engineers' turnover is comparable with the country ranking measured in terms of the GDP.

| Rank (measured in terms of the GDP share) | Country | Share of the GDP in % | Share of the four selected Industries in % | SEs' Turnover in billion € |
|---|---|---|---|---|
| **1** | Germany | 24 | 71 | 690 |
| **2** | Finland | 20 | 82 | 41 |
| **3** | Austria | 16 | 75 | 52 |
| **4** | Italy | 14 | 79 | 231 |
| **5** | USA | 10 | 71 | 1500 |
| **6** | France | 9 | 70 | 201 |
| **7** | UK | 7 | 64 | 152 |

**TABLE 6-6: WORLDWIDE RANKING BY SALES ENGINEERS' SHARE OF THE GDP**

Table 6-16 ranks the countries by the share of sales engineers' turnover which is generated in the four selected industry sectors, of the GDP. The top 5 are presented by Germany, Finland, Austria and Italy, which have a share between 14 and 24 %. This ranking reflects the importance of industry in the respective country. These five states possess a high above-average manufacturing share, which contribute to the respective GDP. It follows that countries with a high industry level, have greater interrelationships of sales engineers. Consequently, sales engineers in market leader countries like Germany contribute around 25 % of the GDP, considering only the turnover of the four selected industries. Thus, normally the share of the GDP is higher. Furthermore, it follows that they are essential for the profitability of the respective country, because the GDPs are based on the turnover of industrial products to at least one quarter. Similarly, the wealthiest countries in Europe measured in terms of the GDP per capita profit from the high sales engineers' industrial influence: Finland and Austria have a sales engineers' share of the GDP of 16 % and 20 %.

The USA has with a 10 % share of the GDP the second largest sales engineers' turnover of 1.5 trillion €. France and the United Kingdom follow the USA with 7 and 9 % share of the GDP. Sales engineers have in these two countries a smaller share in comparison with the previous states, because of their high growth of service sector, which shows a larger relation to the GDP than in other countries.

Sales engineers in Germany and the USA have additionally the similar percentage of around 70 % on average of the turnover of the four industry sectors.

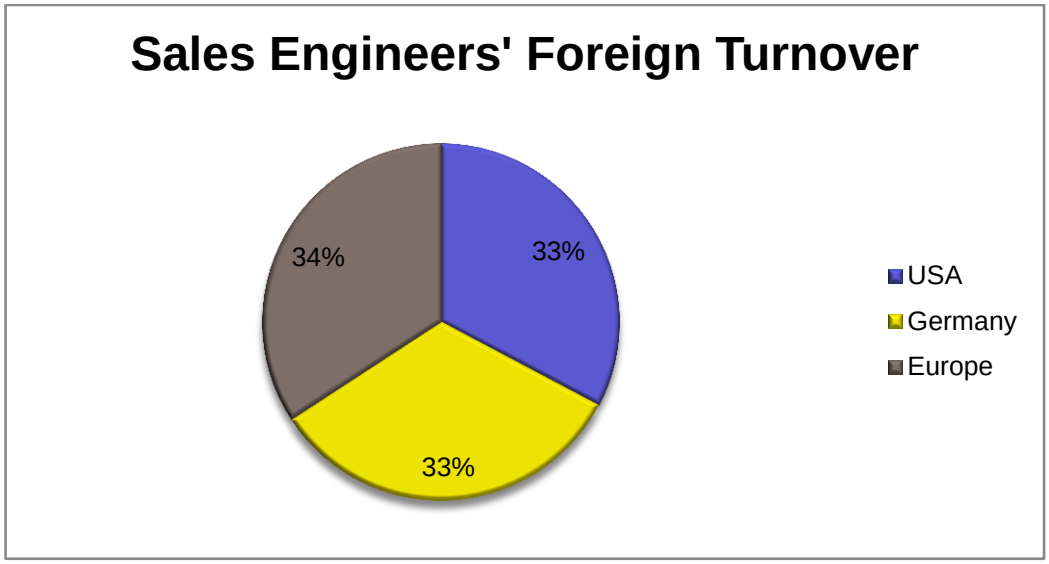



**FIGURE 6-6: FOREIGN TURNOVER OF SALES ENGINEERS WORLDWIDE: 1.5 TRILLION €**

Referring to figure 6-12, Germany's sales engineers overtake the USA related to the ranking of the sales engineers' turnover in domestic markets and generate the same amount of 33 % like in the remaining European countries. In sum, they achieved 1.5 trillion € turnover in 2014.

| Rank (measured in terms of the GDP share) | Country | Share of the total Export in % | Share of the four selected Sectors in % | SEs' Foreign Turnover in billion € |
|---|---|---|---|---|
| 1 | Germany | 43 | 71 | 487 |
| 2 | Italy | 40 | 82 | 160 |
| 3 | Austria | 37 | 74 | 49 |
| 4 | UK | 35 | 70 | 133 |
| 5 | France | 34 | 74 | 148 |
| 6 | USA | 33 | 75 | 482 |
| 7 | Finland | 29 | 78 | 16 |

**TABLE 6-7: RANKING OF THE SHARE OF THE TOTAL EXPORT VALUE WORLDWIDE**

As table 6-17 illustrates, sales engineers contribute around three quarter of the foreign turnover of the four sectors in every country. This high share represents at least one third to nearly two-third of the total export value in the listed countries worldwide. Germany generates the highest share of nearly 43 % of the total export with sales engineers, who sell technical exported automotive, electrical, chemical and mechanical products in international trade.

# 7 Conclusion

The calculated results reflect the high importance of sales engineers worldwide. Generally, around 70 % of the turnover of the four largest industry sectors is generated by sales engineers. This amounts to around 10 to 30 % of the respective GDP in a country. Consequently, they are the essence for an efficient value added chain to produce high-value end products which are offered to end customers. Thereby, sales engineers form an important link within the industry process by representing the individual companies in the B2B sector as sales representatives. Ergo, they strengthen the synergy effect of the industry; interrelationships arise between different branches and international sectors. They support thereby the manufacturing sectors, which contribute in average around 15 % of the GDP. Also the EU's Industry Commissioner Antonio Tajani said that "Industry is at the heart of Europe and indispensable for finding solutions to the challenges of our society, today and in the future." [89] It follows as well from a political perspective that the industry is seen as an important factor for the economy of each state, because it gives competitive ability and profitability by developing continuously innovative products and concepts. This is the reason why the EU commission pursues the goal to increase the industry share from 16 % to 20 % in 2020 [18].

Furthermore, around 30 to 60% (depend on the respective country) of the total export value is generated by sales engineers. It follows that they also have currently in international trade a great position. The growing globalization raises the interdependency between countries, which is reflected by the export and import values. Input products are increasingly demanded by foreign countries, as the statistics of WIOD (World Input Output Database) confirmed that exports of inputs would have grown faster than end products [90]. This suggests growing export and import volumes of technical products which are sold by sales engineers and currently contribute nearly half of the total export. Consequently, sales engineers are decisive for the growing internationalization to strengthen the competitive ability of the respective country.

Measurements in researches for the education of sales engineering could support the objective of a national and international competitiveness by developing a more efficient and target-oriented customer handling and sales process inland and abroad.

Summed up, if researches were set up to investigate and deepening sales knowledge, every country could profit from this mature education of sales engineering. It would then be possible to generate higher export volumes of at least 5 %, with better trained sales engineers in the respective countries.

# 8 Outlook: Formation to a Sales Engineer

Referring to the necessary researches for education of sales engineering, the outlook comprises the current training standards at universities and in companies to show the potential of improvement.

## 8.1 Sales Engineering at Universities

About 30 years ago, the first degree program of sales engineering had been established in the German city of Furtwangen as Mr. Moll expert of technical sales department of the VDI said [4]. It follows that this branch of formation offers a relatively new professional specialization in Germany, because it entered higher education institutions later than the general engineering study. The first engineering school was established for around 300 years ago in Vienna [91]. This historic development is based on the continuously advancement of technology, because companies and their employees need to adapt to the new technical demands, which includes the sale as well [6]. This means that also sales persons need an engineering formation to support the competitiveness of the company.

But there are currently two different directions of education in universities according to the research of the AASE. The first one describes a specialized education, focused on “mechanical, electrical or information technology engineering” [37]. This means their future career is based on their form of technical specialization. The other type of study contains versatile technical subjects to learn the general technical thinking [37]. The second type concentrates on basic knowledge and has the opportunity to work in every industry sector.

Engineering gives students the technical thinking for understanding complex products and their structure and appliances. In other words, it represents the precondition to work in the industry with B2B clients. Furthermore, the business management teaches economic procedures within a company and on market level. Subjects like law, marketing, technical sales and finance management support the comprehensive thinking of sales engineering students, to understand the complex composition of the sales process in the industry. The technical sale is composed of different branches like customer acquisition, consulting in technical realization, market management and turnover calculation. Universities give sales

engineering students this interdisciplinary skill that they are able to manage their different tasks in the profession.

Furthermore, a professional representation of the company as a sales engineer is essential to making a positive impression in front of customers. Educational objectives contain, on the one hand, presentation techniques to receive a competence in form and content structure and, on the other hand, role-playing games to practice sales conversations. Regular presentations intensify a self-confident performance, a hands-free talking and improvisation strength with unknown audience and unexpected happenings.

In addition, several universities, as the University of Aalen, attach importance to a development of an international competence in form of foreign languages as subjects and a practice-oriented semester, an internship abroad. A second foreign language represents a supporting fact to work with different clients all over the world. Likewise, the internship strengthens the openness to other cultures and languages with finding out their mentality in business and private life.

Every subject prepares sales engineering students for the following professional life to practice circumstances in theory and become a well-educated sales engineer after study. Nevertheless, technical sales knowledge in theory has not been sufficiently researched in scientific terms. There is a lack of in-depth knowledge of topics like intercultural competence, sales conversations, dealing with different types of clients, analysis of clients' personality. Moreover, the psychological and communicative actions between sales engineer and customer are at the center of sales competence and could be improved by research and science.

Research for sales engineering is not promoted currently. This is why universities with sales engineering degree programs have joined the AASE. Their aim is to support "research", "professionalization" and "further development of the "Sales Engineer's" job profile" [37].

## 8.2 Sales Engineering in Companies

"[T]he wish of companies for an […] academic formation of sales has existed already for a long time", reported Dieter Moll [4]. He points out that this type of degree program is an important need in the industry, which did not exist in institutionalized form before. It is the kind of combination of two formations with the specialization on technical sales, which makes this study degree attractive for enterprises.

Before sales engineering was established as course of study at universities, 70 to 90 % of the general engineers were trained as sales engineer in some companies [92]. This was the reason why universities did not attach any importance to this branch of teaching, because it was handled by companies of themselves and likewise the training contained many internal practical tasks [92]. But many theoretical and economic contents were excluded to limit the training. This means that the training was not complete and a lack of specific profound sales knowledge existed.

But there are still companies without sales training, generating difficulties in sales process. General engineers do not have sufficient knowledge of marketing and sales and do not have skills for conducting a sales conversation at individual level. This makes the whole sales process difficult and requires high efforts. On the other hand, economical sales persons need more efforts to work into the technical structure to be able to give competent product solutions to the customer. This additional work consumes unnecessary costs, which can be avoided with well-educated sales engineers, who are specialized in these situations. As illustrated in the main chapter, the training of sales engineering can still be improved to professionalize their sales processes continuously.

Sales engineers are responsible for the market investigations and financial pre-planning for expected sales. But the sales have to be generated successfully as well. This is the precondition to advance the economy of the company and to stay competitive [37].

For this reason, further researches of sales actions and knowledge would support the professionalization of the technical sales and the company's existence.

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## Appendix

see digital version

## Affidavit - Eidesstattliche Erklärung

Ich erkläre hiermit, dass ich die vorliegende Arbeit selbständig und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht.
Die Arbeit wurde bisher in gleicher oder ähnlicher Form keiner anderen Prüfungsbehörde vorgelegt und auch noch nicht veröffentlicht.

I affirm that this Bachelor thesis was written by myself without any unauthorized third-party support. All used references and resources are clearly indicated. All quotes and citations are properly referenced. This thesis was never presented in the past in the same or similar form to any examination board.

Aalen, den 21.03.16 Unterschrift

## Vermerk

Ich bin mit einer Veröffentlichung dieser Arbeit durch die Hochschule Aalen und andere Organe einverstanden.