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POLISH, EUROPEAN AND WORLD FLUID POWER MARKET - AT THE TURN OF THE SECOND AND THIRD DECADES OF THE 21ST CENTURY

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Abstract: *(The article describes the fluid power market in Poland, Europe and world. It contains historical and current data as well as a forecast related to the future of the industry. Due to the current policy of the European Union, especially in the field of ecology, fluid power drives and controls are increasingly being replaced by electric drives - commonly considered as ecological. The described situation forces a change in approach in many areas, mainly drive system design as well as management and marketing. The article ends with the authors' forecast for the future of fluid power in Poland, Europe and the world.*

Keywords*: Fluid power market, statistics, analysis, forecast.*

1. Introduction

The world hydraulics and pneumatics market in 2001 was as follows: the production of hydraulics and pneumatics was the domain of global companies and concerns located in six technologically and economically developed countries. Their total sales covered 88% of the global fluid power sector (Table 1) [1], including: - almost 70% in hydraulics, - almost 80% in pneumatics.

Table 1: Share of various countries in the hydraulics and pneumatics market in 2001 [1].

Country	Share in%	GDP at current prices per capita in thousand USD
USA	39	35,475
Japan	23	32,524
Germany	11,5	22,511
Italy	6,7	18,933
France	4,3	22,031
UK	3,8	23,918
Sweden	1,8	23,752
Spain	1,5	14,574
Others, including Poland	8,4 0,35-0,45	- 4,737

The largest producers of hydraulic and pneumatic drives and controls in 2001 were:

- PARKER HANNFIN - annual turnover around 6.6 billion USD [1]. 44 thousand employees in 44 countries.

- BOSCH - total turnover amounted to 35 billion EUR, including 0.5 billion EUR in Poland. 224 thousand employees, including 16 thousand in the area of R&D and production development.

- BOSCH – REXROTH - sales in the area of hydraulics and pneumatics approx. 3.9 billion EUR, over 20 thousand employees.

SAUER - DANFOSS, turnover amounted to approx. 950 million USD, approx. 7.2 thousand employees in 28 modern factories in 10 countries on 3 continents.

Countries associated in the CETOP- European Oil Hydraulic and Pneumatic Committee- 16 national associations of producers of hydraulics and pneumatics from 14 countries: Belgium, Czech Republic, Finland, France, Spain, the Netherlands, Germany, Norway, Slovenia, Switzerland, Sweden, Turkey, United Kingdom and Italy had a global market share of 35%.

The macroeconomic situation in the countries associated in CETOP is presented in Table 2. It can be clearly seen that expenditure on R&D in the countries that joined the EU are on average 3 times lower (0.5-0.6% of GDP) in relative to the average of the more prosperous countries (1.8% of GDP).

Table 2: Selected macroeconomic data for CETOP countries in 2014.

Country	Population (million)	GDP per capita (in current prices in thousands of EURO)	R&D expenditure to GDP in%	R&D employees per 1000 employees	Growth rate of expenditure on R&D in% (2011-2015)
Belgium	10,449	37,407	2,45	10,4	5,4
Czech Rep.	10,627	16,510	1.9	7,4	6,2
Finland	5,268	38,959	2,9	16	-4,1
France	66,259	33,431	2.2	10,3	1,9
Spain	47,737	23,970	1.2	7,1	-1,8
Netherlands	16,877	40,941	2,0	9,5	2,7
Germany	80,996	37,997	2.87	9,0	3,6
Norway	5,147				
Poland	38,346	11,041	$1{,}0^{2015}$	5,0	11,1
Romania	21,729	8,582	0.5	2.2	4,4
Slovakia	5,443	14,907	1,17	6,3	18,6
Slovenia	1,988	19,262	2,2	9,6	-1,2
Switzerland	8,061				
Sweden	9,723	46,564	3.25	14,5	2,6
Turkey	81,619				
UK	63,742	36,096	1.7	9,4	8,6
Italy	61,680	27,588	1.3	5,4	2,5

The shares of the associated countries in CETOP in the hydraulics and pneumatics market in 2009 are presented in Fig. 1.

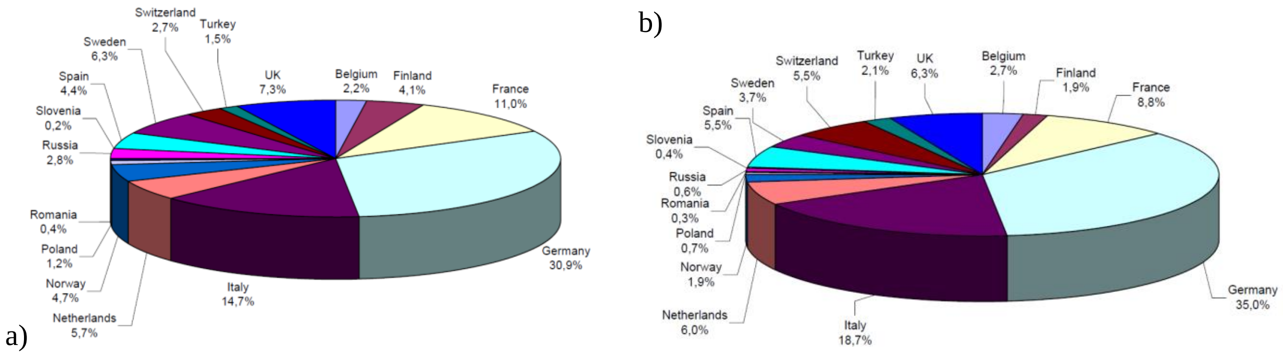

Fig. 1. Share of associated countries in CETOP a) in the hydraulics market with the value of domestic sales in 2009 around 6.1 billion EUR, b) in the pneumatics market with the value of domestic sales in 2009 2.2 billion EUR [3].

2. Global crisis 2008-2009

The situation on the hydraulics and pneumatics market in the years 1980–2009 in Germany is presented in Fig. 2. Until the global crisis of 2008–2009 one can notice a monotonic growth of the market. The largest decreases at that time concerned the fluid power industry and were respectively 44% for hydraulics and 33% for pneumatics. Due to the very strong links between the German economy and Poland (up to 70% of Polish exports go to Germany), this was a very big blow to this industry in Poland.

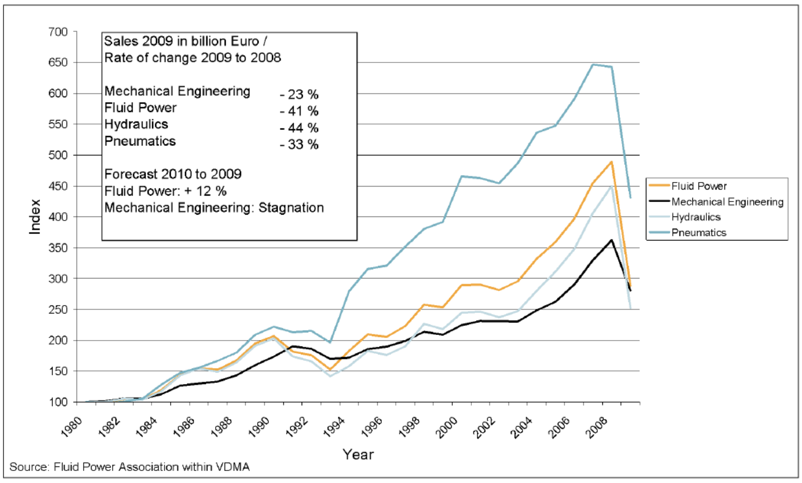

Fig. 2. Sales development of machinery and equipment for fluid power products (hydraulics and pneumatics) in Germany in the years 1980–2009 [3].

Other countries associated in CETOP had similar decreases - from 29% to even 55%, except China. China market growth was at the level of 5% (Fig. 3).

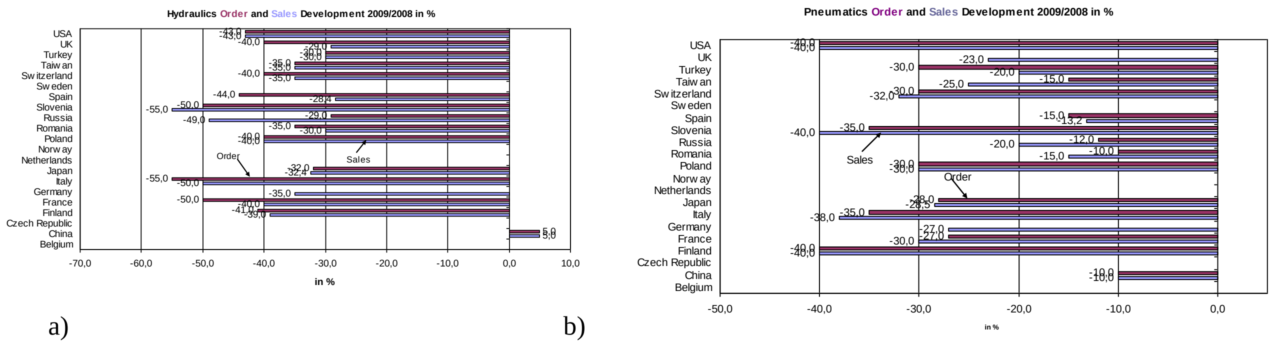

Fig. 3. Dynamics of product orders and sales 2009 to 2008: a) hydraulics, b) pneumatics [3].

3. Nowadays situation in fluid power market

The development of mobile hydraulics in the years 2000 - 2017 is shown in Figure 4.

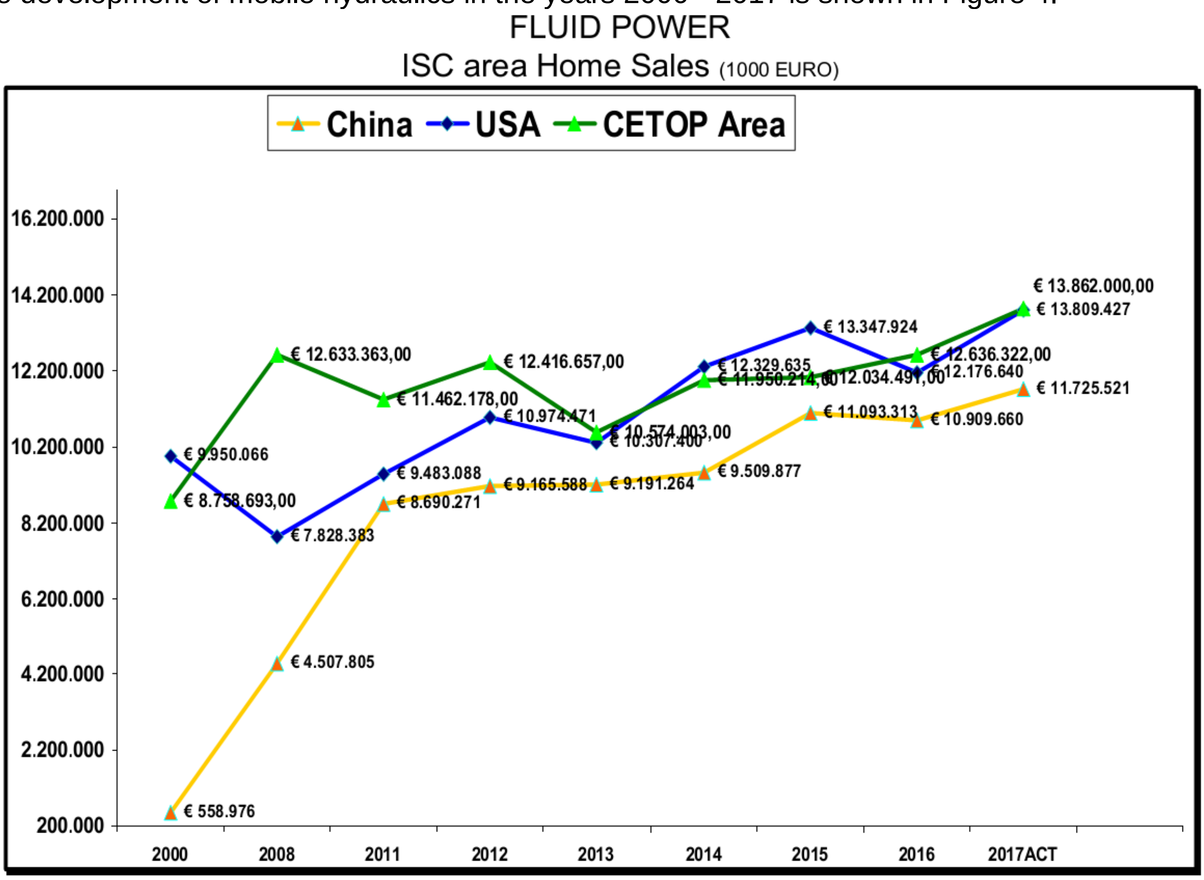

Fig. 4. The development of machine hydraulics market and its main shareholders [3].

A rapid increase in China's share in the hydraulics market in 2000-2011 is visible from 0.5 billion to 8.6 billion EUR. At that time, the US and European market has experienced a crisis, though balance has been restored and remains high today with a slight upward trend.

The years went by and the fluid technology market made up for the losses associated with the crisis and in 2017 the FP market increased from EUR 25.7 billion to EUR 43.6 billion. Figure 5 shows a global comparison of the situation in the field of hydraulics and pneumatics in 2000 and

2017. The graphs presented show that in the field of fluid technology the status quo was maintained by the CETOP countries and the USA. The Chinese market showed the highest increase (almost 14 times) (from 2 to 27%), while the Japanese market recorded a 3-fold decrease in market value (from 23 to 8%).

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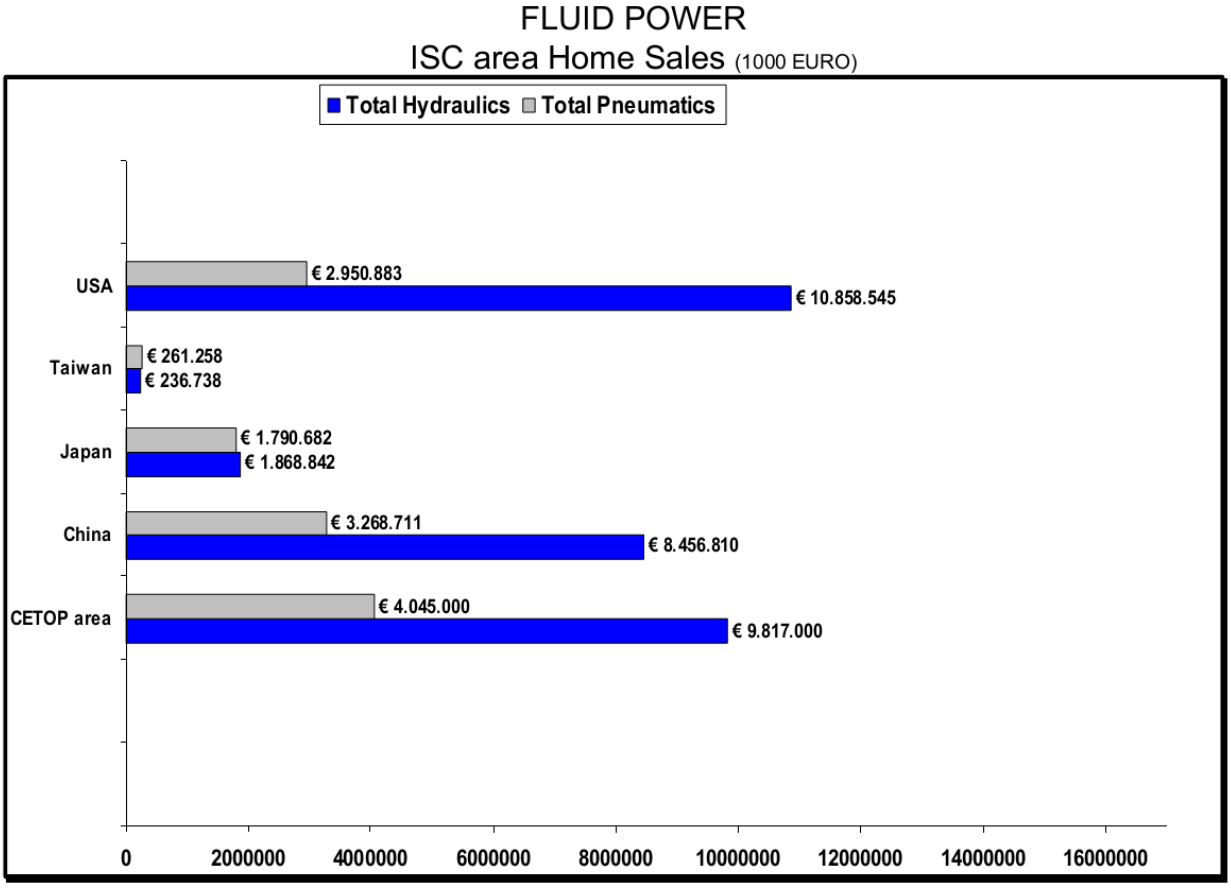


Fig. 5. Global domestic sales of fluid power products and services in 2017 [3].

Associated countries in CETOP have the largest share in the production of hydraulic and pneumatic drives and controls, they are matched by the United States with production worth 13.8 billion EUR. China's potential is 11.7 billion EUR, followed by Japan (3.66 billion EUR) and Taiwan (0.49 billion EUR).

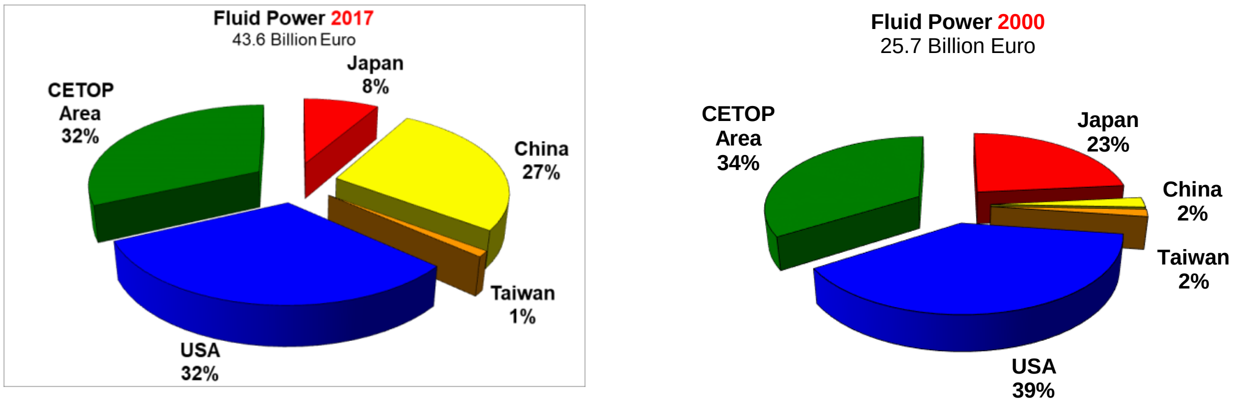


Fig. 6. Global Fluid Power Home Market 2017 and 2000 [3].

The global development of the hydraulics area is shown in Fig. 7, while pneumatics in Fig. 8.

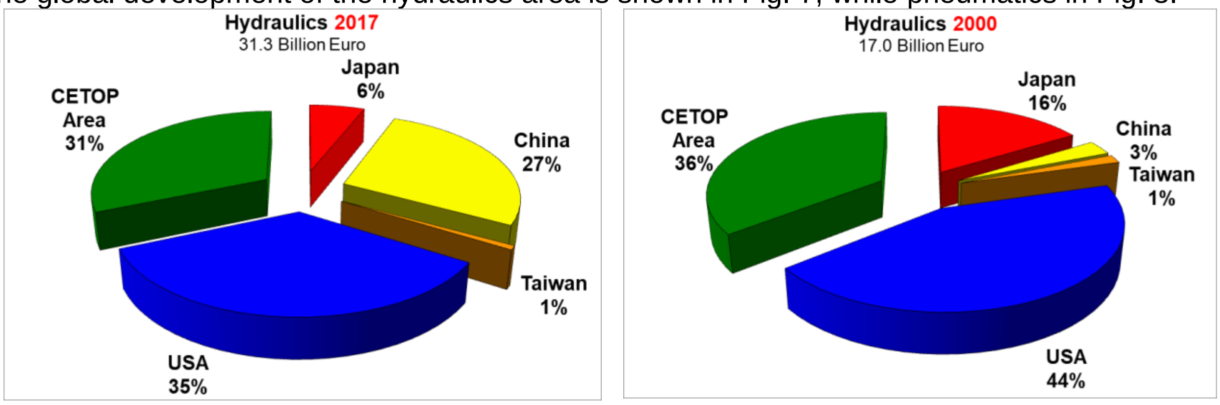


Fig. 7. Global Hydraulics Home Market 2017 and 2000.

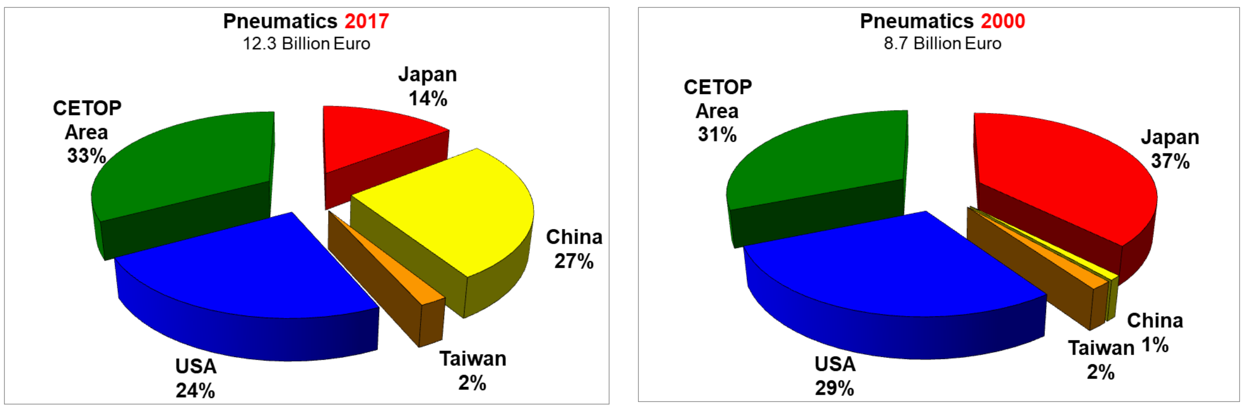


Fig. 8. Global Pneumatics Home Market in 2017 and 2000 [3].

On the European market, Germany still has the largest market share in the fluid technology market, with a 33% market share in 2017, followed by Italy (18%), France (10%) - Figure 9.

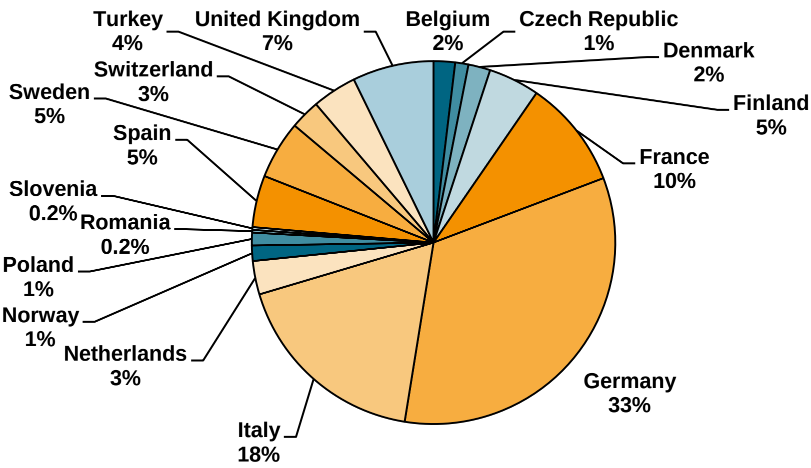
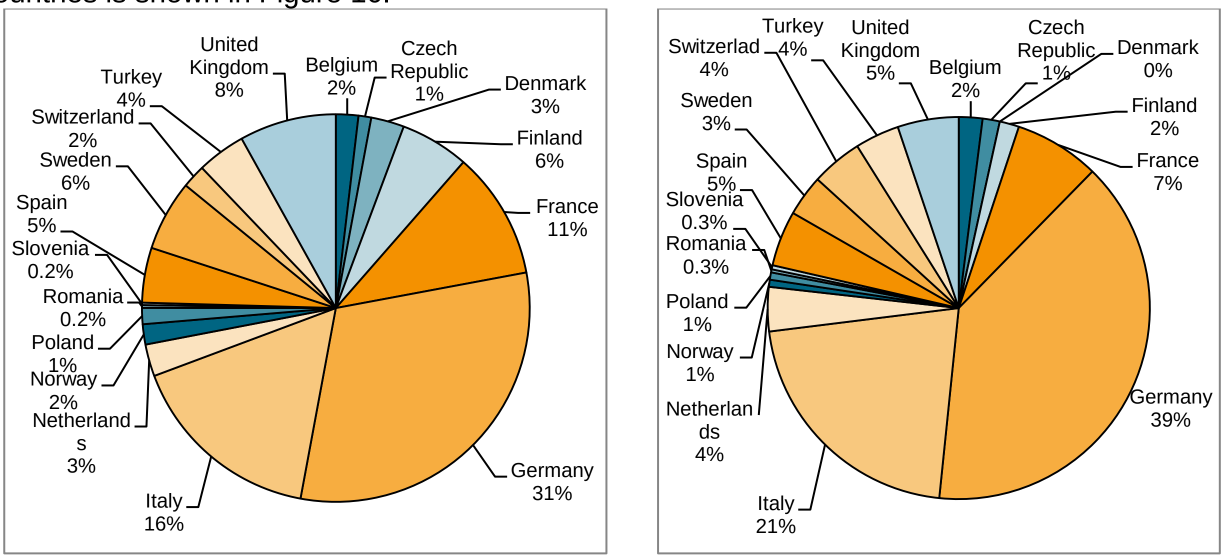


Fig. 9. European fluid power home market in 2017 (13.9 billion Euro) [3].

With a breakdown into hydraulics and pneumatics, the share of individual CETOP member countries is shown in Figure 10.



a) Hydraulics b) Pneumatics

Fig. 10. Home Market of European Fluid Power Industry in 2017 [3]

At present, patent applications are a very important factor influencing the assessment of the potential and possibilities of markets. For several years, the Polish government has been supporting the innovative activity of entrepreneurs and scientists through appropriate financial incentives. As a result of these activities, the number of patent claims increases every year (Fig. 11).

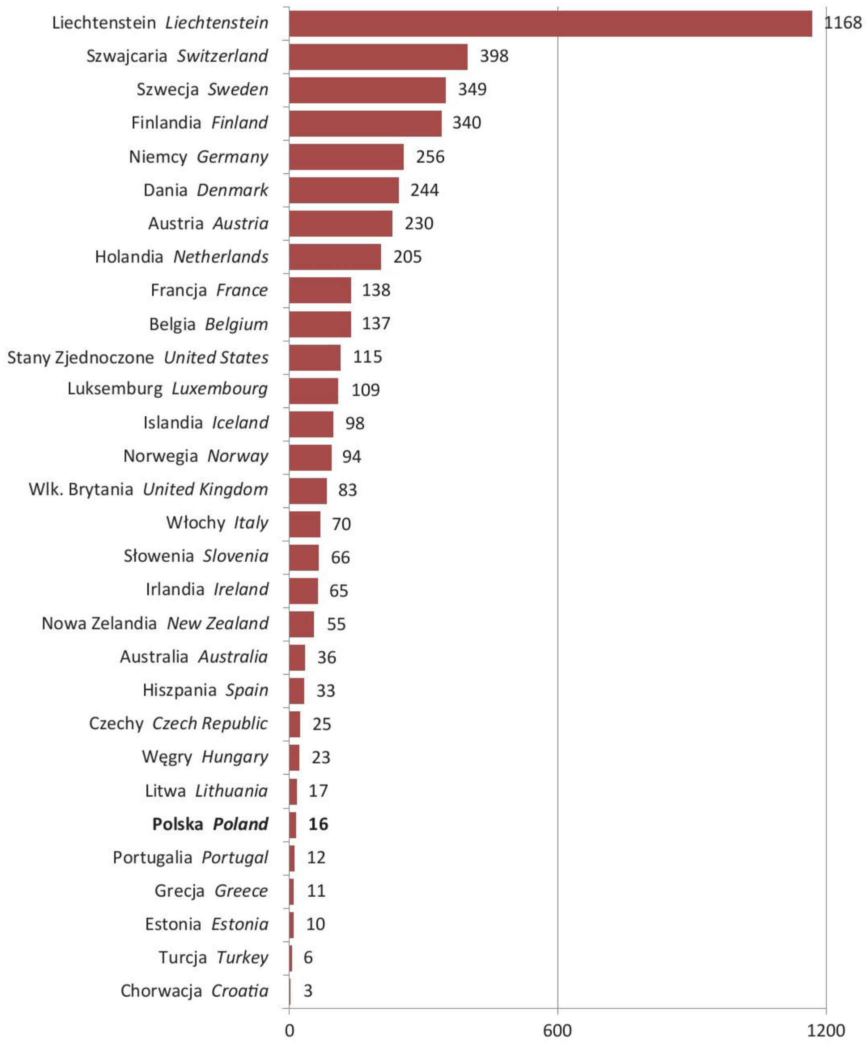


Fig. 11. Patent applications to the European Patent Office per million inhabitants in 2014 [2].

The highest number of applications for inventions per national sum of research and development expenditure was recorded in Finland (284.53 applications per 1 billion EUR), for Poland, according to the estimated data, the number of applications was 157.28 per 1 billion EUR of expenditure and placed Poland on 10th position. In the entire European Union, in 2014 this indicator amounted to 199.86 applications per 1 billion Euro of expenditure.

An analogous number of notifications per total research and development expenditure in the enterprise sector places Poland 9th among European Union countries with a value of 337.62 notifications per 1 billion EUR. The highest number of applications per total domestic research and development expenditure in the enterprise sector was recorded in the Netherlands - 469.57.

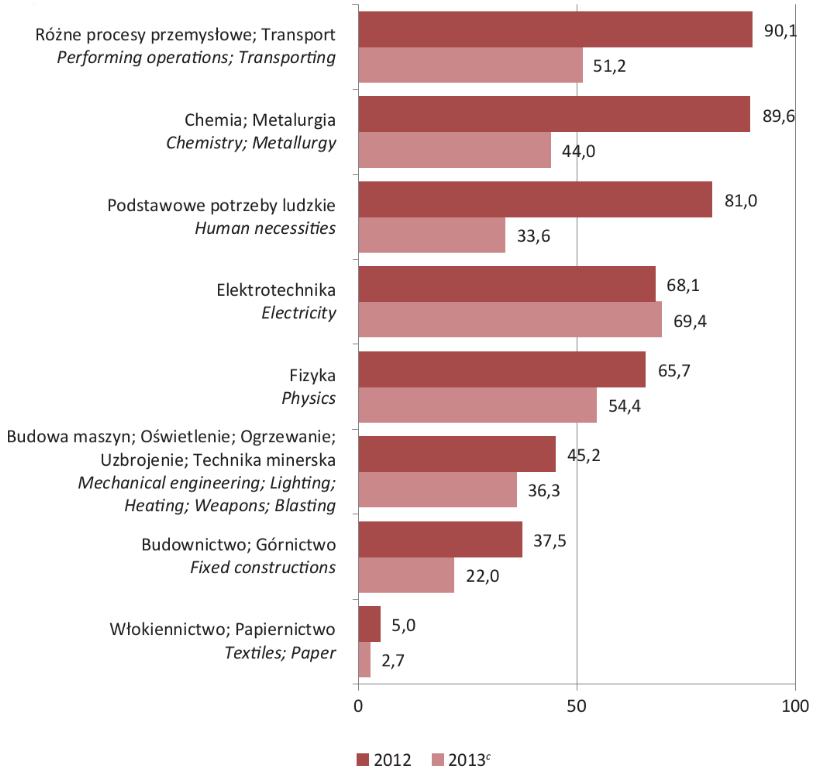


Fig. 12. Applications for inventions made by Polish entities in the European Patent Office by divisions of the International Patent Classification [2].

An interesting situation can be observed in the area of applications to the European Patent Office (Fig. 13), which shows that the number of applications for patent protection of inventions is decreasing each year. According to the authors, this is due to the increasing use of inventors by another form of intellectual property protection - **know how**.

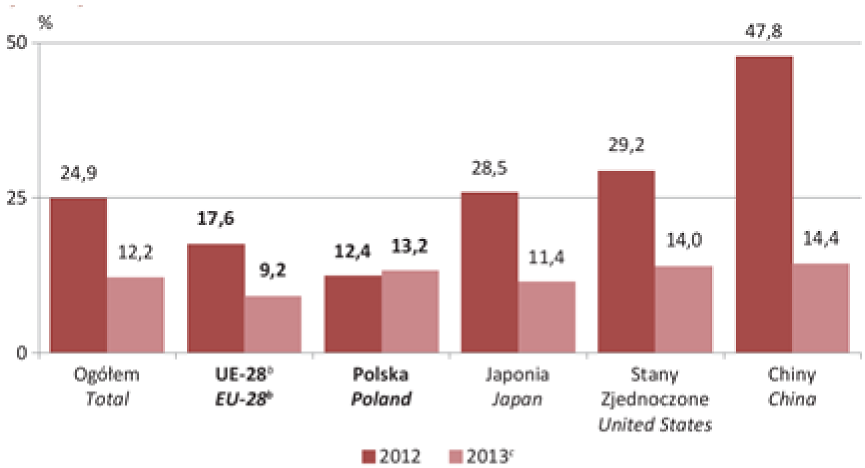


Fig. 13. Percentage of high-tech application to the European Patent Office in 2013 to 2012 [2].

4. Conclusions

The hydraulics and pneumatics market in the last two decades, despite the waves of crisis in 2009 and 2013, the displacement of fluid technology drives by electric drives and unfavourable proecological policy, especially of European countries, is doing well. The reduction of market shares of countries such as Japan, the United States or Germany to China, Brazil or India is due to the globalization of the market and cheap labour. The interest of major players is shifting towards high-technology…

References

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