10 The financing of research and development in the business sector in Poland in the years 2000–2012

Introduction

Companies play a special role in the financing of research and development, as they mainly finance the areas of research where results can be used in business practice. New solutions, if proven to be beneficial, are immediately commercialized so that businesses may gain an edge in the market and reap high profits. Innovation increases their competitiveness and, consequently, the competitiveness of the entire economy.[1]

The purpose of this article is to present and evaluate trends in business expenditure on research and development (BERD) in Poland in the period 2000–2012.

1. Size and growth of business expenditure on R&D

Although spending on research and development activities in Poland had been steadily growing since 2000, it was also remaining at a relatively low level. In 2012, 14.4 billion zlotys were spent on R&D in total, of which 5.3 billion zlotys (37%) was spent by the business sector.[2]

In the years 2000–2012, corporate spending on R&D also showed a growing trend (cf. Table 1). The increase was systematic, with the only exception of 2002, when entrepreneurs cut their spending on R&D by nearly a half compared to a year earlier. The drop was due to a situation in large companies, which will be elaborated on later in this paper. Nonetheless, in the years 2000–2012 corporate expenditure on R&D tripled.

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[1] K. Rychlik, *Innowacyjność i działalność innowacyjna*, in: P. Niedzielski, J. Markiewicz, K. Rychlik, T. Rzewuski, *Innowacyjność w działalności przedsiębiorstw*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2007, p. 86.

[2] *Nauka i technika w 2012 r.*, GUS, Warszawa 2013, p. 53.

Table 1

Expenditure on R&D in business sector in Poland in 2000–2012

Year	BERD	BERD dynamics	
	mln zl	year 2000 = 100	previous year = 100
2000	1,730.7	.	.
2001	1,740.7	100.6	100.6
2002	919.9	53.2	52.8
2003	1,249.7	72.2	135.9
2004	1,478.6	85.4	118.3
2005	1,770.1	102.3	119.7
2006	1,858.3	107.4	105.0
2007	2,025.7	117.0	109.0
2008	2,383.7	137.7	117.7
2009	2,584.7	149.3	108.4
2010	2,773.5	160.3	107.3
2011	3,521.6	203.5	127.0
2012	5,341.1	308.6	151.7

Source: own study based on Eurostat, http://epp.eurostat.ec.europa.eu (July 2014).

Despite the favorable trend growth, business expenditure on R&D remained at a very low level. In 2012, companies spent on R&D only PLN 139 per 1 inhabitant (cf. Table 2). It was up to ten times less than the average in the European Union, where business expenditure on R&D amounted to 336 euro per capita, compared with 33 euro in Poland.[3] Furthermore, the national total expenditure on R&D in Poland per 1 inhabitant was also less than the average expenditure per capita in the EU; in 2012, it was more than three times lower.

The level of expenditure on R&D per 1 employee in R&D differed significantly between business and total expenditure. In 2000–2003, private spending per employee was two times higher (2.3 – cf. Table 2). In 2004 the trend reversed and national expenditure per employee in R&D started to grow faster than in the corporate sector. As a result, in 2012 business expenditure on R&D per employee in R&D, which amounted to 165 thousand zlotys, remained higher than the national average only by 60%.

[3] Based on Eurostat data.

Table 2

Expenditure on R&D per capita and per one employee in the R&D sector in Poland in 2000–2012 (in zlotys)

Year	Total domestic expenditure	Business expenditure	Total domestic expenditure	Business expenditure
	on R&D per capita		on R&D per one employee in R&D sector	
2000	125	45	38,181	71,792
2001	127	46	39,228	77,468
2002	118	24	36,768	81,321
2003	119	33	36,107	83,119
2004	135	39	40,479	87,772
2005	146	46	45,163	99,027
2006	154	49	48,587	102,138
2007	175	53	54,866	109,729
2008	202	63	64,389	135,468
2009	238	68	75,006	139,570
2010	273	73	80,253	122,127
2011	303	91	86,857	131,895
2012	372	139	102,776	164,945

Source: as in Table 1.

Changes occurred also in the ratio of corporate expenditure on R&D to the gross domestic product. The aforementioned reduction of expenses on R&D in the business sector in 2002 resulted in the ratio decreasing by half (cf. Figure 1). However, from 2003 the ratio was gradually rising; the fastest growth and also the highest level of this indicator was recorded in 2012, when business spending on R&D increased to 0.33% of GDP.

This result, however, gave Poland only a very distant place in the European Union (cf. Figure 2). Only companies in Lithuania, Latvia, Greece, Romania and Cyprus spent less on R&D in relation to GDP. Also, Polish spending on R&D per GDP was far below the EU average, which was four times greater (1.31% of GDP). It is worth noting that in six EU countries (Finland, Sweden, Denmark, Germany, Austria and Slovenia) the share of corporate expenditure on R&D in GDP reached

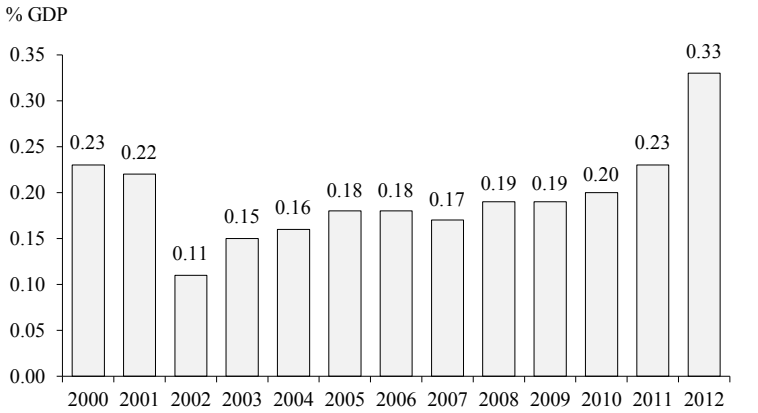

Figure 1. BERD to GDP ratio in Poland in 2000–2012

Source: own elaboration based on Eurostat data.

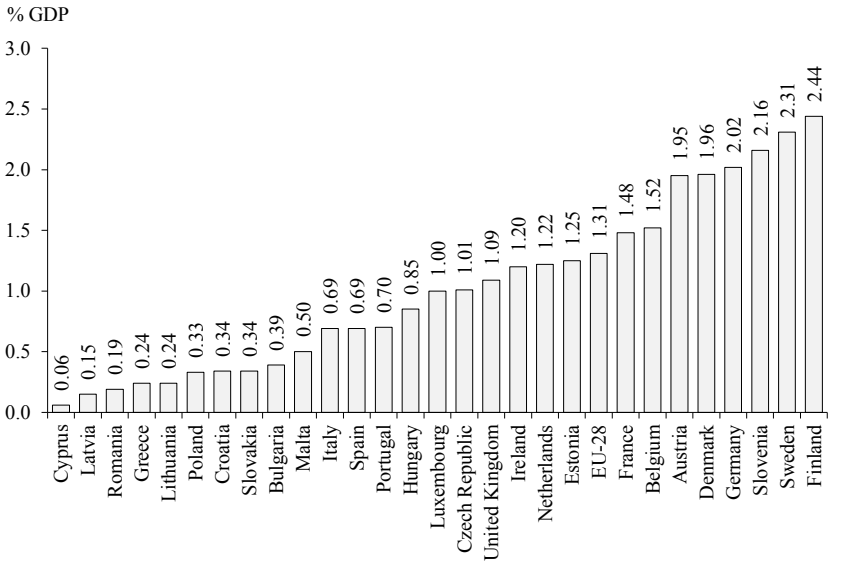

Figure 2. Ratio BERD to GDP in the European Union in 2012

Source: as for Figure 1.

2% of GDP or higher. In order to achieve that level, Polish companies should increase spending on R&D at least six times (at the current GDP).

The distinctly low financing of R&D by the Polish private sector is shown by another indicator, the share of this expenditure in the EU expenditure. Although in the early 2000s this indicator increased in Poland, it was very low and disproportionate to the potential of the Polish economy. Polish companies spent most in 2012 – 0.75% of the EU business expenditure on R&D (cf. Table 3). In comparison, the Polish participation in the total EU's expenditure on R&D was significantly higher – 1.27%. It is worth noting that the Polish GDP accounted for 2.9% of the EU GDP, and Poles constituted 7.6% of the EU population.[4]

Table 3

Selected indicators of the financing of R&D in Poland and the European Union in the years 2000–2012 (%)

Year	The share of business enterprise expenditure on R&D in Poland in the European Union BERD	The share of expenditure on R&D in Poland in the European Union GERD	The share of enterprises in expenditure on R&D	
			in Poland	in EU
2000	0.39	0.70	36.1	64.6
2001	0.41	0.74	35.8	64.6
2002	0.20	0.63	20.3	63.8
2003	0.24	0.55	27.4	63.5
2004	0.27	0.59	28.7	63.4
2005	0.35	0.69	31.8	62.9
2006	0.35	0.70	31.5	63.4
2007	0.37	0.77	30.4	63.6
2008	0.45	0.92	30.9	63.2
2009	0.41	0.88	28.5	61.7
2010	0.46	1.06	26.6	61.8
2011	0.52	1.09	30.1	63.1
2012	0.75	1.27	37.2	63.3

Source: as in Table 1.

[4] Own calculcations based on the Eurostat Database, http://epp.eurostat.ec.europa.eu (4.06.2014).

A too small role of enterprises in the R&D in Poland is also shown by a very low share of enterprises in the domestic expenditure. In the years 2000–2012 it was dominated by public funds (unlike in the EU). At the beginning of the period 2000–2012 there was a sharp decline in business spending on R&D compared to the national expenditure, but from 2003 its share started to increase again (cf. Table 3). The highest share was reached in 2012 (37%), which slightly approached the structure of financing R&D in Poland towards the most appropriate one, dominated by companies.

The structure of spending on R&D by the source of origin differed significantly between various regions of Poland. In 2012, the desirable share of enterprises in the financing of R&D was observed only in the Podkarpackie province where companies provided 65% of funds (cf. Table 4). A favorable situation was also observed in the regions of Śląskie and Dolnośląskie, where the share of the business sector was 45% and 39%, respectively. Generally, however, it was in the range between one third and one fourth of total spending, with the least favorable situation in Lubuskie (only 15%). The role of the latter region in the financing of R&D in Poland, however, was marginal, which is confirmed by its small share in the Polish BERD.

Table 4

Business expenditure on research and development in Polish regions in 2012 – selected indicators

Region	BERD	The share of business expenditure on R&D		
		in GDP	in total BERD	in R&D expenditure of region
	mln zl	%		
1	2	3	4	5
Dolnośląskie	376.9	0.27	8.1	38.8
Kujawsko-pomorskie	94.4	0.13	2.0	31.0
Lubelskie	94.6	0.15	2.0	14.5
Lubuskie	18.3	0.05	0.4	26.1
Lódzkie	161.7	0.02	3.5	21.2
Malopolskie	581.5	0.49	12.5	35.5
Mazowieckie	1,558.7	0.43	33.6	31.9
Opolskie	22.3	0.07	0.5	33.8
Podkarpackie	414.9	0.70	8.9	65.4

1	2	3	4	5
Podlaskie	26.1	0.07	0.6	18.8
Pomorskie	348.8	0.38	7.5	34.5
Śląskie	579.1	0.29	12.5	44.6
Swiętokrzyskie	20.7	0.05	0.4	17.0
Warmińsko-mazurskie	58.5	0.14	1.3	27.6
Wielkopolskie	239.4	0.16	5.2	17.6
Zachodniopomorskie	42.4	0.07	0.9	18.9
Poland	4,636.0	0.33	100.0	32.3

Source: own study based on Eurostat data and *Nauka i technika w 2012 r...*, pp. 95–96; *Rocznik statystyczny województw 2013*, GUS, Warszawa 2014, pp. 496–628.

The central region of Mazowieckie was most crucial for the financing of R&D, while peripheral regions spent significantly less. One third of funds for R&D was provided by companies from the Mazowieckie region (nearly 1.6 billion zlotys – cf. Table 4). About 580 million zlotys each was spent by companies from Małopolskie and Ślaskie provinces. In total, the expenses of companies from these three provinces accounted for more than half of BERD in Poland in 2012, which testifies to the high concentration of expenditure on R&D in the business sector in Poland.

If we compare corporate expenditure on R&D to the GDP of individual provinces, we may see a little different picture. The most favourable ratio was found in the Podkarpackie region where it amounted to 0.7% of GDP, although still well below the recommended 2% of GDP. A slightly worse ratio was achieved in Małopolskie (0.5% of GDP) and Mazowieckie regions (0.4% of GDP). In 6 out of 16 provinces the ratio did not exceed 0.1% of GDP, which is extremely detrimental to the competitiveness and innovativeness of the Polish economy.

Significant underfunding of business research and development in Poland is also confirmed by international rankings. There has never been a Polish company in the list of 2,000 greatest spenders on R&D in the world.[5] The ranking of the 1000 largest investors in R&D in the European

[5] *World – 2000 Companies Ranked by R&D*, http://iri.jrc.ec.europa.eu/documents/10180/99853/Ranking%2520of%2520the%2520world%2520top%25202000%2520companies&rct=j&frm=1&q=&esrc=s&sa=U&ei=RI7WU9TuPOGE4gTO4

Table 5

Top ten largest investors in R&D in the European Union and the positions of Polish companies in 2013

EU rank	Company	Country of origin	Industrial sector	R&D (million euro)
1.	VOLKSWAGEN	Germany	Automobiles & Parts	9,515.0
2.	DAIMLER	Germany	Automobiles & Parts	5,639.0
3.	ROBERT BOSCH	Germany	Automobiles & Parts	4,924.0
4.	SANOFI-AVENTIS	France	Pharmaceuticals & Biotechnology	4,909.0
5.	SIEMENS	Germany	Electronic & Electrical Equipment	4,572.0
6.	GLAXOSMITHKLINE	UK	Pharmaceuticals & Biotechnology	4,229.0
7.	NOKIA	Finland	Technology Hardware & Equipment	4,169.0
8.	BMW	Germany	Automobiles & Parts	3,952.0
9.	ERICSSON	Sweden	Technology Hardware & Equipment	3,862.7
10.	EADS	The Netherlands	Aerospace & Defence	3,630.0
627.	ASSECO POLAND	Poland	Software & Computer Services	16.1
659.	BANK OCHRONY ŚRODOWISKA	Poland	Banks	14.8
880.	NETIA	Poland	Fixed Line Telecommunications	7.4
965.	COMARCH	Poland	Software & Computer Services	5.9

Source: *The EU Industrial R&D Investment Scoreboard*, http://iri.jrc.ec.europa.eu/scoreboard.html (July 2014).

Union did include Polish companies, but only four of them and at very distant positions.[6] At the 627th place was Asseco Poland with a budget of 16 million euro, followed by the Bank of Environmental Protection (659), Netia (880) and Comarch (965) (cf. Table 5). For comparison, the leader

4DABQ&ved=0CBkQFjAB&usg=AFQjCNEGyeoEU2wSPfSj_DUTcpfUC1Xc1w (25.07.2014).

[6] *The EU Industrial R&D Investment Scoreboard*, http://iri.jrc.ec.europa.eu/scoreboard.html (25.07.2014).

– Volkswagen – spent 9.5 billion on research and development in 2013, more than seven times more than the entire expenditure of all Polish companies in 2012. The top of the ranking was dominated by companies from the automotive, telecommunications and pharmaceutical industries. Among the Polish companies included in the list, two operated in the computer industry, one in the banking and one in telecommunications.

2. Changes in the structure of business expenditure on R&D

The beginning of the 2000s saw changes in the structure of financing private R&D by the size of companies, the area of science and categories of expenditure.

Table 6

The structure of business expenditure on R&D by size in the years 2000–2011 (%)

Years	Enterprises		
	small	medium	large
2000	3.6	27.1	69.2
2001	5.3	28.1	66.6
2002	13.0	27.8	59.2
2003	6.9	32.3	60.8
2004	6.4	29.1	64.6
2005	4.5	23.2	72.3
2006	4.2	29.8	66.0
2007	5.3	24.7	70.0
2008	.	.	.
2009	4.6	17.1	77.2
2010	10.7	16.1	73.2
2011	7.5	17.7	74.8

Source: as in Table 1.

In the structure of spending on R&D, there was a growth in the importance of large and small companies, at the expense of medium-sized companies. The financing of R&D was dominated by companies employing more than 250 employees.[7] In addition, they increased their share in BERD by 5.6 percentage points (to three fourths – cf. Table 6). Only in 2002 did large companies significantly reduce expenditure on R&D and as a result their share decreased to 59%. To a large extent, this explains the drop in the corporate spending on research and development in that period. Although the share of small enterprises was the smallest, it doubled and in 2011 amounted to 7.5%; it also fluctuated significantly. Medium-sized companies reported a relative decrease in spending on R&D, by 9.4 percentage points. As a result, they spent on R&D two times more than small companies and about 1/4 of the amount spent by large companies.

Companies spent most on research in technical sciences and engineering (cf. Table 7). This is due to the fact that the solutions developed by researchers in those areas allow entrepreneurs to create new products and processes, increasing their advantage in the market and hence generating profits. However, the share of spending on technical sciences and engineering gradually decreased to 72% in 2011. The second place was occupied by natural sciences, whose share in total expenditure initially declined but in 2010-2011 increased significantly, reaching nearly 16% in 2011, about 3/4 more than in 2000. The next position was taken by research in medicine and health. Expenditure in this area was characterized by the greatest fluctuations; while in the year 2000 companies spent no less than 1% on research in this area, it was as much as 17.6% in the record-high 2008, but again only 7.5% in 2011. Much lower spending was observed in research in agricultural and social sciences, and the smallest in humanities. The share of the latter in corporate spending on R&D did not exceed 1% over the period. This can be explained by reduced and

[7] T. Baczko, E. Puchała-Krzywina, M. Szyl, T. Paczkowski, *Raport o największych inwestorach w badania i rozwój w Polsce w 2012 roku*, INE PAN, Warszawa 2013, p. 15.

sometimes impossible commercialization; companies are not willing to fund or conduct research in areas that do not provide financial benefits.

Table 7
The structure of business expenditure on R&D by the field of science in 2000–2011 (%)

Year	Fields of science					
	natural	engineering and technology	medical and health	agricultural	social	humanities
2000	9.00	86.47	0.70	3.60	0.21	0.01
2001	8.38	87.34	0.56	3.51	0.18	0.02
2002	7.35	83.62	6.97	1.90	0.16	0.00
2003	5.60	.	0.40	.	2.10	.
2004	7.07	85.51	2.71	3.63	0.83	0.26
2005	4.31	82.72	8.93	2.92	1.10	0.02
2006	4.91	85.95	5.64	2.66	0.81	0.03
2007	5.88	74.98	12.09	4.87	2.16	0.02
2008	4.13	74.13	17.64	2.32	1.59	0.18
2009	5.52	81.26	9.27	2.02	1.68	0.25
2010	12.95	74.70	8.23	2.31	1.03	0.79
2011	15.67	71.95	7.47	3.06	1.28	0.55

Source: as in Table 1.

Changes in the structure of business expenditure on R&D by major categories of expenditure were slightly lower. Current expenditure was dominant, although its share in the period 2000–2012 decreased to 78% (cf. Table 8). The largest item in this group accounted for remuneration which also grew in the studied period; in 2011 it accounted for 46% of BERD. Capital expenditure in R&D showed a growing trend, its share increasing from 18% in 2000 to 22% in 2011; it mostly concerned the purchase of research equipment. In 2011, it accounted for almost 16% of business expenditure on R&D.

Table 8

Business expenditure on R&D in Poland
by the main types of costs in the years 2000–2011

Year	Current expenditure		Capital expenditure	
	total	personnel	total	purchase of research equipment
2000	82.0	43.6	18.0	12.4
2001	80.3	40.5	19.7	15.0
2002	79.4	39.1	20.6	16.2
2003	85.6	42.5	14.4	11.6
2004	80.7	41.7	19.3	14.3
2005	80.6	43.6	19.4	13.3
2006	81.1	44.6	18.9	11.8
2007	76.1	42.3	23.9	18.1
2008	78.3	44.2	21.7	14.6
2009	81.2	41.9	18.8	14.3
2010	82.2	50.7	17.8	13.7
2011	77.6	45.7	22.4	15.6

Source: *Nauka*..., p. 71 and earlier editions.

3. The role of foreign financing of business R&D

The financing of BERD in Poland saw an increasing role of funds from abroad. In the years 2005–2012 they recorded more than a seven-fold increase. It was especially high in the years 2006, 2010 and 2012 (cf. Table 9).

In 2012, foreign expenditure on R&D amounted to 408 million zlotys and accounted for 7.6% of expenditure on business R&D in Poland; therefore its share doubled over eight years. Although the importance of foreign capital was gaining in importance, it remained relatively low.

The increase in expenditure was accompanied by an increase in the number of companies active in research and using foreign funds. Initially, the annual growth rate was relatively slow, a few percent (there was even a decline in 2008), but from 2009 it had clearly accelerated. While in 2005 only 63 companies raised funds from abroad, in 2012 it was as many as 227. As a result, in 2005–2012 there was a slight increase in the

percentage of companies benefiting from foreign funds. In 2012, about 11% of companies conducting R&D used foreign sources of financing, compared to 9% seven years earlier.

Table 9

Selected indicators of foreign capital participation in the financing of R&D in Poland in 2005–2012

Year	Gross domestic expenditures on R&D activity in business enterprises sector financed from abroad	Ratio of foreign capital in business enterprise sector to BERD	Number of units with research and development activity in business enterprises sector using foreign capital	Percentage of entities in business enterprises sector using capital in units with research and development activity
	mln zl	%		%
2005	56.1	3.2	63	9.0
2006	123.3	6.6	69	10.2
2007	103.9	5.3	72	9.6
2008	103.1	4.8	58	8.2
2009	115.3	4.5	93	11.0
2010	191.0	6.9	162	13.1
2011	186.8	5.3	178	10.7
2012	407.8	7.6	227	10.7

Source: as in Table 8.

In addition, companies with foreign capital increased involvement in financing R&D in Poland. This is a positive change, because this type of investment is particularly beneficial for the host country, constituting a very important factor for sustainable growth of the economy driven by innovation. In 2005, companies with majority foreign capital in Poland spent 543 million zlotys on R&D, while in 2012 it was four times higher (cf. Table 10). During that period, direct foreign capital in Poland increased by almost 100 billion euro, to 178 billion euro (2.3 times).[8]

[8] Narodowy Bank Polski, www.nbp.pl (25.07.2014).

The inflow of capital into Poland ranged from 20 to 65 billion euro a year, and was also decreasing.

The ratio of expenditure on R&D in companies with majority foreign capital to the direct foreign investment increased in the period 2005–2012. In 2005 it was as low as 1.6% but in 2012 it reached 11%. This shows that investors began to perceive Poland as attractive for investment not only based on low labor costs but also for investment in the area of research and development. This is also confirmed by an increase in the number of foreign direct investment projects in R&D, which in 2012 increased to 449, 362% more than in 2005. They were concentrated in 182 research centers.[9]

Table 10

The role of foreign direct investors in the financing of R & D activity in Poland in 2005–2012

Years	Business expenditure on R&D in companies with predominance of foreign capital	Inflow of foreign direct investment to Poland	Ratio of expenditure on R&D units with predominance of foreign capital to total business expenditure on R&D	Number of R&D units with predominance of foreign capital	Percentage of business enterprises with R&D units and with the predominance of foreign capital in the total number of private R&D units
	mln zl		%		%
2005	543.2	33,304	58.8	124	26.1
2006	506.2	60,832	54.4	123	26.6
2007	590.5	65,215	51.3	149	26.8
2008	730.3	35,750	50.6	142	27.3
2009	1,235.7	40,350	61.8	177	25.2
2010	1,212.5	41,839	53.2	214	19.5
2011	1,599.4	61,081	51.4	353	23.2
2012	2,197.7	19,730	41.1	449	22.6

Source: *Nauka*..., p. 65. and earlier editions. National Bank of Poland, www.nbp.pl (July 2014).

[9] *Polish Information and Foreign Investment Agency*, www.paiz.gov.pl (25.07. 2014).

Companies with majority foreign capital in Poland rapidly increased spending on R&D, although slightly slower than national companies. As a result, the ratio of expenditure on R&D of foreign investors to the spending of private companies in total decreased from 59% in 2005 to 41% in 2012. This indicates a marked increase in the R&D in companies in Poland, especially national firms.

Similar trends occurred in the number of R&D companies with majority foreign capital compared to the number of respective Polish companies. In 2005, such companies with foreign capital accounted for 26.1%, while in 2012 their share was a little lower, at 22.6%. Although the number of companies with majority foreign capital who spent on R&D was lower, on average their spending on research and development was higher than in domestic companies.

Conclusions

Based on the survey, one may draw the following conclusions:

1. In the years 2000–2012 Poland failed to reduce the gap in financing R&D compared to other European Union countries. Expenditure on R&D in Polish companies remained at a very low level, much lower than in most EU countries, and disproportionate to the potential of the Polish economy. Although companies did increase their financing of research and development, the changes were still too small and too slow.
2. The distance between regions also did not decrease. Spending on R&D was concentrated in the central region and much lower in the peripheral regions.
3. There were changes in the structure of the corporate financing of R&D, with the increasing role of small and large companies, at the expense of medium-sized companies. The share of spending on research in engineering and technology slightly dropped, while it increased in life sciences, medicine and health. The proportion of current expenditure decreased while capital expenditure grew.

4. The role of foreign capital in expenditure on R&D increased. There was also an increase in its share in the research sector in Poland.

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Joanna Staśkiewicz
Szczecin University