FACTORS SHAPING INNOVATION COOPERATION BETWEEN COMPANIES AND RESEARCH AND DEVELOPMENT INSTITUTIONS EXEMPLIFIED BY THE CASE OF SOUTH-WESTERN POLAND

Marek Tomaszewski
The University of Zielona Góra
Department for Innovation and Entrepreneurship

Abstract

The aim of this paper is the presentation of the probit models analysis factors shaping innovation cooperation between companies and research. The practical issue is exemplified by the case of south –western Poland. The main aspect is the stimulation of innovation cooperation with the R&D sector. The article shows local influence of regional location of the participants of the supply chain on innovation cooperation between industrial companies of south-west Poland and universities, research institutes and Polish Academy of Science. The paper is divided into three significant parts focusing on: cooperation between business and universities and Polish Academy of Science, research institutes and foreign R&D centers. The author of chapter investigates the probability of innovation cooperation between R&D sector institutions and industrial companies of south-west Poland which operate locally or regionally, the probability of innovation cooperation between R&D sector institutions and industrial companies of south-west Poland which operate internationally or at least nationally and the probability of innovation cooperation between R&D sector institutions and large and medium-sized industrial companies of south-west Poland.
Key words: Innovation, companies and R&D cooperation

Introduction

The literature on the subject separates the sources of innovation into internal and external [Stawasz, 1999]. Internal ones are those which operate inside a company [Świadek, 2011]. External ones are divided into national and foreign [Jasiński, 2000]. Availing of a national or foreign source depends on the company's standing, type of activity, financial situation, type of market and product [Janasz, Kozioł, 2007]. National sources include research and development institutions grouped into four pillars: a) Polish Academy of Sciences departments, b) research institutes, c) universities, d) research departments [www.stat.gov.pl/GUS/definicje].

Foreign sources of innovation come from foreign institutions with their own R&D resources. They are companies or institutions which transfer knowledge, licences and know-how.

Cooperation between R&D institutions and companies boils down to four aspects: a) education of employees or potential employees, b) provision of information on the sector's state and available technical solutions, c) provision of knowledge on new products and processes or improvement of existing products and processes, d) operations of normalisation, certification and calibration of devices (the act on research institutions, 2010; the act on the Polish Academy of Sciences, 2010).

Universities implement the first aspect of R&D sector cooperation with companies. They educate both employees and candidates for employment at three levels (baccalaureate, master and doctoral studies). In addition they offer MBA and post-graduate studies. The Polish Academy of Sciences also provides education (doctoral and post-graduate studies) for employees and candidates for employment.

Universities, research institutes and the Polish Academy of Sciences departments deal with the second aspect of R&D sector cooperation with companies. Within these operations the above mentioned institutions provide expertise, opinions, market research and various analyses for the companies they cooperate with. They can also run and develop databases as well as operate in the areas of scientific, technical, economic information, inventiveness as well as industrial and intellectual property. Additionally, they are occupied with publishing activities, such as releasing monographs and specialised journals.

Research institutes, development departments, the Polish Academy of Sciences departments and universities implement the third aspect of cooperation between the R&D sector and companies. They run scientific and development research, adjust their results to practical demands and put these results into production. They can also, on the basis of their research, start manufacturing devices, equipment, materials and other products which can be made available to companies. The implementation of the latter, in accordance with the acts of law, takes place exclusively in research institutes.

Set in this context, the main aim of the research was to provide an answer to the question of which factors have an impact on establishing cooperation between industrial companies of south-west Poland and R&D institutions. The research hypotheses are the following:

1. The probability of innovation cooperation between R&D sector institutions and industrial companies of south-west Poland which operate locally or regionally is lower than the probability of

innovation cooperation between R&D sector institutions and industrial companies of south-west Poland which operate internationally or at least nationally.

2. The probability of innovation cooperation between R&D sector institutions and large and medium-sized industrial companies of south-west Poland is higher than the probability of innovation cooperation between R&D sector institutions and micro and small industrial companies of south-west Poland.

Methodology of the research

The empirical data, which became the basis for the calculation and consequently interpretation of the results, was obtained from the survey sent to industrial companies of Dolnośląskie and Lubuskie Voivodships. The analysis has a statistical nature and refers to the period 2009-2011, which follows the methodology standards included in the Oslo Manual [2008].

In order to confirm or reject the research hypotheses, the following parameters defining a company and its relations were implemented as independent variables: a) company size (micro, small, medium-size and large), b) the source of capital (national, foreign and mixed), c) company income (growth, drop, stagnation), d) situation in the sector in which a company operates (growth, recession), e) employee qualifications (high, low), f) market features: location in reference to the researched company (local, regional, national, international), territory (major urban centres, minor urban centres, rural areas), PKD[52] section (potential purchasers), g) location in reference to the researched company of other participants of the supply chain (suppliers, purchasers and competitors): local, regional, national, international, h) relations with other participants of the supply chain: only necessary contact, no contact, cooperative, hostile or amicable, i) technology level utilized by the company (technologies: high, medium-high, medium-low, low) . The dependent variable was the reason for establishing cooperation by the researched institution with: a) Polish Academy of Sciences departments, b) universities, c) research institutes and R&D departments, d) foreign R&D institutions .

An index of companies available on the Internet was used as a starting point to establish the researched population. An overall presentation of the group is included in the table below.

---

[52] PKD – Polska Klasyfikacja Działalności – Polsih Statistical Classification of Economic Activities.

Table 1. Features of the research population

No	Features	Dolnośląskie	Lubuskie
1	The number of surveys completed correctly	231	268
2	The number of industrial companies in the region in reference to the overall number of companies according to the applied index	14.2%	13.5%
3	The number of industrial companies in the region in reference to the overall number of companies according to the Central Statistical Office	8.2%	8.2%
4	The number of industrial companies of a voivodship in reference to the overall number of industrial companies from Dolnośląskie and Lubuskie voivodships according to the researched index.	76.6%	23.4%
5	The number of industrial companies of a voivodship in reference to the overall number of industrial companies from Dolnośląskie and Lubuskie voivodships according to the Central Statistical Office	75.8%	24.2%
6	The number of industrial companies from the applied index in reference to the number of industrial companies according to the Central Statistical Office	22.3%	21.4%
7	the number of companies which returned correctly completed questionnaires in reference to the overall number of industrial companies of a given voivodship	1.9%	6.4%

Source: Own work based on data taken from an Internet database and the Central Statistical Office.

As presented in Table 1, the applied index included 21-22% of the overall number of industrial companies from the researched voivodships. Questionnaires were sent to all the institutions in the above index. As for the population number, the data is comparable to the Central Statistical Office information on innovation activities in industry [GUS, 2009].

The return rate of the survey varied from 8.45% in Dolnośląskie to 30.6% in Lubuskie Voivodships. The very high level of returns in the Lubuskie Voivodship stemmed from the method of questionnaire retrieval. Research personnel personally attended the companies after prior arrangements and, based on the interview with the authorised personnel, filled in the questionnaires. Due to technical reasons such conduct was feasible only

in this voivodship. The surveys in the Dolnośląskie Voivodship were sent by post after a prior telephone conversation.

The dependent and independent variables were dichotomous, meaning they acquired values equal to 0 or 1. Dependent variables signify that cooperation with a competitor occurred (then the variable stood at 1), or it did not occur (then the variable stood at 0). The fact of dependent and independent variables being dichotomous results in the impossibility of applying the most popular modelling methods which include multiple regression.

For the purposes of this paper calculations were conducted using Statistica software. In total 228 probit models were created for four dependant variables out of 33 statistically significant and will be presented and discussed below.

Due to the application of models taking into consideration only one factor to interpret the research dependencies, structural models will be presented below. Key importance is attached to the symbol at the parameter. A positive one shows that the probability of establishing cooperation between an institution and an industrial company of a particular size is higher than in the remaining groups. A negative one signifies that the probability of innovation cooperation with an institution is lower than in the remaining groups.

Cooperation between business people and universities and the Polish Academy of Sciences departments

Cooperation between the industrial companies of south-west Poland and universities occurred much more often that cooperation with the Polish Academy of Sciences departments. It resulted in a fewer number of models describing the cooperation between the Polish Academy of Sciences departments and business people of the regions (only 2) in comparison to the number of models describing cooperation between universities and industrial business people (18). The statistically significant models obtained referring to cooperation between universities and the Polish Academy of Sciences departments and industrial companies were grouped according to the factors influencing this type of cooperation and presented in the table below.

Table 2. Probit models describing the influence of selected factors on establishing innovation cooperation between the industrial companies of south-west Poland and universities and the Polish Academy of Sciences departments over the period of 2009-2011

Independent variable	Parameter	S	T	P>|z|	P_1	P_2	χ^2	P
Part 1. The impact of other participants of the supply chain on the occurrence of innovation cooperation between business people and universities								
competitior's location abroad	+1.05	0.23	4.57	0.00	0.36	0.08	19.84	0.00
supplier's location abroad	+0.47	0.19	2.51	0.01	0.18	0.09	6.02	0.01
Purchaser's location national	+0.40	0.16	2.52	0.01	0.15	0.08	6.28	0.01
Supplier's location regional	-0.39	0.18	-2.10	0.04	0.06	0.12	4.71	0.03
Purchaser's location regional	-0.47	0.21	-2.23	0.03	0.05	0.12	5.49	0.02
competitor's location local	-0.50	0.18	-2.87	0.00	0.05	0.13	8.89	0.00
Part 1a. The impact of the location of other participants of the supply chain on the occurrence of innovation cooperation between business people and the Polish Academy of Sciences departments								
competitor's location abroad	+0.91	0.34	2.65	0.01	0.08	0.01	6.12	0.01
Part 2. The impact of sales range on the occurrence of innovation cooperation between business people and universities.								
local sales range	-0.74	0.31	-2.40	0.02	0.03	0.11	7.50	0.01
national sales range	+0.33	0.16	2.13	0.03	0.13	0.07	4.60	0.03
international sales range	+0.39	0.15	2.52	0.01	0.14	0.07	6.41	0.01

Part 3. The impact of Polish Classification of Activities (PKD) purchasers on the occurrence of innovation cooperation between business people and universities								
purchasers from B section of PKD	+0.49	0.22	2.25	0.02	0.20	0.09	4.80	0.03
purchasers from C section of PKD	+0.43	0.16	2.76	0.01	0.15	0.07	7.56	0.01
purchasers from D section of PKD	+0.59	0.21	2.74	0.01	0.22	0.09	7.08	0.01
purchasers from P section of PKD	+1.01	0.26	3.93	0.00	0.36	0.08	14.59	0.00
Part 3a. The impact of Polish Classification of Activities (PKD) purchasers on the occurrence of innovation cooperation between business people and the Polish Academy of Sciences departments								
purchasers from B section of PKD	+0.72	0.33	2.20	0.03	0.06	0.01	4.28	0.04
Part 4. The impact of the type of ownership on innovation cooperation between business people and universities								
Polish ownership of company	-0.46	0.17	-2.76	0.01	0.08	0.17	7.40	0.01
foreign ownership of company	+0.42	0.20	2.14	0.03	0.18	0.09	4.38	0.04
Part 5. The impact of other factors on innovation cooperation between business people and universities								
Large company size	+0.56	0.21	2.61	0.01	0.21	0.09	6.47	0.01
Sector growth	+0.62	0.22	2.84	0.00	0.12	0.04	9.44	0.00
Market located in major urban centre	+0.57	0.16	3.58	0.00	0.15	0.06	13.39	0.00

Source: Own work based on own research.

where:

S – standard error,

T – students's t-distribution for a parameter,

P>|z| – probability of a parameter's insignificance

P1 - probability of the occurrence of a particular phenomenon in the research group of companies

P2 - probability of the occurrence of a particular phenomenon in the other group of companies

$\chi2$ – Chi – squared test

P - probability of a model's insignificance

The influence of the location of the other participants of the supply chain on innovation cooperation between universities and the Polish Academy of Sciences departments and business people of south-west Poland

The most numerous group of factors that influence innovation cooperation between business people of south-west Poland and universities and the Polish Academy of Sciences departments are those linked to the location of the other participants of the supply chain. Within this group the influence of the location of a supplier, competitor and purchaser on the probability of innovation cooperation with universities and the Polish Academy of Sciences departments was considered.

In the researched group model the highest probability of innovation cooperation between universities and industrial companies occurs in the group whose competitors are located abroad. Foreign competitors stimulate cooperation between companies and the Polish Academy of Sciences departments. In the first case the probability of innovation cooperation with universities stood at 0.36 and it was 4.5 times higher than the probability of cooperation between universities and industrial companies whose competitors were located somewhere in Poland. In the other case the probability of innovation cooperation between industrial companies and the Polish Academy of Sciences departments stood at 0.08 and was 8 times higher than the probability of cooperation between the Polish Academy of Sciences departments and companies whose competitors were located in Poland.

Having a foreign supplier encouraged innovation cooperation between universities and industrial companies. Having a purchaser located in Poland, though outside the boundaries of the Lubuskie and Dolnośląskie Voividships, also stimulates innovation cooperation between industrial companies and universities. On the other hand, industrial companies having suppliers and recipients located in the region hampers innovation cooperation with universities. The fact of having local competitors also discourages innovation cooperation between universities and industrial companies.

The influence of sales range and PKD section purchasers on innovation cooperation between universities and business people of south-west Poland

According to the models presented in part two of Table 2, the highest probability of innovation cooperation between universities and industrial companies occurred in the group whose sales range crossed the Polish borders. The probability of cooperation in this group of companies stood at 0.14 and was twice as high as the probability of cooperation between universities and companies whose sales range was limited to Poland.

A slightly lower probability of innovation cooperation between universities and industrial companies occurred in the group of companies whose sales range was national. However, having a local sales range had a decisively negative impact on the probability of innovation cooperation.

Following the data presented in the next part of Table 2 the highest probability of innovation cooperation occurred in the group of companies whose purchasers were ascribed to section PKD P (educational activities). The probability of innovation cooperation in this group of companies stood at 0.36 and was 4.5 times higher than the probability of innovation cooperation between universities and business people whose purchasers were located in other sections of PDB than section P.

Innovation cooperation between universities and industrial companies was also stimulated by having purchasers which fell into; D section of PKD (production and supplying of electric energy, gas, steam, hot water and air for air-conditioning systems), C section of PKD (industrial processing) and B section of PKD (mining and excavation). Having a purchaser belonging to section B of PKD stimulated innovation cooperation between the Polish Academy of Sciences departments and industrial companies.

The influence of the type of ownership and other factors on innovation cooperation between universities and business people of south-west Poland

The models from the fourth part of Table 2 lead to the conclusion that innovation cooperation between universities and industrial companies is stimulated by having the ownership rights to a company by institutions whose headquarters are located abroad. The probability of innovation cooperation in this case stood at 0.18 and was twice as high as the probability of innovation cooperation between universities and companies which belonged to people residing in Poland or were in part-ownership with a person living in Poland.

Similar conclusions can be drawn from the second model presented in part four of Table 2. The probability of innovation cooperation between universities and companies belonging to Polish parties stood at 0.08 and was more than twice as low as the probability of innovation cooperation between universities and companies which belong fully or at least partly to people resident abroad.

The fifth part of Table 2 indicates that the highest probability of innovation cooperation between universities and industrial companies occurred in the case of large companies. The probability stood at 0.21 and was more than twice as high as the probability of innovation cooperation between universities and companies of other sizes.

Having a market located in an major urban centre also stimulates innovation cooperation between universities and business people in south-west Poland.

The final model presented in Table 2 shows the impact of economic stimulation on innovation cooperation between industrial companies of south-west Poland and universities.

Innovation cooperation of business people with research institutes and development departments

In the case of cooperation between industrial companies of south-west Poland and research institutes and development departments there were seven statistically significant models. They were divided into three groups. The first one presents the impact of company size on cooperation with R&D departments and research institutes. The second shows the impact of sales range on innovation cooperation. The third is determined by the influence of location of the other participants of the supply chain and the PKD section of purchasers on innovation cooperation with the R&D sector and research institutes. All significant models created statistically are presented in Table 3.

Table 3. The influence of selected factors on innovation cooperation between research institutes and development departments and business people of south-west Poland between 2009 and 2011

Independent variable	Parameter	S	T	P>|z|	P₁	P₂	χ²	P
Part 1. The impact of company size on innovation cooperation with the R&D sector and research institutes								
Micro companies	-0.54	0.19	-2.80	0.01	0.06	0.16	8.70	0.00
Medium-sized companies	+0.45	0.15	2.94	0.00	0.22	0.11	8.47	0.00
Part 2. The impact of sales range on innovation cooperation with the R&D sector and research institutions.								
Local sales range	-0.48	0.23	-2.07	0,.04	0.06	0.15	4.80	0.03
international sales range	+0.32	0.14	2.28	0.02	0.18	0.11	5.20	0.02
Part 3. The impact of the location of other participants of the supply chain and the PKD section of purchasers on innovation cooperation with the R&D sector and research institutes.								
competitor location local	-0.43	0.16	-2.78	0.01	0.08	0.17	8.09	0.00
Purchaser located within the country	+0.35	0.14	2.39	0.02	0.19	0.11	5.63	0.02
Purchaser falling into section B of PKD	+0.43	0.21	2.07	0.04	0.24	0.13	4.11	0.04

Source: Own work based on own research.

The influence of company size and sales range on innovation cooperation between the R&D sector and research institutes and business people of south-west Poland

The data presented in the first part of Table 3 leads to the conclusion that the highest probability of innovation cooperation between R&D centres and research institutes and industrial companies occurred in the group of medium-size companies. The probability of cooperation between the institutions stood at 0.22 and was twice as high as the probability of innovation cooperation between R&D centres and research institutes and companies of a different size.

However, micro company size has a discouraging impact on innovation cooperation between R&D centres and research institutes. The probability of innovation cooperation stood at 0.06 and was over 2.5 times lower than the probability of innovation cooperation between R&D centres and research institutes and small medium-size or even large companies.

The second part of Table 3 presents the highest probability of innovation cooperation between the institutions, which occurred in the group of companies whose sales range was international. This stood at 0.18 and was 64% higher than the probability of innovation cooperation between R&D centres and research institutes and industrial companies of south-west Poland whose sales range was not international.

A clearly discouraging impact on innovation cooperation between R&D centres and research institutes and business people of south-west Poland came from having a local sales range. The probability of innovation cooperation in this group stood at 0.06 and was 2.5 times lower than the probability of innovation cooperation between R&D centres and research institutes and business people of south-west Poland whose sales range exceeded this.

The influence of other participants of the supply chain and PKD sections of purchasers on innovation cooperation between R&D centres and research institutes and business people of south-west Poland

The last part of Table 3 concludes that having a local competitor has a negative impact on innovation cooperation between business people and R&D centres and research institutes. The probability of innovation cooperation in this group stood at 0.08 and was twice as low as the probability of innovation cooperation between R&D centres and research institutes and business people whose competitors were located further afield.

Innovation cooperation between R&D centres and research institutes and business people of the Lubuskie and Dolnośląskie Voivodships is stimulated by having purchasers located nationally but beyond the borders of south-west Poland. The probability stood at 0.19 and was 73% higher than the probability of innovation cooperation between R&D centres and research institutes and business people whose purchasers were local, regional or even international.

The last statistically significant model presented in the third part of Table 3 depicts the stimulating effect of a purchaser that falls into section B of PKD (mining and excavation) on innovation cooperation between R&D centres and research institutes and business people of south-west Poland. The probability of innovation cooperation between then stood at 0.24 and was 85% higher than the probability of innovation cooperation

between R&D centres and research institutes and business people of south-west Poland whose purchasers were located in sections other than B of PKD.

Cooperation between business people and foreign R&D centres

In the case of innovation cooperation between business people of south-west Poland and foreign R&D centres, six statistically significant models were created which describe the factors influencing innovation cooperation between these institutions. The factors varied greatly therefore are impossible to divide, which is why they were put together. The obtained calculated models are presented in the table below.

Table 4. The influence of selected factors on innovation cooperation with foreign R&D centres and business people of south-west Poland between 2009 and 2011

Independent variable	Parameter	S	T	P>|z|	P_1	P_2	χ^2	P
Large companies	+0.81	0.26	3.07	0.00	0.12	0.02	8.59	0.00
Polish ownership of a company	-0.66	0.23	-2.88	0.00	0.02	0.08	8.12	0.00
Income growth	+0.81	0.37	2.18	0.03	0.04	0.01	6.95	0.01
International sales range	+0.47	0.23	2.06	0.04	0.05	0.02	4.43	0.04
market located in major urban centres	+0.56	0.24	2.32	0.02	0.05	0.01	5.87	0.02
high technologies applied in a company	+0.49	0.24	2.04	0.04	0.05	0.02	4.49	0.03

Source: Own work based on own research.

The above table shows that the probability of innovation cooperation with foreign R&D centres and industrial companies of south-west Poland occurred in the group of large companies. The probabilities of innovation cooperation in this group stood at 0.12 and was six times higher than the probability of innovation cooperation between foreign R&D centres and industrial companies other than large ones.

Having a market located in a major urban centre encourages innovation cooperation between foreign R&D centres and industrial companies of south-west Poland. In this case the probability of innovation cooperation stood at 0.05 and was five times higher than the probability of innovation cooperation between foreign R&D centres and companies whose markets were located in minor urban centres and rural areas.

Another factor which stimulates innovation cooperation between foreign R&D centres and industrial companies of south-west Poland was the income growth achieved by companies. In the case of an improvement in income generated by the companies of south-west Poland the probability of innovation cooperation between foreign R&D centres and the companies stood at 0.04 and was four times higher than the probability of innovation cooperation between foreign R&D centres and companies whose income stayed at the same level or decreased.

Having an international sales range and the application of high technologies stimulated innovation cooperation between foreign R&D centres and industrial companies of south-west Poland. In both cases the probability of innovation cooperation stood at 0.05 and was 2.5 times higher than the probability of innovation cooperation between foreign R&D centres and companies whose range is not international or apply other technologies than high ones.

The only discouraging factor affecting innovation cooperation between foreign R&D centres and industrial companies was Polish ownership of these companies. In this case the probability of innovation cooperation stood at 0.02 and was four times lower than innovation cooperation between foreign R&D centres and companies which were fully or at least partly owned by foreign parties.

Summary

While analysing the probit models attention should be drawn to several patterns. The most frequently occurring regularity is the stimulation of innovation cooperation with the R&D sector by the fact that industrial companies have other participants of the supply chain (competitors, suppliers or purchasers) located abroad or at least beyond the region. This location of the other participants of the supply chain encourages innovation cooperation between industrial companies of south-west Poland and universities, Polish Academy of Sciences departments, research institutes and development departments. On the other hand a local or regional location of the other participants of the supply chain discourages innovation cooperation between

industrial companies of south-west Poland and universities, research institutes and development departments.

A similar dependency occurs in reference to the independent variable 'sales range'. The fact of industrial companies having a market located internationally (or at least beyond the region) encouraged innovation cooperation between industrial companies of south-west Poland and universities, foreign R&D centres, research institutes and development departments. However, a local sales range discouraged innovation cooperation between industrial companies and universities, research institutes and development departments.

The impact of the independent variable 'type of company ownership' follows the above regularity. The probability of innovation cooperation between industrial companies owned by foreign parties and universities is higher than the probability of innovation cooperation between universities and foreign R&D centres and industrial companies owned fully or partly by Polish parties.

The reasons for the above regularities can be found in the demanding nature of innovation activities of companies located not only in Poland, but also within the so called 'Visegrad Group'. The lack of pressure from clients and competitors on the implementation of new products has a negative impact on innovation activities of industrial companies. Due to the low level of economic advancement of the researched regions there is an absence of pressure from customers and local and regional competitors to implement new products into production. In such an environment there is a shortage of innovation cooperation between industrial companies and R&D departments, as companies do not feel compelled to do so. The appearance of a participant of the supply chain located abroad causes pressure on companies to implement a new product and consequently establish cooperation with R&D departments.

While interpreting the research results it is worth paying attention to the stimulating effect of having section B of PKD purchasers (mining and extraction) on innovation cooperation between these companies and R&D institutions such as: universities, Polish Academy of Sciences departments, research institutes and development departments. The reasons for this regularity can be found in the location of KGHM Polska Miedź SA. (an industrial conglomerate) in the Dolnośląskie Voivodshp. Due to its size, wealth and international competition challenges the company demands a lot from its subsidiaries and suppliers, which induce cooperation with the R&D sector.

Company size can also encourage innovation cooperation between universities and foreign R&D centres and industrial companies of south-west Poland. This stems from the fact that large companies have access to more substantial resources (capital, human resources and others) which can be allocated towards cooperation with the R&D sector. Whereas, the smaller the size of a company the less resources it has, which translates into the lower likelihood of cooperation with the R&D sector. It seems crucial as departments of the R&D sector have very humble resources at their disposal and without an external funding source they are not able to initiate cooperation with industrial companies beyond the stage of informing of their willingness to do so. Moreover, departments of the R&D sector favour cooperation with large companies due to the range of cooperation and the possibility of receiving funding.

By and large, one can claim that the smaller the size of a company, the less probability of innovation cooperation between industrial companies and science institutions. Innovation cooperation between industrial companies and departments of the R&D sector is encouraged when medium-size companies cooperate with research institutes and development department. On the other hand, micro size definitely discourages innovation cooperation.

References

1. http://www.stat.gov.pl/gus/definicje_PLK_HTML.htm?id=POJ-226.htm.
2. Jasiński A. H. (ed.), *Innowacje i transfer techniki w gospodarce polskiej*, Wydawnictwo Uniwersytetu w Białymstoku, Białystok, 2000.
3. Janasz W., Kozioł K., *Determinanty działalności innowacyjnej przedsiębiorstw*, PWE, Warszawa, 2007.
4. Nauka i Technika w roku 2007, GUS, Warszawa, 2009.
5. Stawasz E., *Innowacje a mała firma*, Wydawnictwo Uniwersytetu łódzkiego, Łódź, 1999.
6. Świadek A., *Regionalne systemy innowacji w Polsce*, Difin, Warszawa, 2011.
7. Tomaszewski M., *Koopetycja przedsiębiorstw przemysłowych Polski południowo-zachodniej w latach 2009-2011*, Ekonomika i Organizacja Przedsiębiorstw, vol. 753, no 10, 2012, pp. 40-51.
8. Ustawa z dnia 30.04.2010 o instytutach badawczych, Dz. U. No 96 poz. 618.

9. Ustawa z dnia 30.04.2010 o Polskiej Akademii Nauk, Dz. U. No 96 poz. 619.
10. *Zasady gromadzenia i interpretacji danych dotyczących innowacji*, Podręcznik Oslo, 2008.