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Influence of business support organizations on innovation activity in manufacturing companies in the Masovian Voivodeship in Poland

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Abstract
Research background: The first business support organizations (BSO) appeared in Poland in the 90s of the last century. They were transferred from Western Europe and the United States, where they provided system solutions and played an important role in stimulating innovation activity. However, the latter regions are economically developed, while Poland is playing catch-up. The important question is whether business support organizations will significantly increase the innovative potential of Polish enterprises.
Purpose of the article: The purpose of this paper is to probe the impact of business support organizations on innovation activity in Polish industrial companies. It remains to be determined whether enterprises which use BSO services are more likely to engage in innovation activities than enterprises which do not use such services.
Methods: To carry out the study, a multi-factor logit regression method was used. In this study, the method allows the determination of the odds ratio for the likely occurrence of innovation activity in companies that used the services of BSOs compared to enterprises that did not do so. The attributes of innovation activity have been singled out in accordance with the international standards of the Oslo methodology. The study was conducted in 2015 for the years 2012–2014 based on a sample of 951 manufacturing companies in the Masovian Voivodeship.

Findings & Value added: In the Masovian Voivodeship it is the technological parks and training and consulting centres which have the most advanced degree of influence on the innovation activity of enterprises. The roles of technology incubators, and loan and guarantee funds are also significant. With regard to cooperation on innovation, there is a much better arrangement in sectoral systems, i.e., with suppliers, customers and competitors, than with scientific institutions.

Introduction

Today, no one questions the role of innovation in economic development. In a developed country, knowledge plays a major role in economic success. Countries playing catch-up should develop into knowledge-based economies by implementation of innovations. Such a process fuels innovation policy. In terms of the relation between Poland and the European Union, innovation policy does not differ. In the period 2014–2020 support will be given to innovation activities, innovative cooperation and technology transfer from science to business. Entities which fulfil this support function are business support organizations (BSO). In Poland this means such organisations as innovation centres (technological parks and incubators, academic business incubators, technology transfer offices), financing institutions (business angels networks, local/regional load funds, credit guarantee funds) and entrepreneurship centres (training and consulting centres).

In this context, the question is raised of how business support organizations will influence the innovation activity of enterprises in Poland. Between Poland and Western European countries — from which the idea of BSOs comes — there exists a technology gap. The aim of the Europe 2020 strategy it is to bridge this gap (Balcerzak, 2015, pp. 190–205), but the Polish level of economic development is lower than its Western neighbours. The purpose of this paper is to probe the impact of business support organizations on innovation activity in Polish industrial companies. It remains to be determined whether enterprises which use BSO services are more likely to engage in innovation activities than enterprises which do not use such services. The research method used, making it possible to achieve that aim, was logistic regression. The study was conducted on a sample of 951 industrial companies in the Masovian Voivodeship. In this group there were enterprises which used BSO-services and those which did not. The research hypothesis examines the claim that business support organizations increase the odds of innovative activity, but such influence turns out to be varied. This means that not all BSOs are active in the tested region.

The article consists of five parts. The first one presents a review of the literature related to business support institutions. It contains not only theo-

retical issues, but also the results of empirical work in the studied area. The second part employs a statistical framework relevant to the research method used. The third part characterizes the companies that participated in the study and the region from which they came, and the fourth part presents the results of the study. The fifth part confronts the results of the study with the findings of other authors, and finally, the sixth part summarizes the results, including an account of its limitations and suggestions for future research.

Literature review

With respect to the development of innovation, a specific role is assigned to innovation centres. International studies point out rational benefits of innovation activity in dynamic cooperation in the so-called "Triple Helix": university-industry-government. Triple Helix III is generating a knowledge-based infrastructure in terms of overlapping institutional spheres, with each taking on the role of the other and with hybrid organizations emerging at the interfaces (Etzkowitz & Leydesdorff, 2000, pp. 109–123). Such hybrid organizations can be recognised as innovation centres. In Poland they are: technology parks, technology incubators, academic business incubators and technology transfer offices.

Technology parks are agglomerations of research offices of universities, other research institutes, and firms which can benefit from the R&D services of the former. Among companies and scientific institutions there is cooperation in processing relevant R&D spillover. The close proximity of firms and research centres increases the likelihood of cooperation on innovation (Rocio Vasquez-Urriago *et al.*, 2016, pp. 137–147). Inside the science and technology parks, the knowledge provided by the university improves the innovative capacity of firms (Diez-Vial & Montoro-Sanchez, 2016, pp. 41–52). It needs to be highlighted, though, that according to the literature not all technology parks bring hosted firms benefits which are germane to innovation activity (e.g., patents granted, R&D spillover, implementation of new products and processes) in comparison to firms which are located beyond the parks. However, "in-park" firms are better off than "non-park" firms at least in terms of economic performance, investments and profitability indicators (Liberati *et al.*, 2016, pp. 694–729).

Technology incubators and academic business incubators are oftena part of science and technology parks, and they can function as independent institutions, too. Incubators help start-up companies to develop into independent businesses (usually from 3 to 5 years). Incubated firms have better access to business services than non-incubated firms. This has a positive

influence on creating business networks and stimulating the dynamic progress of them (Stokan *et al.*, 2015, pp. 317–327). Further, there are no differences in benefits gained by networking, regardless of whether or not companies are using high or low technology (Soetanto & Jack, 2013, pp. 432–453). This shows that the profits from cooperation with the incubator may be enjoyed by any company.

Technology transfer offices (TTO), especially those linked to universities, can be treated as a sign of transformation from second to third generation universities. A third generation university, aside from education, is centred on research and commercialization of knowledge. TTOs should facilitate this process. However, transition into a third generation university takes time (Cesaroni & Piccaluga, 2016, pp. 753–777) and the accumulation of experience among staff working in such an Office (Hülsbeck *et al.*, 2013, pp. 199–215). Not every university boasting a technology transfer office becomes automatically a third generation university.

Financing plays an important role in the stimulation of innovation activity. This often comes from a group of people functioning as so-called business angels (venture capitalists). They are private investors who invest in innovative projects in exchange for a share in the companies. With their funds they inject business know-how into a particular sector, by, e.g., using their networks of contacts. Thanks to such investments, some very successful companies have emerged, e.g., Apple Computer and Amazon.com. In Poland the sphere of business angels is still in its infancy and it is easier to identify individual projects which have become prosperous than to indicate their systemic impact on the economy (compare Morawczyński, 2014, pp. 607–618; Piekunko-Mantiuk, 2014, pp. 365–379). In the countries of central Europe loan and guarantee funds play an important role in the financing of enterprise activities. Such funds facilitate access to capital, especially for small and medium-sized enterprises (Vienna Initiative Working Group, 2014, pp. 1–82).

Among all the business support organizations in Poland the majority are training and consulting centres. These institutions provide services related to increasing the economic potential of the region in which they operate and to improving the quality of life of the local community (Koprowska-Sklaska, 2010, p. 143). They help to increase the competitive advantage of enterprises that use their services (Kuczewska, 2015, pp. 203–216).

Research methodology

The included variables are tied to the measurement of innovation activity using the Oslo methodology. The dependent variables were divided into four groups:

1. Expenditure on innovation activities – expenditure on (1) research and development activity, (2) land and buildings, (3) machinery, instruments and equipment for manufacturing and improvement of new products and process, and on (4) computer software for use in product and process innovation activities (OECD, 2005, pp. 92–93).
2. Implementation of new products and technological processes – including new manufacturing methods, by-production systems and support systems (OECD, 2005, pp. 48–49).
3. Innovation co-operation – active participation in joint innovation projects with other organizations (OECD, 2005, pp.79–80):
   a. along supply chains, with competitor and within the corporate group,
   b. with public research institution, e.g., with universities.

Business Support Organizations were posited as the independent variable. These were: Technology Parks, Technology Incubators, Academic Business Incubators, Technology Transfer Offices, Business Angels Networks, Local and Regional Loan Funds, Credit Guarantee Funds and Training and Consulting Centres.

The influence of independent variables on the dependent variable was analysed using probability calculus. This results from the fact that the adopted variables have a dichotomous character, i.e., the responses of the respondents were recorded with the value of 1 when, e.g., the services of a support institution were used, or when an analysis of the type of innovation activity was carried out, and with the value of 0 when no service was used or no new solutions were introduced. The dichotomous nature of variables makes it possible to use the probability calculus in the analysis of the research material. The linear probability model can be easily estimated using multiple regression methods, but its use is inadvisable, because the value of such a function may be negative or greater than one, and in the case of this study these values are devoid of interpretative meaning (Stanisz, 2007, p. 217). In such a case, logistic regression gives a much better adjustment to variables. Generally speaking, logistic regression is a mathematical model which can be used to describe the influence of several variables X_1, X_2, ... X_k on the dichotomous variable Y. If all independent variables are qualitative, the model of logistical regression is equivalent to the log-linear model (Świadek, 2011, p. 102).

The method of maximum likelihood estimation (MLE) is used to estimate the parameters of models with a dichotomous variable. It consists in the fact that a parameter vector $\alpha_{(k)}^{ML}$ is sought which guarantees the highest probability of obtaining the values observed in the sample (Welfe, 2008, p. 73). Maximization of the credibility function is performed using techniques used in non-linear estimation (Maddala, 2001, p. 73).

In the logit model probability is expressed with the help of odds. Probability is expressed with the number of successes in relation to the number of attempts, while the odds are expressed by the number of successes in relation to the number of failures (Danieluk, 2010, p. 206). This relation is expressed by the formula:

$$Odds = \frac{p}{1-p}, \tag{1}$$

where p is the probability of the occurrence of the studied phenomenon.

In the conducted study, two groups of enterprises are compared with each other — those that used one or more of the analyzed support institutions and those that did not.Therefore, it can be presented in the so-called odds ratio, which is used for comparison of two classes of observations. There is an odds ratio that a given event (e.g., increasing expenditure on R&D) will occur in the first group of enterprises (e.g., in enterprises cooperating with a technological park) and that it will equally occur in the second group not cooperating. This relation is described in the formula (Stanisz, 2007, p. 221):

$$OddsRatio = \frac{p_1}{1-p_1}\frac{1-p_2}{p_2} = \frac{p_1(1-p_2)}{p_2(1-p_1)} \tag{2}$$

Values of the odds ratio are interpreted as follows:

- *OddsRatio*>1 – in the first group occurrence of the event is highly likely
- *OddsRatio*<1 – in the first group occurrence of the event is less likely
- *OddsRatio*=1 – in both classes of observation the event is equally likely

A model estimating process was conducted at two stages using the Statistica program. In the first step, using interactive tool design models, independent variables (business support institutes) were distinguished, which had a decisive influence on dependent variables (innovation attributes). During the second stage logit models were estimated to show the impact of business support institutions on innovation activities.

This article presents the logit odds ratio model, which fulfils the conditions of statistical significance. The models are also interpreted for the estimated odds ratio constant for the model. This defines the relationship between the chance of occurrence of the dependent variable in the entities using the services of support institutions, which "individually" do not have an influence on the dependent variable (total) in relation to the opposite groups.

Characteristics of the study sample

The Voivodeship of Masovia is the most developed region in Poland. In 2014 expenditure on innovation activities amounted to just over 4 billion zloty (*Warsaw Statistical Office*, 2015, p. 267), and on research and development, almost 6.5 billion zloty (*Warsaw Statistical Office*, 2015, p. 263). In the same year 507 patents were granted to enterprises in the region and 912 patent applications were registered (*Warsaw Statistical Office*, 2015, p. 268). According to these measures the Voivodeship is ranked in the first place on a national scale.

The research data characterising the innovative activities of industrial enterprises in the Masovian Voivodeship were collected in 2015. The survey form covered innovative events which occurred in the period 2012–2014. This three-year period of activity was selected in accordance with measurement standards for innovative activities contained in the Oslo methodology (OECD, 2005, p. 130).

The participants who took part in the research comprised 951 enterprises, whose business profiles corresponded to section C of the Polish Classification of Businesses, i.e., Industrial Processing. With respect to the level of techniques used, the structure of the researched enterprises corresponded to the structure of the enterprises which are in fact found in the Masovian Voivodeship (Table 1). More than half of the research sample and industrial enterprises in fact constitute entities using a low level of manufacturing technology. Approximately a quarter of the enterprises use a medium-low level of technology. Approximately 17% of the research sample constitute entities using a medium-high level of manufacturing technology. In fact, in the Masovian Voivodeship such enterprises amount to 19.1%. In the research sample, a high level of manufacturing technology is employed by 6% of the researched entities, while in fact the figure is 3.6% for the population. The convergence of the research sample and the enterprises appearing in the Masovian Voivodeship are in fact witness to the homogeneity of the sample and is one of the strong points in the research project.

Taking into account the size of the analysed enterprises, with respect to the number of employees (Table 2), more than a half constitute micro businesses, employing up to 9 persons. The share of small businesses with employment of 10 to 49 persons amounts to close on 1/3 of the sample, and for mid-sized enterprises, to close on 13%. The least numerous are large enterprises, employing above 250 employees. They constitute 2.6% of the sample.

When it comes to the use of business support institutions the percentage shares do not sum to 100%, because not all of the surveyed businesses cooperated with support institutions, and any business could cooperate with several institutions.

In the Masovian Voidvodeship the most popular service is that provided by training and consultancy centres, which were used by more than 30% of the surveyed enterprises. Next in popularity, the enterprises cooperated with loan funds (above 23%) and guarantee funds (above 19%). Among innovation centres the highest percentage of enterprises made use of technology park services (5.2%). Slightly fewer businesses cooperated with technology transfer centres (3.3%), and about a half as many, with technology incubators (2.4%). 2% of the surveyed enterprises used the services of the Business Angles Networks, while 0.8% used academic business incubators (Table 3).

Results

Business support organizations significantly and positively (with two exceptions) influenced the innovation activities of industry in the Masovian Voivodeship.

The analysis shows that innovation centres (Table 4), i.e., parks and technology incubators, academic incubators and technology transfer offices, increase the likelihood of introducing research and development work from 4 to more than 8 times. This shows that innovation centres fulfil a function in this area which needs to be filled in the economy, i.e., creating new knowledge. Training and consultancy centres also belong to the group of institutes initiating the introduction of R&D. Their impact is, however, less significant — the likelihood of growth is barely doubled. In enterprises which made use of the services of the remaining support institutes (in total), the likelihood of incurring expenses on R&D activities was more than 60% lower than in entities which did not use these services.

The odds ratio values reflecting investment in new fixed assets were lower than the increase of expenditure on R&D (Table 4). In general, there

was a more than 3-fold increase in the latter for training and consultancy centres, close to 3-fold for technology parks, more than 2-fold for local and regional loan funds, and close to 2-fold for credit guarantee funds. Moreover, the remaining support institutes increased the chances for this type of investment by a total of 50%. If we take a closer look at the investment structure, then under the influence of support institutes enterprises invest more often in new machines and technical equipment than invest in buildings or land for new production. Among enterprises employing the services of technology incubators the chances of investment in new buildings, premises and land rise close to 4-fold, business angle networks, to above 2.5 times, training and consultancy centres, to above 2-fold, and technological parks close on 2-fold. The remaining support institutes do not increase the chances for this kind of investment (the constant suggests even that they are lower than in enterprises which did not use support institutes of the remaining services). With respect to enterprise investment in machinery it is clear that there is a more than 3-fold chance of their occurrence growing in the case of enterprises using the services of business angels, close to 2.5 times for training and consultancy centres, and more than 2-fold for technology parks. Loan guarantee funds increase the chances by almost 1.7 times, and loan funds, almost 1.5 times.

The expenses on new computer software (Table 4) were incurred more often in entities which made use of technology incubators (by a factor of 8 times), technology parks (more than 2.2 times) and training and consultancy centres (more than 1.7 times).

To summarise, the analysis of the influence of business support institutes on expenses related to innovation activity shows that the strongest, i.e., the most effective, institutes in this area are technology parks and training and consultancy centres. They were included in the composition of every model. Moreover, also noticeable was the activity of innovation centres with respect to incurring expenditure on R&D activity, which confirms their proper functioning in this area.

Business support organizations in the Masovian Voivodehsip increase the chances of the implementation of new products and technological processes (Table 5). In relation to new products appearing on the market, technology incubators are particularly active, and their odds on implementation of new products rise by more than 6.5 times. Apart from this institute, technology parks are 3 times more active in this area, and for training and consultancy centres, close on 3 times more often.

Comparing the implementation of new products and technological processes it is noticeable that business support organizations are often more active in the case of the latter type of innovation (Table 5). The chances of

implementing new technological processes increased for technology incubators by more than 12-fold, for training and consultancy centres more than 4-fold, and to more than 2-fold for technology parks (these same institutions had an influence on implementation of new products) and for loan funds (more than 2.8 times) and guarantee funds (more than 2.2 times). The likelihood of introducing new methods of production rose in the case of enterprises which used the services of entrepreneurial academic incubators (close to 7-fold), training and consultancy centres, technology parks and load funds (more than 2-fold). Equally many institutions had an influence on enterprises investing in systems supporting their activities. The likelihood for this type of investment rose by more than 7-fold under the influence of technology incubators, more than 4-fold for business angle networks, more than 2-fold for guarantee funds and training and consultancy centres, and close to 1.5 times more for loan funds. An interesting fact is that in entities which used the services of technology transfer offices for the purchase of support software it occurred less than half as often than in enterprises which did not use their services. Perhaps that shows that the centres concentrate on technology transfer closely related to the activity profile of their clients. Production-related systems are more often implemented by enterprises which use technology incubators and parks (by more than 2-fold) and by training and consultancy centres (close to 2-fold).

In the Masovian Voivodeship, business support organisations most often contribute to establishing cooperation in the area of new solutions within the scope of the corporate group (Table 6). The chances are more than 8-fold that academic incubators increased this kind of cooperation with entrepreneurs, and close on 7-fold for technology incubators, 4-fold for technology transfer offices and technological parks, and close on 2-fold for training and consultancy centres. Technology parks and technology transfer offices increase the likelihood of forming cooperation with suppliers by 2-fold. There are also loan funds active in this area (increasing the likelihood by a factor of 1.6) and guarantee funds (increasing the likelihood by a factor of 1.4). In comparison with the above mentioned kinds of cooperation, the forming of cooperation looks much weaker with recipients and competitors. In the region, the likelihood of the occurrence of cooperation with recipient rises by a factor of 2.6 under the influence of technology incubators and by a factor of 2.1 under the influence of academic incubators. On the other hand, cooperation with a competitor is 4.5 times more likely to be instigated by technology transfer centres.

Given the odds ratio for the constant in the model, it is apparent that the business support institutions which did not come into the model do not contribute to the establishment of the analysed types of cooperation (Table 6).

In the studied region it is clear that innovation centres easier initiate innovative cooperation than the remaining forms of business support organizations. Such a state is understandable, because the most valuable innovations are novelties on the international scale. These kind of novelties are difficult to implement individually in a closed innovation model (inter alia, on account of the high costs of conducting research). As far as access to knowledge in areas of new technologies is concerned, then innovation centres naturally have more to offer than financial institutions.

Cooperation with entities from the field of science occurs less often than from those along the supply chain (Table 7). Transfer of knowledge from scientific entities belongs also to the domain of innovation centres, although it occurs less intensively than in the case of cooperation with enterprises (less institutional support fulfilled the conditions of statistical significance in the models). The likelihood of cooperation with departments of the Polish Academy of Science has increased by more than 13-fold for technology parks, by a factor of 11.5 times for academic incubators, and by more than 5.5 times for technology incubators. When considering cooperation with institutes of higher education, academic business incubators increased the likelihood of establishing it by close on 11-fold, technology parks by close on 6-fold, and technology transfer offices by 3-fold. There was also a greater than 2-fold increase in the likelihood of knowledge transfer from national centres of research and development to enterprises which used services from training and consulting centres.

In the case of cooperation with entities from the field of science, there arose two odds ratios, which indicated that enterprises using the services of support institutions less frequently transferred knowledge from the field of science than did enterprises which did not use such services (Table 7). Namely, enterprises which used the services of training and consultancy centres cooperated 92% less often with the Polish Academy of Sciences than entities which did not use the services of these centres. Similarly, enterprises which used the services of loan funds cooperated 77% less often with national centres of research and development. The constant shows that support institutes which are not included in the models reduce the likelihood of transfer of knowledge from the field of science.

Analysing Table 7 as a whole, it is clear that transfer of knowledge from the field of science contributes to innovation centres.

Discussion

In the Masovian Voivodeship business support organizations play a crucial role in building innovation activity. Innovation centres (technology parks and incubators, academic business incubators and technology transfer offices) as well as training and consultancy centres contribute to the conducting of research and development work. R&D work helps sharpen the competitive edge of enterprises by creating new products and technologies which will be unique on the national and international markets. The importance of technology transfer centres in the field of innovative solutions in the United States has been confirmed by research conducted by Castillo *et al.* (2018, pp. 120–138). The chances of investment in new fixed assets are raised on the other hand by technology parks (which may involve giving quarters on their premises to entities using the services of parks), financial institutes and training and consulting centres. This type of investment allows the creation of infrastructure which will be used for the production of new products and implementation of new technological processes.

What is clear in the region is the strong linking of parks and technology incubators with the creating of new products and implementation of new technological processes. Faster implementation of advanced technologies by enterprises located in the area of incubators has also been confirmed by research conducted by Colombo and Delmastro (2002, pp. 1103–1122). In the Masovian Voivodeship, training and consulting centres were also active in the studied area. Moreover, loan and guarantee funds contribute to the implementation of new production methods. This shows that in the region a crucial factor influencing the creation of innovation is constituted by knowledge and capital. Both these gaps are filled by a support institution. In the case of the activities of loan and guarantee funds, the value of the odds ratio was lower than for parks and incubators. This shows that the capital gap may constitute a problem in building the potential of innovation. In this context, it is also disturbing that this gap is not filled by business angle networks. Their services were used by only 19 entities in the regional study. The lack of models does not actually mean failure in projects deprived of capital by angles, however, their activities do not contribute to systemic stimulation of innovation. This confirms the results of the study presented in the introductory parts of the article.

In the Masovian Voivodeship it is more difficult for support institutions to initiate cooperation in the areas of new solutions than innovation activities. Considering only cooperation, institutes more often influence positively cooperation with other enterprises than with the field of science.

Cooperation plays a crucial role in the implementation of innovation. Studies conducted in Italy have proven that entities located in technology parks more easily engage in interactions with institutions in the field of science (Rocio Vasquez-Urriago *et al*., 2016, pp. 137–147). These benefits are particularly evident in the case of companies that develop quickly and dynamically (Arauzo-Carod *et al*., 2018, pp. 645–658). Incubators also stimulated cooperation (Colombo & Delmastro, 2002, pp. 1103–1122). In the analyzed voivodship precisely these institutions contributed to the establishment of innovative cooperation. In the remaining cases only loan and guarantee funds increased the likelihood of cooperation with suppliers, and training and consultancy centres in capital groups. Moreover, with respect to knowledge transfer from the field of science to business it is clear that innovation centres have a vital influence on the process. At the same time, what is surprising is that the entities which cooperated with guarantee funds cooperated less often than the others with national research units, as well as with training and consultancy centres from Polish Academy of Science units. This shows how important meritorious support is in running projects created in the field of science.

Conclusions

In the light of the above conclusions, it may be stated that the research hypothesis asserted at the beginning of the article has been confirmed. Business support institutes increase the likelihood of introducing innovation activities and cooperation, yet their influence is varied. Technology parks and technology incubators, as well as training and consulting centres, are the most effective. They contributed to the conducting of R&D, implementation of new technologies, introduction of new products to the market, investment in new fixed assets, and also the establishment of cooperation in the area of new solutions. A smaller spectrum of impact was characterised by other support institutions. At this stage, it should also be emphasized that cooperation in the area of innovation is a problem. Despite the impact of support institutions in this area, it remains at an unsatisfactory level.

The research work has increased the knowledge base in the area of innovation support for the economy and innovation of the region. First of all, it has been proven that local government authority investment in business support institutions is profitable. Such activity brings tangible benefits to the economy, however, entrepreneurs should be encouraged to cooperate more in the area of innovation.

Logit modelling is a method that has allowed for a general presentation of the state of the economy of the Masovian Voivodeship in the context of business support institutions. At the same time though, it does not state clearly the reasons for this. Therefore, it would be worthwhile to carry out research on the support institutions themselves and on the entities which use their services in order to evaluate the quality of the services provided by the support centres.

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Annex

Table 1. Structure of the studied companies and the manufacturing companies which are located in the Masovian Voivodeship in terms of the level of technical advancement in 2014

Level of technical advancement	Structure			
	of the studied companies		of the companies in the Masovian Voivodeship	
	Quantity of companies	Percentage	Quantity of companies	Percentage
Low	512	53,8%	32 177	54,1%
Medium-Low	219	23,0%	13 824	23,2%
Medium-High	163	17,2%	11 380	19,1%
High	57	6,0%	2 135	3,6%
Sum	951	100%	57 178	100%

Source: author's own research based on survey and Local Data Bank of Statistical Office in Warsaw on warszawa.stat.gov.pl.

Table 2. Structure of the studied company in terms of size classes in 2014

Company size	Quantity of companies	Percentage
Micro	513	53,9%
Small	292	30,7%
Medium-sized	122	12,8%
Large	24	2,6%
Sum	951	100%

Table 3. Cooperation of the studied company with Business Support Organizations in 2012–2014

Business Support Organizations	Quantity of companies	Percentage
Technology Parks	49	5,2%
Technology Incubators	23	2,4%
Academic Business Incubators	8	0,8%
Technology Transfer Offices	31	3,3%
Business Angels Networks	19	2,0%
Local and Regional Loan Funds	221	23,2%
Credit Guarantee Funds	182	19,1%
Training and Consulting Centres	293	30,8%

Table 4. Influence of Business Support Organizations on expenditure on innovation activity in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Expenditures on R&D	Investment on new fixed assets	of which expenditures on		Expenditures on computer software
			buildings, offices and lands	machinery and technical equipment	
Technology Parks	3,93	2,83	1,98**	2,05**	2,24**
Technology Incubators	6,87		3,75		8,08
Academic Business Incubators	8,50***				
Technology Transfer Offices	4,05				
Business Angels Networks			2,65**	3,31***	
Local and Regional Loan Funds		2,23		1,47**	
Credit Guarantee Funds		1,80**		1,69**	
Training and Consulting Centres	1,86	3,40	2,17	2,47	1,73
Constants	0,37	1,50	0,17		
chi-square	80,02	95,97	42,86	78,90	37,87
p-value	0,0000	0,0000	0,0000	0,0000	0,0000

** - statistical significance 0,05, *** - statistical significance 0,1

Table 5. Influence of Business Support Organizations on product and process innovations in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Implementation of new product	Implementation of new technological processes	including:		
			manufacturing methods	production-related systems	support systems
Technology Parks	3,13	2,32	2,12**	2,65	
Technology Incubators	6,56**	12,48**	5,90	2,33***	7,35
Academic Business Incubators			6,97***		
Technology Transfer Offices					0,42***
Business Angels Networks					4,11
Local and Regional Loan Funds		2,84	1,75		1,44***
Credit Guarantee Funds		2,28	2,06		2,26

Table 5. Influence of Business Support Organizations on product and process innovations in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Implementation of new product	Implementation of new technological processes	including:		
			manufacturing methods	production-related systems	support systems
Training and Consulting Centres	2,74	4,37	2,27	1,98	2,33
constants			0,46	0,25	0,23
chi-square	65,76	155,54	117,15	35,27	114,92
p-value	0,0000	0,0000	0,0000	0,0000	0,0000

** - statistical significance 0,05, *** - statistical significance 0,1

Table 6. Influence of Business Support Organizations on innovation cooperation along supply chains, within competitor and in corporate group in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Cooperation with/in			
	supplier	recipient	competitor	corporate group
Technology Parks	2,02**			3,93
Technology Incubators		2,60**		6,87
Academic Business Incubators		2,15**		8,50***
Technology Transfer Offices	2,64		4,46	4,05
Business Angels Networks				
Local and Regional Loan Funds	1,63			
Credit Guarantee Funds	1,44**			
Training and Consulting Centres				1,86
constants	0,30	0,27	0,04	0,37
chi-square	29,96	9,07	6,31	80,02
p-value	0,0000	0,107	0,0120	0,0000

** - statistical significance 0,05, *** - statistical significance 0,1

Table 7. Influence of Business Support Organizations on innovation cooperation with science research sector in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Cooperation with			
	Polish Academy of Sciences departments	universities	national R&D centres	foreign R&D centres
Technology Parks	13,23	5,96		
Technology Incubators	5,56**			
Academic Business Incubators	11,65**	10,89		
Technology Transfer Offices		3,27**		
Business Angels Networks				

Table 7. Influence of Business Support Organizations on innovation cooperation with science research sector in the Masovian Voivodeship in 2012–2014

Business Support Organizations	Cooperation with			
	Polish Academy of Sciences departments	universities	national R&D centres	foreign R&D centres
Local and Regional Loan Funds				
Credit Guarantee Funds			0,23	
Training and Consulting Centres	0,08**		2,29	
constants	0,01	0,03	0,04	
chi-square	33,12	27,34	10,13	
p-value	0,0000	0,0000	0,0063	

** - statistical significance 0,05, *** - statistical significance 0,1