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**Size and ownership
of enterprise and
innovation activities
of food and beverages
manufacturers in western
Poland in 2009-2012**

1. Introduction

The food sector is one of the most important and fastest growing sectors in the Polish economy. There are more than 400 thousand people employed (GUS 2012). There are only three countries with more people employed in this sector: Germany, France and Great Britain in the European Union. However, in terms of productivity it is much weaker than leading sectors in Europe. This leads to the conclusion that its competitive advantage is based mainly on low labor costs and cheap raw materials. It also means that if both factors increase the companies will not be able to compete. Hence they must increase both its productivity and competitive advantage. The two primary instruments of achieving it are: internal growth based on their own development or external growth through mergers or acquisitions. Time of easy and cheap acquisitions in Poland is over. As a result of it, many local companies were overtaken by the international investors and got an access to the Common European market. Their international achievements attract new investors with their capital to Poland. On the other hand, relatively high labor intensity of most types of food

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processing, strong links with the local market, and a large variety of assortment and a short series production make it permanently attractive for many local small and medium-sized companies. This is an opportunity for domestic producers. However they must redesign their internal structure, products, services, processes and marketing communication to be able to meet not only present but also future customer needs. They should increase their innovation (Janasz 2009, p.42).

The main goal of this work is to determine the nature of relations between innovation activities and the size and ownership of food and beverages manufactures in western Poland in 2009-2012. The analysis is based on data collected in the food industry companies from Wielkopolska, Dolny Śląsk, Lubuskie and Zachodniopomorskie in 2009-2012.

2. Food and beverages sector in Poland

Polish food sector includes two main categories of PKD register: manufacture of food products (PKD 10) and beverages (PKD 11). Each category contains a set of subcategories corresponding to the processed raw materials and manufactured products (Dz.U. z 2007 nr 251, poz.1885, z późn. zm.). Despite such a wide variety of companies, most of them focus on a single business profile due to both strict health regulations and high investment requirements required in this industry. These restrictions often make the companies operate in different market conditions and regulations. As a result, companies have different fields of economic and financial performance, and growth prospects. The sector is subject to a number of formal and legal regulations to a large extent created by the law of the European Union. One of the most important legal requirements especially for exporters (about 80% of Polish exports go to the EU market) is full compatibility with the European standards. Moreover high sanitary standards affect the value of investments that you have to invest before you start doing business in this sector. Furthermore quantitative restrictions on the production of milk and sugar in the European Union and the high quality and environmental standards create high entry barriers to the market for food entrepreneurs (BAA Poland 2012, p.10-13). The annual growth in food production was significantly slower than the dynamics of the increase in gross domestic production in Poland by 2002. After opening the European Community market for Polish exporters proportions were reversed. The value of sold production of food and beverages amounted to 179.25 billion zł in 2011 which makes 18.86% share of sold production of food processing and 15.76% share of total industrial output (GUS 2012). The share of

regions surveyed in the sold production of food and beverages in 2010 amounted to 38.9 billion (23.7%), including: 25.6 billion (15.6%) in Wielkopolska, 6 billion (3.7%) in Zachodniopomorskie, 2.3 billion (1.4%) in Lubuskie and 5 billion (3.0%) in Dolny Śląsk (BAA Polska 2012, p.19). In 2010, Poland had 15,485 enterprises producing food products and 486 beverage producers which together accounted for more than 8.2% of total industrial enterprises in Poland. In 2011, employment in food production was 407 thousand employees (14.5% of total employment in the industry), and in the production of beverages 26.6 thousand (0.9%). It makes 15.4% share of total employment in the industry (GUS 2012).

3. Innovative activity - basic concepts

Innovation can be a process or a result of its implementation (Dolińska 2010, p. 13). A creation of an idea, research and development, design, production and dissemination can also create the innovation process (Stawasz 1999, pp. 24-25). The result of innovation is good, service or idea that is perceived by the recipient as a new (Pomykalski 2001, p 17). The implementation of a new or significantly improved product (service) or process, a new marketing method or organizational business practice, organization, workplace or relationship with the environment is an innovation (OECD 2008). The resource or the company's ability to effectively and efficiently create, implement and manage innovation is its innovative potential (Szymczak 1979, p 854). It is required to achieve the goals of an innovative company. The innovative potential serves to achieve the goals of an innovative company.

Both the structure and organization of innovative companies facilitate the process of innovation. The main features of such a system are: (a) the ability to generate permanent innovation, (b) creativity and the ability to maintain a high competitive position based on core competencies, (c) the ability to anticipate the future, (d) the ability to effectively explore the needs of customers, (e) have innovators team to ensure a high level of innovation in the company, (f) the flexibility of adapting to changing conditions (Sosnowska, Łobejko, Kłopotek 2000, p.11). Innovation determines the willingness and ability of the company to develop and absorb new and improved products, services or technologies (Janasz, Koziol 2007, p.57). Innovation activity is an activity aimed at achieving a particular purpose and not just the activity that results from the occurrence of certain events (Okoń-Horodynska, Zachorowska-Mazurkiewicz 2007, p.105). Innovation activity depends on diversity and structure of its relationship with the sources of information, knowledge, technology, work practices and human and

financial resources. Each link connects an innovative company with a variety of actors in the innovation system. Innovation activity requires investments in: (a) research and development, (b) technology assets, (c) the purchase of advanced machinery, equipment, computer hardware or software, as well as land and buildings (including upgrades and repairs), (d) training of staff and marketing of new and improved products (e) other activities including design work, planning and testing of new products and services, production processes and methods of delivery (Dwojacki and Hlousek 2008, p 49). The important role in shaping the pace of innovation processes plays cooperation with such actors as: (1) universities, higher education institutions, research and development units, (2) the state administration (3) competitors, suppliers and customers. They also act as sources of knowledge and technology (Świadek 2011, p.51). The nature of their relationship depends on companies' nature and the market they operate (Dierkes 2003).

4. Innovation activity of food and beverages manufacturers in Poland

Food and beverages sector is classified in terms of technology and R & D intensity to the lowest level (GUS 2007, pp. 224-225). 35.3% of industrial enterprises in Poland introduced new or significantly improved products or processes between 2008-2010. Food producers' share of such enterprises was 28.3%, whereas beverage sector's share was 51.3%. Both groups are dominated by companies employing more than 249 people. In the group of large enterprises, 56.3% of food producers and 75% of the beverage manufacturers have introduced new or improved products or processes. In the sector of food production, new or improved products have been introduced by the 21.2% of all enterprises (only new products by 10.4%), while in the beverage sector new or improved products have been introduced by the 43.6% of all enterprises (only new products by 20.5%). New or improved processes have been introduced in the production of food by 20.7% of all enterprises. In the beverage sector they have been introduced by 39.7% of all enterprises. However the share of net income from the sale of new or significantly improved products in total net sales in the Polish food sector has been steadily decreasing since 2006. In 2006-2008, new products introduced to the market accounted for 8.2% of all products launched on the market, while in 2009-2011, their share dropped to 4.6%. The trend for the production of beverages is reversed. In 2006-2008, new products introduced to the market accounted for 6.6% of all products placed on the market, and between 2009 to 2011, their share increased to 8.1% (GUS 2011). Most new products are new

at the level of the firm, but not for the industry or for the world. Most of these innovations are imitations or supplements (new flavors and new packaging) or only slightly revised versions introduced in order to improve the quality or reduce the cost of production. They are rarely based on modern technology (such as biotechnology, genetic engineering and nanotechnology) or include the latest achievements of science for example micro-components or biodegradable packaging (Kaczorowska 2009, p.50-57). The capital investment on innovative activity shows the dominance of investment in technical infrastructure and technology. Investments in land and buildings and the machinery, equipment and tools and vehicles amounted to 1,010 million (81.54% of total expenditure) in food production in 2010. In the case of beverage sector capital expenditure amounted to 262.8 million (71.72%). Whereas investment in the marketing of new or improved products, respectively amounted to 104.3 million (8.4%) and 78.7 million (21.47%) (GUS, 2011). Expenditures on staff training related to innovation activities in both sectors were the smallest. The low share of expenditure on research and development of innovation confirms the imitative nature of the Polish food sector enterprises (Chądzyński 2011).

In terms of non-technological innovation, food manufacturers more often introduce marketing innovation than organizational innovation. The predominant type of marketing innovations are changes in project design or packaging of the product. The most common organizational change are the new rules of operation (Juchniewicz 2011). There were 332 people employed (FTE) in R & D departments in food industry including 19 people with a PhD in 2010. None of the companies employs people with the title of professor and postdoctoral.

5. Research sample and methodology of the study

The scope of the study concerns innovation among food and beverage manufacturers. It covers innovation at the level of the firm and new to the firm. The survey is based on a questionnaire sent by an email and a telephone interview with an owner or manager of a company.

The structure of the surveyed companies reflects the Central Statistical Office data. They were collected from 2009 to 2012. The resulting collection comprises 442 enterprises, including micro 127 (28.73%), 201 small (45.48%), 90 medium (20.36%) and 24 large (5.43%) enterprises operating in the following regions: Wielkopolska, Dolny Śląsk, Lubuskie and Zachodniopomorskie. The selected set is a subset of a broader industrial business innovation research conducted in these regions. It includes 393 (88,91%) domestic enterprises, foreign capital is

represented by 22 (4,98%) firms and mixed capital is represented by 27 companies (6,11%). The table 1 shows the structure of the surveyed companies by size and origin of their capital.

Table 1. The structure of the enterprises by employment size and origin of the capital

Ownership of the company	Company size				Total
	Micro (1-9)	Small (10-49)	Medium (50-249)	Large (>249)	
Domestic	127	193	64	9	393
Foreign	0	2	9	11	22
Mixed	0	6	17	4	27
Total	127	201	90	24	442

Source: own study

The methodological part of the analysis uses probit modeling, which allows to determine the probability of various innovative behaviors depending on the size and type of ownership of the company [Świadek 2008, pp. 119-132]. The assumptions for these models are as follows: the data come from a random sample, Y can take only two values: 0 or 1, subsequent Y values are statistically independent, the probability that Y = 1 is defined by NCD (normal distribution) for the probit or LCD model (logistic distribution). There is no perfect linear relationship between the variables in the logit model Xi (assumption of no multicollinearity of independent variables) [Judy-Zajchowska 2003, pp.129-30]. Parameter estimation is performed using maximum likelihood method (MLE). It allows to find a vector of parameters that guarantees the highest probability of obtaining the observed value of the sample [Welfe 1998, pp. 73-6]. MLE requires the definition of likelihood function and finding its extreme. The nonlinear estimation procedure uses a quasi-Newton algorithm to find the minimum of the loss function. In this way, a collection of the best estimators for the loss function is calculated [Stanisz 2007, pp.190-1]. Maximizing the likelihood function for the probit model is made using the techniques used in the nonlinear estimation [Maddala 2006, p. 373]. All calculations were performed in the Statistica package. Due to the fact that the dependent variables (innovation activities)

and independent variables (size and ownership) are binary relationships between them take the form of linear equations. Each model is described by two probabilities. P1 determines the probability of the innovative activity in the selected set of companies. P2 determines the degree of probability of the innovative activity for the rest of companies. If the model is positive ($a > 0$), P1 means that the degree of probability is higher in a surveyed set than for the rest companies. 39 (31%) out of 126 models are statistically significant.

6. The impact of company size on its innovation activity

All statistically significant models for companies employing less than 10 employees have a negative parameter ($a < 0$) what indicates that the small size of the company significantly reduces its innovative activity. Hence P1 indicates the probability not to take a given innovation activity in a given group. Table 2 includes a set of models for the independent variable „size of the company.”

The micro companies are likely not to take such innovation actions as: (1) investment in new fixed assets (0,65), (2) implementation of new technology processes (0,61) and (3) launching new products (0,52). No statistically significant dependence was found in the group of small businesses. This proves that innovative activity is not an essential element of their economic activity. Medium-sized enterprises are the backbone of innovation by the number of statistically significant models and the fact that all models have a positive parameter ($a > 0$). Medium companies mostly implement of new technology processes (0.84), invest in new fixed assets including computer software (0.62), and take innovation cooperation (0.55). They are also likely to invest in R&D activity (0,40), implement new technology processes including non production systems (0,40) and cooperate with suppliers (0,41). Most large companies implement new processes (0.96) including new production methods (0.75). They often introduce new products (0.86) and invest in assets not used so far including computer software (0.75). In comparison to other groups of enterprises, large companies mostly invest in R & D (0.67). However it is not their preferred option within their own group. The analysis shows that the company size does not relate to the investment in fixed assets not used so far including machinery and equipment. There are no relations to: cooperation with PAN units, universities, domestic and international research units so these companies are not interested in transferring university knowledge into practice.

Table 2. Probit models for the dependent variables describing the innovation activities of the food industry and the independent variable „company size”

Innovative feature	Company size									
	Micro (1-9)		Small (10-49)		Medium (50-249)		Large (>249)			
	P1	P2	P1	P2	P1	P2	P1	P2		
R &D expenditure	-0,58x-0,49		no statistically significant models		+0,52x-0,76		+1,14x-0,70			
	0,14	0,31			0,41	0,22	0,67	0,24		
Investment in new fixed assets (including):	-0,30x+0,70									
	0,65	0,76								
a) buildings and grounds	-0,42x-0,52									
	0,17	0,30								
c) computer software	-0,50x+0,14						+0,38x-0,07		+0,70x-0,03	
	0,36	0,56					0,62	0,47	0,75	0,49
Launching new products	-0,36x+0,41								+0,69x+0,27	
	0,52	0,66							0,83	0,61
Implementation of new technology processes (including):	-0,36x+0,65				+0,57x+0,44		+1,23x+0,50			
	0,61	0,74			0,84	0,67	0,96	0,70		
a) New production methods	-0,27x+0,08						+0,70x-0,03			
	0,43	0,53					0,75	0,49		
b) Non production systems					+0,46x-0,66					
					0,42	0,26				
c) Support systems	-0,68x-0,73				+0,56x-1,02					
	0,08	0,23			0,32	0,15				
Cooperation with suppliers	-0,34x-0,51				+0,49x-0,71					
	0,20	0,30			0,41	0,24				
Cooperation with customers					+0,38x-1,03					
					0,26	0,15				
Overall innovation cooperation	-0,35x-0,30				+0,69x-0,56					
	0,26	0,38			0,55	0,29				

Source: own study

7. The impact of company's ownership on its innovation activity

Domestic nature of the surveyed companies has a negative impact on their innovation activity. They are likely not to take: (1) investments in fixed assets not used so far including computer software (0.69) and investments in machinery and equipment (0.63), (2) implementations of new processes including non production systems (0.27) and (3) investments in R & D (0.24) and investments in fixed assets not used so far including buildings and land (0, 24). Table 3 presents probit models for the independent variable "ownership of the company."

Table 3. Probit models for the dependent variables describing the innovation activities of the food industry and the independent variable "ownership of the company"

Innovative feature	Ownership of the company					
	Domestic		Foreign		Mixed	
	P1	P2	P1	P2	P1	P2
R &D expenditure	-,64x-,07		+1,05x-0,70			
	0,24	0,47	0,64	0,25		
Investment in new fixed assets (including):						
a) buildings and grounds	-,51x-0,18				+,53x-0,66	
	0,24	0,43			0,44	0,25
b) technical equipment and machinery	-,42x+0,75					
	0,63	0,77				
c) computer software	-,58x+1,06		+,63-0,02			
	0,69	0,86	0,73	0,49		
Implementation of new technology processes (including):					+,71x+0,51	
					0,89	0,69
b) non production systems	-,48x-0,12				+,65x-0,60	
	0,27	0,45			0,52	0,27

c) support systems	-0,50x-0,44		+ ,57x-0,92			
	0,17	0,33	0,18	0,36		
Cooperation with universitites	-1,25x-1,54		+1,26x-2,60			
	0,01	0,06	0,09	0,01		
Cooperation with foreign R&D units	-,93x-1,40				+1,03x-2,25	
	0,01	0,08			0,11	0,01

Source: own study

The number of models for both foreign and mixed capital is equal, but they represent different innovation activities. Foreign companies mostly invest in computer software (0.73) and the R & D activities (0.64). They are less likely to implement new processes including support systems (0.18) and cooperate with universities (0.09). Mixed capital companies most often implement new processes (0.89) including non production systems (0.52) and invest in buildings and grounds (0.44). They are least likely to cooperate with foreign R & D units (0.11). No statistically significant associations have been found for the introduction of new products, an innovative collaboration with suppliers, customers, competitors, PAN units and domestic R+D units so it is the evidence that there are not interested in cooperation yet.

8. Conclusions

Medium-sized enterprises show the greatest innovative activity. They also take varies innovative steps to improve their market competitiveness the most often. They not only invest in improving their processes, but cooperate with suppliers and customers, as well. On the other hand, large companies are focused on building its position based on the implementation of new technological processes, the introduction of new products and production methods. They also invest in R & D. The least innovation active firms are domestic micro and small enterprises. There is no transfer of knowledge between science (PAN units, universities, domestic and international R&D units) and examined companies. Domestic companies present the least innovative activity while foreign and mixed capital firms take innovation actions more often. The medium-sized companies are likely to take innovation activities the most. It does not comply with the main assumption. Furthermore when we analyze the capital structure of this group we notice that 2/3 of them are domestic and 1/3 are foreign and mixed.

Summary

Size and ownership of enterprise and innovation activities of manufacturers of food and beverages in western Poland in 2009-2012

The paper presents the results of a study aimed at determining the nature of relations between innovation activities and company size and company's ownership in the food and beverage sector in western Poland in 2009-2012. The most innovation active enterprises are medium-sized companies, which are also the only group which leads innovation cooperation with its suppliers and customers. Among the most frequently taken innovation activities are: the implementation of new technological processes, investments in new fixed assets including computer software and investments in R & D. The least innovation active firms are domestic micro and small enterprises.

Key words: *food and beverages sector, innovation activity, company size, company's ownership.*

Streszczenie

Wielkość i charakter własności przedsiębiorstwa a działalność innowacyjna przedsiębiorstw sektora spożywczego w zachodniej Polsce w latach 2009-2012

Artykuł przedstawia wyniki badania, którego celem jest określenie relacji zachodzących pomiędzy wielkością i charakterem własności przedsiębiorstwa a rodzajem podejmowanej działalności innowacyjnej przez producentów artykułów spożywczych i napojów w zachodniej Polsce w latach 2009-2012. Wśród badanej zbiorowości najaktywniejsze innowacyjnie okazały się przedsiębiorstwa średnie, które jako jedyne współpracują innowacyjnie z dostawcami i odbiorcami. Najczęściej podejmowanymi działaniami innowacyjnymi są: implementacja nowych procesów technologicznych, inwestycje w dotychczas niestosowane środki trwałe w tym oprogramowanie komputerowe oraz nakłady na działalność B+R. Najmniej aktywnie innowacyjnie okazały się mikro i małe przedsiębiorstwa krajowe.

Słowa

kluczowe: *sektor spożywczy, działalność innowacyjna, wielkość przedsiębiorstwa, własność przedsiębiorstwa.*

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