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## RELATIONSHIPS WITH SUPPLIERS AND INNOVATION ACTIVITY IN FOOD INDUSTRY IN POLAND

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**Abstract.** The food industry is one of the traditional areas of management, the so-called low-tech. For this reason, technological and spatial proximity may be the key to create new solutions in the Polish food industry. The main objective of the study was an attempt to seek influence of relationships with suppliers on innovation activities of enterprises in the food industry in Poland. As a consequence, this would allow to determine the boundary conditions for the model structure of innovation networks within producers of food and beverages, with special reference to the Polish economy. The study was conducted on a group of 631 companies food industry companies located in Poland. Methodical part of the analysis was based on probit regression (probability theory).

**Key words:** innovation, suppliers, food industry

### SUPPLIERS AND THE INNOVATION OF BUSINESSES – AN OUTLINE OF THE PHENOMENON

Nowadays, in relation to the ongoing process of internationalisation and globalisation, the majority of industrial enterprises, and mainly the production ones, become an element of more or less formalised networks of innovation. The industrial cooperation in the vertical, that is with the suppliers and customers (Hakansson, 1987) prevails in such relations (what can be confirmed by other studies of the authors). Such relations are not typically of market nature, however they are more durable and,

so to speak – interactive (network type) (DeBresson and Walker, 1991). Such relations are more stable, because based on the common trust, they allow for the implementation of the learning process (Asheim, 1996). Also for this reason it is believed that this network activity, and namely the intra- and inter-regional one is currently the main success factor in the innovation activity field (Saxenian, 1994). Including these types of structures to the international and global industrial systems allows to maintain the continuity of functioning and timeliness of the transfer of the broadly understood knowledge within them (Sternberg, 2000).

The functioning of the network of innovations in the local grasp may lead to the creation of chances for the less developed regions. However, it should be remembered that they are not the ready and immediate solutions for all problems of the economic nature. However, they allow for the access to small and medium-sized businesses to global resources (including the resources of knowledge and technology), while on the other hand, they give the possibility to produce products and offer them on the international market (Huggins, 1995).

With regard to the food industry, over the past few decades, it passed from the phase of high growth, to a mature market, as well as projects. Investment risk has thus become high in relation to the opportunities and possibilities to earn profits. Therefore, it has become important to search for the functional areas (marketing, supply chains, innovation), which allow the food

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industries to develop at the local and regional level (Curtis et al., 2013).

Industrial systems in the sector grasp, thanks to the cooperation processes, play an important role in the division of tasks between the manufacturers, sellers, buyers or B+R institutions. Entities, which do not cooperate and do not acquire new knowledge, reduce their competitiveness in the longer term, what is connected with the loss of the ability to enter into agreements related to the exchange (Capello, 1999).

Observations of the most developed economies suggest that despite the increasing importance of the internationalisation of the economy, the region is still perceived as the alternative opportunity not only to survive, but also to develop the SME sector in the new constellation of the global market. For this reason, one of the main objectives of the regional policy in the EU is to ensure the possibility of the smooth adaptation of industrial structures on a regional basis in the face of global changes in social, economic and technological factors (Frenkel, 2003).

The essence of functioning of systems are relations taking place between particular participants, who create such networks of connections. They can take the nature of vertical or horizontal interactions. Given the complexity of the matter discussed in this article, the focus is only on the connections of the so-called system input, so on the relations with suppliers.

Today, regional networks aim to diversify the connections and relations, by activating interactions with different groups of suppliers. In the conditions of traditional nature these dependencies should, however, concentrate on specialised, more narrow co-dependencies – this is the problem of specialisation. It is interesting to ask whether the innovation activity in regional systems in Poland is conditioned by diversified or rather narrow interactions, which take place in a small or also a large distance, and whether they are based on strong and durable or maybe occasional relations of the interpersonal nature.

Enterprises increasingly and more consciously organise themselves in the supply chains. Their goal is to create the additional value for the participants of connections and reduction of functioning costs of the chains as a whole (Baker et al., 2007). Enterprises share their information on demand, logistic capabilities or the owned inventory (Abuhilal et al., 2006). Often within the supply chain there are liquidated routine processes

between partners, what often influences the effectiveness of their deliveries, increase of profitability and improvement of competitiveness. Recently enterprises have expanded such routine tasks in the supply chain with the implementation of the innovation processes. Global research shows that innovative products or processes do not only come from the company, that is the final link in the chain, from which the final product is purchased (Roy et al., 2004). Analyses conducted in this article are to enrich (supplement) the current achievements of knowledge of the discussed scope, in the horizontal way bringing the evolution of economic systems closer.

Conceptual framework outlined above was the cause to undertake the issues of the influence of the industrial companies relations with suppliers on the innovation activity of the food industry. Thus, the research hypothesis is the statement that innovation mechanisms found in the food industry and its relations with the environment are significantly conditioned by the character of relations with suppliers, and they include: the type of the supplier, intensity of these relations and the occurrence of the complete supply chain. These determinants influence the current shape of the food industry in Poland. The correct diagnosis of these innovation processes and barriers in their implementation in the national system of management, can be the basis for the construction of diverse paths of development of innovation networks, which would take into account the national and sector specificity and enabling the acceleration of the processes of creation, absorption and diffusion of new knowledge/products/technology.

The primary objective of the study was the attempt to determine the influence of the character of companies relationships representing the food industry, with suppliers, on their innovation activity, and consequently, the determination of framework conditions for the model structure of the innovation network on the sector basis, taking into account the specificity of Poland. Effects of studies presented in the article are only a selected part of conclusions, which were obtained as a result of the analyses conducted by the authors.

The exemplification layer of the article was based on a case study of the food industry in Poland. Studies were carried out based on the survey created for the purpose of the research, on a group of 631 industrial companies in all voivodeships. The main path of collecting necessary data to conduct analyses was the procedure, which

connected the initial telephone conversation with the sending of a survey form by mail or e-mail. The complementary form was the interview conducted on the phone.

Conducted research and analyses lasted several years, were static in nature and were conducted in a three-year arrangement, according to the methodology of research and innovations conducted in OECD countries.

## METHODOLOGY OF THE CONDUCTED RESEARCH

In order to investigate the influence of the nature of the companies relations representing the food industry with suppliers, on their innovation activity, there were used models based on the probability analysis, and namely the probit ones. This results from the dichotomous nature of data accepted for testing. The variable takes the value of 0, if the studied phenomenon does not occur (e.g. the company did not incur any expenses on investments in fixed assets) or 1, if the studied phenomenon occurs (the company incurred expenses on investments in fixed assets). On the side of dependent variables there were attributes of innovation highlighted in accordance with the international standards set by the OECD countries and Eurostat. These variables included (OECD and Eurostat, 2005):

- expenditures on the innovation activity in relation to their structure,
- implementation of new products and technological processes,
- cooperation in the field of new solutions in terms of the subject, and therefore the vertical and horizontal cooperation and with the units of the science zone).

On the side of independent variables, and therefore the ones influencing the above-mentioned attributes, there was a number of industrial suppliers.

The impact of suppliers on the innovation activity of enterprises of the food industry in Poland – probit modelling

In the presented study on 631 enterprises in 463 there exist relations with suppliers in the same sector, what constitutes 59.3% of the total connections with suppliers. The analysed units indicate the existence of 781 different interactions with the average of about 1,2 relations for the examined enterprise. The technological structure confirms the specificity of the food industry. The greatest importance occupies the area of low

technologies: 77.2%. However, others play a rather marginal role: medium-low (7.2%), medium-high (12.3%) and high technologies (3.3%). In the first place there are suppliers, who produce food products (463 links), and the subsequent are taken by manufacturers of tobacco products (58), machines and equipment (51), paper products (39 links) and plastics (28). The indicated accounts for 81.8% of all connections with suppliers. Others do not play a significant importance in the studied industrial system. An important place of machine and equipment suppliers shows the constantly improving technological equipment of companies of the food industry in Poland, and thus also its competitiveness.

Statistically significant models were created for fourteen of eighteen variables accepted for testing, so they concerned the majority of amounts of the accepted innovation planes. They concern both the financial and implementation areas, and to a lesser degree the innovation cooperation. The models were statistically insignificant, therefore, in the case of the impact of relationships with suppliers on cooperations with units of sciences, universities and both national and international research and development centres.

The number of relationships with suppliers significantly influence the financing of the innovation activity in companies of the food industry in Poland, as shown is Table 1. At the same time it is a sufficient condition to accelerate the innovation processes in this system. Given the intensity of relations with various industrial suppliers, we can observe an important regularity. As it turns out that enterprises manufacturing food products more often finance new solutions, when they cooperate with a greater number of suppliers (various industries). This means the imperative of the relation diversification with this group of subjects. Greater diversity has an positive influence on the innovation processes, what may result from the increased number of the combination of productive factors, but it may also be the effect of a broader channel of the inflow of new knowledge from the environment.

The largest increase of probability is observed in case of the research and development activity. Enterprises, which have four different industrial suppliers more often implement this activity than other participants of the market.

In case of investments in new fixed assets probabilities reach high values. This shows that in the food industry new, but passive, technologies are very often

**Table 1.** The parameter value with the independent value “number of industrial suppliers”, in probit models describing the expenditures of innovations in the food industry in Poland

**Tabela 1.** Wartość parametru przy zmiennej niezależnej „liczba dostawców przemysłowych”, w modelach probitowych opisujących nakłady na innowacje w przemyśle spożywczym w Polsce

Expenditures on innovations Nakłady na innowacje	Parameter Parametr	Number of suppliers Liczba dostawców	Standard error Błąd stan- dardowy	Statis- tics of t-Student Statystyka t-Studenta	$P> z $	$p1$	$p2$
Expenditures on the B+R activity Nakłady na działalność B+R	+0.763	4	0.259	2.943	0.00	0.60	0.30
Investments in new technology, including: Inwestycje w nowe technologie, w tym:	+1.130	4	0.458	2.466	0.01	0.96	0.73
Buildings, premises and lands Budynki, lokale i grunty	+0.636	4	0.257	2.480	0.01	0.52	0.29
Machines and technical equipment Maszyny i urządzenia techniczne	+0.829	4	0.329	2.510	0.01	0.88	0.64
Computer software Oprogramowanie komputerowe	+0.802	4	0.279	2.868	0.00	0.76	0.46

Source: own elaboration based on research.

Źródło: opracowanie własne na podstawie badań.

financed. Moreover, much more often than the B+R works. In this case investments reach 30.5% more chances in entities having the diversified set of suppliers. The internal structure of these expenditures indicates the higher diversification of its particular categories. Investing in new buildings connected with the start of the production or the application of new technologies increases by 79.3%, and in new machines and technical devices by 34.4% and is, respectively: 0.52 and 0.88. Chances to buy new computer software increase, in turn, by 65.2%. For each of these financial categories, the requirement to have the diversified industrial suppliers remains unchanged. What is more, due to the achieved high values of probability in this group of subjects we can see their intensive involvement in the changes of the applied technology.

Within the scope of the implemented new solutions and in this case all potential models achieved the statistical significance (Table 2). This concerns the implementation of new products and technological processes, including manufacturing processes, by-production systems and support. In all cases, the connections with

other industrial suppliers turn out to be the sufficient condition to implement new solutions. At the same time, as previously in case of expenditures on innovation, the number of suppliers should be significant – in four cases four and once one. Therefore, the thesis about the necessity to maintain the diversified relations with other industrial areas is confirmed.

The implementation of new products takes place more often by 52.7% in companies of the food industry having four different suppliers, than in other entities. Units, which have a similar number of links, also more often implement new technological processes, although differences are not that high as previously, the increase of probability by 35.2%. No less detailed analysis of these processes indicates their great internal diversification. And so, the introduction of new directly production processes (three suppliers) takes place more often by 42.0%, the by-production systems by 145.2%, and support systems by 122.2%. At the same time it should be noted that the achieved probability values are high, apart from the last of the indicated and they range between 0.71 and 0.96. Therefore, these are almost certain



**Table 2.** Parameter value with the independent value “number of industrial suppliers”, in probit models describing the implementation of new solutions in the food industry in Poland

**Tabela 2.** Wartość parametru przy zmiennej niezależnej „liczba dostawców przemysłowych”, w modelach probitowych opisujących implementację nowych rozwiązań w przemyśle spożywczym w Polsce

Implementations of new solutions Wdrożenia nowych rozwiązań	Parameter Parametr	Number of suppliers Liczba dostawców	Standard error Błąd standardowy	Statistics of t-Student Statystyka t-Studenta	$P> z $	$p1$	$p2$
Implementation of new products Implementacja nowych wyrobów	+0.878	4	0.306	2.874	0.00	0.84	0.55
Implementation of technological processes Implementacja procesów technologicznych	+1.208	4	0.458	2.638	0.01	0.96	0.71
Manufacturing processes Procesy wytwórcze	+0.535	3	0.171	3.134	0.00	0.71	0.50
By-production systems Systemy okołoprodukcyjne	+1.216	4	0.280	4.340	0.00	0.76	0.31
Support systems Systemy wsparcia	+0.675	4	0.261	2.591	0.01	0.40	0.18

Source: own elaboration based on research.

Źródło: opracowanie własne na podstawie badań.

phenomena. Again, it should be stated that companies of the food industry maintaining the diversified relations with industrial suppliers conduct the primed modernisation of the owned technologies.

Considering the cooperation aspect (Table 3), being a higher form of the innovation maturity, the number of industrial suppliers also plays an important role in the stimulation of technological changes in the food industry in Poland. However, in this case there are visible differences in comparison to the financial and implementation plane. Firstly, the statistical significance was reached only by four models out of eight considered – innovation cooperation in general, including with suppliers, competitors and recipients. What is particularly interesting, industrial suppliers (their number) do not influence the undertaking of the innovation cooperation with the B+R sphere. Thus, these processes are limited to the intra-sector dependencies (industrial networks). No less the mere fact of connections with several industrial suppliers is a prerequisite for acceleration of innovation processes in the food industry in Poland.

Achieved values of probability are not high this time, what proves the much rarer innovation activity in the area of cooperation than financing and implementation

of new solutions. They are in the range from 0.12 to 0.45. This confirms the lower involvement of the food industry in Poland in the innovation cooperative relations. Thus, such companies much more often conduct works in the field of innovation on their own.

The required number of relations with the industrial suppliers, although smaller, still remains the imperative for the implementation of innovation processes in the food industry. For such entities to cooperate innovatively with suppliers, they should maintain the relations with three different industrial groups. The chances for such cooperation increase then by 16 percentage points to the level of 38%, so they almost double. To enter the innovation interactions with competitors there is required at least one industrial supplier. Although the target value of probability remains low (0.12), it is at the same time four times higher than for other companies. For the innovation cooperation with recipients it is necessary to maintain the diversified relations with suppliers (three suppliers). Then, the chances of creating the interaction of the innovation nature almost doubles (from 17.6% to 32.0%). No less, the relations with two industrial suppliers turn out to be sufficient for there to

**Table 3.** Parameter value with the independent value “number of industrial suppliers”, in probit models describing the innovation cooperation of the food industry in Poland

**Tabela 3.** Wartość parametru przy zmiennej niezależnej „liczba dostawców przemysłowych”, w modelach probitowych opisujących współpracę innowacyjną przemysłu w spożywczego w Polsce

Cooperation with Współpraca z	Parameter Parametr	Number of suppliers Liczba dostawców	Standard error Błąd standardowy	Statistics of t-Student Statystyka t-Studenta	$P> z $	$p1$	$p2$
Suppliers Dostawcami	+0.484	3	0.165	2.926	0.00	0.38	0.22
Competitors Konkurentami	+0.677	1	0.270	2.507	0.01	0.12	0.03
Customers Odbiorcami	+0.508	3	0.170	2.991	0.00	0.32	0.17
Overall innovation cooperation Innowacyjna ogółem	+0.336	2	0.115	2.916	0.00	0.45	0.32

Source: own elaboration based on research.

Źródło: opracowanie własne na podstawie badań.

be an innovation cooperation with any other entity – the increase of probability to the level of 0.45 from 0.32, that is by 40.6%.

## CONCLUSION

Having a large number of relations with industrial suppliers has a positive influence and with great intensity on the funding and implementation of new technologies in the food industry in Poland. Less intense, but also diversified relations are required to establish innovation cooperation within the sector networks, but without the influence on the institutional relations with the B+R sphere. However, what is the most important, for the food industry companies in Poland to participate in innovation processes and to accelerate them, their connections with different industrial suppliers are required. This is a necessary and sufficient condition.

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## POWIĄZANIA Z DOSTAWCAMI W KSZTAŁTOWANIU AKTYWNOŚCI INNOWACYJNEJ PRZEMYSŁU SPOŻYWCZEGO W POLSCE

**Streszczenie.** Przemysł spożywczy należy do tradycyjnych obszarów gospodarowania, czyli tak zwanych niskich technologii. Z tego powodu bliskość technologiczna i przestrzenna może być kluczem dla kreowania nowych rozwiązań w polskim przemyśle spożywczym. Głównym celem badania była próba poszukiwania wpływu powiązań z dostawcami na działalność innowacyjną przedsiębiorstw w przemyśle spożywczym w Polsce. W konsekwencji pozwoli to na określenie warunków brzegowych dla modelowej struktury sieci innowacyjnych producentów artykułów spożywczy i napojów, z uwzględnieniem specyfiki polskiej gospodarki. Badanie przeprowadzono na grupie 631 przedsiębiorstw przemysłu spożywczego zlokalizowanych w Polsce. Część metodyczna analiz bazowała na regresji probitowej (rachunek prawdopodobieństwa).

**Słowa kluczowe:** innowacja, dostawcy, przemysł spożywczy

Zaakceptowano do druku – Accepted for print: 12.01.2015

Do cytowania – For citation

Świadek, A., Szopik-Depczyńska, K. (2015). Relationships with suppliers and innovation activity in food industry in Poland. *J. Agribus. Rural Dev.*, 2(36), 335–341. DOI: 10.17306/JARD.2015.36