

Wacława Starzyńska, Maria Magdalena Grzelak***

INNOVATIVENESS IN FOOD PROCESSING INDUSTRY – APPLICATION OF CHOSEN STATISTICAL MEASURES

Abstract. Agriculture in the European Union is handled in a special way. Differences between the Polish and the EU agriculture have caused and still cause necessity of adaptation of the Polish agriculture to the European standards. The paper presents different measures based on the available statistics which aim to be indicators of innovativeness in the Polish food industry with special regards to pre-accession and post-accession periods.

Key words: transformation of economy, EU standards in food industry, innovativeness in food industry, statistical indicators.

1. INTRODUCTION

The course of changes in world economy that have been taking place in recent years indicate a transformation from industrial economy based on economies of scale to a knowledge-absorbing economy based on technological and innovational potential. At this point in time, increasing investments in tangible assets has ceased to be a sufficient means of securing permanent economic growth. Research and development (R&D), innovational activity and the so-called human capital become growth-determining factors. The transition to a knowledge-based economy causes an increase of competitiveness of countries and regions specializing in manufacturing technologically advanced products. Innovativeness is therefore considered one of the most important factors determining the speed and quality of economic growth. As a consequence, the main subject of research conducted in highly developed countries is the search for sources of innovativeness and methods of building an innovative potential, which become the basis of creating an economy based on knowledge (Miedziński 2001, p. 210). In recent years, Poland has undergone huge transformations. The country has turned from a centrally, planned economy that was subordinate to the rules of communism to a democratic country with an economy ruled by the laws of the market. Socio-economic changes occurring in our country were

* DSc, asossiate professor, Univeristy of Lodz.

** Ph.D., Univeristy of Lodz.

aimed at introducing Poland to Europe and bridging the gap that separated the Polish economy from highly developed European economies.

Agriculture in the European Union is handled in a special way. Differences between the Polish and the EU agriculture have caused and still cause the Polish agriculture to be a sector where adaptation processes to the European standards are particularly difficult due to social and financial reasons.

The most expensive and complicated thing to do was to fulfill appropriate veterinary conditions in the meat and dairy sector. Adjusting to Union standards, however, not only enabled access of the Polish products to the common market, but also improved the competitiveness of the whole agricultural sector. The increase of the Polish agricultural sector's competitiveness cannot take place in isolation from the competitiveness of agricultural and food processing, thus the necessity to analyse the basic issues in this field. A change of the nature and function of the food industry is taking place. The development of this sector is closely correlated with the general economic situation and the GDP growth rate. A weak correlation of the food industry with changes of the agricultural production level remains. This means that the main function of this industry is not the processing of agricultural products, but the production of food of a processing degree defined by the market and national/international consumer preferences. At the same time, the influence of the food industry on agricultural manufacturing structures is increasing. Admittedly, the degree of vertical integration of agricultural production with the food processing industry is still too low, but the demands made by food producers have already led to a significant quality advance of agricultural production and to a concentration of agricultural products (*Strategia rozwoju obszarów wiejskich...* 2005).

Can the Polish food industry be a competitor of food manufacturers in other countries?

It shows a large manufacturing potential even now, already being sixth in Europe.

The aim of this paper is the attempt to assess the innovativeness level of the agricultural and food sector in Poland based on available statistic data published by the Central Statistical Office and the Institute of Agricultural and Food Economics.

Making use of different statistic measures, we assess the degree of innovativeness of the food industry and its connections with the economy.

Among other things, we hereby we try to give an answer to the following questions:

Has the socio-economic transformation and integration with the EU influenced the advancement of R&D and innovatory activities in this sector?

Does innovativeness influence the increase of competitiveness of the food industry?

2. CHARACTERISTICS OF AVAILABLE STATISTICAL DATA

The growing significance of science and technology increases the demand for statistical data from this field. In most developed countries, the use of statistical data for making decisions relating to the science and technology policy has a long-term and rich tradition. The interest in science and technology indicators has further increased in connection with the European Union debating the function and effectiveness mechanisms of science systems in Europe. Also the OECD has recently been implementing a special research project aimed at working out a new generation of science and technology indicators for describing knowledge-based society and economy.

The Polish Central Statistical Office is trying to meet this challenge and has been developing a science and technology statistics for several years that is based on methodological recommendations drawn up by OECD and Eurostat and published in a series of manuals called Frascati Family Manuale (The Measurement of Scientific and Technological Activities) (Nauka i technika 2006).

Science and technology statistics (S&T) is a statistics discipline dealing with quantitative descriptions of phenomena related to the functioning of the so-called Science and Technology Systems (STS).

As opposed to certain other countries, science and technology statistics in Poland is centralized and performed almost exclusively by the Main Statistic Office (Science and Technology Department, Economic Statistics Division).

The Ministry of Primary, Secondary and Higher Education, the main user of science and technology statistics data, draws up, develops and analyzes bibliometric indicators based on specialist databases purchased at the Institute for Scientific Information (ISI) in Philadelphia and on examining resources allotted by the government for R&D activities (the so-called GRAORD – Government Budget Appropriations or Outlays for R&D), depending on socio-economic aims.

Internationally, the main source of science and technology statistics data are:

- for developed countries – OECD and Eurostat databases and publications,
- for the remaining countries – UNESCO databases and publications.

The growing interest for science and technology indicators led to an increase of branches within the scope of science and technology statistics.

Depending on the level of methodology development, as well as the means of collecting and analyzing data, two groups of issues are generally distinguished among the branches of science and technology statistics.

The first group includes branches with a well-developed, well-established standard methodology. In most countries, data within the scope of these branches are collected and analyzed based on commonly established, international methodological recommendations.

These branches include:

- Research and Development activity statistics (R&D),
- patent statistics,
- innovation statistics (especially the subjective method based on the so-called Oslo methodology),
- Technology Balance of Payments (TBP),
- High Technology products (HT) and the so-called Knowledge Intensive Services (KIS),
- indicators related to Human Resources for Science and Technology (HRST),
- bibliometrics.

The second group includes branches with a methodology still at an early development stage. Indicators and data, if available, are not entirely comparable neither in time nor in space. They are collected in different countries based not only on different, but also permanently changing methodologies.

This group includes the following issues:

- usage of the so-called Advances Manufacturing Technologies (AMT),
- Information Technologies (ITC), recently called Information Society (IS) statistics,
- indicators based on information from technical magazines (especially regarding innovation "measurement", e.g. LBIO indicators or the so-called subjective method of innovation "measurement"),
- intangible investments,
- "measurements" or organizational changes and non-technological innovations in companies,
- technology development forecasts,
- research of society's attitude towards science and technology.

Among the indicators from the first of the aforementioned groups, two basic categories are generally distinguished, namely input statistics and output and impact statistics.

The first category, the so-called "input" statistics, relates to resources assigned for R&D activities, whereas the aim of the indicators from the second category is the measurement of the effects achieved due to these activities (*output indicators*) and the assessment of how scientific and technological activities influence the functioning of the economy (*impact indicators*). As of now, there are no direct criteria of measuring the effects of scientific and technological activities. The only ones available are the so-called proxy indicators, based on data collected for other purposes than science and technology statistics.

As examples of output indicators usually indicators from the field of patent statistics and the given country's technology balance of payment are provided,

whereas as examples of impact indicators literature quotes first and foremost indicators relating to foreign trade in the field of the so-called high technology.

The conviction prevails among experts that even though each of the aforementioned groups of "effect and input" indicators must be treated with great caution, they deliver, however, a credible picture of a country's "technological effectiveness", providing they are considered as a whole.

The study uses the results of the latest statistical research related to science and technology that is prepared by the Central Statistical Office, including a statistic dataset based on the research of R&D and innovation activities of companies in the industry. Data relating to the following issues have also been taken into consideration:

- means of automating manufacturing processes in industrial companies,
- industrial property protection – patent statistics,
- human resources for science and technology.

Apart from official the data relating to science and technology, other data coming from the Central Statistical Office and the Institute of Agricultural and Food Economics have been used that indirectly describe the competitiveness of the agricultural and food sector, namely: the level and structure of the agriculture and food industry production, foreign trade involving agricultural and food products and the profitability in the food industry.

3. INNOVATIVENESS IN THE FOOD INDUSTRY – A TENTATIVE ASSESSMENT

Innovatory activities and innovations are the basic factor of the Lisbon Strategy proclaimed by the Council of the European Union in March 2000 summit and confirmed at successive Council summits, especially at the Barcelona summit in 2002. The aim of the strategy is to make the European Union an even more dynamic and competitive economy that is based on knowledge. As the main means leading to the realization of this strategic aim the stimulation of innovation and R&D activities has been recognized. The not fully satisfactory level of innovation activity has been recognized by the European Commission as the main cause of the weak productivity increase of EU economy that is insufficient not only compared to the United States or Japan, but also a few other non-European countries. These problems have exacerbated even more after the Union's enlargement by other countries where the level of innovativeness was lower than in the former 15 EU member states. The promotion and support of innovation activity in various economy sectors is one of the main aims of economy policy in EU countries. The proper execution of this aim would not be possible without regular statistical research delivering reliable data depicting the

scope and character of innovation activity on different levels and in various economy sectors. In Poland, such research is conducted by the Central Statistical Office in accordance with international methodology (the Oslo methodology/system).

Innovation activity research that has been conducted based on the Oslo methodology relates to the entirety of various activities aimed at elaborating and implementing technological innovations, i.e. products and technologically new or significantly improved processes. The research accounts for all possible novelty levels of elaborated and implemented innovations, i.e. not only new or significantly improved products and processes from the viewpoint of the market where the company is active (in Poland and/or abroad), but also new or significantly improved products and processes from the viewpoint of the company implementing them.

Innovatory activity may be undertaken by the company itself on its own ground (inside the company) or may consist in the purchase of goods, services (including consulting services) or knowledge from external sources. It also relates to purchasing external technology, both material and non-material.

According to contemporary theories, even though R&D activity is a very important source of innovation and inventions, innovations and innovativeness are phenomena with a broader and more complex meaning than merely the successful implementation of research results, as assumed by the so-called linear innovation model that has been valid until recently. According to the newest theories of innovatory activity that are generally referred to as system model, innovations are the result of numerous, complex interactions between entities, organizations and the environment in which these entities and organizations function, whereas a policy with the aim to stimulate innovatory activity should, in order to be successful, clearly go beyond concentrating solely on the issues of research activity (Nauka i technika 2006, p. 143).

In order to properly interpret the data presented in this paper, classifications of basic terms and methodological remarks have been given.

Three sources of innovation are distinguished :

- research and development activity (R&D),
- purchase of ready-made knowledge in the form of patents and licenses, technological services etc. (the so-called non-material production),
- purchase of the so-called material technology, i.e. “innovatory” machines and devices, usually with improved technical parameters, that are essential for implementing new processes and the production of new products.

Expenditures for innovatory activity include expenditures for:

- research and development (R&D) activities related to the elaboration of new and improved products (product innovations) and processes (process inno-

vations), performed by means of own development base (internal expenditures) or purchased from other entities (external expenditures);

- purchase of ready-made technology in the form of documentation and rights (licenses, patent rights);
- software (costs of purchase, programming and adaptation);
- purchase and assembly of machines and devices, as well as construction, extension and modernization of buildings for the implementation of innovations;
- staff training related to innovatory activity, from the project to the marketing stage, they include both expenditures for the purchase of external training services and expenditures for internal company training, e.g. staff training expenditures related to operating computers due to innovations being implemented etc.;
- marketing related to new and improved products, i.e. expenditures for preliminary market research, market tests, adaptation of products to the requirements of different markets, advertising etc., excluding expenditures for setting up distribution networks for new products;
- other preparations for implementing technological innovations, encompassing especially the elaboration of procedures (including quality control procedures), norms and technical documentation inclusively final texts.

The presented results concern business entities with more than 49 employees in sections C, D and E, in accordance with the Polish Classification of Activity. In the year 2005 this set included 8 119 companies in total, 17.6% of which are companies manufacturing food and beverages. In the structure according to size, companies with 50 to 249 employees dominate in this set, the share of which amounted to 80.4% in the year 2004 (companies with 250 to 499 employees: 11.5%; companies with more than 499 employees: 8.1%).

The analysis concerns the expenditure level for research and development activity, the level and structure of expenditures for innovatory activity, sources of innovation, means of automating manufacturing processes, implementation of licenses, innovation intensity, share of sold output of new and modernized products in the total sold output of products and share of innovatively active companies in the industry. In accordance with the classification above, the standards used for assessing the innovativeness level of the food industry have been divided into two groups, which is depicted in Table 1.

In the years 1995–2005, expenditures for research and development activity (R&D) have been increasing in nominal terms. An exception was the year 2002, when for the first time since 1994 – that is since the Central Statistical Office had begun conducting statistical R&D research based on international methodology – a decrease of expenditures for this activity occurred, and the value of the relation between expenditures for R&D activity and the gross domestic product has decreased to a hitherto unrecorded level, amounting merely to 0.58, i.e. 0.06 percent lower than the previous year. In the following years, the value of one of

the most important indicators relating to science and technology statistics, i.e. the relation between expenditures for R&D activity and the gross domestic product, was running at a similar level and amounted to 0.57 in 2005. In comparison, the value of this indicator in the year 2000 was as follows: EU-15 1.93, the Czech Republic 1.3, Finland 3.37, France 2.13 (Nauka i technika 2004, p. 23).

Table 1

Chosen standards characterizing the innovativeness of the food industry

"Input statistics"	"Output statistics"
<ul style="list-style-type: none"> ◆ level and structure of expenditures for research and development activity, ◆ employment in research and development, ◆ level and structure of expenditures for innovatory activity, ◆ sources of innovativeness. 	<ul style="list-style-type: none"> ◆ inventions and utility models, ◆ innovation intensity, ◆ share of sale of new and modernized products in the total product sale, ◆ share of innovatory companies in the total number of companies, ◆ sale and export of license products, ◆ level and structure of food industry production, ◆ foreign trade of food industry products, ◆ profitability of the food industry.

Source: own elaboration.

Table 2

Basic indicators of research and development (R&D) activity

Details	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Current expenditures for research and development activity ^a (in million PLN)	2132.8	2761.4	3361.0	4005.1	4590.5	4796.1	4858.1	4522.1	4558.3	5155.4	5574.6
Relation between expenditures and the gross domestic product in %	0.63	0.71	0.71	0.72	0.75	0.64	0.64	0.58	0.56	0.56	0.57
Expenditures per capita in PLN	55	71	87	104	119	125	126	118	119	135	146

^a Without depreciation of fixed assets.

Source: Raport o stanie nauki i techniki w Polsce, GUS, Warszawa 1998, Raport o stanie nauki i techniki 1999, GUS, Warszawa 2000, Nauka i Technika w 2001, 2002 i 2005, GUS, Warszawa.

State budget funds dominate the structure of expenditures for R&D activity (Table 3); their share fluctuates between 57.7% in 2005 and 64.8% in 2001. The most important element of non-budget expenditures, i.e. business entity (company) funds, fluctuate between 23% and 30.6%. In Poland, this structure is basi-

cally exactly inverse to the structure currently considered by western experts as optimal from the viewpoint of the effectiveness of scientific research, i.e. its usefulness for the economy. According to newest determinations, the optimal ratio of funds described as "private" to public funds is 65:35. In the above experts' view, if the share of means described as private, i.e. from other sources than the state budget, in the total expenditures for R&D activity is lower than 65%, the so-called global efficiency of these expenditures is significantly lower (Revenue Elargissement 2003). In Poland, expenditures falling to one employee are also insignificant. In 2003, they merely amounted to 64.8 USD, whereas in Spain they were running at 270.3 USD, in Germany at 691.5 USD, in the Czech Republic at 217.8 USD, and in the USA at 997.7 USD (Statistical Yearbook 2006, p. 781).

It is worth noticing that in 2003 there was a significant increase of financial resources for R&D activity from abroad. In 2005, foreign resources amounted to 5.7% of the total expenditures for R&D activity, whereas EU financial resources constituted 4.3%. In 2004, these shares in the total R&D activity expenditures were 5.2% and 2.7% respectively.

The economy's ability to create innovations largely depends on the employment potential in the R&D sector and the effectiveness of its usage. In the years 1995-2005, the total number of people employed in the R&D field has changed insignificantly. The fewest people were employed in the R&D sector in the year 1995 (120 000), the most in 1997 (128 400). In the year 2005, the number of people employed in the R&D sector has decreased by ca. 4 000 to 123 400 as compared to the previous year, while the group of scientific and research employees increased by 1344 people. Almost half of the employed (49%) are people in the age group 25-44, people from the second half are older.

In the analyzed years, the number of research & development employees has decreased in most entities from the so-called R&D sector in Poland, namely in the institutions of the Polish Academy of Sciences (PAN), research and development entities and the so-called development entities (companies). Public higher education institutions constitute the only exception. At present, they show the most growth in this area. Private higher education institutions are mostly into didactic activity, with only a few of them conducting R&D activity.

International comparisons concerning the employment potential in the R&D area mostly present the number of research & development employees per 1 000 employed people. In 2003, the value of this indicator in Poland was 4.3, in Spain 9.1, in Germany 12.5, in the Czech Republic 5.7 and in Sweden 16.6 (*Statistical Yearbook 2006*, p. 781).

Table 3

Structure of R&D expenditures according to financing sources (current prices)

Details	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total	100	100	100	100	100	100	100	100	100	100	100
From the state budget	60.2	57.8	61.6	59.0	58.5	63.4	64.8	61.9	62.7	61.7	57.7
From business entities	24.1	28.8	27.3	29.7	30.6	24.5	24.3	23.0	23.5	22.6	26.0
From scientific institutions of the Polish Academy of Sciences (PAN), as well as research and development entities	11.6	10.1	7.9	8.2	7.5	7.7	6.5	6.3	5.9	7.5	7.0
From international organizations and foreign institutions	1.7	1.5	1.6	1.5	1.7	1.8	2.4	4.8	4.6	5.2	5.7

Source: *Raport o stanie nauki i techniki w Polsce*, GUS, Warszawa 1998, *Raport o stanie nauki i techniki 1999*, GUS Warszawa 2000, *Nauka i Technika 2001*, 2002 i 2005, GUS, Warszawa.

Data relating to inventiveness shows that the efficiency of using the employment potential in Poland is also disturbing. Since the beginning of the economic transformation, a systematic decrease in the number of inventions in Poland has been taking place. The number of inventions submitted yearly for patent protection in Poland by national originators (residents) decreased in 2005 to 49% of inventions submitted in 1990. The value of the so-called inventiveness coefficient, i.e. the number of inventions submitted for protection by residents per 10 000 inhabitants, has been 0.7 in recent years and is similar to the value in the Czech Republic, Spain and Hungary, while it is higher than in Greece, Portugal or Turkey. The mean value of this index in the European Union is a little higher than 2 (Dworak 2003, pp. 12–13).

In western literature, the share of development activity in R&D expenditures is regarded as a measure of the so-called closeness of R&D activity to the market of a given country. Examples of countries where R&D activity is closest to the market, i.e. where it best satisfies the economy's needs, are the United States, Japan and Ireland. In the United States, four of five research and development employees work in companies. In Poland, on the other hand, the structure of current expenditures for R&D activity according to the type of research was as follows: basic research 37.4%, applied research 24.2% and development activity only 38.4% (*Nauka i technika* 2006, p. 36).

Apart from R&D, innovatory activity of companies in the industry is the basic element of a knowledge-based society and economy.

When analyzing the level of expenditures for innovatory activity in industrial companies with more than 49 employees that are included in sections C, D

and E in accordance with the Polish Classification of Activity one may notice that the highest expenditures took place in 2003 and amounted to 16.6 billion PLN. Unfortunately, in the following years there was a decrease and in 2005 the expenditures for innovatory activity in the industry amounted to 14.7 billion PLN, which is, however, an increase of 34% compared to 1997.

The share of entities conducting innovatory activity in the general number of entities in the aforementioned set amounted to 38.2% in 2005 and has been staying on a similar level as compared to 2004.

In 2005, similar to previous years, investment expenditures for the purchase of machines, technical devices and means of transport dominate the structure of expenditures for innovatory activity in accordance with innovatory activity types; their share in 2005 amounted to 58.6%. Compared to the value registered in 2004, expenditures for R&D activity, being one of the most important elements of innovatory activity expenditures, have increased by 20% as a matter of fact, but their share in expenditures for innovatory activity amounted to 9.6% (*Nauka i technika* 2006). Compared to the value of this indicator registered in other, not only highly developed countries, where innovatory research has been carried out based on the Oslo methodology, this result is very low.

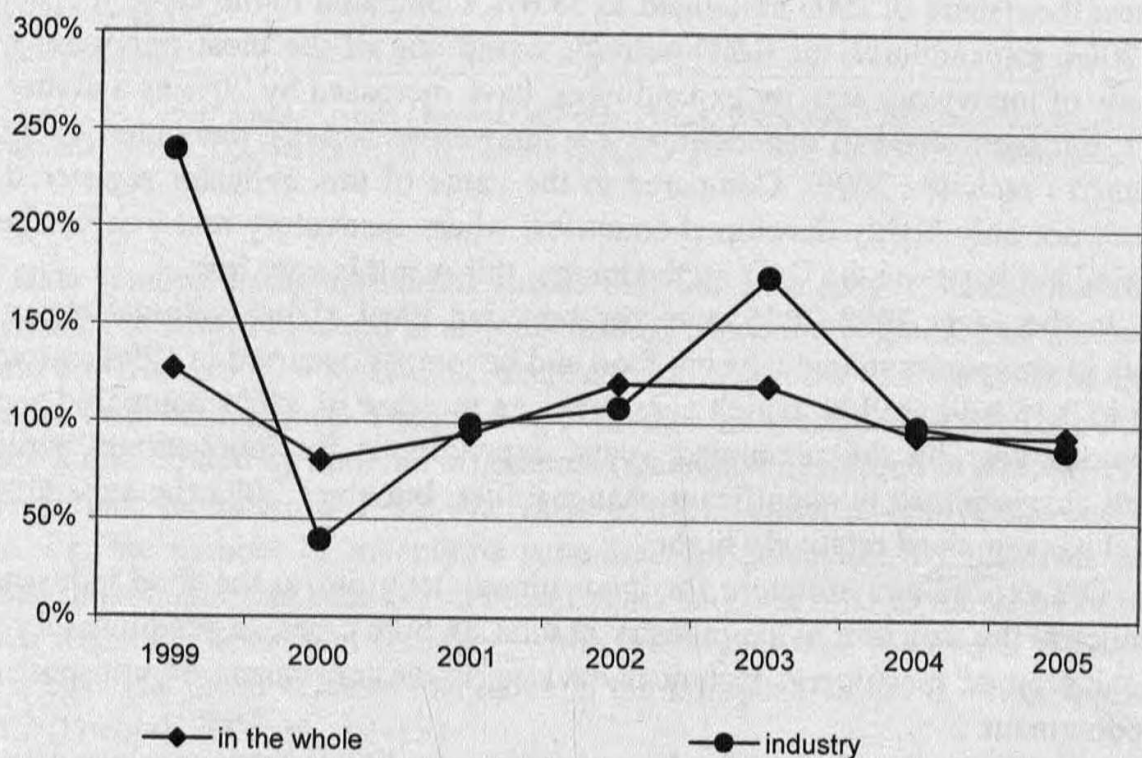
In the years 1998–2005, a record-breaking level of innovational expenditures in companies manufacturing food and beverages occurred in 1999, amounting to 3.15 billion PLN, which constitutes an increase of 140% compared to the previous year. In the remaining years, expenditures for innovational activity were characterized by significant changeability, but since 2003 the expenditure level has remained relatively high.

The expenditure structure for innovational activities in the food industry is similar to the structure in the industry in total. In both cases, expenditures for the acquisition of machinery, technical devices, tools and means of transport are predominant.

The chart below depicts the dynamics of expenditures for innovatory activity in the whole industry and in the food industry.

The innovativeness level of a given country's economy is mostly dependent on the companies' innovative activity, on their ability to quickly and actively acquire new knowledge and technology. The economy's innovativeness is associated with the degree of the modernity of products offered on increasingly competitive markets. One feature of the new economy is the significant reduction of a product's life cycle. At present, the product range of the processing industry in highly developed countries is exchanged within 2–5 years, depending on the line of business. A parameter used to assess the production modernity level is the so-called production renewal coefficient that determines the share of sold output of new and modernized products in the sold output of products in the whole industry. Based on the analysis of this coefficient's level we come to the

conclusion that the share of new and modernized, as well as technologically advanced products in the Polish industry's sales value is increasing. The value of this coefficient in the Polish processing industry was 16.4% in the years 1998–2000, 20.9% in the years 2002–2004 and 21.8% in the years 2003–2005. The share of new and modernized products in companies manufacturing food and beverages was as follows: 9.6% (1998–2000), 12.5% (2002–2004) and 11.1% (2003–2005). Despite this positive tendency, the average modernity level of Polish products still differs negatively compared to the average modernity coefficient in highly developed countries.



Graph 1. Dynamics of expenditures for innovatory activity (previous year = 100)

S o u r c e: *Raport o stanie nauki i techniki w Polsce*, GUS, Warszawa 1998; *Raport o stanie nauki i techniki 1999*, Warszawa 2000, *Nauka i technika 2001, 2002 i 2005*, GUS, Warszawa.

Other standards for assessing the innovative activity of companies are also used for analyzing the level of innovativeness of a given economy's, e.g. the intensity of innovations, measured as a relation between expenditures for innovative activity of industrial companies and the value of the industry's sold manufacture. Table 4 depicts the intensity of innovations in relation to the production of food and beverages.

Table 4
Intensity of innovations in the area of food
and beverages production (in %)

Year	Intensity and innovation indicator
2000	1.4
2001	1.2
2002	1.4
2003	2.1
2004	2.0
2005	1.7

Source: As same as Table 1.

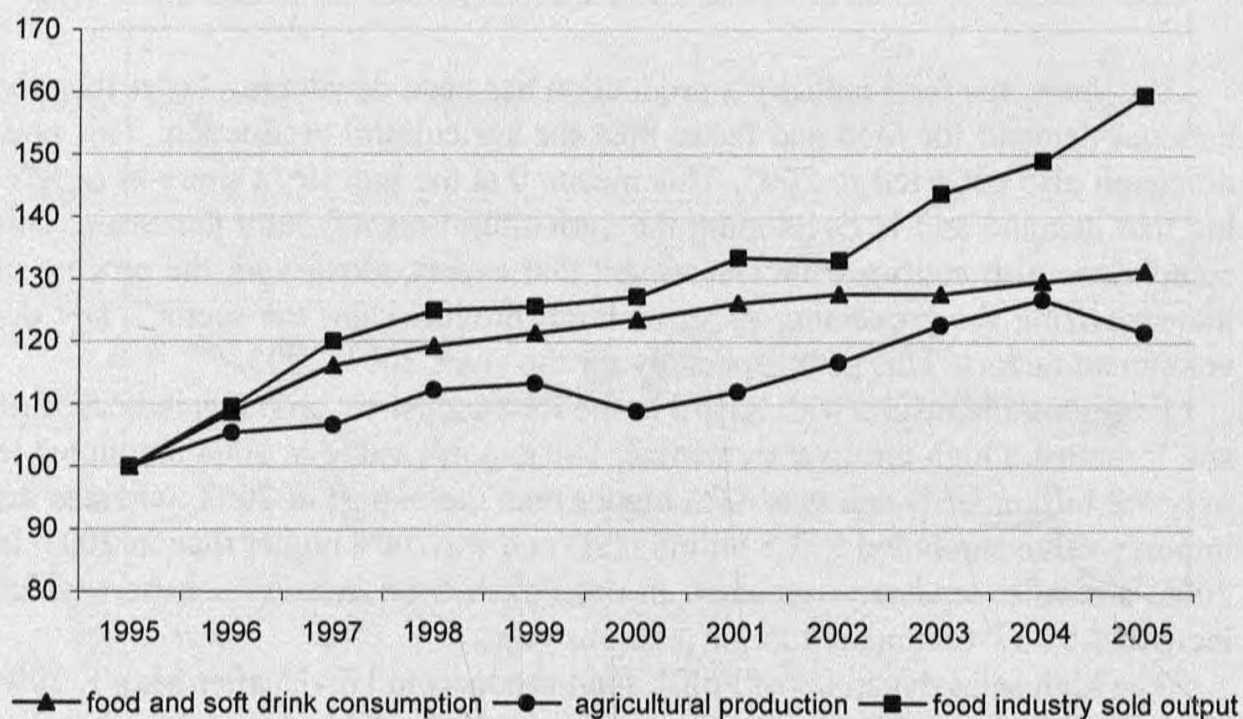
For years, the food industry's production has been developing faster than the national demand for food and faster than the agricultural production. This phenomenon also occurred in 2005. This means that the industry's share in satisfying that demand and in developing the agricultural manufacture increases. This comparison also confirms the assessment that export, along with the process of industrializing the processing of agricultural products, are the sector's key development factors. This goes especially for the years 2003–2005.

Foreign trade results with regard to the food industry's products indicate first and foremost a high turnover dynamics. The export's value in 2004 amounted to over 5.2 billion USD and was 43% higher than the export in 2003, whereas the import's value amounted to 3.5 billion USD and was 34% higher than in 2003. In 2005, a similar tendency remained in the Polish food industry's export which increased by 37% compared to the previous year.

The high sales dynamics of Polish food products to UE-15 after May 1, 2004 on the one hand, and modernization processes in food plants on the other had a significant influence on the favorable trade situation in 2004.

In the years directly preceding the accession to the EU, a significant improvement of effectiveness in the area of agricultural and food processing has taken place (Table 5). After Poland's accession to the EU, the modernization of companies from the agricultural and food processing sector has significantly accelerated. This is proven, among others, by the fact that the number of companies entitled to trade on the single market has been increasing, which has also led to increased export. It is also worth noting that the food sector has been recently experiencing an investment boom, Polish food processing has been an attractive choice for direct foreign investments, which also enabled access to world technologies and management systems. The share of new and modernized products in the total sales has increased from 10% in 1996 to 13.4% in 2003. In 2004 and

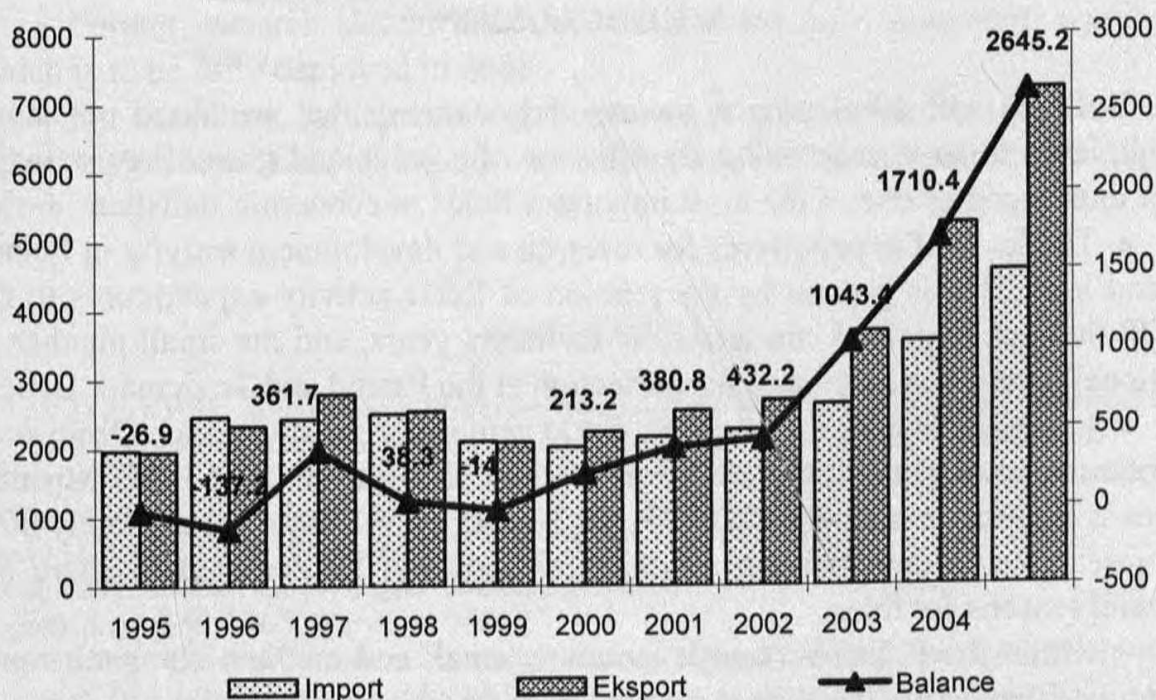
2005, this share was 12.5 and 11.1%, respectively¹. The net profit has been significantly increasing since 2000. Compared to the previous year, the net profitability has marginally decreased (by 0.3 percent) to 3.54% of the net profits, but was still over twice as large as in 2003. In the last two years, the food industry's financial results are high, they are the highest ones since 1990. The profitability level of food and beverage production has become high as well. Profit has become the main source of cash revenue. In 2005, it amounted to ca. 50% of the aforementioned revenue, whereas in 2003 it amounted only to slightly above 30%. In recent years, the share of profitable companies in the sector's turnover has also increased from 60.6% in 1999 to 78.4% in 2005.



Graph 2. Dynamics of food and soft drinks consumption, agricultural production and food industry sold output (fixed prices, 1995=100)

Source: *Statistical Yearbooks of the Main Statistics Office* from 1997–2006.

¹ *Raport o stanie nauki i techniki w Polsce*, Warszawa 1998; *Raport o stanie nauki i techniki 1999*, Warszawa 2000, *Nauka i Technika* w 2001, 2002 i 2005, GUS, Warszawa.



Graph 3. Foreign trade – food industry products

Source: Statistical Yearbooks of the Main Statistics Office from 1996–2006.

Table 5

Economic results of the food industry

Details	1999	2000	2001	2002	2003	2004	2005
Production increase in fixed prices (in %)	0.4	1.3	4.8	-0.2	7.7	3.6	4.7
Profitability indicators (in %) of net profits							
gross profit	0.95	1.32	2.58	3.03	2.58	4.77	4.41
net profit	-0.39	0.24	1.19	1.99	1.56	3.87	3.54
cash revenue ^a	3.01	3.58	5.20	5.47	5.11	7.18	7.05
operational surplus ^b	8.17	8.08	10.75	8.87	8.47	9.59	9.25
Financial costs (in %) of net profits	3.82	3.42	4.20	2.36	2.34	1.50	1.33
Liquidity coefficient	1.21	1.19	1.20	1.19	1.19	1.22	1.27
Investment margin ^c	1.75	1.39	1.28	1.15	1.36	1.63	1.37
Share of companies ^d with net profits (in %)							
in the total number of companies	60.6	65.3	69.4	72.1	74.4	78.9	78.4
in the industry's income	67.3	70.9	73.6	78.3	79.0	83.3	85.8

^a net profit + depreciation; ^b gross profit + depreciation + financial costs; ^c investment/depreciation expenditures; ^d concerns large and medium food and beverage manufacturers

Source: Analiza produkcyjno-ekonomicznej sytuacji rolnictwa i gospodarki żywnościowej w 2005 roku, Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej, Warszawa 2006, p. 308.

3. CONCLUSION

Building and developing a society and economy that are based on knowledge leads to an ever-growing significance of science and technology statistics that thus becomes one of the most important fields of economic statistics.

- The level of expenditures for research and development activity in Poland is too low. This is proven by the relation of R&D activity expenditures to the GDP that has remained similarly low for many years, and the small number of national inventions submitted for protection at the Patent and Trademark Office.

- In highly developed countries, R&D activity is mostly financed from non-public means, especially by companies – their share in the total R&D expenditures is running at a level of ca. 70%. In Poland, on the other hand, merely 30% of research and development expenses are covered by companies. There are several reasons for this:

- within the Polish economic structure, small and medium companies predominate that do not have the means for research and development,

- banks operating in Poland reluctantly grant loans for the deployment of product, technological and organizational innovations without the provision of high guarantees for financing risky undertakings,

- *venture capital* has not yet been activated in Poland to a satisfactory degree, which in many highly developed countries is an important instrument of deploying scientific, R&D and innovatory activity into economic practice.

- In the analyzed years, expenditures for innovatory activity in the food industry have increased. Expenditures for the purchase of machines, technical devices and means of transport were predominant in the expenditure structure. The share of expenditures for research and development activity was unfortunately low.

- The modernization of companies from the agricultural and food sector has hugely increased, which is proven, among others, by the following:

- innovation intensity increase,

- increased share of new and modernized product sales in the total product sales,

- increased share of innovatory companies in the total number of companies,

- increased number of entities entitled to trade on the single market.

- The competitiveness of the food industry has increased. This has led to very good foreign trade results and high profitability of companies from this sector.

- Further research of the food industry's innovativeness level is necessary, since the development potential of this industry is based on higher product innovativeness. Both the national and foreign market are subject to constant change with regard to consumer preferences.

- Further research should take into account the new innovation typology, which is to be fully deployed in 2008.
- For the future, further investigations may prove worthwhile to perform international comparisons taking into account “objective” innovation method indicators.

REFERENCES

- Miedziński H., *Koordinacja procesów innowacji na przykładzie polskiego województwa*, [w:] *Gospodarka oparta na wiedzy, wyzwanie dla Polski XXI w.*, KBN, Warszawa 2001
- Strategia rozwoju obszarów wiejskich i rolnictwa na lata 2007-2013 [z elementami prognozy do roku 2020]*, Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa 2005
- Nauka i technika*, GUS, Warszawa 2002, 2004, 2006
- Revue Elargissement*, no. 44, English edition, April 2003
- Rocznik statystyczny GUS*, Warszawa 2006
- Dworak E., *Gospodarka oparta na wiedzy: istota, tendencje, uwarunkowania w Unii Europejskiej*, [w:] J. Bilski and A. Midera (red.), *Polska w Unii Europejskiej*, Wydawnictwo Uniwersytetu Łódzkiego, Łódź 2003
- Raport o stanie nauki i techniki w Polsce*, GUS, Warszawa 1998, 2000

Wacława Starzyńska, Maria Magdalena Grzelak

INNOWACYJNOŚĆ W PRZEMYSŁE SPOŻYWCZYM – APLIKACJA WYBRANYCH MIAR STATYSTYCZNYCH

Rolnictwo w Unii Europejskiej jest traktowane w szczególny sposób. Odmiennej sposób funkcjonowania polskiego rolnictwa w porównaniu z rolnictwem unijnym powodował i ciągle powoduje, że polskie rolnictwo wymaga proces dostosowawczych do standardów europejskich.

W artykule przedstawiono różne koncepcje miar zbudowanych dostępnych danych statystycznych, których celem jest próba oceny stopnia innowacyjności polskiego przemysłu spożywczego w okresie przed- i poakcesyjnym.

Słowa kluczowe: transformacja gospodarki, standardy unijne w przemyśle spożywczym, innowacyjność w przemyśle spożywczym, mierniki statystyczne.