

## **INNOVATIONS IN FOOD PRODUCTION – STATUS AND DIRECTIONS OF DEVELOPMENT**

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### Abstract

This paper characterises the directions of innovative activities undertaken by food industry enterprises concerning the manufacturing of food products. Based on the subject literature and secondary statistical data, the status of food industry innovativeness and areas of innovative activities related to implementation of technological and non-technological innovations are presented. The activities of enterprises focus on manufacturing new products in response to the ever-changing needs and expectations of consumers. In particular, the production of so-called functional food (which seeks to promote health, minimise the risk of specific diseases, improve psychophysical fitness, lose weight, etc.) is increasingly extensive. Manufacturers must also improve the technologies and techniques of product manufacturing, packaging and storage.

## **INNOWACJE W PRODUKCJI ŻYWNOŚCI – STAN I KIERUNKI ROZWOJU**

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Słowa kluczowe: innowacje, innowacyjność, przemysł spożywczy, żywność.

### Abstrakt

W opracowaniu scharakteryzowano kierunki działań innowacyjnych podejmowanych przez przedsiębiorstwa przemysłu spożywczego, dotyczących produkcji artykułów żywnościowych. Bazując na literaturze przedmiotu oraz wtórnych danych statystycznych, przedstawiono stan innowacyjności branży spożywczej oraz obszary innowacyjnych działań związane z wdrażaniem innowacji technologicznych i nietechnologicznych. Działania przedsiębiorstw koncentrują się na wytwarzaniu nowych produktów, które są odpowiedzią na zmieniające się potrzeby i oczekiwania nabywców. Coraz bogatsza jest zwłaszcza oferta tzw. żywności funkcjonalnej, która ma wspomagać prawidłowe funkcjonowanie organizmu, minimalizować ryzyko wystąpienia określonych chorób, poprawiać sprawność psychofizyczną, zwiększać wydolność itp. Oprócz tego producenci żywności doskonalą techniki i technologie wytwarzania, pakowania i przechowywania produktów.

## Introduction

The development of enterprises, regions or countries is determined by many phenomena and factors whose nature, intensity and scale of influence are so diversified that formulation of a “simple prescription” to achieve them is impossible. Understanding the mechanisms governing these phenomena has been the subject of interest of numerous researchers. By focusing attention on different aspects of economic activity, they formulate the concepts explaining the causes, outcomes and conditions of those processes. Innovations that appeared for the first time in the theory of economic sciences thanks to Schumpeter (1960) are among them. Schumpeter focused mainly on technological innovations and their influence on the economy, highlighting their supply-driven sources (the so-called “supply-based” theory of innovation). He specified that innovations form the basis for changes and are the main economic development driving force. Contemporary theories, particularly those developed in recent years, stress the role of knowledge as a factor linked closely to innovation, which together contribute to economic development. That position is characteristic for, among others, FLORIDA (2010) – the author of such notions as the creative class, the creativity-based economy and the learning region.

Currently, knowledge and innovations form the basis of sustainable development, which is confirmed by the development trends of highly-developed countries (ŁAPINSKI 2010). Enterprises implement innovative solutions in production (of goods and services), technology, administration and marketing techniques. They represent a reaction to market challenges and, as a consequence, become a key factor in modern and dynamic organisations. Innovativeness as a characteristic or image of innovative entities, is frequently, and not without reason, linked to a competitive advantage because it is the outcome of activities seeking to improve market position in relation to competitors. For this reason, it is one of the major sources for obtaining an advantage over them. If this is combined with the current trends of integration and the globalising economy, then innovation implementation proves to be not only necessary, but also inevitable.

This paper focuses on the innovative activities of food industry enterprises narrowing their activities to adjust to current trends in food product manufacturing. Based on the subject literature and the secondary statistical data, the food industry innovation status and areas of innovative activities related to technological and non-technological innovation implementation are presented. This presentation is preceded by a short description of Polish economic innovativeness and its relations to traditional industrial sectors, including the food industry.

## Innovativeness of the Polish economy

In Poland, despite some fluctuations, economic growth has been observed which has resulted in acceleration of the GDP growth rate, among others (*Polska 2011. Raport o stanie...* 2011). The sources of growth used so far, such as access to cheap and qualified labour and raw materials, however, are nearing exhaustion. As highlighted by GULDA (2008), this is manifested in several ways, e.g. increasing costs of labour acquisition. For this reason, it will be increasingly difficult for enterprises to continue competing on the basis of those factors and over time it will actually become impossible. Under those circumstances, the search for, and use of, other sources of competitive advantage represent a chance for continual and dynamic development. Innovation is particularly important among these sources. Increasing innovativeness, next to effectiveness maximisation and resource (knowledge, capital, labour, raw materials and natural resources) optimisation, represents a fundamental assumption for one of the latest strategic documents for attainment of the medium- and long-term development strategy of Poland – *The Strategy of Innovation and Effectiveness of the Economy for the years 2012–2020 (Strategia...* 2012).

The Polish economy is characterised by a low innovation level. As indicated by the Innovation Union Scoreboard (IUS) report published in February 2012, a large gap exists between Poland and many other EU countries (Sweden, Denmark, Germany and Finland) (*Innovation...* 2012), and from outside the EU (Switzerland, Japan and the United States are the leaders in that ranking). The *Summary Innovation Index* – SII achieved by Poland in 2011 (roughly 0.3) was almost two times lower than the EU-27 average and more than 2.5 times lower than that for Sweden. Clear identification of the reasons for that situation is not possible. They are numerous, highly diversified and their character, at least in the case of some of them, is either immeasurable or is difficult to measure, diagnose or define. They are consequences of historical or cultural complexities, for example, for which a low level of public confidence and unwillingness to cooperate may be a factor. At the same time, as highlighted by KLEIBER (2011), public openness to the world is required for innovative economic development under conditions of progressive globalisation. Additionally, CRAFTS (2000) showed that countries representing a higher level of openness have better long-term development potential and this is a factor supportive of innovative activity. In addition to contempt for joint- and organised-cooperation (e.g. science and economics), the other most often highlighted weaknesses of Polish innovativeness include a low diversification of information sources on innovative activities, low outlays on innovation and research, the absence of an innovation-oriented policy, particularly including

a lack of activities integrating the innovative activities of different entities, organisations, institutions and authorities.

Decreasing the distance and improving the position of Poland in the international innovation rankings is possible, but it will be a long-term process. It is estimated that with the current trends, Poland will reach the average level of EU countries in 50 years (*EIS 2005*). Assuming certain “prudential optimism”, it can be assumed that the process of “catching up” has been initiated. In the general classification of countries presented in the IUS Report<sup>1</sup>, Poland was classified in the third group – the so-called *moderate innovators* and, although it was ranked the last in that category, the result was better than in, e.g. 2005, 2007 or 2008. In those earlier cases, it was included in the last category of countries that at that time were called countries “losing ground” (*EIS 2005*). Although it is difficult to formulate any radical conclusions based on this, considering the long-term trend of systematic closing the gap, the situation may indicate, at least, the appearance of certain symptoms and Poland joining the development stream in which innovations represent a key factor. It should be added, as pointed out by ROGUT and PIASECKI (2011), that the promotion of Poland to the category of moderate innovator did not result from increased research intensity or faster commercialisation of their results but was mainly the consequence of development in traditional sectors, including primarily the improvement of labour qualifications as well as the technological and technical competences. Those sectors are among the more important areas of Polish industrial economic activity. In 2009, entities representing low technology (those are generally referred to as “traditional”) represented 50% of the domestic manufacturing industry entities, employing 47% of the working population and generating 35% of production sold in that section (*Nauka... 2011*). The food industry plays an important role among them.

### **Food industry in Poland**

In 2009, food processing enterprises represented almost 20% of the total number of enterprises in Poland (according to the number of entities conducting business during the year). They employed ca. 15% of the total working population and their sales represented 16% of the total value of production sold. If the data for the food industry is compared to industrial enterprises only (section: industrial processing), then the indicators are even higher (total

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<sup>1</sup> Based on the summary innovation index (SII) and the rate of changes in it, the countries were classified by dividing them into four groups: innovation leaders, innovation followers, moderate innovators and catching-up countries (*Innovation... 2012*).

number of enterprises – 21%, average employment – 17% and production sold value – 19% respectively). (*Rocznik Statystyczny...* 2010). This industry, however, is characterised by large dispersion (Fig. 1). Almost 70% of the entities are micro-enterprises and, together with small enterprises, this percentage increases to 90%. The scale of their production is small, which is indicated by the structure of employment and sales. A much larger role is played by medium and large enterprises. This structure (particularly for production sold) was undoubtedly influenced by the processes of consolidation observed within individual segments of the industry, which WIGIER (2011) considers inevitable. The meat industry (10 largest representatives of that segment generate ca. 1/3 of the domestic production) and the dairy industry (5 largest producers control 30% of the milk market and its products – DROŹDŹ 2009) are the best examples.

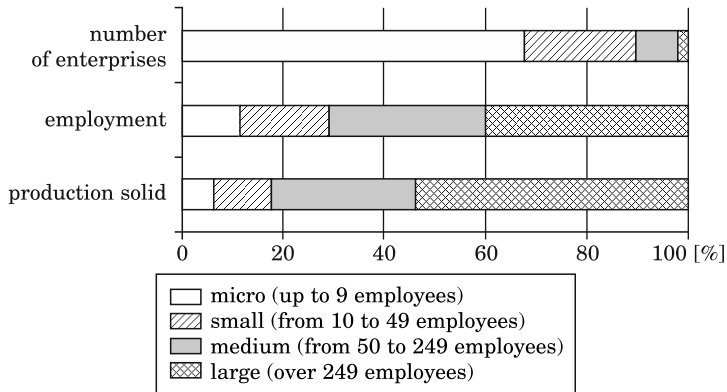


Fig. 1. Structure of food industry entities in Poland in 2009

Source: own work based on the *Industry by Employment Size Classes*. <http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home> (access on 12 March 2012).

Currently, the food industry is one of the most dynamically-developing sectors of the Polish economy. Modernisation processes induced by the necessity of business adjustment for operating under market conditions, as well as the accession of Poland to the European Union, have also resulted in a significant improvement of the technical status and upgrading of the production equipment. As a consequence, this helped firms to achieve standards that made them eligible for trading in the common market. Export sales of agricultural food products increased thanks to which the producers improved their competitive position in the market of the expanded European Union. During the initial 5 years of membership, the share of exports in the total food industry sales increased by ca. 22% (i.e. it was more than 2-times larger than prior to the accession of Poland to the European Union – SZCZEPANIAK, DROŹDŹ 2010).

The dynamics of food product exports by the domestic processing industry means that those products are accepted by foreign consumers and also indicates the ability to compete with other producers. The direct cause of this success, however, was the lower labour costs (lower than in the EU-15) and, as a consequence, lower prices and costs of food production. Those advantages are now steadily decreasing. Prior to the accession of Poland to the EU, the retail prices of food in Poland were lower than in the “old” Union by ca. 40% but during the years 2008–2009 they were lower by only 28% (URBAN 2010). This situation is also applicable to prices at the level of processing and agricultural prices. For food producers, this means the necessity of applying non-price competition instruments to a wider extent than previously and innovations are particularly important among them. The use of innovative solutions is necessary for the production of a new generation of high quality products. The intensity and scale of implementation will determine the potential for maintaining market share in both the foreign and domestic food markets. However, as indicated by the data provided by the Central Statistical Office (GUS), the innovative activity of this sector is relatively low (*Działalność innowacyjna...* 2012). During the years 2008–2010, only 12% of the total number of food enterprises in Poland introduced product and/or process innovations, while fewer than 17% introduced organisational and/or marketing innovations (for comparison, those percentages in the manufacturing industry were 17% and 21% of enterprises, respectively). In their activities, the enterprises focused mainly on expanding the range of products and improving the quality of their products. They generated less than 5% of total sales from sales of product innovations (in the manufacturing industry, that value was almost 3-times higher). The barriers to undertaking innovative activities resulted, similar to the entire industrial sector, from the economic conditions (excessively high innovation costs and lack of funds for implementation) although competing companies increasing market share was a serious concern for almost 25% of enterprises.

### **Innovations in the food industry**

The specificity of the products offered by food industry enterprises is that they satisfy the fundamental nutritional needs and are directly related to human health and life. For these reasons, the offers presented by producers are influenced by various trends in the food market, particularly those in the field of consumption. They are shaped under the influence of consumer behaviour patterns which, despite differences between individual countries, are becoming increasingly homogenous. Their increasing similarity is sup-

ported by the development of the cheap international trade networks, unification of the offer of the commercial centres, development of fast food-type restaurant networks, media, the development of tourism supportive to the exchange of consumption patterns between the tourists and the local population and processes of departing from the traditional consumption patterns (KWASEK 2010). Specific behaviours result from the tastes and preferences (i.e. lifestyle) on the one hand, while on the other they are also a consequence of phenomena (including risks) related to civilizational development. DOWNEY (2005) includes, *inter alia*, safety (consumers expect food that is safe and fear the appearance of pathogenic factors, such as BSE or AH1N1), health, welfare and affluence (factors particularly important in the context of consumer needs, lifestyle and income as well as diseases caused by poor nutrition) and the ageing of society (consumers want innovative products with a high content of nutritive components, which combined with a healthy lifestyle and principles of “healthy ageing”, should improve the quality and length of life) among the key factors causing changes in the food market. Food industry enterprises also consider, or at least should consider, such factors in designing the appropriate product range offer. This involves the vast majority of products which represent modifications to existing solutions. Such proposals are accepted by consumers more readily; they expect novelties, on the one hand, while, on the other, they generally choose products they already know (FREWER et al. 2005).

The trends in food production which form the basis for innovative actions by food industry enterprises also include both fresh and processed food. Fresh products offered in their natural form (or minimally-processed) are perceived as being better, healthier and containing more valuable nutritive components than those that were produced using long and complex technical processes. Minimally-processed food is considered to be a major advantage of Polish production and the image of Poland as a producer of healthy and organic food is popular (KOZIOŁKIEWICZ et al. 2011). Activities of enterprises are focused on the possibilities of retaining that freshness for as long as possible. As a consequence, innovative solutions in this area mainly involve the techniques and technologies of preservation, assuring appropriate storage conditions and transport techniques. Organic food (interpreted as representing natural products, high quality and health safety) fits well with this trend in consumer expectations and requirements. The production of such products is conducted by employing methods that do not disturb the natural environment and the products do not contain preservatives or residues of pesticides. The producers of such foods base their production on natural components and protection methods and often use biodegradable materials.

Packaging plays an important role in food production. As indicated by domestic statistics, enterprises producing food products most often apply

changes related to packaging. This is the most common of all marketing innovations, and differentiates such products from industrial processing, which relies on new methods of pricing or new product media promotion or techniques (*Działalność innowacyjna...* 2012). The package, in addition to its protective or informative function, influences the product use, convenience and safety, facilitates storage and attracts consumer attention with its shape, colours, aesthetics, etc. Extending the freshness period of the product, while maintaining its looks, taste and nutritive components is also among its tasks. Additionally, the increasing pace of social development and changes in consumer lifestyles, particularly for professionally active people, cause consumers to seek products in the form of ready dishes, concentrates or semi-finished products that are suitable for direct consumption or products that are relatively quick and easy to prepare for consumption. This is also linked to packages that may shorten the meal preparation time (e.g. a frozen dinner dish that may be prepared in a microwave oven without taking the packaging off). The new trends in this area of innovative business activities also include the so-called "active" packages (that change the environmental conditions of the food packed in order to guarantee its safety, quality and extended shelf life, for example) or intelligent packages (which monitor the conditions in which the packed food is set – PANFIL-KUNCEWICZ et al. 2011). In addition to innovative packages, food product packaging techniques and technologies are also developing dynamically. Various solutions (e.g. aseptic, vacuum or modified atmosphere packaging) have already been implemented, but they are still being developed (e.g. by substituting high temperatures with bacteria filters). At the same time, the common application of nanotechnologies for the production of innovative food packages is just a matter of time (KOZIOLKIEWICZ et al. 2011).

The increased awareness of the consumers concerning health problems induced by inappropriate nutrition have caused producers to start seeing their products from beyond their basic function of nutrition. Their influence on the health status, welfare or decreasing the risk of diseases is also proving to be important. This is the key characteristic of the so-called functional food. The components that could have a negative influence on health (e.g. allergens) have been removed or have been enriched with physiologically-active substances to obtain products possessing health- and fitness-promoting features (*Żywność i żywienie...* 2010). This includes, *inter alia*, food containing live bacterial cultures (e.g. dairy products), foods with decreased contents of sugar, fat (e.g. "light" products), enriched with vitamins, minerals or cellulose (e.g. juices, breakfast flakes, products made of cereal seeds, deserts), omega-6 and omega-3 fatty acids (e.g. margarines, oils, food concentrates), etc. Given the character of their components, such products are frequently sensitive to the influence of external factors, so, in their case, appropriate packaging and storage condi-



tions are also important. The task of functional food, in addition to nutrition, is its physiological influence, which may help, for example, to decrease the level of so-called “bad” cholesterol, restore the microbiological balance of the digestive system, support anti-carcinogenic activity or boost the immune system (TUORILA 2001). Consequently, it limits and/or prevents the appearance of many civilisation diseases (e.g. diabetes, obesity, cardio-vascular system diseases). It is believed that, in the future, the treatment and prevention of such diseases will be carried out mainly on the basis of a comprehensive and individually-prescribed diet based on new functional additives to food (KOZIOŁKIEWICZ et al. 2011). Additionally, innovative food products also include products designed according to the specific needs of the body. Such products are targeted to a specific group of consumers, e.g. people with diabetes, food intolerance, cardio-vascular diseases as well as athletes, people under stress, pregnant women, infants, children or the elderly.

It is not possible to list all the segments of functional food. In addition to health-promoting characteristics, such food may also influence a consumer’s self-perception or appearance. KRYGIER (2012), quoting J. Mellentin, the editor-in-chief of the “New Nutrition Business” magazine presents the opinion that, in the near future, the trends observed in the global functional food markets will also be present in Poland. In addition to products containing pro- and pre-biotics and antioxidants, natural health food, health snacks or food for children, he also lists beauty food, mood food, food with a “premium” (premiumisation, otherwise known as BFY – Better for You food) and weight-management food. The wide diversification of products of this type, on the one hand, shows the vast diversification of functional food and, on the other, the increasing interest of the consumers in such products, which has led to this becoming one of the fastest developing global food market segments. At the same time, according to KOZIOŁKIEWICZ et al. (2011), production of functional food focused on health characteristics may contribute to the Polish food industry achieving global-scale success. Such opportunities are also offered by new technologies – particularly nano-encapsulation and nano-emulgation of selected health components of food, assuring their durability and allowing precise delivery of them to the body as well as helping to evaluate their influence on the human body.

## **Conclusion**

Producers of food products developing innovative solutions must meet the changing needs and expectations of the buyers with scientific and technological achievements in that particular type of production. Not all of them are fully

accepted and sometimes the level of acceptance is marginal (e.g. transgenic food). The current range of products is constantly being modified. The presented directions of innovative activities conducted by food industry enterprises do not exhaust the subject of innovative solutions employed in this industry. It may be generally concluded that they represent a response to the observed trends in food consumption. They also result from the increasing consumer awareness concerning the quality of living and its correlation with nutrition methods. That is why there has been such great (and continually increasing) interest in functional food observed, particularly for foods with health-supporting characteristics. Such foods may contribute significantly to preventing numerous civilizational diseases and may even represent the most effective way of preventing them. Food industry enterprises in Poland must adjust their offered range of products to these needs and expectations, especially because it offers them a chance for sustainable development and effective competition against foreign producers.

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