
Open Innovation Models Implemented by Polish Food Industry Enterprises from Lublin Region

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Abstract:

Purpose: The aim of the article is to identify models of open innovation implemented by Polish enterprises of food industry in Lubelszczyzna.

Design/Methodology/Approach: The aim of the research was realized based on the analysis of the literature on the subject and the results of own research conducted using the case study method. The information was collected by means of direct interviews with the representatives of the management staff, and the basis for research was the original questionnaire survey.

Findings: The researched companies included external entities in the implemented innovation processes in a very diverse way. The number of partners co-developing innovative solutions within the open model in particular companies ranged from 1 to 25 partners, and the level of their involvement was very different. In the majority of cases the opening included all stages of the innovation process - from the stage of conception to the implementation of innovation and the dominating scheme of opening was the centripetal process, consisting of acquiring ideas and solutions from the environment and building relations with external partners in order to gain access to their knowledge resources allowing to increase the effectiveness of implemented innovative activities.

Practical Implications: The research revealed how the companies involved external partners in their innovation processes and what effects in the form of innovative solutions they achieved thanks to the cooperation. The presented innovative practices in terms of applying the concept of open innovation can be a recommendation for other food industry enterprises.

Originality/Value: The multitude of premises indicating the legitimacy of applying the concept of open innovation in traditional industries revealed the need to carry out research showing how the model of open innovation is implemented by food industry enterprises.

Keywords: Open innovation, food companies.

JEL codes: O30, O36.

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1. Introduction

Progressive globalization, technological development and increased market awareness of buyers contribute to the growing intensification of competitive phenomena. It becomes necessary to constantly seek new ways to compete, increase flexibility of action and strive to use all opportunities to shape and improve market position. In a modern economy, characterized by volatility and unpredictability, the factors contributing to the development of enterprises are therefore primarily the ability of continuous learning, acquiring new skills and their transformation into innovations (Tidd and Bessant, 2018).

Dynamic changes taking place in the market environment of contemporary enterprises make the traditional approach to innovation lose its significance. The consequence of these changes is that companies are looking for new ways to increase the effectiveness and efficiency of innovation processes by increasingly including external partners in their implementation, and thus using the concept of open innovation (Chesbrough, 2003). So far, open innovation has been identified primarily with high-tech sectors. However, there are more and more indications that they should be applied in traditional sectors, such as food industry (Juchniewicz, 2014).

The multitude of these conditions revealed the need to carry out research showing how the model of open innovation is implemented by food industry enterprises. So far this aspect has not been analysed in the context of enterprises operating on the Polish market, therefore an attempt to fill this gap was made in this study. Thus, the aim of the paper is to identify models of open innovation applied by Polish enterprises of the food industry operating in Lubelskie Voivodship in which this industry plays a key role. This objective was achieved on the basis of the analysis of the literature on the subject and the results of own research carried out using the case study method.

The article has a theoretical and research character. The theoretical part of the study presents the evolution of models of innovation processes leading to the model of open innovation, showing at the same time the essence of this concept. There were also presented ways of realization of the processes of open innovation and legitimacy of using this concept by food industry companies. In the further part of the article the methodology of the research and the results obtained in the framework of the research were presented. The summary contains a synthesis of the results and conclusions drawn from them.

2. The Evolution of Innovation Process Models

The literature presents numerous theoretical approaches to models of innovation processes, which have evolved significantly since J.A. Schumpeter (Table 1). In the first models, the innovation process was shown as a linear sequence of events

triggered by a demand or supply stimulus. Then, as a result of increasing competition and the growing pace of technological change, the complexity of subsequent models increased significantly. The third generation of models began to take into account the occurrence of interactions and feedbacks between individual, still sequential, stages of the innovation process. Another model concept pointed to the parallelism and integration of the work of individual departments participating in the innovation process.

In addition, companies began to involve suppliers and lead users in innovation activities. The emergence of the fifth generation of models resulted from further development of cooperation with external partners and intensified use of information and communication technologies for information flow. The innovation process was shown here as an integrated system based on network relationships. The beginning of the 21st century saw further changes in the conditions for the implementation of innovation processes. Dynamic changes taking place in the world economy, progressing globalization and the increasing pace of technological progress have led to the formation of the sixth generation of innovation process models called open innovation (O'Sullivan and Dooley, 2009; Roszkowska-Menkes, 2015).

Table 1. *Innovation process models*

Model type	Brief characteristics
The 1st generation supply-side linear model of innovation.	Supply-side, "science-pushed" innovation model; sequential, simple linear model of the innovation process, focusing on R&D; market is the recipient of innovation; since 1950s.
A 2nd generation demand linear model of innovation.	Demand-side, "market pull" innovation model; simple, linear, sequential model of innovation, emphasis on marketing; market is the source of research, role of research is to respond to market needs; since 1960s
3rd generation interactive demand-supply model; coupling.	Coupling, demand-supply model focuses on continuous feedback; integration of R&D with marketing, and also with production; since 1970s.
4th generation interactive demand-supply model; chain .	Chain, demand-supply model presents continuity of process and shows many interactions occurring between model elements; combination of technical capabilities and market needs; since 1980s.
The 5th generation network model	Flexible model, based on linkages with consumers, suppliers, etc., since 1990s.
The 6th generation model – <i>open innovation</i>	Open innovation model; involving external actors in innovation creation and implementation processes; since 2000.

Source: *Rothwell, 1992, p. 221; Nobelius, 2004, p. 370.*

In introducing the concept of open innovation, H.W. Chesbrough drew a distinction between the traditional innovation process, in which companies create, develop, and implement their own ideas while performing technical and marketing research based solely on internal resources, and the process in which companies apply ideas and solutions generated both inside and outside the organization while allowing others to use ideas they do not currently use (Chesbrough, 2006). The open innovation model thus represents a holistic approach to innovation management strategy that involves:

systematically searching for and exploiting diverse sources of innovation; consciously integrating selected sources with company capabilities and resources; and using a variety of channels to develop and exploit identified innovation opportunities (West and Gallagher, 2006).

At the same time, it is worth emphasizing that the enormous complexity and diversity of innovation processes make it unrealistic to expect a single, universal model of the innovation process. It should be assumed that the development of theories of innovation and research methods will lead to the emergence of new, more complex concepts of innovation processes that will better explain the complex processes that accompany the dissemination of innovation (Brzeziński, 2017). These newly emerging models should take into account such conditions as: the increasing dynamics of changes in the macro- and micro-environment and within the company, shorter and shorter innovation life cycles, dynamic development of technologies (especially information technology), the possibility of shared learning among network partners participating in the implementation of the innovation process and the development of cooperation between companies and representatives of the innovative environment (Brzeziński and Wróblewska, 2013).

3. Innovation Processes Implemented in an Open Model

Open innovation processes can be implemented according to three patterns, which are based on the direction of innovation flow, which can take the form of (Gassmann and Enkel, 2004):

- centripetal, where the process of innovation flow "inwards" dominates, i.e., from the environment to the enterprise,
- centrifugal, where the process of innovation flow "outwards" dominates, i.e., from the company to the environment,
- mixed, where the flow of innovation takes place through cooperation of entities.

The first of the identified processes, i.e., the centripetal model of innovation consists in acquiring (for a fee or free of charge) ideas, solutions and technologies from the company's environment. The most important advantages resulting from its application are: the possibility of gaining access to unique knowledge resources, the possibility of creating a competitive advantage by adapting the offered solutions to the needs of purchasers (thanks to including them in the process of innovation creation), increasing the efficiency of implemented innovative undertakings, more effective use of resources and reduction of risk associated with conducting innovative activity (Sopińska and Mierzejewska, 2017).

The second process, i.e., the centrifugal model, involves using the environment to commercialize solutions developed within the company that do not fit its current business model. Among the benefits of the centrifugal innovation process are:

efficient use of knowledge resources, shortening the time to market of innovations, focusing on unique competencies, increasing flexibility, or generating additional revenue from licenses (Chesbrough and Garman, 2008).

The third type of process, the so-called open mixed innovation involves the company creating formal and informal partnership networks and undertaking cooperation with external entities at various stages of the innovation process (Chiaromonte, 2006). The mixed process combines open centripetal and centrifugal innovation. On the one hand, the company obtains the opportunity to benefit from the knowledge of the partners, while on the other hand it makes some of its own solutions available for the benefit of the joint project, sharing them with other entities. The application of this concept allows innovators to share risks and pool complementary resources, and represents an important potential for achieving synergistic benefits as a result of mutual learning.

In summary, it can be stated that the first two types of processes, i.e., centripetal and centrifugal, are characterized by a unidirectional flow of knowledge between the company and its environment, and external partners act here as a source of innovation (centripetal model) or a channel for its commercialization (centrifugal model). In the case of open mixed innovation, the flow of knowledge between the company and the environment is bilateral, and each partner has equal access to the results of cooperation. At the same time it is worth stressing that the level and degree of opening of innovation processes is determined individually by each enterprise, depending on the specificity of their activities and the business model implemented, therefore it can be assumed that there are as many models of open innovation as there are companies using them (Sopińska and Mierzejewska, 2017).

4. Open Innovation in the Food Industry

The food industry is one of the most important branches of the Polish economy, playing an important role in the creation of gross domestic product, labor market, international exchange and satisfying domestic demand (Wróblewska, 2017). At the same time, food industry enterprises are underdeveloped entities with low technological capabilities and a relatively low propensity to develop new knowledge (Castellacci, 2008).

Considering the specificity of innovations introduced in the food industry, it should be emphasized that the demand models of the innovation process are implemented here first of all (Lagnevic, 2003), as the essence of this type of business is to satisfy customer needs and the implemented solutions are primarily incremental (Garcia Martinez and Briz, 2000). This is due to the limitations arising from the stringency of safety regulations and the distrust of consumers in relation to completely new products. Moreover, due to the relatively high stability of technology used in the food industry, marketing competence is often more important than technological skills in achieving success in innovation activities (Sarkar and Costa, 2008).

The issues highlighted above explain to a large extent why the food industry is one of the sectors least likely to implement the concept of open innovation. The key barriers in this respect include: limited technological intensity, low intensity of research and development works and emphasis on incremental innovations only. However, the current conditions of functioning on the market cause that enterprises from the food industry more and more strongly feel the need to include external partners in their innovation processes. Among significant incentives for the use of open innovation models in the food industry, the following can be singled out: the increasing complexity of innovation processes resulting from growing consumer requirements and restrictive requirements related to food safety, increased competition, both on the domestic and international market, as well as the convergence of industries progressing in the economy, creating new possibilities in terms of satisfying consumer needs (Brasili and Fanfani 2006; Juriaanse, 2006).

5. Research Methodology

The aim of the research was realized using the descriptive case study method (Lee, Collier, and Cullen, 2007). The information was collected by means of direct interviews with the representatives of the management, while the basis for conducting the research was the author's questionnaire survey. The analyses attempted to answer the following questions:

- With how many and what kind of entities was cooperation undertaken in the field of implemented innovative activity?
- What was the level of involvement of particular partners in innovation processes carried out in the open model?
- At what stages of innovation process was cooperation established?
- What was the direction of knowledge flow between the company and the environment?
- Which party initiated works on creating innovations in the open model?
- What was the nature of the cooperation (formal or informal)?
- How long did the cooperation last and what did it consist of?
- What was the scale of occurrence of open innovation in the studied companies, i.e. how many innovative solutions (product, process, organizational and marketing) were implemented as a part of cooperation with external partners?
- What were the main motives of establishing cooperation?
- What barriers occurred during the implementation of open innovation processes?
- What benefits have been achieved as a result of cooperation with external partners within the framework of conducted innovation activities?

The information gathered in the course of the research was the basis for the construction of models of open innovation used by the analysed companies. Among

the various criteria presented in the literature for determining the type and specificity of cooperation during the implementation of open innovation processes, the construction of models within the framework of the case studies was carried out based on the following criteria:

- number of external partners participating in innovation processes,
- the degree of involvement of partners in the implemented innovation activity,
- number of phases of the innovation process that were opened,
- direction of knowledge flow between the company and the environment (centripetal, centrifugal or mixed).

The simultaneous inclusion of four criteria in the proposed models made it possible to capture the phenomenon of open innovation in a way that highly illustrates the scope of openness and identifies the principles of participation of particular parties in innovation processes.

The research was carried out among Polish enterprises of the food industry operating in the Lubelskie Voivodeship. The choice of the scope of research was determined by the leading role of the food industry in the region in question, which is indicated among others by data related to the value of the sold production and the level of employment. The development of the food industry in Lubelskie Voivodship is favoured by favorable geographical and climatic conditions and the infrastructural environment in which enterprises operate (Wróblewska, 2020).

The selection of enterprises for the study was theoretical selection (Eisenhardt and Graebner, 2007), which means that a deliberate choice was made of entities in relation to which it was possible to present practices in the implementation of open innovation processes. To ensure the results of the research on a heterogeneous group of enterprises, entities with a diverse profile of activity and meeting the following criteria were selected for the study:

- undertaking cooperation with external entities within the framework of innovative activity,
- classification to the group of the so-called innovative enterprises.

The certainty that the surveyed companies met the above criteria was due to the fact that all these entities were known, due to their participation in the quantitative research conducted earlier. In accordance with the above assumptions, 5 specific cases of companies were identified for the study (Table 2).

Table 2. Characteristics of the surveyed companies

Specification	Company				
	„1”	„2”	„3”	„4”	„5”
Type of activity	Processing and preserving of fruit and vegetables and vegetables	manufacture of bakery and farinaceous products	manufacture of chocolate and confectionery	processing processing and preserving of meat	manufacture of dairy products
Size of the company	medium size	medium size	medium size	medium size	medium size
Age of the company	15 years	14 years	65 years	15 years	90 years
The scale of operations	international	international	international	national	national
Revenue trend over the past 3 years	increasing	increasing	increasing	increasing	unchanged
Number and type of innovations implemented	6 procedural 1 organizational 1 marketing	6 product-related 2 process-related 1 marketing	4 product-related	3 product-related 2 process-related	3 product-related 2 process-related 1 organizational 1 marketing-related
Type of external partners, with which the cooperation was undertaken in the field of innovative activities	suppliers	recipients universities consulting companies	universities	suppliers recipients	suppliers recipients universities

Source: Own elaboration based on conducted research.

All cases considered are medium-sized enterprises (with 50-249 employees), with an established market position. Most of the analyzed entities operate internationally, observing an upward trend in revenues over the last three years. All analyzed entities have implemented in the analyzed period technological innovations (product and/or process), and three of them have also introduced innovative solutions of a non-technological character (organizational and/or marketing). Within the framework of their innovative activity, the surveyed enterprises have undertaken cooperation with various entities from the environment - customers, suppliers, universities and consulting companies.

6. Research Findings

Company "1":

Within the framework of the conducted innovative activity, the enterprise "1" undertook cooperation with 1 supplier, assessing highly the level of the partner's involvement in the implemented innovation process. The external partner

participated to a high degree in all stages of the innovation process, i.e. concept, research, development and implementation. Cooperation with the supplier was carried out within the so-called centripetal process, consisting of using external knowledge resources to increase effectiveness of implemented innovative activity (Figure 1). The analyzed company was the party initiating works on innovation creation in the open model. The cooperation was formalised and of a short-term nature (lasting less than a year). The aim of the cooperation was to verify the needs of the analyzed company, to create a program tailored to the defined expectations, and then to implement an IT system that allows, above all, for the immediate identification of goods in stock.

The result of this cooperation was the implementation of 1 organizational innovation. During the implementation of the innovation process, high costs associated with looking for solutions outside the company were encountered as a barrier. The main objective of the cooperation was to accelerate and increase the efficiency of innovation processes, which was achieved within the framework of the undertaken cooperation.

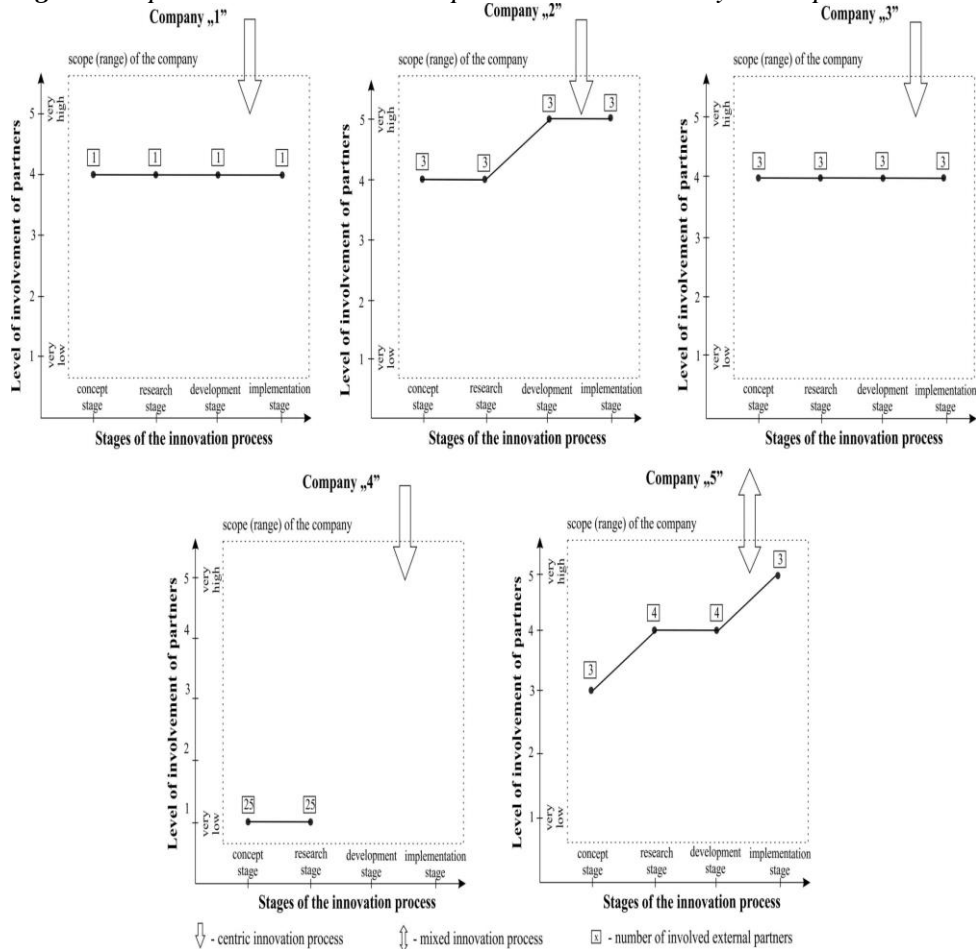
Company "2":

The enterprise "2" has established cooperation with 1 customer, 1 university and 2 consulting companies in the scope of its innovative activity. When evaluating the level of involvement of particular partners in the implemented innovation processes, the enterprise declared a very high level of involvement in relation to the university and consulting companies and a low level of involvement in the case of the recipient of the offered products. There were 3 external entities involved in each phase of the innovation process, and the level of their involvement was assessed as high in the first two phases, i.e. at the stage of conception and research, and as very high - at the stage of development and implementation of innovative solutions (these are average levels of involvement for all partners participating in particular phases of the innovation process).

In the company, a centripetal scheme of opening innovation processes was implemented, consisting of acquiring ideas and solutions from the environment and creating relations with external entities in order to gain access to their knowledge resources (Figure 1).

The initiator of the undertaken cooperation was the analyzed company. The cooperation with the recipient was informal and short-lived, and its aim was to obtain support in developing an innovative product, first of all in terms of concretisation of ideas. The cooperation with the university and consulting companies, on the other hand, was of a formalized nature, where the cooperation with the consulting companies lasted less than a year, while the cooperation with the university lasted 3 years. Consulting companies provided support especially in preparing applications for funding of innovative projects, while the university was a partner in developing new and improved products and technological processes.

Figure 1. Open innovation models implemented in the surveyed companies



Source: Own study.

Within the cooperation with external partners the company introduced 1 new product to the market and implemented 1 process innovation. The main motives for establishing cooperation with external entities were: acceleration and increase of efficiency of innovation processes, possibility to react faster to changes in the market environment and better adjustment of products to customers' expectations. Thanks to the application of the concept of open innovation, the enterprise gained access to extensive knowledge resources and increased its own capabilities in terms of proper identification of buyers' preferences and thus better adjustment of the offer to their needs.

Company "3":

During the implementation of innovation processes, Enterprise "3" started cooperation with 3 universities. These entities were highly involved in all phases of the innovation process, i.e. concept, research, development and implementation. The

cooperation with universities took place within the framework of the so-called centripetal process (Figure 1). The company was the initiator of cooperation with external partners. The cooperation was formalised, without a clearly defined duration - the cooperation with universities takes place under permanent employment contracts, with the possibility of termination at any time. The cooperation is based on the following principles: the company notifies the universities of a problem in the scope of implemented innovative activities and then receives the developed concepts together with a cost estimate, and then makes a decision on the possible implementation of the proposed solutions.

The result of the cooperation in question was the introduction of two innovative products to the market. During the implementation of open innovation processes, difficulties were encountered in the form of failure to meet the expectations of the company by the partners. The main reasons for establishing this kind of cooperation were to reduce the costs of innovative activities and access to a wide range of knowledge and unlimited number of ideas, which was achieved in the framework of the undertaken cooperation.

Company "4":

Enterprise "4" has established cooperation with 5 suppliers and 20 recipients of the offered products, however, evaluating very low the level of involvement of individual partners in the implemented innovation processes. External entities participated only in initial phases of innovation process i.e. at the stage of conception and research. This took place within the framework of the so-called centripetal scheme, consisting of acquiring ideas and solutions from outside (Figure 1). The cooperation was initiated by the analysed company. The cooperation with customers and suppliers was informal and long-term, and its primary goal was to gain access to various ideas for creating new and improved products.

As part of the collaboration with external partners, the company launched 2 innovative products. During the implementation of the open innovation model, barriers were encountered in terms of divergent interests of individual partners. The main motive for establishing cooperation with entities from the environment was the possibility of better adjustment of offered products to customers' needs and this goal was achieved.

Company "5":

Enterprise "5" has established cooperation with 3 suppliers, 2 customers and 1 university. The level of involvement of particular partners in realized innovation processes has been assessed as very high - in case of suppliers, high - in case of university and low - for recipients of offered products. Four external entities participated in the research and development phases, while at the conception and implementation phases 3 external partners were involved. The level of cooperation at the concept stage was assessed as medium, at the R&D stage - as high, while at the implementation stage - as very high (these are average levels of involvement for

all partners participating in particular phases of the innovation process). Cooperation with external entities took place within the framework of the so-called mixed process, consisting in mutual exchange of knowledge, learning and sharing benefits resulting from jointly developed solutions (Figure 1).

The company was the initiator of cooperation with partners. Cooperation with customers was informal and short-lived, and its aim was to adjust newly developed products to consumer needs. On the other hand, cooperation with suppliers and the university had a long-term and formalized character. The suppliers supported the company in testing products and co-creating innovative solutions of technological nature, while the university was a partner in developing new products and process innovations.

The cooperation resulted in launching 3 new products on the market and implementing 2 process innovations. During the implementation of open innovation processes, a barrier was encountered in the form of differences in the interests of individual partners. The main reasons for establishing this type of cooperation were the desire to respond faster to changes in the environment and the ability to better adapt products to customer needs. Thanks to the cooperation, the company has achieved a reduction in costs associated with conducting innovative activities and has increased its flexibility to respond to dynamic changes in the market environment.

7. Summary and Conclusions

Based on the case studies it can be observed that the studied companies included external entities in a very diverse way in the implemented innovation processes. The number of partners co-developing innovative solutions within the open model in particular companies ranged from 1 to 25 partners, but the level of their involvement varied greatly.

The analyzed companies most often started cooperation with customers, suppliers and universities. The main objective of establishing cooperation with consumers was the possibility of gaining access to unlimited resources of ideas for creating innovative products, as well as the opportunity to better understand the needs of buyers and adapt to them offered products. Suppliers, constituting an important group of partners due to a high level of availability and compatibility of their knowledge with the knowledge of enterprises, constituted a support both in terms of creating new products and creating innovative solutions of technological and organizational nature. On the other hand, cooperation with universities enabled access to broad knowledge resources with a high degree of novelty, which gave an opportunity to build a competitive advantage difficult to imitate by competitors. Entities constituting the source of scientific knowledge were partners both in developing new products and process innovations.

In most cases, opening included all stages of the innovation process - from the stage of conception to the implementation of innovation, and the dominant pattern of opening was the centripetal process, consisting in acquiring ideas and solutions from the environment and building relations with external partners in order to gain access to their knowledge resources, allowing to increase the effectiveness of implemented innovative activities.

In spite of the identified barriers and difficulties during the implementation of open innovation processes, all the analyzed companies have realized the objectives underlying the decision to involve external partners in their innovative activities, achieving the effects in the form of: better identification of customers' expectations and thus better adjustment of products to their needs, reduction of costs of innovative activities, shortening the time of implementation of innovative processes and increased flexibility in response to dynamically changing environment.

Therefore, enterprises from the food industry should strive for wide participation of external partners in innovation processes, involving in its individual phases entities from the environment that have diversified knowledge resources. Intensification of activities in this scope could be achieved through participation in conferences, fairs and various types of meetings with representatives of the world of business and science, which would be an opportunity for establishing contacts, mutual understanding of needs and exchange of knowledge.

At the same time, it is worth stressing that a valuable and interesting direction of future research would be to carry out quantitative research, on a representative research sample, on innovation practices in the field of implementation of the open innovation model by Polish food industry enterprises.

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