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## NEW CONCEPTS OF INNOVATION IN ECONOMIC SCIENCES – IMPLICATIONS IN THE FIELD OF FOOD ECONOMY

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### Abstract

*The development of innovation theory points to the growing importance of innovation in the processes occurring in the economy. The paper characterizes evolutionary changes innovation models - starting with the linear models up to the cooperation network concept. Particular attention was paid to the creation of contemporary models of innovation and the possibility of their implementation in the food industry. It was found that innovation should increasingly be based on the concept of open innovation. It assumes the active participation of many actors in the creation of cross-organizational knowledge and skills improvement. This trend may be the answer to food industry companies to the growing competitive pressure in global markets.*

**Keywords:** innovativeness, innovation model, open innovation, user-driven-innovation, open knowledge

**JEL classification:** A10, L66, O30, O11

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### 1. INTRODUCTION

In the contemporary economy, focus of structural changes on innovation and innovativeness is consistent with the fundamental cultural and civilizational changes taking place in the global environment. Those changes at the same time modify approach to innovation in the theory of economy. Evident transition from the neoclassic through endogenous to evolutionary economic growth theories that result in changes to the innovation models is noticeable. Initially the supply and demand based concept of creating inventions and technological progress developed in the economic theory. Those models referred to the deterministic resource allocation model based on single direction in the information flow (from the buyer to the manufacturer – market pull model or from the manufacturer to the buyer – technology push model). Being sequential in their nature, they did not consider the feedbacks typical for modern economies. The evolutionary economic growth theory, highlighting the importance of knowledge and learning processes taking place within the complex relations involving numerous entities of the economic scene caused changes in the

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approach to the innovation models. The most important and best visible trends in that area include treatment of innovation activity as a system that requires combined action of numerous entities. As a result, the concepts of interactive innovation models were developed: the model of feedbacks and interactions (so-called chain-linked model) by [Kline and Rosenberg \(1986\)](#), the „feedback” model by [Rothwell and Zegveld \(1985\)](#) as well as the network and systemic innovation process concept. The presented innovation models indicate at the same time, which is correctly noticed by [Rogut \(2007\)](#), the necessity for changing the views concerning the character of advantages determining success in the contemporary world. The author, referring to the works of [Porter, \(1990, 1998\)](#), states that the first of such changes occurred during mid-1970-s. It involves shifting the focus from comparative advantages to competitive advantages. Continuing those considerations she states, after [Cooke and Leydesdorff \(2006\)](#), that the economies in which rapid and effective process of learning and development of friendly environment for exchange of knowledge are the most effective economies functioning in the global environment. Consequently the concept of intended advantages emerges. Such advantages are built on the foundations of knowledge based economy while simultaneously using the instruments applied in parallel in a number of interlinked areas. Another evolutionary change in the approach to the innovation models on the grounds of economic sciences was related to the finding that the tacit knowledge was the major source of innovation ([Chaminade and Roberts, 2002, p. 11](#)). In the currently described innovation models at micro-, meso- and macro- levels the exchange of knowledge during various processes of group interaction is of the critical importance. In this context, making use of generally available knowledge generated based on public funds and for the general benefit (the so-called knowledge spillover) is also important. Joint use of knowledge resources allows the synergy effect involving simultaneous increase of innovation and value of the knowledge itself. In the economic sciences the following innovation models are currently present: the open innovation, user-driven-innovation and the open knowledge idea.

## 2. MODERN INNOVATION MODEL CONCEPTS – THEORETICAL PRESENTATION

Increasing the level of innovation and competition of enterprises, regions and countries is seen increasingly frequently from the perspective of the necessity for establishing relations among organisations, clients, suppliers, competitors, public and private research institutions or enterprises, even seemingly unrelated. It is to allow, as a consequence, allow acquiring additional knowledge and skills generating innovation improvement at business and territorial entities ([Hauser et al., 2006, p. 688](#)). Hence, intensification of activities aiming at expanding collaboration between entities and sharing the knowledge is the key element. The concept of open innovation by [Chesbrough \(2003\)](#) fits that flow of economic considerations. The paradigm of open innovation model is based on the assumption that business entities may and should search for opportunities for innovation improvement not only within their structures but also in their environment. This equalizes the importance of the internal and external paths of creating innovations and treats them as complementary. [Pomykalski \(2011, p. 139\)](#) claims also that under conditions of open innovation the principle of maximising the values originating from different ideas, emerging within the organisation and outside it is the most important. This means that its formal frameworks represent just a conventional border in the flow of knowledge between organisation and its environment. It is worth mentioning here that this is a very wide concept, it is the subject of interest for

numerous scientific disciplines, not only economics but also, e.g. psychology, sociology and even cultural anthropology (von Krogh and Spaeth, 2007, p. 239).

Within the open innovation concept two its dimensions can be identified: the *outside-in open innovation* and the *inside-out open innovation* (Chesbrough and Garman, 2010, p. 49). The outside-in open innovation is based on the principle of knowledge flowing into the organisation and making use of external cooperation. The inside-out open innovation assumes transfer of a part of the resources or projects outside the organisation. This approach means, on the one hand, extensive and selective use of the knowledge available in the environment and on the other, less closing the knowledge within the business entities. In the first case, the propensity to undertake cooperation by business entities is higher – enterprises (or industry sectors) may generate benefits from access to knowledge, innovation and technology developed and financed earlier by other entities. The situation where organisations transfer their knowledge to the environment finds much lower acceptance in them (Cheng and Huizingh, 2010). Kline (2003, p. 91) claims that the situation results, among others, from the historical considerations and the fear of making own knowledge available to others. This is interrelated mainly to protection of intellectual and industrial property rights.

The open innovation concept assumes searching for innovative solutions in the environment. The idea of *user-driven-innovation* (UDI), which is based on better understanding and knowledge (of both open and tacit) needs and expectations of the consumers is a consequence and a specific variation of that model. It can be defined as the process of using the knowledge of the users for the purpose of developing new products, services and concepts, which are based on true understanding of the user needs, and which involves the users in the enterprise development process in a systematic way (NORDEN, 2008, p. 8). The client has always been and will be the reference point in development of new concepts. This approach, hence, is not an innovative approach. The new element in the UDI though is the systematic and scientific approach in determining the client needs. It assumes not only obtaining information from the consumers (as it took place most often in the past) but also including them to take active part in the innovation activity. Participation of the users in the innovation process allows presentation of own demands that will be satisfied later. This takes place thanks to the increasingly common acceptance of the open innovation model. Not without importance here are also the information technology solutions that facilitate communication among the innovation process participants. Hence, the enterprises, in a systematic way, obtain knowledge and inspiration from outside, get better insight as concerns the increasingly sophisticated demands of the consumers and focus on developing of products and services that satisfy their so far unsatisfied needs or provide new solutions for the existing problems (PARP, 2012, p. 22). In the UDI model, the users are also not perceived as individual consumers but in a wider sense as, e.g. the family, children, disabled, sportsmen, groups of citizens or the public as the whole. On the one hand, they have different requirements concerning the product while on the other they possess different qualifications to offer. Moreover, the term “user” also encompasses enterprises or sectors that may also be the source for innovative ideas. This expands the potential for obtaining valuable information but also the group of active participants in innovation creation significantly.

Within the demand innovation model, two notions can be identified: the voice of the customer and the lead-user innovation (Nordic Council of Ministers, 2006, p. 13). The first is linked to identification of hidden needs and the effect is the modification or improvement

of the existing products or services. The important element of such activities is to diversify between the identified and unidentified (hidden) needs. During the times of fierce competition, reading just the identified needs is insufficient to maintain lasting competitive advantage. It is necessary to design solutions that would be able to satisfy also the new, not yet revealed needs. In the second case (the consumer leadership), the search goes for solutions originating from the clients. Enterprises involve users as active participants in the innovation processes. It should be noticed that the above-mentioned types of consumer participation in the UDI model are complementary. This results from the fact that the dialogue between the enterprise and the clients or other market entities should be the outcome of observations and discovering the needs. This may lead to development of further collaboration that may result in creating innovative solutions. The effectiveness of user involvement in the user driven innovation model is the result of the increasingly common belief that the user has certain added value that he/she can offer. Thanks to that, it creates opportunities for increasing the effectiveness of operation under conditions of complexity in case of contemporary economic transformations (TACTICS and European Commission, 2012, p. 17). This approach supports maintaining long-term competitiveness as the users are treated as the source for projections of the market trends.

The involvement of participants in the innovation activity according to the UDI may assume different forms. Nordic Innovation Centre (NICe) lists user exploration, user participation, user innovation and user tests (NORDEN, 2010, p. 15). User exploration aims at observation and understanding to user actions and customs in the cultural context. The aim of participation is to create new ideas and innovative solutions. Innovative users (in most cases experts or so-called *advanced users*) are involved in the innovation team at some stages of the innovation process. In that way their specific knowledge that is not available within the enterprise is used. User tests are the oldest and the form of collaboration most frequently employed by enterprises. They aim at conducting evaluation of the developed product or service and making required adjustments according to consumers' suggestions. A different classification of users based on the level of their involvement was proposed by Ives and Olson (1984, p. 588). Those authors identify six user involvement categories: *no involvement* – the users do not want or were not invited to collaborate, *symbolic involvement* – the situation where the users were invited to collaborate but their ideas are not used, *involvement by advice*, *involvement by weak control* – the situation where the users are required „to sign off” at each stage of the development process, *(involvement by doing)* – the users are design team members or have the official collaboration agreement, and finally *involvement by strong control* – the users may pay for development of new solutions and evaluation of activities depends on the development work results. It should be pointed out here that some researchers (Barki and Hartwick, 1989) differentiate between the notion of participation and involvement of the users. The concept of participation encompasses the actions performed during the innovation process while involvement represents the mental condition where the users are more committed to it. Olsson (2004, p. 374) supplements this concept by the statement that the notion of participation is imprecise and the users are frequently treated as the source of information and not as equal partners.

The never-ending need of searching for access to knowledge is the consequence of the open innovation model, including the *user-driven innovation*. This triggers discussions aiming at determination who is the holder of the knowledge and on what conditions the holder can transfer it to those that need it. This became the premise for spreading of the open access movement activities and hence the *open knowledge* model. Hofmokr *et al.* (2009, p.

54) point out that the notion of open knowledge is wider than the notion of open access because it encompasses access to not only the scientific publications but to the entire scientific accomplishment. According to the assumption this applies to the dynamic process of scientific communication (treating the publication as a process and not the output), openness and transparency as well as expanded measures of scientific accomplishments and hence establishment of new “knowledge communities” around the available contents (Otwarta Nauka, 2013). The principles of open science have been formulated within the framework of the Science Commons project (Science Commons, 2013). The first of them – open access to contents – encompasses, according to the *open access* model, access to scientific publications. The next principle is that of open access to the tools meaning the possibility of access to materials that make repeating the given research possible. Implementation of the open science principle also involves the principle of open access to the data, i.e. the possibility of accessing and using raw data obtained from other research processes. Formulation of the widest approach to the open science was possible thanks to the digital technologies. The principle of open cyber-infrastructure assumes creating public infrastructure allowing not only storage and search through the data but also combining various sources. The open science model assuming public access to its resources favours development of the open innovation model and hence improvement of the economy innovation. Despite increasingly wide development of the open science idea the economic, legal and technical barriers to popularisation of it are still pointed at.

### **3. MODERN INNOVATION MODELS IMPLEMENTATION POSSIBILITIES IN THE FOOD ECONOMY**

The considerations presented indicate that simultaneously with significant benefits of modern innovation models’ concepts the potential problems related to implementation of them emerge. This offers premises for formulating the conclusion that despite the visible process of transition (in many sectors and industries) from the closed and traditional innovation model to the open innovation system, not all the entities may apply the open innovation principle to the same extent. So far, it has been applied more frequently in the sectors of advanced technologies such as computer industry and information technology industry, pharmaceutical and biotechnology industry, financial services and in large enterprises and multinational corporations. This is caused by their dynamic development and relatively short life cycle of the technology and short product life cycle. In some industries, e.g. nuclear or aviation engines’ industries that base their operations on strong internal technology and low labour mobility, the closed innovation idea dominates (Gassmann, 2006, p. 224). Other studies confirm that depending on the sector and industry differences exist as concerns the acceptance intensity for the open innovation model (Lichtenthaler and Ernst, 2009, p. 48; van de Vrande *et al.*, 2009, p. 424).

High technology enterprises are by their nature more innovative than the traditional ones and they decide the level of innovation of the given economy. This, however, does not mean that the solutions applied in that sector may not be applied in traditional sectors among which the widely understood agribusiness is classified. Skilful adaptation of the solutions implemented by high technology enterprises may be a factor in improving competitiveness and innovation of food economy. This is of key importance in the regions where the agricultural food sector represents the natural direction for development. This induces formulating questions concerning the potential for and scope of applying open innovation

models in the food economy. Empirical studies concerning that issue in the global subject literature are relatively few (Huston and Sakkab, 2006; Sarkar and Costa, 2008; Vanhaverbeke and M., 2006; Enzing *et al.*, 2011). Dahlander and Gann (2010) project low level of openness in low technology industries. Sarkar and Costa (2008, p. 575) claim that this may apply in particular to small and medium enterprises operating in the food economy sector. According to Huston and Sakkab (2006), however, there is no clear evidence that the open innovation model may not be applied in traditional and mature sectors.

Premises inducing application of modern innovation models in the food economy sector can be presented from a number of perspectives. First, there are many different entities involved in widely understood food production. Satisfying all heterogeneous (and frequently even contradictory) requirements of the indirect clients, end users and public institutions requires coordination of their activities. This is the circumstance that supports conducting innovation processes along the value chain and not within individual organisations (Costa and Jongen, 2006). Hence, the larger the dependence between the entities (agriculture, food industry and trade) is involved in creating, development and commercialisation of new solution, the larger is their propensity to implement the principles of the open innovation model. In the light of this, stimulation and development of open innovation in the Polish agricultural food sector may be stimulated by establishment and development of clusters. Figiel *et al.* (2011, p. 130) claim that the process is supported, first of all, by the supply factors resulting from the manufacturing capacity of that sector (particularly the processing industry). The authors add that this allows achievement of a higher specialisation level and development of exports of innovative products with high added value. Similar to the entire economy, lack of links between the sectors of enterprises and science as well as low level of social capital are the major problems in operation of cluster type structures. The currently applied structural and institutional solutions have not eliminated those weaknesses. Hence, the ability of spreading the knowledge in the cluster and the potential for creating improving as well as radical (novelty) innovations is limited. Knowledge exchange within the cluster may have the character of commercial or non-commercial (based on mutual trust) transactions. The open knowledge idea stimulates non-commercial exchange among the cluster participants and joint creation of innovative knowledge by scientific entities. It seems that the development of cluster structures in food economy supports the open approach to innovation by all the participants. It should still be taken into account that supporting bottom-up cluster initiatives or top-down organisation of clusters may not take place without appropriate analyses determining their actual economic potential. Undoubtedly this is one of the activities that can be used for improving food economy sector innovation and competitiveness.

The specific character of innovation in food economy sector represents another perspective influencing the degree of innovation process openness. Innovation processes in food sector are burdened with relatively higher uncertainty than in the other sectors. Pascucci *et al.* (2011, p. 169) list the characteristics of food sector that influence increased uncertainty of innovation activities. They point out the key importance of agricultural products, which are characterised by short shelf life and influence of unpredictable weather conditions on their volume and quality in food manufacturing. Second, food industry obtains raw materials from many, frequently diversified and small farmers, which is also not without influence on the quality and volume of supplies. The specificity of innovations in the food economy sector is also a consequence of their type. On the one hand, they are tightly related to the so-called „*technology-pushed*” – the use of modern technologies



developed by high technology sector for the purpose of creating new products. For that reason the conclusion by [Avermaete et al. \(2004, p. 480\)](#) that in determining the index of the capacity of food economy sector to innovate one should not focus on the internal closed innovation processes (i.e. the effort in the research and development domain) only seems right. However, the strong R&D department and the possibility of using well-educated employees and experts represents the condition necessary for assuming a more open innovation system. In this context, the observation made by [Gooroochurn and Hanley \(2007, p. 1492\)](#) that according to transaction costs economy enterprises incurring high R&D activity costs will protect those investments to decrease the risk of revealing and prevent or delay imitation by competitors (particularly in concentrated markets) seems interesting. As a result, larger food economy sector enterprises will show lower propensity to implement open innovation. In that situation it is important to differentiate the areas that should be protected as critical for survival of enterprises from those in which partnership may accelerate technology and market development. On the other hand, innovations in food economy are “pulled by the market”. Hence, they are rather of the increase and not radical type. Consumers are afraid of entirely new products and changes in consumption habits. This is confirmed by surveys of innovation preferences for products and services conducted among the citizens of the EU countries ([Baruk, 2010, p. 70](#)). More than a half of the buyers purchase known products and they are not interested in novelties. In Poland that percentage (62%) is the highest among the surveyed countries. This has been reflected by food manufacturers. Surveys conducted by [TNS Pentor \(2011\)](#) indicate that as many as 75% of manufacturers plan improving the existing products and many fewer (65%) development of entirely new products. In this context the commercialisation effectiveness in case of newly implemented products involves favourable interactions with partners from the end of the value chain, i.e. the wholesalers and retailers. Consequently, collaboration with them within the open innovation model framework may decrease the market risk involved in new solutions. This is of even larger importance as new food products usually have low success index ([Enzing et al., 2011](#)).

Within the framework of the global food system within which the innovation activities of producers is linked to the changing patterns of consumption and the necessity of assuring food safety and sustainable development, agricultural food sector entities should undertake actions that can allow meeting those challenges. Increasingly frequently the consumers prefer so-called health food, light type products, etc. The increased professional activity of many people and hence limited time for preparation of meals is a common phenomenon. In the European market the interest in the *fair trade* i.e. foods originating from fair trade has increased ([Wyborcza.biz, 2013](#)). For that reason convenience food, organic food, functional food and minimally processed food are the dominating directions for product innovations in food industry. It can be assumed that the prospects for applying the *user-driven innovation* will create opportunities to individual segments of food economy for more rapid reacting and getting ahead of the expectations presented by the consumers. Participation of food products’ clients in the innovation development process may assume the earlier mentioned forms. The current experiences at the same time indicate that the enterprises in most cases cooperate with the clients. It seems, nevertheless, that the cooperation takes the form of surveying their opinions and to a lesser extent including them in the innovation activities and designing the new products. It should be noticed that the potential for active cooperation will expand continually and supplying clients with exactly the things they expect will be the outcome. In the food economy sector this will not apply to all the products. This approach

results in better matching of production and services provided to the expectations of the end buyer and hence reduction of the costs involved in the innovation development.

Meeting the increasing food products consumers' expectations causes higher than in the other sectors demand of food economy sector entities for using the external knowledge resources. According to [Enzing \*et al.\* \(2011\)](#), this is another area for considerations concerning correlation between the food economy sector specificity and the open innovation. Development of such scientific disciplines as, e.g. biotechnology and nanotechnology shows high potential for increasing the added value of products satisfying the demands of modern consumers. This has led at the same time to the development and floating to the market the food products that were more sophisticated (e.g. functional food and nutraceuticals). A significant proportion of innovative solutions that can potentially find application in food economy are present outside that sector. This causes the necessity of undertaking more or less formal agreements with other innovation sector entities and hence supports open innovation.

#### 4. CONCLUSION

The approach to innovation evolved during the last few decades starting with the linear models up to the cooperation network concept. The development of theory provides evidence for the increasing importance of innovation and innovativeness in the processes taking place in the economy. Contemporary innovation models are holistic and they stress different links between entities implementing them. This results from the new innovation creating perception according to which it is a process requiring interactive collaboration of many entities (from different areas of activities). Perception of innovation in the open process categories represents a relatively new model that because of its high effectiveness coupled with relatively low costs is gaining increasing popularity. Progressing globalisation processes and technology development exert at the same time direct influence on the consumer role perception. The consumer is no longer just the passive buyer of products but he is becoming also the partner in creating them. This means that innovation activities in food industry may be based to the increasing extent on the open innovation models considering active participation of many entities in creating inter-organisational knowledge and improving skills. This trend may represent the response of the food economy enterprises to the increasing competition pressure in the global markets. The effectiveness of those models in the agricultural food sector still is the subject of relatively limited studies by the scientific community. This indicates the need for continuation of research activities concerning the theoretical components of open models, such as learning (acquisition of knowledge) and ability of adjusting to the changing socioeconomic and institutional conditions (adaptation potential). This leads at the same time to the conclusion that the concepts of open innovation models should not be implemented in separation from other opportunities for innovative development of food economy entities but should represent a valuable complement to them.



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