

Article

Search Strategies in Innovation Networks: The Case of the Hungarian Food Industry

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Abstract: In the food sector, open innovation has become of particular interest. This paper considers open innovation search strategies in the food and beverages industry and examines the probability of using different innovation sources with respect to the type of innovation. Although the information search for new ideas, tools and solutions in the innovation process regarding the scope and depth is well explored and interpreted in the literature, the probability of using the different sources with respect to type of innovation is rarely investigated. To answer these questions, first a probit, then OLS regression model is adopted, in order to understand the chance of a specific source of information being chosen, and then, to verify how much of these sources are selected in different types of innovation. Findings show that food companies use several kinds of information sources during their product, process, organization and market innovation development processes and apply different sourcing strategies based on innovation type. The study concludes that managers have to take into consideration the type of innovation when they formulate their innovation search strategies. Moreover, if they would like to strive on the European, or even more on the world market, they necessarily have to cooperate with universities and research institutes. Our recommendation for policymakers is that they should encourage the food companies in creation of a viable information network with their business, scientific and professional partners. It is also important that they help the food producers in their continuous innovation activities as well as in expanding their business to European, or even more, to world level.

Keywords: innovation network; innovation sourcing strategy; policy implication; food industry; Hungary

1. Introduction

Innovation is one of the main economic activities that lead the company to organizational success and high results, independently of its size and the sector in which it operates [1]. It brings a positive change within the enterprise and it is led by many factors such as, for example, competition and customer demand. For this reason, every company must adapt its behavior to external demands, in order to maintain or raise the level of its performance [2]. Over time, innovation has also gained interest in the agri-food sector, where the open type of innovation is very much appreciated in the recent decades [3,4]. Open innovation is an effective driving force to promote innovation performance [5,6]. It is based on obtaining technical resources and market information, to increase the company's internal resources, thus improving the original level [7]. It is possible to distinguish four types of open

innovation [8]: product innovation (which concerns a good or a service); process innovation (which involves a new production method); marketing innovation (which refers to a new marketing method, such as changes in product packaging, product promotion or prices); and organizational innovation (which involves improvements in the organization of work or in the company's external relations).

Among the main advantages of open innovation, we can list the improvement of business efficiency [9], which makes late companies keep up with the technological development of the reference market [10]. On the other hand, open innovation can lead the company to a reduction in marginal returns, caused by the time spent on search [11] and by collaborative activities with other entrants or companies [12], which require significant coordination efforts [13].

The openness assumes that firms construct several ties with business, science and professional partners in order to create bi- and multilateral connections for acquiring innovation ideas, making development progress, as well as promoting and marketing new products and services [3,14]. Indeed, companies that want to innovate, can turn to external sources of information for innovation, in order to seek specific knowledge useful for their purpose [15]. In particular, four specific sources of external knowledge sources have been identified in the literature [16], including suppliers [17], customers [18], competitors [19] and universities [20]. Through these relations the in- and outflow of information related to innovation can more efficiently and smoothly be managed [21]. The effectiveness of open innovation activities, as well as creating links with the external environment is now consolidated [22]. It is clear that sourcing needs resources (financial, managerial and specific knowledge) and that each of them competes with other possible uses. This rivalry of resources for recruiting outside information should be explored, as, net of our knowledge, the topic has received scant attention in the existing literature. In addition, using too many information sources can lead to management problems [23]. Consequently, our research question focuses on the information acquiring strategy of the firm. We are interested, from which directions it is appropriate that information arrives to the company and how much information is really needed. Our assumption is that this strategy differs based on the type of innovation. Therefore, the present study positions a double research question: 1. What is the chance that a specific source of information is selected in relation to the type (product, process, organization and market) of the innovation? and, 2. By grouping the sources into three different ones (business, science and professional), how many of them are selected in different types of innovation? In order to answer the two research questions, we use the Community Innovation Survey—2012 Hungary data [24] filtering for the Nace. Rev 10-12 categories (food, beverages and tobacco industries—more precise breakdown is not possible within this database). We apply probit and OLS regression for exploring our answer. Hungary is an interesting case from an innovation point of view, because according to the European Innovation Scoreboard (2017) report [25], Hungary's summarized innovation score is 67.4 against the EU28 average of 102. This implies that the Hungarian economy has got rather serious disadvantages in the EU community. This statement is more pronounced in case of the food industry. From an innovation point of view, food industry is seen as a slow one, which is lagging behind the technology pushed possibilities, but sometimes behind the customers' desires and requirements as well. One possible way of boosting the food economy is, therefore, to speed up the innovation.

The remaining part of this paper is structured as follows: first we shed light on some basic theoretical concepts and empirical findings in the related fields. Next, we introduce our data and methodology. After that, we comprise the results. At the end, we discuss, conclude and draw the limitations of our findings.

2. Theoretical Considerations and Empirical Evidences

Open innovation can be defined as "the use of inflows and outflows of knowledge that improve internal innovation and at the same time widen the markets for the external use of innovation" [26]. It involves the use of multiple internal and external sources, integrating this activity with company resources and exploiting these opportunities through multiple channels [27]. Indeed, based on the theories of inter-organizational knowledge flows and organizational learning, many authors [28–33]

have stated that the use of a limited number of external channels facilitates the performance of the innovative company. This approach refers to the depth of the research strategy [34], according to which the term "depth of open research" indicates from how many intense channels the company gets ideas for innovation.

The incremental nature of innovation is a realistic hypothesis in the case of the food industry, because the fundamental attributes of the food we eat today are only slightly different from what humanity ate a hundred years ago. For this reason, previous researches e.g., [21,32,35] have shown that organizations that do not use current external knowledge, do not have the means to be effective competitors. Therefore, companies often establish collaborations with other actors in the supply chain, such as suppliers, customers in the public and private sector, competitors, universities, professional and sector associations for self-improvement [1]. Suppliers and industry associations are an important source of knowledge, and collaboration is usually an opportunity to get more information about the competition. At the same time, consumers and universities are valuable sources of knowledge as they know the product better than the manufacturer [36].

However, the increase in external collaborations entails higher costs for the company, while the advantages of this open innovation system may only be observable in the long term [37], connecting this scheme to strategic thinking. The costs of selecting suitable partners are also likely to increase, leading to the need for supplementary resources. In addition, companies must pay attention to balancing external and internal research activities as otherwise, they will have negative consequences for their innovative performance [11] and their costs of coordination, management and control of partner activities involved will increase [38]. Furthermore, in transition to an open research and development system, the company's internal research and development structure requires a fundamental transformation, as its role shifts "from the generation of discovery as a primary activity to the design and integration of systems as a function key" [26].

Open innovation concept has sparked the interest of both academics and practitioners, as illustrated by the multiple studies on this topic. In this vein, many debates have developed in managerial literature and several studies have investigated the innovating company's methods of accessing knowledge from external channels. Although these empirics and theories touch and sometimes describe the different ways of information acquisition for certain types of innovation, they do not develop applicable information search strategies. For illustrating this shortcoming, we summarize the main findings of several papers from the last one and a half decade.

In 2006, Cassiman and Veugelers [39] analyzed complementarity between internal research, development and external knowledge acquisition, suggesting that they are complementary innovation activities, but the degree of complementarity is sensitive to other elements of the firm's strategic environment. In the same year, Emden and colleagues [40] developed the process theory of partner selection for collaboration, using a theory development approach. Laursen and Salter [11] studied the effect of open research strategies with other companies that rely on the product life cycle theory. They used data from the UK's Innovation Survey and found that the more important the innovation is, the deeper the influence of external research on the company's innovative performance will be.

In 2007, Perkmann and Walsh [41] analyzed links between university and industry and they have emphasized how important the collaboration is between companies and the scientific sector. Subsequently, Knudsen [36] analyzed the employment of inter-organizational relationships in product innovation by European manufacturing in the food sector. It appeared that all the companies interviewed had collaborated with at least one other organization in order to increase their production. He also has found that these companies preferred to collaborate with customers, suppliers and competitors rather than with public/private research organizations or consultants, preferably in the phase of initial research rather than during the development of the innovations acquired.

Gumusluoglu and Ilsev [42] found that transformational leadership positively affects organizational innovation in small businesses.

In 2010, Dahlander and Gann [43] studied the advantages and disadvantages of innovation in the procurement and acquisition processes, creating a guideline for the development of the research agenda. In the same year, Zhou and Wu [44] supported the argument that technological capability has an inverted U-shaped relationship with exploration. That is, a high level of technological capability prevents exploratory innovation. Capitanio and co-workers [45] stressed that the ability to build relationships on product markets is a key factor in successfully developing and introducing product innovation.

In 2013, Xiaobao and co-authors [21] analyzed the effect the size of a company has on innovation, using data from a survey of 420 innovative SMEs in China from the point of view of social networks. Garcia Martinez and collaborators [34] studied the impact of companies' open behavior on their performance, considering the breadth and depth of collaboration. Subsequently, Bayona-Saez and colleagues [46] wanted to extend our knowledge on the relationship between open innovation and the company's innovative performance. In particular, the authors aimed to determine whether the benefits of open innovation practices are different for food businesses than for other industries.

Ferraris, Santoro and Dezi [47] verified the positivity of using moderate external knowledge. This means that branches with superior Knowledge Management are more capable of managing external information, improving their innovative performance. Giacosa, Ferraris and Monge [48] in their study concerning an Italian company, stated that the company's competitiveness is the result of a balanced management of innovation and tradition.

In 2019, Török, Tóth and Balogh [49] studied how external impulses and internal knowledge resources influenced the development of innovation in the Hungarian agri-food sector, finding that tacit knowledge is more important than explicit knowledge.

Apparently, there are many studies that take into consideration the different channels of information acquisition and their methods of attainment. Although in the field of open innovation there are different research findings and empirical results, we could get convinced that there were no investigations which linked the type of innovation with the search strategy.

Understanding these dynamics is therefore essential for the development of specific programs for the promotion of each type of innovation.

Table 1 comprises all the studies mentioned in the section.

Table 1. Open innovation publications.

Authors	Year	Title	Aim	Methodology	Findings
Cassiman, B. Veugelers, R.	2006	In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition.	To analyze complementarity between internal research and external knowledge acquisition,	Empirical methodology.	Development of internal research and acquisition of external knowledge are complementary innovation activities.
Emden, Z., Calantone, R. J. Droge, C.	2006	Collaborating for new product development: Selecting the partner with maximum potential to create value.	To develop a process theory of partner selection for collaborative NPD alliances using a theory development approach.	Narrative analysis.	Development of a new theory of the partner selection process, which envisages relational and strategic alignments as well as technological alignment of the partners.
Laursen, K. Salter, A.	2006	Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms.	To link search strategy to innovative performance.	Open search strategies that involve the use of a wide range of external actors and sources.	Link between research strategy and innovative performances (wide and deep research is curvilinear and correlated to performance).
Perkmann, M. Walsh, K.	2007	University-industry relationships and open innovation: Towards a research agenda.	To explore the diffusion and characteristics of collaborative relationships between universities and industry.	Literature review.	The organizational dynamics of university-business relations are still poorly explored.
Knudsen, M.P.	2007	The Relative Importance of Interfirm Relationships and Knowledge Transfer for new product development success.	To investigate the nature and relative importance of different types of interfirm relationships for new product development success.	Empirical methodology.	Suppliers and universities are important external sources of knowledge for innovative performance. The combination of suppliers and competitors has had a positive effect on innovative performance.
Gumusluoğlu, L. Ilsev, A.	2009	Transformational Leadership and Organizational Innovation: The Roles of Internal and External Support for Innovation.	To determine whether internal and external support for innovation as contextual conditions influence transformational leadership on organizational innovation.	Hierarchical regression analysis.	Existence of the positive influence of transformational leadership on organizational innovation.
Dahlander, L. Gann, D. M.	2010	How open is innovation?	To clarify the definition of 'openness' as currently used in the literature on open innovation, and to re-conceptualize the idea for future research on the topic.	Combination of bibliographic analysis with a systematic content analysis of the field.	Subdivision between inbound and outbound innovation in pecuniary and non-pecuniary interactions, with relative advantages and disadvantages.

Table 1. Cont.

Authors	Year	Title	Aim	Methodology	Findings
Capitano, F. Coppola, A. Pascucci, S.	2010	Product and process innovation in the Italian food industry.	To develop an econometric analysis using information from one of the most important national datasets for innovation analysis.	Exploratory analysis.	A determinant to successfully develop and introduce product innovation is the capacity to built relationships on the product markets.
Zheng Zhou, K. Wu, F.	2010	Technological capability, strategic flexibility, and product innovation.	To examine the role of technological capability in product innovation.	Use of a technological capability has curvilinear and differential effects on exploitative and explorative innovations.	Though technological capability fosters exploitation at an accelerating rate, it has an inverted U-shaped relationship with exploration.
Xiaobao, P. Wei, S. Yuzhen, D.	2013	Framework of open innovation in SMEs in an emerging economy: firm characteristics, network openness, and network information.	To propose a network framework by bridging the resource-based view and the social network perspective with their respective emphases on the importance of EM SME innovation capacity.	Structural equation modelling (SEM).	Importance of innovation capacity and innovation barriers for understanding open innovation in EM SMEs.
Garcia M., M. Lazzarotti, V. Manzini, R. Sánchez G., M.	2014	Open innovation strategies in the food and drink industry: determinants and impact on innovation performance.	To examine the determinants of openness and the impact of open behaviors by companies on innovation performance.	Cluster analysis.	Food companies can be grouped into three open innovation modes in terms of an external knowledge search strategy ranging from limited collaboration with traditional partners to a broad and profound openness approach.
Ferraris, A. Santoro, G. Dezi, L.	2017	How MNC's subsidiaries may improve their innovative performance? The role of external sources and knowledge management capabilities.	To explore the effect of knowledge management (KM) practices on the relationship between external research and development (R&D) and innovative performance.	OLS regression analysis.	The authors found positive evidences in favor of a moderator effect of KM.
Giacosa E. Ferraris, A. Monge, F.	2017	How to strengthen the business model of an Italian family food business.	To focus on how a medium-sized company operating in the food sector should strengthen its business model.	OLS regression analysis.	The company's competitiveness is the result of a balanced management of innovation.
Bayona-Saez, C. Cruz-Cázares, C. García-Marco, T.	2017	Open innovation in the food and beverage industry.	To extend our knowledge into the relationship between open innovation and firm innovative performance.	Tobit and Logit models by random effects.	Presence of the classic inverted U-shaped relationship between OI and solid innovative performance for FnB and non-FnB companies.
Török, Á. Tóth, J. Balogh, J. M.	2019	Push or Pull? The nature of innovation process in the Hungarian food SMEs.	To explore how external impetuses and internal knowledge resources influence the innovation development in agri-food industry.	OLS and hurdle regressions.	The use of internal tacit knowledge is significant and relevant in the innovation production process.

3. Data and Empirical Strategy

The empirical analysis in this paper is based on data from Community Innovation Survey (CIS-2012) [24], filtering for the Nace. Rev 10-12 categories (food, beverages and tobacco industries—more detailed breakdown is not possible within this database). We use the openness of firms to European and global markets and continuous innovation activity as control variables. This is because the European food companies are mainly SMEs, and they usually do not have enough resources for doing their own serious R&D activities. However, the openness and past innovation activities force them to be innovative in the present.

This survey covers 6317 Hungarian firms that are distributed across all major sectors of economic activity. Out of them, there are 440 companies which belong to food, beverage and tobacco industries. The questionnaire includes three main sections: general information about the enterprise, type of innovation and source of information.

In particular, we have twelve types of innovation, which are divided into four groups according to the questionnaire (Table 2).

Table 2. Types of innovation.

Type of Innovation	Acronym	Group
New or significantly improved goods	INPDGD	Product innovation
New or significantly improved services	INPDSV	
New or significantly improved methods of manufacturing	INPSPD	Process innovation
New or significantly improved logistics	INPSLG	
New or significantly improved supporting activities	INPSSU	
New business practices for organizing procedures	ORGBUP	Organization innovation
New methods of organizing work responsibilities	ORGWKP	
New methods of organizing external relations with other firms	ORGEXR	
Significant changes to the aesthetic design	MKTDGP	Marketing innovation
New media or techniques for product promotion	MKTPDP	
New methods for product placement or sales channels	MKTPDL	
New methods of pricing goods or services	MKTPRI	

In addition, we considered ten sources supporting the innovation activities which, by factor analysis, are being grouped into three major sets: business, science and profession (Table 3).

Table 3. Innovation activities sources.

Information Sources of Innovation Activities	Acronym	Groups
Suppliers of equipment, materials, components, or software	SSUP	Business
Clients or customers from the private sector	SCLPR	
Clients or customers from the public sector	SCLPU	
Competitors or other enterprises in your industry	SCOM	
Consultants and commercial labs	SINS	Science
Universities or other higher education institutions	SUNI	
Government, public or private research institutes	SGMT	
Conferences, trade fairs, exhibitions	SCON	Profession
Scientific journals and trade/technical publications	SJOU	
Professional and industry associations	SPRO	

In order to understand what is the possibility of choosing a specific source of information regarding the type of innovation, and then, to verify how much of a source is selected in different types of innovation, the data collected through the questionnaire were processed in three distinct phases, using the STATA 16.0 integrated statistical software. In the first phase, the descriptive analysis of the data were conducted in order to define the socio-demographic characteristics of the sample; in the second

phase, a probit regression was made between source of information, type of innovation and two control variables (ongoing innovation and openness to European and world markets); in the final part, after doing a Factor Analysis in order to group information sources into three large groups, the three new variables were used as dependent variables for an OLS regression with type of innovation and control variables.

4. Descriptive Statistics

The sample consists of 440 small- and medium-sized Hungarian enterprises, with data from Community Innovation Survey (CIS-2012) [24]. The mean enterprise employed 135.52 people and had a turnover of € 68,594.9. The average of enterprise employees, who in 2012 had a tertiary degree, was 1.657.

Table 4 shows the data set characteristics in terms of turnover, size, and percentage of enterprise employees having a tertiary degree. Table 5 displays the innovation types and *control variables*, and Table 6 illustrates the quantity of information sources.

Table 4. Data set characteristics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Turnover (€)	440	68,594.9	178,000	290.407	1,710,000
Size (number of employees)	440	135.523	157.703	10	500
% of tertiary degree *	440	1.657	1.24	0	6

* Categorical variable, 0 = 0%, 1 = 1–4%, 2 = 5–9%, 3 = 10–24%, 4 = 25–49%, 5 = 50–74%, 6 = 75–100%.

Table 5. Innovation Types.

Variable	Obs	Mean	Std.Dev.	Min	Max
Product innovation	440	0.195	0.414	0	2
Process innovation	440	0.166	0.475	0	3
Organizational innovation	440	0.266	0.629	0	3
Market Innovation	440	0.659	1.106	0	4
Openness *	440	0.927	0.845	0	2
Ongoing innovation **	440	0.1	0.3	0	1

* Categorical variable, 0 = Domestic, 1 = European, 2 = world market; ** Dummy variable, 1 = Yes and 0 = No.

Table 6. Information sources.

Variable	Obs	Mean	Std.Dev.	Min	Max
Business	440	0.695	1.363	0	4
Science	440	0.359	0.858	0	3
Professional	440	0.527	1.08	0	3

5. Results

In order to comprise the results, we have used the *coefplot* [50] procedure of STATA for graphical interpretation. The first six charts show the coefficients of individual information source contingencies (Figures 1–6), while the other six analyze the quantity of information sources applied in innovation activities (Figures 7–12). In all Figures, the horizontal axis shows the value of the estimated parameters, while “*p*” denotes the significance level.

We summarize the probit and OLS coefficients and significances in the Appendix A–Table A1.

We have explored the role of 10 different information sources in innovation with regard to the Hungarian food and beverage processing companies. Using the CIS 2012 data [24], we have learned that

search strategies applied by food companies are greatly different depending on the type of innovation in question. The results can be discussed at two connecting, but distinct layers. First, we evolve the strategy orientation, which relies on whether the chance of being selected is significant in case of the particular information source. Then, we have estimated the number of information sources used by companies in three appropriate groups of sources: business, science and profession, which refers to the quantity of information.

According to these two layers, we can postulate the findings below:

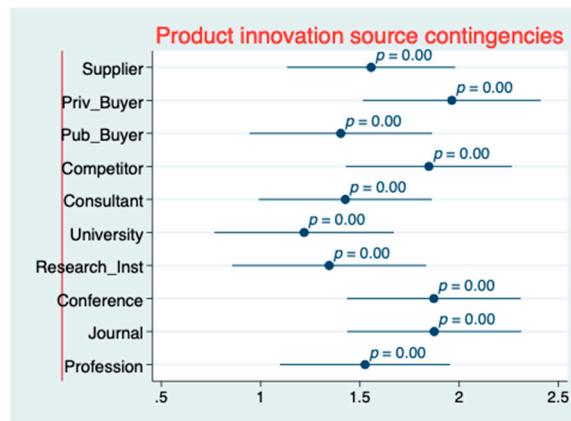


Figure 1. Product information source contingencies.

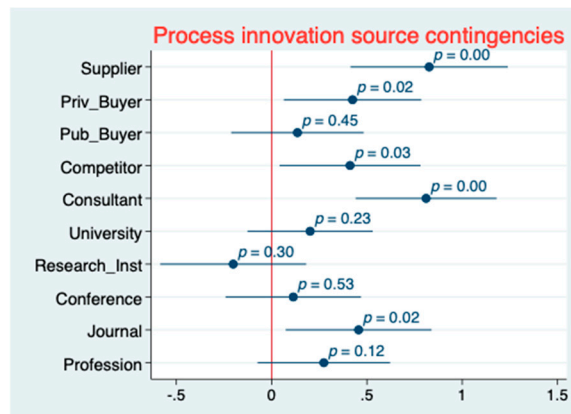


Figure 2. Process information source contingencies.

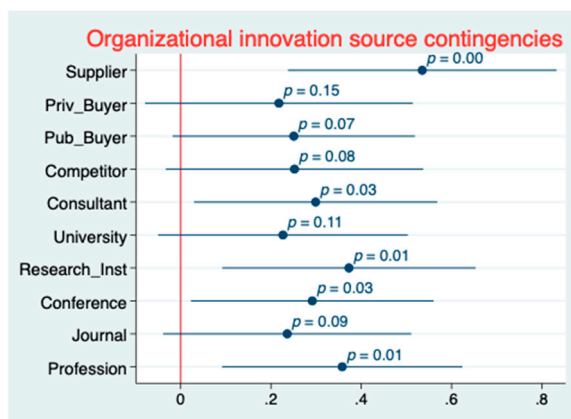


Figure 3. Organ. information source contingencies.

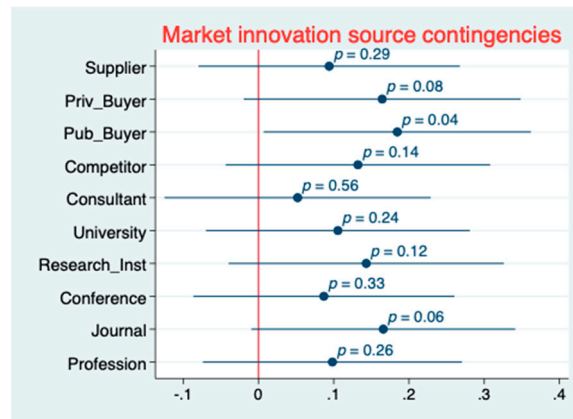


Figure 4. Market information source contingencies.

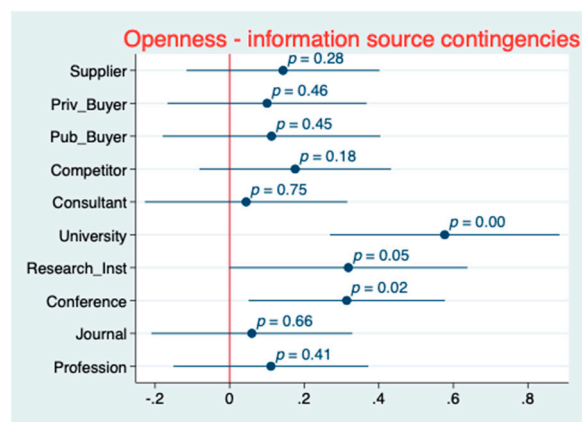


Figure 5. Openness information source contingencies.

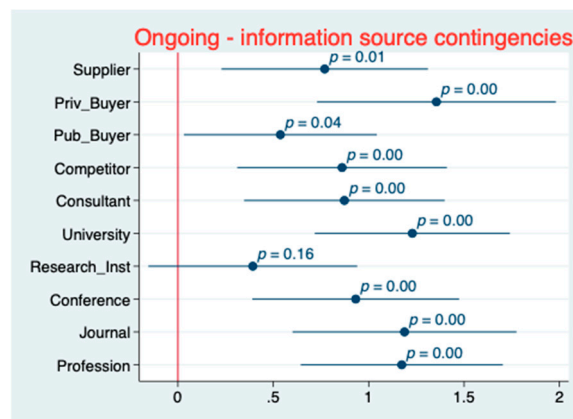


Figure 6. Ongoing information source contingencies.

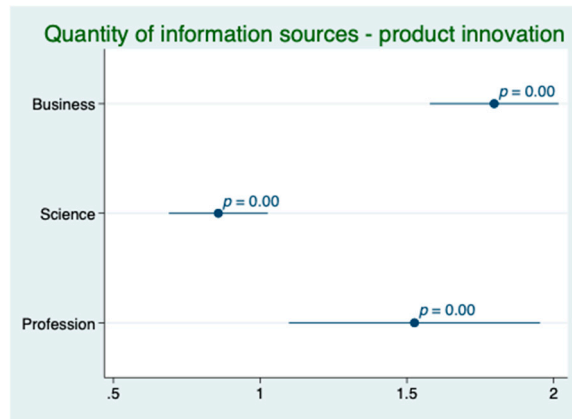


Figure 7. Product innovation.

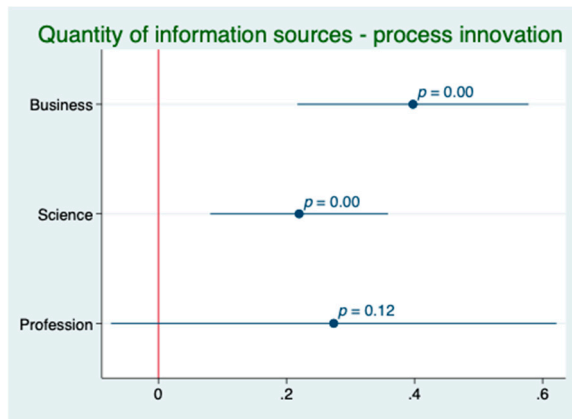


Figure 8. Process innovation.

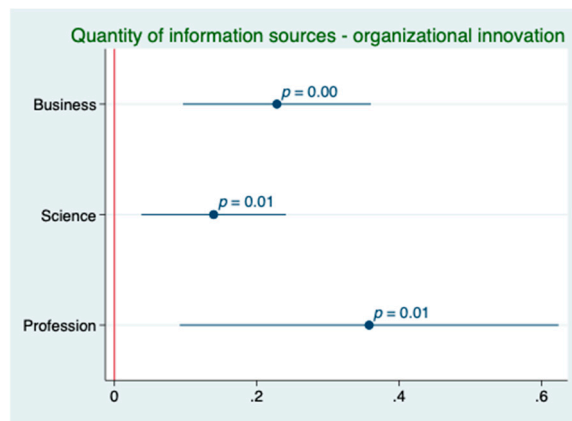


Figure 9. Organizational innovation.

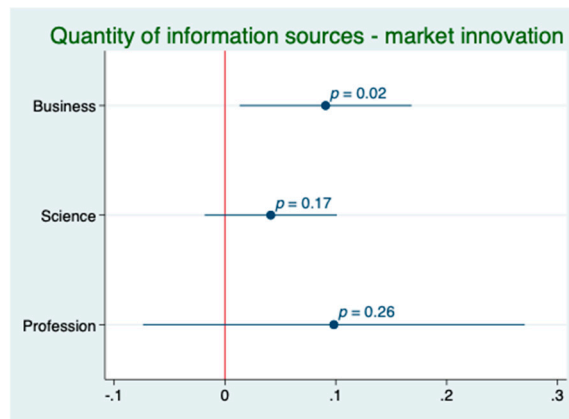


Figure 10. Market innovation.

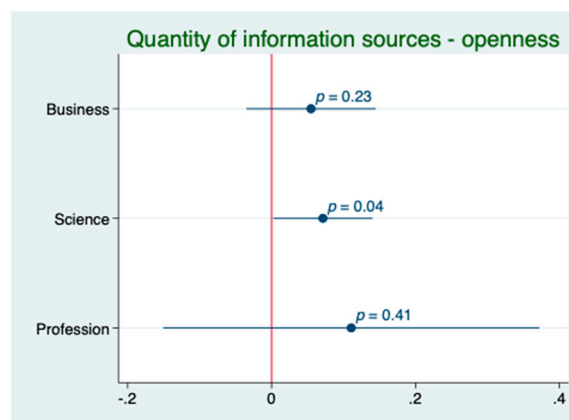


Figure 11. Openness-information quantity.

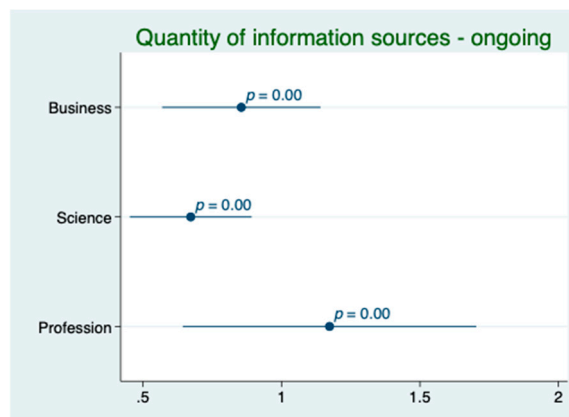


Figure 12. Ongoing-information quantity.

5.1. Strategy Orientation

- For *product* innovators, the chance for an individual innovation source being used in the innovation development process is equally positive and significant for all sources. It is very much in line with the open attribute of innovation which derives basically from the SMS nature of the Hungarian food manufacturing companies.
- For companies concentrating on *process* innovation, mainly business sources (extended with some professional information) have the possibility of becoming information source. These firms do not rely on science.

- *Organizational* innovators orient mainly towards professional sources and some business inputs.
- For *market* innovating firms, the probability of becoming an appropriate innovation information source is given almost exclusively for the information coming from the downstream partners. This is very articulate, because they necessarily need to trust in their buyers' opinion and recommendations.
- Companies with more *openness* to European and world markets align themselves with information for innovation originating from the scientific world. This is because they need to compete with global challenges. Therefore, they have to follow the latest trends, achievements and results of the science in order to sound on the European, or even on the global market.
- Those enterprises, which have been carrying out innovations for a long time, expect new ideas and hints from everywhere to successful completion of the *ongoing* innovation projects. Therefore, any kind of sources—except the research institutes—may become a springboard for innovation.

5.2. Quantity of Sources/Information

- In case of *product* innovation, each of the sourcing groups are relevant, significant and positive: the more product innovation the firms proceed with, the more sources they use from each of the sourcing partner groups.
- The picture is different with *process* innovation: the application of business and science sources' quantity is positively related to the process innovation. However, the professional sources' connection is not significant.
- The *organizational* innovation shows the same picture as product innovation: positively and significantly relates to each information source group; consequently, the more organizational innovation a company can accomplish, the more sources it acquires from any source group.
- The *market* innovation confirms our previous ascertainment that companies are looking at marketing innovation as a very confidential one, therefore, they are not willing even to consult with their partners, except the business ones.
- The *openness* proves also in this case, that if the firms are more exposed to global market contests, they use more scientific information sources in their innovation process.
- The more *continuous innovation* activity is running within the frame of the company, the more information sources will be applied, independently from the type of information source groups.

6. Discussion and Conclusions

In line with Rosa, Chimendes and Amorim [51], we can claim that an open innovation model guides companies towards opportunities in a more interactive way, seeking the integration of knowledge between them. Companies need to innovate constantly, faster and more original than competing companies [31], and this makes communication, networking and collaboration between knowledge producers and users fundamental [52].

The present study aimed to investigate the probability of using different sources with respect to the type of innovation, since through the analysis of these relationships it is possible to manage the in- and outflow of information related to innovation in a more efficient and easier way [21]. To answer our research questions, Hungary's data on Community Innovation Survey have been used, and probit as well as OLS regressions were applied.

The above examination unequivocally supports our perception of the different nature of innovation source strategies based on the type of innovation. We can derive that food companies in Hungary use different types of sources of innovation during their product, process, organization and market development processes. It has also been shown that at least two different, but connecting layers are formulating the sourcing strategy, namely (a) orientation and (b) quantity decision. Based on the analysis, food companies can compile their search strategies according to the nature of their planned innovation activities. They can also use the results related to open innovating companies: if they want

to engage on the European market, or even on the world market, they must necessarily cooperate with universities and research institutes.

Our results follow the footsteps of studies already present in the literature, which have shown that collaboration is a worthy way for improving the innovation capacity of companies [41,53–56].

With regard to product innovation, previous literature argues that collaboration with other external sources plays a fundamental role, provided the resources necessary for business success are not available within the company [57,58]. In addition, our contribution discovers that in this specific case, the more the desired product innovation is, the greater quantity of information from each sourcing group is used.

It happens partly differently for process and organization innovations, where business sources are preferred. In particular, process innovation favors the use of just a few sources, the organizational innovation evolves more or less in the same way as product innovation. These results find their basis of reasoning in the study of Gumusluoglu and Ilsev [42], Dressler and Paunovic [59], Amit and Zott, [60] and Capitanio and colleagues [45], which highlight the importance of external support in organizational and process innovation.

In accordance with Storbacka and Nenonen [61], we finally found that market innovation prefers to turn to a few, mainly downstream sources, as this represents a complex, delicate and confidential division of a company.

A very important aspect to consider in relation to innovation is that of sustainability, too [62,63]. Sustainable partnerships encourage companies to adopt practices that offer environmental, economic and social benefits to their wider communities [64]. Once companies understand that innovating is likely to offer private economic benefits in terms of lower input costs or better business results, they will make the economic decisions to carry them out. However, the community's interest should prioritize those innovation practices with the greatest environmental benefits to improve the overall sustainability [59]. If the Hungarian food companies follow the strategical sourcing recommendations developed in this study, they really can contribute to better economic sustainability of the society, but they are also supposed to prefer those innovations, which have more environmental and social benefits.

We deem this study has important implications for the Hungarian market, which is now struggling to innovate. We suggest to policymakers that it is worth considering support and encouraging companies in their creation and maintaining good networks with commercial, scientific and professional partners in order to help companies' progress for private, social and environmental advantage. It is also important to help companies in continuous innovation activities by different means (e.g., tax reduction). We also believe that our results can help the politics of inspiring food companies to cooperate with their competitors on the world market rather than locally, thus managing to improve innovation adequately.

However, despite the gap-filling nature of our study, there are mainly two limitations that affect the validity of our results. The first is that there is a geographical boundary which should be dissolved by extending the survey to other countries which are included in the CIS system. The second limitation is given by the time constraint which ought to be reduced. Although the data of CIS 2014 are available, these do not contain data on the sources of information on innovation. It would therefore be interesting to see how the sourcing strategy changes over time. Based on the above, an interesting future research area could be to extend the analysis to other sectors of the economy as well, and make a comparison between "slow" (such as food and agriculture) and "fast"(like IT) industries. Furthermore, it may be useful to make a further comparison with the markets of the more or less developed countries compared to Hungary, to see the significant differences.

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Appendix A

Table A1. Probit Regression (Information source contingencies).

	Supplier		Private Buyer		Public Buyer		Competitor		Consultant	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Product innovation	1.556	***	1.963	***	1.404	***	1.847	***	1.426	***
Process innovation	0.826	***	0.424	**	0.135		0.411	**	0.810	***
Organizational innovation	0.535	***	0.218		0.251	*	0.252	*	0.299	**
Market innovation	0.094		0.164	*	0.184	**	0.132		0.052	
Openness—information source	0.143		0.100		0.112		0.176		0.044	
Ongoing—information source	0.769	***	1.355	***	0.537	**	0.860	***	0.873	***
CONSTANT	−2.164	***	−2.089	***	−2.517	***	−2.137	***	−2.168	***
Pseudo R ²	0.577		0.616		0.454		0.579		0.536	
	University		Research Institutes		Conference		Journal		Profession	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Product innovation	1.219	***	1.345	***	1.872	***	1.874	***	1.526	***
Process innovation	0.202		−0.202		0.114		0.456	**	0.274	
Organizational innovation	0.227		0.373	***	0.291	**	0.236	*	0.358	***
Market innovation	0.106		0.143		0.087		0.166	*	0.098	
Openness—information source	0.577	***	0.318	*	0.314	**	0.060		0.111	
Ongoing—information source	1.229	***	0.393		0.932	***	1.188	***	1.173	***
CONSTANT	−2.873	***	−2.824	***	−2.304	***	−2.155	***	−2.168	***
Pseudo R ²	0.522		0.415		0.556		0.596		0.526	

* Significant at 1% level; ** Significant at 5% level; *** Significant at 10% level .

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