Journal of Open Innovation: Technology, Market, and Complexity

Article

Open Innovation in the ICT Industry: Substantiation from Poland

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Abstract: Open innovation (OI) is among the key strategic resources of enterprises, especially in high-tech sectors such as the ICT industry. The use of OI platforms and/or networks that facilitate access to and sharing of OI knowledge is gaining increasing interest. This study aimed to assess the factors motivating and hindering the use of OI platforms and/or networks in the ICT industry in Poland. The uniqueness of this approach lies in the use of a PROFIT analysis to develop proprietary models of the importance of the various motivating factors and barriers to the use of OI platforms and/or networks in the ICT industry in relation to the job position held. This study hypothesized that the knowledge of factors motivating and hindering the use of OI platforms and/or networks in the ICT industry varies across occupational groups. In order to verify the hypothesis and answer the formulated research questions, a diagnostic survey method with a survey technique was used. The results of this study confirm that the job position occupied by employees in the ICT industry is relevant to each of the factors that pose obstacles to their use of OI platforms and/or networks. Managers and management, as well as developers, are less likely to restrict the use of the aforementioned solutions due to organizational and/or administrative barriers, while more likely due to reluctance to share knowledge. For specialists and analysts, legal barriers and NIH syndrome are greater obstacles. For programmers, negative attitudes toward open innovation and lack of internal commitment to the company are less of an obstacle. Insufficient support from top management is a major barrier for administrative staff and programmers. The conclusions formulated can be useful in practice for managers in the ICT industry to make optimal use of access to OI.

Keywords: open innovation; platforms; networks; innovations; innovativeness; ICT; Poland

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Citation: Ober, J. Open Innovation in the ICT Industry: Substantiation from Poland. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 158. https://doi.org/10.3390/joitmc8030158

Received: 11 August 2022
Accepted: 4 September 2022
Published: 7 September 2022

1. Introduction

Open innovation (OI), is among the key strategic resources of enterprises and their environment. They represent the sixth generation of innovation process models [1], which are particularly important in the development of modern organizations [2]. In addition to innovation, their development is influenced by other factors including economic, technical-production, organizational, personnel and information [3–8]. The term innovation is derived from the Latin word innovatis, meaning to renew and/or create something new [1]. Innovation is also defined as the introduction of something new, novelty or reform [9]. In the 20th century, a definition of innovation was adopted, according to which it is the introduction of changes that are fundamental, radical and non-repeatable on the scale of a particular industry [10]. Nowadays, innovation also means minor changes introduced regularly in a given organization, which may be novel only on the scale of that company, and not necessarily groundbreaking for the entire industry [11]. Innovation has many aspects and dimensions, and the innovative capacity of a company is among them. Innovation capability is defined as a combination of different types of resources that foster innovation [12]. Innovation, therefore, is considered the driving force behind economic development and business success.

The popularization of the concept of open innovation by H.W. Chesbrough and M.L. Bogers [2] influenced its gradual development from exploratory to quantitative [13] and

qualitative [14] research. Open innovation is defined as the use of internal and external knowledge transfers to accelerate internal innovation and expand markets for the use of innovations [15]. The concept of open innovation defines the R&D process as an open system in which a company can attract new ideas to create a new product and bring it to market. OI is an approach that allows for increased profits from the joint creation and commercialization of innovative projects, which is also related to the use of external sources of inventions and technology for the effective implementation of projects [16].

OI platforms and/or networks are tools that foster the combination of innovation, education and research. In recent years, innovation activities have been evolving into more agile and user-centered processes and OI dynamics are increasing [17]. OI platforms and/or networks are a key mechanism to automate these processes and provide a new space for interaction between science, education and innovation [18]. Users of such platforms/networks have opportunities to quickly access new technologies, share knowledge and use the digital environment to attract external collaboration partners. Numerous studies show that OI platforms/networks support knowledge co-creation, and companies, especially in the high-tech industry, use them to accelerate internal innovation processes and knowledge outflows to expand markets [19]. The concept of using OI platforms/networks is now widespread, and an increasing number of them are being established around the world [20]. Given the high interest in such networks/platforms and the benefits of their use, it seems interesting to study the factors motivating and constituting obstacles to their use. The results of such studies can provide theoretical and practical implications that can be used by management.

An analysis of the available literature has identified a gap involving the lack of a link between the factors motivating and constituting obstacles to the use of OI platforms/networks and the job position held in high-tech industries. Building on the results of the author's previous study [8], which demonstrated the relationship of jobs occupied with innovation adoption, a new study was designed to fill the identified gap. The uniqueness of this approach lies in the use of a PROFIT analysis to develop proprietary models of the importance of individual motivators and barriers to the use of OI platforms and/or networks in relation to the type of position held. This research was conducted in the ICT industry, which operates at the intersection of many other industries in Poland and is among the most rapidly growing sectors of the economy using OI. This industry, similar to others, is characterized by certain peculiarities. The rapid development of this industry forces immediate reactions to changes, so it can be said that innovation inevitably accompanies it. The COVID-19 pandemic in 2020–2022 has further accelerated the digitization of society. This is directly related to the even more rapid growth of the ICT industry and its importance not only for the economy but also for each and every person in the context of everyday life and the labor market.

The structure of the rest of this article begins with a literature review, which presents the genesis of open innovation, discusses its specifics and characterizes its main assumptions with special attention to the ICT industry. This is followed by a presentation of the research methodology and results with a discussion. This article concludes with a summary that singles out theoretical contributions, practical implications, and limitations and opportunities for further research.

2. Theoretical Background

Using external sources of knowledge to advance or transform certain realities is a fundamental aspect of open innovation. OI also aims to explore a wide range of existing sources and opportunities, along with company resources through multiple channels [21]. They condition the perspectives and strategies of organizations, thus influencing their development [22]. The implementation of open innovation means the transformation of a company into an organization that is open to the environment in the sphere of innovative activities. OI should ensure the achievement and sustained perpetuation of high innovation,

and consequently the long-term and stable development of enterprises, with a flexible and effective response to the challenges of the environment [23].

IOs combine tangible ideas into a unified system, which is a concrete business model. This model transforms internal mechanisms into ones that help extract value and bring internal ideas to market through external diffusion channels [24]. Knowledge consists of important resources for companies, and open innovation should be included in a business strategy that explicitly promotes the use of external ideas and knowledge and technology [25]. OI is very critical because of their ability to use external knowledge to adapt new technologies, which is especially important for companies with limited resources.

Rapidly evolving technology is associated with shortening product life cycles, and OI provides new opportunities to effectively increase innovation with the latest solutions. OI offers a new way to access up-to-date sources of knowledge outside the company, thus minimizing financial, technological and human resource barriers [26].

Factors such as increasing competition, high complexity of new technologies, shorter product life cycles, mobility, state support for the development of innovative enterprises, market orientation of projects and the need to commercialize them, Internet access and search capabilities, along with the need to reorganize strategic supplier networks contribute to the popularization of OI [16]. Openness to new solutions, willingness to share knowledge, cooperation and trust were seen as determinants of the success of various collaborating entities [27].

The new approach and scope of open innovation have gone beyond the business environment. In this sense, and because of the effects and benefits for users and the organization itself, open innovation has become a challenge for centers that have decided to transform and improve their procedures and performance. For the ICT industry, OI is an opportunity for change and information transfer [28]. OI has become particularly important in a society in crisis [29], where the link between education and industry is evident in many types of business or intellectual property protection [30]. Collaborations between students, academia and companies in joint initiatives have become a significant approach to innovation [31].

OI is often a poorly formalized instrument, preventing some companies from managing them effectively. Large companies pursuing advanced innovation projects but lacking the necessary organization infrastructure cannot properly implement their projects. Various barriers including cultural and psychological obstacles can arise when implementing innovation [8,32,33].

OI refers to the value created by combining markets and new technologies of different companies and introducing innovative business patterns. Digitization and ICT technologies are contributing to the development of OI in companies, which are becoming a source of competitive advantage for them in a dynamic economy [34]. OI has begun to create a new paradigm of innovation. Openness also allows organizations to take into account their own, internal research and development processes. Companies can access new technologies while discovering them on their own [35].

Innovation based on collaboration, information exchange or knowledge transfer relies on knowledge networks. Diffusion of innovations in an open system is an internal evolutionary process that has the property of network topology. The proximity of the network contributes to the creation of an innovation ecosystem, thereby supporting the process of diffusion of open innovations and promoting economic growth [36]. Knowledge sharing is becoming more frequent, and after the outbreak of the COVID-19 pandemic, many new technologies were quickly applied and gained widespread public attention. ICT solutions and their applicability to other sectors have also become particularly important. OI has enabled the flow of knowledge from the ICT industry and the solutions it uses to other sectors of the economy. The ICT industry contributes to the increased use of innovation for the economy as a whole. The sector requires new business models that rely on collaboration with external parties to generate value for the customer and for themselves [1].

Digital companies must evolve and innovate to improve their business models. Investment in ICT, mainly in revitalizing digital capabilities for operational change, is particularly important for their growth. Most companies look to outside organizations for innovation. OI has a significant impact on a company's performance, as indicated by a substantial increase in revenue after two years. Digital transformation is about investing in information and technology to make operational change more efficient. Companies are trying to use OI for internal business innovation and management operations [34].

An example of open innovation can be seen in the development of Mobility as a Service (MaaS), which is an intentional but inherently contingent process involving the development as well as implementation of new ideas that challenge conventional wisdom and break with established practices in a specific transport service context. The MaaS platform combines mobility services and the digital economy [37]. Regardless of the industry in which a company operates, OI has becoming a determinant of a company's success and level of competitiveness. They are also seen as a major factor in adapting to changing economic realities [38].

3. Materials and Methods

3.1. Purpose and Research Questions

This study aimed to assess the factors motivating and hindering the use of open innovation platforms and/or networks in the ICT industry in Poland. The following research questions were posed:

- Which factors most motivate employees in the ICT industry to use open innovation platforms and/or networks?
- Which factors pose the greatest obstacles for employees in the ICT industry to use open innovation platforms and/or networks?
- Are there any of the factors that motivate employees in the ICT industry and/or constitute obstacles for them to use platforms and/or open innovation networks based on their gender and age?
- Does the job position occupied by employees in the ICT industry have a bearing on any of the factors that motivate them and/or constitute an obstacle for them in the use of platforms and/or open innovation networks?
- Does the number of people employed by an ICT company affect any of the factors motivating its employees and/or constituting a disadvantage for them in the use of platforms and/or open innovation networks?
- Does the duration of an ICT company's existence in the market matter to any of the factors motivating its employees and/or acting as a disadvantage to them in the use of platforms and/or open innovation networks?
- Under what conditions are different professional groups most likely to use open innovation platforms and/or networks?

This study hypothesized that the importance of factors motivating and hindering the use of open innovation platforms and/or networks in the ICT industry varies across occupational groups.

3.2. Research Tools

The researchers decided to use the survey technique, which provides in numerical form information, a description of trends, attitudes or opinions found in the population [39]. This technique is a combination of highly effective and known for centuries ways of obtaining information with modern methods of data analysis and visualization [40]. In addition, quantitative data obtained from surveys play a special role in building models, as they allow to verify the assumptions made and answer the research questions posed.

This study used a proprietary survey questionnaire, consisting of 11 questions, including one qualifying question. The questionnaire asked respondents about their experience of using open innovation platforms and/or networks and their opinions on such solutions. In addition, respondents were asked to rate on a 5-point Likert scale nine factors in terms of the

degree to which they were motivated to use platforms and/or open innovation networks (where 1 meant "they don't encourage me at all" and 5 meant "they encourage me very much") and nine other factors in terms of the degree to which they were an obstacle to their use of such solutions (where 1 meant "they are not an obstacle at all" and 5 meant "they are a very big obstacle"). In addition, the questionnaire included three questions to collect anonymous socio-demographic information (i.e., gender, age and education) and three on the professional situation (i.e., the job position held, the number of people employed at the company and how long the company has been in existence). To assess the reliability of the aforementioned questionnaire, Cronbach's alpha coefficient was used, the results of which indicated a satisfactory level of reliability (alpha = 0.59). When interpreting the magnitude of Cronbach's alpha coefficient, it is important to note that it is strongly dependent on the number of questions in the survey (the more questions, the higher the coefficient) and the number of respondents (the more respondents, the higher the value of the reliability coefficient) [41]. This is because successive scale items, even if weakly correlated, tend to improve the value of this index. In the case of very elaborate questionnaires, a value of 0.7 of this index may be satisfactory, while for simple questionnaires with only a few items, lower values of the alpha index are accepted [42]. Therefore, it can be assumed that the small number of survey questions (5 questions in addition to the particulars, including 2 matrix questions with nine answers each) allows the acceptance of the value of the coefficient of internal compliance alpha = 0.59. In addition, the study of open innovation issues on different aspects (both advantages and disadvantages, indirectly may have contributed to the variation in responses).

Questionnaires were collected electronically via the Interankiety.pl online platform from 21 March to 14 April 2022. The criteria for inclusion in the survey were being 18 years of age or older, working for an ICT company, and consenting to participate in this study. Respondents were informed about the scientific purpose of the survey and the anonymous and voluntary nature of participation in this study.

3.3. Object of Statistical Analysis

The main focus of this analysis was the factors motivating employees from the ICT industry to use platforms and/or networks of open innovation and factors having a negative impact on the use of such solutions in this industry. As variables determining the above-mentioned the factors were adopted as grades assigned by the respondents (on a scale of 1–5) regarding the degree of motivation and the degree of obstacles to them by selected factors in the use of the solutions in question, and to compare individual factors, the values of the descriptive statistics of the above-mentioned ratings. The aim of the statistical analysis was to identify factors of similarly high importance (both positive and negative) in the use of platforms and/or networks of open innovation by the surveyed employees, to learn about the variables differentiating the degree of negative and positive impact of individual factors on the use of the above-mentioned solutions and identifying a work environment conducive to the use of platforms and/or networks of open innovation, adapted to the workplace.

The statistical analysis consisted in the first instance of evaluating the overall results of this study (including estimating the average scores assigned to specific motivating factors and obstacles to the use of open innovation platforms and/or networks, and identifying groups of similarly assessed factors). Then, the influence of selected variables on the degree of motivation and creating an obstacle by individual factors, such as gender, age, job position, number of people employed in the company and the company's existence period was examined.

Finally, an analysis was carried out to create models of the importance of incentives and obstacles in the use of platforms and/or networks of open innovation in the ICT industry in individual professional groups.

3.4. Methodology of Statistical Analysis

The results of the survey were analyzed quantitatively and descriptively. Responses to the questions were described using size (n) and percentage distribution (%). Data on the degree of motivation for the use of open innovation platforms and/or networks, as well as data on the degree to which individual factors pose an obstacle to the use of such solutions, were analyzed primarily based on a numerical rating scale of 1–5, and thus descriptive statistics were developed for these variables. The conformity of the distribution of the aforementioned variables to a normal distribution was analyzed in selected groups using the Shapiro–Wilk test. Statistical calculations were based on:

- The Mann–Whitney U test, for comparison of groups in terms of quantitative or ordinal variables [43]. The Glass rank biserial correlation coefficient was also used [44].
- The Kruskal–Wallis test, for comparing a minimum of three groups in terms of quotient or ordinal variables [43]. The epsilon-square coefficient [45] was also used.
- Spearman's rank order correlation [43].
- Multidimensional cluster analysis, for separating homogeneous subgroups of factors that are more "similar" to objects in a given cluster compared to objects in other clusters [46].
- PROFIT analysis, for assessing the similarity of objects in terms of their selected characteristics and developing a graphic presentation of the results in the form of a perception map [47].

The calculations in the statistical analysis were performed using the statistical package Statistica v.13.3 PL Tulsa, OK, USA. A 5% risk of inference error was assumed; $p < 0.05$ was considered a statistically significant level.

3.5. Characteristics of the Research Sample

The survey questionnaire link was sent to 6000 randomly selected ICT companies throughout Poland. The response rate was 6.7%, and is close to the average values for surveys distributed via e-mail. The survey was conducted on a group of 402 employees in the ICT industry in Poland, including 92 women (22.89%) (M_{Age} = 27.04 yr.; SD_{Age} = 28.35) and 310 men (77.11%) (M_{Age} = 32.92 yr.; SD_{Age} = 34.28). The following tables show the characteristics of the study group in terms of sociodemographics (Table 1) and occupation (Table 2), both for all respondents in total and for groups distinguished by gender.

Table 1. Sociodemographic characteristics of respondents in total and by gender.

		Total (n = 402)		**Women (n = 92)**		**Men (n = 310)**	
		n	**%**	**n**	**%**	**n**	**%**
Age	18 to 24 yr.	115	28.61%	49	53.26%	66	21.29%
	25 to 34 yr.	150	37.31%	28	30.43%	122	39.35%
	35 to 44 yr.	103	25.62%	12	13.04%	91	29.35%
	45 to 54 yr.	24	5.97%	2	2.17%	22	7.10%
	55 and over	10	2.49%	1	1.09%	9	2.90%
Education	Basic	1	0.25%	1	1.09%	0	0.00%
	Vocational	0	0.00%	0	0.00%	0	0.00%
	Secondary	94	23.38%	41	44.57%	53	17.10%
	Higher	307	76.37%	50	54.35%	257	82.90%

Table 2. Occupational characteristics of respondents in total and by gender.

		Total (n = 402)		Women (n = 92)		Men (n = 310)	
		n	%	n	%	n	%
Type of position held	Administrative employee	78	19.40%	43	46.74%	35	11.29%
	Specialist	98	24.38%	27	29.35%	71	22.90%
	Programmer	129	32.09%	2	2.17%	127	40.97%
	Lower-level manager	32	7.96%	5	5.43%	27	8.71%
	Senior manager	21	5.22%	3	3.26%	18	5.81%
	Management	16	3.98%	2	2.17%	14	4.52%
	Student	8	1.99%	3	3.26%	5	1.61%
	Analyst	8	1.99%	4	4.35%	4	1.29%
	Other	12	2.99%	3	3.26%	9	2.90%
Number of people employed in the company	1–9	41	10.20%	8	8.70%	33	10.65%
	10–49	85	21.14%	18	19.57%	67	21.61%
	50–99	109	27.11%	28	30.43%	81	26.13%
	100–249	100	24.88%	16	17.39%	84	27.10%
	250 and more	67	16.67%	22	23.91%	45	14.52%
How long the company has been in existence	Up to 3 years	25	6.22%	5	5.43%	20	6.45%
	4 to 6 years	55	13.68%	12	13.04%	43	13.87%
	7 to 10 years	111	27.61%	25	27.17%	86	27.74%
	11 and more	211	52.49%	50	54.35%	161	51.94%

In estimating the minimum sample size, the sample size formula for qualitative characteristics (with a finite sample) was applied [48]. In doing so, the size of the population of those employed in the "ICT" sector was assumed to be 408,500 people (as of 31 December 2020) [49]. In addition, in estimating the sample size, a 95% probability was assumed that the result obtained in this study would not deviate from the actual value in the population by more than 5%. According to these estimates, the minimum sample size is 384 people, which means that the achieved number of respondents (N = 402) exceeded the minimum volume.

4. Results and Discussion

4.1. Analysis of Results in Total

First, the distribution of the overall results of the survey conducted was analyzed, including the respondents' experiences of using platforms and/or open innovation networks, their opinions about such solutions, and the factors motivating the respondents and constituting obstacles for them in using the above-mentioned solutions. In the course of these analyses, in addition to an overall assessment of the survey results, an attempt was also made to identify factors motivating and constituting obstacles of similar importance to respondents in the use of platforms and/or open innovation networks.

4.1.1. Use of Open Innovation Platforms and/or Networks and Opinions on Such Solutions

Open innovation platforms and/or networks were used by surveyed ICT employees in their work mostly frequently (43.53%). Nearly one in three respondents used the aforementioned solutions regularly (29.60%). Infrequent use of open innovation platforms and/or networks accounted for 16.17%. On the other hand, the proportion of those

who used the above solutions occasionally and never used them at all was 6.72% and 3.98%, respectively.

The surveyed employees mostly expressed skeptical opinions about open innovation platforms and/or networks. According to one in three respondents (35.57%), the aforementioned solutions are rather not exclusively beneficial to their company, and one in four (26.62%) shared the above opinion strongly ("Definitely not"). The said solutions were considered definitely exclusively beneficial to the company by 14.68% and 3.73%, respectively. On the other hand, nearly one in five respondents (19.40%) had no opinion on the subject. Other studies, conducted in Finland, Spain, the Netherlands, China, Italy, and the U.S. [50,51] indicate that collaboration and sharing access to new knowledge through OI platforms/networks provide more benefits and opportunities for innovation than competing against each other.

4.1.2. Factors Motivating the Use of Open Innovation Platforms and/or Networks

When assessing the extent to which they were motivated to use open innovation platforms and/or networks, the majority of respondents rated factors such as access to new technologies (75.12% of ratings of 5 on a scale of 1–5) and the ability to share knowledge (50.75%, respectively) highly. Slightly less frequently, though also most often, factors such as lowering the company's operating costs and reducing the time to market for a product and/or service were rated highly for motivation (34.08% and 43.78% of ratings of 5 on a scale of 1–5, respectively). Gaining external partners for cooperation and the mutual complementation of various skills during cooperation with external partners (44.28% and 44.78%, respectively) were assessed slightly lower (on a scale of 1–5) in terms of motivation. In the case of sharing intellectual property rights to software as a motivating factor, the respondents were more divided, and most often assessed the above-mentioned factor in terms of motivation on the level 1 and 3 on a scale of 5 (31.34% and 31.84%, respectively). On the other hand, the largest division in the assessments of the respondents was noted in the case of the possibility of external communication with recipients of products and/or services, where the highest percentage of respondents (22.89%) indicated a score of 3.

Analysis of the ratings of individual factors in the category of quantitative variables (raw scores) in terms of the degree of motivation to use open innovation platforms and/or networks showed that access to new technologies (M = 4.62; SD = 0.77) and the ability to share knowledge (M = 4.28; SD = 0.88) were the most important. On the other hand, the least important in terms of motivating surveyed employees to use the aforementioned solutions was the sharing of intellectual property rights to software (M = 2.47; SD = 1.25) (Table 3).

Based on the results of the cluster analysis using the agglomerative method, similarities were found in terms of the degree of motivation for the use of open innovation platforms and/or networks for factors such as access to new technologies, the ability to share knowledge, acquisition of external collaboration partners, and complementing each other's different skills when working with external partners. A two-component cluster consisting of motivating factors in the form of sharing software intellectual property rights and support for the collaborative software development process was also noted. In addition, the above analysis showed that the following factors were of similar importance in motivating the use of open innovation platforms and/or networks for the respondents: reducing the cost of operating the company, reducing the time to market of the product and/or service, and the ability to communicate externally with the recipients of the products and/or services (Figure 1).

Table 3. Degree of motivation of respondents by individual factors to use open innovation platforms and/or networks and descriptive statistics.

Factors	Degree of Motivation (on a Scale of 1–5)										Descriptive Statistics—Degree of Motivation					
	1—They Don't Encourage Me at All		2		3		4		5—They Encourage Me Very Strongly		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error
	n	%	n	%	n	%	n	%	n	%				−95.00%	+95.00%	
Access to new technologies	4	1.00%	4	1.00%	34	8.46%	58	14.43%	302	75.12%	4.62 ± 0.77	5 (5–5)	1–5	4.54	4.69	0.04
Ability to share knowledge	2	0.50%	16	3.98%	54	13.43%	126	31.34%	204	50.75%	4.28 ± 0.88	5 (4–5)	1–5	4.19	4.36	0.04
Sharing of intellectual property rights to software	126	31.34%	70	17.41%	128	31.84%	48	11.94%	30	7.46%	2.47 ± 1.25	3 (1–3)	1–5	2.34	2.59	0.06
Supporting the team process of software development	93	23.13%	18	4.48%	78	19.40%	150	37.31%	63	15.67%	3.18 ± 1.39	4 (2–4)	1–5	3.04	3.32	0.07
Reduction in operating costs of the company	73	18.16%	62	15.42%	50	12.44%	80	19.90%	137	34.08%	3.36 ± 1.52	4 (2–5)	1–5	3.21	3.51	0.08
Reducing time to market of the product/service	64	15.92%	53	13.18%	45	11.19%	64	15.92%	176	43.78%	3.58 ± 1.53	4 (2–5)	1–5	3.43	3.73	0.08
Acquisition of external partners for cooperation	11	2.74%	27	6.72%	60	14.93%	178	44.28%	126	31.34%	3.95 ± 0.99	4 (4–5)	1–5	3.85	4.04	0.05
Complementing each other's different skills when working with external partners	10	2.49%	37	9.20%	55	13.68%	180	44.78%	120	29.85%	3.9 ± 1.01	4 (3–5)	1–5	3.80	4.00	0.05
Ability to communicate externally with the recipients of my products/services	72	17.91%	65	16.17%	92	22.89%	88	21.89%	85	21.14%	3.12 ± 1.39	3 (2–4)	1–5	2.99	3.26	0.07

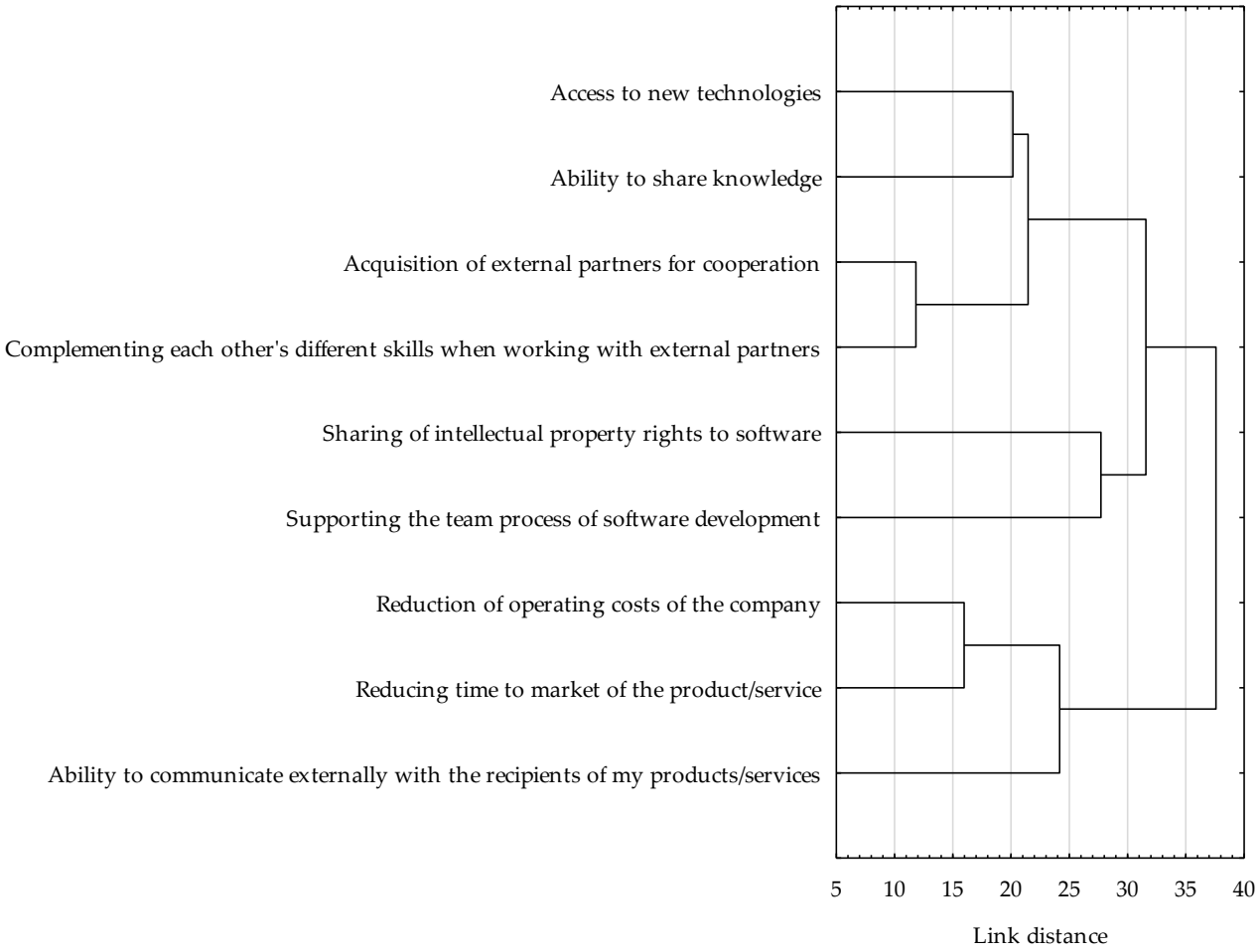

Figure 1. Dendrogram obtained for analyzed factors motivating respondents to use open innovation platforms and/or networks (results of cluster analysis using agglomeration).

The results of the cluster analysis using the non-hierarchical feature clustering method, the so-called k-means clustering, were found to be in full agreement with the results of this analysis using the agglomerative method. The individual factors motivating respondents to use open innovation platforms and/or networks were divided into three analogous clusters (consisting of the same factors). In contrast, analysis of descriptive statistical values showed that factors such as access to new technologies, ability to share knowledge, acquisition of external collaboration partners, and complementing each other's different skills when collaborating with external partners were most important in motivating respondents to use platforms and/or open innovation networks (M = 4.19; SD = 0.96). Respondents were slightly less motivated to use the aforementioned solutions by factors such as reducing the cost of operating the company, reducing the time to market of the product and/or service, and the ability to communicate externally with recipients of products and/or services (M = 3.36; SD = 1.49). In contrast, the other two factors (i.e., sharing of intellectual property rights to software and support of the team software development process) were assigned the least importance (M = 2.82; SD = 1.37) (Table 4).

Table 4. Cluster elements for the analyzed factors that motivate respondents to use platforms and/or open-innovation networks (results of cluster analysis using k-means clustering).

Elements of Individual Clusters		Distance	Descriptive Statistics of the Factors Included in Each Cluster					
			Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error.
						−95.00%	+95.00%	
Cluster 1	Sharing of intellectual property rights to software	0.6911	2.82 ± 1.37	3 (1–4)	1–5	2.73	2.92	0.05
	Supporting the team process of software development	0.6911						
Cluster 2	Reduction in operating costs of the company	0.5864	3.36 ± 1.49	4 (2–5)	1–5	3.27	3.44	0.04
	Reducing time to market of the product/service	0.5307						
	Ability to communicate externally with the recipients of my products/services	0.7853						
Cluster 3	Access to new technologies	0.7799	4.19 ± 0.96	4 (4–5)	1–5	4.14	4.23	0.02
	Ability to share knowledge	0.6387						
	Acquisition of external partners for cooperation	0.5709						
	Complementing each other's different skills when cooperating with external partners	0.5995						

4.1.3. Factors Hindering the Use of Open Innovation Platforms and/or Networks

In terms of becoming an obstacle to the use of open innovation platforms and/or networks, most factors were rated low by the respondents surveyed. For the majority of respondents, factors such as legal barriers (73.88%) and negative attitudes toward open innovation (60.95%) did not constitute an obstacle to the use of the above-mentioned solutions (i.e., rating 1 on a scale of 1–5). Factors such as lack of internal commitment to the company (45.27%), NIH syndrome (44.28%), rigidity of work organization (37.81%) and organizational and/or administrative barriers (35.07%) were also rated most often low in terms of being an obstacle. Greater obstacles to respondents' use of open innovation platforms and/or networks included communication barriers and reluctance to share knowledge, where the largest percentage of respondents indicated a rating of 4 on a scale of 1–5 (46.27% and 36.32%, respectively). The same factors also ranked among the most common obstacles for respondents (18.41% and 31.84% of ratings of 5 on a scale of 1–5, respectively), with insufficient support from top management (34.33%).

The values of descriptive statistics on the degree to which individual factors constitute an obstruction to the use of open innovation platforms and/or networks indicate that the biggest obstacles for the surveyed employees were reluctance to share knowledge (M = 3.68; SD = 1.32), communication barriers (M = 3.6; SD = 1.11) and insufficient support from top management (M = 3.59; SD = 1.43). On the other hand, legal barriers (M = 1.57; SD = 1.08) and negative attitudes toward open innovation (M = 1.72; SD = 1.08) were the least important for the surveyed employees in terms of hindering the use of the above solutions (Table 5).

Table 5. Degree of obstruction for respondents by individual factors in the use of platforms and/or open innovation networks and descriptive statistics.

Factors	Degree of Obstruction (on a Scale of 1–5)										Descriptive Statistics—Degree of Obstruction					
	1—They Pose No Obstruction		2		3		4		5—They Pose a Very Big Obstruction		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error
	n	%	n	%	n	%	n	%	n	%				−95.00%	+95.00%	
Legal barriers	297	73.88%	28	6.97%	42	10.45%	23	5.72%	12	2.99%	1.57 ± 1.08	1 (1–2)	1–5	1.46	1.68	0.05
Organizational/administrative barriers	141	35.07%	91	22.64%	112	27.86%	51	12.69%	7	1.74%	2.23 ± 1.11	2 (1–3)	1–5	2.12	2.34	0.06
Communication barriers	32	7.96%	27	6.72%	83	20.65%	186	46.27%	74	18.41%	3.6 ± 1.11	4 (3–4)	1–5	3.50	3.71	0.06
Negative attitudes toward open innovation	245	60.95%	73	18.16%	48	11.94%	23	5.72%	13	3.23%	1.72 ± 1.08	1 (1–2)	1–5	1.62	1.83	0.05
Reluctance to share knowledge	48	11.94%	34	8.46%	46	11.44%	146	36.32%	128	31.84%	3.68 ± 1.32	4 (3–5)	1–5	3.55	3.81	0.07
NIH syndrome	178	44.28%	93	23.13%	68	16.92%	49	12.19%	14	3.48%	2.07 ± 1.19	2 (1–3)	1–5	1.96	2.19	0.06
Rigidity of work organization	152	37.81%	76	18.91%	104	25.87%	52	12.94%	18	4.48%	2.27 ± 1.22	2 (1–3)	1–5	2.15	2.39	0.06
Lack of internal commitment to the company	182	45.27%	59	14.68%	70	17.41%	68	16.92%	23	5.72%	2.23 ± 1.33	2 (1–3)	1–5	2.10	2.36	0.07
Insufficient support from top management	67	16.67%	22	5.47%	56	13.93%	119	29.60%	138	34.33%	3.59 ± 1.43	4 (3–5)	1–5	3.45	3.73	0.07

As cluster analysis using the agglomerative method showed, the individual factors representing barriers to the use of open innovation platforms and/or networks for respondents fell into two clusters. It turned out that obstructions such as legal barriers, negative attitudes toward open innovation, organizational and/or administrative barriers, rigidity of work organization, NIH syndrome and lack of internal commitment to the company were rated similarly. In addition, there were similarities in evaluations of factors such as communication barriers, reluctance to share knowledge, and insufficient support from top management (Figure 2).

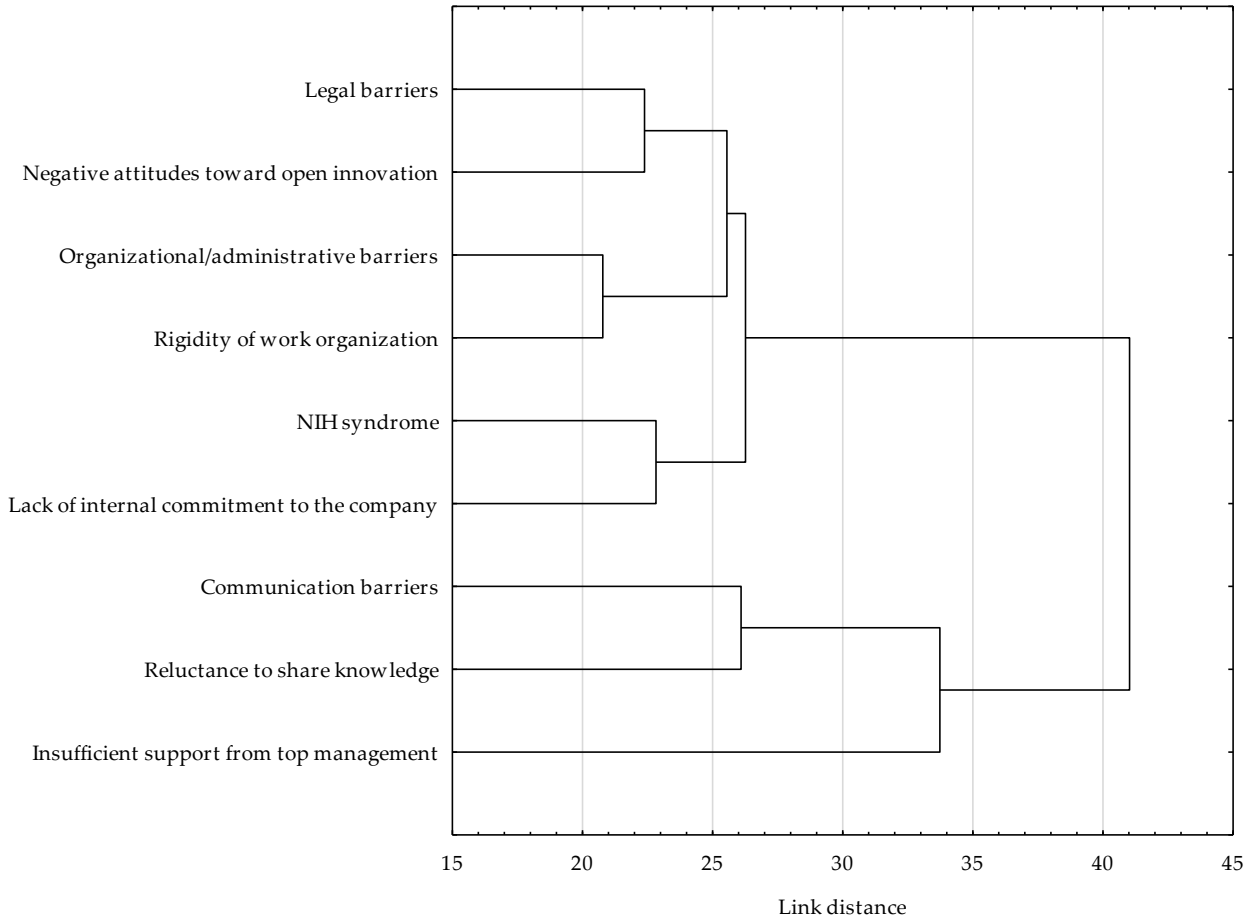

Figure 2. Dendrogram obtained for the analyzed factors that are barriers to the use of open innovation platforms and/or networks for the respondents (results of cluster analysis using agglomeration).

The above distribution of assessments of individual obstructions to the use of open innovation platforms and/or networks was confirmed in the results of cluster analysis using a non-hierarchical clustering method of characteristics, the so-called k-means clustering. The values of descriptive statistics for the factors included in both clusters, in turn, indicate that for the respondents the biggest obstacles to using the above-mentioned solutions were communication barriers, reluctance to share knowledge and insufficient support from top management (M = 3.63; SD = 1.29). The importance of the other obstacles was lower for the respondent employees (M = 2.02; SD = 1.2) (Table 6).

Table 6. Cluster elements for the analyzed factors that constitute obstacles for the respondents to use open innovation platforms and/or networks (results of cluster analysis using k-means clustering).

Elements of Individual Clusters		Distance	Descriptive Statistics of the Factors Included in Each Cluster					
			Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error.
						−95.00%	+95.00%	
Cluster 1	Communication barriers	0.7577	3.63 ± 1.29	4 (3–5)	1–5	3.55	3.70	0.04
	Reluctance to share knowledge	0.9617						
	Insufficient support from top management	1.1418						
Cluster 2	Legal barriers	0.8551	2.02 ± 1.2	2 (1–3)	1–5	1.97	2.07	0.02
	Organizational/	0.8818						
	Administrative barriers	0.8556						
	Negative attitudes towards open innovation	0.9105						
	NIH syndrome	0.9545						
	Rigidity of work organization	0.9747						

4.2. Study of Selected Relationships on Factors Motivating and Hindering the Use of Open Innovation Platforms and/or Networks in the ICT Industry

Next, the influence of selected sociodemographic and occupational factors on factors determining respondents' use of open innovation platforms and/or networks and constituting obstacles to the use of such solutions was verified.

4.2.1. Influence of Gender and Age on Factors Motivating and Constituting Obstacles to the Use of Platforms and/or Open Innovation Networks

The importance of most of the factors motivating respondents to use open innovation platforms and/or networks depended on their gender. Women attributed less importance than men to factors such as access to new technologies (M_{Women} = 4.32; SD_{Women} = 0.91 and M_{Men} = 4.71; SD_{Men} = 0.69) and support of the software development team process (M_{Women} = 2.72; SD_{Women} = 1.54 and M_{Men} = 3.32; SD_{Men} = 1.32); and greater to factors in the form of reduced operating costs for the company (M_{Women} = 4.12; SD_{Women} = 1.01 and M_{Men} = 3.14; SD_{Men} = 1.58), reducing the time to market a product and/or service (M_{Women} = 4.48; SD_{Women} = 0.84 and M_{Men} = 3.32; SD_{Men} = 1.59) and the ability to communicate externally with recipients of products and/or servicesg (M_{Women} = 4.11; SD_{Women} = 1.07 and M_{Men} = 2.83; SD_{Men} = 1.34). The differences found between the two groups reached statistical significance, as shown by analysis with the Mann–Whitney U test. This was true for both access to new technologies: $Z = -3.84$; $p < 0.001$; $r_g = -0.26$; support of team software development process: $Z = -3.07$; $p < 0.01$; $r_g = -0.21$; reducing company operating costs: $Z = 4.9$; $p < 0.001$; $r_g = 0.34$; reduced time to market a product and/or service: $Z = 5.84$; $p < 0.001$; $r_g = 0.4$; as well as external communication abilities with product and/or service recipients: $Z = 7.71$; $p < 0.001$; $r_g = 0.53$.

The other factors motivating respondents to use open innovation platforms and/or networks did not differ significantly between men and women in terms of the importance attributed to them. The degree of motivation to use the aforementioned solutions was similar in both groups for both the factor concerning the sharing of intellectual property rights to software (M_{Women} = 2.54; SD_{Women} = 1.43 i M_{Men} = 2.45; SD_{Men} = 1.19), factor related to the ability to share knowledge (M_{Women} = 4.23; SD_{Women} = 0.94 and M_{Men} = 4.29; SD_{Men} = 0.86), as well as with the acquisition of external cooperation partners (M_{Women} = 3.83; SD_{Women} = 1.14 and M_{Men} = 3.98; SD_{Men} = 0.94) and complementing each other's different skills when working with external partners (M_{Women}= 3.74;

SD_{Women} = 1.18 and M_{Men} = 3.95; SD_{Men} = 0.95). Based on the results of the analysis with the Mann–Whitney U test, it was found that women were not statistically significantly different from men in terms of the use of open innovation platforms and/or networks as influenced by both knowledge sharing abilities: Z = −0.33; p = 0.738; r_g = −0.02; sharing software intellectual property rights: Z = 0.47; p = 0.64; r_g = 0.03; obtaining external cooperation partners: Z = −0.72; p = 0.472; r_g = −0.05; as well as complementing each other's different abilities when working with external partners: Z = −1.06; p = 0.291; r_g = −0.07 (Table 7).

Most of the obstacles to the surveyed employees' use of open innovation platforms and/or networks were related to their gender. Women felt less hindered than men when it came to communication barriers (M_{Women} = 3.2; SD_{Women} = 1.23 and M_{Men} = 3.73; SD_{Men} = 1.04) and reluctance to share knowledge (M_{Women} = 3.17; SD_{Women} = 1.44 and M_{Men} = 3.83; SD_{Men} = 1.25); while the bigger obstacle in the former group were legal barriers (M_{Women} = 2; SD_{Women}= 1.34 and M_{Men} = 1.44; SD_{Men} = 0.95), organizational and/or administrative barriers (M_{Women} = 2.71; SD_{Women} = 1.07 i M_{Men} = 2.09; SD_{Men} = 1.09), negative attitude towards open innovation (M_{Women} = 2.2; SD_{Women} = 1.32 and M_{Men} = 1.58; SD_{Men} = 0.96), rigidity of work organization (M_{Women} = 2.86; SD_{Women} = 1.27 and M_{Men}= 2.1; SD_{Men} = 1.15) and lack of internal commitment to the company (M_{Women} = 2.6; SD_{Women} = 1.34 and M_{Men} = 2.12; SD_{Men} = 1.31). These differences proved to be statistically significant, as shown by analysis with the Mann–Whitney U test, both with regard to the aforementioned factors that constitute barriers to the use of open innovation platforms and/or networks, such as legal barriers: Z = 3.29; p < 0.01; r_g = 0.23; organizational and/or administrative barriers: Z = 4.48; p < 0.001; r_g = 0.31; communication barriers: Z = −3.48; p < 0.001; r_g = −0.24; negative attitudes toward open innovation: Z = 3.81; p < 0.001; r_g = 0.26; reluctance to share knowledge: Z = −3.82; p < 0.001; r_g = −0.26; rigidity of work organization: Z = 4.85; p < 0.001; r_g = 0.33; as well as lack of internal commitment to the company: Z = 2.98; p < 0.01; r_g = 0.2.

NIH syndrome was a slightly greater barrier for women than men to using open innovation platforms and/or networks (M_{Women} = 2.3; SD_{Women}= 1.3 and M_{Men} = 2.01; SD_{Men} = 1.15), while insufficient top management support was such an obstacle to a very similar degree in both groups (M_{Women} = 3.65; SD_{Women} = 1.31 and M_{Men}= 3.58; SD_{Men} = 1.46). However, analysis with the Mann–Whitney U test showed that there were no statistically significant differences between the two groups in terms of the degree to which both NIH syndrome posed an obstacle to the use of the above solutions: Z = 1.83; p < 0.067; r_g = 0.13; as well as insufficient support from top management: Z = 0; p = 0.999; r_g = 0.

Analysis by Spearman's rank order correlation method showed that there was a positive and statistically significant relationship between the age of the respondents and the degree to which they were motivated to use open innovation platforms and/or networks by factors such as access to new technologies: R = 0.38; t(N–2) = 8.13; p < 0.001; ability to share knowledge: R = 0.28; t(N–2) = 5.91; p < 0.001 and acquisition of external collaboration partners: R = 0.14; t(N–2) = 2.93; p < 0.01. This means that older employees paid more attention to the above-mentioned factors when deciding to use open innovation platforms and/or networks. This is clearly confirmed by the results on the degree of motivation by the aforementioned factors to use open innovation platforms and/or networks. The older the respondents were, the more they were motivated to use the above-mentioned solutions: access to new technologies (from $M_{18\ to\ 24\ yr.}$ = 4.24; $SD_{18\ to\ 24\ yr.}$ = 0.89 to $M_{35yr.and\ more}$ = 4.85; $SD_{35yr.and\ more}$ = 0.62), ability to share knowledge (from $M_{18\ to\ 24\ yr.}$ = 3.98; $SD_{18\ to\ 24\ yr.}$ = 0.99 to $M_{35yr.\ and\ more}$ = 4.59; $SD_{35yr.\ and\ more}$ = 0.7) and acquisition of external cooperation partners (from $M_{18\ to\ 24\ yr.}$ = 3.74; $SD_{18\ to\ 24\ yr.}$ = 1.18 to $M_{35yr.\ and\ more}$ = 4.2; $SD_{35yr.\ and\ more}$ = 0.67).

Table 7. Relationship between respondents' gender and the degree to which individual factors motivate them to use platform and/or open innovation networks.

Factors	Gender	Descriptive Statistics—Degree of Motivation						Mann–Whitney U Test	r_g of Glass
		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. error		
					−95.00%	+95.00%			
Access to new technologies	Women (n = 92)	4.32 ± 0.91	5 (4–5)	1–5	4.13	4.50	0.10	Z = −3.84; $p < 0.001$	–0.26
	Men (n = 310)	4.71 ± 0.69	5 (5–5)	1–5	4.63	4.78	0.04		
Ability to share knowledge	Women (n = 92)	4.23 ± 0.94	5 (4–5)	2–5	4.03	4.42	0.10	Z = −0.33; $p = 0.738$	–0.02
	Men (n = 310)	4.29 ± 0.86	5 (4–5)	1–5	4.20	4.39	0.05		
Sharing of intellectual property rights to software	Women (n = 92)	2.54 ± 1.43	3 (1–4)	1–5	2.25	2.84	0.15	Z = 0.47; $p = 0.64$	0.03
	Men (n = 310)	2.45 ± 1.19	3 (1–3)	1–5	2.31	2.58	0.07		
Supporting the team process of software development	Women (n = 92)	2.72 ± 1.54	3 (1–4)	1–5	2.40	3.04	0.16	Z = −3.07; $p < 0.01$	–0.21
	Men (n = 310)	3.32 ± 1.32	4 (3–4)	1–5	3.17	3.46	0.07		
Reduction in operating costs of the company	Women (n = 92)	4.12 ± 1.01	4 (4–5)	1–5	3.91	4.33	0.11	Z = 4.9; $p < 0.001$	0.34
	Men (n = 310)	3.14 ± 1.58	3 (2–5)	1–5	2.96	3.31	0.09		
Reducing time to market of the product/service	Women (n = 92)	4.48 ± 0.84	5 (4–5)	2–5	4.30	4.65	0.09	Z = 5.84; $p < 0.001$	0.40
	Men (n = 310)	3.32 ± 1.59	4 (2–5)	1–5	3.14	3.50	0.09		
Acquisition of external partners for cooperation	Women (n = 92)	3.83 ± 1.14	4 (3–5)	1–5	3.59	4.06	0.12	Z = −0.72; $p = 0.472$	–0.05
	Men (n = 310)	3.98 ± 0.94	4 (4–5)	1–5	3.88	4.09	0.05		
Complementing each other's different skills when working with external partners	Women (n = 92)	3.74 ± 1.18	4 (3–5)	1–5	3.49	3.98	0.12	Z = −1.06; $p = 0.291$	–0.07
	Men (n = 310)	3.95 ± 0.95	4 (4–5)	1–5	3.85	4.06	0.05		
Ability to communicate externally with the recipients of my products/services	Women (n = 92)	4.11 ± 1.07	4 (4–5)	1–5	3.89	4.33	0.11	Z = 7.71; $p < 0.001$	0.53
	Men (n = 310)	2.83 ± 1.34	3 (2–4)	1–5	2.68	2.98	0.08		

The same analysis also found a statistically significant, but this time negative, relationship between the age of the surveyed employees and the degree to which they were motivated to use open innovation platforms and/or networks by factors such as sharing software intellectual property rights: R = −0.29; t(N–2) = −6.08; $p < 0.001$; support for the team process of software development: R = −0.11; t(N–2) = −2.29; $p < 0.05$; and ability to communicate externally with recipients of products and/or services: R = −0.28; t(N–2) = −5.74; $p < 0.001$. The direction of these correlations indicates that older employees were less likely to choose to use open innovation platforms and/or networks under the influence of the aforementioned factors. The older the respondents were, the less they were motivated to use the aforementioned solutions by factors such as sharing intellectual property rights to software (from $M_{18 \text{ to } 24 \text{ yr.}} = 3.14$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.32$ to $M_{35\text{yr. and more}} = 2.14$; $SD_{35\text{yr. and more}} = 1.07$) and the ability to communicate externally with my product/service recipients (from $M_{18 \text{ to } 24 \text{ yr.}} = 3.72$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.31$ to $M_{35\text{yr. and more}} = 2.76$; $SD_{35\text{yr and more}} = 1.21$). In contrast, support for the team process of software development motivated those in the youngest age group to a greater extent ($M_{18 \text{ to } 24 \text{ yr.}} = 3.5$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.25$) than was the case in the other groups ($M_{25 \text{ to } 34 \text{ yr.}} = 3.04$; $SD_{25 \text{ to } 34 \text{ yr.}} = 1.48$ and $M_{35 \text{ yr. and more}} = 3.07$; $SD_{35\text{yr. and more}} = 1.37$).

Other factors motivating respondents to use open innovation platforms and/or networks did not depend in terms of the degree of the above motivation on their age. By age group, the degree to which respondents were motivated to use the above-mentioned solutions by lowering their company's operating costs ranged from $M_{25 \text{ to } 34 \text{ yr.}} = 2.93$; $SD_{25 \text{ to } 34 \text{ yr.}} = 1.49$ to $M_{18 \text{ to } 24 \text{ yr.}} = 3.68$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.26$; by reducing the time to market a product and/or service—from $M_{25 \text{ to } 34 \text{ yr.}} = 3.21$; $SD_{25 \text{ to } 34 \text{ yr.}} = 1.59$ to $M_{18 \text{ to } 24 \text{ yr.}} = 3.9$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.23$; while by complementing each other's different abilities when working with external partners, respectively, from $M_{25 \text{ to } 34 \text{ yr.}} = 3.75$; $SD_{25 \text{ to } 34 \text{ yr.}} = 1.09$ to $M_{35\text{yr. and more}} = 4.14$; $SD_{35 \text{ yr. and more}} = 0.72$. Based on the results of Spearman's rank order correlation analysis, it was found that there was no statistically significant relationship between the age of the respondents and the importance in their use of open innovation platforms and/or networks of motivational factors such as reduction in company operating costs: R = 0.03; t(N–2) = 0.52; $p = 0.603$; reduction in time to market a product and/or service: R = 0; t(N–2) = 0.1; $p = 0.923$; and complementing each other's different skills when working with external partners: R = 0.09; t(N–2) = 1.88; $p < 0.061$ (Table 8).

Among the individual factors that were barriers to the use of open innovation platforms and/or networks for the surveyed employees, communication barriers were positively and significantly statistically correlated with their age, as shown by Spearman's rank correlation analysis: R = 0.43; t(N–2) = 9.65; $p < 0.001$, and reluctance to share knowledge: R = 0.4; t(N–2) = 8.78; $p < 0.001$. Thus, older employees were more likely to have impediments to using platforms and/or open innovation networks due to the above-mentioned factors. The above thesis is confirmed by the results on the degree of obstruction by the aforementioned factors in each age group. The older the respondents were, the greater the obstacle to the use of platforms and/or open innovation networks was for them due to communication barriers (from $M_{18 \text{ to } 24 \text{ yr.}} = 2.7$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.29$ to $M_{35 \text{ yr. and more}} = 4.07$; $SD_{35 \text{ yr. and more}} = 0.7$) and reluctance to share knowledge (from $M_{18 \text{ to } 24 \text{ yr.}} = 2.85$; $SD_{18 \text{ to } 24 \text{ yr.}} = 1.45$ to $M_{35 \text{ yr. and more}} = 4.26$; $SD_{35 \text{ yr. and more}} = 0.94$).

In addition, based on the results of the same analysis, a negative and statistically significant relationship was noted between the age of the respondents and the degree to which they were hindered in the use of platforms and/or open innovation networks by factors such as legal barriers: R = −0.52; t(N–2) = −12.2; $p < 0.001$; organizational and/or administrative barriers: R = −0.36; t(N–2) = −7.66; $p < 0.001$; negative attitudes toward open innovation: R = −0.23; t(N–2) = −4.63; $p < 0.001$; rigidity of work organization: R = −0.37; t(N–2) = −7.96; $p < 0.001$; and lack of internal commitment to the company: R = −0.11; t(N–2) = −2.31; $p < 0.05$. This means that the aforementioned factors were a greater obstacle with the use of open innovation platforms and/or networks among younger employees. The older the respondents were, the less of an obstacle for them were organizational and/or administrative barriers (from $M_{18 \text{ to } 24 \text{ yr.}} = 2.75$;

$SD_{18\ to\ 24\ yr.}$ = 1.1 to $M_{35\ yr.\ and\ more}$ = 1.74; $SD_{35\ yr.\ and\ more}$ = 0.97), rigidity of work organization (from $M_{35\ yr.\ and\ more}$ = 1.77; $SD_{35\ yr.\ and\ more}$ = 1 to $M_{18\ to\ 24\ yr.}$ = 2.93; $SD_{18\ to\ 24\ yr.}$ = 1.27) and legal barriers, with in the case of the latter factor, the degree of limitation in the use of the above solutions was clearly greater in the youngest age group ($M_{18\ to\ 24yr.}$ = 2.46; $SD_{18\ to\ 24\ yr.}$ = 1.26) compared to others ($M_{25\ to\ 34\ yr.}$ = 1.3; $SD_{25\ to\ 34\ yr.}$ = 0.89 and $M_{35\ yr.and\ more}$ = 1.12; $SD_{35\ yr.\ and\ more}$ = 0.52). In addition, in the youngest age group, negative attitudes toward open innovation were a bigger barrier ($M_{18\ to\ 24\ yr.}$ = 2.19; $SD_{18\ to\ 24\ yr.}$ = 1.21) than in other groups ($M_{25\ to\ 34\ yr.}$ = 1.46; $SD_{25\ to\ 34\ yr.}$ = 0.86 and $M_{35\ yr.\ and\ more}$ = 1.61; $SD_{35\ yr.\ and\ more}$ = 1.08). The same was true for the lack of internal commitment to the company, which was also a bigger obstacle in the youngest group. ($M_{18\ to\ 24\ yr.}$ = 2.68; $SD_{18\ to\ 24\ yr.}$ = 1.29) than in other groups ($M_{25\ to\ 34\ yr.}$ = 1.85; $SD_{25\ to\ 34\ yr.}$ = 1.18 and $M_{35\ yr.\ and\ more}$ = 2.28; $SD_{35\ yr.\ and\ more}$ = 1.4).

Table 8. Relationship between the age of respondents and the degree to which they are motivated by particular factors to use open innovation platforms and/or networks.

Factors	Age	Descriptive Statistics—Degree of Motivation						Spearman's Rank Order Correlation
		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error	
					−95.00%	95.00%		
Access to new technologies	18 to 24 yr. (n = 115)	4.24 ± 0.89	4 (4–5)	1–5	4.08	4.41	0.08	R = 0.38; t(N–2) = 8.13; $p < 0.001$
	25 to 34 yr. (n = 150)	4.69 ± 0.68	5 (5–5)	2–5	4.58	4.8	0.06	
	35 and over (n = 137)	4.85 ± 0.62	5 (5–5)	1–5	4.74	4.95	0.05	
Ability to share knowledge	18 to 24 yr. (n = 115)	3.98 ± 0.99	4 (3–5)	1–5	3.8	4.17	0.09	R = 0.28; t(N–2) = 5.91; $p < 0.001$
	25 to 34 yr. (n = 150)	4.22 ± 0.84	4 (4–5)	2–5	4.08	4.36	0.07	
	35 and over (n = 137)	4.59 ± 0.7	5 (4–5)	2–5	4.47	4.71	0.06	
Sharing of intellectual property rights to software	18 to 24 yr. (n = 115)	3.14 ± 1.32	3 (3–4)	1–5	2.9	3.38	0.12	R = −0.29; t(N–2) = −6.08; $p < 0.001$
	25 to 34 yr. (n = 150)	2.25 ± 1.16	2 (1–3)	1–5	2.07	2.44	0.09	
	35 and over (n = 137)	2.14 ± 1.07	2 (1–3)	1–5	1.96	2.32	0.09	
Supporting the team process of software development	18 to 24 yr. (n = 115)	3.5 ± 1.25	4 (3–4)	1–5	3.26	3.73	0.12	R = −0.11; t(N–2) = −2.29; $p < 0.05$
	25 to 34 yr. (n = 150)	3.04 ± 1.48	3.5 (1–4)	1–5	2.8	3.28	0.12	
	35 and over (n = 137)	3.07 ± 1.37	3 (2–4)	1–5	2.83	3.3	0.12	
Reduction in operating costs of the company	18 to 24 yr. (n = 115)	3.68 ± 1.26	4 (3–5)	1–5	3.45	3.91	0.12	R = 0.03; t(N–2) = 0.52; $p = 0.603$
	25 to 34 yr. (n = 150)	2.93 ± 1.49	3 (2–4)	1–5	2.69	3.17	0.12	
	35 and over (n = 137)	3.58 ± 1.65	4 (2–5)	1–5	3.3	3.86	0.14	
Reducing time to market of the product/service	18 to 24 yr. (n = 115)	3.9 ± 1.23	4 (3–5)	1–5	3.68	4.13	0.11	R = 0; t(N–2) = 0.1; $p = 0.923$
	25 to 34 yr. (n = 150)	3.21 ± 1.59	3 (2–5)	1–5	2.96	3.47	0.13	
	35 and over (n = 137)	3.72 ± 1.62	5 (2–5)	1–5	3.45	4	0.14	
Acquisition of external partners for cooperation	18 to 24 yr. (n = 115)	3.74 ± 1.18	4 (3–5)	1–5	3.52	3.96	0.11	R = 0.14; t(N–2) = 2.93; $p < 0.01$
	25 to 34 yr. (n = 150)	3.87 ± 1.03	4 (4–5)	1–5	3.71	4.04	0.08	
	35 and over (n = 137)	4.2 ± 0.67	4 (4–5)	2–5	4.09	4.32	0.06	
Complementing each other's different skills when working with external partners	18 to 24 yr. (n = 115)	3.82 ± 1.14	4 (3–5)	1–5	3.61	4.03	0.11	R = 0.09; t(N–2) = 1.88; $p < 0.061$
	25 to 34 yr. (n = 150)	3.75 ± 1.09	4 (3–4)	1–5	3.58	3.93	0.09	
	35 and over (n = 137)	4.14 ± 0.72	4 (4–5)	2–5	4.02	4.26	0.06	
Ability to communicate externally with the recipients of my products/services	18 to 24 yr. (n = 115)	3.72 ± 1.31	4 (3–5)	1–5	3.48	3.96	0.12	R = −0.28; t(N–2) = −5.74; $p < 0.001$
	25 to 34 yr. (n = 150)	2.99 ± 1.46	3 (2–4)	1–5	2.76	3.23	0.12	
	35 and over (n = 137)	2.76 ± 1.21	3 (2–4)	1–5	2.55	2.96	0.1	

In contrast, NIH syndrome and insufficient top management support as barriers to the use of open innovation platforms and/or networks were not dependent on the age of the respondents. Across age groups, NIH syndrome was an obstacle at levels ranging from $M_{25\ to\ 34\ yr.}$ = 1.79; $SD_{25\ to\ 34\ yr.}$ = 1.14 to $M_{18\ to\ 24\ yr.}$ = 2.3; $SD_{18\ to\ 24\ yr.}$ = 1.22; while insuf-

ficient support from top management—from $M_{35\ yr.\ and\ more} = 3.03$; $SD_{35\ yr.\ and\ more} = 1.77$ to $M_{25\ to\ 34\ yr.} = 4.21$; $SD_{25\ to\ 34\ yr.} = 0.96$. As Spearman's rank correlation analysis showed, there was no statistically significant relationship between the age of the respondents and the degree to which both NIH syndrome: $R = -0.01$; $t(N-2) = -0.28$; $p = 0.777$; and inadequate support from the top management stood in the way of their use of open innovation platforms and/or networks: $R = -0.05$; $t(N-2) = -0.91$; $p = 0.361$

4.2.2. Influence of Company-Related Factors on Factors Motivating and Hindering the Use of Open Innovation Platforms and/or Networks

The degree to which surveyed employees were motivated by any of the factors to use platforms and/or open innovation networks was not related to the number of people employed at the company. In the different groups distinguished by the number of employees at the company, access to new technologies motivated respondents to use the above solutions at levels ranging from $M_{1–9} = 4.39$; $SD_{1–9} = 1.02$ to $M_{100–249} = 4.71$; $SD_{100–249} = 0.7$; the ability to share knowledge—from $M_{1–9} = 3.95$; $SD_{1–9} = 1$ to $M_{100–249} = 4.4$; $SD_{100–249} = 0.82$; sharing of intellectual property rights to software—respectively from $M_{10–49} = 2.27$; $SD_{10–49} = 1.2$ to $M_{250\ and\ more} = 2.93$; $SD_{250\ and\ more} = 1.29$; supporting the software development team process—from $M_{50–99} = 2.83$; $SD_{50–99} = 1.47$ to $M_{250\ and\ more} = 3.67$; $SD_{250\ and\ more} = 1.22$; reducing the company's operating costs—from $M_{10–49} = 3.06$; $SD_{10–49} = 1.51$ to $M_{1–9} = 3.54$; $SD_{1–9} = 1.55$; reducing the time to market a product and/or service—from $M_{10–49} = 3.36$; $SD_{10–49} = 1.59$ to $M_{50–99} = 3.76$; $SD_{50–99} = 1.48$; acquisition of external cooperation partners—from $M_{1–9} = 3.85$; $SD_{1–9} = 1.15$ to $M_{100–249} = 4.06$; $SD_{100–249} = 0.91$; complementing each other's different abilities when working with external partners—from $M_{1–9} = 3.76$; $SD_{1–9} = 1.24$ to $M_{250\ and\ more} = 4.1$; $SD_{250\ and\ more} = 0.84$; while the ability to communicate externally with the recipients of products and/or services—from $M_{10–49} = 3.02$; $SD_{10–49} = 1.47$ to $M_{250\ and\ more} = 3.33$; $SD_{250\ and\ more} = 1.42$. The above results indicate that there was no downward or upward trend in the degree of motivation by any of the above factors as the number of employees in the company increased, and the differences between the groups were not significant. Based on the results of Spearman's rank order correlation analysis, there was no statistically significant relationship between the number of people employed at the respondents' company and the degree to which they were motivated to use platforms and/or open innovation networks by both access to new technologies: $R = 0.04$; $t(N-2) = 0.85$; $p = 0.397$; ability to share knowledge: $R = 0.08$; $t(N-2) = 1.65$; $p = 0.101$; sharing of software intellectual property rights: $R = 0.07$; $t(N-2) = 1.35$; $p = 0.178$; support for team process of software development: $R = 0.09$; $t(N-2) = 1.89$; $p < 0.059$; reducing company operating costs: $R = 0.04$; $t(N-2) = 0.76$; $p = 0.448$; reducing time to market product and/or service: $R = 0.05$; $t(N-2) = 0.94$; $p = 0.349$; acquisition of external collaboration partners: $R = 0.03$; $t(N-2) = 0.51$; $p = 0.609$; complementing each other's different abilities when working with external partners: $R = 0.08$; $t(N-2) = 1.63$; $p = 0.105$; as well as the ability to communicate externally with recipients of products and/or services: $R = 0.05$; $t(N-2) = 0.93$; $p = 0.353$ (Table 9).

Table 9. Relationship between the number of people employed at the respondents' company and the degree to which each factor motivates them to use open innovation platforms and/or networks.

Factors	Number of People Employed by the Company	Descriptive Statistics—Degree of Motivation						Spearman's Rank Order Correlation
		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error	
					−95.00%	95.00%		
Access to new technologies	1–9 (n = 41)	4.39 ± 1.02	5 (4–5)	1–5	4.07	4.71	0.16	R = 0.04; t(N–2) = 0.85; p = 0.397
	10–49 (n = 85)	4.61 ± 0.76	5 (5–5)	2–5	4.45	4.78	0.08	
	50–99 (n = 109)	4.64 ± 0.75	5 (5–5)	1–5	4.5	4.78	0.07	
	100–249 (n = 100)	4.71 ± 0.7	5 (5–5)	1–5	4.57	4.85	0.07	
	250 and over (n = 67)	4.58 ± 0.7	5 (4–5)	3–5	4.41	4.75	0.09	

Table 9. *Cont.*

Factors	Number of People Employed by the Company	Descriptive Statistics—Degree of Motivation						Spearman's Rank Order Correlation
		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error	
					−95.00%	95.00%		
Ability to share knowledge	1–9 (n = 41)	3.95 ± 1	4 (3–5)	2–5	3.64	4.27	0.16	R = 0.08; t(N–2) = 1.65; p = 0.101
	10–49 (n = 85)	4.32 ± 0.8	5 (4–5)	2–5	4.14	4.49	0.09	
	50–99 (n = 109)	4.27 ± 0.89	5 (4–5)	2–5	4.1	4.43	0.09	
	100–249 (n = 100)	4.4 ± 0.82	5 (4–5)	1–5	4.24	4.56	0.08	
	250 and over (n = 67)	4.27 ± 0.93	5 (4–5)	1–5	4.04	4.5	0.11	
Sharing of intellectual property rights to software	1–9 (n = 41)	2.83 ± 1.2	3 (2–3)	1–5	2.45	3.21	0.19	R = 0.07; t(N–2) = 1.35; p = 0.178
	10–49 (n = 85)	2.27 ± 1.2	2 (1–3)	1–5	2.01	2.53	0.13	
	50–99 (n = 109)	2.28 ± 1.25	2 (1–3)	1–5	2.04	2.51	0.12	
	100–249 (n = 100)	2.39 ± 1.2	2.5 (1–3)	1–5	2.15	2.63	0.12	
	250 and over (n = 67)	2.93 ± 1.29	3 (2–4)	1–5	2.61	3.24	0.16	
Supporting the team process of software development	1–9 (n = 41)	3.39 ± 1.26	4 (3–4)	1–5	2.99	3.79	0.2	R = 0.09; t(N–2) = 1.89; p < 0.059
	10–49 (n = 85)	3.06 ± 1.46	3 (1–4)	1–5	2.74	3.37	0.16	
	50–99 (n = 109)	2.83 ± 1.47	3 (1–4)	1–5	2.56	3.11	0.14	
	100–249 (n = 100)	3.24 ± 1.32	4 (3–4)	1–5	2.98	3.5	0.13	
	250 and over (n = 67)	3.67 ± 1.22	4 (3–5)	1–5	3.37	3.97	0.15	
Reduction in operating costs of the company	1–9 (n = 41)	3.54 ± 1.55	4 (2–5)	1–5	3.05	4.03	0.24	R = 0.04; t(N–2) = 0.76; p = 0.448
	10–49 (n = 85)	3.06 ± 1.51	3 (2–4)	1–5	2.73	3.38	0.16	
	50–99 (n = 109)	3.47 ± 1.48	4 (2–5)	1–5	3.19	3.75	0.14	
	100–249 (n = 100)	3.41 ± 1.57	4 (2–5)	1–5	3.1	3.72	0.16	
	250 and over (n = 67)	3.4 ± 1.51	4 (2–5)	1–5	3.04	3.77	0.18	
Reducing time to market of the product/service	1–9 (n = 41)	3.46 ± 1.43	4 (2–5)	1–5	3.01	3.92	0.22	R = 0.05; t(N–2) = 0.94; p = 0.349
	10–49 (n = 85)	3.36 ± 1.59	4 (2–5)	1–5	3.02	3.71	0.17	
	50–99 (n = 109)	3.76 ± 1.48	5 (2–5)	1–5	3.48	4.04	0.14	
	100–249 (n = 100)	3.65 ± 1.62	5 (2–5)	1–5	3.33	3.97	0.16	
	250 and over (n = 67)	3.55 ± 1.45	4 (3–5)	1–5	3.2	3.91	0.18	
Acquisition of external partners for cooperation	1–9 (n = 41)	3.85 ± 1.15	4 (3–5)	1–5	3.49	4.22	0.18	R = 0.03; t(N–2) = 0.51; p = 0.609
	10–49 (n = 85)	3.93 ± 0.9	4 (4–5)	1–5	3.74	4.12	0.1	
	50–99 (n = 109)	3.93 ± 1.06	4 (4–5)	1–5	3.73	4.13	0.1	
	100–249 (n = 100)	4.06 ± 0.91	4 (4–5)	1–5	3.88	4.24	0.09	
	250 and over (n = 67)	3.9 ± 1	4 (3–5)	1–5	3.65	4.14	0.12	
Complementing each other's different skills when working with external partners	1–9 (n = 41)	3.76 ± 1.24	4 (3–5)	1–5	3.36	4.15	0.19	R = 0.08; t(N–2) = 1.63; p = 0.105
	10–49 (n = 85)	3.85 ± 0.96	4 (3–4)	1–5	3.64	4.05	0.1	
	50–99 (n = 109)	3.83 ± 1.09	4 (3–5)	1–5	3.62	4.03	0.1	
	100–249 (n = 100)	3.96 ± 0.96	4 (4–5)	1–5	3.77	4.15	0.1	
	250 and over (n = 67)	4.1 ± 0.84	4 (4–5)	2–5	3.9	4.31	0.1	
Ability to communicate externally with the recipients of my products/services	1–9 (n = 41)	3.05 ± 1.43	3 (2–4)	1–5	2.6	3.5	0.22	R = 0.05; t(N–2) = 0.93; p = 0.353
	10–49 (n = 85)	3.02 ± 1.47	3 (2–4)	1–5	2.71	3.34	0.16	
	50–99 (n = 109)	3.17 ± 1.33	3 (2–4)	1–5	2.92	3.43	0.13	
	100–249 (n = 100)	3.04 ± 1.36	3 (2–4)	1–5	2.77	3.31	0.14	
	250 and over (n = 67)	3.33 ± 1.42	3 (2–5)	1–5	2.98	3.67	0.17	

Analysis by Spearman's rank order correlation method showed a positive and statistically significant relationship between the number of people employed at the respondents' company and the degree to which they are hindered from using open platforms and/or net-

works by negative attitudes toward open innovation: R = 0.1; t(N–2) = 2.08; $p < 0.05$ and lack of internal commitment to the company: R = 0.11; t(N–2) = 2.23; $p < 0.05$. This means that a larger number of employees in the company favored restrictions on the use of platforms and/or open networks due to the above-mentioned factors, while the relationship was weak. On the other hand, from the distribution of the results for the aforementioned factors in the groups distinguished by the number of employees in the company, it can be read that among respondents working in companies with 10 to 99 employees, negative attitudes toward open innovation were less of an obstacle ($M_{10–49} = 1.41$; $SD_{10–49} = 0.82$ i $M_{50–99} = 1.55$; $SD_{50–99} = 0.92$) compared to other groups, especially those working in a company with a minimum of 250 employees ($M_{250 \text{ and more}} = 2.1$; $SD_{250 \text{ and more}} = 1.3$). The same was true for the lack of internal involvement in company affairs, where this factor was also less of an obstacle for respondents working in companies with 10–99 employees ($M_{10–49} = 1.95$; $SD_{10–49} = 1.23$ and $M_{50–99} = 2.08$; $SD_{50–99} = 1.24$) than for other groups, particularly those with a minimum of 250 employees ($M_{250 \text{ and more}} = 2.49$; $SD_{250 \text{ and more}} = 1.4$).

Other factors constituting barriers to the use of open innovation platforms and/or networks were not dependent on the number of people employed at the respondents' company. In the different groups distinguished by the number of people employed at the company, legal barriers were an obstacle to the use of the above solutions at levels ranging from $M_{50–99} = 1.3$; $SD_{50–99} = 0.79$ to $M_{250 \text{ and more}} = 2.1$; $SD_{250 \text{ and more}} = 1.32$; Organizational and/or administrative barriers—respectively from $M_{50–99} = 2.11$; $SD_{50–99} = 1.05$ to $M_{250 \text{ and more}} = 2.48$; $SD_{250 \text{ and more}} = 1.21$; communication barriers—respectively from $M_{1–9} = 3$; $SD_{1–9} = 0.97$ to $M_{100–249} = 3.91$; $SD_{100–249} = 1.01$; reluctance to share knowledge—respectively from $M_{250 \text{ and more}} = 3.27$; $SD_{250 \text{ and more}} = 1.43$ to $M_{100–249} = 3.95$; $SD_{100–249} = 1.18$, NIH syndrome—respectively from $M_{50–99} = 1.91$; $SD_{50–99} = 1.06$ to $M_{250 \text{ and more}} = 2.36$; $SD_{250 \text{ and more}} = 1.21$; while rigidity of work organization—respectively from $M_{100–249} = 2.15$; $SD_{100–249} = 1.25$ to $M_{1–9} = 2.63$; $SD_{1–9} = 1.18$. The more people the respondents' company employed, the greater the obstacle to using open innovation platforms and/or networks, the more insufficient support from top management (from $M_{250 \text{ and more}} = 3.34$; $SD_{250 \text{ and more}} = 1.45$ to $M_{1–9} = 3.85$; $SD_{1–9} = 1.06$). However, based on the results of Spearman's rank order correlation analysis, there was no statistically significant relationship between the number of people employed at the respondents' company and the degree to which they were hindered from using the above solutions by factors such as legal barriers: R = 0.04; t(N–2) = 0.89; $p = 0.376$; organizational and/or administrative barriers: R = 0; t(N–2) = 0.1; $p = 0.922$; communication barriers: R = 0.04; t(N–2) = 0.82; $p = 0.41$; reluctance to share knowledge: R = 0; t(N–2) = 0.06; $p = 0.954$; NIH syndrome: R = 0.08; t(N–2) = 1.58; $p = 0.115$; rigidity of work organization: R = −0.05; t(N–2) = −1.05; $p = 0.293$; and insufficient top management support: R = −0.09; t(N–2) = −1.82; $p < 0.07$.

The factors motivating respondents to use open innovation platforms and/or networks did not depend on the duration of their company's existence. The degree to which they were motivated to use the aforementioned solutions by access to new technologies in the groups distinguished by the aforementioned period ranged from $M_{\text{to 6 yr.}} = 4.54$; $SD_{\text{to 6 yr.}} = 0.79$ to $M_{7 \text{ to 10 yr.}} = 4.65$; $SD_{7 \text{ to 10 yr.}} = 0.72$; by sharing intellectual property rights to software—from $M_{7 \text{ to 10 yr.}} = 2.02$; $SD_{7 \text{ to 10 yr.}} = 1.18$ to $M_{\text{to 6 yr.}} = 2.86$; $SD_{\text{to 6 yr.}} = 1.17$; supporting the team software development process—respectively from $M_{7 \text{ to 10 yr.}} = 2.71$; $SD_{7 \text{ to 10 yr.}} = 1.52$ to $M_{\text{to 6 yr.}} = 3.51$; $SD_{\text{to 6 yr.}} = 1.29$; reducing the company's operating costs—respectively from $M_{7 \text{ to 10 yr.}} = 3.25$; $SD_{7 \text{ to 10 yr.}} = 1.48$ to $M_{11 \text{ yr. and more}} = 3.43$; $SD_{11 \text{ yr. and more}} = 1.57$; reducing the time to market a product and/or service—respectively from $M_{\text{to 6 yr.}} = 3.46$; $SD_{\text{to 6 yr.}} = 1.39$ to $M_{7 \text{ to 10 yr.}} = 3.64$; $SD_{7 \text{ to 10 yr.}} = 1.58$; acquisition of external cooperation partners from $M_{7 \text{ to 10 yr.}} = 3.8$; $SD_{7 \text{ to 10 yr.}} = 1.06$ to $M_{11 \text{ yr. and more}} = 4.02$; $SD_{11 \text{ yr. and more}} = 0.9$; while by complementing each other's different skills when working with external partners—respectively from $M_{7 \text{ to 10 yr.}} = 3.74$; $SD_{7 \text{ to 10 yr.}} = 1.08$ to $M_{\text{to 6 yr.}} = 3.98$; $SD_{\text{to 6 yr.}} = 1.06$. The longer the respondents' company had been in the market, the more often they used open innovation platforms and/or networks because of the ability to share knowledge (from $M_{\text{to 6 yr.}} = 4.14$; $SD_{\text{to 6 yr.}} = 0.88$ to $M_{11 \text{ yr. and more}} = 4.33$; $SD_{11 \text{ yr. and more}} = 0.89$)

and the less often they were driven by the ability to communicate externally with the recipients of their products and/or services (from $M_{to\ 6\ yr.} = 3.2$; $SD_{to\ 6\ yr.} = 1.35$ to $M_{11\ yr.\ and\ more} = 3.07$; $SD_{11\ yr.\ and\ more} = 1.39$). However, the differences between successive groups in terms of the importance of individual factors were not significant. Analysis by Spearman's rank order correlation method showed that there was no statistically significant relationship between how long the company has been in existence and the degree to which they were motivated to use open innovation platforms and/or networks by factors such as access to new technologies: R = 0.05; t(N–2) = 0.96; $p = 0.339$; ability to share knowledge: R = 0.09; t(N–2) = 1.85; $p < 0.065$; sharing of software intellectual property rights: R = 0; t(N–2) = −0.09; $p = 0.931$; support of team software development process: R = 0.01; t(N–2) = 0.19; $p = 0.847$; reducing company operating costs: R = 0.05; t(N–2) = 0.96; $p = 0.337$; reducing time to market product and/or service: R = 0.04; t(N–2) = 0.83; $p = 0.408$; acquisition of external collaboration partners: R = 0.03; t(N–2) = 0.61; $p = 0.54$; complementing each other's different abilities when working with external partners: R = 0.02; t(N–2) = 0.32; $p = 0.747$; and ability to communicate externally with recipients of products and/or services: R = −0.04; t(N–2) = −0.86; $p = 0.391$ (Table 10).

Table 10. Relationship between the duration of the respondents' company and the degree to which they are motivated by individual factors to use open innovation platforms and/or networks.

Factors	How Long the Company Has Been in Existence	Descriptive Statistics—Degree of Motivation						Spearman's Rank Order Correlation
		Mean ± Stand. Dev.	Median (Q25–Q75)	Min.–Max.	Confidence Interval		Stand. Error	
					−95.00%	95.00%		
Access to new technologies	Up to 6 years (n = 80)	4.54 ± 0.79	5 (4–5)	1–5	4.36	4.71	0.09	R = 0.05; t(N–2) = 0.96; $p = 0.339$
	7 to 10 years (n = 111)	4.65 ± 0.72	5 (5–5)	2–5	4.51	4.78	0.07	
	11 and more (n = 211)	4.63 ± 0.78	5 (5–5)	1–5	4.52	4.74	0.05	
Ability to share knowledge	Up to 6 years (n = 80)	4.14 ± 0.88	4 (4–5)	2–5	3.94	4.33	0.1	R = 0.09; t(N–2) = 1.85; $p < 0.065$
	7 to 10 years (n = 111)	4.29 ± 0.85	5 (4–5)	2–5	4.13	4.45	0.08	
	11 and more (n = 211)	4.33 ± 0.89	5 (4–5)	1–5	4.21	4.45	0.06	
Sharing of intellectual property rights to software	Up to 6 years (n = 80)	2.86 ± 1.17	3 (2–3)	1–5	2.6	3.12	0.13	R = 0; t(N–2) = −0.09; $p = 0.931$
	7 to 10 years (n = 111)	2.02 ± 1.18	2 (1–3)	1–5	1.8	2.24	0.11	
	11 and more (n = 211)	2.55 ± 1.25	3 (1–3)	1–5	2.38	2.72	0.09	
Supporting the team process of software development	Up to 6 years (n = 80)	3.51 ± 1.29	4 (3–4)	1–5	3.22	3.8	0.14	R = 0.01; t(N–2) = 0.19; $p = 0.847$
	7 to 10 years (n = 111)	2.71 ± 1.52	3 (1–4)	1–5	2.43	3	0.14	
	11 and more (n = 211)	3.3 ± 1.31	4 (3–4)	1–5	3.12	3.48	0.09	
Reduction in operating costs of the company	Up to 6 years (n = 80)	3.35 ± 1.47	4 (2–5)	1–5	3.02	3.68	0.16	R = 0.05; t(N–2) = 0.96; $p = 0.337$
	7 to 10 years (n = 111)	3.25 ± 1.48	4 (2–5)	1–5	2.97	3.53	0.14	
	11 and more (n = 211)	3.43 ± 1.57	4 (2–5)	1–5	3.21	3.64	0.11	
Reducing time to market of the product/service	Up to 6 years (n = 80)	3.46 ± 1.39	4 (2–5)	1–5	3.15	3.77	0.16	R = 0.04; t(N–2) = 0.83; $p = 0.408$
	7 to 10 years (n = 111)	3.64 ± 1.58	4 (2–5)	1–5	3.34	3.94	0.15	
	11 and more (n = 211)	3.6 ± 1.56	4 (2–5)	1–5	3.39	3.81	0.11	
Acquisition of external partners for cooperation	Up to 6 years (n = 80)	3.96 ± 1.08	4 (3.5–5)	1–5	3.72	4.2	0.12	R = 0.03; t(N–2) = 0.61; $p = 0.54$
	7 to 10 years (n = 111)	3.8 ± 1.06	4 (3–5)	1–5	3.6	4	0.1	
	11 and more (n = 211)	4.02 ± 0.9	4 (4–5)	1–5	3.9	4.14	0.06	
Complementing each other's different skills when working with external partners	Up to 6 years (n = 80)	3.98 ± 1.06	4 (4–5)	1–5	3.74	4.21	0.12	R = 0.02; t(N–2) = 0.32; $p = 0.747$
	7 to 10 years (n = 111)	3.74 ± 1.08	4 (3–4)	1–5	3.54	3.94	0.1	
	11 and more (n = 211)	3.96 ± 0.95	4 (4–5)	1–5	3.83	4.09	0.07	
Ability to communicate externally with the recipients of my products/services	Up to 6 years (n = 80)	3.2 ± 1.35	3 (2–4)	1–5	2.9	3.5	0.15	R = −0.04; t(N–2) = −0.86; $p = 0.391$
	7 to 10 years (n = 111)	3.17 ± 1.43	3 (2–4)	1–5	2.9	3.44	0.14	
	11 and more (n = 211)	3.07 ± 1.39	3 (2–4)	1–5	2.88	3.25	0.1	

Based on the results of the Spearman's rank order correlation analysis, a negative and statistically significant relationship was found between how long the company has been in existence and the degree to which they were hindered from using open innovation platforms and/or networks by a factor in the form of rigidity of work organization: R = −0.14; t(N–2) = −2.85; $p < 0.01$. The direction of this correlation indicates that the longer a company has been in existence in the market, the more they favored less restriction in the use of platforms and/or open innovation networks due to the aforementioned factor, which also follows directly from the distribution of descriptive statistics on the degree of becoming an obstacle by the aforementioned factor in the groups distinguished by the said period. The longer the company that employed the respondents existed, the less of an obstacle for them in using platforms and/or open innovation networks was the rigidity of work organization (from $M_{\text{to 6 yr.}} = 2.66$; $SD_{\text{to 6 yr.}} = 1.14$ to $M_{\text{11 yr. and more}} = 2.17$; $SD_{\text{11 yr. and more}} = 1.26$).

As for the other factors representing barriers to the use of open innovation platforms and/or networks for respondents, no significant relationship was found with how long the company has been in existence. In the different groups distinguished by the aforementioned period, legal barriers constituted an obstacle at levels ranging from $M_{\text{7 to 10 yr.}} = 1.23$; $SD_{\text{7 to 10 yr.}} = 0.73$ to $M_{\text{to 6 yr.}} = 1.85$; $SD_{\text{to 6 yr.}} = 1.21$; communication barriers—respectively from $M_{\text{to 6 yr.}} = 3.16$; $SD_{\text{to 6 yr.}} = 1.13$ to $M_{\text{7 to 10 yr.}} = 4.01$; $SD_{\text{7 to 10 yr.}} = 0.86$; negative attitudes towards open innovation—respectively from $M_{\text{7 to 10 yr.}} = 1.5$; $SD_{\text{7 to 10 yr.}} = 0.95$ to $M_{\text{11 yr. and more}} = 1.83$; $SD_{\text{11 yr. and more}} = 1.19$; reluctance to share knowledge—respectively from $M_{\text{to 6 yr.}} = 3.4$; $SD_{\text{to 6 yr.}} = 1.35$ to $M_{\text{7 to 10 yr.}} = 3.77$; $SD_{\text{7 to 10 yr.}} = 1.31$; NIH syndrome—respectively from $M_{\text{7 to 10 yr.}} = 1.87$; $SD_{\text{7 to 10 yr.}} = 1.12$ to $M_{\text{to 6 yr.}} = 2.18$; $SD_{\text{to 6 yr.}} = 1.22$; lack of internal commitment to the company—respectively from $M_{\text{7 to 10 yr.}} = 2.03$; $SD_{\text{7 to 10 yr.}} = 1.28$ to $M_{\text{11 yr.and more}} = 2.34$; $SD_{\text{11 yr. and more}} = 1.4$; while insufficient support from top management—respectively from $M_{\text{11 yr. and more}} = 3.45$; $SD_{\text{11 yr. and more}} = 1.55$ to $M_{\text{7 to 10 yr.}} = 3.77$; $SD_{\text{7 to 10 yr.}} = 1.42$. The longer the company had been in business, the less of an obstacle were organizational and/or administrative barriers (from $M_{\text{to 6 yr.}} = 2.31$; $SD_{\text{to 6 yr.}} = 1.05$ to $M_{\text{11 yr. and more}} = 2.18$; $SD_{\text{11 yr. and more}} = 1.16$). Differences between successive groups in terms of the degree to which the above-mentioned factors constituted a barrier were found to be insignificant. As Spearman's rank order correlation analysis showed, how long the company has been in existence did not have a statistically significant effect on the degree to which respondents were constrained in their use of open innovation platforms and/or networks by factors such as legal barriers: R = 0; t(N–2) = −0.01; $p = 0.995$; organizational and/or administrative barriers: R = −0.06; t(N–2) = −1.23; $p = 0.218$; communication barriers: R = 0.05; t(N–2) = 0.97; $p = 0.335$; negative attitudes toward open innovation: R = 0.04; t(N–2) = 0.81; $p = 0.42$; reluctance to share knowledge: R = 0.08; t(N–2) = 1.63; $p = 0.104$; NIH syndrome: R = 0.03; t(N–2) = 0.59; $p = 0.553$; lack of internal commitment to the company: R = 0.05; t(N–2) = 0.9; $p = 0.368$; and insufficient top management support: R = −0.05; t(N–2) = −0.98; $p = 0.327$.

4.3. Models of the Importance of Individual Factors Motivating and Hindering the Use of Open Innovation Platforms and/or Networks in the ICT Industry in Relation to the Job Position Held

Finally, an attempt was made to build models of the significance of the factors motivating and hindering the use of platforms and/or networks for open innovation in the ICT industry across occupational groups using a PROFIT (PROperty FITting) analysis. This was aimed at finding out the situation of people employed in different positions in terms of the most and least favorable conditions for using the above-mentioned solutions.

4.3.1. Factors Motivating the Use of Open Innovation Platforms and/or Networks

To begin with, a model was developed on the factors motivating the use of open innovation platforms and/or networks, and the first step in building this model was multidimensional scaling, which was used to develop a graphic representation of the structure of similarity (or dissimilarity) between the analyzed objects in relation to a selected set of variables (characteristics). The analyzed objects in this model were individual

occupational groups, such as administrative worker, specialist/analyst, programmer and manager/management.

On the other hand, the variables (features) were the individual factors motivating the use of open innovation platforms and/or networks, such as access to new technologies (M1), ability to share knowledge (M2), sharing of intellectual property rights to software (M3), support of the team process of software development (M4), reduction in the company's operating costs (M5), reduction in the time to market the product/service (M6), acquisition of external partners for cooperation (M7), complementing each other's different skills when working with external partners (M8), and possibility of external communication with the recipients of my products/services (M9).

The average ratings of the degree of motivation by each factor for the use of platforms and/or open innovation networks indicated in the surveyed professional groups were used to develop the model. The above data are represented in Table 11.

Table 11. Average degree to which respondents were motivated by individual factors to use open innovation platforms and/or networks in groups distinguished by job type.

	Administrative Worker	Specialist/Analyst	Programmer	Manager/Board
Access to new technologies (M1)	4.23	4.50	4.94	4.81
Ability to share knowledge (M2)	3.97	4.26	4.38	4.58
Sharing of intellectual property rights to software (M3)	1.88	2.59	2.55	2.43
Supporting the team process of software development (M4)	2.03	2.85	4.01	3.29
Reducing the cost of operating the company (M5)	4.09	3.79	1.71	4.72
Reducing the time to market a product/service (M6)	4.79	3.83	1.90	4.77
Acquiring external partners for collaboration (M7)	3.29	4.03	4.18	4.14
Complementing each other's different skills when working with external partners (M8)	3.15	4.04	4.18	4.07
Ability to communicate externally with the recipients of my products/services (M9)	4.50	3.44	1.90	3.16

The identical nature of the analyzed characteristics (5-point Likert scale) as variables precluded the need to standardize them. During multidimensional scaling, the classical Euclidean distance was used and, as a result, the nine features describing the four objects under study were reduced to two dimensions. The *STRESS* coefficient for multidimensional scaling considering all features was 0.00, which meant high reliability of the results of the multidimensional scaling procedure.

In the next step, the match of individual objects was verified. Accordingly, the results of the regression analysis were evaluated, in which the dependent variable was the individual factors motivating the use of platforms and/or open innovation networks, and the independent variables were the values of the two dimensions for each entity obtained by multidimensional scaling: Dimension 1 and Dimension 2. The above analysis showed that most of the factors studied had a very high impact on the differentiation of the units studied ($R^2 > 0.90$). The lowest, but also very high, matching was observed in the case of software IPR sharing (M3) ($R^2 = 0.83$). Therefore, there was no need to limit the number of features studied in the model (Table 12).

Table 12. The results of the regression analysis between the individual motivating factors for the use of platforms and/or open innovation networks and the dimensions of the studied units obtained from the regression analysis.

	Absolute Term		Dim. 1		Dim. 2		R^2
	b0	*p*	b	*p*	b	*p*	
Access to new technologies (M1)	4.620	$p < 0.05$	0.248	$p = 0.224$	0.294	$p = 0.248$	0.93
Ability to share knowledge (M2)	4.300	$p < 0.01$	0.079	$p = 0.488$	0.333	$p = 0.188$	0.92
Sharing of intellectual property rights to software (M3)	2.366	$p < 0.05$	0.175	$p = 0.44$	0.363	$p = 0.31$	0.83
Supporting the team process of software development (M4)	3.043	$p < 0.05$	0.748	$p < 0.082$	0.650	$p = 0.124$	0.99
Reducing the cost of operating the company (M5)	3.580	$p < 0.05$	–1.347	$p = 0.125$	0.450	$p = 0.424$	0.96
Reducing the time to market a product/service (M6)	3.823	$p < 0.05$	–1.430	$p = 0.157$	0.027	$p = 0.964$	0.94
Acquiring external partners for collaboration (M7)	3.912	$p < 0.01$	0.239	$p = 0.12$	0.504	$p < 0.076$	0.99
Complementing each other's different abilities when working with external partners (M8)	3.861	$p < 0.05$	0.284	$p = 0.201$	0.556	$p = 0.138$	0.97
Being able to communicate externally with the recipients of my products/services (M9)	3.251	$p < 0.01$	–1.039	$p < 0.05$	–0.685	$p < 0.05$	1.00

The final step in building a model on the motivating factors for the use of platforms and/or open innovation networks in different professional groups was a PROFIT analysis, and the result is shown in the chart below (Figure 3). The model developed showed that managers and management and specialists and analysts using platforms and/or open innovation networks were driven by the greatest number of motivating factors, with the latter group being slightly more important. This was especially true in terms of lowering the company's operating costs (M5) and reducing the time to market a product and/or service to market (M6), but also of relatively high importance to both groups (with specialists and analysts also more important) were factors such as the opportunity to share knowledge (M2), sharing intellectual property rights to software (M3), acquisition external collaboration partners (M7) and complementing each other's different skills when working with external partners (M8). The latter four factors definitely did not motivate the use of platforms and/or open innovation networks of administrative staff, for whom the ability to communicate externally with the recipients of products and/or services was much more important (M9). Programmers, on the other hand, were most motivated to use the aforementioned solutions by access to new technologies (M1) and support for the team software development process (M4), but given the placement of this group in relation to the coordinates of the directional coefficients M1 and M4, it should be borne in mind that the importance of both of these factors in the context of programmers' use of open innovation platforms and/or networks was not relatively high.

Comparing the results to other studies, conducted in Finland, Spain, the Netherlands, China and Italy [50], it is possible to point to similarities in terms of lowering company operating costs and getting a product or service to market faster as motivating factors for using OI platforms/networks. These studies [50] indicate that by using OI platforms/networks, companies can share the cost of developing innovations, which in turn can increase production and lower the price of the product/service. Research on OI platforms/networks in Western, mainly American, settings indicates that access to new global markets is the most important motivating factor [51]. This increases the dynamics of OI platforms/networks

and makes them an agent for monetization on a global scale. This is also supported by studies conducted in Finland and Italy [18,20], which suggest that reciprocal involvement in innovation activities using OI platforms/networks can offer more benefits to their users. Other studies conducted in Italy [19] emphasize the importance of the factor of attracting external collaboration partners and complementing each other's knowledge. They point out that OI platforms/networks support knowledge co-creation processes and enhance collaboration and participation in new projects [19].

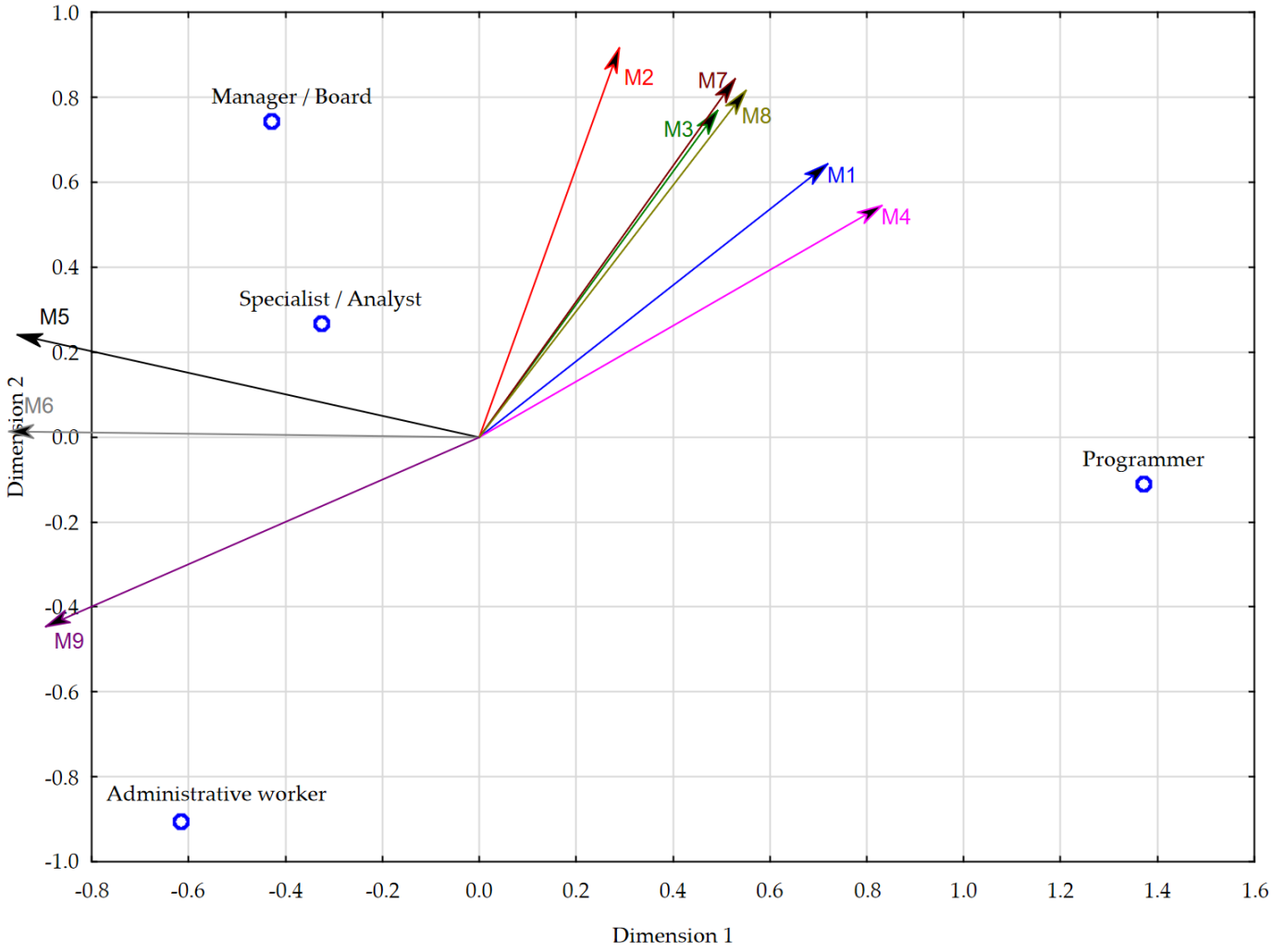

Figure 3. Biplot incorporating the result of multidimensional scaling based on individual factors motivating the use of open innovation platforms and/or networks.

4.3.2. Factors Hindering the Use of Open Innovation Platforms and/or Networks

Next, a model was developed on the factors that constitute obstacles to the use of open innovation platforms and/or networks. Analogous to the previous model, the first step in building a model on barriers to the use of the above-mentioned solutions was multidimensional scaling. The analyzed objects in this model were, as in the previous model, individual occupational groups. On the other hand, the variables (features) were individual factors that constitute barriers to the use of open innovation platforms and/or networks, such as legal barriers (O1), organizational/administrative barriers (O2), communication barriers (O3), negative attitudes toward open innovation (O4), reluctance to share knowledge (O5), NIH syndrome (O6), rigidity of work organization (O7), lack of internal commitment to the company (O8) and insufficient support from top management (O9).

To develop the model, we used the average ratings of the degree to which individual factors constitute an obstacle to the use of open innovation platforms and/or networks indicated in the surveyed professional groups, the values of which are presented below (Table 13).

Table 13. Average degree of barriers to the surveyed by individual factors in the use of open innovation platforms and/or networks in groups distinguished by type of occupation.

	Administrative Worker	Specialist/Analyst	Programmer	Manager/Board
Legal barriers (O1)	1.62	1.91	1.15	1.42
Organizational/administrative barriers (O2)	2.82	2.53	1.90	1.48
Communication barriers (O3)	3.69	3.18	3.95	3.84
Negative attitudes toward open innovation (O4)	1.81	1.82	1.26	2.17
Reluctance to share knowledge (O5)	3.23	3.47	4.06	4.23
NIH syndrome (O6)	1.99	2.33	1.47	2.80
Rigidity of work organization (O7)	2.81	2.52	2.08	1.52
Lack of internal commitment to the company (O8)	2.29	2.54	1.40	3.14
Insufficient support from top management (O9)	4.24	3.46	4.48	1.51

Due to the equal nature of the analyzed characteristics (5-point Likert scale) as variables, there was no need to standardize them. Analogously, as before, during multidimensional scaling, the classical Euclidean distance was used. The STRESS coefficient for multidimensional scaling considering all features was 0.00, which is equivalent to high reliability of the results.

In the next step, the match of individual objects was checked. For this purpose, the results of the regression analysis were evaluated, in which the dependent variable was the individual factors that were barriers to the use of platforms and/or open innovation networks, and the independent variables were the values of the two dimensions for each entity obtained by multidimensional scaling: Dimension 1 and Dimension 2. Based on this analysis, it was found that most of the factors studied had a very high impact on the variation of the units studied ($R^2 > 0.90$). The lowest impact was recorded for communication barriers (O3), but it remained at a level that was also high ($R^2 = 0.71$). Such results eliminated the need to drop any of the features in the model (Table 14).

Finally, in order to build a model on the motivating factors for the use of platforms and/or open innovation networks among different professional groups, a PROFIT analysis was conducted, and the result is shown below (Figure 4). The model thus developed showed that for administrative employees, organizational and administrative barriers (O2) were a particular obstacle to the use of platforms and/or open innovation networks. This factor was a relatively large disadvantage for specialists and analysts as well. In addition, both groups (administrative employees and specialists and analysts) faced significant obstacles in the form of rigidity of work organization (O7) and legal barriers (O1). For programmers, the biggest obstacles were communication barriers (O3) and insufficient support from top management (O9). The latter factor, for obvious reasons, was decidedly not an obstacle for managers and the board of directors, while in this group the bigger obstacles to using open innovation platforms and/or networks were factors such as reluctance to share knowledge (O5), NIH syndrome (O6), lack of internal commitment to the company (O8) and negative attitudes toward open innovation (O4).

Table 14. The results of the regression analysis between the various factors that are barriers to the use of open innovation platforms and/or networks and the dimensions of the units under study obtained from the regression analysis.

	Absolute Term		Dim. 1		Dim. 2		R^2
	b0	*p*	b	*p*	b	*p*	
Legal barriers (O1)	1.522	$p < 0.05$	–0.001	$p = 0.995$	–0.429	$p = 0.175$	0.93
Organizational/administrative barriers (O2)	2.182	$p < 0.05$	–0.439	$p = 0.208$	–0.611	$p = 0.19$	0.95
Communication barriers (O3)	3.666	$p < 0.05$	0.054	$p = 0.835$	0.395	$p = 0.369$	0.71
Negative attitudes toward open innovation (O4)	1.765	$p < 0.05$	0.352	$p < 0.083$	–0.281	$p = 0.13$	0.99
Reluctance to share knowledge (O5)	3.749	$p < 0.05$	0.284	$p = 0.275$	0.531	$p = 0.193$	0.94
NIH syndrome (O6)	2.147	$p < 0.05$	0.55	$p < 0.096$	–0.337	$p = 0.192$	0.98
Rigidity of work organization (O7)	2.231	$p < 0.05$	–0.462	$p = 0.181$	–0.491	$p = 0.213$	0.95
Lack of internal commitment to the company (O8)	2.343	$p < 0.01$	0.689	$p < 0.05$	–0.517	$p < 0.05$	1
Insufficient support from top management (O9)	3.423	$p < 0.05$	–1.472	$p < 0.098$	0.088	$p = 0.811$	0.98

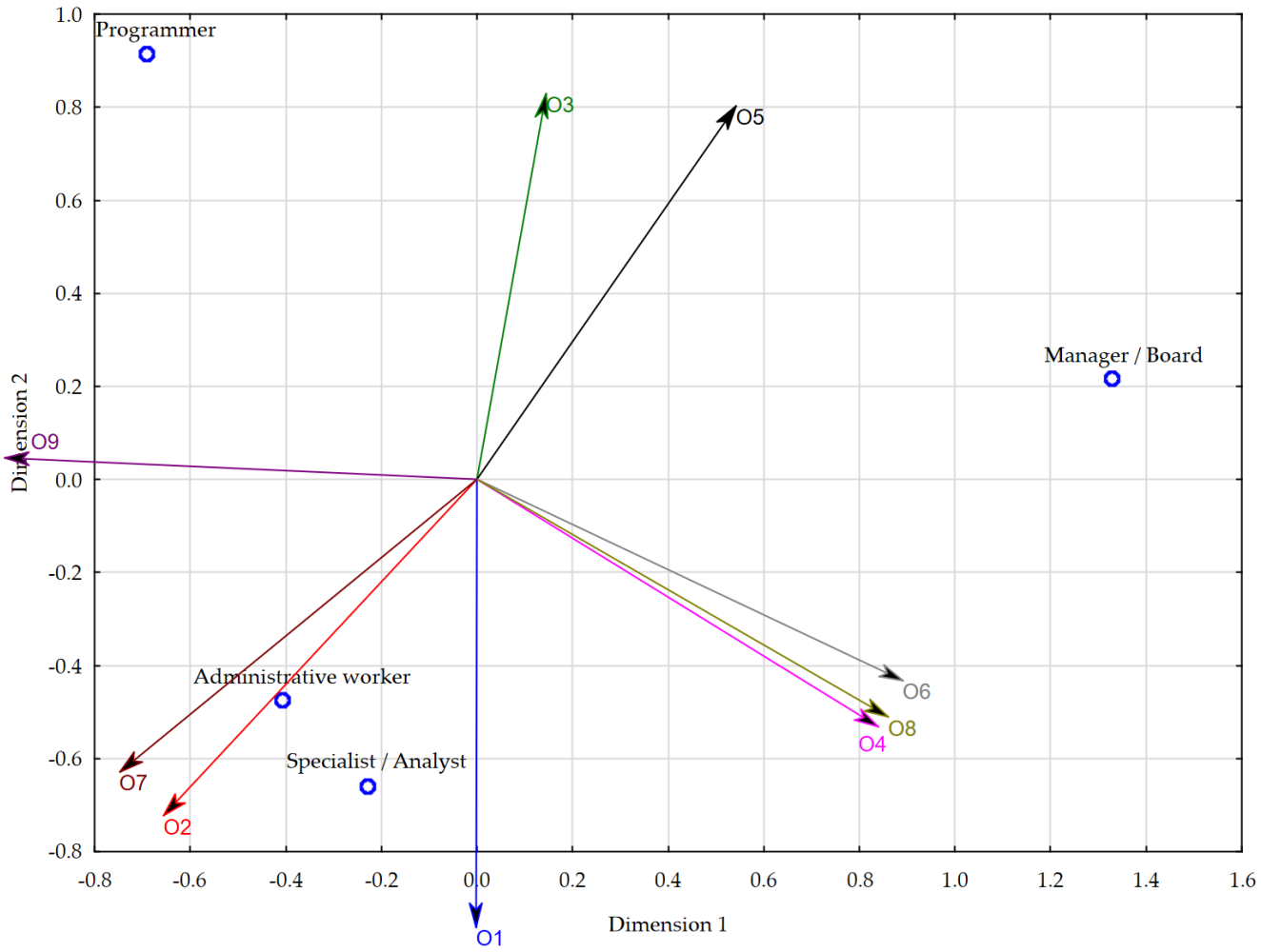

Figure 4. Biplot considering the result of multidimensional scaling based on individual factors that are obstacles to the use of platforms and/or open innovation networks.

Comparing the results to other studies, conducted in Finland, Spain, the Netherlands, China and Italy [50], a certain convergence can be identified in the case of high impact of organizational and administrative barriers. These studies [50] indicate that strong bureaucracy amplifies the phenomenon of fear and reluctance to undertake changes and use of OI platforms/networks. Studies conducted in Western countries and the US [51], on the other hand, indicate a strong impact of the barrier related to the factor of reluctance to share knowledge, which was not as strongly emphasized in the present study. For companies using OI platforms/networks, the most important issue was what to disclose and what to hide [51]. In this approach, knowledge is treated as a valuable, rare and unique source of competitive advantage. Research in Germany [16] identifies the biggest barriers as lack of internal employee commitment, lack of management support, and problems with cooperation and communication with external partners. The first of these factors was not strongly emphasized in this study, while the second and third were similarly highly perceived but only by programmers. NIH syndrome comes second in the study [16], which was also highly rated in the present research, but only by managers and management. Perhaps combining internal and external knowledge very early in the integration process would help prevent reluctance and distrust towards external knowledge.

5. Conclusions

5.1. Theoretical Contribution

Employees in the ICT industry in Poland are most motivated to use platforms and/or open innovation networks by factors such as access to new technologies, ability to share knowledge, acquisition of external cooperation partners, and complementing each other's different skills when working with external partners.

The biggest obstacles for employees in the ICT industry in using open innovation platforms and/or networks are communication barriers, reluctance to share knowledge, and insufficient support from top management.

When deciding to use open innovation platforms and/or networks, men are more likely to be driven by access to new technologies and support for the team process of software development, while women are more likely to be motivated by lowering the cost of operating a company, reducing the time to market a product and/or service, and the ability to communicate externally with recipients of products and/or services. At the same time, men perceive fewer obstacles to the use of open innovation platforms and/or networks than women. For men, such obstacles are more often communication barriers and reluctance to share knowledge; for women, such obstacles are legal barriers, organizational and/or administrative barriers, negative attitudes toward open innovation, rigidity of work organization and lack of internal commitment to the company.

Older ICT employees, when deciding to use open innovation platforms and/or networks, are more driven by access to new technologies, the ability to share knowledge, and the ability to acquire external collaboration partners; younger employees, respectively, by the sharing of intellectual property rights to software, support for the collaborative software development process, and the ability to communicate externally with product and/or service recipients. For older employees, communication barriers and reluctance to share knowledge are a greater obstacle to using the above solutions; for younger employees, legal barriers, organizational and/or administrative barriers, rigidity of work organization, and lack of internal commitment to the company, respectively.

The job position held by employees in the ICT industry is relevant to each of the factors motivating them to use open innovation platforms and/or networks. Programmers and managers and management are more motivated to use the above-mentioned solutions by access to new technologies. Managers and management also pay attention to the possibility of sharing knowledge and lowering the cost of the company's functioning, while programmers pay attention to the support of the team process of software development. For administrative staff, factors such as sharing intellectual property rights to software, obtaining external cooperation partners and complementing each other's different skills

when working with external partners are less important; they attribute greater significance to the ability to communicate externally with recipients of products and/or services. In contrast, reducing the time to market a product and/or service motivates programmers and specialists and analysts less than administrative staff and managers and management.

The job position held by employees in the ICT industry is relevant to each of the factors that are barriers to their use of open innovation platforms and/or networks. Managers and management, as well as programmers, are less likely to restrict the use of the aforementioned solutions due to organizational and/or administration barriers; more often due to reluctance to share knowledge. For specialists and analysts, legal barriers and the NIH syndrome (the latter is a fairly big barrier for managers and management as well) are a bigger obstacle. For programmers, a smaller obstacle is negative attitudes toward open innovation and lack of internal commitment to the company. In contrast, insufficient support from top management is a big obstacle for administrative staff and programmers.

A larger number of employees in a company foster greater restrictions on its employees' use of open platforms and/or networks due to negative attitudes toward open innovation and lack of internal commitment to the company. In contrast, none of the factors motivating ICT employees to use the above-mentioned solutions is dependent on the number of people employed at their company.

How long the company has been in existence in the market is conducive to fewer restrictions on its employees' use of open platforms and/or networks due to rigidity of work organization. On the other hand, none of the factors motivating ICT employees to use the aforementioned solutions is dependent on the duration of their company's existence in the market.

Managers and management, as well as specialists and analysts, are most eager to use open innovation platforms and/or networks, seeing in these types of solutions the opportunity to reduce the cost of operating the company, share intellectual property rights to software, the ability to share knowledge, acquire external partners for collaboration, and complement each other's different abilities when collaborating with them. Administrative employees are much more eager to use open innovation platforms and/or networks, seeing these solutions as an opportunity to communicate externally with recipients of products and/or services. Programmers, on the other hand, are more likely to use the aforementioned solutions having access to new technologies and support for the team software development process thanks to them.

Administrative employees and specialists and analysts find it particularly difficult to use platforms and/or open innovation networks under similar conditions, i.e., encountering organizational and administrative barriers, legal barriers and rigidity of work organization. Programmers are especially hampered in using the platform and/or open innovation networks by communication barriers and insufficient support from top management. Managers and management, on the other hand, find it most difficult to use the aforementioned solutions having to deal with reluctance to share knowledge, NIH syndrome, lack of internal commitment to the company and negative attitudes towards open innovation.

5.2. Practical Implications

Based on the research, it is possible to identify practical tips that can be useful for managers in the ICT industry in Poland to make optimal use of OI access. First, from the point of view of positively motivating employees to use OI platforms/networks, it is worth paying attention to promoting open and free access to information about new technologies. Second, it is worthwhile to plan, support and reward various methods of knowledge sharing both among the company's employees and during their cooperation with the external environment. Thirdly, it is worth noting that, based on the results of the survey, cooperation with external partners is related to complementing each other's skills, which is important for improving employees' qualifications.

Analyzing the obstacles that ICT employees indicate in the use of OI platforms and/or networks, it is necessary to point out in the first place the communication barriers that prevail in the opinions of respondents. This is a valuable indication for managers, who can take efforts towards a detailed diagnosis of these barriers and building a further strategy that takes this problem into account. Another barrier identified concerns the lack of willingness to share knowledge among employees. This confirms the earlier considerations regarding motivational factors. On the one hand, the opportunity to share knowledge has a positive impact, while on the other hand, unwillingness to share knowledge is a barrier. It can be assumed that some employees may treat their knowledge as a competitive advantage, which provides a basis for building and/or modifying human resource management strategies towards solving this problem.

The vast majority of respondents in non-managerial positions cite insufficient support from top management as another significant barrier to using OI platforms and/or networks. It is interesting that those in managerial positions do not notice this barrier. Therefore, what we have here is a diversity of perceptions of this phenomenon depending on the position held. Employees point to insufficient support, and management is convinced that it is making every effort in this regard. Managers should revise perceptions of this phenomenon and strive to identify the actual support needs of employees.

The results of the survey indicate that organizational, administrative and legal barriers, as well as the rigidity of work organization, are significant obstacles to the use of OI platforms and/or networks for administrative staff, specialists and analysts. However, the above barriers are not recognized by management and programmers. Here, we have another variation in the perception of barriers depending on the position. At this point, it is worth advising managers in the ICT industry to conduct a thorough analysis of the organizational structure and interviews with employees in terms of the barriers mentioned above.

5.3. Limitations and Future Research

This paper has some limitations. First, this research was conducted only in Poland, and second, only in the ICT industry. This industry, similar to any other, has its own peculiarities. It can be said that it is accompanied by OI on a daily basis and employees treat them as an integral part of the structure. From the point of view of the continuation of the research, it seems interesting to compare the results obtained with other industries and countries.

Funding: This research received no external funding.

Institutional Review Board Statement: According to our University Ethical Statement, following, the following shall be regarded as research requiring a favorable opinion from the Ethic Commission in the case of human research (based on document in polish: https://prawo.polsl.pl/Lists/Monitor/Attachments/7291/M.2021.501.Z.107.pdf (accessed on 01 September 2022)): research in which persons with limited capacity to give informed or research on persons whose capacity to give informed or free consent to participate in research and who have a limited ability to refuse research before or during their implementation, in particular: children and adolescents under 12 years of age, persons with intellectual disabilities, persons whose consent to participate in the research may not be fully voluntary prisoners, soldiers, police officers, employees of companies (when the survey is conducted at their workplace), persons who agree to participate in the research on the basis of false information about the purpose and course of the research (masking instruction, i.e., deception) or do not know at all that they are subjects (in so-called natural experiments); research in which persons particularly susceptible to psychological trauma and mental health disorders are to participate mental health, in particular: mentally ill persons, victims of disasters, war trauma, etc., patients receiving treatment for psychotic disorders, family members of terminally or chronically ill patients; research involving active interference with human behavior aimed at changing it research involving active intervention in human behavior aimed at changing that behavior without direct intervention in the functioning of the brain, e.g., cognitive training, psychotherapy psychocorrection, etc. (this also applies if the intended intervention is intended to benefit the subject (e.g., to improve his/her memory)); research

concerning controversial issues (e.g., abortion, in vitro fertilization, death penalty) or requiring particular delicacy and caution (e.g., concerning religious beliefs or attitudes towards minority groups); research that is prolonged, tiring, physically or mentally exhausting. Our research was not conducted on humans meeting the mentioned condition. Any of the researched humans: any of them had limited capacity to be informed, any of them had been susceptible to psychological trauma and mental health disorders, the research did not concern the mentioned-above controversial issues, the research was not prolonged, tiring, physically or mentally exhausting.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Kościelniak, H. Open innovation in enterprise development strategies—Empirical research results. *Hum. Univ. Res. Papers Manag.* **2019**, *20*, 121–133. [CrossRef]
2. Chesbrough, H.W.; Bogers, M.L. Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation. In *New Frontiers in Open Innovation*; Chesbrough, H.W., Vanhaverbeke, W., West, J., Eds.; Oxford University Press: Oxford, UK, 2014; pp. 3–28. [CrossRef]
3. Wolniak, R.; Jonek-Kowalska, I. The level of the quality of life in the city and its monitoring. *Innov. Eur. J. Soc. Sci. Res.* **2021**, *34*, 376–398. [CrossRef]
4. Stuss, M.M.; Makieła, Z.J.; Stańczyk, I. Role of Competences of Graduates in Building Innovations via Knowledge Transfer in the Part of Carpathian Euroregion. *Sustainability* **2020**, *12*, 10592. [CrossRef]
5. Marszałek-Kotzur, I. Cognitive Technologies—Are We in Danger of Humanizing Machines and Dehumanizing Humans? *Manag. Syst. Prod. Eng.* **2022**, *30*, 269–275. [CrossRef]
6. Bugdol, M.; Nagody-Mrozowicz, K. *Management, Organization and Fear: Causes, Consequences and Strategies*; Routledge: London, UK, 2022; pp. 1–152.
7. Kuzior, A.; Postrzednik-Lotko, K.A.; Postrzednik, S. Limiting of Carbon Dioxide Emissions through Rational Management of Pro-Ecological Activities in the Context of CSR Assumptions. *Energies* **2022**, *15*, 1825. [CrossRef]
8. Ober, J. *Adaptation of Innovation in the Light of Organizational Behavior—Selected Aspects*; Wydawnictwo Politechniki Śląskiej: Gliwice, Poland, 2022; pp. 1–422. [CrossRef]
9. Żukowska, J.; Pindelski, M. Rola innowacji w zarządzaniu organizacjami-studium przypadku. In *Nowoczesność Przemysłu i usług—Współczesne Wyzwania i Uwarunkowania Rozwoju Przemysłu i Usług*; Pyka, J., Ed.; TNOIK: Katowice, Poland, 2010; pp. 1–20.
10. Roszkowska-Menkers, M. *Otwarte Innowacje: W Poszukiwaniu Równowagi*; Oficyna Wydawnicza SGH: Warsaw, Poland, 2015.
11. Schroll, A.; Mild, A. A critical review of empirical research on open innovation adoption. *J. Betr. Manag. Rev. Q.* **2012**, *62*, 85–118. [CrossRef]
12. Zastempowski, M. The innovative potential of polish enterprises. *Acta Univ. Nicolai Copernici* **2014**, *1*, 27–37. [CrossRef]
13. Rauter, R.; Globocnik, D.; Perl-Vorbach, E.; Baumgartner, R.J. Open innovation and its effects on economic and sustainability innovation performance. *J. Innov. Knowl.* **2019**, *4*, 226–233. [CrossRef]
14. Ferraris, A.; Santoro, G.; Papa, A. The cities of the future: Hybrid alliances for open innovation projects. *Futures* **2018**, *103*, 51–60. [CrossRef]
15. West, J.; Bogers, M. Open innovation: Current status and research opportunities. *Innov. Organ. Manag.* **2017**, *19*, 43–50. [CrossRef]
16. Weissenberger-Eibl, M.A.; Hampel, T. Bridging the gap: Integrating external knowledge from open innovation platforms. *SN Bus. Econ.* **2021**, *1*, 98. [CrossRef]
17. Yun, J.J.; Liu, Z. Micro- and Macro-Dynamics of Open Innovation with a Quadruple-Helix Model. *Sustainability* **2019**, *11*, 3301. [CrossRef]
18. Raunio, M.; Nordling, N.; Kautonen, M.; Rasanen, P. Open Innovation Platforms as a Knowledge Triangle Policy Tool—Evidence from Finland. *Foresight STI Gov.* **2018**, *12*, 62–76. [CrossRef]
19. Abbate, T.; Codini, A.P.; Aquilani, B. Knowledge co-creation in Open Innovation Digital Platforms: Processes, tools and services. *J. Bus. Ind. Mark.* **2019**, *34*, 1434–1447. [CrossRef]
20. Troise, C.; Matricano, D.; Sorrentino, M. Open Innovation Platforms: Exploring the importance of knowledge in supporting online initiatives. *Knowl. Manag. Res. Pract.* **2021**, *19*, 208–216. [CrossRef]
21. Wu, I.-L.; Hu, Y.-P. Open innovation based knowledge management implementation: A mediating role of knowledge management design. *J. Knowl. Manag.* **2018**, *22*, 1736–1756. [CrossRef]
22. Lee, S.M.; Trimi, S. Convergence innovation in the digital age and in the COVID-19 pandemic crisis. *J. Bus Res.* **2021**, *123*, 14–22. [CrossRef]
23. Poznańska, K. *Nowe Formy Innowacji*; Oficyna Wydawnicza SGH: Warsaw, Poland, 2018.
24. Gajewski, Ł. Otwarte innowacje jako nowy paradygmat w procesach innowacyjnych. *Stud. Prace Praw. Adm. Ekon.* **2010**, *7*, 55–66.

25. Lombardi, M.; Pascale, F.; Santaniello, D. EIDS: Embedded Intrusion Detection System using Machine Learning to Detect Attack over the CAN-BUS. In Proceedings of the 30th European Safety and Reliability Conference and the 15th Probabilistic Safety Assessment and Management Conference, Venice, Italy, 1–5 November 2020. [CrossRef]
26. Brodny, J.; Tutak, M. Analyzing the Level of Digitalization among the Enterprises of the European Union Member States and Their Impact on Economic Growth. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 70. [CrossRef]
27. Brodny, J.; Tutak, M. The Use of the Open Innovation Concept to Develop a Method to Improve Safety during the Mining Production Process: A Case Study of the Integration of University and Industry. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 75. [CrossRef]
28. McCausland, T. COVID-19′s Impact on Globalization and Innovation. *Res. Technol. Manag.* **2020**, *63*, 54–59. [CrossRef]
29. Yun, J.J.; Zhao, X.; Jung, K.; Yigitcanlar, T. The Culture for Open Innovation Dynamics. *Sustainability* **2020**, *12*, 5076. [CrossRef]
30. Huggins, R.; Prokop, D.; Thompson, P. Universities and open innovation: The determinants of network centrality. *J. Technol. Transf.* **2020**, *45*, 718–757. [CrossRef]
31. Ankrah, S.; AL-Tabbaa, O. Universities—Industry collaboration: A systematic review. *Scand. J. Manag.* **2015**, *31*, 387–408. [CrossRef]
32. Onetti, A. Turning open innovation into practice: Trends in European corporates. *J. Bus. Strat.* **2021**, *42*, 51–58. [CrossRef]
33. Ferraris, A.; Santoro, G.; Bresciani, S. Open innovation in multinational companies' subsidiaries: The role of internal and external knowledge. *Eur. J. Int. Manag.* **2017**, *11*, 452–468. [CrossRef]
34. Tutak, M.; Brodny, J. Business Digital Maturity in Europe and Its Implication for Open Innovation. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 27. [CrossRef]
35. Gomes, S.; Lopes, J.M.; Ferreira, L.; Oliveira, J. Science and Technology Parks: Opening the Pandora's Box of Regional Development. *J. Knowl. Econ.* **2022**, *3*, 1–24. [CrossRef]
36. Lewin, A.Y.; Välikangas, L.; Chen, J. Enabling Open Innovation: Lessons from Haier. *Int. J. Innov. Stud.* **2017**, *1*, 5–19. [CrossRef]
37. Koźlak, A. Mobility-as-a service jako postęp w integracji transportu. *Prace Kom. Geogr. Komun.* **2020**, *23*, 7–17. [CrossRef]
38. Chrzanowski, M.; Zawada, P. *Otwarte Innowacje i Ich Wykorzystanie w Przedsiębiorstwach Typu Start-Up*; Oficyna Wydawnicza Politechniki Rzeszowskiej: Rzeszów, Poland, 2018.
39. Creswell, J.W. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*; Sage: Los Angeles, CA, USA, 2009.
40. Sułek, A. *Ogród Metodologii Socjologicznej*; Scholar: Warsaw, Poland, 2002.
41. Brzeziński, J. *Metodologia Badań Psychologicznych*; PWN: Warsaw, Poland, 2002.
42. Jurczak, J.; Jurczak, G. *Zastosowanie Analizy Czynnikowej w Obszarze Zarządzania Przedsiębiorstwem*; OWPW: Warsaw, Poland, 2021.
43. Stanisz, A. *Przystępny Kurs Statystyki z Zastosowaniem STATISTICA PL na Przykładach z Medycyny. Tom 1. Statystyki Podstawowe*; StatSoft Polska: Cracow, Poland, 2006.
44. Panczyk, M. Prezentacja Podstawy Biostatystyki 9a. Miary Wielkości Efektu. Available online: https://www.authorstream.com/Presentation/panstudio-2620824-9a-miary-wielko-ci-efektu-dla-por-wna-dw-ch-grup/ (accessed on 25 June 2022).
45. Panczyk, M. Prezentacja Podstawy Biostatystyki 9b. Miary Wielkości Efektu. Available online: https://www.authorstream.com/Presentation/panstudio--2657958--9b--wielko--efektu/ (accessed on 25 June 2022).
46. Stanisz, A. *Przystępny Kurs Statystyki z Zastosowaniem STATISTICA PL na Przykładach z Medycyny. Tom 3. Analizy Wielowymiarowe*; StatSoft Polska: Cracow, Poland, 2007.
47. Zaborski, A. Analiza PROFIT i Jej Wykorzystanie w Badaniu Preferencji. In *Taksonomia 19. Klasyfikacja i Analiza Danych—Teoria i Zastosowania*; Jajuga, K., Walesiak, M., Eds.; Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu: Wrocław, Poland, 2012; pp. 487–494.
48. Mynarski, S. *Praktyczne Metody Analizy Danych Rynkowych i Marketingowych*; Kantor Wydawniczy Zakamycze: Cracow, Poland, 2000.
49. Główny Urząd Statystyczny. Available online: https://stat.gov.pl/obszary-tematyczne/rynek-pracy/pracujacy-zatrudnieni-wynagrodzenia-koszty-pracy/pracujacy-i-wynagrodzenia-w-gospodarce-narodowej-dane-ostateczne-w-2020-r-,17,5.html (accessed on 25 June 2022).
50. Ojasalo, J.; Kauppinen, H. Collaborative Innovation with External Actors: An Empirical Study on Open Innovation Platforms in Smart Cities. *Technol. Innov. Manag. Rev.* **2016**, *6*, 49–60. [CrossRef]
51. Nambisan, S.; Siegel, D.; Kenney, M. On open innovation, platforms, and entrepreneurship. *Strateg. Entrep. J.* **2018**, *12*, 354–368. [CrossRef]