Journal of
Risk and Financial Management

MDPI

Article

Management of the Company's Innovation Development: The Case for Polish Enterprises

Marek Dziura * and Tomasz Rojek *

Department of Economics and Organization of Enterprises, Cracow University of Economics, 27 Rakowicka St., 31-510 Cracow, Poland
* Correspondence: dziuram@uek.krakow.pl (M.D.); rojekt@uek.krakow.pl (T.R.)

Abstract: Management of innovation processes in a company is a field that is still not sufficiently researched and applied in practice. Managers in companies often do not know about modern techniques and design tools for creating innovation processes and about the possibility of their effective usage for management and in decision-making conditions. Therefore the main aim of the paper is to present contemporary theoretical and practical achievements in the field of innovation management, which focus on the area of innovation processes and emphasize the possibilities of managing innovation processes in business. The practical purpose of this study was to analyze the state and development of innovativeness of a selected group of Polish enterprises. The following methods were used in the work: a critical analysis of the literature, deductive methods, CAWI method (Computer Assisted Web Interview), and synthesis of measurement results of analytical indicators in selected functional areas of the studied enterprises. The conclusion was that for several years, it is clearly visible that a small group of innovative companies has formed in Poland that constantly increases its expenditure on innovative activities including research and development. In addition, the expenditures incurred are at a very decent level when compared to the European Union (EU) average, which suggests that these companies are competitive not only at the country level, but also outside it.

Keywords: competitiveness; innovation management; innovativeness

Citation: Dziura, Marek, and Tomasz Rojek. 2021. Management of the Company's Innovation Development: The Case for Polish Enterprises. *Journal of Risk and Financial Management* 14: 156. https://doi.org/10.3390/jrfm14040156

Academic Editor: Timo Kuosmanen

Received: 27 February 2021
Accepted: 30 March 2021
Published: 2 April 2021

1. Introduction

Currently, aspects of competitiveness and innovativeness are probably among the most frequently exercised conversations relating to discussions about economic progress and prosperity. Numerous studies have highlighted the crucial importance of innovation to economic development and well-being (e.g., McArthur and Sachs 2003; Porter 1990; Rutten and Boekema 2005; Blanke et al. 2003; OECD 1992; Lööf and Heshmati 2006). It is accepted that one must be innovative in order to be competitive. It should be noted though that innovation can be interpreted in different ways (Frascati Manual, OECD 2002; Oslo Manual, OECD 2005; Rogers 1998). Different interpretations of innovation make for an imposing obstacle when researching this subject. As a consequence, the same is true of the notion of innovativeness, along with the recognition of means that enhance its levels. Since innovativeness is considered to be a complex issue, and its measurement is not possible within the framework of accepted definitions of innovativeness, indicators and indexes are used in order to "quantify" this construct (e.g., Dosi et al. 1988; Archibugi and Coco 2005; Innovation Union Scoreboard, European Commission (2011); Sajeva et al. 2005; Freudenberg 2003; Saisana and Tarantola 2002; Katz 2006; Arundel and Hollanders 2005; Schibany and Streicher 2008). This makes it possible to "measure" levels of innovativeness and rank countries with respect to their dedication to innovativeness (e.g., Innovation Union Scoreboard, European Commission 2011; Sajeva et al. 2005; Hollanders and van Cruysen 2008; Arundel and Hollanders 2006; Nasierowski 2010a, 2010b). The results of

this activity may be indicative of organizational, legal, social, and political means and arrangements conducive to the augmentation of innovativeness.

These arrangements can be discussed within the scope of the concept of National Innovation Systems (e.g., Dahlman 1994; Dosi et al. 1988; Freeman 1995; Lundvall 1992; Nelson 1993; Shariff 2006; Nasierowski 2009; Mas-Tur and Sapena Bolufer 2016). However, when researching the subject "innovations", each of the steps from invention (innovation) to the National Innovation System (NIS), is punctuated with a lack of precision, somewhat denotes a type of a discussion that has started, but has not produced a conclusion yet. This paper intends to review the current stock of experience with interpretation and assessments of innovativeness. First, various perspectives to innovativeness are explored. Then, aspects of the measurement of innovativeness are reviewed, along with the examination of the practicability of such attempts. The concluding section provides some suggestions for further studies. Furthermore, it is explained why addressing these questions is warranted from practical and theoretical viewpoints.

2. Concepts of Innovativeness—Literature Overview

One of the problems relevant to research on innovativeness is the difficulty of establishing a precise definition for the following constructs: innovation, invention, creativity, and entrepreneurship, definitions that would allow for the quantification of these constructs. Scholarly discourse on these definitions has created a dizzying array of differing and sometimes contradicting explanations.

Some attribute this state of affairs, at least in part to misdefinitions, or misinterpretations of what the above-mentioned constructs denote (e.g., Rogers 2002; Seng Tan 2004). There seems to be agreement on considering innovation to be a novelty applied to something that already exists. The disagreement arises as to whether the change should be new to the market in general, or only to a particular company (e.g., Välimäki et al. 2004). The former, denoted for the purposes of this discussion as the Frascati (Frascati Manual, OECD 2002) approach, suggests that innovation is rooted in the notion of novelty in global terms. These novelties are assessed indirectly by the level of various educational attainment statistics (European Innovation Scoreboard, European Commission 2005; World Bank 2006; R&D expenditures EIS, European Commission 2005; IUS, European Commission 2011), and patent counts (e.g., Griliches 1990; Khan and Dernis 2006). The latter, the Oslo Manual (OECD 2005) approach, takes a more micro perspective. It deals primarily with the implementation and adaptation of solutions, and is oriented toward a practitioner's viewpoint. This approach conceptualizes innovation as an application for commercial purposes.

Inventions often originate as a result of systematically undertaken research and development (R&D) activities. The following is a definition offered by the United Nations, which is also accepted by the Organization for Economic Coopearation and Development (OECD) in the Frascati Manual: "R&D is a creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society and the use of this stock of knowledge to devise new applications The basic criterion for distinguishing R&D from the rest of Science and Technology is that there is an appreciable element of novelty" (OECD 2002). "Technical innovation activities are all of the scientific, technological, organizational, financial and commercial steps, including investments in new knowledge, which actually, are intended to, lead to the implementation of technologically new and improved products and processes" (OECD 2002), and that are crucial to a company's survival (e.g., Jamison and Hård 2003). From the Frascati perspective, innovations are those solutions implemented in technologically new products/processes, or to products/processes, subject to significant technological improvements, that exhibit characteristics of novelty.

When such interpretations of innovation are accepted, then the majority of small and medium-size (SMEs) do not qualify as being innovative. These types of enterprises mainly imitate and adopt solutions. It is a very sound business concept. Next, inventiveness is only

one element in the innovation process. R&D activities (leading to inventions) are only initial stages of the innovation process, which can be described in many different ways (e.g., Kline and Rosenberg 1986; Betz 1987; Nasierowski and Arcelus 1999). The concept of novelty in global terms is not emphasized in these models, and hence a weakened interpretation of novelty and innovation can be adopted. Innovations in an enterprise can be defined as an economic decision made in order to carry out tasks related to taking advantage of emerging market opportunities, or to prevent threats from materializing. Such decisions are often of strategic nature. They may have consequences for the competitive position of the company and to all aspects of its functioning; in short, they may bring profits. A similar interpretation is advocated by the Oslo Manual (OECD 2005), where the minimum requirement for something to be termed an "innovation" is for the product or process to be new or substantially improved for the specific company.

Schumpeter (Schumpeter 1949) defines the economic phenomenon of innovation as a process that takes an invention and develops it all the way to a marketable product or service that changes the economy. It can be conceptual or perceptual, should be related to opportunities, focused, and can be breathtakingly simple (Drucker 1985). Innovation can also be interpreted as a process specific to a period of time or particular region, which means that the introduction of an "old technology" to the region, with no previous exposure to this technology, is also an innovation. For example, Sajeva et al. (2005) define innovation as "the process leading to the adoption and diffusion of new technologies, aimed at creating new processes, products, and services. While the term adoption represents the final stage of an invention, diffusion focuses on the supply of new goods and services to the customer. In this context, innovation is the method to achieve competitiveness in the framework of the revised Lisbon agenda." Such a view is also consistent with the Europe 2020 Strategy.

Although such interpretations enhance discussions on innovativeness, the quantification of innovativeness or level of involvement in new activities remains a perplexing, multidimensional concept. One can advocate an indirect means for the measurement of innovations. For example, levels of productivity, employment, revenues, or the betterment of competitive position can be used to measure innovativeness. Further measures may include the examination of distinctive competencies, or of quality. Such indicators, however, depend on the context of operations, market conditions, actions undertaken by competition, economic and political situations in the region, reputation of the company, and customer loyalty. These may all have a strong impact on the results of so called "indicatoring" of innovation. Quantification of these processes is almost impossible in light of the diversity of possible contextual factors. We deal with very dynamic systems, and "many of their properties emerge from interactions among the entities in them" (Katz 2006). Interrelationships between and among these factors of innovativeness are not documented, and the measurement of innovation processes may fail to provide evidence regarding casual relationships.

Another troubling issue in the study of technological change is differentiating innovation from creativity. Innovation can be defined as an output (product, device, theory, etc.) that is somewhat new to the place, time, or purpose of its application. Innovation occurs as a result of successful implementation of creative ideas within an organization. Creativity, on the other hand, is the development of a novel and useful idea in any domain and is a seed for all innovations (Amabile 1997).

Innovation is always creative, but not all creativity is innovative. "In this view, creativity by individuals and teams is a starting point for innovation: the first is a necessary but not sufficient condition for the second". In short, creativity is a manifestation of a drive to shape an opportunity, whereas innovation is an attempt to apply this opportunity practically. Creativity is a process, which may not lead to implementation. To that end, identification or development of creative ideas and an ability to implement them are among the most important abilities of successful entrepreneurs.

For many practitioners, "innovation refers to the development and improvement of products and processes arising from the exchange of knowledge among firms and other

players in their environment" (CEDO 2001). Such interpretations stem from the concept advocated by the Oslo Manual (OECD 2005), where a minimum requirement of innovation is for a product or a process to be new (or substantially improved) for the specific company: it need not be new in global terms. Thus, innovativeness deals with the implementation of new solutions in the place or for the purpose, for which these have not been used earlier. Some public institutions also take a similar micro/practitioner's approach. For example, the Atlantic Canada Opportunities Agency (ACOA) recognizes the fact that innovation means different things to different people.

In their terms, innovation is "a process through which economic value is extracted from knowledge through the generation, development, and implementation of ideas to produce new or improved products, processes, and services. Innovation encompasses much more than R&D or technological change. Innovation makes knowledge useful and turns it into wealth and prosperity."

It has been observed that several items from the composite indexes, which may relate to the notion of innovativeness, deal primarily with inventiveness (e.g., on the Input side-expenditures on R&D and S&E graduates, or on the Output side—patents and trademarks). Thus, these indicators fall more toward the Frascati Manual's interpretation of innovations (hence inventions) (OECD 2002), quite a difference from innovations as interpreted by the Oslo Manual (OECD 2005). Consequently, it is arguable whether these common composite indexes serve the needs of practitioners oriented toward the interpretation of the innovations of enterprises aimed at the improvement of economic prosperity at a "shop floor level" (Drucker 1985), or are primarily a manifestation of pro-innovation policies and mechanisms at the macro-economic level.

Further difficulties lie awaiting researchers when they try to formulate plans for stimulating innovativeness and creativity as well as entrepreneurship enhancement, along with attempting to improve the economic performance of firms. As if this is not enough, differences regarding interpretations are further amplified when micro and macro-economic perspectives are taken into account. It is observed that two perceptions of innovativeness can be identified; they refer to the same phenomenon, though from varying perspectives. One deals with a macro-economic view, suitable for big inventive companies, and levels of innovativeness are measured by composite indexes. The second perspective is more "shop-floor" oriented and deals with problems of changing ideas into commercial success. The first is leaning toward inventiveness, the second toward commercialization. Micro- and macro-perspectives are somewhat different 'worlds'—explained by state policies and international competitiveness determinants on one side, and a drive to increase competitive position and profits of an enterprise on the other. These two 'worlds' coexist, and more coordination of their principles and related activities may bring positive results. It would be incorrect to attempt to discuss the two as the same phenomena, and there is a need to identify means to bridge the gap between 'macro' and 'micro' perceptions and interpretations of innovation (Nasierowski 2009, 2010a, 2010b). Hence, a comparison of concepts of innovativeness from the viewpoint of macro-economic indicators (e.g., as expressed by the EIS (European Commission 2005)/IUS (European Commission 2011)), with opinions/perceptions of entrepreneurs that will provide a micro-economic perspective to the problem (Drucker 1985) is warranted. These considerations are expected to aid in finding better means to assist companies in enhancing their performance, thus contributing to economic progress at the macro-economic level.

The European Commission adopts a comprehensive approach to the definition of innovativeness and attempts to combine both macro- and micro-approaches. The term innovation not only describes innovation as an invention or technological improvement, but also includes the implementation of new ideas, processes, and methods for leveraging existing ideas, technologies, or inventions. Discussion is no longer limited to products, processes, or technologies (e.g., Kedia and Bhagat 1988; or spin-offs by Arundel and Hollanders 2005), but also focuses on an overall replication of solutions that have been used somewhere else, or used for a separate purpose. The term innovation not only

describes innovation as an invention, or a technological improvement, but also includes in its scope the implementation of new ideas, processes, and methods for leveraging existing ideas, technologies, or inventions further.

3. Practicalities of Measuring Innovations and Efficiency of Pro-Innovative Approaches

Even though diverse interpretations of creativity, innovativeness, and entrepreneurship may enliven possible discourses about their nature imperatives and effectiveness, it does not help find a reasonable way to measure them. For example, studies that make the tall claim of measuring innovation (or productivity of innovation generating units) by recording the number of patents, publications, etc. seem hollow and incomplete because they completely ignore the meaty qualitative dimensions of innovation, while excessively fixating on the quantitative dimensions. This leads one to advocate for an indirect means of measuring innovation. We can measure innovation by evaluating factors such as productivity, employment, revenue, or profit increase, improvement of competitive position, creating distinctive competencies, or quality (if such indicators can indeed be measured). However, these indicators depend upon a variety of factors such as the specific context of operations, market forces, actions undertaken by competition, economic and political influences shaping the particular region, company's reputation, and customer loyalty, all of which may significantly impact the results of innovation measurements.

It is quite a task to measure the impact of innovation upon business performances given the insidious presence of market forces. Additionally, quantification of these processes is virtually impossible taking into account the diversity and numerous possible contextual factors. It is highly unlikely that companies will disclose information regarding their innovation related procedures, nor would they allow outsiders to observe their processes. Thus, the intimacy of the relationship between these factors will not be documented. Moreover, measurement of innovation processes may fail to provide evidence regarding a not regular relationship, which additionally may be of a non-linear character.

It is at times accepted that composite indexes may serve as a policy setting mechanism (which has also been one of the objectives of the EIS/IUS approach). However, recommended innovation policies should not be considered as "an average" of responses from different sectors, by companies of different size, which operate within very different economic, political, and social contexts. An assumption that "indicators have policy implications" is difficult to endorse. Presented observations suggest that countries should adopt different innovation policies. Consequently, the power of indexes as a tool that sets direction for policy formulation is substantially decreased.

Problems arise when using composite indexes also due to the conceptual quandary between allocative efficiency ('are we doing the right things?') versus technical efficiency ('are we doing things the right way?'). Further dilemmas stem from problematic definitions and the various taxonomies used to measure the consequences of the output achieved (e.g., Seng Tan 2004).

Increases in innovation and the benefits that result from such an attitude are important factors in fostering economic activity and boosting competitive advantage. The vital role of innovation in national competitiveness is recognized by most nations. Knowing a nation's strengths and weaknesses allows a government to institute interventions aimed at fostering its innovation record. Therefore, attempts to "measure" levels of innovativeness, along with the assessment of efficiency/effectiveness of pro-innovative policies, have been undertaken. One may identify two basic approaches to estimate effectiveness:

- First, probably the most popular now, where the level of innovativeness is determined as a sum, or a ratio, of inputs and outputs to the innovation processes. In such a case, one may expect that the higher the input, the higher the output, and hence the higher the level of innovativeness. This is the underlying assumption of the EIS/IUS approach, and its associated composite index of innovativeness, probably the leading approach to measure levels of innovativeness in Europe. This concept has

been "developed by the European Commission, under the Lisbon Strategy, to evaluate and compare the innovation performance of its Member States" (EIS, (European Commission 2005)); and

- Second, where the efficiency of organizations (systems, approaches) is denoted with the use of the "best practice frontier" concept; here, the distance from such a frontier represents inefficiency, in other words, the inability to produce maximum output from the given inputs. This approach is linked to the effectiveness approach to National Innovation Systems, the line of thinking about the issue initiated by Nasierowski and Arcelus (2003) and Balzat and Hanusch (2004).

4. The Characteristics of the Research and the Studied Enterprises

The analysis of the research findings was carried out by the authors based on the results of the evaluation research into the support for innovative enterprises–beneficiaries of the Smart Growth Operational Program (SMOP) for the years 2014–2020. The program was implemented by the Ministry of Investment and Economic Development of the Republic of Poland via Polska Agencja Rozwoju Przedsiębiorczości-PARP (Polish Agency for Enterprise Development). The program is addressed to innovative entities including enterprises (particularly those operating in the small and medium-sized enterprises sector), scientific and research units, and institutions of the business environment. The objective of the program is to support beneficiaries which as their strategic goal set their own growth or enhancement of the innovativeness level. In the first place, it concerns enterprises which through investments, development, and implementation of innovative products of services, or through cooperation with research and development units conquer new markets and improve their products (MIiR 2019).

The subjective research was ordered by the Polish Agency for Enterprise Development and conducted by specialized units (MCN Institute Poland Sp. z o.o., Fundacja Idea Rozwoju, Idea Instytut Sp. z o.o., Exacto Sp. z o.o., Realizacja Sp. z o.o.), and its findings were published in the report entitled Barometr Innowacyjności. Program Operacyjny Inteligentny Rozwój (The Innovation Barometer, Smart Growth Operational Program) (PARP 2018). In the article, the research findings are analyzed with regard to the objective of the article and the research gap identified in this respect.

The aim of the research was to identify the innovativeness level of the studied enterprises and the influence of innovativeness on the functioning and development of these enterprises and their adaptability in the environment. The study was based on research carried out by the Central Statistical Office (it is the only organization that is able to conduct a survey of this type on such a large scale in the country). The results of these studies were included in various reports and many reports of the Central Statistical Office—only then were they collected jointly by the authors of the article and reworked, from which one consistent synthesis was created.

Additionally, the authors relied on the measures and indicators proposed by the Central Statistical Office (providing the primary data) and did not want to interfere with them, treating it as unauthorized. This is the main reason why they were left in their original shape. The research was carried out with the use of the CAWI technique (Computer Assisted Web Interview) on the sufficient population of SMOP beneficiaries. In the invitation to the research, the beneficiaries obtained a link to online questionnaires and tips on how to complete them. During the research, the team of consultants (the help desk) provided technical and substantive support to respondents when needed. To maximize the response rate, the entrepreneurs who had not completed the questionnaire were contacted several times (an email and phone remainder). The research was carried out between 4 June and 5 July 2018 and primarily concerned the following issues:

- The character of the innovations introduced,
- Obtained co-financing,
- Entrepreneurs' experiences related to the patent procedure,

- An influence of innovative projects on the revenues and gross profit level in the firms taking part in the projects, and
- An influence of the implementation of innovative projects on the employment in firms participating in the projects.

Within the research, two measurements were taken: the first (initial) one referred to the assumptions of the projects implemented, and the second one (the final one) referred to the effects of the implementation. A total of 1238 enterprises were invited to participate in the survey. The average response rate for the first measurement was 45%, and for the other measurement, it was 19%.

Of the studied enterprises, the biggest number of them were located in the following voivodeships: Masovian (23%), Silesian (13%), Greater Poland (10%), and Lesser Poland (9%), whereas the smallest number of entities was from Opole voivodeship (0.5%), Lubusz (1%), and West Pomeranian (1%). As for the size of the enterprises, 38% were micro-firms, 34% were small firms, and 28% were medium-sized firms. A total of 6% of the studied enterprises were start-ups (0–2 years of activity), 28% were young firms (3–5 years of activity), and 66% were other firms with market activity longer than six years. According to the criterion of core activity, the biggest number of entities declared their activity in the industrial processing sector (57%), followed by the information and communication sector (13%), professional, scientific and technical activity sector (13%), wholesale and retail sale sector (12%), and construction sector (5%). With regard to the legal form of activity, 50% were limited liability companies, 21% natural persons conducting business activity, 12% joint stock companies, 7% general partnerships, 6% limited partnerships, and 4% others. Of the studied enterprises, 85% were manufacturers of a final product, 15% played the role of a supplier of a direct product, 9% were suppliers of a service for the manufacturer of a final product, 7% were an intermediate service provider, and 5% were suppliers of an intermediate product. Within the scope of Krajowe Inteligentne Specjalizacje-KIS (National Intelligent Specializations) classification (see Endnotes), the most frequently represented were: KIS 1: Health and society (13%), KIS 2: Innovative technologies of the agricultural and food sector (13%), KIS 14: Automation and robotics of technological processes (12%), KIS 12: Intelligent networks and ITC (12%), KIS 8: Minimization of waste production (10%), KIS 3: Biotechnology (8%), KIS 5: Intelligent and energy-efficient construction (8%), and none of the above (24%).

5. The Assessment of the Studied Enterprises in the First Measurement (Before the Implementation of Innovative Projects)

Within the first measurement, the following characteristics of the studied enterprises were noted:

- Minimum 1 innovation was planned to be introduced by 82% firms, of which: innovation in the national scale—57%; innovation in the European scale—31%, innovation in the global scale—22%;
- In total, 1466 innovations are planned to be introduced in the studied enterprises (216 services, 883 goods, and 367 processes) including: evolutionary innovations—52%, derivative innovations—21%, breakthrough innovations—35%, intermediate goods production—22%, final goods production—59%;
- A total of 40% of the studied enterprises had experiences in filing industrial designs or utility models applications to the Patent Office of the Republic of Poland;
- A total of 32% of the firms had their own infrastructure to conduct R&D works (one year before the research);
- Before the research, expenditure on R&D increased in 31% of the firms, decreased in 17% of the firms, and expenditure on R&D stayed the same in 52% of the firms; and
- Before the research, 35% firms had departments or units responsible for the development of innovative projects.

Moreover, Table 1 presents plans of the studied enterprises as for the classification of the projected innovations, which the enterprises formulated at the beginning, during the first measurement.

Table 1. Classification of planned innovations, declared during the first measurement of the enterprises.

	Product Innovations	Process Innovations	Organizational Innovations	Marketing Innovations
All enterprises	72%	53%	30%	38%
Manufacturing enterprises	74%	54%	31%	40%
Service enterprises	72%	55%	31%	38%

Source: Own study based on (PARP 2018).

6. The Final Assessment of the Studied Enterprises (the Other Measurement-after the Implementation of Innovative Projects)

The final assessment, realized within the second measurement, was a leading assessment, fulfilling the main research aim. Therefore, it was made in the following research areas, referring to the studied enterprises:

- Innovativeness,
- Competitiveness,
- Employment,
- Internationalization, and
- Administrative environment.

6.1. Analysis of Innovativeness

The assessment of the innovative potential of the studied enterprises began from examining the resources necessary from the point of view of the implementation of an investment project. The results of this assessment are included in Table 2.

Table 2. The innovative resources possessed.

No.	Specification	Disagree	Somewhat Agree	Strongly Agree
1	We have adequate human resources to implement innovations	2%	48%	50%
2	We have adequate technical resources to implement innovations	6%	56%	38%
3	We have adequate financial resources to implement innovations	19%	58%	23%

Source: Own study based on (PARP 2018).

Then, the analysis of innovativeness was conducted based on the following measures:

- **Synthetic ratio of innovativeness**—created as a weighted average of the following components:
  - The scope of the innovation—the wider the scope of innovation (the national, European, or global), the higher the value of the ratio;
  - The character of the innovation—the more often the innovation changes status quo (an evolutionary innovation to the least extent, a derivative innovation to a greater extent, a breakthrough innovation to the greatest extent), the higher the value of the ratio;
  - Final goods—if the firm planned to launch new goods in the form of final goods, the higher the value of the ratio; and

- Strategic management of innovations—if the firm has a strategy (written down or not) of the implementation of innovations in the firm, the higher the value of the ratio.

The ratio takes the maximum value of 10, if the firm planned innovations in the global scale and of breakthrough character, it planned to launch new products in the form of final goods and has a strategy of managing innovation in the firm. The minimum value of the ratio (0) is obtained by firms who do not plan any of the aforementioned innovations and have no strategy of innovation implementation.

- **Innovation scope ratio**—the ratio was created as a weighted average of the scope of innovation (the national, the European, the global scope). The larger the scope of innovations, the higher the value of the ratio. The score of 10 is obtained by firms who planned global-scale innovations. Firms planning Europe-scale innovations obtain 5 points. Firms in the case of which the largest scope of innovations is nationwide obtain 1.5 points. We should remember the ordinal character of the innovation scope scale. A global innovation has at the same time the European and national scope, and the European-wide innovation is by definition an innovation of the national scope. Therefore, for example, world-scale innovators obtain an extra score due to the fact that their innovations are at the same time on the European and national scale. This additionally promotes the most innovative ventures undertaken by the studied entities.
- **Innovation character ratio**—the ratio was created as a weighted average of the innovation character (evolutionary, derivative or breakthrough). The more the character of innovation changes the status quo, the higher the ratio value. The score of 10 is obtained by firms who planned breakthrough innovations. Firms planning derivative innovations score 5 points. Firms in the case of which innovations are of evolutionary character obtain 1.5 points.
- **Final goods ratio**—the ratio was created as the average of the percentage of final goods out of product innovations planned by the firm. The ratio does not consider the number of planned product innovations being final goods, and only their percentage out of all planned product innovations.
- **The strategic management of innovation ratio**—the ratio was created as the weighted average of firms declaring the possession of a strategy of the implementation of innovations in the firm. It takes values from 0 to 10. If a firm declares possessing such a strategy in the written form, it obtains 10. If a strategy exists but has not been written down, the firm obtains 5. If a strategy does not exists, the firm scores 0.

Table 3 presents the average values of the innovativeness analysis ratios for all the studied enterprises.

Table 3. Average values of innovativeness ratios for the studied enterprises.

No.	Name of the Ratio	Average Value of the Ratio
1	Synthetic ratio of innovativeness	5.6
2	Innovation scope ratio	2.8
3	Character of innovation ratio	6.1
4	Final goods ratio	7.3
5	Strategic management of innovation ratio	4.7

Source: Own study based on (PARP 2018).

What arises from Table 3 and from the research findings not published in the article is that a great majority of the studied enterprises are planning to introduce at least one innovation within their innovative activities. Every third innovation is supposed to be a European-scale innovation, and every fifth one a global-scale one. A total of 35% of the total number of respondents defined at least one of the planned innovations as a breakthrough one. The scale of filed applications for industrial designs or utility models as well as inventions, although it increased slightly in the years preceding the research, is

still very low. In the years preceding the research, the activeness of the studied firms in the area of R&D increased (in comparison with the previous year), and the expenditure on research and development was conducted inside the enterprise. Two-thirds of the firms had capabilities (machines, devices) to conduct R&D works, and every third firm had its own infrastructure (separate buildings, premises) to perform such works. At the same time, the percentage of firms having a strategy including, among others, the problems of implementing innovations was 78%, 13% of which had a written, formalized strategy. The greatest strength of the studied enterprises as for the implementation of innovations is possessing adequate human resources, whereas the greatest weakness is possessing adequate financial resources. The lack of sufficient financial resources in the first place tackles micro-firms (26%).

6.2. Analysis of Competitiveness

During the survey before the commencement of the research (the first measurement), it was established that:

- The average revenue of a studied enterprise was PLN 14.5 million; and
- A total of 83% of the firms that earned revenues generated net profit (at the level of 7% on average).

At the end of the research, within the second measurement, it was found that:

- A total of 53% of the enterprises thought that the implementation of innovations positively influences the level of annual revenues, 20% pointed to no influence, and 0.5% to negative influence; and
- A total of 46% of the enterprises thought that the project positively influences the profit level, 16% indicated no influence, and 6% indicated negative influence.

Within the research into the level of competitiveness of the examined enterprises, their sources of competitiveness were determined. The results of that survey are included in Table 4.

Table 4. The sources of competitiveness of the enterprises.

No.	Specification	Most Important Factor of Competitiveness	The Second Most Important Factor of Competitiveness	The Third Most Important Factor of Competitiveness
1	We have unique knowledge	29%	13%	9%
2	We enjoy high reputation and business reliability	19%	13%	15%
3	We have state-of-the-art technology	15%	14%	13%
4	We offer competitive prices	12%	16%	15%
5	We have high capability of designing goods	12%	14%	11%
6	We guarantee punctual and fast deliveries	9%	12%	14%
7	We have a considerable R&D potential	3%	10%	12%

Source: Own study based on (PARP 2018).

Unique knowledge is the most frequently declared (as the most important) source of competitiveness of the studied firms. The second most important factor for competitiveness is proper price. At the same time, the price and possessing appropriate business reliability are factors that for some entrepreneurs are the third most important factors of their competitiveness.

Within the assessment of competitiveness, the synthetic ratio of competitiveness was also calculated, which was created as the average of the following components:

- The percentage of firms declaring that carrying out the project has a beneficial influence on the level of annual revenues on the sales of products (goods/services), merchandise, and materials, and
- The percentage of firms declaring that carrying out the project has a beneficial influence on the value of gross profit.

The ratio takes the maximum value of 10 if the firm assesses that the implementation of innovations beneficially influences those two ratios: 5 if it influences one of them, and 0 if it influences none of them.

The average value of this ratio for all the studied enterprises was: 4.1.

To sum up, it can be noted that in the initial measurement, the values of basic ratios describing the economic situation of the enterprises for the year preceding the research were determined. The picture achieved is static, in this stage of the research, there is no possibility yet to observe the dynamics of the economic ratios of the firms. In the year preceding the research, the entrepreneurs achieved revenues at the level of 14.5 million PLN on average. A total of 83% of the firms making revenues generated profit in that year, which is a value similar to the totality of national economy entities according to the Central Statistical Office. About a half of those firms already during the research marked (subjectively) a beneficial influence of the implementation of innovations on revenues and the level of gross profit.

6.3. Analysis of Employment

During the survey, it was established that:

- The average employment level in the year of the commencement of the innovative project was 42 people (39% women), of which 90% were full-time,
- The average number of people with whom civil law contracts were concluded was 1.5 people (no y/y change),
- The average number of people employed in R&D activity was 0.8 person (no change in comparison with the previous year),
- A total of 35% of firms thought that the implementation of the project translated into the growth of employment, and 34% thought that the project had no impact on employment, and
- The change in employment (in the year of the project in comparison with the preceding year) was as follows: 56% increased their employment, 27% did not mark any changes in their employment, and 17% decreased employment.

Within the assessment of employment, the synthetic ratio of employment was also calculated, which was created as the average of the following components:

- The percentage of firms increasing employment in the year preceding the year of submitting the application for co-financing the innovative project; and
- The percentage of firms assessing that the implementation of the project causes an increase in employment.

The ratio takes the maximum value of 10 if the firm both increased employment and assigned the growth to the implementation of the innovative project; the value of 5 if one of those conditions occurred; and 0 if none of them occurred. The average value of this ratio for all the studied enterprises was: 4.6.

To sum up, we can claim that the studied enterprises employed 42 people on average. In the year of the implementation of the innovation, more than a half (56%) increased employment in comparison with the previous year (by 10% on average). The growth of employment was first of all declared by small and medium-sized enterprises as well as exporters (especially those which are small or medium-sized enterprises). On the other hand, the percentage of people employed in R&D activity did not change, and stayed at a low level of 0.8. Out of firms with their own infrastructure for R&D works, the average number of people employed in R&D activity was 1.5. Every third firm declared that the

project implemented influenced an increase in employment, and a similar percentage of people thought that the project did not translate into an increase or decrease in employment.

6.4. Analysis of Internationalization

In the course of the research, it was found that:

- The percentage of firms selling to foreign markets was 73%;
- Exporters came most often from the following voivodeships: Masovian (19%), Silesian (11%), and Lesser Poland (11%);
- The average length of the existence of an exporting firm was 12 years against the total number of respondents where the average was 11 years;
- The average level of employment in an exporting firm was 51 workers against the total number of respondents, where the average was 42 workers;
- The average time of conducting activity on foreign markets was eight years;
- The average number of countries to which sales were made before the implementation of the innovation was 12;
- The average value of sales revenues (export) per firm before the project was PLN 4.7 million, and after the project, it was PLN 5.4 million; including to European Union countries: before the project PLN it was 2.2 million, and after the project, it was PLN 3.1 million; and
- The method of sales to foreign markets was as follows: independent 62%, mixed 32%, and via intermediaries 6%.

During the research, it was also found that a studied enterprise cooperated with 20 business partners on average including six from abroad (the average number of business partners for micro-firms is 11, for small firms 21, and for medium-sized firms 30). The median of the number of business partners was, however, four, which means that among beneficiaries, there is a division into a relatively small group of firms that cooperate with a large number of partners and a relatively large group of firms that cooperate with a small number of business partners. The number of business partners increases with the size of the enterprise.

To sum up, as many as three-fourths of the studied firms generated revenues on sales for export in the two years preceding the implementation of an innovative SMOP project. The percentage of exporters was distinctly bigger in the group of entrepreneurs who participated in a SMOP project in comparison with the total enterprises on the market. It also increased in each next range of the size of the firm's employment (micro—57%, small—66%, and medium-sized—89%). Exporters are basically firms from the industrial processing sector and trade. Before the commencement of the project implementation, export revenues were growing year to year. In the year before the commencement of the implementation of an innovation, they constituted about one-third of the total revenues of the enterprise.

6.5. Analysis of the Administrative Environment

During the evaluation of the administrative environment, the quality, flexibility, and adequacy of the support provided to entrepreneurs with regard to carrying out projects of the implementation of an innovation within the SMOP program was investigated. The results of that evaluation are presented in Tables 5 and 6.

Within the evaluation of the administrative environment, the synthetic ratio of the evaluation of the SMOP implementation system was also calculated. It averages detailed evaluations of the system (the process, procedures, and co-financing), made on a scale from 1 to 10. The average value of this ratio for all the studied enterprises was 5.2.

To sum up the analysis of the administrative environment based on the conducted research, we can formulate conclusions that relatively low scores occur in it, particularly with regard to the clarity of the procedures of the purchase of goods and services for the needs of the project and the clarity of the reporting system. The highest scores were obtained for the support from the project manager and the usefulness of the website (PARP),

and lower scores were obtained for the usefulness of briefings and the functioning of the help desk.

Table 5. The evaluation of the process, procedures, and the value of co-financing within the SMOP program in the scale (0–10).

No.	Criterion	Low Score (0–4)	Medium Score (5–6)	High Score (7–10)	Average of Scores (0–10)
1	The level of co-financing and its adequacy to the project objectives	18%	28%	54%	6.6
2	Understanding the process related to the choice of projects for co-financing	23%	33%	44%	6.0
3	The clarity of procedures concerning the system of reporting	32%	34%	33%	5.3
4	The functionality of procedures concerning the method of making purchases/procurements for the needs of the project	40%	27%	32%	5.1

Source: Own study based on (PARP 2018).

Table 6. The evaluation of individual tasks within the innovation implementation project.

No.	Criterion	Low Score (0–4)	Medium Score (5–6)	High Score (7–10)	Did Not Use	The Average of Scores (0–10)
1	Support from the project manager	18%	16%	60%	7%	7.2
2	Usefulness of the Polish Agency for Enterprise Development (PARP) website	10%	14%	22%	53%	6.4
3	Functioning of the call center	20%	12%	24%	44%	5.7
4	Usefulness of briefings for representatives of enterprises	21%	26%	42%	12%	6.1

Source: Own study based on (PARP 2018).

7. Discussion and Conclusions

In the numerous reports on interpretations of innovativeness, it is somewhat counterproductive to argue which interpretation is more correct or appropriate. While continuing to study the topic, a clear interpretation should be accepted and consistently used. Taking into account the circumstances, it is acknowledged that innovativeness is a multidimensional, complex phenomenon—not defined precisely, not prone for operationalization, and its interpretation may be impacted by several situational elements and interdependencies between sub-dimensions. Certainly, it would be very convenient to gain access to a comprehensive composite index of innovativeness that is simple and clear, based on easily available and reliable data and an index that remains unchanged in terms of indicators selected over prolonged period of time that captures issues of inventiveness and innovativeness that are pertinent for big as well as for small enterprises, which may contain policy-setting suggestions.

The assessment of the technical efficiency of innovation efforts is probably the most desirable outcome of further studies. Based on the assessment of efficiency, the key points for policies oriented on enhancing innovativeness can be established. These key points, along with the results of analysis of detailed innovation policies, may lead to the identification of "Best Management Practices in Innovations" (BMPI), which are applicable to the specific context. If some stability while measuring innovativeness is achieved, longitudinal studies may be undertaken, cross-validating the assessment of the accuracy of procedures and policies. Results will bring more clarity to the quandary: Are countries and companies innovative because they are rich, or is it vice-versa? and countries and

companies become rich when they become innovative. Certainly, the problem of isolation of the results of assessments from market forces and contextual elements should be explained. When results of such studies become available, a more precise taxonomy of countries can be developed. As it stands now, "the more you spend, the better the country's ranking": such a classification can be enhanced with comments regarding efficiency in terms of the utilization of available resources. Again, conclusions from such a study may assist in the identification of the extent to which the alleged decrease in the productivity growth of many countries can be explained by differences in efficiency and by differences in its components, namely scale and congestion. Some results, along this line of reasoning, have already been published (Nasierowski and Arcelus 2003) These results indicate a lead to the harmonization of policies dealing with the acquisition and development of technology throughout the years and across countries. Additionally, a classification of countries into two clusters based on their commitment to technology development was presented. Indexes of commitment to technological change were identified and countries were ranked according to their technological competitiveness. These results may also be influential in terms of the operationalization of National Innovation Systems (NIS) and the clarification of the dichotomy between macroeconomic perceptions of innovativeness and microeconomic reality. There are still several important to economic progress topics in the field of innovativeness, whose exploration is warranted.

Endnote: Krajowa Inteligentna Specjalizacja (KIS) (eng. National Intelligent Specialization) indicates preferences in providing support for the development of research and development works and innovativeness (R + D + I) within a new financial perspective for the years 2014–2020. KIS consists in determining economic priorities in the area of R + D + I and focusing investment on areas ensuring an increase in the value added of the economy and its competitiveness on foreign markets. National Innovation System (NIS) is the flow of technology and information among people, enterprises, and institutions, which is key to the innovative process on the national level.

Author Contributions: The contribution share of the authors is equal, amounting to 50% each. All authors have read and agreed to the published version of the manuscript.

Funding: The article was financed with subsidies granted to the Project financed by the Ministry of Science and Higher Education within the "Regional Initiative of Excellence" Program for 2019–2022. Project no.: 021/RID/2018/19. Total financing: 11 897 131,40 PLN.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Publicly available datasets were analyzed in this study. MIiR (Ministerstwo Inwestycji i Rozwoju/Ministry of Investment and Development). Retrieved from https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/badania-ewaluacyjne/barometr-innowacyjnosci-program-operacyjny-inteligentny-rozwoj-raport-roczny-wyniki-ii-rundy-badania/ (accessed on 15 December 2020); PARP (Polska Agencja Rozwoju Przedsiębiorczości/Polish Agency for Enterprise Development). Retrieved from https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/badania-ewaluacyjne/barometr-innowacyjnosci-program-operacyjny-inteligentny-rozwoj-raport-roczny-wyniki-i-rundy-badania/ (accessed on 15 December 2020).

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analysis, or interpretation of the data; in the writing of the manuscript; or in the decision to publish the results.

References

Amabile, Teresa M. 1997. Entrepreneurial Creativity Through Motivational Synergy. *Journal of Creative Behavior* 31: 18–26. [CrossRef]

Archibugi, Daniele, and Alberto Coco. 2005. Measuring Technological Capabilities at the Country Level: A Survey and a Menu for Choices. *Research Policy* 34: 175–94. [CrossRef]

Arundel, Anthony, and Hugo Hollanders. 2005. *Policy Indicators and Targets: Measuring the Impact of Innovation Policies*. Brussels: European Commission.

Arundel, Anthony, and Hugo Hollanders. 2006. *2006 Trend Chart Methodology Report: Searching the Forest for the Trees: "Missing" Indicators of Innovation*. Maastricht: MERIT-Maastricht Economic Research Institute on Innovation and Technology.

Balzat, Markus, and Horst Hanusch. 2004. Recent Trends in the Research on National Innovation Systems. *Journal of Evolutionary Economics* 14: 197–210. [CrossRef]

Betz, Frederick. 1987. *Managing Technology: Competing through New Ventures, Innovation, and Corporate Research*. Prentice-Hall: Englewood Cliffs.

Blanke, Jennifer, Paua Fiona, and Xavier Sala-i-Martin. 2003. *The Growth Competitiveness Index: Analyzing Key Underpinnings of Economic Growth*. Cologny/Geneva: Global Competitiveness Report of the World Economic Forum.

CEDO. 2001. *Emerging Regional Practices in Support of SME Innovation*. Montreal: Canada Economic Development Observatory.

Dahlman, Carl J. 1994. Technology Strategy in East Asian Developing Countries. *Journal of Asian Economics* 5: 541–72. [CrossRef]

Dosi, Giovanni, C. R. Freeman, R. R. Nelson, and Luc Soete. 1988. *Technological Change and Economic Theory*. London: Pinter Publishers.

Drucker, Peter Ferdinand. 1985. *Innovation and Entrepreneurship: Practice and Principles*. New York: Harper & Row.

European Commission. 2005. *EIS-European Innovation Scoreboard 2005: Comparative Analysis of Innovation Performance, European Trend Chart on Innovation*. Brussels: European Commission.

European Commission. 2011. *IUS-Innovation Union Scoreboard 2010*. Inno-Metrics. Brussels: European Commission.

Freeman, Chris. 1995. The National System of Innovation in Historical Perspective. *Cambridge Journal of Economics* 19: 5–24.

Freudenberg, Michael. 2003. *Composite Indicators of Country Performance: A Critical Assessment*. STI Working Paper 2003/16. Paris: OECD.

Griliches, Zvi. 1990. Patent Statistics as an Economic Indicator: A Survey. *Journal of Economics Literature* 28.

Hollanders, Hugo, and Adriana van Cruysen. 2008. *Rethinking the European Innovation Scoreboard: A New Methodology for 2008–2010*. Maastricht: ProInno Europe, Inno-Metrics.

Jamison, A., and M. Hård. 2003. The Story-Lines of Technological Change: Innovation, Construction and Appropriation. *Technology Analysis and Strategic Management* 15: 81–91. [CrossRef]

Katz, J. Sylvan. 2006. Indicators for Complex Innovation Systems. *Research Policy* 35: 893–909. [CrossRef]

Kedia, Ben L., and Rabi S. Bhagat. 1988. Cultural Constraints on Transfer of Technology across Nations: Implications for Research in International and Comparative Management. *Academy of Management* 13: 559–71.

Khan, Mosahid, and Hélène Dernis. 2006. *Global Overview in Innovative Activities from the Patent Indicators Perspective*. STI Working Paper 2006/3. Paris: OECD.

Kline, Stephen J., and Nathan Rosenberg. 1986. *An Overview of Innovation*. Washington: National Academy Press.

Lööf, Hans, and Almas Heshmati. 2006. On the Relationship between Innovation and Economic Performance. *Economics of Innovation and Technological Change* 15: 317–44. [CrossRef]

Lundvall, Bengt-Åke, ed. 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter Publishers.

Mas-Tur, Alicia, and Juan Sapena Bolufer. 2016. Different innovation policies for different types of innovative companies? Social implications. *European Journal of International Management* 10: 467–78.

McArthur, John W., and Jeffrey D. Sachs. 2003. *The Growth Competitiveness Index: Measuring Technological Advancement and the Stages of Development, in the Global Competitiveness Report 2001–2002*. New York: Oxford University Press for the World Economic Forum.

MIiR. 2019. Available online: https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/badania-ewaluacyjne/barometr-innowacyjnosci-program-operacyjny-inteligentny-rozwoj-raport-roczny-wyniki-ii-rundy-badania/ (accessed on 20 December 2020).

Nasierowski, Wojciech, and Francisco J. Arcelus. 1999. Interrelationships among the Elements of National Innovation Systems: A Statistical Evaluation. *European Journal of Operations Research* 119: 235–53. [CrossRef]

Nasierowski, Wojciech, and Francisco J. Arcelus. 2003. On the Efficiency of National Innovation Systems. *Socio Economic Planning Sciences* 37: 215–34. [CrossRef]

Nasierowski, Wojciech. 2009. A Conceptual Framework for Formalization of National Innovation Systems. *Foundations of Management* 1: 159–66. [CrossRef]

Nasierowski, Wojciech. 2010a. About Technical Efficiency of Efforts to Enhance Innovativeness in European Union. *International Journal of Innovation and Technology Management* 7: 389–404. [CrossRef]

Nasierowski, Wojciech. 2010b. Composite Indexes and Indicators of Innovativeness: Some Critical Comments. *Global Management Journal* 2: 40–49.

Nelson, Richard R., ed. 1993. *National Innovation Systems. A Comparative Analysis*. New York and Oxford: Oxford University Press.

OECD. 1992. *Technology and the Economy: The Key Relationships. The Technology/Economy Programme*. Paris: OECD.

OECD. 2002. *Frascati Manual: The Measurement of Scientific and Technological Activities*. Paris: OECD.

OECD. 2005. *Oslo Manual-OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*. Paris: OECD/EuroStat.

PARP. 2018. Available online: https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/badania-ewaluacyjne/barometr-innowacyjnosci-program-operacyjny-inteligentny-rozwoj-raport-roczny-wyniki-i-rundy-badania/ (accessed on 21 January 2021).

Porter, Michael E. 1990. *Competitive Advantage of Nations*. New York: Free Press.

Rogers, Mark. 1998. *The Definition and Measurement of Innovation. Melbourne Institute of Applied Economic and Social Research*. Melbourne: The University of Melbourne.
Rogers, Bill, ed. 2002. *Teacher Leadership and Behaviour Management*. Thousand Oaks: Sage.
Rutten, Roel, and Frans Boekema. 2005. Innovation, Policy and Economic Growth: Theory and Cases. *European Planning Studies* 13: 1131–36. [CrossRef]
Saisana, Michaela, and Stefano Tarantola. 2002. *State-of-the-Art Report on Current Methodologies and Practices for Composite Indicator Development*. Italy: Joint Research Centre—European Commission.
Sajeva, Maurizio, Debora Gatelli, Stefano Tarantola, and Hugo Hollanders. 2005. *Methodology Report on the European Innovation Scoreboard 2005*. Brussels: European Commission, Enterprise Directorate-General.
Schibany, Andreas, and Gerhard Streicher. 2008. *How Not to Compare Innovation Performance: A Critical Assessment of the European Innovation Scoreboard*. Vienna: Joanneum Research Institute of Technology and Regional Policy.
Schumpeter, Joseph A. 1949. Economic Theory and Entrepreneurial History. In *Change and the Entrepreneur: Postulates and Patterns for Entrepreneurial History*. Edited by A. H. Cole. Cambridge: Harvard University Press, pp. 63–84.
Seng Tan, Bann. 2004. The Consequences of Innovation. *The Innovation Journal* 9: 1–42.
Shariff, Naubahar. 2006. Emergence and development of the National Innovation System concept. *Research Policy* 35: 745–66. [CrossRef]
Välimäki, Harri, Anssi Niskanen, Kimmo Tervonen, and Ilkka Laurula. 2004. Indicators of Innovativeness and Enterprise Competitiveness in the Woods Products Industry in Finland. *Scandinavian Journal of Forestry Research* 19: 90–6.
World Bank. 2006. The Knowledge Assessment Methodology and Scorecards, World Bank, New York. Available online: http://vle.worldbank.org/gdln/Programs/kam2001/methodology.htm (accessed on 24 November 2020).