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Do Regional Smart Specialization Strategies Affect Innovation in Enterprises?

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Abstract: According to the European Commission, the smart specialization strategy is intended as a response to complex development challenges and a tool for stimulating innovation at the regional level. At the same time, it is known that the conditions in which businesses operate, including institutional framework, socio-economic aspects, infrastructure and forms of business support, do not always meet their needs. The research and analyses carried out in this study were aimed at testing the relationships mainly between the external activities that most create/develop innovation in enterprises, networking within the innovation ecosystem, and barriers inhibiting innovation development. For this purpose, 250 survey interviews were conducted with representatives of innovative enterprises from five regions in Poland. Our research and analyses have shown that regions make considerable efforts to comprehensively define rather complex RIS3 (Research and Innovation Smart Specialization Strategy) policy priorities, while in reality these priorities often do not coincide with the expectations of entrepreneurs.

Keywords: RIS3; innovation ecosystem; innovative enterprises; regional innovation; innovation policy; smart and sustainable development; regional development management

Citation: Kogut-Jaworska, M.; Ociepa-Kicińska, E. Do Regional Smart Specialization Strategies Affect Innovation in Enterprises? *Sustainability* **2023**, *15*, 16405. https://doi.org/10.3390/su152316405

Academic Editors: Panagiotis Petrakis, Elias Carayannis and Pantelis Kostis

Received: 3 October 2023
Revised: 24 November 2023
Accepted: 24 November 2023
Published: 29 November 2023

1. Introduction

The European Union's smart specialization policy is considered by some to be the world's largest ongoing experiment in regional, industrial, and innovation policy [1]. With the establishment of a smart specialization strategy as a prerequisite for any European Union region to apply for structural funds, more than 120 smart specialization strategies have been developed across Europe, with more than EUR 67 billion in the European Regional Development Fund (2014–2020 programming period) to support them, along with national and regional funding [2–4].

As envisioned by the European Commission [5], integrated smart specialization strategies respond to complex development challenges by adapting policies to regional contexts. Smart specialization causes regions to focus their resources on a few key priorities, aiming to maximize the efficiency of their regional resources and emphasize their specific characteristics. As a result, smart specialization makes it possible to identify each country or region's unique characteristics and strengths and play up its competitive advantages by concentrating regional partners and resources [6].

According to Zhang [7], the combination of investment in innovation with market environment, foreign technology and government support matched with the type of region are decisive factors for technological innovation. This view is consistent with the one shown by Kroll et al. [8], according to whom the benefits ensuing from RIS3 are multi-dimensional rather than purely technological and research-related. In their analyses, Kroll et al. [9] indicate that the effectiveness of such a political approach was confirmed by research which

has shown that enterprises increase their expenditure on R&D as well as their patent rates in response to public policies aimed at stimulation of innovations.

Entrepreneurs are most often not familiar with the theoretical assumptions of RIS3 (Research and Innovation Smart Specialization Strategy), so it is crucial to verify what stimulates innovation in their organizations, what influences it, and what regional factors help or hinder the development of this process. By filling the research gap in assessing the level of business response to the opportunities provided by the regional smart specialization strategy, we have attempted to clarify which of the exposed factors on a regional basis are most important for innovation stimulation policies, especially in regions considered weaker in terms of innovation development. This is consistent with the views of Trippl et al. [10], according to which it is surprising that so little is yet known about how smart specialization works in different types of regions and about specific opportunities. On this basis, the purpose of the study was to verify the effectiveness of the regional innovation policy from the perspective of companies. Our hypothesis is that the public activities implemented under RIS3 do not sufficiently meet the real needs of innovative enterprises.

One of the key reasons why Polish regions were included in the study is that the country is ranked low in surveys conducted by the World Economic Forum—in the 2021 Global Competitiveness Index (GCI) ranking [11], Poland ranked 50th among 63 countries surveyed. Since one of the core sections of the ranking is innovation, defined as 'encouraging and expanding patient investment in research, innovation and invention that can create new 'markets of tomorrow", and the country scores low, despite the implementation of a regional innovation policy in line with RIS3, doubts arise about the effectiveness of this policy.

The main premise of our research was to learn from innovative businesses which public activities are effective and how the implementation of RIS3 is evaluated. The research question posed is: do the policy combinations meet the real needs of entrepreneurs for innovation development, which public measures under RIS3 are effective, and which constraints hinder the development of business innovation the most? The research was based on a questionnaire addressed to business entities, which was created on the basis of previously conducted in-depth interviews with representatives of regional ecosystems, including offices responsible for the creation and implementation of smart specialization strategies. The level of correlation between responses and their significance was assessed using the Wilcoxon–Mann–Whitney U test, Pearson correlation coefficients and Spearman rank classification.

The rest of the paper is organized as follows: in the next section we discuss the instruments and limitations of RIS3-based innovation policies, then we present the concept of our study and a description of the research methods we used. In the fourth section, we show the results of our research, and the last section contains the conclusions and summary of our work.

2. Theoretical Background

2.1. Public Innovation Policy and Its Instruments—The RIS3 Perspective

Public innovation policies evolve and change with new trends, new policymakers, and changes in other policies, thus creating a whole. Kern, Rogge, and Howlett [12] think that in order to stimulate innovations, it is recommended to combine technology-pushing instruments and demand, whereas research on mission-oriented policies favored combinations of policies rather than single-policy instruments, especially because RIS3 is not a one-time process, necessary simply to respond to ex ante conditions, but rather an ongoing process of improving governance and policymaking.

The multi-level reality of regions leads to serious consequences for coherence of the policies' combinations. Karo and Kattel [13] stress that the elimination of conflict between political goals, synergy existing between the instruments, and adjustment of the set of instruments to evolving regional innovation strategies become even more complicated when administrative issues and boundaries of various policies are blurred. Additionally, as

Karo and Kattel indicate, public policy management is strongly dependent on the general structural conditions of the territory, which include aspects such as institutional structure and territorial capital. They are often connected with even more general factors such as the region size. In this context, some doubts arise with regard to the structure of the applied solutions comprising selection (identification), implementation, coordination, and evaluation of the solutions currently applied in the area of smart specialization; the role of the public sector entities in shaping them; and the final effect connected with those processes, i.e., development of innovativeness in enterprises.

In the policy, mix management (defined as dialogue, commitment, and coordination) assumes particular importance due to the fact that the design and implementation of a policy become integrally connected with wider-scale decisions regarding the focus of the territorial strategy on a local or regional level in relation to the public system. They also indicate that there are few references to new innovation policy instruments and new combinations of such instruments in the literature on smart specialization. Karo and Kattel [14] think that the premise of diverse specialization requires effective procedures, capabilities, and governance practices. Ghinoi et al. [15] pinpoint the issue that even though researchers emphasize that management capabilities and practices should refer to local stakeholders, there is limited empirical evidence coming from peripheral regions about how management capabilities and practices connected with smart specialization implementation relate to regional networks of stakeholders.

Ghinoi et al. [15] state that the earlier understanding of innovations focused solely on scientific endeavors and those connected with research and development, whereas now we understand that many aspects of innovation are basically of both a local and a social nature (involving society, civic society entities, and private sector entities). Nauwelaers et al. [16] emphasize that initially, researchers engaged in analyzing innovations focused mainly on policy sets specified as a combination of policy instruments which have an impact on the quantity and quality of R&D investments in the public and private sectors, where research questions often pertain to an optimal combination of instruments to achieve a specific political goal. Nauwelaers et al. [13] point out to a risk that the support will go to projects or activities marked as 'priority treatment' so as not to lose earlier support, which may lead to opportunistic behaviors. Nauwelaers et al. [17] in turn find a relative homogeneity of policy combinations across Europe. Gianelle et al. [18] examined how and to what extent the smart specialization approach to regional innovation policy translates into strategic decisions and political interventions. Meanwhile, in another study, Gianelle et al. [19] examine key factors for effective cooperation between public and private entities.

Research studies that analyze combinations of innovativeness policies in the RIS3 context show very diverse territorial scopes, explore barriers to the implementation of RIS3, and verify how regional governance affects the innovative development of regions and/or the overall situation of the country [8,11,18].

2.2. Stimulating Innovation in RIS3 vs. Barriers and Constraints to Implementationin the Context of Research

According to Trippl, Zukauskaite, and Healy [10], it is surprising that so little is yet known about how smart specialization works in various types of regions and about specific opportunities and hindrances to transforming the concept into a political practice. At the same time, it was implemented not only in 160 EU regions, but it also became a 'travelling policy', adopted in countries such as the USA and Australia [20]. In the literature on smart specialization, the main hindrance is often identified as a lack of regional capability to devise an experiment based on a regional policy [13]. Because of the dynamic institutional context in which the policies are embedded, an optimal combination of innovation policies is elusive. The behavior and interaction of various elements of a set of policies are conditioned by the specificity of the place and context of multi-level governance, whereby policies emerge and evolve over time [13].

Barriers and constraints in the area of innovativeness development may be identified at the macro/mezo and micro levels, i.e., with regard to a system of implementation of a smart specialization strategy (regional policy), and in the context of increasing the innovativeness of enterprises as such (implementation of innovations in the regions). Both at the macro/mezo and micro level, liquidation of barriers and constraints is to result in sustainable economic growth, to a larger and larger extent based on knowledge, cooperation, and organizational excellence, at the same time effectively implementing a sustainable development program [21]. This is because innovative activities engage many actors in the innovation system, creating complex interactions in the form of knowledge diffusion or transfer. Detailed analyses regarding bottlenecks in innovation implementation, due to the close relationships between key stakeholders, regional self-governments and entrepreneurs, constitute a very important contribution to the process of innovative policy creation and activities aimed at elimination of existing barriers. Analyses conducted at the regional level are taken into account in drawing up not only appropriate smart specialization strategies, but also instruments for supporting innovativeness.

2.2.1. Barriers and Constraints to the Implementation of RIS3 and the Development of Innovation in the Regions

Difficulties with smart specialization strategy implementation are identified at the regional level; in the most general approach, they may be regarded as an incomplete transition from the traditional industrial policy to a new one based on smart specializations. As indicated by Gianelle, Guzzo, and Mieszkowski [18], there are tangible symptoms showing that regions and countries introduce mechanisms that may circumvent the premise of smart specialization. In this approach, constraints and barriers to implementation of smart specialization strategies are a result of lobbying, higher political returns from the large-scale public aid means, attitudes taken by risk-reluctant decision-makers, and lack of appropriate institutional and administrative capabilities, which may be observed at the national and regional level. The results presented by Trippl et al. [10] have shown that the barriers to implementation of smart specialization strategies differ considerably between regions that are economically less developed, moderately developed, or highly developed. They show the inter-organizational and institutional features of regional innovation systems which shape smart specialization practices. According to Cortinovis, Boschma, and van Oort [21], the frailty of public institutions as well as the low quality of decisions taken by authorities (regional decision-makers), combined with concurrently binding social capital, have a negative effect on the possibilities of smart specialization policy diversification in the regions, especially in the peripheral ones. Therefore, even if there were appropriate regional capabilities and inter-regional connections, a poor institutional structure still may prevent regions from diversification in the area of new, promising pro-innovation activities [22].

Insufficient institutional and financial potentials are the weakness of and major constraint on smart specialization strategy implementation. This was confirmed by the evidence provided by Uyarra, Marzocchi, and Sorvik [23], who studied cooperation instruments as well as the factors and barriers encountered by regions in the course of implementing cooperation under RIS3 and by Braslina, Batraga, Legzdina, Salkovska, Kalkis, Skiltere, Braslins, and Bormane [24], who identified barriers to regional competitiveness development in the context of regional economies in the EU, namely in Latvia, in the Vidzeme region. Grillitsch and Asheim [25] discuss the relationships between the prerequisites for, barriers to, and possibilities of industrial diversification. Consequently, they propose archetypical policy frameworks that are territory-oriented, covering general policy goals, and also the means at the level of entities and networks, as well as institutional and organizational support structures. Taking into account the general barriers and weakness of RIS3 policy implementation, especially in less developed regions, it seems necessary to modernize the access paths to developing innovativeness in regions. Identification of various additional factors in this regard contributes to a successful regional system of innovations and is subject to analyses [26]. Květoň and Blažek [27], in turn, by

examining the perception of key barriers and mechanisms hindering individual evolution trajectories of regional stakeholders, have demonstrated that providing a more radical path is hindered due to a wide range of barriers operating at various levels. The barrier typology prepared by them for various trajectories of development paths outlines the major barriers that limit key regional actors, connections, and institutions responsible for implementing pro-innovation policies.

The analyses completed by Asheim et al. [28] suggest that mutual interaction between a set of features that are specific to the region shapes the development and implementation of smart specialization practices in different ways. The literature on the subject also features numerous articles regarding evaluation and monitoring of RIS3 as a concept (e.g., [29–34]). Kern, Rogge, and Howlett [12] think that in order to stimulate innovations, it is advisable to combine technology-pushing instruments and demand, whereas research on mission-oriented policies favored combinations of policies rather than single-policy instruments. Uyarra et al. [35] suggest there is a need for more bottom-up (or focused on individual locations) approach to innovation policies, at the same time underlining the significance of structural factors in shaping the scope within which national or regional economies may develop and diversify. Veldhuizen [20] points out that the realities of formulating any policy are always complicated, and they depend on the context and the goals at its core.

2.2.2. Barriers and Constraints to the Implementation of RIS3 and the Development of Innovation in Enterprises

According to Coenen [36], the RIS3 concept is based on business and organizational dynamics evolving alongside the framework for design, implementation, and evaluation of regional innovation policies. Papamichail et al. [37] emphasize that lack of cooperation culture at the institutional level, diverse understanding of strategic networking between the key RIS3 entities, and lack of relations based on trust constitute the three major barriers to RIS3 implementation and prevent the practices from following a progressive path. According to Muller et al. [34], a significant barrier to raising the innovativeness of companies can be improperly coordinated connections of the implementation systems with possible innovation types. Kuhlmann and Ordóñez-Matamoros [38] and Malanowski et al. [39] state that in such situations, it is additionally necessary to discuss any failures in innovation management from the past, so as to better understand the possibilities offered at present.

In this context, it is worth noting the opinion of Magro and Wilson [27], who emphasize the importance of understanding change as a condition for its usefulness. Aranguren et al. [40] suggest that regional governments must have well-developed, sustainable coordination mechanisms, since, as practice shows, the most valuable processes in this area, such as consultative processes (formal and customary) or regular dialogues, are not always formalized. This was confirmed by Nauwelaers, Midtkanal, and Forte [41], who, analyzing a typology of innovation policy instruments in terms of policy goals and policy interactions, showed a gap between RIS3 design and RIS3 implementation.

RIS3 requires wise, strategic choices and evidence-based policy-making, and this approach distinguishes it from other policies based solely on indicator studies or statistical analyses. The RIS3 assumptions based on the unique resources of the region on the one hand make use of the entrepreneurial process of discovery, covering a wide range of regional stakeholders from the quadruple helix of government, business, scientific research and civic society [13], and on the other hand the premise of diverse specialization requires effective procedures, capabilities and practices of governance with regard to the regional networks of stakeholders [15]. Aranguren, Magro, Navarro, and Wilson [42] conclude that application of the RIS3 approach may be shaped by the heritage of previously existing strategies and policy combinations or may be in conflict with them. Institutional contexts in regions create both barriers and opportunities for new RIS3, and it is necessary to take into account continuity mechanisms and changes in policy shaping.

The conditions under which companies operate, including the institutional framework, socioeconomic aspects, infrastructure and forms of business support, do not always meet

their needs. In particular, skills related to the ability to identify factors inherent in the potential and resources of a region and to create a pro-innovative environment for the activities of business entities are gaining particular importance [43]. There are a number of studies pointing to the drivers of business innovation in this regard [37,42,43]. The innovative activity of enterprises is the result of many factors that change over time and are dynamic in nature. These factors form the innovation potential of an enterprise, i.e., the ability of an enterprise to innovate effectively (e.g., financial potential, human potential, material potential, technical knowledge, and market information).

3. Materials and Methods

In this paper, we discuss the results of one phase of a wide-ranging study we designed to verify the interactions between the implementation of innovation strategies in the form of RIS3, the barriers and bottlenecks to innovation diffusion, and the development of business innovation in the regions. The object of the entire research project was to collect and present data describing the progress and development of the region in the implementation of the smart specialization strategy and the impact of this public intervention on its stakeholders.

The study covered five regions located in Western Poland. First, regional RIS3 strategies were explored, which were analyzed via a qualitative structural content analysis. The information contained in them was juxtaposed with the results of the literature review and EU documents applicable to the 2014–2020 period. The authors of the study assumed that in order to properly assess the situation, it is particularly important to verify the views and main priorities of representatives of institutions implementing RIS3 (public sector) and business representatives. This assumption accounts for the uniqueness of the study—available reports primarily analyze single aspects related to the implementation of RIS3 (e.g., [44,45]) and/or focus on the broader innovation of Polish regions. Slightly deeper analyses of RIS3 are being carried out at the regional level (see: [46–48]); however, to date, no cross-regional study has been developed that analyzes the same areas related to RIS3 from the perspective of two key stakeholder groups.

On this basis, a qualitative study was designed, using individual in-depth interviews (IDIs). The design of the interviews included questions on RIS3 management practices in terms of, among other things, the role of stakeholders in the RIS3 implementation process, barriers to RIS3 implementation/innovation activities, benefits of RIS3 implementation, RIS3 implementation tools, and the effects of RIS3 implementation in the region and its overall assessment. In-depth interviews were conducted with representatives of provincial governments, local governments, business environment institutions, and enterprises (the details of the IDI survey are described in the paper: [49]). Based on these, a survey questionnaire was developed for the quantitative study.

The main survey, implemented using the CATI method, covered enterprises that from 2016 to 2020 supported their innovative activities with public/European funds at the national level (Operational Program Intelligent Development) and regional level (Research and Development under Regional Operational Programs). The survey was carried out using the random-quota sampling method among 250 companies engaged in innovative activities in the following provinces: Zachodniopomorskie (n = 37), Lubuskie (n = 16), Dolnośląskie (n = 87), Opolskie (n = 16), and Wielkopolskie (n = 94) (Figure 1). The survey sample was a representation of the population of innovative enterprises of the five selected provinces. Data were collected between November 2020 and January 2021. The distribution of the sample mirrored that of the general population, i.e., innovative companies in Western Poland, which provided a basis for generalizing the results to the entire population (of innovative companies in Western Poland). The maximum measurement error with a sample of 250 was the satisfactory 6% with the 94% confidence level.

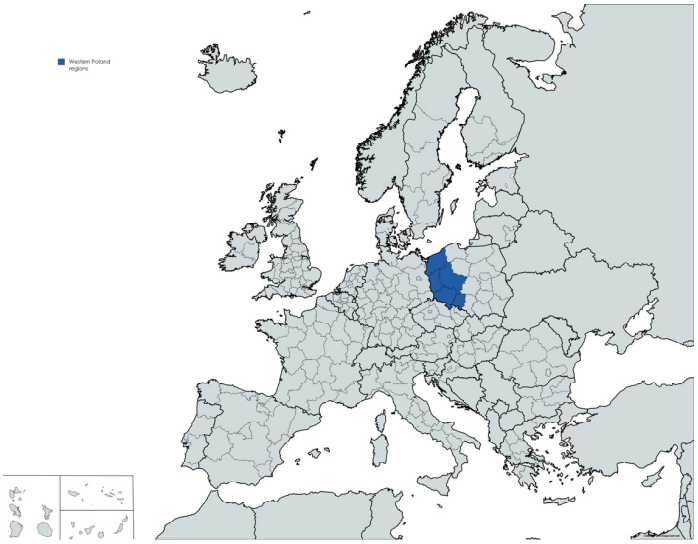

Figure 1. Regions covered by the study. Source: created in MapChart [50].

The survey questionnaire, which was also pre-tested, consisted of five parts providing data on general information to classify respondents, the progress of RIS3 strategy implementation, the assessment of obtaining the expected results, and the effectiveness of innovation management in the regions under RIS. It contained 16 multiple-choice questions, and 2862 records were used. When completing the sample, refusals were encountered, which were mostly related to the absence of competent persons (n = 326), lack of interest in participating in the survey (n = 123), and inability to be contacted via phone (n = 122).

The collected survey material was subjected to a reliability (internal consistency) analysis of the indicators calculated from each group of questions based on Cronbach's α coefficient (this method is used in similar studies, including, among others, Zheng, Hu, and Yang [51] and Zhu, Liu, Lin, and Liang [52]). Due to the ordinal nature of the responses to the questions, Cronbach's α coefficient was calculated based on polychoric correlation coefficients [53,54]. Conventionally, Cronbach's α values > 0.7 indicate a scale with sufficient reliability for research purposes. Responses of 'don't know/don't have an opinion' were treated as missing data.

Descriptive statistics (mean, standard deviation, coefficient of variation) were analyzed for all parameters. Spearman's R was used to calculate the correlation between activities/tools/resources/regional pro-innovation initiatives resulting from the RIS3 policy and their evaluation/effectiveness from a business perspective. Spearman's rank correlation was used due to the fact that it is a non-parametric measure (meaning that no assumptions are made about the distribution of the data), is more resistant to outliers than the traditional Pearson correlation, allows analysis of rank data, and enables comparison of the interrelationships between rank variables. It measures the degree of monotonic dependence between variables, regardless of their linearity, which makes it possible to detect both linear and non-linear relationships. In regional studies related to innovation, it is used by, among others, Makkonen and Van der Have [55] and Firsova and Tsypin [56]. This coefficient is used for nonparametric analysis of the relationship between two variables. The rank correlation coefficient takes a value in the range $[-1; 1]$. The closer the value of this measure is to -1, the stronger the negative correlation between the studied characteristics, while the closer it is to +1, the stronger the positive correlation. Values close to zero indicate a weak relationship between the variables [57].

The Mann–Whitney test, which is a test of both location and shape given two independent samples, was used to assess the relationship between response groups, testing whether one variable tends to have higher values than the other [58]. The Wilcoxon–Mann–Whitney test is used to compare two independent groups to determine whether they differ significantly in terms of the median. This test is used in a variety of scientific fields, including

studies related to economics, among others, to examine the impact of policy actions or reforms on different social or economic groups [59]. On this basis, data sets were selected, describing those areas of the quantitative survey for which there was a statistically significant relationship, describing the phenomenon under study. In the final step of the analyses, Spearman's R index was used to analyze the correlation between the views of respondents and the region they represent and the size of the companies they represent.

4. Results

The overall results of our survey show that, from the perspective of companies, the activities that most create/develop innovation in their companies are the work of the R&D team, management initiatives, customer expectations, obtaining external financing, and new market opportunities. These responses demonstrate the importance of both internal company potential and external support.

Detailed analyses based on correlations between the answers of business representatives to various questions are to give a picture of the situation: how businesses use the opportunities created under RIS3 and, above all, whether the initiatives and tools created under this policy respond to the needs of the businesses. Below are those aspects related to the activities of innovative companies for which there is a correlation between the answers to the various questions. A significant positive correlation was found between the evaluation of RIS3 and the activities that were identified as crucial to the development of innovation in an enterprise (Table 1). Organizations for which obtaining external sources of financing is important ('very important' and 'rather important') are far more likely to believe that RIS3 increases business research and innovation activity (45.4%) than those for which external financing is not important (4.5%). This may confirm the fact that ignorance of RIS3, or more generally ignorance of regional innovation policies, determines the way companies act—they do not seek external support but rely on their own resources. Enterprises that rate RIS3 as benefiting them, at the same time, believe that purchasing technology is important for creating/developing innovation (37.8%), as is the work of the R&D team (38.6%). At the same time, however, the same elements are identified as important by organizations that evaluate RIS3 negatively (22.6% and 25.6%, respectively). There is an interesting way of evaluating cooperation with academic centers, where companies evaluating RIS3 positively consider this cooperation important (31.9%), whereas companies evaluating RIS3 negatively describe this cooperation as unimportant (29.4%). It can be assumed that RIS3 reinforces the importance of R&D for entrepreneurs who are familiar with its principles and the tools they can use.

Table 1. Relationships between activities that develop innovation in the company and the assessment of the benefits of RIS3.

		Increases the Research and Innovation Activity of the Enterprise			
		Definitely Yes	**Yes**	**No**	**Definitely No**
Purchase of technology, licenses, patents, know-how	Very important	10.3%	8.8%	2.3%	4.5%
	Rather important	8.8%	10.0%	11.3%	4.5%
	Rather unimportant	3.3%	5.8%	5.8%	2.3%
	Not at all relevant	2.5%	0.5%	5.8%	13.8%
Spearman's test: rho = 0.25, $p < 0.01$					
Cooperation with academic centers	Very important	11.2%	4.7%	3.5%	2.2%
	Rather important	6.2%	9.7%	9.0%	5.7%
	Rather unimportant	3.2%	8.2%	2.2%	8.0%
	Not at all relevant	4.5%	2.2%	10.2%	9.0%
Spearman's test: rho = 0.28, $p < 0.01$					

Table 1. *Cont.*

		Increases the Research and Innovation Activity of the Enterprise			
		Definitely Yes	**Yes**	**No**	**Definitely No**
Obtaining external funding sources	Very important	17.9%	13.2%	7.9%	13.6%
	Rather important	5.0%	9.4%	10.2%	5.7%
	Rather unimportant	1.0%	1.2%	3.5%	1.2%
	Not at all relevant	1.2%	1.0%	3.5%	4.5%
Spearman's test: rho = 0.22, $p < 0.01$					
R&D team's work	Very important	13.8%	6.3%	4.8%	8.0%
	Rather important	7.0%	11.5%	8.3%	4.5%
	Rather unimportant	2.8%	5.3%	8.3%	3.5%
	Not at all relevant	1.5%	2.0%	3.5%	9.0%
Spearman's test: rho = 0.31, $p < 0.01$					

Source: own study.

Of the enterprises for which building various cooperation networks is important, 36% rate the regional base of science and technology institutions as sufficient, and 34% as insufficient (Table 2). The opinion of companies that consider the creation of cyclical forms of R&D cooperation as important is similar—the base is sufficient in the opinion of 30.7% and insufficient according to 31.2%. Organizations for which organizing/providing venues that are centers of cooperation is important assess the regional base of science and technology institutions as insufficient (36%); it is sufficient according to 29% of them.

Table 2. Relationships between the evaluation of the regional base of science and technology institutions and selected pro-innovation local government activities.

		Science and Technology Institutions	
		The Base Is Adequate	**The Base Is Not Enough**
Building various cooperation networks (between the industry and business environment institutions and academic centers)	Very important	16.0%	18.5%
	Important	20.0%	15.5%
	Neutral	7.5%	10.0%
	Not very important	4.5%	3.0%
	Irrelevant	2.0%	3.0%
WMW test: Z = 7.67, $p < 0.001$, r = 0.53			
Organizing/providing venues that will serve as centers of cooperation for all these entities	Very important	12.5%	16.0%
	Important	16.5%	20.0%
	Neutral	13.5%	11.0%
	Not very important	4.5%	2.5%
	Irrelevant	3.0%	0.5%
WMW test: Z = 8.46, $p < 0.001$, r = 0.58			
Creating cyclic forms of R&D cooperation	Very important	9.5%	12.6%
	Important	21.1%	18.6%
	Neutral	12.6%	13.6%
	Not very important	3.5%	2.5%
	Irrelevant	3.0%	3.0%
WMW test: Z = 9.55, $p < 0.001$, r = 0.66			

Source: own study.

The base of institutions involved in supporting and intermediating the acquisition of innovations is rated as sufficient (33.3%) and insufficient (34.8%) by the companies for which building diverse networks of cooperation is important (Table 3). The ratings are similarly distributed among the companies for which cooperation venues are important (29% rate the base as sufficient and 33% as insufficient) and the companies that consider the creation of cyclical forms of cooperation as important (for 29.2% of them, the base is sufficient; 32.2% consider it insufficient). This fairly even distribution of responses in terms of evaluation of the science and technology institutions base and cooperation shows that a large proportion of enterprises prefer to work on their own. Using the infrastructure of universities can be too time-consuming for them (procedures related to signing agreements between institutions) and costly (surcharges imposed by universities). Other priorities may also be important—academics want to publish the results of their research first, while businesses do not want to wait; they want to use them and implement them in their processes.

Table 3. Relationships between the evaluation of the regional base of institutions for support and intermediation in the field of innovation acquisition and selected pro-innovation activities of local governments.

		Institutions for Support and Intermediation in the Field of Innovation Acquisition	
		The Base Is Adequate	**The Base Is Not Enough**
Building various cooperation networks (between the industry and business environment institutions and academic centers)	Very important	14.4%	18.4%
	Important	18.9%	16.4%
	Neutral	8.5%	10.9%
	Not very important	6.5%	2.5%
	Irrelevant	2.0%	1.5%
WMW test: Z = 7.58, $p < 0.001$, r = 0.52			
Organizing/providing venues that will serve as centers of cooperation for all these entities	Very important	11.0%	15.0%
	Important	18.0%	18.0%
	Neutral	13.0%	12.0%
	Not very important	5.0%	3.5%
	Irrelevant	3.0%	1.5%
WMW test: Z = 8.86, $p < 0.001$, r = 0.6			
Creating cyclic forms of R&D cooperation	Very important	9.9%	11.9%
	Important	19.3%	20.3%
	Neutral	13.9%	12.9%
	Not very important	4.0%	2.0%
	Irrelevant	3.0%	3.0%
WMW test: Z = 9.39, $p < 0.001$, r = 0.65			

Source: own study.

Among the barriers hindering the development of innovation, representatives of enterprises most often indicated insufficient financial capacity (75.6%), insufficient human resources/human capital (64%), low level of technical infrastructure (52.8%), and limited conditions for the development of the local economy (46.4%). A study of the relationships between the indicated barriers and the regional base for the development of innovative activities (Table 4) showed that the education and training base is not sufficient according to 36.3% of the respondents (sufficient in the opinion of 28.9%), who consider human capital important and very important. Human capital (understood in this case as skilled

workers and researchers) is also rated as insufficient by 44.3% of these companies (sufficient according to 23.4%). This shows the need to adapt education and training offerings to the actual demand of the regional labor market. In turn, the base of financial services institutions is assessed as sufficient by 39% of the companies (for whom financial potential is important and very important in terms of innovation development). At the same time, 36.5% of respondents in this group rate it as insufficient.

Table 4. Relationships between the indicated barriers and the regional base for the development of innovative activities.

		Financial Service Institutions	
		The Base Is Adequate	**The Base Is Not Enough**
Insufficient financial capacity	Very important	21.0%	26.0%
	Important	18.0%	10.5%
	Neutral	5.5%	6.0%
	Not very important	2.5%	2.0%
	Irrelevant	3.5%	5.0%
WMW test: Z = 7.83, $p < 0.001$, r = 0.53			
		Education and training system	
		The base is adequate	**The base is not enough**
Insufficient human resources/human capital	Very important	14.9%	24.4%
	Important	13.9%	11.9%
	Neutral	10.0%	7.5%
	Not very important	3.5%	3.0%
	Irrelevant	7.5%	3.5%
WMW test: Z = 7.32, $p < 0.001$, r = 0.49			
		Human capital i.e., skilled workers, scientists	
		The base is adequate	**The base is not enough**
Insufficient human resources/human capital	Very important	10.4%	28.9%
	Important	12.9%	15.4%
	Neutral	11.9%	4.0%
	Not very important	5.5%	0.0%
	Irrelevant	9.5%	1.5%
WMW test: Z = 6.45, $p < 0.001$, r = 0.42			

Source: own study.

Asked what type of financing helps them implement innovation in their enterprises, entrepreneurs most often indicated their own funds (Figure 2), followed by the Operational Program Intelligent Development financed by national funds and European Regional Development Funds, and funds from the Regional Operational Program. It should be recalled at this point that the sampling frame for the survey included companies that, between 2016 and 2020, participated in the Operational Program Intelligent Development or/and Regional Operational Program under Measure 1.2 Research and Development; thus, the following data should be considered primarily in a comparative context—the most important conclusion from the answers to this question indicates the particular relevance of the company's own funds, and, at a later stage, external sources. This conclusion leads to a reflection—why do companies, when creating innovative activities, prefer to use their own resources rather than external funds? It may be related to complicated procedures, long waiting times, and complex formalities when settling funds.

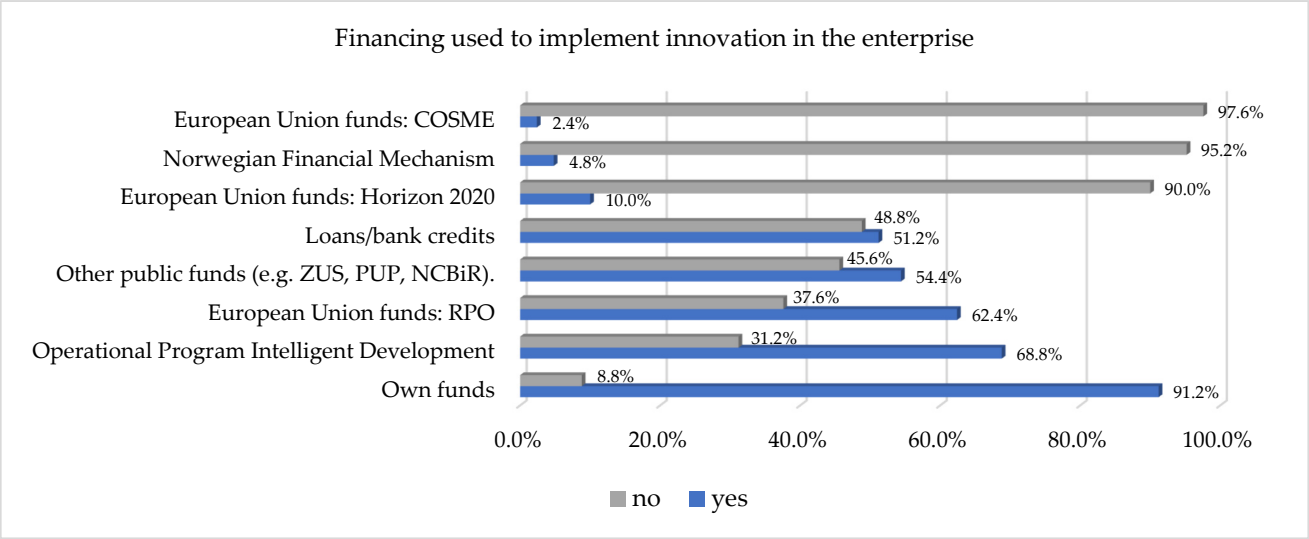

Figure 2. Sources of funding for innovation in the company. Source: own study.

The analysis has also shown that creation of cyclical forms of R&D cooperation is important for 32.2% of the companies which consider purchases of technology, licenses, patents, and know-how important to the development of innovation (at the same time, it is unimportant for 29.2% of these companies)—Table 5.

Table 5. Relationships between the creation of R&D cooperation and the relevance of purchase of technology, licenses, patents, and know-how to the development of innovation.

		Purchase of Technology, Licenses, Patents, Know-How			
		Very Relevant		**Rather Irrelevant**	
Creating cyclic forms of R&D cooperation	Very important	6.7%	4.5%	3.5%	6.7%
	Important	10.7%	10.2%	9.0%	10.0%
	Neutral	5.2%	7.7%	7.2%	5.0%
	Not very important	2.0%	0.7%	3.0%	0.0%
	Irrelevant	0.2%	1.7%	2.5%	3.2%
Spearman's test: rho = 0.11, p = 0.087					

Source: own study.

Summarizing the results, it can be concluded that the surveyed innovative companies often do not use the tools proposed by RIS3. Entrepreneurs try to rely on their own resources and funds. At the same time, a lack of knowledge regarding this innovation policy can be observed. Unaware entrepreneurs are able to neither objectively evaluate it nor use it effectively. These findings support our hypothesis.

The analysis of the relationship between the views (answers) of the respondents and the region they represent showed the absence of a statistically significant relationship between the region and the effectiveness of pro-innovation measures implemented under RIS3 in the opinion of the respondents. A similar lack of correlation was found with regard to the size of companies and their views. This may indicate design/implementation errors at the supra-regional level.

5. Discussion

In our work, we try to give an answer to the questions: Do the policy combinations meet the real needs of entrepreneurs for innovation development, which public measures

under RIS3 are effective, and which constraints hinder the development of business innovation the most? This is because there is a risk that entrepreneurs may buy into the assumptions of the policies promoted at a given moment in order to obtain financing for their projects, which, however, will not continue in the long term. Thus, we complemented the conclusions of Radosevic [60], according to whom the experimental approach to the smart specialization strategy is limited to the selection phase, while its implementation is based on traditional instruments and also Jacobs [61], who argued as early as in the 1990s that it is the policies of national governments that can be crucial within national systems of approach to innovation, ignoring the importance of regional coverage. Our research shows, by contrast, that businesses for which it is important to build various networks, rate the regional base of local government and scientific research institutions as necessary and still not sufficient.

The hypothesis posed in this paper, i.e., that public activities implemented within the framework of RIS3 do not sufficiently meet the real needs of innovative enterprises, was confirmed by us. The main conclusions of the analysis conducted in the study indicate that the enterprises for which the strategy of smart specializations is important and which appreciate it as a tool for supporting innovation in the region at the same time report a need for external sources of financing such as grants or preferential loans. At the same time, one-third of the enterprises believe that the strategy of smart specializations is not of major importance to their business, and within the framework of increasing their business activity, financial support measures directed via RIS3 are not attractive enough to reach for. In addition, the companies that benefit from RIS3 funding believe that it is more important to purchase technology than to produce it for their innovation development. In contrast, the companies for which RIS3 is not very important articulate needs related to developing research facilities and increasing the efficiency of R&D teams, which in turn may mean that they are economically strong enough to meet the needs related to pro-innovation investments on their own. Among the group of enterprises indicating a number of significant barriers to the development of innovation (mainly financial, personnel, and infrastructure barriers) are enterprises articulating needs related to the expansion of educational and training offerings, as well as cooperation with scientists and skilled workers. In conclusion, it should be said that the above conclusions often contradict the overarching goal of the current public support under RIS3, which concentrates most of its efforts around the creation of a system of financing for enterprises within the framework of operational programs. This is because the system of financial support alone for the purchase of new technologies by companies is becoming insufficient in the context of the need to build a whole ecosystem of links between business, public administration and environmental institutions. As Mahardhani points out, properly executed policies can create a favorable environment for innovation, stimulate research and development, and empower human resources to face rapid technological challenges [62].

In our view, the observations of entrepreneurs can provide important guidance for those who implement new solutions. In this regard, the results of our research show some consistency with the observations of Zhang [7], who argues that, depending on the type of region, the decisive factor for technological innovation is investment in innovation, market environment, foreign technology, and public support. Our research and analyses have proved that regions make considerable efforts to comprehensively define rather complex RIS3 policy priorities based on broad stakeholder involvement in the entrepreneurial discovery process, while in reality these priorities are not aligned with entrepreneurs' expectations. Entrepreneurs are often unaware of the theoretical assumptions involved in the implementation of public policies, yet the analyses by Kroll, Muller, Schnabl, and Zenker [9], among others, indicate that companies are increasing their R&D spending and patenting rates in response to public policies designed to stimulate innovation. In the long perspective, this is consistent with the conclusions of Lankauskienė, Simonaitytė, Gedminaitė-Raudonė, and Johnson, who notes the lack of evaluation of the course taken on the real impact on the characteristics of economic development [63]. In this aspect, it is

also important that policy decisions be socially embedded for the intended transformative impacts [64].

Our findings complement the assertions of Steen [65], who points out that the proactive role of the state requires significant work on the part of institutional entrepreneurs who lead the way, aligning innovation actors and networks, and building hard and soft infrastructure, thus leading to the creation of new institutions. At the same time, they develop the theses of Gianelle et al. [19], who stress the importance of the presence of effective institutions, dynamic social contexts, characterized by trust, reciprocity and strategic cooperation between public and private actors in cultivating development processes. This confirms the conclusions of the Noor, Danar, and Wahyudi analysis, according to which the collaboration innovation should be able to generate innovation based on ideas, knowledge, expertise, and opportunities that can be obtained from the full collaboration of all actors [66].

Filling the identified research gap and in response to the hypothesis stated in our paper, we have selected the most important barriers and constraints to the development of innovation identified at the mezo and micro levels, i.e., in relation to the implementation system of the smart specialization strategy (regional policy) and in the context of increasing the innovation of enterprises as such (implementation of innovation in enterprises). At both the mezo and micro levels, the removal of barriers and constraints boiled down to cooperation and organizational excellence while effectively implementing a sustainable development program, which in this case confirmed the assertions of Veldhuizen [21], showing the importance and relevance of the base of institutions involved in supporting and mediating the acquisition of innovation.

6. Conclusions and Future Research Orientations

The research and analyses carried out in the study were aimed at testing the relationships mainly between external activities that most create/develop innovation in enterprises, networking within the innovation ecosystem, and barriers inhibiting innovation development. By filling the research gap in assessing the level of response of enterprises to the opportunities provided by the regional smart specialization strategy, we attempted to clarify which of the exposed factors on a regional basis are most important for innovation stimulation policies, especially in regions considered weaker in terms of innovation development. Thus, referring to the studies carried out in this regard, which, unfortunately, cannot be considered to be unequivocally conclusive with regard to regions with different levels of development, new data and current conclusions were presented.

The results of our study are consistent with the latest approach to the Preparation of Science, Technology, and Innovation (STI), which, as a tool for achieving the Sustainable Development Goals (SDGs), is designed with the use of the road-mapping methodology. According to this method, data and evidence on STI roadmaps of smart specializations provide tools to identify socio-economic and environmental drivers of innovation, local growth, competitive advantages, as well as opportunities and weaknesses. Thus, our analyses conducted at the regional level can not only provide empirical evidence for literature discussions and research conclusions, but also be used in the development of relevant smart specialization strategies that include innovation support instruments.

Our findings showed that investing in building political capacity and institutional infrastructure capacity to design and implement RIS3 policies is still a major challenge, and that those implementing the strategy, while focusing on assumptions and implementation, forget about its important stakeholders, namely entrepreneurs. The obtained empirical results make us see the need to reorient the meaning of RIS3 in regions such as those we studied, with regard to the creation and development of new innovation policies. Despite a general increase in emphasis on coordination and changes aimed at the effectiveness of coordination mechanisms, we still do not see proximity in the relationships between key stakeholders. Knowledge, collaboration and organizational excellence should be able to help decision-makers contribute to better implementation of RIS3, and consequently to

improved business innovation. We confirm in our conclusions the insights of Meyer [67], who revealed the need to use social innovators and social capital as available regional assets for the effective development of innovation policies in the regions.

Pointing to recommendations for the future, we propose to continue the activities initiated in the regions with regard to the implementation of innovation policies based on smart specializations (RIS3) with a particular emphasis on basing pro-innovation activities on strong partnerships and supra-regional and international cooperation. Given that RIS3 strategies in the regions of the European Union will continue to be present in the 2021–2027 perspective, which is reflected in the European Commission's approach and its stipulation of the condition 'Good governance of national and regional smart specialization strategy for Policy Objective 1—A smarter Europe by fostering innovative and smart economic transformation in the 2021–2027 financial perspective (CP1)' [68], we believe that it is necessary to increase the activity of the innovation ecosystem in the international space. While the very concept of smart specializations, at its core, refers to strictly local conditions for the development of innovation in specific areas or niches, we believe that it should be based more broadly on the premise of creating an international network of links between complementary regional ties (value chain creation). Such establishment and consolidation of reciprocal relations with partners from outside the country in priority areas supported by the smart specialization strategy can bring concrete benefits via the use of synergies, such as manifested in a strong internationalization of production, research or activities aimed at creating a strategic framework for innovation growth. In our opinion, one of the fundamental assumptions from the point of view of the economic well-being of enterprises and, in the further pursuit of the broader growth of regional economies, is to base the instruments of innovation policy, in particular the catalog of instruments to support smart regional specializations, on partnerships and internationalization of cooperation with foreign partners.

In our opinion, the conclusions of the research results obtained may prove helpful in improving regional research and innovation systems in the 2021–2027 financial perspective and beyond. In addition to the recommendations indicated above regarding the development of innovation ecosystems, as well as the building of cross-regional partnerships and internationalization, we also point to measures that can increase the effectiveness of innovation policy and RIS3, such as the construction of a strong and sustainable institutional system and profiled support focused on reducing constraints and eliminating barriers, which were indicated by the entrepreneurs surveyed and have already been extensively discussed by us in the paper. Looking for practical implications for implementing a better system of public support under RIS3, we highlight the innovation ecosystem as one that should be developed as a priority. It seems that the construction of a coherent system of product development, technology transfer, and knowledge, consisting of institutions and activities leading to the transformation of knowledge into new products, services, technologies, and organizational and marketing solutions, as well as instruments of financial support for the commercialization phase of an innovative idea, are the answer to the challenges faced by RIS3 developers, which are the result of the demand currently reported by businesses. Ecosystems should be present in innovation strategies based on smart specializations encompassing a business layer, a technological layer, and a knowledge (scientific) layer—and thus should be able to jointly generate new value. This can bring much greater benefits than simply financing purchases of technology by companies, as is still the case today.

1. The inference from our research about the key business support of smart specialization strategies, as well as the verification of the assumption that RIS3 responds to the real needs of entrepreneurs in stimulating innovation development, are somewhat limited. These limitations are due to three important reasons: In the case of the enterprises surveyed in our study, the majority of the sample was made up of small and medium-sized enterprises, while a minority was made up of large enterprises, whose preferences for opportunities and means of investing in innovation are far

greater. Based on the assumption that the size of enterprises in an economy matters for its innovativeness, it is to be expected that large enterprises are more innovatively active than small and medium-sized enterprises (although they rarely benefit from public support), and, moreover, they cooperate with other enterprises in innovation activity. Here we point out a research gap arising from our analysis inspiring further research and in-depth diagnoses with regard to mainly large enterprises, more often undertaking investment activity in innovation and allocating significant resources to research and development (R&D) in the context of exploiting (or not) the potential of the regional smart specialization strategy.

2. Our study generalizes the research sample, ignoring the issues of differentiating into the industries in which enterprises operate, and therefore limits the inference to the total and not by key industries in the regions studied. Businesses operating in different areas of the economy often show different levels of demand for support for pro-innovation activities (they generate demand for different types of innovation). The direction of further research may therefore be, the selection of key industries and on their basis to infer their specificities and differences in the context of assessments of the benefits and limitations of smart specialization strategies.
3. Existing, developing, or potential smart specializations are evidenced not only by the functioning of the entities of a specific industry but primarily by the presence of criteria that are difficult to identify, such as, for example: the quality of links between them, external competition or the existing potential to develop specialization in an interregional arrangement. Due to the limited research framework of our project in terms of scope and time, we could not examine the above aspects in detail. We point out, however, an interesting research field that would be worth exploring on a larger research sample in the regional linkage system. For it is very possible that there is a causal relationship between these variables and the implementation of smart specialization. Very similar relationships would also be worth exploring and evaluating in an international setting.
4. Finally, according to the latest European innovation scoreboard [69], Poland is an Emerging Innovator with performance at 62.8% of the EU average. This score is rising, confirming the growth of the economy, but at the same time manufacturing is taking a larger share of the economy. The report pointed out that Poland has a much higher share of Non-Innovators with no propensity to innovate than the EU average.

Recognizing the limitations of our findings, our evidence and findings can contribute to the area of smart specialization implementation, and can also prove to be part of the discourse conducted in the area of innovation development policies in the coming years. In our opinion, the study we designed should be extended to other regions of the EU countries, this will allow us to find key areas for improvement in the context of RIS3 implementation, taking into account the different levels of development of the innovation potential in the regions.

Author Contributions: Conceptualization, E.O.-K. and M.K.-J.; methodology, E.O.-K. and M.K.-J.; validation, E.O.-K. and M.K.-J.; formal analysis, E.O.-K. and M.K.-J.; resources, E.O.-K. and M.K.-J.; writing—original draft preparation, E.O.-K. and M.K.-J.; writing—review and editing, E.O.-K. and M.K.-J.; visualization, E.O.-K. and M.K.-J.; supervision, E.O.-K. and M.K.-J.; project administration, E.O.-K. and M.K.-J.; funding acquisition, E.O.-K. and M.K.-J. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the program of the Minister of Science and Higher Education under the name 'Regional Excellence Initiative' in the years 2019–2022; project number 001/RID/2018/19; the amount of financing: PLN 10,684,000.00.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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

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