Impact of Public Support for Innovation on Company Performance: Review and Meta-Analysis

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Abstract: In recent years, there has been a significant shift in public policies directed to firms, with several governments launching public measures to support innovation. To promote firms’ innovation, governments can implement incentives such as subsidizing companies, inducing them to undertake those investments. Hence, the aim of this study is to review the results of a set of studies published on the evaluation of public support to firms’ innovation. To achieve this goal, we conduct a literature review that combines bibliometric analysis, network, qualitative analysis (content review), and quantitative analysis through meta-regression. The analysis was performed using the VOSviewer and Stata software and the results of the meta-regression (regression with Logit model) suggest that there are no characteristics of studies on this topic that affect the results obtained. It was verified that, in the set of articles analyzed, there is strong evidence that public support for innovation leads to favorable results for the company’s performance. The main trends in the topics addressed were also identified and analyzed and, in addition to financial support for innovation, support for small and medium-sized companies, support for the development of the high-tech industry, and open and collaborative innovation stand out.

Keywords: bibliometric analysis; innovation; literature review; meta-regression; performance and public support

1. Introduction

Innovation is a widely used concept mainly in the business, environmental and economic spheres. The act of innovating means the need to create different strategies to achieve certain goals. Innovation is not only based on the development of new products or services, but it also helps to promote other aspects such as new business models and process improvements. For this to happen, it is important that innovation is valued and properly recognized and, instead of being seen as an expense, it is understood as an investment. In this way, it is extremely important to promote public intervention in companies’ research and development (R&D) activities [1–3].

Based on public support for innovation, the system of incentives for innovation has been increasing over the last few years, both in more developed and emerging economies. As mentioned by [4] the efficiency of these innovation incentive systems has been widely studied within different economic and management theories, such as innovation systems, the triple helix and, more recently, business and innovation ecosystems.

R&D market failures related to research externalities that produce greater social production than private production require and justify public intervention. But since regulation, especially in relation to intellectual property protection, direct subsidies or tax incentives, the effectiveness of public intervention instruments has often been debated.

According to some studies, these incentive systems have had a positive impact on the performance of companies supported in terms of investment (namely in fixed capital), the qualification of human resources, innovation, competitiveness and the internationalization
of companies [5–7]. However, it is possible to identify studies where the impact presented by government support is not positive [8–12].

In this study, the research procedure and selection of articles is presented first. This procedure is based on the objective of deepening knowledge about the effect of public support for R&D and innovation on the performance of the company’s innovative activity, as well as on the performance of the company. The selected articles were later analyzed through bibliometric analysis and through a meta-analysis to understand if there are characteristics of the studies that somehow affect the results obtained. After this analysis, a qualitative analysis was carried out where four dimensions were identified. The first dimension, the most general, refers to public support for innovation and R&D. The other three, more specific, dimensions refer to public support for innovation in small and medium-sized enterprises (SMEs), cooperation and open innovation and the development of high-tech industries. Finally, the main conclusions of this study, its limitations and suggestions for future research are presented.

2. Research Method

This study was conducted using a systematic literature review approach, which combined bibliometric analysis and meta-analysis such as studies by Jugend, Fiorini, Armellini and Ferrari, Bhimani, and Mention, Barlatier and Garcia-Quevedo [4,13,14].

The articles included in this study were identified through a search carried out in the Scopus database, one of the main databases worldwide [4,15,16].

Several steps were followed until reaching the final sample of articles. Our research design, summarized in Figure 1, is based on our research objectives which, together with the inclusion and exclusion criteria, allow us to arrive at a final sample of articles that can be analyzed [4].

The article search started with the combination of the expressions “R&D”, “Research and Innovation” or “Innovation” with the expressions “Public support”, “Government support”, “Subsidy”, “Subsidies” or “Grants” and the term “Performance”. These expressions were chosen given their emergence in studies that assess the effect of government support for innovation on company performance [17–20].

The referred expressions were inserted in the Scopus database in the Abstract, Title and Keywords fields. This search returned 804 results. Subsequently, it was found that
from 2010 onwards the number of publications increases exponentially, thus defining the first exclusion criterion, eliminating the results prior to 2010. This exclusion criterion also allows for greater uniformity in the studies and samples analyzed to be included in the meta-analysis. Also, when considering 11 years, we tried to cover the studies in the follow-up of the last crisis and subsequent years.

Publications that were not classified as articles and that did not belong to the areas of business, management and accounting or economics, econometrics and finance were also excluded. With the application of these criteria, we were left with a sample of 230 publications.

Subsequently, the 230 articles were analyzed, having been organized according to the PRISMA analysis checklist items [21]. The purpose of the study is to expand knowledge about the impact of public support for innovation and analyze the relationship of this support with innovation performance and company performance. Another purpose is to analyze whether there are characteristics of the studies that may influence the results obtained in the empirical results, this objective being analyzed using a meta-regression.

Based on the analysis of the articles, those that were not related to the above-mentioned concepts, theoretical articles, literature review articles or those that focused on very specific issues and, therefore, were not comparable with other articles for analysis, were excluded. qualitative analysis or for its inclusion in the meta-regression. Based on this selection, we obtained a final sample of 56 articles.

The analysis of the 56 articles was carried out in two steps. First, a bibliometric approach with the objective of analyzing the evolution of publications, the countries studied, the most used methodologies and the most frequently related concepts. Second, a meta-analysis was carried out using meta-regression models, with the aim of better understanding the common characteristics of the articles analyzed and that may influence the results obtained. After these two stages of analysis, the discussion is based on a qualitative analysis, highlighting the most discussed topics in the literature—support for innovation in SMEs, high-tech innovation, and open and collaborative innovation.

3. Bibliometric Analysis

This section presents the bibliometric analysis that aims to guide the purpose of this study. In this analysis it is possible to identify current areas of research interest and potential directions.

There is a growing trend of published articles with a clear emphasis on the last five years. This observation is the same when we analyzed the initial sample of 230 articles and remains with our final sample of 56 articles after applying the inclusion/exclusion criteria. This exponential growth in the number of publications, with a clear emphasis on the years 2016 to 2020, reflects the growing interest in better understanding where and how state support for innovation is being applied and what results come from it.

This increase in the number of publications over the years has been accompanied by an increase in the number of countries targeted by these studies, as can be seen in Figure 2.

In the set of 56 articles analyzed, 40 different countries were studied, of which approximately 55% are European countries. China, Italy, Germany, and South Korea are the countries studied in more articles, with a clear emphasis on China, which, being an emerging economy, represents one of the current leading economies worldwide.

It is interesting to note that most studies are applied to only one country. Of the 56 articles analyzed, only 5 articles studied sets of countries. These articles have in common the fact that they focused their study on European countries and were based on the Community Innovation Survey database.

Along with this growing interest we have the number of scientific journals, which is equally vast. We identified 40 different scientific journals where the 56 articles analyzed were published. Of the journals with the highest number of publications, Research Policy and Chinese Management Studies stand out with 32% and 12% of the total publications analyzed in this study, as can be seen in Figure 3. The other most frequent journals are: the
Asian Journal of Technology Innovation, International Journal of Technology Management, Singapore Economic Review, Small Business Economics, Structural Change and Economic Dynamics, Technological Forecasting, and Social Change and Technovation.

Figure 2. Geographic location of the most studied countries.

Figure 3. Source network over the years.
There is also a wide variety of authors who direct their study to the relationship between public support for innovation and its effects on business activity and performance. The 56 articles analyzed have the participation of 144 different authors, including Hong J., Hottenrott H., Huergo E., Lopes-Bento C., Wang L. and Wang Y, as can be seen in Figure 4. These authors contribute topics in the Scopus database: Additionality; subsidies; Tax Incentives; Alliance Portfolios; Absorptive Capacity; Open Innovation; Eco-Innovation; Porter Hypothesis and Environmental Innovation.

Figure 4. Author network over the years.

Some of these authors, in addition to contributing to a greater number of publications compared to our sample of 56 articles, are also the ones with the highest number of citations, as can be seen in Figure 5. Citation analysis provides an overview of the most cited articles and demonstrates that documents located next to each other are related by citation or being cited. The works that stand out are Kang, K.N. and Park, H. [22] with 151 citations, Czarnecki, D., Hanel, F. and Rosa, J.M. [23] with 130 citations, Hottenrott, H. and Lopes-Bento, C. [24] with 85 citations, Hong, J., Feng, B., Wu, Y. and Wang, L. [25] with 80 citations and Nishimura, J. and Okamuro, H. [26] with 73 citations. Other prominent authors are also Barajas, A., Huergo, E. and Moreno, L. [5], Colombo, M.G., Grilli, L. and Murtinu, S. [6], Vanino, E., Roper, S. and Beckerc, B. [7], Kang, J., Gwon, S., Kim, S. and Cho, K. [27], Nguyen, H.T.T., Van, H.V., Bartolacci, F. and Tran, T.Q. [28], Merito, M., Giannangeli, S. and Bonaccorsi, A. [29], Yan, C., Yanghao, Z. and Bhatti, M.H. [30], Beck, M., Lopes-Bento, C. and Schenker-Wicki, A. [31], Cin, B.C., Kim, Y.J. and Vonortas, N.S. [32], Szczygielski, K., Grabowski, W., Pamukcu, M.T. and Tandogan, V.S. [33] and Wang, F., Li, Y. and Sun, J. [34].

To identify the main related concepts in the articles studied, a keyword analysis was performed.

As can be seen in Figure 6, at the beginning of the period under analysis the most discussed and related concepts are R&D, business performance, public support, and open innovation. Throughout this period, these concepts are being complemented with the concepts of innovation, innovation performance, collaboration, high tech industry and in several articles applied to small and medium-sized companies. Finally, the articles published in 2020 also include the concept of high-tech, collaborative innovation and SME, in addition to the concept of emerging economies.
When analyzing the relationship of the most frequent concepts with other expressions, it was found that the concepts of R&D and subsidies are often used together and related to innovation and technological innovation, also with productivity and financial efficiency, small and medium-sized companies, and open innovation [26,35,36].

The concept of innovation, in addition to its frequent relationship with R&D, appears several times associated with government support and once again related to small and medium-sized companies and technology and to the concept of collaboration [12,37,38].

The concept of company performance is associated with the previous concepts, but also with R&D subsidies, green process innovation, entrepreneurship, job creation and emerging economies.

Finally, the concept of innovation performance appears related to R&D subsidies or government support and related to high-tech industry, China, collaboration, and policy evaluation.
Regarding the most frequently used data processing methodologies, the probit and logit models are the most used. Around 55% of the studies used these models and, in some cases, reconciled them with methodologies such as propensity score matching and difference in differences.

Some authors (about 17%) opted for Tobit or Heckman (Tobit type II) models.

Other authors used structural equation models to analyze the relationship between variables (about 10%) and the remaining articles used other approaches such as semi-parametric models, hierarchical regression, and negative binomial regression.

4. Meta-Analysis

Considering the bibliometric analysis previously carried out and using the sample of selected articles, a database was built that includes these studies, their characteristics, and results. This being the first step of a meta-analysis [39].

To compare the results of existing studies, a summary statistic is needed, which is the dependent variable used in the meta-regression. In this case, from our sample of articles, 30 analyzed the impact of public support on company performance and 39 analyzed its effect on innovation performance. That is, 13 articles analyzed the effect of public support on company performance and on innovation performance.

As mentioned by Neves and Sequeira [40], defining the dependent variable to be used in a meta-regression is not an easy task and is a common problem in meta-analysis. The empirical studies used in this meta-analysis sometimes estimate elasticities and other marginal effects without it being possible, in most of them, to calculate dimension-free parameter estimates, such as elasticities due to the lack of necessary statistical information [14].

Some studies, when analyzing innovation performance, define the dependent variable as total R&D expenditures [41–43], on the other hand, other authors [44,45] use the insertion in the market for new or improved products and others use patent registration [46–48]. Regarding company performance, some authors choose to analyze sales volume [49,50] while other authors use asset profitability which makes the estimated coefficient to be interpreted in a different way [28,51].

Therefore, it follows the approach commonly used for meta-analyses in medicine, psychology and in economics, which seek to analyze the effects of treatment by defining a binary outcome [40]. In this way, the articles selected for the meta-analysis were analyzed and the dependent variable PERF (performance) was defined, which refers to the performance of the company and/or innovation. If the analyzed article concluded that subsidies for innovation were relevant for improving the company’s performance and/or innovation, the dependent variable assumes the value 1, otherwise it assumes the value 0.

The purpose of a meta-analysis is to examine whether the characteristics of the studies influence the results. These characteristics are the independent variables—also often called moderating variables—in the meta-regression. The choice of variables was based on the analysis of the articles in our sample, together with the combination of approaches followed by other authors [14,51–53]. The variables are shown in Table 1.

Table 1. Meta-independent variables.

| Variable | Description |
|----------|-------------|
| NCOUNT  | Number of countries studied |
| OBS     | Number of observations |
| NAUT    | Number of authors |
| PANEL   | 1 if a study uses panel data |
| LAGDEP  | 1 if a study uses a lagged dependent variable |
| CG      | 1 if a study uses a control group |
| IDUM    | 1 if a study uses industry dummies |
| INSEC   | 1 if a study focus in a specific industry or sector of activity |
The econometric evidence on the relationship between public funding and company and innovation performance is ambiguous, and the literature on this relationship is fundamentally empirical and descriptive, yielding sometimes contradictory results.

The meta-analysis performed and presented in Tables 2 and 3 synthesizes the results of research previously obtained on the subject. And while meta-analysis is not without its problems, it is a useful alternative in trying to determine whether a particular choice of method, design, and data affects reported results [14].

### Table 2. Logit models: Innovation/company performance.

| Variable | (1) PERF | (2) PERF | (3) PERF | (4) PERF | (5) PERF | (6) PERF | (7) PERF | (8) PERF |
|----------|---------|---------|---------|---------|---------|---------|---------|---------|
| NCOUNT   | 0.0549  | 0.0569  | 0.0557  | 0.0620  | 0.0848  | 0.0867  | 0.101   | 0.0984  |
| OBS      | -0.000004 | -0.000004 | -0.000004 | -0.000007 | -0.000006 | -0.000007 | -0.000008 |
| NAUT     | -0.0969 | -0.0993 | -0.117 | -0.159 | -0.162 | -0.136 |
| PANEL    | 0.262   | 0.0494  | 0.105  | 0.197  | 0.268  |
| LAGDEP   | 0.637   | 0.696   | 0.500  | 0.455  |
| CG       | -0.488  | 0.000  |
| INDUM    | 0.623   | 0.062  |
| INSEC    | -0.3801 | -0.34  |

Note: N = 56; Log-pseudolikelihood value is −22.64; Wald test for the null hypothesis that all coefficients are zero $\chi^2(7) = 2.81; \text{Prob} > \chi^2 = 0.9024\text{ and Pseudo } R^2 = 0.0416$. The explanatory variable NCOUNT was not included in the model since 91% of the observations assume a value of 1 and its presence in the logit model with marginal effects would not be relevant.

The results show that there are no specific study characteristics that lead to a certain result, namely results that indicate that public support for innovation contributes or not to the performance of companies and the innovation of companies.
5. Qualitative Analysis and Discussion

As mentioned by Guillou and Longhi [54] developing an innovative culture in the corporate environment is one of the current challenges and the development of knowledge management in companies incorporates the relationship between knowledge and innovation. And as defended by Bhimani, Mention, and Barlatier [13] the need to innovate is a fundamental condition for a competitive market. Support for innovation has increased (in number and in value) over the past few years with the aim of promoting qualified entrepreneurship; support the expansion of activities with a strong technological nature and encourage investment in productive innovation. Productive innovation promotes business performance, in the field of production of new goods, services, processes or manufacturing methods, logistics, distribution, organizational methods or significant improvements in current production through the transfer and application of knowledge [23,44].

Public support makes it possible to intensify the effort of R&D and knowledge creation and to promote relations between companies and scientific institutions.

As mentioned by Merito, Giannangeli, and Bonaccorsi [29], it is through supporting innovation that companies increase the intensity of R&D and its economic value. In this sense, they manage to increase projects and activities in cooperation between companies with the other entities of the research system [54]. Through this support, companies develop new products and services, especially in activities of greater technological and knowledge intensity. Likewise, they reinforce the economic valorization actions of successful R&D projects and increase national and international participation in R&D incentive programs [54,55].

Incentives for R&D centers make it possible to support projects that aim to create or reinforce companies’ internal skills through the creation of structures dedicated to carrying out R&D and the necessary certification of research. Likewise, they promote the development and management of systems innovation, considering indirect and direct costs.

As highlighted by Vanino, Roper, and Becker and Howell [7,8] direct costs include: expenses with technical personnel dedicated to R&D promotion; human resources training; technical and scientific assistance; instruments and equipment; and software for the project, among other costs.

Based on the above, Yan, Yanghao and Bhatti and Lin and Luan [30,56] point out that several countries reinforce their policies to encourage innovation by combining tax incentives and financing instruments (subsidized loans, economic subsidies, among others). The analysis of the effects of these policies presents divergent results, although most conclude that the additinality effect predominates (complementarity between public and private gestures) and the denial of the crowding out hypothesis (substitution between public and private expenditures) [7,8,30,57].

Through the analysis of the selected articles and considering the analysis of the keyword network, it was possible to identify three main dimensions addressed in the articles published since 2010 and grouped in Table 4: (i) public support for innovation, with an emphasis on support for small businesses (SME’s); (ii) innovation in the high technology industry; and (iii) open and collaborative innovation.

As mentioned by Mariani and Mealli [9] the reason for public intervention in support of private R&D resides mainly in two distinct sources of market failure: externalities and public goods and capital market imperfections. These failures can affect companies, especially SMEs, preventing them from investing and discouraging risk-taking. In this sense, Wei and Liu [48] emphasize the importance of government support for companies’ R&D activities as a fundamental incentive to promote their innovative performance. Thus, the use of government support to promote private R&D activities is a practice recognized as essential in several countries.

Since the objective of public support for R&D is to promote business innovation, it is essential to analyze the extent to which this support contributes to the performance of companies. And the relationship between innovation and performance has been consistently found in several empirical studies. In today’s uncertain environment, innovation is essential for the survival of SMEs since it enables the production of better-quality products and
services at lower costs [5,31,47]. Several studies conclude that innovation allows SMEs to build a better competitive position in the market, increase their profitability and strengthen their stability [58,59].

Table 4. Dimensions of public support for innovation.

| Dimensions | Studies |
|------------|---------|
| Public support for innovation and support for small businesses (SMEs) | Merito, Giannangeli and Bonaccorsi (2010); Guillou and Longhi (2010); Czarnitzki, Hanel and Rosa (2011); Kampik and Dachs (2011); Cerulli and Poti (2012); Sohn, Kim and Hur (2012); Kang and Cho (2013); Jaklić, Burger and Rojec (2013); Arqué-Castells and Castells (2013); Hottenrott and Lopes-Bento (2014); Wei and Liu (2015); Simachev, Kuzyk and Feygina (2015); Yao and Zhang (2015); Kim, Oh and Lee (2015); Rehman (2016); Xie and Zhu K (2016); Catuzzella and Vivarelli (2016); Barajas, Huergo and Moreno (2016); Huergo, Trenado and Ubierna (2016); Petti, Rubini and Podetti (2017); Crowley and Crowley (2017); Xiang and Worthington A (2017); Cin., Kim and Vonortas (2017); Szczygielski and Tandogan (2017); Ravsøl and Aristovnik (2017); Howell and Howell (2017); Wang, Li and Furman (2017); Han and Son J (2017); Žampa and Bojnec (2017); Pereira, Correia and Scattolo (2018); Basit, Kuhn and Ahmed (2018); Mariani and Mealli (2018); Prokop and Stejskal (2019); Dvoulety and Blažková (2019); Bianchini, Llerena and Martino (2019); Santos and Santos (2019); Vanino, Roper and Becker (2019); Hanifah and Vafaei-Zadeh (2019); Wang, Li and Sun (2019); Yan, Yanghao and Bhatti (2020); Oh, Shim and Lee (2020); Tingvall and Videnord (2020) |
| Innovation in the high-tech industry | Colombo, Grilli and Murtuz (2011); Kang and Park (2012); Adeyeye, Jegede and Akinwale (2013); Kang and Cho (2013); Hong and Zhao (2015); Yao, Xu, Jiang and Zhu (2015); Hong and Wang (2016); Petti, Rubini and Podetti (2017); Zhu, Wang and Wang (2019); Hottenrott and Richstein (2020); Lin and Luan (2020) |
| Open and collaborative innovation | Nishimura and Okamuro (2011); Kang and Park (2012); Kang, Gwon, Kim and Cho (2013); Hottenrott and Lopes-Bento (2014); Reze, Kutschke and Baier (2016); Beck, Lopes and Schenker-Wicki (2016); Greco, Grimaldi and Cricelli (2017); Prokop and Stejskal (2019) |

Kang, Gwon, Kim, and Cho [27] and Cin, Kim, and Vonortas [32] confirmed the positive impact of Korean public support for innovation, highlighting that an innovative capability represents the specific capabilities and assets of the company, based on processes, systems, resources and organizational structure. Barajas, Huergo, and Moreno [5] also found empirical evidence that corroborates a direct and positive impact on technological assets. And, regarding economic indicators, EBITDA per worker and labor productivity are positively influenced by the improvement of the technological environment, confirming that SMEs are involved in market-oriented R&D projects.

Arkali and Bulu [50] reached similar conclusions when analyzing the Turkish government’s policies to promote innovation among SMEs and company performance, finding that support contributes positively to companies’ net sales. Petti, Rubin, and Podetti [58], in addition to corroborating the above, highlight the importance of supporting the competitive modernization of Chinese SMEs. Xiang and Worthington [59] reinforce the importance of supporting innovation for SMEs, as they lack sufficient funding.

In recent years, several studies show the existence of a significant activity in innovation in SMEs. And as mentioned by Basit, Kuhn, and Ahmed and Zhu, Wang, and Wang [60,61], developments in the field of neo-Shumpeter theory allowed the characterization of innovation as a complex phenomenon, whose determinants extrapolate formalized R&D expenditures. And, as mentioned, SMEs play a key role in today’s global economy in terms of their large share of the workforce and the number of companies. While SMEs have great potential for innovation, there are many barriers to innovation and growth. First, these companies do not have the financial power to compete with large global companies. Likewise, SMEs lag far behind large companies based on information and communication technology use, know-how and skill
levels. SMEs face additional challenges arising from globalization and the rate of technological change. These barriers end up diminishing the competitive power of SMEs in relation to their peers in similar industrial sectors [23,61].

Some studies that analyzed funds to support innovation capacity confirmed the positive impact of this support on company sales, verifying that the greater the private spending on R&D, the smaller the increase in these expenses in subsidized companies and the greater the revenue, the greater the increase in spending on R&D by subsidized companies [23,24,49].

However, despite the popularity of public incentives, evidence on the effects of public programs on firms’ innovation performance remains mixed and controversial. Howell [8] when studying the impact of subsidies on the innovation process and its implications for the productivity of a set of Chinese companies, did not find evidence that subsidies contribute positively to the economic performance of companies. Xie, Huo, Qi, and Zhu [12] adopting the resource-based view, conjecture that green process innovation represents effective resources for industries and, in turn, industries can develop unique features to gain competitive advantage and improve performance. However, the results of their study indicate that green subsides weaken the link between clean technologies and financial performance. And Kim, Oh, and Lee [43] despite verifying that the supported companies invest greater amounts in R&D, they obtain external financing through a general improvement in their level of reliability. That is, the results showed that this was not related to improvements in business performance. Likewise, Catozzella and Vivarelli [62] when analyzing the impact of public funding on the productivity of a group of Italian companies, reached identical results, not validating the hypothesis that subsidies contributed positively to productivity. In other words, the issue of financing for SMEs is of great importance, given the structural difficulties that these companies have in accessing credit.

Other studies seek to analyze the impact of public support on innovative activity, highlighting the results in terms of patent registration. Kang and Park [22] when analyzing South Korean companies, highlight the importance of studying the factors that influence innovation performance in countries with unfavorable environments, having concluded that support stimulates internal and external R&D and upstream national collaboration and downstream. Along the same lines, other studies have focused attention on emerging economies, concluding that support for SMEs promotes the creation of network ties with other institutions, making them more likely to introduce patents and product innovations [46–48,61,63].

It is concluded that for SMEs, empirical evidence shows that the set of elements that favor their innovation activity differentiates them from large companies. It is necessary to consider the non-formalized expenditures on R&D and the different interactions that favor and stimulate learning mechanisms. They also stimulate interactions that combine internal and external knowledge and that are effective in the relationship with customers/suppliers with competing companies, with universities/research centers, among others. These interactions present sectoral differences and a strong territorial content, aspects that have been addressed in recent studies [9,55]. A sector that has been extensively studied and where the positive effect of public support for innovation has been confirmed is the manufacturing sector, with a clear emphasis on the resource-based view [27,28,35,42]. Other sectors (defense, services, food industry, among others) also corroborate the above [38,54,56,57,64], confirming that publicly induced R&D is generally productive, as it translates into marketable product innovations and the effect of policy-induced R&D investment on market novelty sales is greater for SMEs [24].

In short, despite the dubious results of some studies, such as those carried out by Hong, Feng, Wu, and Wang and Nishimura and Okamura [25,26], there is a clear interest of countries in supporting SMEs. This support aims to promote business transformation, train and readjust the workforce and promote the creation of a favorable environment for development, namely technological development.
It is in technology-driven economies that start-up business models are typically based on the specific knowledge of scientists and engineers, and the success of start-ups depends on their ability to fund cutting-edge research. Zhu, Wang, and Wang [61] mention that grants must also fund the development of products and processes to transform their research into new products and services. Unlike established companies with cash flows, the extent to which start-ups can internally finance this R&D is limited and the indivisibility of investments results in a large ratio between investment needs and equity [65].

As highlighted by Kang and Park [22], technological innovation must be the result of an environment that produces cutting-edge science and influences the productive sector, mainly through the research and development sectors generated in companies. In this way, technological innovation is essential for the survival of companies. This is due to the fact that the market is highly competitive and companies need to innovate to protect their position and gain more space. Otherwise, they are outperformed by competitors with better products and more efficient processes [22,27].

As mentioned by Czarnitzki, Hanel, and Rosa [23], public support for innovation in the high-tech industry positively influences the increase in total factors of production. Thus, capital market imperfections in financing R&D investments are often cited as a theoretical justification for government support for private R&D. This argument is especially relevant for new technology-based companies [6].

Although some studies do not validate the efficiency of public support for innovation in the high-tech industry, there is a consensus that technological development allows optimizing processes, strengthening the company’s organizational culture, increasing productivity and stimulating competitiveness [25,66].

Regarding the attention given to SMEs and the interest in the high technology sector, there are some studies such as those developed by Czarnitzki, Hanel, and Rosa and Petti, Rubin, and Podetti [23,58] that suggest that policies to support SMEs technology positively moderate the relationship between investments in R&D and performance. That is, public support effectively leads to better performance outcomes when there is an internal balance within the company between investment in R&D and other sources of innovation [56,58]. In this way, it appears that the high technology sector is clearly privileged in obtaining public support for innovation, especially when it comes to SMEs.

It is concluded that the high technology industry assumes a leading role in the political agenda of several countries, since it is one of the most important industries of the century of knowledge. Thus, many countries seek to develop high technology industry to transform the national industrial structure and raise the level of the workforce [46].

Intrinsic in the different innovation strategies, regardless of whether they are SMEs and are oriented towards high technology, we have the concept of open innovation. And this concept can be seen as the antithesis of the traditional model of vertical integration (closed innovation), in which products were entirely developed by a single company. The importance of studying the results of collaborative innovation is increasingly recognized, as most studies focus on isolated companies and today companies tend to collaborate more and more [45,67].

The notion behind the concept of open innovation is that organizations cannot innovate in isolation and must relate to different types of partners to acquire new ideas and resources to remain competitive. And as highlighted by Kang, Gwon, Kim and Cho [27] an example of how collaboration can promote innovation, especially in venture companies, are companies located in Silicon Valley.

As mentioned by Hottenrott and Lopes-Bento and Prokop and Stejskal [24,68], open innovation is fundamental for industries and organizations that promote open ideas, thoughts, processes and research in order to improve the development of their products, provide better services to its customers, increase efficiency and increase added value. However, the success of open innovation as a new paradigm to increase the development of innovation has led public authorities to encourage companies to collaborate with external
organizations [37,69]. This incentive is often provided in the form of support programs and public subsidies for R&D activities [33,70].

Some studies note that public subsidies are generally successful in pursuing the goal of promoting open innovation [26]. However, as the number of partners increases, the positive effect of collaboration on innovation performance tends to decrease due to excess research and collaboration problems [24].

Open innovation encompasses the management and accumulation of ideas, knowledge, licenses, intellectual property, patents and inventions and can be considered user innovation, marketing innovation, cumulative innovation and distributed innovation [22,34,71]. Therefore, open innovation theory corresponds to a series of innovation approaches whose base element is innovation carried out beyond the organizations’ R&D departments [31].

Based on the above, it is understood the development of innovation systems that can be analyzed at a transactional-global level [72,73]. It incorporates commercial transactions and knowledge transfers between nations and these transfers are evident in the character of product development, manufacture and installation, which commonly involve companies from different nations [37,38,74].

Prokop and Stejskal [38] conclude that innovation systems are, therefore, extremely important and generally combine three sets of entities—private entities (companies), public entities (government) and knowledge entities (universities)—and help to promote innovation, cooperation and generate innovative results.

6. Conclusions

The objective of this study is to analyze a set of articles that studied the impact of public support for innovation on company performance. The articles analyzed are indexed to the Scopus database and a bibliometric analysis, meta-analysis and qualitative analysis were performed. Through the analysis of the selected articles, it was found that the main lines of research are related to support for SMEs, high-tech companies, and the promotion of collaborative innovation.

In addition, two subjects were identified that go beyond the policy areas proposed by the publications mentioned: support for green innovation and support for development in emerging economies.

The results of the meta-analysis show that there are no specific characteristics of the studies that lead to a certain result. That is, the characteristics of the studies do not lead to bias in the results.

The main limitations of this study are the fact that it was a final sample of 56 articles over 10 years, with the risk associated with the small sample size and possible errors related to the approaches followed by the authors of these studies over the years. When using a sample of studies, relevant articles may have been excluded. Articles that deepen one of the issues raised in this study: the complementarity in the performance of companies between public aid to innovation and cooperation between companies [75] and the fact that many companies take advantage of research efforts carried out by others and thus companies that carry out R&D efforts may give up doing so and, in this sense, cooperation agreements between companies can help to control the spillover problem [76].

Another limitation is the fact that it does not cover publications of studies that address the COVID-19 problem. That is, much public support has been and is currently directed towards supporting the development of COVID-19 vaccines, offered not only to large companies such as Pfizer, but also to startups such as Moderna and Oxford AstraZeneca [77].

Despite the limitations identified, it is a work in progress, which could serve to deepen the conclusions identified. It is intended to advance the study with a view to reaching useful conclusions for the design of public policies and identifying the impact channels of public R&D funding on business behavior.

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