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The Role of Public Incentives in Promoting Innovation: An Analysis of Recurrently Supported Companies

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Abstract: This study delves into the intricate relationship between corporate innovation and public support, underscoring innovation's vital role in driving economic growth and competitiveness. Recognizing the multifaceted nature of innovation, from product and process improvements to organizational and marketing innovations, we examine how specific business characteristics and sectoral specificities condition access to public research and development (R&D) support, both nationally and at the European level. We analyze data from five Community Innovation Survey (CIS) reports spanning from 2008 to 2018 using ordered logit models. This approach evaluates the likelihood of companies receiving recurring public support for R&D based on internal R&D investments, interinstitutional collaboration, employee qualifications, and sectoral attributes. The findings reveal that internal R&D investments and collaboration with other entities significantly increase the likelihood of a company receiving recurrent public support. Furthermore, companies in high-tech sectors are more prone to receive public assistance. However, the analysis of European support shows no widespread statistical significance of the considered variables, suggesting the influence of evolving funding policies and an imbalanced dependent variable distribution. We conclude that the ability to secure public R&D support is influenced by a mix of company-internal and -external factors, highlighting the need for comprehensive and adaptable innovation policies. This study's limitations, including potential sample non-representativeness and the dynamics of funding policies, underscore the importance of further, more encompassing research.

Keywords: CIS; cooperation; innovation; logit model; sector of business activity; public support

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1. Introduction

Innovation is widely recognized as a crucial driver of economic growth, business competitiveness, and sustainable development. Companies that adopt innovative practices not only improve their productivity and competitive capacity, but also contribute significantly to the economic and technological evolution of their societies. Schumpeter (1934) was one of the first theorists to highlight the importance of innovation as a driving force behind economic and business development, a perspective that continues to be widely recognized in contemporary literature (Hitt et al. 2013; Bloom et al. 2019; Urbaniec and Żur 2021).

Innovation can manifest itself in several forms, including product, process, organizational, and marketing innovations, each contributing in a unique way to the growth and competitiveness of companies (Tidd and Bessant 2021; Damanpour 1991; Kotler and Keller 2016). Recognizing the multiplicity of benefits brought about by innovation, the role of the state in promoting and supporting innovative activities has been the subject of intense debate and study. State intervention, through public investment in research and development (R&D), tax incentives, and financial support, is seen as both a complement to and a catalyst for private investment in innovation, countering concerns that it may discourage private investment (Aghion et al. 2014b; Hall and Lerner 2010).

Furthermore, the literature suggests that government intervention can take a more proactive role, not only correcting market failures, but also shaping and creating markets to drive technological development and innovation (Mazzucato 2013; Acemoglu and Restrepo 2019). However, the effectiveness of this intervention and the impact of public support for innovation vary significantly, depending on the way programs are designed and implemented, as well as the specific characteristics of the benefiting companies and sectors (Dosi et al. 2006).

This article aims to deepen understanding of public support for innovation by exploring how different business and sectoral characteristics influence companies' ability to access national and European support for R&D. Using data from five reports from the Community Innovation Survey (CIS), this study analyzes the profiles of the companies that have received recurring support, and the implications of this recurrence for the innovative independence of companies. In doing so, we seek to contribute to the debate on the effectiveness of innovation policies and offer insights for improving innovation support strategies adapted to the needs of different sectors and business models.

In this introduction, we have established the context and relevance of public support for innovation, outlining the scope of the investigation and the research questions guiding this study. Based on a review of the existing literature, we will highlight the complexity of innovation phenomenon and the importance of a multifactorial approach to understanding the interaction between public support, business innovation, and economic development. The methodology section presents the database, the variables used, the data processing methodology, and the sample characterization. In the data analysis and results discussion section, the estimated models are analyzed and the results obtained are discussed. Finally, the main conclusions of this study are highlighted, as well as their limitations and guidelines for future studies.

2. Literature Review

2.1. Historical and Economic Context of Public Support for Companies

The origin of public incentives for companies dates back to the mercantilist period, when nation-states began to form and compete for wealth and power on the world stage (Dixit 2002). During this period, governments played a central role in the economy, imposing tariffs on imports, granting monopolies, and providing direct subsidies to strengthen domestic industries and expand trade (Ekelund and Tollison 1981). These policies aimed to accumulate national wealth and ensure state security through a trade surplus.

Entering the era of the Industrial Revolution, the nature of government incentives began to change. Technological innovation emerged as an engine of economic growth, leading governments to adopt new forms of support, such as patent protection and investment in infrastructure, to stimulate industrial development (Mokyr 1990). These policies not only facilitated the expansion of productive capacity, but also helped establish the basis for sustained economic growth.

The 20th century saw a significant transformation of economic policies, especially with the adoption of Keynesianism in response to the Great Depression (Carabelli and Cedrini 2014). Keynesian theory advocates active government intervention in the economy to regulate aggregate demand and avoid economic cycles of booms and busts. This led to an unprecedented expansion of government's role in the economy, including the provision of tax incentives and subsidies to stimulate business investment and consumption (Keynes 1936). This period also marked the beginning of government involvement in areas such as social welfare and job creation, reflecting a broader view of government's role in promoting economic and social development (Carabelli and Cedrini 2014).

With globalization and the advent of the knowledge economy in the late 20th and early 21st centuries, government incentives for businesses have taken on new forms. Policies aimed at innovation and research and development have become fundamental to maintaining economic competitiveness in an increasingly integrated global market. Governments around the world have begun offering tax incentives, research and development subsidies, and technology transfer support to stimulate innovation and promote sustainable economic growth (Rodrik 2004).

2.2. Types and Objectives of Public Support

This support is designed to overcome market failures, stimulate the economy in times of recession, promote international competitiveness, and support strategic sectors. However, the effectiveness of these policies depends on their ability to adapt to the specific economic needs of each period and sector.

One of the main justifications for public support for companies is the correction of market failures. Market failures occur when the market itself does not allocate resources efficiently, resulting in less innovation, insufficient investment in public goods such as education and infrastructure, and negative externalities, such as pollution (Stiglitz 1989). Government incentives, such as research and development grants, can stimulate innovation in areas of high risk or great public need that would otherwise be neglected by the private sector.

Another vital role of public support is to provide economic stimulus in times of recession. Keynesian policies, which involve increasing government spending and reducing taxes, aim to increase aggregate demand, creating jobs and encouraging business investment (Keynes 1936). These measures can help the economy recover more quickly from periods of low economic activity (Carabelli and Cedrini 2014).

In the context of globalization, public support also aims to improve the competitiveness of companies on the international stage. This includes measures such as tax incentives for exports, support for research and development of emerging technologies, and financing for expansion into foreign markets (Porter 1990).

Governments often identify strategic sectors that are vital to national security, innovation, or sustainable development. Support for these sectors can take many forms, including direct incentives, regulatory protection, and investments in sector-specific infrastructure. These policies aim to ensure that a country maintains critical capabilities and leadership in key areas (Rodrik 2004).

Each type of support has distinct implications for economic efficiency, resource distribution, and innovation, and is essential for shaping the environment in which companies operate.

Direct subsidies are often used to promote sectors considered strategic for national development, whether due to their importance in innovation, their contribution to national security, or their role in addressing social and environmental challenges. A classic example of this type of support is investment in renewable energy, aiming both to reduce dependence on fossil fuels and to achieve global technological leadership (Rodrik 2004). Direct subsidies allow for more focused intervention, making it possible to direct resources to areas where social returns are high, but private investment is insufficient due to high risks or uncertain returns.

Tax incentives, on the other hand, are a versatile tool for stimulating business activity across a wide range of sectors. They can be designed to support objectives such as increasing investment in R&D, promoting small and medium-sized enterprises (SMEs), or stimulating investment in critical infrastructure. Tax incentives offer companies the flexibility to invest according to their specific needs, while reducing the total tax burden, thus promoting an environment more conducive to business growth (Porter 1990).

Venture financing, provided through seed capital, government-backed venture capital funds, or loan guarantees, is intended to overcome private investors' hesitancy to commit to startups and innovative early-stage companies. This form of support is vital for innovation ecosystems, as it allows for revolutionary ideas and emerging technologies to overcome initial financing challenges and reach the market (Lerner 2002). By sharing the risk of innovative investments, governments can catalyze the development of new industries and accelerate the adoption of disruptive technologies.

Government-funded or -subsidized training programs address another critical dimension of business support: human capital development. Such programs aim to equip the workforce with the skills necessary to thrive in growing or transforming sectors, thus facilitating the transition to knowledge-based economies and increasing the global competitiveness of national companies (Becker 1964). Human resources training not only benefits companies by improving the quality and productivity of their employees, but also has a wider positive impact on society by increasing employability and income.

The range of government support for businesses is crucial to addressing today's complex economic challenges, requiring diverse strategies to promote growth, innovation, and sustainability. The selection of support should be based on strategic goals, market understanding, and analysis of potential impacts, allowing government interventions to maximize economic and social benefits.

2.3. Innovation as a Driver of Economic Growth and Development

Innovation is critical to economic advancement and business competitiveness, with companies that innovate showing improvements in growth, productivity, and competitiveness. Schumpeter (1934) identified innovation as the engine of economic and business development, and it is essential for creating competitive advantages (Hitt et al. 2013).

Innovation resilience is a crucial concept for understanding the ability of a socioeconomic system to adapt to internal or external shocks and disruptions. This resilience is demonstrated by the ability of companies to maintain and develop innovative activities even during economic crises. Persistence in innovation, especially in knowledge exploration activities, allows for the creation of new paths and renewal after a shock, which are essential for the resilience of regional innovation systems (Pinto et al. 2019). Studies have suggested that exploration strategies are particularly important for product innovation, while exploration strategies are more relevant for process innovation. Innovation policies must, therefore, consider the contextualized variety and balance between sustainable and disruptive innovation to increase the resilience of the innovation system, ensuring support for both dominant and marginal sectors (Pinto et al. 2019; Van der Loos et al. 2024).

Process innovation can increase production efficiency, increasing productivity (Bloom et al. 2019). Innovation takes many forms, each contributing uniquely to business and economic growth.

Product innovation: Developing new products or significantly improving existing ones is crucial for competitive advantage (Schumpeter 1934; Tidd and Bessant 2021).

Process innovation: Implementing new or significantly improved production or distribution methods is key to efficiency and cost reduction (Damanpour 1991).

Organizational innovation: Changes in the management, organizational work, and external structures of a company are essential for market adaptation and survival (Lam 2005; Birkinshaw et al. 2008).

Innovation in marketing: New marketing techniques, including improvements in products, packaging, and distribution, are vital to meeting changing consumer needs (Kotler and Keller 2016; Higgins 2020).

The importance of innovation for growth and competitiveness is widely recognized, and there is a clear link between innovation and productivity (Hall et al. 2013; Hakhverdyan and Shahinyan 2022), with organizational innovation being a cornerstone of sustainability and company success (Kianto et al. 2020). Different types of innovation affect company performance differently, but in a complementary way, suggesting a holistic view of innovation (Damanpour and Aravind 2006; Chen et al. 2018).

This holistic view of innovation considers the integration of multiple economic, technological, institutional, and human capital factors that together influence the innovative process of companies (García-Quevedo 2004). Employee skills and R&D collaboration are crucial for innovative success, demonstrating the complementarity between internal competencies and external cooperation (Castellacci et al. 2022). The quality of national institutions also plays a fundamental role in reducing transaction costs and facilitating investments in innovation, especially in developing countries (Antonelli et al. 2023). Furthermore, the combination of subsidies for R&D and tax incentives promotes the introduction of new products and improves the commercialization of innovations, demonstrating the effectiveness of government support policies (Bérubé and Mohnen 2009). Finally, knowledge-intensive technological change, influenced by the availability of qualified labor and access to large stocks of knowledge, reinforces the importance of a favorable economic and technological environment for innovation (Antonelli et al. 2023). This integrated and multifaceted approach reflects the true essence of the holistic view of innovation. Furthermore, innovations, especially in products, can create markets or transform existing ones, boosting economic growth (Christensen 1997; Tellis et al. 2009).

2.4. The Role of the State in Promoting Innovation

The importance of innovation for economic and social progress highlights the need for proactive and strategic government participation in promoting innovation. Robust theoretical and empirical evidence justifies this participation, pointing to specific market failures that have affected the innovative process (Aghion et al. 2014a). By investing in R&D, the public sector can complement private sector investments, challenging the view that government funding could inhibit these investments. Instead, state interventions can increase incentives for business innovation, creating an environment conducive to technological development (Hall and Lerner 2010). In addition to correcting market failures, governments must adopt a more interventionist stance, actively influencing the creation and formation of new markets, especially in areas of high risk or long-term returns that would otherwise be overlooked by the market (Mazzucato 2013; Acemoglu and Restrepo 2019). The persistence and resilience of innovation are essential to understanding why companies continue to innovate despite changes in business cycles. The state's role in financing innovation, therefore, must include not only subsidies and tax incentives, but also direct support to strategic sectors, human resource training, and the creation of a favorable regulatory environment (Braunerhjelm and Henrekson 2024).

From this perspective, governments, by taking initial risks and investing in strategic sectors, can boost innovation in areas that would otherwise be neglected by the market due to the high perception of risk or the expectation of long-term returns (Acemoglu and Restrepo 2019).

The recognition of innovation as a driver of substantial transformations is universal among government institutions, highlighting its contribution to improving the quality of life and developing sustainable approaches (Porter and Stern 2000; Acemoglu and Restrepo 2019). However, it is also necessary to recognize that innovation is not a simple path, being characterized by challenges, high risks, and the need for substantial investments in R&D, which can often discourage private financing (Arrow 1962; Autor and Dorn 2020).

In this context, the need for strategic state intervention emerges to overcome these barriers, providing adequate financial resources, encouraging collaboration between different entities, and establishing a conducive regulatory and economic environment (Hall and Lerner 2010). Strategies to stimulate innovation, including tax benefits and financial support for R&D projects, are fundamental to activating innovative activity in companies and academia (Mazzucato 2013; Braunerhjelm and Henrekson 2024).

Public policy initiatives, such as subsidies, tax incentives for R&D, and direct financing for research projects, are crucial to offset the positive externalities generated by innovations and to address the problems of information asymmetry and facilitating access to financing for innovations. Studies have indicated that government support can significantly increase private investment in R&D and promote the introduction of innovations into the market, although the effectiveness of these policies varies depending on their implementation and the characteristics of the target companies and sectors (Zúñiga-Vicente et al. 2014; Dosi et al. 2006).

Programs, such as Horizon 2020 and Horizon Europe in Europe, and the Incentive System for Research and Technological Development (SI I&DT) in Portugal, exemplify the commitment to promoting innovation, aiming to boost scientific excellence, industrial leadership, and respond to social challenges. These programs and initiatives not only promote technological and scientific innovation, but also seek innovative solutions to social challenges, contributing to the construction of a greener, digital, and resilient economy (European Commission 2020; AD&C 2024).

In conclusion, analyses of the impact of public incentives on business innovation have highlighted the variability of the effects of these incentives, which strongly depend on the specific characteristics of companies and the type of innovation pursued (Lööf and Heshmati 2002; Zhang and Guan 2018). Therefore, it is imperative that policies to encourage innovation are carefully targeted and consider the diversity of companies' innovative trajectories.

2.5. Characteristics of Companies That Have Received Public Support for Innovation

Evidence shows that public support can boost business innovation, but its effectiveness depends on adapting to companies' specific needs. This highlights the importance of flexible and well-analyzed public innovation policies to foster economic growth and competitiveness. At the same time, it is essential to understand the profile of the companies that are recurrently supported. The main features to highlight are as follows:

Activity sector: Companies that frequently receive support for innovation operate in different sectors, with a notable concentration in high and medium–high technology areas. According to the OECD (2019), the information technology, biotechnology, and pharmaceutical sectors are among the most likely to receive support, reflecting the priority given to technological innovation in public policy (OECD 2019).

Technological intensity: The technological intensity of these companies is generally high, characterized by a high volume of patents and a constant search for disruptive innovations. Technological intensity is a determining factor for access to innovation funds, with high-tech companies showing a significantly higher probability of receiving public support (Archibugi et al. 2013).

Internal and external investment in R&D: Investment in research and development is a central characteristic of these companies, both internally and through external partnerships. Companies that invest significantly in R&D tend to be more innovative and competitive, which in turn increases their eligibility for public support.

Cooperation: Cooperation, both nationally and internationally, is another distinguishing feature. Collaboration with universities, research centers, and other companies is essential for the development of innovations. Public policies that encourage collaborative partnerships tend to increase the effectiveness of supporting innovation, promoting the greater sharing of knowledge and resources (Leyden and Link 2015).

Higher training of workers: The qualification of workers is equally crucial. Companies with a high number of workers with higher education tend to be more innovative, due to their ability to generate new ideas and technological solutions (Vinding 2006).

Membership in business groups: Companies that are part of business groups often have better access to resources, including financing for innovation. Belonging to a business group can facilitate access to specialized knowledge and innovation networks, increasing innovation capacity (Czarnitzki and Toole 2011).

Turnover: Companies' revenue also influences their ability to access public support for innovation. Larger companies, with greater business volumes, tend to have more resources to invest in R&D and are often seen as "safer" by public financing bodies (Hall et al. 2013).

The characteristics mentioned refer to companies that receive government support on a more recurring basis. Furthermore, it is important to highlight that the effectiveness of public support for innovation is commonly assessed by its impact on companies' innovation capacity. Research has indicated that such support contributes to significant increases in R&D activities, obtaining patents, and product and process innovations in the companies that receive it (Arqué-Castells 2012).

2.6. Companies' Dependence on Public Support for Innovation

A recurring concern is the possible dependence of companies on public financing, especially for those that receive support on an ongoing basis. Studies have suggested that while this support may initially help companies overcome obstacles to innovation, prolonged dependence can discourage private investment and autonomous innovation (Gonzalez et al. 2005). Thus, there is a high complexity and variability to innovation support, suggesting that both the positive aspects and potential pitfalls vary considerably between different contexts and sectors (Czarnitzki and Toole 2011).

It is true that financing for innovation can play a crucial role in overcoming market failures associated with high risks and uncertainties in R&D activities (Jugend et al. 2020). This financial support is often seen as a mechanism to increase companies' innovation capacity, allowing them to take on more ambitious and risky R&D projects. Recurrent financial support is often associated with an increase in companies' innovation capacity. Companies that receive public financial support on an ongoing basis are more likely to develop new products, processes, and services, thus contributing to increasing market competitiveness (Zúñiga-Vicente et al. 2014).

However, there are some potential negative effects of recurrent public funding. The concept of "funding dependence" (Beck et al. 2017) suggests that companies that receive financial support on a recurring basis may become less inclined to seek private financing or invest their own resources into innovation, which may limit their financial sustainability and long-term independence. This dependence on public financing can lead to a "crowding-out" effect, where private financing is disincentivized by the presence of public financial support.

In addition to the "crowding-out" effect, public subsidies must guarantee additionality, that is, an increase in innovation activity that is not completely offset by substitution and deadweight effects. Studies have indicated that, although there is evidence that subsidies can both complement and replace private investment in R&D, it is essential to demonstrate that subsidies result in additional research and innovation effort on the part of companies, rather than just replacing the expenses that would be carried out anyway. Furthermore, subsidies are just one component of a broader context known as the National Innovation System, which includes the interaction of various institutions, policies, and agents that, together, influence a country's innovative performance (Bérubé and Mohnen 2009). This phenomenon can limit the diversity of financing sources available to companies and reduce their motivation to seek operational efficiencies and disruptive innovations (Czarnitzki and Lopes-Bento 2013).

Although the existing literature highlights the crucial role of public support for innovation in enabling companies to develop new technologies and processes, a deeper analysis of the specific characteristics and long-term effects of this support on the beneficiary companies remains insufficient. There is a significant gap in the study of companies that receive public financing on a recurring basis (Hall et al. 2013). Furthermore, the relationship between dependence on this financing and companies' autonomous innovation capacity requires additional research (Czarnitzki and Toole 2011; Czarnitzki and Lopes-Bento 2014).

3. Methodology and Data Sample

3.1. Methodology and Variables

According to the literature review presented, there are characteristics that enhance access to public support for innovation, and it is from this point that this study's main research question arises: are there specific characteristics that condition access to public support for innovation? In other words, we seek to determine the profile of the Portuguese companies that are recurrently supported, trying to determine whether there is a difference between the companies recurrently supported by national programs and European programs.

To answer this research question, data from five CIS reports were reconciled. The 2008–2010 CIS report was responded to by 6160 companies, the 2010–2012 report included 6840 responses, the 2012–2014 report had 7083 responses, the 2014–2016 report had 6775 responses and, finally, the 2016–2018 report was made up of responses from 13,701 companies. When combining the five reports, the sample for this study is made up of 945 companies, which corresponds to the companies that always responded to these surveys.

The database was built by combining the relevant information common to the five CIS reports, from which the variables presented in Table 1 were selected. Although the use of CIS data provides a comprehensive view of companies' innovative behavior, it is important to recognize the limitations inherent to this type of analysis. First, the sample is limited to the companies that consistently responded to the surveys, which may introduce a bias that favors organizations more engaged in R&D activities. Furthermore, innovation financing policies, especially at the European level, are dynamic and subject to frequent changes, which can dilute the effects of individual explanatory variables on the probability of receiving financing. These variations can result in an unbalanced distribution of the dependent variable, making it difficult to identify significant trends and interpret statistical results. Therefore, when using econometric models to analyze the impact of public support for innovation, it is crucial to consider these limitations and interpret the results with caution. Future studies should explore more deeply the specific characteristics that favor access to European support, considering changes in eligibility guidelines and funding priorities, to provide more precise insights into how to maximize innovation support opportunities in a changing European context.

Table 1. Variables.

Acronym	Variable Description
NS	It takes values between 0 and 5, depending on the number of times the company has received national support.
ES	It takes values between 0 and 5, depending on the number of times the company has received European support.
PI	It takes values between 0 and 5, based on the number of times the company has implemented product innovations.
SI	It takes values between 0 and 5, based on the number of times the company has implemented service innovations.
IPP	It takes values between 0 and 5, based on the number of times the company has implemented process innovations.
IDP	It takes values between 0 and 5, based on the number of times the company has implemented innovations in distribution.
IR&D	Internal investment in R&D (average values in euros).
ER&D	External investment in R&D (average values in euros).
Coll	It takes values between 0 and 5, based on the number of times the company has collaborated with other entities.
GC	It takes a value of 1 if the company belongs to a group of companies, and 0 otherwise.
WHE	Assumes values between 0 and 1, corresponding to the average number of workers with higher education (%).
T	Turnover resulting from sales and/or provision of services.
EI	It takes a value of 1 if the company belongs to the extractive industry sector, and 0 otherwise.
MI	It takes a value of 1 if the company belongs to the manufacturing sector, and 0 otherwise.
EGSW	It takes a value of 1 if the company belongs to the electricity, gas, steam, hot and cold water, or air sector, and 0 otherwise.
W	It takes a value of 1 if the company belongs to the water collection, treatment, and distribution or sanitation, waste management, and depollution sector, and 0 otherwise.
C	It takes a value of 1 if the company belongs to the construction sector, and 0 otherwise.
WR	It takes a value of 1 if the company belongs to the wholesale and retail trade sector or the repair of motor vehicles and motorcycles, and 0 otherwise.
TS	It takes a value of 1 if the company belongs to the transport and storage sector, and 0 otherwise.
IC	It takes a value of 1 if the company belongs to the information and communication activities sector, and 0 otherwise.
FI	It takes a value of 1 if the company belongs to the financial and insurance activities sector, and 0 otherwise.
CST	It takes a value of 1 if the company belongs to the consulting, scientific, technical, and similar activities sector, and 0 otherwise.
HHSA	It takes a value of 1 if the company belongs to the human health and social support activities sector, and 0 otherwise.

To answer the research question presented, ordered logit models were used for the dependent variable corresponding to national support (NS) and for the dependent variable corresponding to European support (ES). The respective models relating to the marginal effects on the probability of a company being recurrently supported at the national or European level are presented. Stata software (version 18) was used to estimate the models.

In this study, panel data were not used, since the dependent variable was defined to reflect the intensity of support received, assuming values between 0 and 5, depending on the number of times public support for innovation was received.

3.2. Sample Characterization

In this study, data from CIS reports from 2008 to 2018 were combined, with 945 companies in common in these 5 reports.

As previously mentioned, the aim of this study is to determine the profile of companies that are recurrently supported. As can be seen in the following table (Table 2), there are a greater number of companies receiving national support. Around 45% of the companies received national support; however, only 3.92% (37 companies) received support in all periods of this study.

Table 2. Frequency and percentage of variables, with scale from 0 to 5.

Source of support	Number of times companies received public support for innovation											
	0		1		2		3		4		5	
National Support (NS)	523	55.34%	140	14.81%	111	11.75%	67	7.09%	67	7.09%	37	3.92%
European Support (ES)	782	82.75%	109	11.53%	38	4.02%	11	1.16%	4	0.42%	1	0.11%
Type of Innovation	Frequency of each type of innovation											
	0		1		2		3		4		5	
Product Innovation: Goods (PI)	308	32.59%	165	17.46%	120	12.70%	100	10.58%	80	8.47%	172	18.20%
Product Innovation: Service (SI)	381	40.32%	216	22.86%	137	14.50%	86	9.10%	63	6.67%	62	6.56%
Process Innovation: Production (IPP)	264	27.94%	193	20.42%	165	17.46%	102	10.79%	109	11.53%	112	11.85%
Process Innovation: Distribution (IDP)	422	44.66%	232	24.55%	125	13.23%	91	9.63%	51	5.40%	24	2.54%
Degree of Collaboration (Coll)	Number of times companies collaborated for innovation											
	0		1		2		3		4		5	
	438	46%	158	17%	110	12%	86	9%	68	7%	85	9%

n = 945 companies.

Regarding the recurrence of European support, only around 18% received European support, with only 1 company receiving this support for the entire period covered by this study.

It is also important to note that if we consider the recurrence of this support, regardless of its origin (national or European), the frequency increases significantly. In this case, we would have around 7.72% of companies receiving support in all periods of the analysis, 7.62% receiving support in 4 of the 5 periods, and 8.15% receiving support in 3 of the 5 periods. This happened because some companies alternate between receiving national and European support, obtaining frequent and constant support throughout the period analyzed.

As for the outputs of innovative activity, analyzed here through the frequency of innovation in product, service, production, and distribution processes, there is a greater frequency of innovation in products and production. Product innovation stands out as being very common, with 172 of the 945 companies presenting product innovation results in all periods of this analysis. On the opposite side we have innovation in distribution processes, for which only 24 of the 945 companies presented results for this type of innovation.

Regarding the degree of collaboration, and as mentioned in the description of the variables, its classification varied between 0 and 5 depending on the frequency of collaboration between the company and other entities. The frequency of collaboration for innovation is analyzed here, and it can be seen that more than half of the companies (approximately 54%) collaborated at least once during this time. Around 25% collaborated at least 3 times during this study period.

Another important variable used in this study concerns belonging to a group of companies and, in this case, about half of the companies (49.63%) claimed to belong to a group of companies.

Table 3 presents the variables for which continuous values were assumed and, starting with those that refer to investments in R&D, it appears that the investments in R&D made internally are substantially higher than those made externally, being around 5 times higher. Even so, when these investments are analyzed as a proportion of sales, it appears that, on average, they represent less than 1% of total turnover.

Table 3. Descriptive statistics of variables in euros and percentages.

Descriptive Statistics	Mean	Std. Dev.	Min	Max
Internal investment in R&D (EUR) (IR&D)	459,946.4	3,041,725	0	5.58×10^7
External investment in R&D (EUR) (ER&D)	77,183.07	477,555.9	0	1.15×10^7
Turnover (EUR) (T)	8.08×10^7	3.33×10^8	0	5.78×10^9
Internal investment in R&D as a proportion of turnover (%)	0.97%	4.50%	0.00%	76.67%
External investment in R&D as a proportion of turnover (%)	0.19%	1.51%	0.00%	43.84%
Workers with higher education (WHE)	22.09%	21.22%	0.00%	87.50%

n = 945 companies.

As for the proportion of workers with higher education in relation to the total number of workers in a company, it appears that on average it represents around 22%.

Regarding the distribution of companies across different sectors of activity, it is important to start by clarifying that there are 21 different sectors. This classification is in accordance with the revised company classification code 3. The 945 companies studied are divided into 11 different sectors, with a clear emphasis on the manufacturing (MI) sector, with 55.98% of the companies belonging to this sector. The remaining companies are distributed across the remaining 10 sectors of activity, with a very small number of companies belonging to the extractive Industry, construction, and human health and social activities sectors, as can be seen in Table 4.

Table 4. Distribution of companies by activity sectors.

Activity Sector	Freq.	Percent
EI	12	1.27%
MI	529	55.98%
EGSW	19	2.01%
W	90	9.52%
C	12	1.27%
WR	63	6.67%
TS	78	8.25%
IC	43	4.55%
FI	61	6.46%
CST	29	3.07%
HHSA	9	0.95%

n = 945 companies.

4. Data Analysis and Discussion

Table 5 shows the results from the ordered logit model with the variable NS as the dependent variable. Table 6 shows the results of the estimates of the marginal effects of the explanatory variables on the probabilities that NS takes each of its possible values.

The results suggest that in terms of the investments made in R&D, the companies that carry out these investments internally are more likely to receive recurring support, even if the expression of this impact is significantly reduced in magnitude as the frequency of recurring support increases.

There is a clear emphasis on the role of collaboration between companies and other entities, given that the greater the degree of collaboration, the greater the probability of obtaining national support. Specifically, a greater degree of collaboration leads to an increase of 5.1 percentage points (p.p.) on the probability of receiving support once, 7.3 p.p. on the probability of receiving support twice, 3.7 p.p. on the probability of receiving support three times, and 2.3 percentage points on the probability of receiving support four times. The impact that the degree of collaboration has on the probability of receiving support always is 0.7 p.p., which is not very significant in magnitude.

Regarding the training of company employees, when analyzing the impact that a higher proportion of workers with higher education has on the probability of the company receiving recurrent support, it appears that there is a greater probability (around 11 p.p.) of receiving national support. The magnitude of this impact is less significant on the probability of receiving support four or five times (3 p.p. and 1 p.p.), but it still is statistically significant.

Concerning the importance of each sector of activity on the probability of receiving support more frequently, the sector with the greatest impact is the extractive industry sector, with an increase in probability of 16 p.p. and 29 p.p. for receiving support three and four times, respectively. The manufacturing industry sector also has considerable impact, being around 14.5 p.p. and 4.9 p.p. more likely to receive support four or five times.

As for the electricity, gas, steam, hot and cold water, and cold air sector, it also has an impact, with an approximately 11 p.p. and 14 p.p. increase in the probability of a company being supported two or three times. Although this sector did not report receiving support five times, there is an increase of 14.2 p.p. on the probability of receiving support four times, indicating that its importance is a reason for its recurrent support.

Table 5. Ordered logit model (NS).

Ordered Logit Model (National Support)			
Variable	**Estimate**	**SE**	**Z**
IR&D	1.22×10^{7} ***	4.40×10^{-8}	2.77
ER&D	5.88×10^{-8}	1.34×10^{-7}	0.44
Coll	0.772 ***	0.049	15.62
GC	0.129	0.149	0.87
WHE	1.169 **	0.481	2.43
T	-5.78×10^{-11}	2.04×10^{-10}	−0.28
EI	3.152 ***	0.805	3.92
MI	3.963 ***	0.528	7.51
EGSW	1.995 ***	0.672	2.97
W	2.457 ***	0.574	4.28
C	2.757 ***	0.803	3.43
WR	2.304 ***	0.594	3.88
TS	2.599 ***	0.573	4.54
IC	3.015 ***	0.558	5.22
CST	2.670 ***	0.649	4.12
HHSA	2.555 ***	0.789	3.24

n = 945; LR χ^2 = 529.38; Log likelihood = −1024.29; *p*-value = 0.0000; Pseudo R^2 = 0.2053. ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.10$.

Table 6. Estimates of the marginal effects of the explanatory variables on the probabilities of NS.

Estimates of the Marginal Effects of the Explanatory Variables on the Probabilities of National Support						
Variable	**Pr (NS = 0)**	**Pr (NS = 1)**	**Pr (NS = 2)**	**Pr (NS = 3)**	**Pr (NS = 4)**	**Pr (NS = 5)**
IR&D	-3.03×10^{-8} *** (0.000)	8.05×10^{-9} *** (0.000)	1.16×10^{-8} *** (0.000)	5.85×10^{-9} ** (0.000)	3.75×10^{-9} ** (0.000)	1.09×10^{-9} ** (0.000)
ER&D	-1.46×10^{-8} (0.000)	3.88×10^{-9} (0.000)	5.59×10^{-9} (0.000)	2.82×10^{-9} (0.000)	1.81×10^{-9} (0.000)	5.26×10^{-10} (0.000)
Coll	−0.192 *** (0.012)	0.051 *** (0.076)	0.073 *** (0.0082)	0.037 *** (0.0049)	0.023 *** (0.0033)	0.007 *** (0.0014)
GC	−0.032 (0.037)	0 008 (0.009)	0.012 (0.0142)	0.006 (0.0072)	0.004 (0.0046)	0.001 (0.0014)
WHE	−0.291 ** (0.119)	0.077 ** (0.0334)	0.111 ** (0.0468)	0.056 ** (0.0239)	0.036 ** (0.0155)	0.010 ** (0.0047)
T	1.44×10^{-11} (0.000)	-3.82×10^{-12} (0.000)	-5.49×10^{-12} (0.000)	-2.77×10^{-12} (0.000)	-1.78×10^{-12} (0.000)	-5.17×10^{-13} (0.000)
EI	−0.499 *** (0.045)	−0.145 *** (0.049)	0.030 (0.076)	0.161 *** (0.039)	0.291 *** (0.089)	0.161 (0.112)
MI	−0.745 *** (0.055)	0.135 *** (0.016)	0.242 *** (0.022)	0.176 *** (0.027)	0.145 *** (0.029)	0.049 *** (0.013)
EGSW	−0.407 *** (0.086)	−0.051 (0.059)	0.119 *** (0.024)	0.144 *** (0.046)	0.142 * (0.081)	0.052 (0.038)
W	−0.484 *** (0.068)	−0.061 (0.042)	0.125 *** (0.029)	0.168 *** (0.032)	0.182 ** (0.071)	0.070 * (0.038)
C	−0.476 *** (0.059)	−0.118 ** (0.059)	0.068 (0.072)	0.169 *** (0.021)	0.243 ** (0.106)	0.113 (0.085)
WR	−0.457 *** (0.071)	−0.061 (0.047)	0.122 *** (0.029)	0.161 *** (0.036)	0.170 ** (0.074)	0.065 * (0.038)
TS	−0.494 *** (0.061)	−0.077 * (0.042)	0.112 *** (0.036)	0.173 *** (0.027)	0.209 *** (0.073)	0.083 * (0.044)
IC	−0.511 *** (0.044)	−0.122 *** (0.037)	0.062 (0.050)	0.173 *** (0.023)	0.267 *** (0.072)	0.131 * (0.067)
CST	−0.478 *** (0.056)	−0.104 ** (0.049)	0.084 (0.053)	0.172 *** (0.022)	0.227 *** (0.087)	0.099 (0.061)
HHSA	−0.459 *** (0.066)	−0.104 (0.064)	0.084 (0.064)	0.168 *** (0.024)	0.217 ** (0.107)	0.094 (0.073)

***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.10$.

Another sector that stands out is the water collection, treatment and distribution, sanitation, waste management, and depollution sector, with its significant contribution increasing the probability of receiving recurrent national support. In this case, it increases the probability of a company receiving support four and five times by 18.2 p.p. and 7 p.p.

The construction sector has a relevant positive impact on the probability of a company receiving support three or four times, with an increase in the respective probabilities of 16.9 p.p. and 24.3 p.p., proving to be quite significant.

Likewise, being in the wholesale and retail trade sector and the repair of motor vehicles and motorcycles is extremely important for obtaining national support, increasing the probability that a company receives this support two, three, four, or five times by about 12 p.p., 16 p.p., 17 p.p., and 6.5 p.p., respectively.

Another clearly important sector is the transport and storage sector, with an increase of around 21 p.p. and 8 p.p. on the probability of a company being recurrently supported. Similarly, being in the information and communication activities sector contributes to an increase of around 27 p.p. and 13 p.p. on the probability of receiving national support on a recurring basis.

The sectors of consulting, scientific, technical, and similar activities, and human health and social support activities are also relevant, but are not statistically significant for receiving support five times. However, their impact significantly increases the probability of receiving support three or four times, by 17 p.p. and 22.7 p.p. for the CST sector, and 16.8 p.p. and 21.7 p.p. for the HHSA sector.

In short, the various sectors are relevant, but a clearly defined standard that favors obtaining national support for innovation has not been identified. Even so, the MI, W, WR, TS, and IC sectors stand out, as they are the ones that have a constant positive impact and have obtained support two, three, four and five times.

The data analysis strongly suggests that obtaining recurrent national support for investments in R&D does not depend on a single factor, but on a combination of internal company strategies, interinstitutional collaboration, employee qualifications, and the sector of activity. Companies that invest internally in R&D and those that promote greater collaboration with other entities are more likely to receive continued support, highlighting the importance of sharing knowledge and resources in driving innovation. Additionally, the academic background of employees emerges as a significant factor, especially regarding the initial probability of receiving support, which highlights the value of training and specialized knowledge in obtaining financing for innovation projects.

In the sectoral context, the analysis reveals that some sectors demonstrate a greater propensity to receive recurrent support, highlighting the differentiated impact that certain sectors have on the national economy and the prioritization of investments in innovation. The significant variation in the probability of receiving support among the different sectors points to the need for more targeted policies to encourage innovation, which would consider the particularities and potential of each sector to contribute to sustainable economic development.

Therefore, it is concluded that a company's ability to receive recurring national support for R&D is multifactorial and reflects the intersection of internal investment strategies, institutional cooperation, worker qualifications, and sectoral specificities. This indicates that policies to encourage innovation must be comprehensive and adaptable to the specific needs of different sectors and business models, aiming to maximize the impact of the support offered and promote a more innovative and competitive economic environment.

Table 7 presents the results from the ordered logit model with the variable ES as the dependent variable. Table 8 shows the results of the estimates of the marginal effects of the explanatory variables on the probabilities that ES takes each of its possible values.

Table 7. Ordered logit model (ES).

Ordered Logit Model (European Support)			
Variable	**Estimate**	**SE**	**Z**
IR&D	-8.44×10^{-9}	2.66×10^{-8}	−0.32
ER&D	1.68×10^{-7}	1.26×10^{-7}	1.33
Coll	0.384	0.055	7.02
GC	−0.281	0.199	−1.42
WHE	0.531	0.611	0.87
T	3.81×10^{-11}	$2.15 \times {}^{-10}$	0.18
EI	15.685	854.008	0.02
MI	16.441	854.007	0.02
EGSW	16.618	854.008	0.02
W	16.795	854.007	0.02
C	0.426	2139.717	0.00
WR	15.540	854.008	0.02
TS	15.835	854.008	0.02
IC	16.336	854.007	0.02
CST	15.443	854.008	0.02
HHSA	−0.065	2398.603	0.00

n = 945; LR χ^2 = 116.14; Log likelihood = −525.223; p-value = 0.0000; Pseudo R^2 = 0.0996. ***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.10$.

Table 8. Estimates of the marginal effects of the explanatory variables on the probabilities of ES.

Estimates of the Marginal Effects of the Explanatory Variables on the Probabilities of European Support						
Variable	**Pr (ES = 0)**	**Pr (ES = 1)**	**Pr (ES = 2)**	**Pr (ES = 3)**	**Pr (ES = 4)**	**Pr (ES = 5)**
IR&D	3.63×10^{-10} (0.0000)	-2.62×10^{-10} (0.0000)	-7.29×10^{-11} (0.0000)	-1.97×10^{-11} (0.0000)	-7.01×10^{-12} (0.0000)	-1.74×10^{-12} (0.0000)
ER&D	-7.22×10^{-9} (0.0000)	5.21×10^{-9} (0.0000)	1.45×10^{-9} (0.0000)	3.91×10^{-10} (0.0000)	1.39×10^{-10} (0.0000)	3.46×10^{-11} (0.0000)
Coll	−0.017 (0.9663)	0.0119 (0.7161)	0.003 (0.1971)	0.001 (0.1142)	0.0003 (0.0945)	0.0001 (0.0388)
GC	0.012 (0.7075)	−0.009 (0.4958)	−0.002 (0.1512)	−0.001 (0.0418)	−0.0002 (0.0149)	−0.0001 (0.0037)
WHE	−0.023 (1.3353)	0.016 (0.9896)	0.005 (0.2724)	0.001 (0.1577)	0.0004 (0.1306)	0.0001 (0.0536)
T	-1.64×10^{-12} (0.0000)	1.18×10^{-12} (0.0000)	3.29×10^{-13} (0.0000)	8.89×10^{-14} (0.0000)	3.17×10^{-14} (0.0000)	7.86×10^{-15} (0.0000)
EI	−0.963 (2.802)	−0.027 (1.906)	−0.007 (0.496)	−0.002 (0.072)	0.0000 (0.532)	0.9989 (0.715)
MI	−0.985 (4.464)	0.040 (12.069)	0119 (29.718)	0.231 (31.403)	0.368 (22.099)	0.223 (55.861)
EGSW	−0.967 (2.662)	−0.024 (1.820)	−0.006 (0.482)	−0.002 (0.095)	−0.0002 (0.216)	0.999 *** (0.324)
W	−0.991 (1.453)	−0.007 (0.956)	−0.002 (0.214)	−0.0003 (0.059)	0.001 (0.678)	0.999 (0.857)
C	−0.022 (133.290)	0.016 (94.874)	0.005 (27.538)	0.001 (7.526)	0.0004 (2.689)	0.0001 (0.669)
WR	−0.984 (2.135)	−0.012 (1.365)	−0.003 (0.291)	−0.001 (0.160)	0.002 (1.408)	0.9975 (1.762)
TS	−0.987 (1.812)	−0.009 (1.167)	−0.002 (0.238)	−0.0003 (0.1616)	0.002 (1.353)	0.9976 (1.686)
IC	−0.978 (2.256)	−0.016 (1.555)	−0.004 (0.389)	−0.001 -	0.0003 (0.463)	0.9991 (0.618)
CST	−0.971 -	0.021 (1.757)	−0.005 (0.429)	−0.001 (0.070)	0.001 (0.903)	0.9983 (1.162)
HHSA	0.003 (97.374)	−0.002 (70.345)	−0.001 (19.450)	−0.001 (5.247)	−0.0001 (1.868)	−0.00001 (0.464)

***: $p < 0.01$; **: $p < 0.05$; *: $p < 0.10$.

As can be seen through the analysis of the results presented in Table 8, the variables used in this study are not statistically significant, except for the variable corresponding to the EGSW sector of activity, which is statistically significant in the ordered logit model, with marginal effects corresponding to the probability of a company obtaining European support during the five periods.

Considering that around 82% of the companies did not receive European support in any of the considered periods, it is possible that the fact that the dependent variable has an unbalanced distribution, with an excessive number of cases in a single category, might explain the lack of statistically significant results.

It is important to note that the fact that European funding policies for innovation are not static may also explain the results obtained. That is, these supportive policies change and evolve in response to a variety of factors, including economic changes, technological advances, environmental concerns, and changes in the political climate. Therefore, when financing policies change, the historical relationship between explanatory variables (such as sector of activity, turnover, or investments in R&D) and obtaining European support can change significantly. This means that we may be in the presence of a data dilution effect, whereby if European support is directed towards a wider range of activities or becomes more inclusive in the types of projects it finances, the effect of any individual explanatory variable on the probability of receiving financing may be diluted. This suggests that changes to funding eligibility guidelines may affect which businesses qualify for support, which may change the basis on which a statistical analysis is performed.

5. Conclusions

This article highlights the complexity and multifactorial nature inherent in public support for innovation, both at the national and European levels. The ability of companies to receive recurring support for R&D does not depend on a single factor, but rather on a combination of internal investment strategies, interinstitutional collaboration, worker qualifications, and sector specificities. Specifically, the research shows that companies that invest internally in R&D and promote greater collaboration with other entities are more likely to receive ongoing support, highlighting the importance of sharing knowledge and resources in driving innovation.

The academic background of employees emerges as a significant factor, especially in relation to the initial probability of receiving support, which highlights the value of training and specialized knowledge in obtaining financing for innovation projects. In the sectoral context, the analysis reveals that certain sectors demonstrate a greater propensity to receive recurring support, highlighting the differentiated impact that certain sectors have on the national economy and the prioritization of investments in innovation.

Therefore, it is concluded that a company's ability to receive recurring national support for R&D reflects the intersection of internal investment strategies, institutional cooperation, worker qualifications, and sectoral specificities. This indicates that policies to encourage innovation must be comprehensive and adaptable to the specific needs of different sectors and business models, aiming to maximize the impact of the support offered and promote a more innovative and competitive economic environment.

On the other hand, the analysis of European support reveals a more complex picture, where the variables used in this study did not demonstrate statistical significance. This suggests the possibility of an unbalanced distribution of the dependent variable and the influence of changes in European financing policies, which may have evolved in response to several factors, potentially diluting the effect of individual explanatory variables on the probability of receiving financing.

This finding emphasizes the importance of considering the dynamics and evolution of innovation support policies, as well as the need for adaptation and flexibility in business and public strategies to foster innovation effectively. Future research should explore in more depth the specific characteristics that favor access to European support, considering changes in eligibility guidelines and funding priorities, to provide more precise insights into how to maximize innovation support opportunities in a European context that is constantly evolving.

Finally, it is important to note that this study, although comprehensive and informative in its analysis of public support for innovation, faces several limitations that must be considered when interpreting its results and conclusions. In particular, the use of data from CIS reports limits the sample to companies that responded to these surveys, and may not fully capture the diversity and breadth of the business fabric. Furthermore, the concentration on companies that consistently responded to the surveys may introduce a bias, favoring organizations that may have a greater predisposition to participate or that are already more engaged in R&D activities. The variability in financing policies must also be considered, since innovation support policies, especially at the European level, are dynamic and subject to frequent changes that reflect new political, economic, and social priorities. The analysis may not fully capture the impact of these changes on financing trends and the opportunities available to companies. Another limitation is the fact that there is an unbalanced distribution of the dependent variable, especially regarding European support, which can make it difficult to identify significant trends and interpret statistically significant variables, limiting the ability to generalize the results to the entire population of companies. Additionally, a significant limitation of this study is the lack of direct control for the "Matthew effect", which describes the tendency for companies that have already received support to continue to benefit on a recurring basis, potentially amplifying inequalities in access to resources for innovation. Although our analysis identified determining factors for receiving public support, the influence of the Matthew effect was not robustly quantified due to restrictions in the available data. We recognize that the failure to consider this effect may have impacted the estimates and interpretations of the results, suggesting the need for future research that integrates mechanisms to control for this dynamic and, thus, provide a more balanced view of the effectiveness of policies to support innovation. Lastly, this study does not consider all the external factors that influence a company's ability to receive public support, including changes in the economic environment, disruptive technological innovations, and the emergence of new markets or global challenges that can affect the prioritization of funds for innovation.

Based on the conclusions and limitations identified, the following suggestions for future research are highlighted: exploring the evolution of financing policies; deepening knowledge about how innovation support policies change and adapt to the economic and technological context; studying the effect of external factors; evaluating how economic crises, technological advances, and new market demands impact innovation and focus on specific sectors; and analyzing key sectors in detail to understand their specific needs and barriers to financing.

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