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# Maximizing research impact: strategies for securing competitive funding in research and development centers

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## Abstract

**Purpose** – This study analyzes the effectiveness of research and development (R&D) organizations' strategies for obtaining competitive international funding and the role of research management offices (RMOs) in this process. It examines the internal factors that influence the proactivity and effectiveness of R&D centers and provides a theoretical model for improving the fundraising capacity and, ultimately, the competitiveness and sustainability of these institutions.

**Design/methodology/approach** – The study sample comprised Spanish public R&D centers in the health and biomedical sectors. Partial least squares were used in the analyses to ensure the robustness of the results.

**Findings** – Several independent variables showed a significant impact on the proactivity and effectiveness of R&D centers. The dispersed priorities of R&D managers reduce proactivity and fundraising effectiveness. Incentives and RMO workload increase proactivity, but workload alone also improves effectiveness.

**Originality/value** – This study focuses on the management of health and biomedical R&D centers. It examines the influence of internal factors, such as managerial priorities, RMO incentives and RMO workload, on competitive international funding. These findings have significant theoretical and practical implications for the development of internationally applicable management strategies to enhance the effectiveness of research funding acquisition.

**Keywords** International research funding, R&D centers, Research management office, Proactiveness, Managerial priorities, Fundraising

**Paper type** Research paper

## 1. Introduction

One guideline of the Lisbon Strategy is to improve the global competitiveness of the European Union (EU) by maximizing productive research and transforming it into value-added technologies and products (Presidency Conclusions, 2000). In public policy, promoting cooperation between firms and public research organizations is challenging. Various funding programs have been implemented internationally to encourage research and development (R&D) efforts and research partnerships (Grimpe, 2012; Jin *et al.*, 2022). Public funds largely support R&D activities as a key source for the prosperity and maintenance of public institutions. However, government funding for European public sector research has remained static in most countries in recent years, and public R&D entities have been encouraged to seek new funds. Since the 1980s, the EU has developed its own independent science, technology,



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and innovation policy, establishing several framework programs for R&D. The European Commission's Horizon Europe Program, which will run until 2027, provides competitive funding for international R&D activities (European Commission, 2021).

However, the success rates of different countries and sectors within the EU in securing competitive funding show discernible discrepancies. Spain particularly exhibits lower R&D investment levels than the European average, which constrain its capacity to compete effectively in the European stage (Europa Press, 2024; PEICTI, 2023). The current study addresses the gap in the existing literature by examining the factors that contribute to the success of Spanish public R&D centers, especially those in the biomedical and health sectors, in obtaining competitive European funding. This study is vital as it enriches the research on the challenges and strategies employed by Spanish R&D centers in these sectors to secure funding, essential for their sustainability and competitiveness.

Spain was selected for this study because of its distinct status within the EU. Notwithstanding the recent augmentation of national R&D budgets, Spain still faces considerable obstacles in attaining the EU average for R&D investment. The biomedical and health sectors were selected owing to their status as areas of intense competition and high investment. These sectors are critical for public health and innovation. The factors contributing to successful funding acquisition in these areas can provide valuable insights for other sectors and regions. Moreover, Spanish biomedical and health R&D centers have excelled in the generation of knowledge and significant outcomes in research policy (Hall *et al.*, 2022).

R&D areas are thematic knowledge units that can be divided into subareas and specific research lines encompassing several research groups. Most research in R&D centers has been developed within these areas through projects that bridge R&D with study objectives and societal impact. R&D areas have limited national funds for R&D activities and are in a highly competitive environment to achieve proper results and guarantee their operations and functional activities (Bazeley, 1998; Fang and Casadevall, 2015). Therefore, R&D areas must obtain external funds through competitive international programs to ensure their organizations' longevity (Bonaccorsi *et al.*, 2022; Wiebe and Maticka-Tyndale, 2017). In recent years, the capacity of public R&D centers to secure competitive funds has become crucial for the survival and sustainability of public well-being systems in Europe (Bazeley, 1998). Securing this funding from competitive funds for R&D projects is essential for the medium- and long-term development and sustainability of these centers (Cunningham *et al.*, 2014, 2022). This natural selection of R&D projects ensures efficient resource allocation. Previous studies have explored group effectiveness in R&D performance (Lin *et al.*, 2005) and the impact of managerial support structures on research groups (Kennedy *et al.*, 2009). However, they have rarely investigated the factors influencing proactivity in project application, the capacity to acquire competitive funds, and the supporting role of research management offices (RMOs) in this success (Caldera and Debande, 2010; Nepelski and Piroli, 2018).

Accordingly, the current study analyzes the effectiveness of R&D organizations' strategies in securing competitive international funding and the role of RMOs. It examines the internal factors influencing R&D centers' proactivity and effectiveness and provides a theoretical model for enhancing fundraising capacity, competitiveness, and sustainability. This study innovatively addresses the funding acquisition challenges faced by Spanish public R&D centers in the biomedical and health sectors by identifying key factors for effectively securing international funding. Understanding these factors is crucial for developing policies to improve Spain's research performance and achieve the European average amid growing competition for European funds.

The results of this study offer stakeholders (R&D centers, R&D areas, RMOs, and other institutions) insights into the variables that determine success in obtaining competitive international funds, thereby aiding internal analysis and performance improvement through appropriate measures. These findings will help optimize resource allocation, enhance innovation capacity, and boost competitiveness, ultimately improving the performance of the national public science and technology system.

## 2. Theoretical framework

The success of R&D areas in acquiring external funds depends on many external and internal factors. External factors are exogenous variables beyond the control of researchers in their R&D areas, whereas internal factors are more endogenous and can be modified (Laudel, 2006; McAlpine, 2020). These factors influence the quality of research proposals, likelihood of obtaining funding, and overall chances of scientists to acquire external funds.

Organizational support is an important internal factor. R&D centers provide R&D areas with resources and information to enhance efficiency and performance (Clausen *et al.*, 2012; Kennedy *et al.*, 2009). This organizational support comes from heads of R&D areas and RMOs, who influence application submissions to obtain public funding. According to attention-based view (ABV) theory, their decisions may differ depending on their focal issues (Ocasio, 1997). The intensity of their attention to these issues is related to managers' existing attentional drivers, that is, the social, economic, cultural, and cognitive factors that shape organizational decision makers' allocation of time, effort, and attentional focus (Grimpe *et al.*, 2022; Ocasio, 1997). Prior experience or expertise is often theorized as a driver of attentional focus that helps determine the key head of an R&D area who would be able to identify the set of priorities (Ocasio, 2011; Nicolini and Korica, 2021). Cognitive research acknowledges that performance is only partly determined by the selected target of attention as it also requires the study of attention intensity (Fiske and Taylor, 2008).

Heads of R&D areas in R&D centers set priorities and allocate resources for short-to medium-term activities, including the application for and acquisition of competitive international funds. Their decisions on priority tasks are crucial in shaping centers' proactivity in R&D challenges. According to ABV, the attention of heads of R&D area to certain activities is the main factor in determining the proactivity of their researchers and, by extension, the effectiveness of the R&D center. The ABV is an appropriate theoretical framework for analyzing proactivity in international project application and competitive fund acquisition as it explains how organizational decision makers' attention influences strategic behavior, especially in a competitive global environment (Brielmaier and Friesl, 2022). Similarly, cognitive research has shown that attention mechanisms impact outcomes (Knockaert *et al.*, 2015; Ocasio, 2011; Wilden *et al.*, 2022). The current study examines the prioritization of actions by heads of R&D areas as an internal factor affecting R&D centers' effectiveness. Without clear prioritization and undivided attention to tasks, R&D centers may see a decrease in the number and quality of project applications, potentially compromising their scientific excellence. With less time to meet excellence standards, R&D centers experience increased risk of mistakes and reduced effectiveness. Consequently, we propose a tentative explanatory framework supported by ABV theory as the prioritization of R&D activities by heads of the R&D areas may influence proactivity and, by extension, the effectiveness of R&D centers. The following hypotheses are formulated:

*H1a.* A dispersed or unclear set of priorities by heads of R&D areas decreases the proactivity of R&D centers in applying for competitive international public funds.

*H1b.* A dispersed or unclear set of priorities by heads of R&D areas decreases the effectiveness of R&D centers in acquiring competitive international public funds.

In the European context, institutional policies for public research organizations, such as the Spanish system, are often restrictive. Most of the analyzed R&D centers show similar patterns with minimal incentive policies. These centers share common characteristics, including staff recruitment, R&D area composition, and limited opportunities to contract excellent researchers or motivate personnel.

Self-determination theory (SDT) provides a useful approach for understanding the motivational bases for effective organizational behavior by explaining the association between

extrinsic incentives, intrinsic motivation, and performance (Deci and Ryan, 1985; Ryan and Deci, 2000; Taylor *et al.*, 1998). The literature reveals that organizations may boost trust by setting clear objectives and measurable project rewards and by choosing a staff approach that allows for familiar team members, long-standing team composition, and permanent team membership (Maurer, 2010). This finding is in line with SDT, which states that implementing a specific set of incentives may motivate and impact intention (Deci and Ryan, 1985; Manganelli *et al.*, 2018; Orazbayeva *et al.*, 2020). Thus, we expect that permanent contracts (job stability) and rewards designed by projects may increase trust among R&D area members, thus improving their performance in project achievements.

Career paths for university technology licensing officers are often limited and short term, necessitating immediate rewards to encourage desired behaviors (Pohle *et al.*, 2022). Appropriate incentives are also crucial for researchers as inventors and primary contributors to technology transfer (Aalbers *et al.*, 2013). For international project applications and fund acquisition, reflected as "performance" in the scope of our study, we focus on the motivation and reward policies designed for RMOs that support R&D groups (Huang, 2022). We also evaluate the potential increase in trust, proactivity, and commitment to strategic objectives for enhancing project achievement. SDT is the most appropriate theory to justify how incentives for RMOs in R&D centers can influence their proactivity and effectiveness. Given the significance of reward policies in enhancing performance and yield in research institutions (Pohle *et al.*, 2022), the rewards and motivations regarding competitive international project applications and accomplishments in R&D centers must be profoundly understood. Therefore, as RMOs are crucial in shaping the application process for competitive international public funding, we suggest the following hypotheses according to SDT while discussing the importance of setting reward policies to increase the motivation, commitment to strategic objectives (proactivity), and performance (effectiveness) of R&D centers:

*H2a*. RMOs' incentives positively influence the proactivity of R&D centers.

*H2b*. RMOs' incentives positively influence the effectiveness of R&D centers.

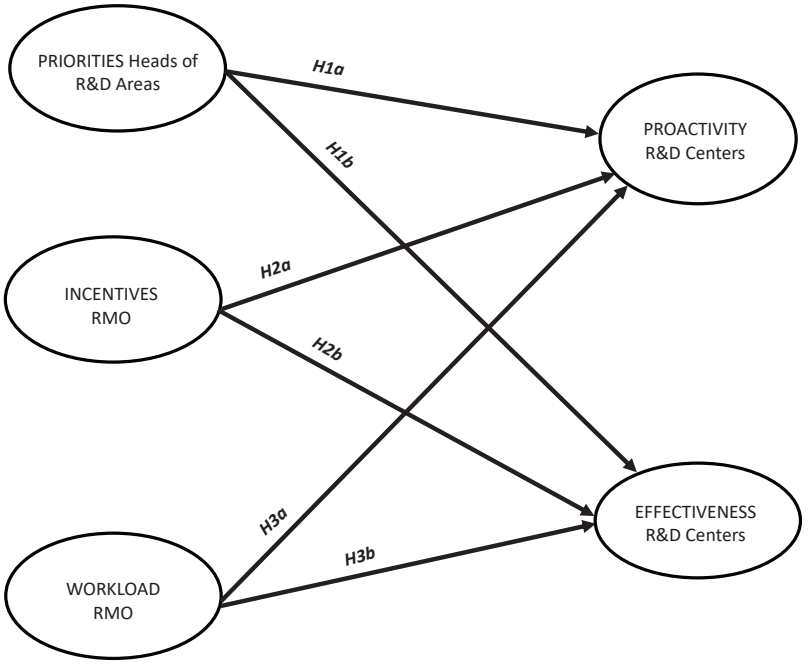
R&D centers' support to R&D areas in terms of competitive funds is managed through RMOs. Experienced researchers supported by public infrastructure are much more likely to apply for and gain this type of funding. Therefore, supportive infrastructure reduces transaction costs and information asymmetries, and R&D centers that have established RMOs outperform those that have not (Sellenthin, 2009).

The importance of innovation and expected impact in European-funded competitive projects highlights the need for professional staff capable of handling funding application and management (Vidal *et al.*, 2015). RMO employees can reduce information asymmetry in the scientific knowledge market and improve communication and interaction with R&D areas. We can determine the RMO-related factors that may influence R&D areas as those that increase the requested amount of competitive international public funding and the resources gained by studying the number of people working at RMOs to guarantee proper service to R&D areas. We can also examine the workload of RMOs in terms of their roles and functions in assisting R&D area researchers and facilitating the processes established. According to this argument, the expectation is that appropriate support from RMOs during R&D centers' application for competitive international public funding improves the proactivity and effectiveness of these centers. We observe that efficiently conducted and managed attention can boost proactivity and effectiveness while searching for funding opportunities and preparing and submitting competitive applications. According to ABV, the greater workload of RMOs can enable them to improve their capacity to allocate resources and routines toward the activities prioritized by R&D areas (Joseph and Wilson, 2018) for maximizing success in obtaining competitive funds. These ABV-based arguments support the idea that a well-managed workload can improve the operational capabilities of RMOs as supporting

structures in R&D areas. Thus, they reinforce the following formulated hypotheses and provide a robust theoretical framework for analysis (Figure 1):

*H3a*. RMOs' workload positively influences the proactivity of R&D centers in competitive international public funding applications.

*H3b*. RMOs' workload positively influences the effectiveness of R&D centers in competitive international public funding applications.




**Source(s):** Authors' elaboration

**Figure 1.** Proposed model

## 3. Research method

This section discusses the research methodology, particularly the sample and data collection and the measures used.

### *3.1 Sample and data collection*

The study sample comprised Spanish public R&D centers in the health and biomedicine sectors. These research fields are highly competitive, and most research activities are funded through competitive financial mechanisms (Milanés Guisado *et al.*, 2010). The focus on Spain was driven by the recognition that most of its research activities are undertaken by public R&D centers and that public funding is crucial for maintaining their infrastructure, personnel, and research development over time.

We identified the study population using secondary sources, including public and private databases, scientific publications, annual reports, and company reports. By accessing available scientific reports, we identified Spanish R&D centers in the health and biomedical fields that participated in competitively funded national and international projects from 2011 to 2016.

The final population consisted of 68 public nonprofit R&D centers and institutes located in Spain. The list of R&D centers was compiled by a panel of experts from the ISCIII European Office and European Office of the Spanish Ministry of Economy, Industry, and Competitiveness. These entities have their own R&D areas and RMOs. To obtain a representative sample with a high degree of consistency and viability in terms of data collection costs, we attempted to connect with the R&D centers. However, only 47 R&D centers (69.11% of the total population) were available for interview. A total of 27 out of the 47 R&D centers interviewed (39.71%) provided responses from all roles, including the CEO, research area heads, and RMO heads. Despite the reduced size, the final sample was heterogeneous and geographically representative and accurately reflected the broader population of public R&D centers in Spain.

We combined primary and secondary sources to collect data for empirical analysis (Figure 2). We conducted a thorough pretest to refine the questionnaires and reviewed the survey with a panel of experts in biomedicine and management research. Additionally, we engaged respondents by emphasizing the relevance of the study and the implications of the results.

### *3.2 Measures*

Our dependent variables are the proactivity (PROACT) and effectiveness (EFFEC) of R&D centers in raising competitive funds. We assessed the activities of each R&D center based on the number of competitive international public funding applications to diverse international agencies and funding programs made by its research staff from 2011 to 2016. We used a 5-point Likert scale ranging from "20 or less" to "more than 100" to assess the R&D center's degree of competitive international public project applications.

We measured the effectiveness of each R&D center using the total amount of competitive international public funds it secured from 2011 to 2016. We employed a 5-point Likert scale ranging from "none" to "more than 36" to assess the R&D center's degree of competitive international public projects.

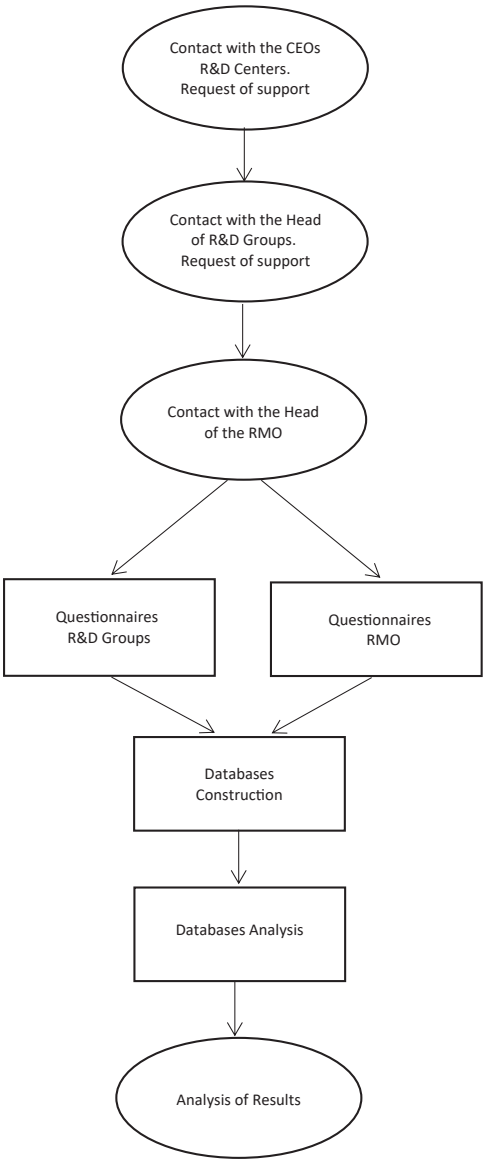
In complex questionnaires such as ours, the use of numerical intervals reduces variance, facilitates data grouping, enables robust statistical analysis, and benefits respondents by not requiring exact answers. This approach increases response rates, reduces errors, and improves data quality by smoothing deviations, thereby providing more coherent and reliable data.

The independent variables of the study are as follows:

(1) Priorities of R&D area heads (PRIOR): The scale for this independent variable was adapted from Clausen *et al.* (2012). We used a 5-point Likert scale ranging from 1 ("not a priority") to 5 ("crucial priority").

(2) Incentives of RMOs (INCRMO): The incentives offered by an R&D center represent the policies adopted by the institution to increase the applications and receipt of competitive international public funding. Regarding motivating and promoting international research success rates, we collected data on the potential and different intrinsic and extrinsic incentives offered by each center to research managers when acquiring competitive projects. We adapted the scale of Linz and Semykina (2012) to fit our research context and used a 5-point Likert rating ranging from "not done" to "always done."

(3) Workload of RMOs (WORKRMO): Workload represents the activities that research managers perform to assist researchers and the types of services they provide to R&D areas. We calculated the workload of each RMO by dividing the total number of services developed by the RMO when researchers applied for competitive international public funding by the total number of people comprising the RMO. The content design for these data was derived from the annual scientific reports of most of the centers in 2013–2015 as at least 80% of them included these figures in their annual reports. We used a 5-point Likert scale ranging from "none" to "more than 35."




**Source(s):** Authors' elaboration

**Figure 2.** Primary data collection process

A large number of research staff in a center can increase R&D activities and potential projects. In competitive international funding, the size of the R&D center is crucial as more members can increase opportunities to apply for and gain competitive funds and allow R&D area heads to allocate more resources to this effort. To better capture the impact of the independent variables on R&D centers' proactivity and effectiveness, we included the number of researchers (NRESEAR) as a control variable.

## 4. Data analysis and results

This section summarizes the validation of the measurement instruments, estimation of the structural model, and detailed results.

### *4.1 Validating the measurement instruments*

SmartPLS (version 2.0) software was employed for the measurement and structural model analyses. We chose partial least squares (PLS) as our research method for two reasons. PLS aligns with the objectives and limitations of our research, namely, sample size considerations and predictive orientation. It is particularly effective in smaller sample sizes and is thus important given the scope and data available for our study. In contrast to other methods that typically require larger samples to obtain reliable results, PLS can provide robust results even with a limited number of observations. This feature maintains the validity and reliability of our research despite sample size restrictions (Chin *et al.*, 2003). Regarding the predictive orientation of PLS, the objective is to maximize the explained variance of dependent constructs, thereby enhancing the predictive relevance of the model. This feature is important in our study as we seek to understand and predict outcomes in a practical context (Tenenhaus *et al.*, 2005).

To assess the validity and reliability of the measurement model, we analyzed whether the theoretical concepts were properly measured by the observed variables. To evaluate the reliability of the individual variables, we examined the loadings of the indicators in relation to their respective constructs. In exploratory research, loadings between 0.6 and 0.7 are deemed acceptable while values exceeding 0.7 are highly satisfactory (Sarstedt *et al.*, 2014). We obtained a factorial structure of six factors, with each item having a loading greater than 0.7 on its designated factor and lower loadings on all other factors. Exceptions are some PRIOR items (349 and 3417), INCRMO items (211, 212, 216, 217, and 2111), and PROACT items (182, 183, 184, 185, 188, 189, 1810, 1811, 1812, 1813, and 1814), whose loadings with corresponding dimensions were lower than 0.7. We removed these items from their corresponding factors and obtained favorable results for the remaining items (Table 1).

INCRMO items 218 and 2110 showed multicollinearity problems in the multicollinearity analysis using SPSS version 26 and in the variance inflation factor (VIF) and tolerance revision for assessing statistical collinearity. Accordingly, we removed the two items such that multicollinearity was no longer a problem and that each pair of items had tolerance ratios higher than 0.2 and VIF <5 in accordance with Kleinbaum *et al.* (2013).

The reliability of the constructs was calculated based on both criteria. In all cases, the composite reliability index (CRI) values exceeded the optimal threshold of 0.7 (Chin and Newsted, 1999; Nunnally, 1994). To analyze convergent validity, we used the average variance extracted (AVE), which is an indicator of the variance captured by a factor relative to the variance due to measurement error (Fornell and Larcker, 1981). The AVE values exceeded 0.5 in all cases, indicating that more than 50% of the variance in each construct was due to their indicators (Table 2).

We used the Kaiser–Meyer–Olkin (KMO) test to assess model validity. The KMO index measures the adequacy of partial correlations between variables for factor analysis, indicating whether the data are suitable (Hutcheson and Sofroniou, 1999; Hair *et al.*, 2018; Kaiser, 1974). The overall measure of sampling adequacy (MSA) was 0.79, with all individual MSAs ranging from "acceptable" to "perfect" (Table 3). We calculated the model fit index to evaluate the model fit. The indices confirmed the model's acceptability: normed fit index (NFI) = 0.92, Tucker–Lewis index (TLI) = 0.899, relative fit index (RFI) = 0.885, incremental fit index (IFI) = 0.927, and comparative fit index (CFI) = 0.919. A non-NFI, also known as the TLI, of 0.95 indicates that the model of interest improves fit by 95% and is preferable for smaller samples. The values should be > 0.90 (Byrne, 1994). The RFI is not guaranteed to vary from 0 to 1; a value close to 1 indicates a good fit. The IFI adjusts the NFI for sample size and degrees of freedom, and a value exceeding 0.90 indicates a good fit. The CFI, a revised form of the NFI, is not sensitive to sample size (Fan *et al.*, 1999) and compares the fit of a target model with the fit of an independent or null model. The acceptable value is > 0.90 (Byrne, 1994).

**Table 1.** Factors and items loading

| Factor | Item | Description | Individual item loading |
|---|---|---|---|
| F1. PRIOR (Priorities of heads of R&D areas) | PRIOR341 | To obtain higher long-term financing associated to projects | 0.9804* |
| | PRIOR3410 | To improve researchers' employment opportunities | 0.9804* |
| | PRIOR3411 | To increase collaborations with industry | 0.9778* |
| | PRIOR3412 | To develop education and training programs | 0.8031* |
| | PRIOR3413 | To obtain practical and applicable results from the developed research projects | 0.8029* |
| | PRIOR3414 | To obtain more support from other R&D areas | 0.8029* |
| | PRIOR3415 | To improve the research culture of the area and the center | 0.8029* |
| | PRIOR3416 | To increase the support from other local or regional R&D areas | 0.7172* |
| | PRIOR342 | To obtain more basal funds not coming from national or international projects | 0.9807* |
| | PRIOR343 | To increase the number of international scientific publications | 0.9758* |
| | PRIOR344 | To attract good researchers | 0.7445* |
| | PRIOR345 | To improve international collaborations | 0.9782* |
| | PRIOR346 | To develop a better scientific program | 0.9774* |
| | PRIOR347 | To obtain more support from the CEO and top management team | 0.9799* |
| | PRIOR348 | To improve the scientific leadership of the R&D area | 0.9806* |
| F2. INCRMO (RMO Incentives) | INCRMO213 | It provides the RMO members with more job security | 0.8708* |
| | INCRMO214 | It increases the promotion opportunities for the RMO members | 0.8277* |
| | INCRMO215 | It improves the appreciation and respect for the RMO members among the rest of the staff | 0.9033* |
| | INCRMO219 | It offers opportunities for RMO members to learn new things | 0.8325* |
| F3. WORKRMO (RMO Workload) | WORKRMO | Number of activities undertaken by the RMO in the last year, in relation to the staff members of the office | 1* |
| F4. NRESEAR (Number of researchers in the centers) | NRESERAR | Number of research staff in the centers | 1* |
| F5. PROACT (Proactivity of the center) | PROACT181 | 7th FP - Cooperation–Health | 0.8100* |
| | PROACT1815 | 7th FP - Cooperation-NANO 7th FP–IDEAS | 0.8783* |
| | PROACT186 | (ERC) | 0.9160* |
| | PROACT187 | 7th FP - PEOPLE (Marie Curie Actions) | 0.8708* |
| F6. EFFEC (Effectiveness of the center) | EFFEC | Number of international competitive projects acquired by the center in the last five years | 1* |

**Note(s):** *All loadings are significant ($p$<0.1)
Items PRIOR (349 and 3417); Items INCRMO (211, 212, 216,217 and 2111); Items PROACT (182, 183, 184, 185, 188, 189, 1810, 1811, 1812, 1813 and 1814) were eliminated (the values of their loads were below 0.7)
**Source(s):** Authors' elaboration

We calculated discriminant validity by comparing the square root of the AVE with the correlations between the factors to show that the correlations between constructs were less than the square root of the AVE (García-Rodríguez *et al.*, 2017; Hair *et al.*, 2019). The correlations in our study were less than the square root of the AVE, thus confirming discriminant validity (Table 4).

*4.2 Structural model estimation*

After evaluating the psychometric properties of the measurement instruments, we analyzed the structural model using PLS. Previous studies (see García-Rodríguez *et al.*, 2017;

**Table 2.** Reliability and convergent validity of constructs

| Factor | CRI | AVE | Cronbach's alpha |
|---|---|---|---|
| PRIOR (Priorities of heads of R&D areas) | 0.985 | 0.818 | 0.9833 |
| INCRMO (RMO Incentives) | 0.918 | 0.738 | 0.8833 |
| WORKRMO (RMO Workload) | 1 | 1 | 1 |
| PROACT (Proactivity of the center) | 0.925 | 0.756 | 0.8924 |
| EFFEC (Effectiveness of the center) | 1 | 1 | 1 |
| NRESEAR (Number of researchers in the centers) | 1 | 1 | 1 |

**Note(s):** *All loadings are significant ($p$<0.1)

**Table 3.** Kaiser–Meyer–Olkin (KMO) factor adequacy

| Factor | Item | Description | MSA for each item |
|---|---|---|---|
| F1. PRIOR (Priorities of heads of R&D areas) | PRIOR341 | To obtain higher long-term financing associated to projects | 0.83 |
| | PRIOR3410 | To improve researchers' employment opportunities | 0.83 |
| | PRIOR3411 | To increase collaborations with industry | 0.78 |
| | PRIOR3412 | To develop education and training programs | 0.87 |
| | PRIOR3413 | To obtain practical and applicable results from the developed research projects | 0.87 |
| | PRIOR3414 | To obtain more support from other R&D areas | 0.89 |
| | PRIOR3415 | To improve the research culture of the area and the center | 0.85 |
| | PRIOR3416 | To increase the support from other local or regional R&D areas | 0.82 |
| | PRIOR342 | To obtain more basal funds not coming from national or international projects | 0.76 |
| | PRIOR343 | To increase the number of international scientific publications | 0.83 |
| | PRIOR344 | To attract good researchers | 0.72 |
| | PRIOR345 | To improve international collaborations | 0.86 |
| | PRIOR346 | To develop a better scientific program | 0.83 |
| | PRIOR347 | To obtain more support from the CEO and top management team | 0.84 |
| | PRIOR348 | To improve the scientific leadership of the R&D area | 0.76 |
| F2. INCRMO (RMO Incentives) | INCRMO213 | It provides the RMO members with more job security | 0.82 |
| | INCRMO214 | It increases the promotion opportunities for the RMO members | 0.73 |
| | INCRMO215 | It improves the appreciation and respect for the RMO members among the rest of the staff | 0.71 |
| | INCRMO219 | It offers opportunities for RMO members to learn new things | 0.76 |
| F3. WORKRMO (RMO Workload) | WORKRMO | Number of activities undertaken by the RMO in the last year, in relation to the staff members of the office | 0.62 |
| F4. NRESEAR (Number of researchers in the centers) | NRESERAR | Number of research staff in the centers | 0.54 |
| F5. PROACT (Proactivity of the center) | PROACT181 | 7th FP - Cooperation–Health | 0.77 |
| | PROACT1815 | 7th FP - Cooperation-NANO 7th FP–IDEAS | 0.45 |
| | PROACT186 | (ERC) | 0.77 |
| | PROACT187 | 7th FP - PEOPLE (Marie Curie Actions) | 0.69 |
| F6. EFFEC (Effectiveness of the center) | EFFIC | Number of international competitive projects acquired by the center in the last five years | 0.44 |

**Note(s):** Overall MSA = 0.79; *Measure: 0.8 ≥ perfect for performing a FA; 0.6 to 0.7 = adequate; 0.4 to 0.5 = acceptable; Less than 0.4 = an AF is not recommended*

**Source(s):** Authors' elaboration

**Table 4.** Discriminant validity coefficients

| Factors | PRIOR | INCRMO | WORKRMO | PROACT | EFFEC | NRESEAR |
|---|---|---|---|---|---|---|
| PRIOR | *1* | 0 | 0 | 0 | 0 | 0 |
| INCRMO | −0.0579 | *1* | 0 | 0 | 0 | 0 |
| WORKRMO | 0.0553 | 0.3037 | *1* | 0 | 0 | 0 |
| PROACT | −0.0953 | 0.3507 | 0.5447 | *1* | 0 | 0 |
| EFFEC | −0.1126 | 0.3445 | 0.6303 | 0.796 | *1* | 0 |
| NRESEAR | −0.0778 | 0.4271 | 0.6291 | 0.4685 | 0.516 | *1* |

**Note(s):** Values of the diagonal in italic: Square root of extracted variance. Values below the diagonal: Estimated correlation between factors
**Source(s):** Authors' elaboration

Morales *et al.*, 2019) have employed $R^2$ values, which reflect the amount of construct variance explained by the structural model; and the Stone–Geisser test ($Q^2$) to assess the predictive ability of the model (Chin and Newsted, 1999). $R^2$ values can be broadly classified into three levels: substantial predictive power ($R^2 = 0.67$), moderate predictive power ($R^2 = 0.33$), and weak predictive power ($R^2 = 0.19$). For the Stone–Geisser test, all values above 0 are considered acceptable (Table 5). This high level of predictive relevance indicates that the analyzed model is robust and stable under all observations (Chin and Newsted, 1999; Hair *et al.*, 2019).

**Table 5.** Structural model estimation

| Dependent variables | $R^2$ | $Q^2$ |
|---|---|---|
| PROACT (Proactivity of the center) | 0.355 | 0.240 |
| EFFEC (Effectiveness of the center) | 0.696 | 0.264 |

**Source(s):** Authors' elaboration

### *4.3 Results*

The results in Table 6 confirm the significant impact of the independent variables on the proactivity and effectiveness of the R&D centers. H1a was supported ($\beta = -0.099$; $p < 0.05$), indicating that a dispersed or unclear set of priorities of R&D area heads decreases R&D

**Table 6.** Hypotheses testing

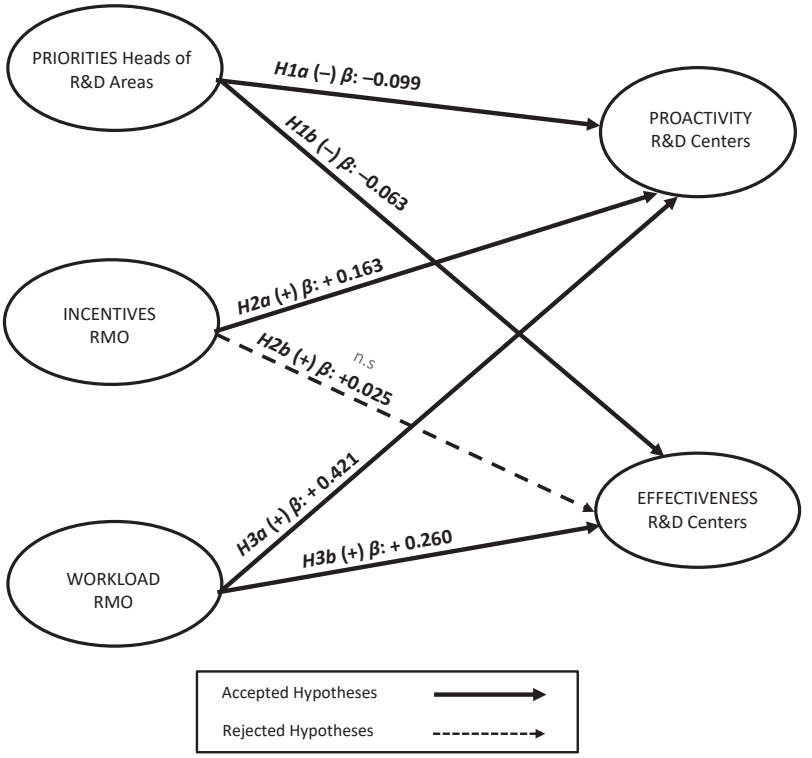
| Relationship | Hypotheses | Standardized β | *t*-value bootstrap |
|---|---|---|---|
| H1a: Priorities heads of R&D areas → Proactivity of the center | Accepted | $-0.099^{**}$ | 1.821 |
| H1b: Priorities heads of R&D areas → Effectiveness (International projects gained by the center) | Accepted | $-0.163^{*}$ | 1.523 |
| H2a: RMO incentives → Proactivity of the center | Accepted | $0.163^{**}$ | 2.08 |
| H2b: RMO incentives → Effectiveness (International projects gained by the center) | Rejected | $0.025^{n.s}$ | 0.719 |
| H3a: RMO workload → Proactivity of the center | Accepted | $0.428^{***}$ | 3.002 |
| H3b: RMO workload → Effectiveness (International projects gained by the center) | Accepted | $0.260^{***}$ | 2.924 |
| No. of researchers in the center → Proactivity of the center | Rejected | $0.126^{n.s}$ | 1.248 |
| No. of researchers in the center → Effectiveness (International projects gained by the center) | Rejected | 0.048n.s | 0.85 |
| No. of researchers in the center → RMO workload | Accepted | $0.629^{***}$ | 7.459 |

**Note(s):** $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
$R^2$ (workload of RMO) = 0.396; $R^2$ (proactivity of the center) = 0.355; $R^2$ (efficacy or international projects gained by the center) = 0.696
$Q^2$ (workload of RMO) = 0.395; $Q^2$ (proactivity of the center) = 0.240; $Q^2$ (efficacy or international projects gained by the center) = 0.264
**Source(s):** Authors' elaboration

centers' proactivity in asking for competitive international public funds. H2a ($\beta = 0.163$; $p < 0.05$) and H3a ($\beta = 0.421$; $p < 0.01$) were also supported. Thus, RMO incentives and workload positively influence the proactivity of R&D centers in competitive international public funding applications.

H1b was also supported ($\beta = -0.063$; $p < 0.1$), indicating that a dispersed or unclear set of priorities of R&D area heads decreases the effectiveness of R&D centers in acquiring competitive international public funds. H3b was likewise supported ($\beta = 0.260$; $p < 0.01$). Hence, the workload of RMOs positively influences the effectiveness of R&D centers. Meanwhile, H2b was not supported; therefore, we could not conclude that RMOs' incentives positively influence the effectiveness of R&D centers.

The control variable, the number of researchers, does not influence proactivity and effectiveness, but it does affect workload. The key results derived from the proposed model are illustrated in Figure 3, offering a comprehensive representation of the main relationships and outcomes.




**Source(s):** Authors' elaboration

**Figure 3.** Results

## 5. Discussion

This study presents evidence that internal factors can affect the proactivity and effectiveness of R&D centers. A clear set of priorities for R&D area heads, a reasonable workload for RMOs, and a specific set of incentives for RMO alignment can boost the proactivity and effectiveness

of R&D centers. One of the primary contributions of this study is the presentation of a theoretical model that suggests the influence of controllable internal factors by the main actors within public R&D centers on their success in acquiring competitive international public funding.

Applying for international projects is a long and complex process, with researchers facing significant challenges in adhering to international norms and bureaucratic requirements. The success of a proposal depends on factors such as annual program funds, types of funding actions, and allocated budgets. However, the good results obtained in previous framework programs by Spanish entities indicate that the acquisition of international public is extremely competitive and has a low success rate. Despite rigorous competition in which less than 10% of applications are successful, Spanish entities have historically secured a notable proportion of international public funding. In fact, 3,328 entities in Spain have obtained funding for their research and innovation activities (CDTI, 2021; European Commission: Directorate-General for Research and Innovation, 2019).

R&D areas that persistently apply for competitive international funding despite initial rejections can improve their proposal standards by incorporating feedback from reviewers and policy officers, refining their understanding of program rules, and enhancing the quality of their project memos. This persistence can increase their chances of success in future calls and deepen their knowledge of the funding process (Laudel, 2006; Shuman, 2019). However, while proactivity is associated with R&D center effectiveness, less productive areas may become less proactive over time, thereby affecting their success in securing competitive projects. For this study, we assumed that the most proactive R&D centers—those with the highest participation in competitive calls, that is, those with the largest number of project applications submitted to current international funding programs—are the most effective.

ABV highlights the role of managerial capacity in developing certain activity types in competitive international public projects. We extend the theory by demonstrating that an unclear set of priorities of heads of R&D areas regarding their promotion of competitive international public project applications is crucial to understanding how R&D centers perform and in which aspects they differ from others. The results demonstrate the relationship between the priorities established by R&D area heads and the success of their respective centers. The negative beta coefficient in H1a, that is, a unit increase in the dispersion of priorities corresponds to a decrease in proactivity levels, highlights the importance of focused strategic planning in R&D centers. If a group fails to prioritize its activities, it inadequately allocates resources toward competitive project proposals. Therefore, the number of project proposals and their quality are lower. In R&D centers, research areas handle many activities; however, if staff members are overwhelmed, they have less time to prepare high-quality international grant proposals that meet stringent excellence criteria, including consortium requirements. This deficiency increases the risk of mistakes and can undermine R&D centers' effectiveness because of potential project rejections.

We examined RMOs' role in promoting performance, focusing on staff motivation and intrinsic and extrinsic rewards. Regarding the promotion of international competitive research and rewards for research managers, we found that extrinsic rewards are rare in R&D centers. While incentives for RMOs boost the proactivity of R&D centers, they do not affect the number of projects awarded. Specifically, the services provided to the researchers are mainly aimed at fulfilling the grant application process during the pre-award phase (Bruggen, 2015). The lack of significant findings for H2b prompts a deeper examination of the nature of the incentives provided by RMOs and their direct alignment with funding success criteria. Table 7 outlines the RMO incentives associated with securing competitive international projects.

The results further revealed that a higher RMO workload positively impacts R&D centers' proactivity and effectiveness. An active RMO handles more tasks and maintains frequent communication and better relationships with researchers, thereby experiencing increased success in competitive projects. This dynamic workload improves RMO staff's knowledge of funding opportunities and procedures and consequently enhances their connections with

**Table 7.** RMO incentives when obtaining international competitive projects

| Type of incentive | Average | Standard deviation |
|---|---|---|
| INCRMO211 It positively affects the salary of the members of the RMO | 1.5 | 1.2 |
| INCRMO212 It positively affects the salary of ALL researchers of the center, even those outside the group that obtains the international project | 1.4 | 0.7 |
| INCRMO213 It provides the RMO members greater job security | 2.1 | 1.3 |
| INCRMO214 It increases the promotion opportunities for the RMO members | 1.6 | 1.1 |
| INCRMO215 It improves the appreciation and respect for the RMO members among the other center staff | 2.4 | 1.2 |
| INCRMO216 It improves the recognition the RMO members receive from their superiors | 2.7 | 1.3 |
| INCRMO217 It provides the RMO members greater freedom in terms of time flexibility, autonomy, less supervision, etc. | 1.5 | 1.1 |
| INCRMO218 It enables the RMO members to reach worthy personal objectives | 2.7 | 1.5 |
| INCRMO219 It offers opportunities for the RMO members to learn new things | 3.7 | 1.1 |
| INCRMO2110 It allows the RMO members to develop things that make them feel good about themselves | 3.3 | 1.3 |
| INCRMO2111 It offers the RMO members good opportunities to develop their skills and abilities | 3.6 | 1.1 |

**Source(s):** Authors' elaboration

colleagues. R&D center researchers ultimately gain more opportunities and become aware and proactive in applying for competitive projects.

## 6. Conclusion

This study aims to identify and analyze the factors that may exert a significant influence on the success of public R&D centers in the biomedicine and health sectors in relation to applying for and securing competitive international funding. We pay special attention to the role played by RMOs and R&D areas within R&D centers. We focus on internal factors, that is, the factors that can be changed and can boost the efficiency of R&D centers in obtaining such funding. Specifically, we analyzed the influence of the priorities of R&D area heads, the incentives and motivations within RMOs, and RMOs' workload relative to R&D centers' proactivity and effectiveness while considering, in all cases, the size of the centers.

Results have implications for business management as understanding and adjusting internal factors to leverage international programs is crucial for institutions seeking to secure competitive research funding in knowledge-based economies. Implementing these organizational factors may add value to the current literature on R&D area performance and research management services.

We also contribute to the advancement of ABV by reporting that the priorities of R&D area heads relative to their intention to apply for international projects are crucial in understanding how R&D centers perform and in which aspects these organizations differ from others. This understanding can allow them to conduct internal analyses and implement the necessary measures to improve their performance.

As for RMOs, studies about organization rewards associated with international project applications and acquisition by R&D centers are lacking. Our study expands previous results supported by SDT beyond the motivations of personnel in R&D organizations by analyzing rewards and motivations associated with the proactivity and effectiveness of R&D centers in applying for international projects. We also evaluate the increase in trust among team members and the improvement of results in project acquisition. We observe that project management services are crucial to researchers as support structures for R&D areas in the process of applying for competitive projects and in enhancing proactivity and effectiveness. These results

have practical implications because knowing how to implement measures to achieve better RMO performance is key for R&D institutions seeking to maintain their competitive advantage.

Our results indicate that the RMOs' variable workload, which refers to the number and type of tasks they develop, influences the relationships of research managers within R&D areas. It also improves the quality of services provided by RMOs, thereby positively affecting the proactivity and effectiveness of R&D centers. Our findings suggest that because of the dynamic portfolio of services of RMOs, R&D areas gain opportunities to be more proactive and consequently improve the overall effectiveness of R&D centers.

An interesting future research direction is to analyze the connection between RMOs and R&D areas, focusing on RMO staff's familiarity with the knowledge areas they support. Investigating the alignment and technical knowledge of RMO members relative to the work of research groups could be crucial as it may foster closer relationships and improve R&D performance. RMO staff's enhanced understanding of the projects they manage could lead to higher-quality services and better interactions, which positively influence the support that researchers receive. Future studies could also explore R&D centers in different countries or regions and perform cross-cultural comparisons to identify universal and context-specific factors that influence funding success. Longitudinal studies could monitor changes in fundraising effectiveness due to strategic or policy shifts to deepen our understanding of the causal links between internal management practices and funding outcomes. Another valuable research direction is to examine whether collaborative networks among R&D centers improve the success of funding applications through the sharing of best practices and resources.

One limitation of this study is the lack of comparative analysis with similar research, due to the absence of studies specifically addressing the effectiveness of public research centers in securing competitive international funding. Although related literature has explored R&D and innovation in various contexts, no study has focused on our specific research context. Hence, we were unable to conduct an in-depth comparison between our findings and existing knowledge. This limitation also hindered the analysis of how cultural, economic, or political differences might influence the applicability of the results. Further comparative studies would provide a broader understanding of the factors affecting the effectiveness of public R&D organizations in diverse international settings. Nevertheless, the novelty of this study paves the way for further research on the topic. Further studies are required to build a robust body of knowledge and enable more detailed comparisons and analyses. In essence, our study is the first step toward understanding the factors that influence competitive international funding for R&D centers, and it lays the groundwork for detailed and rigorous future research.

Another limitation of our study is the small sample size, which was necessary given the novelty of the topic and the complexity of the data collected. While concentrating on Spanish public nonprofit R&D centers provides valuable insights, expanding the sample to include a broader range of institutions, both geographically and across sectors, could improve the generalizability of the findings. Additionally, a larger sample size would enhance the statistical power of the analysis.

Moreover, the results from competitive research projects by Spanish institutions are not publicly accessible, unlike those in other European countries. This lack of transparency limits researchers' ability to conduct thorough studies. Given the high cost and time invested in such research, Spanish authorities should view it as a convenient and useful opportunity to supply academics, researchers, and public institutions with a vested interest in R&D project performance with official information that can help ensure the continuation of research and progress in this field.

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