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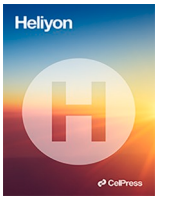

Research article

Competing for research funding: Key elements impacting the evaluation of grant proposal

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ABSTRACT

As funding is one of the key pillars of research activity, identifying the factors that impact the evaluation results in research funding competitions remains challenging, due to the heterogeneity of funding instruments. In this context, our study aims to identify the elements that ensure the application's success, comparing two perspectives: one of the applicant and the other based on the evaluation grid. The empirical investigation focuses on a survey of 243 Romanian researchers. As analysis methods, we use a binary logistic regression model to correlate the success in funding competitions for research projects with a set of factors considered determinants. The results show that the researcher's past performance influences the proposal's future performance/success, with the quality of the project director's previous publications, and its international visibility being the key drivers of successful research project applications.

1. Introduction

Since financial resources are relatively modest, competitiveness in attracting research funding is becoming extremely high. In this context, this paper analyses the applicants' perceptions regarding the factors that impact the application's success in research funding competitions. The main objective of our study is to investigate the factors that influence the success of applicants in research funding competitions from two perspectives: a subjective one and one starting from the evaluation grid of the research project. The evaluation grid is a common instrument for assessing the quality of a research proposal, based on different criteria and adapted to each funding competition (for an example, see Appendix). Our research corroborates the results of the evaluation process with a series of factors relevant for the project applicants: (i) time allocated to writing the project proposal; (ii) previous experience in implementing research projects; (iii) the scientific profile of the members of the research team proposed for implementation.

The theoretical support for this paper is found in the role that the search for funding plays in the researchers' recognition, as well as in the peer review process, the primary instrument for allocating public Research and Development (R&D) funds. The study focuses on the applicant's perception, resulting from a questionnaire administered to academic staff from various research fields in Romanian universities. The applicants were asked to respond to questions that assessed their perception of the evaluation process and other questions that presented the indicators included in the evaluation grids. Based on the evaluation grid of the funding competition, the proposal aspects are assessed. The research depicts a more complex image of the peer review process in the competition for Romanian public research funding and contributes to a deeper understanding of the factors that impact the success of a research proposal.

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Understanding the grant review process and ensuring that the research grant application addresses all required elements is vital for applicants to increase their chances of success.

This is the first study to analyse and compare the applicant's perception with the evaluation grid items and to identify the factors that could increase the success of a research proposal. By examining a sample of academic staff from different research fields who participated in research project competitions organised by the national bodies responsible for scientific research, our paper adds value to the literature, unlike other studies dedicated to a particular research area. Thus, our approach offers valuable insights into the dynamics of research funding competitions, shedding light on subjective applicant perceptions and the objective evaluation criteria across Science, Technology, Engineering and Mathematics (STEM) and Arts, Humanities and Social Sciences (AH&SS) research fields. By bridging the gap between these perspectives, our research contributes to a deeper understanding of the factors driving success in securing research funding, particularly in the context of Eastern European countries like Romania. Moreover, using data on the results of the competition for public research funding, we provide some suggestions for success in such competitions, pointing out the factors that applicants should consider to increase their chances of obtaining funding.

For the empirical analysis, we chose to analyse the answers of researchers from Romania only to facilitate the data collection process. But, even though the empirical study relies on data collected for one country, we assume that our results can be considered representative at the regional level and can be extrapolated for neighbouring countries, especially those located in Central and Eastern Europe (CEE).

Considering the proposed aim, the present study addresses the following two research questions: (i) what are the main factors that impact an evaluation grant proposal? (ii) how do factors such as the applicant's previous publications, and its international visibility shape the evaluation result?

This study contributes to the field by providing a better understanding of the research project evaluation process. This knowledge can improve the applicants' proposals and make their projects more competitive. The data can also support the revision of the assessment guide, especially for interdisciplinary or multidimensional research projects involving different stakeholders and disciplines that need a more appropriate structured evaluation process. The paper is organised into several sections comprising: a section dedicated to the context of research and the analysis of the literature in the field, reviewing the main research directions and the corresponding outcomes; a second section describing the research methodology, including the binary logistic regression model performed to explain the relationships between variables; results and discussion section presenting research findings and their implications.

2. Theoretical and empirical foundation of the analysed problem

2.1. Describing the context for research project competitions in Europe and Romania

Research and Innovation systems are complex ecosystems whose optimal functioning depends on several factors: the need for a solid research infrastructure for high-quality results; the regulation of the framework conditions for research activity and the need to ensure knowledge flows between research and innovation stakeholders; the need for optimal funding of research, development and innovation activities to support the progress of knowledge and thus economic growth. Investment in research, development, and innovation is crucial for scientific progress, for finding solutions to societal challenges, for the development and use of technologies with an impact on the quality of life, for increasing productivity and competitiveness, and last but not least, for creating sustainable

Table 1
The structure of the sample.

	Number	Percentage
Gender		
Female	99	40.74 %
Male	135	55.56 %
Did not want to say	9	3.70 %
Total	*243*	*100 %*
The main field of interest		
Natural Sciences, Exact Sciences and Engineering Sciences	94	38.68 %
Humanities	81	33.34 %
Social and Economic Sciences	68	27.98 %
Total	*243*	*100 %*
The professional degree		
Senior Researcher[a][1]/Professor	40	16.46 %
Senior Researcher[a]/Associate professor	72	29.63 %
Scientific Researcher[a]/University lecturer	92	37.87 %
Scientific Researcher[a]/Teaching assistant	22	9.05 %
Research Assistant	17	6.99 %
Total	*243*	*100 %*

[a] Note: Senior researcher is a researcher with greater experience, who are assimilated in Romania with the didactic degrees of Professor or Associate professor. Scientific Researcher are researchers with less experience who are assimilated to the didactic degrees of Teaching assistant or University lecturer.
Source: author's calculations

jobs. Starting from these premises, in March 2002 the European Council set a new strategic objective for the Member States: to increase Research and Development (R&D) expenditures as a percentage of Gross Domestic Product (GDP). According to statistics, over the past decade, the share of R&D expenditure in GDP has increased in the EU from 2 % in 2010 to 2.3 % in 2020. According to data published by Eurostat, European Union (EU) Member States spent around 311 billion euros on research and development in 2020, as R&D expenditure increased in 24 of the EU countries. However, in some member states, research funding remains at a relatively low level compared to other sectors. This particular aspect affects the quality of the public Research and Innovation (R&I) system. Romania is such a case, with only 0.13 % of GDP allocated to research in 2020, and ranks last in the European Union.

In European countries, public research funding comprises two major instruments to support research and innovation activities: (i) institutional funding and (ii) project competition funding. Institutional funding is defined as a direct and global financial flow towards public research, development, and innovation organisations – such as research institutes, academies, or universities, with funds distributed based on assessment algorithms that include the results of the respective organisations. Institutional funding ensures a reliable basis for research activity and sustainability of institutions, funding long-term projects and research regarded as less attractive economically. It also permits a sufficient degree of autonomy in selecting research topics and other related components.

The second instrument, project competition funding, consists of allocating resources, based on an open and competitive selection process, to the entity carrying out the actual research activity, i.e. a researcher, a research group, a research centre, a network of researchers. The scope, budget, and timeline of the research effort are constrained, as specified in the grant agreement. Competitive project funding aims at channelling resources directly to the research activity rather than the host organisation, thus being a vehicle for external prioritisation of research through intermediary agencies. Existing studies indicate a direct relationship between project

Table 2
Factors that led the projects to obtain financing in research funding competitions (Model A).

Models	Model 1			Model 2 (Male)			Model 3 (Senior Researcher/ Professor)		
Dependent variable	Success rate			Success rate			Success rate		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
The quality of the scientific publications of the project director	**0.401* (0.178)**	0.670	5.077	**0.568* (0.293)**	0.567	3.753	0.034 (0.653)	1.035	0.003
The impact and applicability of the project idea	0.063 (0.175)	1.065	0.131	0.323 (0.320)	1.381	1.019	1.256 (1.001)	3.512	1.576
The match between the proposed topic and previous publications	**0.335* (0.192)**	0.715	3.039	**0.920* (0.368)**	0.398	6.265	**2.200* (1.124)**	0.111	3.834
Time allocated for writing the project	0.008 (0.161)	1.008	0.003	0.374 (0.318)	1.453	1.383	−0.502 (0.608)	0.605	0.682
Project team	−0.061 (0.164)	0.941	0.137	0.171 (0.305)	1.186	0.314	−0.027 (0.600)	0.973	0.002
Constant	**1.771* (0.406)**	5.879	19.071	**1.790* (0.641)**	5.990	7.804	**5.368* (1.890)**	214.425	8.069
Nagelkerke R^2	0.111			0.204			0.401		
Cox & Snell R^2	0.128			0.224			0.454		
−2 Log likelihood	133.131			251.296			355.026		
No. of observations	243			135			40		
Chi-square	24.336*			17.932*			14.633*		

Models	Model 4 (Senior Researcher/ Associate Professor)			Model 5 (Scientific Researcher/ University Lecturer)			Model 6 (Natural Sciences, Exact Sciences and Engineering Sciences)		
Dependents variable	*Success rate*			*Success rate*			*Success rate*		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
The quality of the scientific publications of the project director	−0.238 (0.438)	0.788	0.295	**0.754* (0.327)**	0.471	5.311	−0.322 (0.341)	0.724	0.896
The impact and applicability of the project idea	0.133 (0.401)	1.143	0.111	0.121 (0.287)	1.129	0.179	−0.013 (0.329)	0.987	0.001
The match between the proposed topic and previous publications	**1.152* (0.518)**	0.316	4.949	0.118 (0.300)	1.126	0.156	−0.420 (0.329)	0.657	1.624
Time allocated for writing the project	**−0.874* (0.444)**	2.397	3.872	−0.151 (0.271)	0.860	0.311	0.474 (0.307)	1.607	2.386
Project team	**0.721* (0.417)**	0.486	2.993	0.039 (0.259)	1.040	0.023	**0.571* (0.314)**	0.565	3.310
Constant	**2.923* (0.951)**	18.603	9.452	1.029 (0.707)	2.800	2.118	**1.703* (0.689)**	5.488	6.097
Nagelkerke R^2	0.275			0.094			0.098		
Cox & Snell R^2	0.310			0.131			0.180		
−2 Log likelihood	233.126			145.912			154.423		
No. of observations	72			92			94		
Chi-square	17.849**			15.844*			13.577*		

Sources: processed by the authors in SPSS

competition funding and the productivity of research systems, measured in terms of publications per direct financial investment, highlighting that 'excellence in scientific research is correlated with the assessment of researchers based on internationally comparable criteria and with the competition between researchers' [1], [p. 9].

In most European countries, institutional funding remains the primary way of financing R&D activities from public funds. Thus, there are only 6 European countries where project funding exceeds 50 % of public research funding (Great Britain, Poland, Belgium, The Czech Republic, Estonia, and Ireland) and only one of the above-mentioned six institutional funding represents less than 30 % of the total (Estonia). Establishing performance indicators based on which funds for research activity are allocated has become a priority for the EU Member States.

An analysis of research funding mechanisms in Romania reveals several shortcomings that result in a low degree of competitiveness for research organisations. Consequently, current institutional R&D funding has a limited competitive character and is more closely correlated with the number of researchers, and less with strategic objectives, performance, and impact. Institutional R&D funding does not include universities, an aspect which is also reflected in the low number of full-time researchers employed by universities. A fund dedicated to university science research was allocated by the Ministry of Education from the institutional funding of the educational process only starting in the year 2021, to increase the Romanian research performance and international recognition. On the other hand, Romania has a significant number of public research organisations functioning with few researchers, leading to high administrative costs, a lack of critical mass, and a low level of competitiveness in international competitions. All of these aspects are reflected in the country's low international rankings. Furthermore, funding through national project competitions is ensured by a low percentage of the R&D budget and is, therefore, less predictable and unable to sustain the continuity of research activities. This, in turn, contributes to the exodus of R&D/academic staff to other sectors or countries. The National Research and Development and Innovation Plan is the main instrument used to implement the national strategy in R&I. The Romanian Ministry of Research, Innovation, and Digitisation has proposed that research projects be funded through a multiannual mechanism to ensure stability and predictability. National research projects are evaluated through a competitive process, with applications submitted in English and assessed by international evaluators to reduce conflicts of interest [2].

Each project proposal is independently assessed in terms of quality by three expert evaluators. They fill in an evaluation sheet, for the following evaluation criteria related to the principal investigator, research project, state-of-the-art, feasibility, risks, and expected impact. When scoring each sub-criterion, the evaluators use a full scale, from 0 to 5 – in 0.5 increments, and their scores must reflect the strengths and weaknesses and be in line with the comments. Once the individual assessments for a project are completed, each evaluator from the committee has access to the comments of the other two evaluators, allowing them to revise their initial remarks if necessary. All these underscore the challenges and efforts to improve research funding mechanisms in Romania, highlighting the importance of competitiveness, strategic allocation of funds, and international collaboration in enhancing the country's research and innovation ecosystem.

2.2. Analysing the relevant literature

In the current hypercompetitive research arena, the main goal is to increase research contribution in innovation, economic performance, and accomplishing social needs. Over the past decades, growing economic pressure has led to reduced research funding in numerous countries, and the actual situation is further exacerbated these days by crises upon crises: the COVID-19 pandemic and the Russian-Ukrainian geopolitical conflict. Funding competition represents a key asset and is seen as a fight for limited resources (positions, promotions, funding); symbolic capital (recognition, prestige, fame); and social hierarchy positioning [3,4], [p. 98].

Table 3
Factors that led the projects to not obtaining financing in research funding competitions (Model B).

Models	Model 1			Model 2 (Scientific Researcher/ University Lecturer)			Model 3 (Natural Sciences, Exact Sciences and Engineering Sciences)		
Dependent variable	Success rate			Success rate			Success rate		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
Too little time for writing the project	−0.150 (0.130)	0.860	1.334	−0.093 (0.202)	0.911	0.211	**0.446* (0.236)**	0.640	3.580
Lack of experience in project coordination	**−0.299* (0.141)**	1.348	4.513	**−0.398* (0.232)**	1.489	2.934	**−0.435* (0.234)**	1.544	3.455
Large discrepancy between the scores given by the evaluators	−0.093 (0.127)	0.911	0.530	0.014 (0.233)	1.014	0.004	−0.049 (0.198)	0.952	0.062
The improper justification of the impact of the project	**−0.292* (0.154)**	1.339	3.575	**−0.473* (0.256)**	1.605	3.413	0.165 (0.257)	1.179	0.411
CV and previous publications	−0.060 (0.147)	0.942	0.166	0.044 (0.240)	1.045	0.034	0.304 (0.270)	1.355	1.262
Constant	−0.696 (0.530)	0.499	1.727	−2.637 (1.201)	0.072	4.823	−1.317 (0.864)	0.268	2.325
Nagelkerke R^2	0.042			0.095			0.107		
Cox & Snell R^2	0.065			0.127			0.172		
−2 Log likelihood	125.551			129.457			131.552		
No. of observations	243			92			94		
Chi-square	12.012*			11.192*			12.986*		

Sources: processed by the authors in SPSS

Table 4
Factors that led to obtaining financing for a research project in a funding competition, according to the evaluation grid used by the evaluators (Model C).

Models	Model 1			Model 2 (Male)			Model 3 (Senior Researcher/ Professor)		
Dependent variable	Success rate			Success rate			Success rate		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
The quality of the results of the previous research of the project director	−0.122 (0.259)	0.885	0.224	0.301 (0.495)	1.351	0.370	0.672 (1.133)	1.957	0.351
International visibility and impact of project director research results	−0.093 (0.232)	0.911	0.161	−0.551 (0.438)	0.576	1.587	**2.430* (1.337)**	0.088	3.304
Correlation between previous publications and the proposed topic	−0.041 (0.226)	0.960	0.034	**1.183* (0.542)**	0.306	4.759	−0.378 (0.901)	0.685	0.176
The degree of novelty/originality of the proposed theme	−0.113 (0.206)	0.893	0.299	0.207 (0.378)	1.230	0.300	0.745 (1.065)	2.107	0.490
The problem addressed by the project is clearly identified in relation to the state of knowledge in the field	0.048 (0.241)	1.049	0.039	−0.228 (0.452)	0.796	0.254	−1.038 (1.370)	0.354	0.574
Chosen research methodology	0.031 (0.211)	1.031	0.022	0.301 (0.434)	1.352	0.483	−1.365 (1.208)	0.255	1.276
Presentation of a clear work plan, with the division of tasks between project members	−0.388 (0.251)	0.679	2.377	−0.398 (0.481)	0.672	0.684	3.203 (2.209)	4.600	2.102
The impact of the project on the state of knowledge	−0.174 (0.294)	0.841	0.348	−0.474 (0.674)	0.623	0.493	**4.042* (1.771)**	0.018	5.206
Project implications	0.085 (0.273)	1.089	0.097	0.655 (0.559)	1.925	1.374	3.265 (1.987)	26.170	2.700
Constant	2.018 (0.456)	7.522	19.623	3.533 (0.892)	4.238	15.690	4.603 (1.935)	9.788	5.661
Nagelkerke R^2	0.123			0.261			0.410		
Cox & Snell R^2	0.091			0.203			0.335		
−2 Log likelihood	123.361			245.962			352.526		
No. of observations	243			135			40		
Chi-square	23.307*			21.205*			19.954*		

Models	Model 4 (Senior Researcher/ Associate Professor)			Model 5 (Scientific Researcher/ University Lecturer)		
Dependents variable	*Success rate*			*Success rate*		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
The quality of the results of the previous research of the project director	0.321 (0.646)	1.378	0.247	−0.199 (0.427)	0.819	0.218
International visibility and impact of project director research results	−0.249 (0.584)	0.779	0.182	0.375 (0.367)	1.454	1.043
Correlation between previous publications and the proposed topic	**0.958* (0.539)**	0.384	3.162	0.246 (0.413)	1.279	0.354
The degree of novelty/originality of the proposed theme	−0.346 (0.470)	0.707	0.541	0.073 (0.457)	1.076	0.026
The problem addressed by the project is clearly identified in relation to the state of knowledge in the field	0.547 (0.636)	1.727	0.739	**−1.134* (0.493)**	3.107	5.286
Chosen research methodology	0.708 (0.508)	2.030	1.943	**1.078* (0.455)**	0.340	5.603
Presentation of a clear work plan, with the division of tasks between project members	−0.031 (0.559)	0.969	0.003	0.392 (0.353)	1.480	1.233
The impact of the project on the state of knowledge	−0.579 (0.690)	0.560	0.704	−0.550 (0.483)	0.577	1.296
Project implications	−0.387 (0.599)	0.679	0.417	0.450 (0.411)	1.568	1.198
Constant	3.365 (1.067)	8.937	9.948	**2.627* (1.194)**	0.072	4.837
Nagelkerke R^2	0.271			0.224		
Cox & Snell R^2	0.201			0.195		
−2 Log likelihood	235.112			220.962		
No. of observations	72			92		
Chi-square	19.328*			19.834*		

Sources: processed by the authors in SPSS

A substantial body of literature offers tips and tools, covering various disciplines and regions, as well as examines the criteria for writing a winning grant proposal. They point out the need to pay attention to technical compliance with proposal requirements as well as the successful factors that lead to obtaining research funds. Many studies cover the medical and health sciences, concentrating on data from different regions of the world: America, Canada, Australia, and Western European countries [5–7]. In other areas of study, such approaches are sparse: only a few in the social sciences and humanities [8,9], and even fewer in interdisciplinary research [10]. Usually, studies dedicated to criteria in health and medical fields focus on a single discipline and concentrate on tips and tricks for improving the peer review process. On the contrary, studies involving more fields of research or across different fields emphasise understanding the peer review process. Thus, in different health-related studies, researchers advance some key elements of writing project grants or make recommendations to scientists on the most important strategies to maximize the likelihood of success for a

Table 5
Factors that led to the rejection of the research project from funding in a funding competition, according to the evaluation grid used by the evaluators (Model D).

Models	Model 1			Model 2 (Male)			Model 3 (Senior Researcher/ Associate professor)		
Dependent variable	*Success rate*			*Success rate*			*Success rate*		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
Poor quality of the project director's previous research results	−0.314 (0.204)	0.731	2.373	−0.473 (0.400)	0.623	1.394	−0.833 (0.517)	0.435	2.596
Low international visibility and low impact of project director research results	0.258 (0.179)	1.294	2.079	0.496 (0.330)	1.643	2.268	0.320 (0.462)	1.378	0.481
Lack of correlation between previous publications and the proposed topic	**−0.394*** **(0.195)**	1.483	4.067	0.398 (0.360)	1.488	1.161	**−0.813*** **(0.424)**	2.254	3.682
Low degree of novelty/originality of the proposed theme	0.123 (0.192)	1.131	0.411	0.084 (0.451)	1.087	0.035	0.351 (0.391)	1.421	0.807
The problem addressed by the project is not clearly identified in relation to the state of knowledge in the field	0.045 (0.216)	1.046	0.044	−0.119 (0.382)	0.888	0.096	0.594 (0.536)	1.812	1.227
The chosen research methodology is inadequate or insufficiently described	0.018 (0.176)	1.018	0.010	−0.077 (0.470)	0.926	0.027	**−1.255*** **(0.671)**	0.285	3.495
Unclear presentation of a clear work plan and/or lack of division of tasks between project members	0.011 (0.195)	1.011	0.003	0.263 (0.510)	1.301	0.266	0.950 (0.666)	2.586	2.032
The low impact of the project on the state of knowledge	**−0.490*** **(0.257)**	0.613	3.643	−1.015 (0.827)	0.363	1.504	**−1.400*** **(0.751)**	0.247	3.480
Unclear presentation of project implications	0.200 (0.221)	1.222	0.822	**−0.772*** **(0.438)**	2.163	3.099	0.261 (0.702)	1.298	0.138
Constant	−0.477 (0.500)	0.621	0.910	**0.888*** **(0.514)**	0.411	2.983	1.534 (2.144)	4.637	2.028
Nagelkerke R^2	0.043			0.101			0.197		
Cox & Snell R^2	0.062			0.155			0.230		
−2 Log likelihood	154.872			197.676			230.552		
No. of observations	243			135			72		
Chi-square	11.529*			12.027*			12.784*		

Models	Model 4 (Natural Sciences, Exact Sciences and Engineering Sciences)			Model 5 (Humanities)		
Dependents variable	*Success rate*			*Success rate*		
Independent variables	Coefficient B (S.E.)	Exp (B)	Wald	Coefficient B (S.E.)	Exp (B)	Wald
Poor quality of the project director's previous research results	−0.565 (0.409)	0.568	1.907	−0.199 (0.427)	0.819	0.218
Low international visibility and low impact of project director research results	0.507 (0.364)	1.660	1.938	0.375 (0.367)	1.454	1.043
Lack of correlation between previous publications and the proposed topic	**−0.668*** **(0.366)**	1.950	3.331	0.246 (0.413)	1.279	0.354
Low degree of novelty/originality of the proposed theme	0.490 (0.317)	1.632	2.378	0.073 (0.457)	1.076	0.026
The problem addressed by the project is not clearly identified in relation to the state of knowledge in the field	−0.603 (0.369)	0.547	2.667	**−1.134*** **(0.493)**	3.107	5.286
The chosen research methodology is inadequate or insufficiently described	**−0.785*** **(0.349)**	2.191	5.067	**−1.078*** **(0.455)**	0.340	5.603
Unclear presentation of a clear work plan and/or lack of division of tasks between project members	−0.277 (0.380)	0.758	0.530	0.392 (0.353)	1.480	1.233
The low impact of the project on the state of knowledge	−0.578 (0.420)	0.561	1.897	−0.550 (0.483)	0.577	1.296
Unclear presentation of project implications	0.023 (0.365)	1.023	0.004	0.450 (0.411)	1.568	1.198
Constant	−1.199 (0.863)	0.302	1.928	**2.627* (1.194)**	0.072	4.837
Nagelkerke R^2	0.201			0.223		
Cox & Snell R^2	0.211			0.278		
−2 Log likelihood	179.432			187.334		
No. of observations	94			81		
Chi-square	16.180**			18.823*		

Sources: processed by the authors in SPSS

strong research grant application [5,11–14]. For example, Hunter et al. [6] addressed the cornerstone factors of a successful application, namely the significance and innovation of the idea described in the proposal, underlying the fact that these sections in a grant are fundamentally important and represent grant scoring elements that reviewers will carefully and critically read [6], [p. 1080]. However, Hume et al. in a study based on the reviewers' comments, classified common grant application weaknesses into five general categories: project concept, project design, plan for execution, team environment, and other grantsmanship [13], [p. 3–4].

Guetzkow et al. [15], investigating peer-review panellists in grant competitions for the social sciences and humanities fields, took

into consideration only one criterion, namely the originality of a proposal, as an indication of the PI's moral character, especially of PI's authenticity and integrity. They identified differences across disciplines concerning this criterion: humanists often referred to the originality of data and approach, whereas social scientists emphasised the originality of methods. Berning et al. [8] also addressed criteria for evaluating proposals in the humanities and especially literary studies across eight European countries, underlying the importance of 'meta-category' quality in research proposals. In their study, discussing funding for research proposals by young Swiss humanities scholars, Ochsner et al. [9] provided the following significant criteria, specifically their originality, feasibility, rigour, relevance, complexity, and variety.

The complexity of our world nowadays and the solutions to the grand challenges facing society imply an interdisciplinary approach. Due to its specific features, such as the integration of complex theories, different methodologies and concepts, and the implementation of unconventional strategies, interdisciplinary research contributes to answers that go beyond the traditional disciplinary boundaries [16,17]. Although interdisciplinary research has become increasingly central to both academic interest and government science policies [10,18], little work has been done on the evaluation of interdisciplinary research proposals, because of special review procedures for interdisciplinary evaluation [19] and the variability of inter- and transdisciplinary research criteria and indicators [20]. Thus, in a comprehensive approach, McLeish and Strang [21] mentioned the best practices concerning interdisciplinary research grants based on a selection of published reports on the evaluation and wider peer review, and they labelled the criteria set applied in interdisciplinary assessment in terms of: holistic, social, experience, leadership and effectiveness. Khan et al. [22] explored disciplines that play a significant role in interdisciplinary grant success, showing that only a few research fields contributed more in this sense: Engineering, Technology, and Biological science-related disciplines. These disciplines attracted the most funding, and hence the multidisciplinary research was concentrated within these areas rather than arts and humanities-related disciplines. Bammer [23] considered four critical elements on which evaluations of funding proposals are based: the significance of the topic; the importance and tractability of the research question; the appropriateness of the methods; and the competence of the applicants, based on track records. Through these elements, the author stresses the differences between disciplinary and interdisciplinary research in addressing questions and in approaching appropriate methods. Having a holistic approach to the problem under discussion, it is widely acknowledged in the literature that, although all stakeholders support the merit of interdisciplinary research, such proposals face challenges in funding due to lower success rates compared to disciplinary research [24–27].

In a rigorous scientific perspective addressing the topic, Wisdom et al. [28] conducted a qualitative analysis and synthesised the scientific literature published concerning writing successful funding applications. They list some recommendations based on the number of times a certain advice is offered by different authors, from 83 studies chosen from an in depth-review: identifying appropriate funding opportunities; using key proposal components to persuade reviewers of project significance and feasibility; describing the activities plan and their significance persuasively, clearly, and concisely; seeking review and feedback from colleagues/internal board evaluation; developing a study design that is simple, logical, feasible, and appropriate for the research questions; creating a timetable for the proposal process; choosing a novel, high-impact project idea; conducting thorough literature review; ensuring that budgets are reasonable; and considering interdisciplinary collaborations.

There are some important strategies to achieve higher rates of success, including mentoring, internal evaluation, and feedback from colleagues and other stakeholders before submitting a proposal [5,29–31]. There is limited training on how to write a research grant. Therefore, this action is very critical in an era when research funding is becoming increasingly restricted, and obtaining grants is getting immensely competitive [12]. Thus, Johnson et al. discussed an internal peer-review assessment before submitting a proposal to the funding agency and stressed the importance of submitting the highest quality grant applications to maximize potential success [32], [p. 2]. In this line, under the growing pressure of contests, Wiebe and Maticka-Tyndale [7]asserted the need for a grant-writing group in universities before submitting a proposal in a funding competition, while Visovsky [33] provided the necessity of an Internal Review Board (IRB) that help improve the quality of proposals. These strategies are considered to ensure a high success rate.

Summing up, the top key elements of successful proposals are correlated with those of the evaluation criteria: applicant's academic achievements (visibility and impact of the research outputs about the research proposal); research idea implying originality and innovation, suitable methodological approach, and efficient work plan; feasibility in terms of available resources, research team, and preliminary results. Besides these, several other factors are considered relevant from the project applicants' perspective: the amount of

Table 6
Centralised results of empirical analysis.

Plus factors	Minus factors
The quality of the scientific publications of the project director/International visibility and impact of project director research results	Lack of experience in project coordination
The match between the proposed topic and previous publications/Correlation between previous publications and the proposed topic	Lack of correlation between previous publications and the proposed topic
Project team	The improper justification of the impact of the project/Unclear presentation of project implications
The impact of the project on the state of knowledge/The problem addressed by the project is clearly identified in relation to the state of knowledge in the field	The low impact of the project on the state of knowledge/The problem addressed by the project is not clearly identified in relation to the state of knowledge in the field
Chosen research methodology	The chosen research methodology is inadequate or insufficiently described
Inverse effect	
Time allocated for writing the project/Too little time for writing the project	

Sources: processed by the authors in SPSS

time allocated for writing the project proposal (especially when the competition for funding is unpredictable, as in Romania); previous experience in implementing research projects; and the scientific profile of the research team members.

3. Methodology

To achieve the main purpose of the paper, we adopted an empirical investigation that focused on academic staff from Romanian public universities, across all research fields. We created a questionnaire entitled *Applicant Perception and Success in Research* Funding *Competitions*, consisting of 17 items, designed to gather data on factors influencing success rates in research funding competitions. For applying the questionnaire and conducting this study on human subjects, we obtained written consent from the Research Ethics Commission of the Institute of Interdisciplinary Research (approval number: 2/February 2, 2022).

The questionnaire is structured in three sections. The first section of the survey contains several socio-demographic questions to screen out the respondents: age, gender, academic affiliation, work experience, professional degree, and research field. The second section comprises a set of questions that focus on the respondents' experience in project funding competitions. The third section analyses the factors influencing success rates in research funding competitions considering two approaches: the participants' perspective (subjective), and their view upon criteria from the evaluation grid. These questions are designed with five-point Likert scale responses (1- total disagreement; 2- partial disagreement; 3- neutral; 4- partial agreement; 5- total agreement).

The questionnaire was applied online and sent by email, between July and December of 2021. The time to complete the questionnaire was approximately 15 min, and the respondents were informed about data protection.

The pre-testing phase was conducted with a pilot sample of 15 respondents to refine questions. Using a pre-defined selection bias method, we selected several people from the total population of Romanian research staff members. We targeted academic staff across STEM and AH&SS fields, from top universities in Bucharest, Cluj-Napoca, and Iași who had participated in at least one national/international research project funding competition during their careers. The participation in the survey was conditioned by the application of at least one research proposal for funding by respondents. Therefore, the total population who met the previous criteria was 385 academic staff. Thus, the questionnaires were emailed to 385 persons, with reminders sent over five months. A total of 243 answers were received, representing a 63 % response rate. All questions were marked as mandatory, ensuring that all 243 questionnaires for which we received answers were completed.

We used a binary logistic regression model to analyse the responses. This method is used when the dependent variable of a regression model is of the 'yes/no' type. In our case, we considered the success rate in research funding competitions to be the dependent variable. This variable took the value 1 for the respondents who declared they had obtained financing in research funding competitions in the last five years, and the value 0 for those who did not.

The study's empirical section focuses on analysing two main parts: the participants' perceptions and the main factors from the evaluation grids. For quantifying the participants' perceptions, we analysed the answers of the respondents related to how they were evaluated. We included questions about factors that appear in the evaluation grids, stipulated in the information packages for Romanian national competitions to analyse how the evaluators relate to the project evaluation process.

The first part of the empirical analysis considers the factors that influenced the evaluation of the projects submitted in competitions, focusing on the participant's perception. This is the subjective part that only considers the participants' opinions and interpretations regarding the evaluation process. Thus, for the participants' perception, we proposed two different models.

- the first model analyses the factors considered by participants that led to their proposed project to obtain financing in a research funding competition. The equation for Model A is:

$$\text{Success} = \beta 0 + \beta 1 \cdot \text{Factors plus} + m \quad (1)$$

- the second model analyses the factors considered by participants to have disadvantaged their proposed project and led to not obtaining financing in a research funding competition. The equation for Model B is:

$$\text{Success} = \beta 0 + \beta 1 \cdot \text{Factors minus} + m \quad (2)$$

The second part of our empirical investigation analyses the factors that influenced the results of the evaluation of the projects based on the grids used by the evaluators. Participants in project financing competitions are not permitted to serve also as evaluators in the same competition. They receive scores and recommendations that are based on the evaluation grid. Therefore, the answers to this section were formulated based on the evaluations received by the participants. Hence, from the perspective of the evaluation grid, we proposed two other models.

- Model C analyses the factors that led to obtaining financing for a research project in a funding competition, based on the evaluation grid. The equation for Model 3 is:

$$\text{Success rate} = \beta 0 + \beta 1 \cdot \text{ Factors grid plus} + m \quad (3)$$

- Model D analyses the factors that led to the rejection of the research project from funding in a funding competition, based on the evaluation grid. The equation for Model 4 is:

$$\text{Success rate} = \beta 0 + \beta 1 \cdot \text{Factors grid minus} + m \quad (4)$$

Where βi represents the coefficients and m is the error term. *Factors plus* represents a series of factors that led the projects to obtain financing as described from the participant's perception. *Factors grid plus* takes into account the main items from the evaluation grid. *Factors minus* represent the factors that led the projects not to obtain financing, as described by the participant. While, *factors grid minus* refers to the factors that led to the rejection of the research project, defined as items from the evaluation grid. We created specific questions to assess each category of factors. A question was assigned to each category, and the factors were presented in the answers. The respondents had to evaluate each factor using a 5-point Likert scale (1- total disagreement; 2- partial disagreement; 3- neutral; 4- partial agreement; 5- total agreement).

For statistical data processing, we used the Statistical Package for the Social Sciences (IBM SPSS Statistics, version 22.0).

4. Results and discussions

The questionnaires were sent by email to the heads of the departments who distributed them further to the academic staff. Therefore, we only have an estimated number of the total targeted population, and we do not have access to information regarding the structure of the population by key variables. The structure of our sample is detailed in Table 1 below. Thus, the sample structure indicates a greater proportion of male respondents and a diverse distribution across fundamental research fields. Researchers in Natural Sciences, Exact Sciences, and Engineering Sciences have a slightly higher share, while those in Social and Economic Sciences have the lowest.

The sample structure according to the professional degree shows that most respondents are mid-career researchers, with researchers in higher positions being more inclined to participate in the study, possibly due to their frequent involvement in project submissions. Participation in research project competitions typically necessitates the fulfilment of minimum eligibility conditions, more easily met by those with more research experience.

The main results of our study point out that 71 % of those who applied for a grant in the last five years were successful in research project funding competitions. As a result, we intended to identify the factors that ensured this success rate, and underline the factors that could stimulate, in the future, an increase of the percentage of those who manage to obtain financing.

The first part of the study analyses the factors that influenced the evaluation of the projects submitted in the competitions as perceived by participants. In Table 2 we summarise the results obtained for Model A. Thus, as independent variables for this model, we considered five factors that could help projects get higher scores and increase their chances of obtaining funding. These factors were considered because they are related to the evaluation's key elements, stipulated in the information packages, along with the time allocated for the completion and submission of the project proposal. The importance of five considered factors on the success rate was evaluated by the respondent on a Likert scale ranging from 1-to-5 total agreement.

We have synthesised in the tables only the results for the statistically significant models. First, we ran the model on the entire sample, and the results show that an increased quality of the project director's scientific publications, but also a match between the proposed topic and its previous publications, increase the success rate in research project funding competitions.

To further examine whether the hypothesised associations differ by gender, we divided the sample into male and female groups for regression testing. The results reveal that the associations are significant for males, confirming our expectations, with increased quality of scientific publications and topic-match correlating with success.

We found statistically significant models only for three of five ranks when we analysed the factors that encourage the earning of funding for projects by professional degrees. Thus, the match between the proposed topic and previous publications is the main factor and the only statistically significant factor that stimulates the success rate for Senior Researcher/Professor. For Senior Researchers/Associate professors, besides the match between the proposed topic and previous publications, the project team also proved significant, and the time allocated for writing the project but inversely associated. Therefore, allowing more time for writing the project does not guarantee a higher success rate for these respondents. It is more important if the previous research output relates to the proposed topic, and if the well-established team ensures the successful implementation of the project.

For Scientific Researchers/University lecturers, the factor that stimulates the project's success rate is the PI quality of the scientific publications, namely the applicant's international academic visibility.

When we analysed the econometric model based on the respondent's main field of research, we obtained a statistically significant model only for respondents in Natural Sciences, Exact Sciences and Engineering Sciences. Thus, the project team is the only factor among those mentioned, that is statistically significant, and increases the success rate of projects in competitions.

Changing the direction of analysis, we focused on the factors that disadvantaged the research projects that were downgraded and determined the research projects submitted in the competitions not to receive funding. The results obtained for Model B are centralised in Table 3. The respondents evaluated the five factors on a Likert scale from 1- total disagreement to 5- total agreement, regarding their importance on the success rate. Similar to the previous situation, we presented in the table only the results for the statistically significant models.

Thus, the results for the model run for the entire sample revealed that the main factors reducing the success rate of projects are the PI's lack of experience in project coordination and the improper justification of the project's impact.

When we ran the models by demographic categories, we obtained significant models only for Scientific Researchers/University lecturers respondents whose main fields of research are Natural Sciences, Exact Sciences, and Engineering Sciences. Thus, the respondents who are Scientific Researchers/University lecturers mentioned that the lack of experience in project coordination and the improper justification of the project's impact are factors that affected their success rates. Similar, researchers in Natural Sciences, Exact Sciences, and Engineering Sciences mentioned that the PI's lack of experience is a factor that reduces the success rate. Furthermore, the

fact that they had limited time to write the project had an unexpected effect and did not reduce the success rate.

The second part of the study analyses the factors that influenced the evaluation of the projects based on the evaluation grids. The results for Model C are summarised in Table 4. As independent variables for this model, we considered nine factors that might determine the project's scores and chances of obtaining funding. These factors were evaluated by the respondent on the Likert scale and were taken from the evaluation grids. When we ran the model on the entire sample, none of the factors considered had a statistically significant effect on the success rate. According to the model, for male respondents, the correlation between previous publications and the proposed topic determined the success rate of the projects proposed.

The models display differences between participants with different professional degrees. Thus, the international visibility and impact of project director research results, as well as the impact of the project on the state of knowledge, are factors that stimulate the success rate for Senior Researchers/Professors. For Senior Researchers/Associate professors, the correlation between previous publications and the proposed topic is a major factor influencing the project's success. The clearly defined problem addressed by the project to the state of knowledge in the field and the chosen research methodology are the factors that stimulate the project's success rate for Scientific Researchers/University Lecturers.

When directing the analysis to investigate the factors that led to the rejection of the research project from funding, based on the evaluation grid used by the evaluators (see Model D from Table 5), we observe that the success rates are affected by the lack of correlation between previous publications and the proposed topic, and also by the project's low impact on the state of knowledge. Analysing these factors by category reveals that the success rate of male respondents is affected only by the unclear presentation of the project implications.

Respondents who are Senior Researchers/Associate Professors stated that a lack of correlation between previous publications and the proposed topic, the chosen research methodology being inadequate or insufficiently described, and the project's low impact on the state of knowledge hampered their success rate.

When analysing the factors according to the respondents' main field of research, we obtained differences between domains. Thus, researchers in Natural Sciences, Exact Sciences, and Engineering Sciences reported that the lack of correlation between previous publications and the proposed topic, as well as the chosen research methodology, hampered their success rates. Humanities researchers, on the other hand, claimed that factors that have negatively affected their success rate include the fact that the problem addressed by the project is not identified in relation to the state of knowledge in the field, in addition to the chosen research methodology being inadequate or insufficiently described.

4.1. Discussions: strengths and limitations of the study

We formulate a series of conclusions after centralising the results obtained in this study. Thus, the proposed solution for ensuring a project's funding success consists primarily of providing an increased quality of the PI publications' international visibility. Furthermore, the proposed project theme must be correlated with previous publications, and identify its relationship with the state of knowledge in the field, as well as the project's impact. Likewise, noteworthy are the project team and the chosen research methodology (see Table 6). In addition to these, previous experience in project coordination would have been a significant factor. Our results are consistent with the similar findings published in the literature [5,23,29–31].

Although time shows an inverse correlation with success rate, it still appears to be a statistically significant factor. Thus, an increased amount of time for the participant to write the project does not ensure a higher success rate. But, as Wisdom et al. [28] have shown, establishing a timeline would increase the project's chances of success.

A limit of our empirical investigation comes from the low availability of the academics' members to answer the questionnaire, sometimes because their schedules are very busy. Over time, we had to send several emails to remind them about our request to complete the questionnaire, and for this reason the process of collecting data spread over five months.

4.2. Discussions: implications of findings

The implications of our findings come from the fact that we obtained essential differences between the factors that influence the success rate depending on the professional degree, the main field of research, and gender. Experience in research and the field of research also changes the way researchers address participation in competitions.

Moreover, our study is analysing data only for one country, from the Central and Eastern European region. But, considering the common elements in the history of the countries from this region, and the fact that they were centrally planned economies for a long time, the effects were also felt at the level of research evolution. Research activity, research funding, and the organisation of competitions for the funding of research projects were influenced to a similar extent by the economic specifics, and currently have similar features in these countries. Researchers and policymakers in CEE countries can draw insights from our study to inform strategies for enhancing research competitiveness and securing funding.

5. Conclusions

Our research highlights the factors that ensure success in research funding competitions, both from the applicant's perception and the evaluation grid. Successful grant writers must address real-world complex problems and challenges while making a significant contribution to their field, building on previous work, strengthening stakeholders' collaboration, and responding to a recognised societal need in their proposal, all while taking into consideration the evaluation methodology. The main purpose of our study was to

identify the factors that could ensure the success of projects submitted in research funding competitions and to provide a solution for success. To test these, we created a questionnaire that was distributed to academic staff at Romanian universities. The results obtained in this study provide valuable information for academic staff who want to submit a project to research competitions and obtain funding. The empirical results highlight the most important elements that they must focus on depending on gender, research field, or research/didactic rank. Our findings list some strengths.

- the researcher's previous performance influences the proposal's future performance/success;
- the improved quality of the project director's publications and international visibility are the main drivers of future project application success;
- previous project coordination experience is also seen as a plus;
- the proposed project theme must continue the researcher's previous concerns and be related to previous publications;
- the project idea must be well anchored in the field's current state of knowledge and make a significant contribution to it, emphasising the project's impact;
- the project team must be well-coordinated, with team members sharing common concerns about the proposed research topic;
- the research methodology also impacts the success rate: the concepts, models and assumptions that underpin the project. Important methodological challenges should be identified, including the proposed solutions to tackle these challenges.

Our study complements the literature by providing a solution to ensure the success of projects submitted in research funding competitions. The results obtained in our study can be used as a starting point for researchers who want to participate in such competitions, considering the factors that need to be taken into account to increase the chances of success. The added value of the study comes from the fact that we considered a sample of researchers from all research fields. Previous studies [6,8,9,11,13,28,34] have focused only on specific research fields, but our study provides an overview of them, and emphasises the guidelines for success, regardless of the field of research.

As expected, in the empirical analysis, we obtained differences when we took into account variables such as gender, academic rank, and research field. This study contributes to shaping a more complex image of the research grant evaluation process and a deeper understanding of the key impact factors influencing success rate. Our result may also contribute to improving the evaluation and decision-making process for research funding by considering a proposal's holistic approach which includes: written applications, enacted performance, and researchers' group dynamics. Our study also has some limitations that will pave the way for future lines of research. The shortcomings of our study come mainly from the low availability of Romanian academic staff to answer the questionnaire as well as the fact that many of them have not participated in a research project funding competition in the previous five years. Our findings could be used as support for a longitudinal study: by measuring the success rates over time and using the same sample, we could gather useful information about the factors influencing competitiveness in research grant competitions. The results are relevant for the optimization of similar processes, such as publication, recruitment, and selection. A further approach will be to broaden the analysis through collaborations with Universities and Research Institutes in other countries, particularly in the Central and Eastern European (CEE) region, to determine whether the key factors for success in research funding competitions are country-dependent.

Ethic statement

We have obtained written consent from the Research Ethics Commission of the Institute of Interdisciplinary Research, approval number: 2/February 2, 2022.

Data availability statement

The data that has been used is confidential. The answers received allow the identification of the respondents and cannot be provided because it would mean violating the GDPR rules according to Regulation (EU) 2016/679 and Directive (EU) 2016/680. A commitment to confidentiality was ensured for all participants in the survey, being stipulated at the beginning of the questionnaire as follows: 'The answers you provide are completely anonymous and confidential, will not be given to other third parties, and will be statistically processed exclusively for this study.'

Data will be made available on request.

CRediT authorship contribution statement

Mihaela Mocanu: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Valentina Diana Rusu:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Anca-Diana Bibiri:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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References

[1] M. Doussineau, E. Marinelli, M. Chioncel, K. Aegeman, G. Carat, M. Boden, ERA Communication Synthesis Report, Publications Office of the European Union, Luxembourg, 2013.
[2] OECD, Effective Operation of Competitive Research Funding Systems, *OECD Science, Technology And Industry Policy Papers*, vol. 57, OECD Publishing, Paris, 2018, https://doi.org/10.1787/2ae8c0dc-en.
[3] C. Ayoubi, M. Pezzoni, F. Visentin, The important thing is not to win, it is to take part: what if scientists benefit from participating in research grant competitions? Res. Pol. 48 (1) (2019) 84–97, https://doi.org/10.1016/j.respol.2018.07.021.
[4] S. Mavin, M. Yusupova, Competition and gender: time's up on essentialist knowledge production, Manag. Learn. 52 (1) (2021) 86–108, https://doi.org/10.1177/1350507620950176.
[5] R.A. Guyer, M.L. Schwarze, A. Gosain, M. Maggard-Gibbons, S.G. Keswani, A.M. Goldstein, Top ten strategies to enhance grant-writing success, Surgery 170 (6) (2021) 1727–1731, https://doi.org/10.1016/j.surg.2021.06.039.
[6] C.J. Hunter, A.M. Goldstein, J. Lockem, S. Cho Clifford, A. Gosain, Significance and innovation: cornerstones of a successful grant application, Surgery 170 (4) (2021) 1080–1082, https://doi.org/10.1016/j.surg.2021.03.011.
[7] N. Wiebe, E. Maticka-Tyndale, More and better grant proposals? The evaluation of a grant-writing group at a mid-sized Canadian university, J. Res. Adm. 48 (2) (2017) 67–92. https://scholar.uwindsor.ca/educationpub/57.
[8] N. Berning, A. Nünning, C. Schwanecke, National criteria, norms and standards in literary studies, Germanisch-Romanische Monatsschrift 65 (1) (2015) 115–135 (Trans-.
[9] M. Ochsner, S.E. Hug, H.D. Daniel, Assessment Criteria for Early Career Researcher's Proposals in the Humanities, *ISSI 2017*, 2017, pp. 105–111.
[10] K. Okamura, Interdisciplinarity revisited: evidence for research impact and dynamism, Palgrave Communication 5 (141) (2019), https://doi.org/10.1057/s41599-019-0352-4.
[11] E.K. Proctor, B.J. Powell, A.A. Baumann, A.M. Hamilton, R.L. Santes, Writing implementation research grant proposals: ten key ingredients, Implement. Sci. 7 (96) (2012), https://doi.org/10.1186/1748-5908-7-96.
[12] G.H. Koppelman, J.W. Holloway, Successful grant writing, Paediatr. Respir. Rev. 13 (1) (2012) 63–66, https://doi.org/10.1016/j.prrv.2011.02.001.
[13] K.M. Hume, A.M. Giladi, K.C. Chung, Factors impacting successfully competing for research funding: an analysis of applications submitted to the plastic surgery foundation, Plast. Reconstr. Surg. 134 (4S-1) (2015) 429e–435e, https://doi.org/10.1097/01.prs.0000455401.44917.98.
[14] S.E. Hug, M. Aeschbach, Criteria for assessing grant applications: a systematic review, Palgrave Communication 6 (37) (2020), https://doi.org/10.1057/s41599-020-0412-9.
[15] J. Guetzkow, M. Lamont, G. Mallard, What is originality in the humanities and the social sciences? Am. Socio. Rev. 69 (2) (2004) 190–212, https://doi.org/10.1177/000312240406900203.
[16] Y. Huang, Y. Zhang, J. Youtie, A.L. Porter, X. Wang, How does national scientific funding support emerging interdisciplinary research: a comparison study of big data research in the US and China, PLoS One 11 (5) (2016) e0154509, https://doi.org/10.1371/journal.pone.0154509.
[17] W.B. De Bruin, M.G. Morgan, Reflections on an interdisciplinary collaboration to inform public understanding of climate change, mitigation, and impacts, Proc. Natl. Acad. Sci. USA 116 (16) (2019) 7676–7683, https://doi.org/10.1073/pnas.1803726115.
[18] C. Franzoni, C. Rossi-Lamastra, Academic tenure, risk-taking and the diversification of scientific research, Ind. Innovat. 24 (2017) 691–712, https://doi.org/10.1080/13662716.2016.1264067.
[19] C. Lyall, E. King, International Good Practice in the Peer Review of Interdisciplinary Research, Report to the RCUK Research Group, 2013. www.tinyurl.com/idwiki.
[20] J.T. Klein, Evaluation of interdisciplinary and transdisciplinary research – a literature review, American Journal of Preventative Medicine 35 (2) (2008) S116–S123, https://doi.org/10.1016/j.amepre.2008.05.010.
[21] T. McLeish, V. Strang, Evaluating interdisciplinary research: the elephant in the peer-reviewers' room, Palgrave Communication 2 (2016) 16055, https://doi.org/10.1057/palcomms.2016.55.
[22] A. Khan, N. Choudhury, S. Uddin, Few research fields play a major role in interdisciplinary grant success, Scientometrics 119 (2019) 237–246, https://doi.org/10.1007/s11192-019-03043-w.
[23] G. Bammer, What constitutes appropriate peer review for interdisciplinary research, Palgrave Communications 2 (16017) (2016), https://doi.org/10.1057/palcomms.2016.17.
[24] L. Bromham, R. Dinnage, X. Hua, Interdisciplinary research has consistently lower funding success, Nature 534 (2016) 684–687, https://doi.org/10.1038/nature18315.
[25] K.J. Boudreau, E.C. Guinan, K.R. Lakhani, C. Riedl, Looking across and looking beyond the knowledge frontier: intellectual distance, novelty, and resource allocation in science, Manag. Sci. 62 (10) (2016) 2765–2783, https://doi.org/10.1287/mnsc.2015.2285.
[26] Y. Sun, G. Livan, A. Ma, V. Latora, Interdisciplinary researchers attain better long-term funding performance, Commun. Phys. 4 (263) (2021), https://doi.org/10.1038/s42005-021-00769-z.
[27] M. Seeber, J. Vlegels, M. Cattaneo, Conditions that do or do not disadvantage interdisciplinary research proposals in project evaluation, Journal of the Association for Information Science and Technology (2022), https://doi.org/10.1002/asi.24617.

[28] J.P. Wisdom, H. Riley, N. Myers, Recommendations for writing successful grant proposals: an information synthesis, Acad. Med.: Journal of the Association of American Medical Colleges 90 (12) (2015) 1720–1725, https://doi.org/10.1097/ACM.0000000000000811.
[29] I. Okeigwe, C. Wang, J.A. Politch, L. Heffner, W. Kuohung, Physician-scientists in obstetrics and gynecology: predictors of success in obtaining independent research funding, Am. J. Obstet. Gynecol. 217 (1) (2017) 84.e1–84.e8, https://doi.org/10.1016/j.ajog.2017.03.007.
[30] L.O. Lin, J.C. Barker, I. Khansa, J.E. Janis, A primer for success as an early career academic plastic surgeon, Plastic and Reconstructive Surgery – Global Open 10 (1:e4066) (2022), https://doi.org/10.1097/GOX.0000000000004066.
[31] P. Van Den Besselaar, C. Mom, The effect of writing style on success in grant applications, Journal of Informetrics 16 (1) (2022) 1–12, https://doi.org/10.1016/j.joi.2022.101257 [101257].
[32] M.O. Johnson, T.B. Neilands, S.M. Kegeles, S. Gaffney, M.A. Lightfoot, The architecture of an internal, scientific, presubmission review Program designed to increase the impact and success of grant proposals and manuscripts, Acad. Med.: Journal of the Association of American Medical Colleges 95 (2) (2020) 200–206, https://doi.org/10.1097/ACM.0000000000003008.
[33] C. Visovsky, Writing a successful grant: tips and tools, Journal of the Advanced Practitioner in Oncology 6 (3) (2015) 279–280, https://doi.org/10.6004/jadpro.2015.6.3.10.
[34] Jong De, P.L. Stefan, R. Muhonen, Who benefits from *ex-ante* societal impact evaluation in the European funding arena? A cross-country comparison of societal impact capacity in the social sciences and humanities, Res. Eval. 29 (1) (2020) 22–33, https://doi.org/10.1093/reseval/rvy036.