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Does scientists' prosocial fire fuel research collaborations with external partners? The role of research motivations and networking skills

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ABSTRACT

Recent studies suggest that prosocial motivation increases research interactions between scientists and actors outside a university context. However, these studies have often drawn on conflicting conceptualizations and measurements of prosocial motivation. To provide a systematic analysis of the relationship between prosocial motivation and interaction with external partners, we address two critical aspects. First, we assess the contrasting influence of prosocial, intrinsic, and extrinsic motivations for conducting research on the intensity of joint research with external partners. Second, we investigate the moderating role of networking skills and external partner types, as boundary conditions. We employ data derived from a survey of scientists from Spanish universities and public research organizations. We find that scientists with a strong prosocial research motivation engage more intensively in joint research with external partners compared to intrinsically or extrinsically motivated scientists. We also show that this relationship is enhanced if the scientists have well developed networking skills.

KEYWORDS

Prosocial motivation; joint research; science-society interactions; networking skills; self-determination theory

JEL CLASSIFICATION

O31; O32; I23

1. Introduction

The motivational antecedents driving scientists' research collaborations with external partners – i.e. actors outside the university/public research organisation (PRO)[1] context – continue to be a subject of ongoing debate in the science-society interactions literature (Balven et al. 2018; Perkmann et al. 2021). Given the relative flexibility related to scientific work and scientists' significant autonomy in allocating their working time and research priorities (Tartari, Perkmann, and Salter 2014; van de Burgwal, Hendrikse, and Claassen 2019), individual preferences are crucial for shaping a scientist's commitment and effort to engage in research-related interactions with societal actors. Prior research exploring the motivational factors influencing research interactions between scientists and society often considers that these interactions are based on pecuniary (e.g. financial benefits, access to research funding) or non-pecuniary (e.g. access to research ideas, opportunities for research applicability) reasons.

However, there is a recent stream of research which suggests that an important driver of scientists' engagement with external partners is the explicit desire to benefit or to contribute to the well-being of others. Increasingly, these so-called other-focused (Omoto, Snyder, and Hackett 2010), prosocial (Grant and Berry 2011), or public service (Ritz et al. 2020) motivations are being considered potential antecedents to university/PRO scientists' engagement with third parties. Several papers examine university/PRO scientists' prosocial motivation to engage with external partners. For instance, Atta-Owusu and Fitjar (2022), Iorio, Labory, and Rentocchini (2017) and Orazbayeva and Plewa (2022) among others, discuss different types of 'motivations-to-engage' in collaborations with societal actors and find a positive association between indicators of the desire to promote the well-being of others and scientists' societal engagement.

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[1]Throughout this article, we employ interchangeably the terms 'external partners' and 'societal actors' to refer to organisations outside the public research system – that is, outside universities and PROs. This includes firms, government agencies, civil society organisations or other societal partners with which scientists engage in research-related collaboration.

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Despite this growing strand of research on the relevance of prosocial motivations for scientists' engagement with societal actors, there are several conceptual and empirical dissonances that undermine its contribution. First, there is a lack of clarity and consistency in the conceptualisation and measurement of prosocial reasons for science-society interactions (Ritz et al. 2020). For instance, some studies treat a prosocial motivation as a specific type of moral rationale (van de Burgwal, Hendrikse, and Claassen 2019), others consider prosocial motivation as a blend of intrinsic and extrinsic drivers (Iorio, Labory, and Rentocchini 2017). This conceptual ambiguity complicates efforts to isolate the unique influence of a prosocial motivation for collaborating with societal actors. Social psychology scholars underscore that prosocial motivations are distinct from intrinsic and extrinsic drivers, and differ in terms of aspects such as self-regulation, goal directedness, and temporal focus (Grant 2008; Ryan and Deci 2020). It is crucial to establish a precise conceptualisation and measures to avoid the blurring or conflation of the influence of prosocial motivation on engagement with external partners with other types of motivations.

Second, most prior studies adopt a situational approach to scientists' prosocial motivations and focus on motivations to task-specific behaviours. Much of the work on scientists' motivations investigate the antecedents to a particular type of behaviour: for instance, Iorio, Labory, and Rentocchini (2017, 502) examine the motivations for 'engagement with the non-academic environment', Atta-Owusu and Fitjar (2022, 5), discuss the 'motivations for engagement with external partners', and Orazbayeva and Plewa (2022, 6) analyse the 'motivations for cooperating with businesses'. While these studies provide valuable insights, the motivations examined are confined to particular behavioural situations (Grant and Berg 2011). Their focus overlooks the broader rationales that are deeply rooted in the scientist's professional role of researcher and which are not specific of a particular behaviour or activity.

In our study we address these limitations by adopting a contextual perspective on prosocial motivation and focusing on the motivations linked to a particular occupation or job (Grant and Berg 2011), in our case, the role of a research professional (Lam 2010; Roach and Sauermann 2010). This approach allows us to explore how the scientist's desire to contribute to society through his/her research shapes the individual's engagement with societal actors. We make two significant contributions. First, drawing on social psychology (Grant 2008; Grant and Berry 2011) and self-determination theory (SDT) (Ryan and Deci 2000, 2020), we propose a consistent framework for examining scientists' research motivations and the relative influence of intrinsic, extrinsic, and prosocial drivers of research on collaborations with external partners. While previous studies compare different types of motivations (Atta-Owusu and Fitjar 2022; Cohen, Sauermann, and Stephan 2020; Iorio, Labory, and Rentocchini 2017; Sormani and Uude 2022) they often lack a consistent theoretical grounding and do not provide comparable constructs. This leaves the relative influence of intrinsic, extrinsic, and prosocial motivations on research interactions with societal actors underexamined. Our study provides a conceptual and analytical framework to consistently compare the influence of scientists' intrinsic, extrinsic and prosocial motivations on research interactions with societal actors

Second, we investigate the boundary conditions that moderate the relationship between scientists' prosocial motivation and joint research with societal actors, which are largely unexplored in current studies. Specifically, we focus on two critical boundary conditions. We examine scientists' networking capabilities (Ferris et al. 2007) and suggest that the relationship between prosocial research motivation and engagement with external actors is moderated by the scientist's networking skills – the ability to recognise and respond to the demands of external partners. We also examine the types of societal actors involved in joint research collaboration (D'Este and Fontana 2007; Ramos-Vielba, Sánchez-Barrioluengo, and Woolley 2016; van de Burgwal, Hendrikse, and Claassen 2019) and propose that scientists with prosocial motives might be selective in choosing the different types of external partners to engage with and may prioritise collaboration with civil society organisations (CSOs).

This study addresses these two issues by analysing the responses to a large-scale survey of more than 10,000 Spanish researchers with different institutional affiliations and from multiple disciplines. When designing the survey, we focused on obtaining robust measures of intrinsic, extrinsic, and prosocial motivations for research, and on collecting information on interactions with different types of external partners. Science-society interactions include a range of mechanisms such as consulting, licencing, contract research, and joint research. However, the present study focuses on joint or collaborative research since this represents a particularly significant type of interaction involving scientists and external players in active

cooperative research activities, sharing of intellectual resources, and commitment to the co-creation of knowledge (D'Este and Patel 2007; D'Este et al. 2019; Perkmann et al. 2013). This focus allows us to examine motivational drivers of science-society interactions in the form of collaborative research activities rather than transactional or arms' length exchanges.

2. Theoretical background

2.1. Motivation types: a hierarchical model

Motivation can be conceptualised at different levels of generality, each of which has distinct implications for behaviour. Vallerand (1997) proposes a three-level hierarchy of motivations: global (or personality) (Deci and Ryan 2013), contextual (e.g. work-related) (Guay and Vallerand 1996), and situational (e.g. specific activity or task) (Guay, Vallerand, and Blanchard 2000).

At the global level of generality, motivation refers to the overarching, long-term goals and values that the individual strives to achieve. These tend to be stable personal traits, such as a general tendency towards risk-taking or tolerance of uncertainty. In the context of science, these traits are likely to permeate all aspects of the scientist's life, including the approach to research. At the contextual level of generality, Vallerand (1997) discusses contextual motivations, which are domain-specific and relate to spheres of life such as work, education, and leisure (Lavigne and Vallerand 2010). For instance, the scientist might consistently select research topics with clear potential for societal impact, reflecting inherent prosocial motivation associated with his or her professional role as a researcher. The third category of situational motivation is the most specific and refers to particular behavioural situations (Grant and Berg 2011). This type of motivation is highly dependent on the particular circumstances, is activity-oriented, and does not reflect an enduring orientation or permanent values. Thus, situational motivations are not necessarily mirrored at the contextual or global levels (Hardy and Carlo 2005). For instance, a scientist might be intrinsically motivated to conduct research (contextual level) but extrinsically motivated to engage in specific research-related administrative tasks (situational level).

Much of the research into scientists' motivations to engage with external partners or contribute to commercialisation activities either adopts a situational approach or conflates the contextual and situational perspectives. For instance, studies that explore scientists' motives for interacting with business mostly adopt a situational approach, focusing on motivations for a very specific activity. Similarly, when a scientist's desire to achieve societal impact is examined in relation to engagement in a particular interaction with external partners, this reflects a situational perspective of prosocial motivation. As mentioned above, situational motivation may explain proclivity for certain activities or tasks, but it is highly context-specific.

In our examination of researchers' motivations, we adopt a contextual perspective focusing on the underlying rationales for conducting research activities in the context of scientists' professional roles. This allows us to capture more enduring motivational orientations and their possible correlation with a range of professional activities. In our framework, contextual prosocial motivation is a continuing and passionate desire to benefit society through scientific work. This lasting motivation might permeate several aspects of the scientist's professional life such as the choice of research topic, research partners and the means of disseminating research findings. Thus, a contextual motivation approach is appropriate for examining domain-specific behaviours (including collaborative research) and is better able to balance specificity with generalisability compared to a global or a situational approach (Vallerand, 1997). Since the contextual setting of the present study refers to the scientist's professional role, we term these broader, persistent motivational orientations as 'research motivations'.

2.2. Diversity of scientists' research motivations

There is a large body of research showing that scientists exhibit considerable heterogeneity in terms of their personal interests and motivations for scientific work. Roach and Sauermann (2010) suggest significant individual-level variability in what they term the 'taste for science'. For instance, some scientists may be interested mainly in advancing understanding of natural phenomena while others might be driven by solving concrete problems and creating artefacts with direct societal impact (Cohen, Sauermann, and

Stephan 2020). This variability is manifested also in the research topics that appeal to the individual scientists (Altenmüller, Lange, and Gollwitzer 2021), and which eventually shape the nature and focus of their scientific output.

Most work on the diversity of motivations is related directly or indirectly to self-determination theory (SDT) (Gagné and Deci 2005; Ryan and Deci 2000, 2020). SDT predicts that motivation lies on a (self-determination) continuum, ranging from amotivation – i.e. no volitional drive to engage in any activity – to intrinsic motivation – i.e. inherent interest and enjoyment drives the individual's engagement in the activity (Ryan and Deci 2000, 2020). In the context of scientific research, intrinsic motivation is manifested in the satisfaction derived from the research process itself; the creative and intellectual challenge of solving a complex problem is its own reward (Lam 2011).

Extrinsic motivation is positioned on the spectrum between amotivation and intrinsic motivation. Extrinsic motivation refers to the motivation to engage in an activity in order to achieve a distinct outcome and involves varying levels of autonomous regulation (Ryan and Deci 2000). At its extreme extrinsic motivation includes behaviours driven by externally imposed rewards – e.g. institutional incentives for professional career progression. However, the extrinsic motivation category includes a range of different motivated behaviours including fully externally controlled actions to actions that involve a significant level of autonomous regulation. Extrinsic motivation can involve behaviours regulated by internal rewards, such as enhanced self-esteem or a sense of accomplishment. This internalisation allows for a degree of autonomy in decision-making which implies that in some forms extrinsic and intrinsic motivation are similar in terms of autonomous regulation. However, the key distinction lies in the source of motivation: extrinsically motivated individuals perceive their actions as worthwhile based on external rewards or consequences, whereas intrinsically motivated individuals engage in activities purely for the inherent satisfaction they derive from the task. In the case of scientists, extrinsic motivation is often manifested in pursuit of career advancement or reputational gain, and involves both external and internal regulatory processes (Ryan and Deci 2020): seeking approval from self and others through peer recognition or promotion (Lam 2011).

2.3. Prosocial motivation as distinct from intrinsic and extrinsic motivations

Seminal studies consider prosocial motivation as a distinct motivational form and define it as the desire to benefit others through one's work (Grant 2007, 2008). Similar to intrinsic motivation, prosocial motivation relies largely on self-motivation rather than external regulation. Nevertheless, the underlying reasons for expending effort are different in each case (Grant 2008). While intrinsically motivated individuals feel naturally drawn to a task based on an inherent interest in the task itself, prosocially motivated individuals exert effort based on conscious self-regulation and an end goal of benefiting others (Grant 2008). This is a crucial distinction: intrinsic motivation is process-focused and the action is an end in itself, while prosocial motivation is outcome-focused and the task is a means to an end – the greater goal of helping others (Grant and Berg 2011; Grant and Berry 2011).

Drawing on applied psychology research, prosocial motivation encourages the individual to go beyond the job's formal requirements (McNeely and Meglino 1994). Individuals driven by the desire to help others tend to exhibit greater commitment and dedication to their work (Grant and Sumanth 2009; Thompson and Bunderson 2003). Moreover, prosocial motivations foster feelings of task significance and social worth (Grant 2007).

Prosocial motives are a defining feature of certain professions. Healthcare workers such as doctors and nurses, often prioritise the well-being of individuals and communities. Similarly, prosocial motives are a defining element of the professional identities of firefighters and public service workers (Patil and Lebel 2019; Sonnentag and Grant 2012). And public service motivation, the desire to help others and safeguard the public interest, is a key driver of job performance (Bellé 2013; Ritz, Brewer, and Neumann 2016). For the professional scientist prosocial motivations can be a significant influence in all scientific disciplines. For example, geneticists working on bioinformatics may not interact directly with patients, but if they perceive that new diagnostics or treatments could improve healthcare quality and wellbeing, their research activities might be driven by prosocial motivation. In other areas such as sustainable energy transition, prosocial motivation is particularly prominent with researchers adopting both scientific and advocacy roles and working actively to promote societal change (Wittmayer and Schäpke 2014).This research shows that

prosocially motivated individuals, who often go beyond the job's formal requirements, display more creativity (Grant and Berry 2011), extra-role activities (De Dreu and Nauta 2009), and improved work performance (Grant, 2008; Puffer, 1987).

3. Hypotheses development

3.1. Prosocial research motivation and joint research with external partners

From a policymaker and university management perspective, the involvement of scientists in interactions with societal actors is at the core of the university and PRO third mission (Laredo, 2007; Molas-Gallart et al., 2002). However, there is empirical evidence showing considerable variation in the extent and intensity to which scientists engage with external partners. As already argued, this heterogeneity depends mostly on scientists' differences in the taste for science (Roach and Sauermann 2010) and role identity (Jain, George, and Maltarich 2009). From the perspective of scientists' research motivations, the psychological processes underlying research motivations may encourage or discourage interactions with societal actors.

There are several reasons why scientists' prosocial research motivations may be positively associated with their engagement in research collaborations with societal actors. First, scientists driven by the desire to benefit others through their research are likely to go beyond traditional academic roles, actively seeking engagement with societal actors rather than focused mainly on scientific knowledge production and peer communication. Joint research with external partners offers greater potential for direct societal impact than research confined to the academic community, which makes this type of research collaboration particularly attractive for prosocially motivated scientists (Bolino and Grant 2016). For instance, Van der Weijden, Verbree, and Van Den Besselaar (2012) found that biomedical research group leaders who emphasised the societal impact of their research were more likely to engage with a range of external partners, such as the general public or patient organisations.

Second, joint research with societal partners offers opportunities to steer scientists' research towards addressing societal challenges – an outcome that prosocially motivated scientists value highly. By collaborating with societal actors, scientists can align their research agendas with real-world needs and problems. This alignment creates a sense of shared responsibility (Grant and Patil 2012), reinforcing the scientist's commitment to generating meaningful social outcomes through his/her research.

Based on the above, we expect that a strong prosocial research motivation will lead to more intensive engagement with external partners through joint research. Therefore, we hypothesise that:

Hypothesis 1. *Prosocial research motivation is positively associated with the scientist's involvement in joint research with external partners.*

Scientists typically are motivated by a combination of factors, as 'different motivational drivers can co-exist and scientists may be extrinsically or intrinsically motivated to different degrees' (Lam 2011, 1358). In other words, intrinsic motivation does not preclude influence of an extrinsic incentive and also does not rule out a prosocial motive (Lam 2011). The scientist may be deeply intrinsically motivated by the intellectual challenge of research and may also seek peer recognition (extrinsic reward) as an outcome of his or her commitment to research. Within a framework of coexisting motivations, we argue that prosocial research motivation is likely to have the strongest association with intensity of participation in joint research with societal actors. In contrast, for several reasons, intrinsic and extrinsic research motivations are likely to have a weaker association with participation in joint research with societal actors, or may dissuade the scientist from engagement in such interactions.

First, scientists with a high intrinsic research motivation who derive enjoyment and intellectual satisfaction from their research may be reluctant to engage in joint research collaboration with external partners because these interactions might limit their autonomy (Siegel, Waldman, and Link 2003). Collaboration with societal actors can constrain the scientist's freedom to make decisions about research topics, time frames, and content of deliverables (Perkmann and Walsh 2009). This constraint on autonomy could be perceived as detracting from the inherent satisfaction and intellectual freedom related to an intrinsic research motivation. Additionally, joint research with societal actors requires substantial investment of

time to overcome coordination challenges, and this reduces the time available for traditional academic research activities potentially diminishing the intrinsic rewards of pure research pursuits.

Second, with regards to scientists with high extrinsic research motivations, interactions with external partners may impose restrictions on open dissemination of research findings (Perkmann, McKelvey, and Phillips 2018) or lead to outcomes perceived as less scientifically rigorous or as influenced by the societal actors (Hessels and van Lente 2008). This might affect the scientist's reputation and credibility among peers and hinder opportunities for future funding or promotion. The risks on professional career advance, as reflected in these negative perceptions on the implications of interactions with external partners, may make extrinsically motivated scientists less inclined to pursue joint research with societal actors. Therefore, we hypothesise:

Hypothesis 1a. *Prosocial research motivation is more strongly linked than intrinsic research motivation to the scientist's involvement in joint research with external partners.*

Hypothesis 1b. *Prosocial research motivation is more strongly linked than extrinsic research motivation to the scientist's involvement in joint research with external partners.*

3.2. Boundary conditions: the moderating role of networking skills

According to SDT, the relationship between motivations and performance is influenced significantly by contextual factors. However, the literature on knowledge transfer and academic entrepreneurship generally fails to take account of the contingency perspective when considering the relationship between scientists' motivations and engagement with external partners. We hypothesise that the positive relationship between prosocial research motivation and involvement in joint research with societal actors will be greatly enhanced when scientists have stronger networking skills – that is, the capacity to form linkages among actors, to intermediate across different communities, and to effectively communicate and disseminate their work beyond scientific boundaries.

Intermediation skills are highlighted in several literatures. For example, social network theory scholars highlight that individuals adopt different networking strategies which affect how they mobilise and leverage the knowledge generation opportunities provided by their connections (Llopis, D'Este, and Díaz-Faes 2021; Soda, Tortoriello, and Iorio 2018). In this context, Obstfeld (2005, 102) identifies variations in individuals' 'behavioural orientation toward connecting people in one's social network' by linking disconnected individuals or facilitating exchanges among connected individuals. This networking behaviour promotes the triangulation of information, enhances circulation of reliable knowledge, and fosters reciprocity among network partners. These dynamics promote creation of a shared language and interpretative framework which mitigates conflicts between partners from diverse institutional contexts with competing priorities (Llopis, D'Este, and Díaz-Faes 2021).

Moreover, management scholars highlight the large inter-individual heterogeneity regarding ability and competence to identify and further develop diverse contacts and networks of people (Ferris et al. 2007). Individuals with strong networking skills are better able to create opportunities and build alliances with social actors (Pfeffer 1992). Prior work shows that, similar to other knowledge workers, scientists exhibit wide variability in their networking skills. For instance, in a study of a large technology firm, Ter Wal, Criscuolo, and Salter (2023) showed that some scientists were significantly better than others at mobilising the 'right' contacts from within their social circles to seek social support for research developments. Similarly, García-Chas, Neira-Fontela, and Varela-Neira (2015) found that R&D engineers able to build networks and interact convincingly with others displayed greater task efficiency, adaptability, and proactivity.

Based on the above, we argue that the positive relationship between prosocial research motivation and joint research with external partners is enhanced for scientists with stronger networking skills. In particular, skills enabling intermediation across diverse communities, identification of collaboration opportunities, effective communication of ideas, and sustained professional relationships are all competencies with a skewed distribution among scientists and often are difficult to

cultivate. Therefore, we suggest that interaction between scientists' prosocial research motivation and their networking skills is synergistic, and predicts higher intensity of joint research with societal actors. The rationale is that networking skills facilitate channels and coordination mechanisms to enable sharing of tacit knowledge and sensitive information, and foster trust among partners with different perspectives. Thus, we hypothesise:

Hypothesis 2. *Networking skills positively moderate the relationship between scientists' prosocial research motivation and their involvement in joint research with external partners.*

3.3. Boundary conditions: the type of external partner

Most research on scientists' engagement with external partners focuses primarily on collaborations involving scientists and industry partners (large or small and medium sized enterprises – SMEs). However, it has been noted that scientists engage with a broader range of societal actors which includes among others public administrations and CSOs (D'Este and Fontana 2007; Ramos-Vielba, Sánchez-Barrioluengo, and Woolley 2016; van de Burgwal, Hendrikse, and Claassen 2019). For instance, Ramos-Vielba et al. (2016) found that in some fields such as the physical sciences, the frequency of collaboration with businesses and governments is comparable whereas in other fields such as biomedicine and social sciences, partnerships with government agencies are more frequent.

Examining scientists' motives is important to understand whether and why they prioritise interactions with certain types of societal actors and limit engagement with others (Ramos-Vielba, Sánchez-Barrioluengo, and Woolley 2016; van de Burgwal, Hendrikse, and Claassen 2019). For example, Bodas Freitas and Verspagen (2017) focus on the alignment of goals and motivations between university and industry partners, and show that alignment of 'motivational spaces' increases the likelihood of effective knowledge transfer and impactful outcomes. However, several studies overlook prosocial motivation as a distinct driver and do not fully account for inter-individual variation in research motivations from a contextual work-related perspective. For instance, Ramos-Vielba, Sánchez-Barrioluengo, and Woolley (2016) examine, from a situational perspective, the scientists' motivations to interact with external partners, focusing predominantly on extrinsic motivations such as access to equipment, research funding, or checking the validity of research.

Based on the above, we examine whether scientists with a strong prosocial research motivation exhibit a preference for specific types of societal actors, particularly those whose missions align with their desire to contribute to societal well-being. More specifically, we examine whether the scientists' 'prosocial fire' fuels collaboration with CSOs compared to interaction with for-profit organisations or government agencies. CSOs are mission-driven institutions dedicated to benefiting diverse stakeholders through the pursuit of social goals, public service missions, ideological causes, and contributions to community and societal interests (Thompson and Bunderson 2003). Thus, the social missions and values of CSOs likely resonate with the research motivations of prosocial scientists, facilitating alignment of the 'motivational space' between the involved parties (Bodas Freitas and Verspagen 2017).

In contrast, collaboration with for-profit organisations can pose some major challenges for prosocially motivated scientists. The commercial priorities of business partners (profit maximisation, shareholder value) can conflict with the societal motivations of prosocial researchers, leading to an unstable and uneasy balance (Geuna and Muscio 2009). This may manifest in tensions over collaboration objectives and outcomes and might prompt the scientist to prioritise collaboration with other partner types.

We suggest that a prosocial research motivation will be positively associated with intensity of collaboration with CSOs compared to other partner types such as business organisations. We hypothesise that:

Hypothesis 3. *Prosocial research motivation is more strongly associated with the scientist's involvement in joint research with civil society organizations (CSOs) compared to other types of external partners.*

4. Methods

4.1. Empirical setting

This study draws on primary sources of data from a survey administered in 2016 to scientists in the Spanish public research system. In the absence of an official public register, our target population was the scientists affiliated to a university or PRO located in Spain, who had at least one published article indexed in the Web of Science (WoS) in the period 2012–2014. This approach is in line with prior work that uses WoS to delimit the research-active population (e.g.: Teplitskiy et al. 2022; Walsh and Lee 2015), and ensures inclusion of all research-active faculty in the Spanish public research system. The starting population numbered 64,508 individuals covering all scientific fields including physical sciences, engineering and mathematics (STEM), biology and medicine (BIOMED), and social sciences and humanities (SSH).

After dropping individuals with invalid email addresses and affiliations to other types of organisations (e.g. private universities), we obtained a final sample of 57,406 individuals who were invited to participate in the survey. The data were collected using a web-based questionnaire developed based on a focused literature review. To refine and validate the survey instrument, we conducted a total of 16 interviews with individuals from public universities, public research centres, and a university hospital. This sample included both male ($n = 9$) and female ($n = 7$) scientists at various career stages, and represented a range of experience of research partnerships with external partners by scientists at university and PRO. The final questionnaire was administered electronically in June and July 2016. Potential respondents received a personalised link to the online survey. Non-respondents were sent reminders two and four weeks after initial administration of the survey. We received 11,992 valid responses, a response rate of 21%. Table 1 presents response rates by scientific discipline. The respondents covered all fields of science including STEM, BIOMED and SSH. The respondents were largely representative of the target population in terms of scientific disciplinary distribution; almost all response rates range between 19% and 23% for total responses (overall response rate 21%) and between 16% and 20% for the final sample (N = 10,334; overall response rate 18%).

4.2. Measures

4.2.1. Intensity of participation in joint research with external partners

We measured scientists' intensity of interaction with external partners using a two-stage process. First, survey respondents were asked to indicate different types of external partners they had personally engaged with in any kind of formal interaction[2] related to their scientific activity during the period 2013–2015. The list included: SMEs, Large firms, Public Administration, Private non-profit institutions (e.g. foundations, non-governmental organisations – NGOs), Hospitals, Associations (e.g. professional, patient, citizen),

Table 1. Population surveyed, valid responses and response rates by scientific disciplines.

	Population surveyed	Total responses	Response rate (%)	Final sample	Final sample Response rate (%)
Biological sciences	7,270	1,656	22.8	1,495	20.6*
Chemistry and physics	8,443	1,966	23.3	1,786	21.2*
Earth & Environ. sciences	5,102	1,174	23.0	1,044	20.4*
Engineering	4,805	956	19.9	847	17.6
Humanities	2,651	775	29.2	528	19.9*
Maths & computer science	4,958	919	18.5	834	16.8
Medical sciences	11,203	1,909	17.0	1,614	14.4*
Social sciences	5,476	1,222	22.3	1,000	18.3
Other disciplines	7,498	1,415	18.9	1,186	15.8*
Total	*57,406*	*11,992*	*20.9*	*10,334*	*18.0*

Note: 'Other disciplines' includes researchers with the same number of publications in two or more disciplines during the period (2012–2014). Since these scientists could not be assigned to a specific discipline based on WoS, we classified them as other disciplines. * indicates response rates that are significantly different from the overall rate (18.0%) at $p < 0.05$.

[2]The term 'formal interaction' in our survey question was used to help respondents distinguish interactions that involved formal agreements (e.g. contracts) from purely informal, personal contacts.

International institutions (e.g. World Bank, UNESCO), or other. Respondents could select one or multiple options or indicate no interaction.

In the second stage, for each selected partner type, respondents were asked to report the frequency of the different types of interaction with a societal actor. We focused specifically on joint research, since this form of interaction represents a relatively frequent and well-defined type of collaboration requiring active cooperation between the scientist and an external actor, and it is consistently understood – and practiced – across scientific disciplines[3] (D'Este and Patel 2007; Perkmann et al. 2013). Respondents' indicated frequency was assessed based on the following scale: no interaction, 0 times; 1–2 times; 3–5 times; 6–9 times; 10 or more times. We recoded these categories using the midpoint of each range (0, 1.5, 4, 7.5, 10) to create a continuous measure. Our main dependent variable (intensity of participation in joint research), was operationalised by summing the frequency of joint research interactions across all societal actor types with which the focal scientist had engaged in the period 2013–2015. Thus, this variable represents intensity of engagement in joint research activities with all types of societal actors. To test hypothesis 3, we created separate measures for joint research with three different partner types: CSOs, industry, and public administration. To quantify the intensity of engagement with CSOs and industry, we aggregated data for non-profit organisations institutions and associations (for CSOs), and SMEs and large firms (for industry).[4]

4.2.2. Independent variables

Research motivations. The main independent variables correspond to the motivations for conducting scientific research. We measured them based on Ryan and Connell's (1989) self-regulation questionnaire. This instrument assesses different forms of motivation in various domains. In our study, we are interested in capturing scientists' motivations for research as the underlying rationales for the primary activity in the context of their professional role. We adapted a set of items to capture the underlying reasons for this endeavour. Specifically, respondents were asked to report the degree of importance (1 - not at all important to 5 - very important) they would attribute to a range of motives for conducting scientific research. These motives included 'the intellectual challenge of solving problems' and 'the degree of personal satisfaction derived from my research activities' to address intrinsic research motivation, and 'opportunities for advancement of my professional career' and 'professional recognition from the academic community in my field' to capture scientific extrinsic motivation. We also included three items to explicitly assess factors related to prosocial research motivation: 'the potential positive impact of my research on non-academic actors', 'my contribution to responding to societal needs or addressing social challenges', and 'the generation of useful responses to solve specific third-party problems'. We performed a factor analysis which supported the existence of three constructs: prosocial (Cronbach's alpha = 0.86), intrinsic (Cronbach's alpha = 0.70), and extrinsic (Cronbach's alpha = 0.80) research motivations. The constructs were computed as the average of the items. Table A1 in the Appendix presents detailed results of the factor analysis and all the items included in each scale.

Networking skills. This variable was measured based on the responses to a survey question that asked respondents to judge their abilities related to networking and connecting actors, using a 5-point Likert scale ranging from 1 - Not skilled to 5 - Highly skilled. The question listed four items: 'Intermediating between people from different backgrounds with common interests', 'Finding opportunities for collaboration among researchers from different disciplines', 'Disseminating my research to attract the interest of people not in my professional community', and 'Sustaining satisfactory personal relationships with colleagues'. The construct was computed as the average of the four items (Cronbach's alpha = 0.71).

[3]As a robustness check, we replicated our analyses using alternative mechanisms of scientists' engagement in interactions with external partners. Subsection 5.3 provides more detail on the robustness checks.

[4]We excluded hospitals and international institutions, since these types of external partners do not fit neatly into the industry, civil society, or government categories. We maintained the distinction between civil society and public administration based on their different institutional logics: CSOs (NGOs, foundations, associations) operate under mission-driven logics focused on advocacy and social change while public administration entities adhere to a bureaucratic-legal logic that emphasises policy implementation and regulation.

4.2.3. Control variables

The control variables fall into three categories: scientific performance, individual characteristics, and team and institutional characteristics. The first set of variables for scientific performance account for aspects associated with the characteristics of the respondent's scientific production which might influence his or her involvement in interactions with external partners. Specifically, we control for two dimensions of scientific performance: research productivity and research impact. For research productivity, we counted the total number of WoS publications for each respondent prior to 2013 – which is the starting year of the time-window covered by the survey. Given the skewed distribution of this variable, we applied a logarithmic transformation. For research impact, we computed the proportion of the scientists' papers, published prior to 2013, corresponding to the top 10% most highly cited papers in the field. We use a ratio form, scaling the proportion relative to 1.

The second set of variables (individual characteristics) measures the scientist's socio-demographic and experience-related indicators. We controlled for scientist's age since more-senior scientists tend to engage more frequently with societal actors and scientist gender since male academics tend to engage more with external partners (Tartari and Salter 2015) although female scientist's often engage with more diverse types of societal actors (Díaz-Faes et al. 2020). We included a set of dummies to control for respondent's seniority/academic ranking and also controlled for time spent by the respondent on a regular weekly basis on different tasks: teaching, research, administrative duties, cultivating external connections, and obtaining research funding. Since prior career experiences can facilitate subsequent interactions with societal actors we controlled for previous experience (i.e. number of years employed) outside a university or PRO context (Gulbrandsen and Thune 2017). Moreover, we controlled for the applied orientation of each respondent's research activities. Specifically, respondents were presented with a scale ranging from 0 - basic research to 100 - applied research horizontal bar where they could indicate the specific balance between basic and applied research for each scientist. Finally, we added a dummy variable to control for a PhD degree.

The last set of variables (team and institutional characteristics) is associated with the scientist's current context. We controlled for type of institutional affiliation based on a survey question asking the respondent to indicate the type of institution of current affiliation: university, PRO, hospital, other. We created a hybrid category to accommodate those respondents who chose more than one option. All the variables were included as dummies. We controlled for team size, that is the number of members of the respondent's research team, as reported in the survey, and included a variable to account for interdisciplinarity of the respondent's team. Specifically, respondents were presented with a list of up to 51 sub-disciplines and were asked to indicate all the scientific disciplines covered by the respondent's regular research team. We included 17 dummies to control for geographic region. Finally, we controlled for respondent's current scientific field based on self-reporting of nine dummy variables for disciplines. All variables are detailed in Table 2.

4.3. Empirical model

We employed an ordinary least squares (OLS) regression model to explore the relationship between scientists' research motivations and joint research with external partners. Given the highly skewed nature of our dependent variable, we applied log transformation to respond to the linear regression assumptions. Thus, the dependent variable was measured as the log-transformed intensity of participation in joint research with societal actors – i.e. frequency of interaction in joint research activities with all types of external partners. To facilitate comparison of effect sizes across different predictors, we standardised all the continuous independent variables. To test Hypothesis 3, we created three separate dependent variables, each representing intensity of engagement with a specific type of societal actor: civil society, industry, government. We ran separate OLS regressions for each of the dependent variables, using the same set of independent variables and controls as in our main model, and additionally including the frequency of engagement with the other two actor types as controls.

5. Results

5.1. Descriptive statistics and correlations

Approximately 41% of respondents reported that they engage in joint research with at least one partner type over the examined period. Figure 1 depicts the distribution and overlap of collaboration with the three main partner categories: industry, government, and civil society. Industry is the most common external partner – 25% of scientists report they engage at least once with industry over the examined period – followed by government (15%) and CSOs (10%). It is worth noting that these are not mutually exclusive categories, as 11% of respondents have engaged with more than one type of external partner. For example, 5% of scientists have been involved in joint research with both industry and government and 2% engaged with all three partner types.

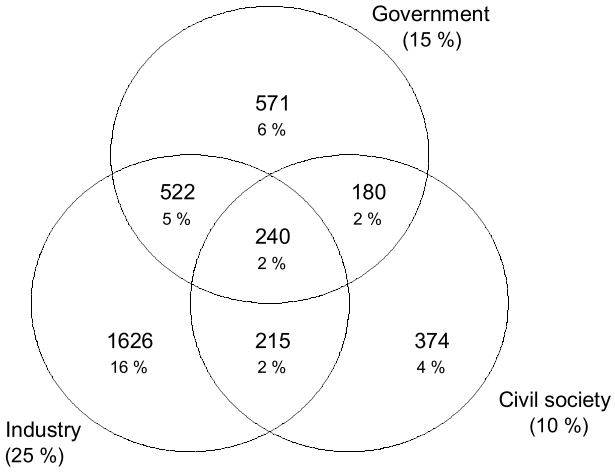

Figure 1. Distribution of scientists' joint research by partner type. Notes: $N = 10{,}334$. Percentages represent the proportion of scientists engaging in joint research with each partner type or combination. The diagram shows the three main partner categories.

Table 2 presents summary statistics for all variables used in the analysis. In terms of the degree of joint-research interaction with external partners, Industry has the highest score suggesting that our respondents tend to interact more frequently with industry partners (SMEs and/or large firms) than with CSOs or Government.

Also, in Table 2 overall intrinsic research motivation scores highest, showing that scientists are driven primarily by intrinsic motivations for conducting research activities.[5] Figure 2 presents mean values for prosocial, intrinsic, and extrinsic research motivations by scientific field. We observe that overall social sciences and environmental studies researchers scored highest for prosocial research motivation, and that maths, chemistry, and physics scientists scored comparatively lower for prosocial research motivation.

Appendix Table A2 presents the correlations among the variables. As suggested by the factor analysis results, motivations are not highly correlated to each other. The highest correlation is between extrinsic research motivation and both intrinsic and prosocial research motivation ($r = 0.37$, $p < 0.05$). Time allocation variables show the expected negative correlations since time devoted to one particular activity reduces the time available for other duties. Most of the other correlations were relatively modest in magnitude. Variance inflation factors (VIF) values for all main predictors — research motivations and networking skills — are below 2, indicating negligible multicollinearity. The largest VIF in the model is 6.33 (research time), well below the threshold of 10 that signals a serious concern.

[5]In a separate analysis, we examined the proportions of scientists reporting high values (above 4) for prosocial, intrinsic, and extrinsic research motivation: 80% of respondents reported high values for intrinsic research motivation, 53% for prosocial motives, and 37% for extrinsic research motivation.

Table 2. Descriptive statistics.

	Mean	SD	Min	Max
Dependent variables				
Joint research with external partners	2.33	4.96	0	70
Joint research with industry	1.04	2.64	0	20
Joint research with civil society	0.32	1.35	0	20
Joint research with public admin.	0.52	1.67	0	10
Independent variables				
Prosocial research motivation	3.78	0.87	1	5
Intrinsic research motivation	4.34	0.52	1	5
Extrinsic research motivation	3.64	0.71	1	5
Networking skills	3.65	0.58	1	5
Control variables				
Nº publications	2.67	7.16	0	326
Top publications (ratio)	0.08	0.13	0	1
Applied research (%)	50.77	32.97	0	100
Age	49.08	10.06	23	83
Female	0.36	0.48	0	1
Full professor	0.18	0.38	0	1
Associate professor	0.54	0.50	0	1
Assistant professor	0.13	0.34	0	1
Postdoc	0.03	0.18	0	1
Other prof. Categories	0.11	0.31	0	1
Time for teaching	27.62	18.22	0	100
Time for research	44.39	19.68	0	100
Time for admin	13.27	12.66	0	100
Time for networking	5.15	6.78	0	100
Exp. outside Univ./PROs	1.92	4.31	0	41
PhD = Yes	0.95	0.23	0	1
University	0.74	0.44	0	1
Research centre	0.17	0.37	0	1
Hospital	0.05	0.22	0	1
Hybrid institution	0.04	0.20	0	1
Team size	6.39	4.10	1	21
Nº of disciplines in the team	2.50	1.78	1	27
Chemistry & physics	0.16	0.36	0	1
Humanities	0.04	0.20	0	1
Earth & environment	0.10	0.30	0	1
Social sciences	0.17	0.38	0	1
Engineering	0.16	0.37	0	1
Biological sciences	0.12	0.33	0	1
Maths & computer sc.	0.13	0.33	0	1
Medical sciences	0.11	0.31	0	1
Multidisciplinary sc.	0.01	0.08	0	1

$N = 10{,}334$.

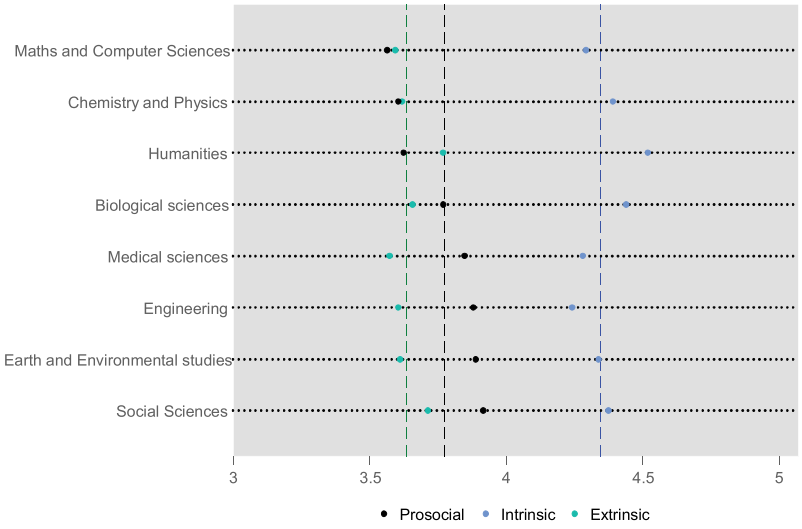

Figure 2. Average values of research motivations by scientific fields. Notes: $N = 10{,}334$.

5.2. Testing the hypotheses

Table 3 presents the results of the OLS regressions examining the relationship between research motivations -prosocial, intrinsic, and extrinsic- and the degree of scientists' participation in joint research with external partners. Model 0 provides the estimates for the control variables, and Model 1 includes scientists' prosocial, intrinsic, and extrinsic research motivations, and networking skills.

Our analysis reveals significant relationships between scientists' research motivations and their engagement in joint research with external partners (Table 3). Model 1 shows that prosocial research motivation is positively and significantly associated with joint research with external partners ($\beta = 0.066$, $p < 0.001$). In contrast, the relationships are negative and significant for both intrinsic ($\beta = -0.044$, $p < 0.001$) and extrinsic ($\beta = -0.024$, $p = 0.011$) research motivations. These findings support Hypothesis 1, confirming a positive association between prosocial research motivation and joint research with external partners. Furthermore, they support Hypotheses 1a and 1b, which suggest that prosocial research motivation has a stronger positive association with joint research than either intrinsic (H1a) or extrinsic (H1b) research motivation. To further test whether there are significant differences between these estimated coefficients, we conducted post-hoc tests comparing the coefficients of prosocial research motivation with the coefficients of intrinsic and extrinsic research motivation. The results confirm that the coefficient of prosocial research motivation differs significantly from both intrinsic ($F = 57.19$, $p < 0.001$) and extrinsic ($F = 34.77$, $p < 0.001$) which provides further support for Hypotheses 1a and 1b.

Model 2 tests Hypothesis 2 by adding the interaction term between prosocial research motivation and networking skills. We observe that the interaction term is positive and statistically significant ($\beta = 0.022$, $p = 0.003$) which supports our prediction that networking skills positively moderate the relationship between prosocial research motivation and joint research with external partners. This confirms that the positive association between prosocial motivation and joint research with societal actors is stronger for scientists with better networking skills. A test for joint significance of prosocial research motivation and its interaction with networking skills showed that this was significant ($F = 26.82$, $p < 0.001$), indicating that these variables in combination have a meaningful association with joint research with external partners. To visualise this interaction effect, we plotted the marginal effects of prosocial research motivation on joint research with external partners in a context of weak (Mean − 1 SD) and strong (Mean +1 SD) networking

Table 3. Research motivations and intensity of participation in joint research with external partners.

	M0: Controls		M1: Main model		M2: Interaction	
	Coef.	SE	Coef.	SE	Coef.	SE
Prosocial res. motivation			0.066***	(0.01)	0.069***	(0.01)
Intrinsic res. motivation			−0.044***	(0.01)	−0.043***	(0.01)
Extrinsic res. motivation			−0.024**	(0.01)	−0.025**	(0.01)
Prosocial*Networking					0.022***	(0.01)
Networking skills	0.103***	(0.01)	0.104***	(0.01)	0.104***	(0.01)
Age	0.017	(0.01)	0.015	(0.01)	0.015	(0.01)
Female = 1	−0.077***	(0.02)	−0.085***	(0.02)	−0.084***	(0.02)
Exp. outside Univ./PROs	0.045***	(0.01)	0.044***	(0.01)	0.043***	(0.01)
Nº publications	0.037***	(0.01)	0.041***	(0.01)	0.041***	(0.01)
Top publications (ratio)	−0.027***	(0.01)	−0.028***	(0.01)	−0.028***	(0.01)
Applied research (%)	0.179***	(0.01)	0.157***	(0.01)	0.157***	(0.01)
University	−0.118**	(0.05)	−0.130**	(0.05)	−0.133***	(0.05)
PRO	−0.157***	(0.05)	−0.171***	(0.05)	−0.174***	(0.05)
Hospital	−0.025	(0.06)	−0.024	(0.06)	−0.027	(0.06)
Team size	0.111***	(0.01)	0.110***	(0.01)	0.110***	(0.01)
Nº of disciplines in the team	0.087***	(0.01)	0.082***	(0.01)	0.080***	(0.01)
Constant	1.861***	(0.07)	1.922***	(0.08)	1.931***	(0.08)
Time distribution (5)	Yes		Yes		Yes	
Research field (9)	Yes		Yes		Yes	
Academic rank (4)	Yes		Yes		Yes	
Geographical dummies (17)	Yes		Yes		Yes	
N	10,334		10,334		10,334	
Log Likeli.	−12641.3		−12612.2		−12607.8	
R^2	0.194		0.198		0.199	

Notes: Significance levels: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. The dependent variable is the log-transformed intensity of joint research with external partners. All models are estimated using ordinary least square regressions. Continuous independent variables are standardised. Robust standard errors are reported in parentheses. Reference categories: Institution type = Hybrid, Time distribution = Research funding, Research field = Chemistry and Physics, Academic rank = Postdoc + other, Geographical dummies = Ceuta.

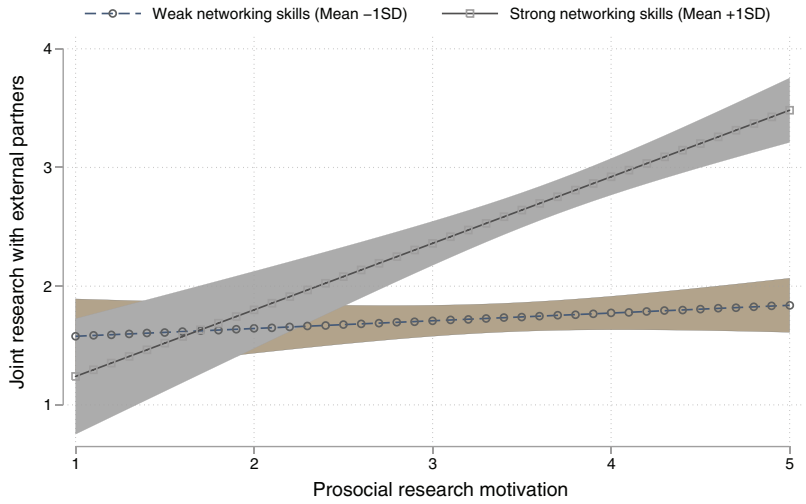

Figure 3. Networking skills strengthen the positive relationship between prosocial research motivation and joint research with societal actors. Note: Predicted values of joint research intensity with external partners across prosocial research motivation, for weak (-1 SD) and strong (+1 SD) networking skills. Shaded areas represent 95% confidence intervals. Based on regression coefficients from Table 3 (Model 2).

skills (Figure 3). The plot shows that the positive association between prosocial research motivation and joint research with societal actors increases for scientists with stronger networking skills.

Hypothesis 3 suggests that compared to other types of external partners prosocial research motivation will be more strongly related to joint research with CSOs. To test this hypothesis, we ran three different regressions, each employing a different dependent variable for intensity of interaction with each type of societal actor (see Table 4). Table 4 shows that prosocial research motivation is positively and significantly associated with joint research for both CSOs ($\beta = 0.017$, $p < 0.001$) and industry partners ($\beta = 0.037$, $p < 0.001$) but that the relationship between prosocial research motivation and joint research with government partners is not statistically significant ($\beta = 0.001$, $p > 0.10$). This suggests that prosocially motivated scientists engage more intensively in joint research with industry partners and CSOs rather than government. To formally test for differences in the prosocial research motivation coefficients across partner types, we conducted coefficient comparison employing Wald tests. The results confirm statistically significant differences between all coefficient pairs: industry vs. civil society ($\chi2 = 5.49$, $p = 0.019$), civil society vs. government ($\chi2 = 4.13$, $p = 0.042$), and industry vs. government ($\chi2 = 13.52$, $p = 0.0002$). Therefore, while the results show that prosocial research motivation is positively associated with joint research with CSOs, we observe no clear prioritisation of CSOs: thus, Hypothesis 3 is not confirmed.

5.3. Robustness checks

We conducted several additional analyses to confirm the validity and reliability of our findings, which can be found in the Online Supplementary Material. First, to account for potential correlations among our three dependent variables and to test Hypothesis 3, we employed seemingly unrelated regressions (SUREG). The results presented in Table S1 corroborate our main findings and provide additional support for the positive association of prosocial research motivation with different types of partners. After examination of residual correlations across equations, which revealed relatively weak relationships, we considered OLS rather than seemingly unrelated regressions (SUREG) for the main analysis. Furthermore, we constructed two alternative indicators for engagement with external partners to further test whether our results would vary if we had considered a mechanism of interaction different from joint research. First, we built a broader indicator that encompassed 10 different activities (such as contract research and specialised training for societal actors) potentially related to interaction with external partners. Second, we constructed an indicator for response mode interactions such as contract research and consulting activities. The results of our analyses using these two alternative dependent variables are presented respectively in Tables S2 and S3 (for the

Table 4. Research motivations and intensity of joint research with different types of external partners.

	Civil society		Industry		Government	
	Coef.	SE	Coef.	SE	Coef.	SE
Prosocial res. motivation	0.017***	(0.00)	0.037***	(0.01)	0.001	(0.01)
Intrinsic res. motivation	0.008*	(0.00)	−0.021***	(0.01)	−0.013**	(0.01)
Extrinsic res. motivation	−0.011**	(0.00)	−0.016**	(0.01)	0.000	(0.01)
Networking skills	0.008*	(0.00)	0.039***	(0.01)	0.027***	(0.01)
Age	0.002	(0.01)	−0.004	(0.01)	0.019***	(0.01)
Female = 1	0.003	(0.01)	−0.084***	(0.01)	−0.018*	(0.01)
Exp. outside Univ./PROs	0.026***	(0.00)	0.007	(0.01)	0.002	(0.01)
Nº publications	−0.004	(0.01)	0.047***	(0.01)	−0.013*	(0.01)
Top publications (ratio)	0.000	(0.00)	−0.014*	(0.01)	−0.006	(0.01)
Applied research (%)	0.010**	(0.00)	0.093***	(0.01)	0.020***	(0.01)
University	−0.025	(0.02)	0.007	(0.03)	−0.007	(0.03)
PRO	−0.029	(0.02)	−0.056	(0.04)	0.003	(0.03)
Hospital	−0.013	(0.03)	−0.068*	(0.04)	−0.040	(0.03)
Team size	0.019***	(0.00)	0.069***	(0.01)	0.014***	(0.01)
Nº of disciplines in the team	0.033***	(0.00)	0.006	(0.01)	0.031***	(0.01)
Industry	0.070***	(0.01)			0.183***	(0.01)
Government	0.160***	(0.01)	0.287***	(0.01)		
Civil society			0.165***	(0.02)	0.243***	(0.01)
Constant	−0.126	(0.39)	0.235	(0.60)	−0.067	(0.48)
Time distribution (5)	Yes		Yes		Yes	
Current research field (9)	Yes		Yes		Yes	
Academic rank (4)	Yes		Yes		Yes	
Geographical dummies (17)	Yes		Yes		Yes	
N	10,334		10,334		10,334	
Log Likeli.	−4924.5		−9379.4		−7072.8	
R^2	0.145		0.246		0.169	

Notes: Significance levels: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$. Ordinary least square regressions. Dependent variables are the log-transformed intensity of engagement in joint research with each non-academic partner category. Continuous independent variables are standardised. Robust standard errors are reported in parentheses. Reference categories: Institution type = Hybrid, Time distribution = Research funding, Research field = Chemistry and Physics, Academic rank = Postdoc + other, Geographical dummies = Ceuta.

broader indicator) and Tables S4 and S5 (for response mode). Overall, the results are consistent with our main findings, suggesting that had we considered a different interaction mechanism for engagement with societal actors the results would not vary significantly.

Next, to account for potential disciplinary differences, we conducted separate analyses for three broad scientific domains: STEM, BIOMED and SSH. The results of these field-specific analyses show that the overall patterns and directions of relationships between research motivations and joint research with external partners are consistent with our main findings (see Table S6). We also created binary indicators for engagement with each societal actor category and employed logistic regressions. The results (Table S7) corroborate our main findings. Prosocial motivation is significantly positively associated with civil society and industry engagement, while the association with government remains non-significant. Finally, we conducted a Tobit regression analysis to address the zero-inflated nature of our dependent variable; the results generally confirm our findings, with prosocial research motivation remaining positively significant and intrinsic/extrinsic research motivation showing a negative association. However, these results show two differences relative to our main findings. First, the interaction between prosocial and networking skills is non-significant in this specification (Table S8). Second, the partner-specific Tobit provides support for Hypothesis 3, with the coefficients of prosocial research motivation following the predicted hierarchy: CSOs ($\beta = 0.246$) >Industry ($\beta = 0.152$) >Government ($\beta = 0.054$), all p-values below 0.001. Wald tests confirmed that all the pairwise differences are statistically significant ($p < 0.001$), suggesting that after accounting for censoring, prosocially research motivated scientists prioritise civil society partners (Table S9).

6. Conclusions

Our study aimed to provide a deeper understanding of the relationship between scientists' prosocial research motivation and the intensity of their research interactions with external partners. While there has been a recent surge of studies on this matter, much of the literature focuses on prosocial motivation towards engaging in specific types of science – society interactions (e.g. Atta-Owusu and Fitjar 2022; Iorio,

Labory, and Rentocchini 2017; van de Burgwal, Hendrikse, and Claassen 2019), rather than on the underlying motivational orientations that shape scientists' research behaviour more broadly. Our contextual approach to prosocial motivation and consideration of its boundary conditions makes several contributions to work on the drivers of scientists' engagement in joint research with societal actors.

6.1. Theoretical contributions

The theoretical contributions of this study are described below. First, the contextual approach adopted in our work advances understanding of prosocial motivation in the context of scientific research (Grant and Berg 2011). This perspective allowed us to capture a more generalisable form of scientists' prosocial motivation that is rooted in their professional role identities as researchers. This contrasts with previous studies which examine scientists' motivations related to particular behaviours - i.e., specific interactions with societal actors. (e.g. Atta-Owusu and Fitjar 2022; Iorio, Labory, and Rentocchini 2017). Our approach is more aligned to Cohen et al.'s (2020) examination of scientists' job-related motives and their association to commercialisation activities. Building on this perspective, we focus specifically on what we refer to as 'research motivations' - the scientists' motivational antecedents to conduct research. We found that, compared to both intrinsic and extrinsic research motivations, prosocial research motivation is comparatively more strongly associated with the intensity of the research interactions with societal actors. In fact, our findings suggest that while intrinsic and extrinsic research motivations are negatively associated with joint research collaborations with societal actors, prosocial research motivation has a positive and statistically significant relationship with this type of collaboration. This suggests that scientists driven primarily by the inherent satisfaction derived from research (i.e. intrinsically research motivated) might view engagement with external partners as constraining their autonomy and diverting time from core scientific pursuits. Similarly, scientists with high extrinsic research motivation – oriented towards career advancement and peer recognition within the academic reward system – may perceive engagement with external partners as detracting from publication-focused activities or as compromising publication quality, and thus negatively affecting peer recognition and career progression. These findings align with our contextual approach to research motivations. For instance, in the case of extrinsic research motivation, the proposed approach frames this motivational type as capturing an orientation to behaviour largely shaped by traditional academic rewards. This explains its negative association to engagement with external partners. In sum, our conceptual framework allows for a consistent comparison of intrinsic, extrinsic, and prosocial research motivations, and explains why it is scientists' desire to contribute to society that most strongly shapes their engagement with societal actors.

Second, our study provides novel insights into the boundary conditions of the relationship between prosocial research motivation and joint research collaboration with societal actors. To our knowledge, this is the first large-scale study to adopt an explicit contingency perspective on the role of prosocial motivation in science. More specifically, we investigated whether networking skills, understood as the ability to connect members of one's social network (Ferris et al. 2005, 2007), moderate the relationship between prosocial research motivation and joint research with societal actors. Our results show that the stronger an individual's networking skills, the higher the positive association between prosocial research motivation and intensity of research collaboration with societal actors. These findings are consistent with the expectancy theory framework (Vroom 1964), which posits that engagement in a given activity requires both motivation and ability. In our setting, networking skills enable the translation of prosocial research motivation into concrete collaborative behaviour with societal actors. Building on this, we suggest that our results also contribute to SDT (Ryan and Deci 2020) in the context of science-society interactions: prosocial research motivation functions as a stronger form of self-regulation when matched with well-developed networking skills. This suggests that the capacity to act in accordance with one's prosocial motivation reinforces the motivational drive itself, creating a synergistic relationship between motivation and capability.

Third, we explored whether prosocial research motivation is associated with a particular type of societal actor by considering the heterogeneity among external partners involved in knowledge exchange activities with scientists (Ramos-Vielba, Sánchez-Barrioluengo, and Woolley 2016; van de Burgwal, Hendrikse, and Claassen 2019). We contribute to prior research on goal alignment in science-society interactions (e.g. Bodas Freitas and Verspagen 2017; Geuna and Muscio 2009) by examining whether prosocial research

motivation is related to greater intensity of engagement with CSOs compared to other types of societal actors (such as industry or government agencies). Our results do not support this hypothesis: we found that prosocial research motivation is strongly associated with greater intensity of engagement with both CSOs and for-profit organisations, showing no clear prioritisation of CSOs.

Notably, our findings reveal contrasting effects of intrinsic and prosocial research motivations depending on partner type. For industry collaboration, results are robust and consistent: prosocial research motivation is positively associated with engagement, while intrinsic motivation shows a negative association. This suggests that intrinsically motivated scientists view collaboration with industry as potentially constraining their research autonomy and scientific freedom, whereas prosocially motivated scientists perceive industry partnerships as valuable opportunities to generate practical applications and societal impact. Thus, different motivational orientations lead to systematically different evaluations of the same collaborative opportunity. For CSOs, by contrast, both intrinsic and prosocial research motivations are positively associated with intensity of engagement, suggesting that these motivational drivers are aligned rather than conflicting when it comes to civil society partners. Considering intrinsic and prosocial research motivations jointly may therefore help to explain individual variation in partner choices in the context of joint research with external partners.

6.2. Practical implications

Our findings have several implications for university administrators, policymakers, and scientists. First, the strong association between prosocial research motivation and joint research with external partners suggests that fostering a sense of societal purpose in scientific work could be an effective strategy for increasing scientists' involvement in research-related interactions with societal actors. Universities and research institutions might consider emphasising the potential societal impacts of research in their organisational culture and reward systems. For example, university administrators could implement practices to enhance prosocial research motivation by facilitating direct interaction between scientists and the potential beneficiaries of their research (Grant 2007, 2012; Llopis and D'Este 2016) to make the impact of their research more tangible and personally meaningful. Second, the moderating role of networking skills highlights the importance of scientists' developing a specific type of competence. Training to enhance networking abilities could help to maximise the impact of prosocially motivated scientists.

Third, our finding that prosocial research motivation is associated with engagement across multiple types of societal actors suggests that we should adopt a broader approach to research collaboration beyond interactions with industry. Our results suggest that prosocially motivated scientists engage actively in joint research with both industry and CSOs. This in turn suggests that prosocial research motivations could provide a bridge enabling scientists to identify potentially valuable collaboration opportunities across different institutional contexts – e.g., civil associations and for-profit organisations – which potentially would extend the societal impacts of their research.

6.3. Limitations and future research

This study is not without limitations. First, since our research is cross-sectional we cannot make causality claims. Thus, future research could employ a longitudinal design to provide a better understanding of the causal relationships between motivations, skills, and societal engagement behaviours over time. Second, our empirical context is limited to a single country. Although there may be no reasons to believe that the relationships observed would not hold for other contexts, cross-cultural research would provide valuable insights into how national and institutional contexts might influence the role of prosocial research motivation in research collaborations with external partners. Third, while our measure of research collaboration is comprehensive, future research could use more fine-grained measures that distinguish between different types and qualities of engagement activities. This would help unpack the complex relationships observed between different research motivations and engagement with societal actors. Fourth, we acknowledge the possibility of omitted variable bias; in particular, personality traits such as extroversion could influence both prosocial research motivation and networking skills. While we control for several relevant individual characteristics, the absence of direct measures for personality traits is a shortcoming of this study.

Fourth, our findings on the relative influence between prosocial, intrinsic and extrinsic research motivations suggest new research directions. Future work could explore the potential synergies and tensions among different research motivations and could employ qualitative methods to obtain a deeper understanding of how scientists navigate reinforcing and conflicting motivations.

To conclude, by jointly examining prosocial, intrinsic, and extrinsic research motivations and suggesting a synergistic interaction between prosocial research motivations and networking skills in predicting joint research with societal actors, we have advanced understanding of the micro-foundations of scientists' engagement with external partners. Our study underscores the complexity of motivational dynamics involved in academic work and highlights the need for nuanced approaches to fostering productive science-society interactions.

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References

Altenmüller, M. S., L. L. Lange, and M. Gollwitzer. 2021. "When Research Is Me-Search: How Researchers' Motivation to Pursue a Topic Affects Laypeople's Trust in Science." *PLOS ONE* 16 (7): e0253911. https://doi.org/10.1371/journal.pone.0253911.

Atta-Owusu, K., and R. D. Fitjar. 2022. "What Motivates Academics for External Engagement? Exploring the Effects of Motivational Drivers and Organizational Fairness." *Science & Public Policy* 49 (2): 201–218. https://doi.org/10.1093/scipol/scab075.

Balven, R., V. Fenters, D. S. Siegel, and D. Waldman. 2018. "Academic Entrepreneurship: The Roles of Identity, Motivation, Championing, Education, Work-life Balance, and Organizational Justice." *Academy of Management Perspectives* 32 (1): 21–42. https://doi.org/10.5465/amp.2016.0127.

Bellé, N. 2013. "Experimental Evidence on the Relationship Between Public Service Motivation and Job Performance." *Public Administration Review* 73 (1): 143–153. https://doi.org/10.1111/j.1540-6210.2012.02621.x.

Bodas Freitas, I. M., and B. Verspagen. 2017. "The Motivations, Institutions and Organization of University-Industry Collaborations in the Netherlands." *Journal of Evolutionary Economics* 27 (3): 379–412. https://doi.org/10.1007/s00191-017-0495-7.

Bolino, M. C., and A. M. Grant. 2016. "The Bright Side of Being Prosocial at Work, and the Dark Side, Too: A Review and Agenda for Research on Other-Oriented Motives, Behavior, and Impact in Organizations." *Academy of Management Annals* 10 (1): 599–670. https://doi.org/10.5465/19416520.2016.1153260.

Cohen, W. M., H. Sauermann, and P. Stephan. 2020. "Not in the Job Description: The Commercial Activities of Academic Scientists and Engineers." *Management Science* 66 (9): 4108–4117. https://doi.org/10.1287/mnsc.2019.3535.

Deci, E. L., and R. M. Ryan. 2013. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Springer.

De Dreu, C. K. W., and A. Nauta. 2009. "Self-Interest and Other-Orientation in Organizational Behavior: Implications for Job Performance, Prosocial Behavior, and Personal Initiative." *Journal of Applied Psychology* 94 (4): 913–926. https://doi.org/10.1037/a0014494.

D'Este, P., and R. Fontana. 2007. "What Drives the Emergence of Entrepreneurial Academics? A Study on Collaborative Research Partnerships in the UK." *Research Evaluation* 16 (4): 257–270. https://doi.org/10.3152/095820207X254448.

D'Este, P., O. Llopis, F. Rentocchini, and A. Yegros. 2019. "The Relationship Between Interdisciplinarity and Distinct Modes of University-Industry Interaction." *Research Policy* 48 (9): 103799. https://doi.org/10.1016/j.respol.2019.05.008.

D'Este, P., and P. Patel. 2007. "University–Industry Linkages in the UK: What Are the Factors Underlying the Variety of Interactions with Industry?" *Research Policy* 36 (9): 1295–1313. https://doi.org/10.1016/j.respol.2007.05.002.

Díaz-Faes, A. A., P. Otero-Hermida, M. Ozman, and P. D'Este. 2020. "Do Women in Science Form More Diverse Research Networks Than Men? An Analysis of Spanish Biomedical Scientists." *PLOS ONE* 15 (8): e0238229. https://doi.org/10.1371/journal.pone.0238229.

Ferris, G. R., D. C. Treadway, R. W. Kolodinsky, W. A. Hochwarter, C. J. Kacmar, C. Douglas, and D. D. Frink. 2005. "Development and Validation of the Political Skill Inventory." *Journal of Management* 31 (1): 126–152. https://doi.org/10.1177/0149206304271386.

Ferris, G. R., D. C. Treadway, P. L. Perrewé, R. L. Brouer, C. Douglas, and S. Lux. 2007. "Political Skill in Organizations." *Journal of Management* 33 (3): 290–320. https://doi.org/10.1177/0149206307300813.

Gagné, M., and E. L. Deci. 2005. "Self-Determination Theory and Work Motivation." *Journal of Organizational Behavior* 26 (4): 331–362. https://doi.org/10.1002/job.322.

García-Chas, R., E. Neira-Fontela, and C. Varela-Neira. 2015. "Comparing the Explanatory Capacity of Three Constructs in the Prediction of Engineers' Proficiency, Adaptivity, and Proactivity." *Human Resource Management* 54 (4): 689–709. https://doi.org/10.1002/hrm.21639.

Geuna, A., and A. Muscio. 2009. "The Governance of University Knowledge Transfer: A Critical Review of the Literature." *Minerva* 47 (1): 93–114. https://doi.org/10.1007/s11024-009-9118-2.

Grant, A. M. 2007. "Relational Job Design and the Motivation to Make a Prosocial Difference." *Academy of Management Review* 32 (2): 393–417. https://doi.org/10.5465/amr.2007.24351328.

Grant, A. M. 2008. "Does Intrinsic Motivation Fuel the Prosocial Fire? Motivational Synergy in Predicting Persistence, Performance, and Productivity." *Journal of Applied Psychology* 93 (1): 48–58. https://doi.org/10.1037/0021-9010.93.1.48.

Grant, A. M. 2012. "Leading with Meaning: Beneficiary Contact, Prosocial Impact, and the Performance Effects of Transformational Leadership." *Academy of Management Journal* 55 (2): 458–476. https://doi.org/10.5465/amj.2010.0588.

Grant, A. M., and J. M. Berg. 2011. *Prosocial Motivation at Work*. New York: Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199734610.013.0003.

Grant, A. M., and J. W. Berry. 2011. "The Necessity of Others Is the Mother of Invention: Intrinsic and Prosocial Motivations, Perspective Taking, and Creativity." *Academy of Management Journal* 54 (1): 73–96. https://doi.org/10.5465/AMJ.2011.59215085.

Grant, A. M., and S. V. Patil. 2012. "Challenging the Norm of Self-Interest: Minority Influence and Transitions to Helping Norms in Work Units." *Academy of Management Review* 37 (4): 547–568. https://doi.org/10.5465/amr.2010.0437.

Grant, A. M., and J. J. Sumanth. 2009. "Mission Possible? The Performance of Prosocially Motivated Employees Depends on Manager Trustworthiness." *Journal of Applied Psychology* 94 (4): 927–944. https://doi.org/10.1037/a0014391.

Guay, F., and R. J. Vallerand. 1996. "Social Context, Student's Motivation, and Academic Achievement: Toward a Process Model." *Social Psychology of Education* 1 (3): 211–233. https://doi.org/10.1007/BF02339891.

Guay, F., R. J. Vallerand, and C. Blanchard. 2000. "On the Assessment of Situational Intrinsic and Extrinsic Motivation: The Situational Motivation Scale (SIMS)." *Motivation and Emotion* 24 (3): 175–213. https://doi.org/10.1023/A:1005614228250.

Gulbrandsen, M., and T. Thune. 2017. "The Effects of Non-Academic Work Experience on External Interaction and Research Performance." *The Journal of Technology Transfer* 42 (4): 795–813. https://doi.org/10.1007/s10961-017-9556-1.

Hardy, S. A., and G. Carlo. 2005. "Identity as a Source of Moral Motivation." *Human Development* 48 (4): 232–256. https://doi.org/10.1159/000086859.

Hessels, L. K., and H. van Lente. 2008. "Re-Thinking New Knowledge Production: A Literature Review and a Research Agenda." *Research Policy* 37 (4): 740–760. https://doi.org/10.1016/j.respol.2008.01.008.

Iorio, R., S. Labory, and F. Rentocchini. 2017. "The Importance of Pro-Social Behaviour for the Breadth and Depth of Knowledge Transfer Activities: An Analysis of Italian Academic Scientists." *Research Policy* 46 (2): 497–509. https://doi.org/10.1016/j.respol.2016.12.003.

Jain, S., G. George, and M. Maltarich. 2009. "Academics or Entrepreneurs? Investigating Role Identity Modification of University Scientists Involved in Commercialization Activity." *Research Policy* 38 (6): 922–935. https://doi.org/10.1016/j.respol.2009.02.007.

Lam, A. 2010. "From 'Ivory Tower Traditionalists' to 'Entrepreneurial Scientists'?: Academic Scientists in Fuzzy University—Industry Boundaries." *Social Studies of Science* 40 (2): 307–340. https://doi.org/10.1177/0306312709349963.

Lam, A. 2011. "What Motivates Academic Scientists to Engage in Research Commercialization: 'Gold', 'Ribbon' or 'Puzzle'? Res." *Research Policy* 40 (10): 1354–1368. https://doi.org/10.1016/j.respol.2011.09.002.

Laredo, P. 2007. Revisiting the third mission of universities: toward a renewed categorization of university activities?. *Higher education policy*, 20(4), 441–456.

Lavigne, G. L., and R. J. Vallerand. 2010. "The Dynamic Processes of Influence Between Contextual and Situational Motivation: A Test of the Hierarchical Model in a Science Education Setting." *Journal of Applied Social Psychology* 40 (9): 2343–2359. https://doi.org/10.1111/j.1559-1816.2010.00661.x.

Llopis, O., and P. D'Este. 2016. "Beneficiary Contact and Innovation: The Relation Between Contact with Patients and Medical Innovation Under Different Institutional Logics." *Research Policy* 45 (8): 1512–1523. https://doi.org/10.1016/j.respol.2016.03.004.

Llopis, O., P. D'Este, and A. A. Díaz-Faes. 2021. "Connecting Others: Does a Tertius Iungens Orientation Shape the Relationship Between Research Networks and Innovation? Res." *Research Policy* 50 (4): 104175. https://doi.org/10.1016/j.respol.2020.104175.

McNeely, B. L., and B. M. Meglino. 1994. "The Role of Dispositional and Situational Antecedents in Prosocial Organizational Behavior: An Examination of the Intended Beneficiaries of Prosocial Behavior." *Journal of Applied Psychology* 79 (6): 836. https://doi.org/10.1037/0021-9010.79.6.836.

Molas-Gallart, J., Salter, A., Patel, P., Scott, A., & Duran, X. 2002. Measuring third stream activities. *Final report to the Russell Group of Universities. Brighton: SPRU, University of Sussex*, 81.

Obstfeld, D. 2005. "Social Networks, the Tertius Iungens Orientation, and Involvement in Innovation." *Administrative Science Quarterly* 50 (1): 100–130. https://doi.org/10.2189/asqu.2005.50.1.100.

Omoto, A. M., M. Snyder, and J. D. Hackett. 2010. "Personality and Motivational Antecedents of Activism and Civic Engagement." *Journal of Personality* 78 (6): 1703–1734. https://doi.org/10.1111/j.1467-6494.2010.00667.x.

Orazbayeva, B., and C. Plewa. 2022. "Academic Motivations to Engage in University-Business Cooperation: A Fuzzy Set Analysis." *Studies in Higher Education* 47 (3): 486–498. https://doi.org/10.1080/03075079.2020.1761784.

Patil, S. V., and R. D. Lebel. 2019. ""I Want to Serve but the Public Does Not Understand:" Prosocial Motivation, Image Discrepancies, and Proactivity in Public Safety." *Organizational Behavior and Human Decision Processes* 154:34–48. https://doi.org/10.1016/j.obhdp.2019.07.002.

Perkmann, M., M. McKelvey, and N. Phillips. 2018. "Protecting Scientists from Gordon Gekko: How Organizations Use Hybrid Spaces to Engage with Multiple Institutional Logics." *Organization Science* 30 (2): 298–318. https://doi.org/10.1287/orsc.2018.1228.

Perkmann, M., R. Salandra, V. Tartari, M. McKelvey, and A. Hughes. 2021. "Academic Engagement: A Review of the Literature 2011-2019." *Research Policy* 50 (1): 104114. https://doi.org/10.1016/j.respol.2020.104114.

Perkmann, M., V. Tartari, M. McKelvey, E. Autio, A. Broström, P. D'Este, R. Fini, et al. 2013. "Academic Engagement and Commercialisation: A Review of the Literature on University–Industry Relations." *Research Policy* 42 (2): 423–442. https://doi.org/10.1016/j.respol.2012.09.007.

Perkmann, M., and K. Walsh. 2009. "The Two Faces of Collaboration: Impacts of University-Industry Relations on Public Research." *Industrial and Corporate Change* 18 (6): 1033–1065. https://doi.org/10.1093/icc/dtp015.

Pfeffer, J. 1992. *Managing with Power: Politics and Influence in Organizations*. Boston, MA: Harvard Business Press.

Puffer, S. M. 1987. "Prosocial Behavior, Noncompliant Behavior, and Work Performance Among Commission Salespeople." *Journal of Applied Psychology* 72 (4): 615–621. https://doi.org/10.1037/0021-9010.72.4.615.

Ramos-Vielba, I., M. Sánchez-Barrioluengo, and R. Woolley. 2016. "Scientific Research Groups' Cooperation with Firms and Government Agencies: Motivations and Barriers." *The Journal of Technology Transfer* 41 (3): 558–585. https://doi.org/10.1007/s10961-015-9429-4.

Ritz, A., G. A. Brewer, and O. Neumann. 2016. "Public Service Motivation: A Systematic Literature Review and Outlook." *Public Administration Review* 76 (3): 414–426. https://doi.org/10.1111/puar.12505.

Ritz, A., C. Schott, C. Nitzl, and K. Alfes. 2020. "Public Service Motivation and Prosocial Motivation: Two Sides of the Same Coin?" *Public Management Review* 22 (7): 974–998. https://doi.org/10.1080/14719037.2020.1740305.

Roach, M., and H. Sauermann. 2010. "A Taste for Science? PhD Scientists' Academic Orientation and Self-Selection into Research Careers in Industry." *Research Policy* 39 (3): 422–434. https://doi.org/10.1016/j.respol.2010.01.004.

Ryan, R. M., and J. P. Connell. 1989. "Perceived Locus of Causality and Internalization: Examining Reasons for Acting in Two Domains." *Journal of Personality and Social Psychology* 57 (5): 749–761. https://doi.org/10.1037/0022-3514.57.5.749.

Ryan, R. M., and E. L. Deci. 2000. "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being." *The American Psychologist* 55 (1): 68–78. https://doi.org/10.1037//0003-066X.55.1.68 .

Ryan, R. M., and E. L. Deci. 2020. "Intrinsic and Extrinsic Motivation from a Self-Determination Theory Perspective: Definitions, Theory, Practices, and Future Directions." *Contemporary Educational Psychology* 61:101860. https://doi.org/10.1016/j.cedpsych.2020.101860.

Siegel, D. S., D. Waldman, and A. Link. 2003. "Assessing the Impact of Organizational Practices on the Relative Productivity of University Technology Transfer Offices: An Exploratory Study." *Research Policy* 32 (1): 27–48. https://doi.org/10.1016/S0048-7333(01)00196-2.

Soda, G., M. Tortoriello, and A. Iorio. 2018. "Harvesting Value from Brokerage: Individual Strategic Orientation, Structural Holes, and Performance." *Academy of Management Journal* 61 (3): 896–918. https://doi.org/10.5465/amj.2016.0123.

Sonnentag, S., and A. M. Grant. 2012. "Doing Good at Work Feels Good at Home, but Not Right Away: When and Why Perceived Prosocial Impact Predicts Positive Affect." *Personnel Psychology* 65 (3): 495–530. https://doi.org/10.1111/j.1744-6570.2012.01251.x.

Sormani, E., and K. Uude. 2022. "Academics' Prosocial Motivation for Engagement with Society: The Case of German Academics in Health Science." *Science & Public Policy* 49 (6): 962–971. https://doi.org/10.1093/scipol/scac042.

Tartari, V., M. Perkmann, and A. Salter. 2014. "In Good Company: The Influence of Peers on Industry Engagement by Academic Scientists." *Research Policy* 43 (7): 1189–1203. https://doi.org/10.1016/j.respol.2014.02.003.

Tartari, V., and A. Salter. 2015. "The Engagement Gap: Exploring Gender Differences in University–Industry Collaboration Activities." *Research Policy* 44 (6): 1176–1191. https://doi.org/10.1016/j.respol.2015.01.014.

Teplitskiy, M., E. Duede, M. Menietti, and K. R. Lakhani. 2022. "How Status of Research Papers Affects the Way They Are Read and Cited." *Research Policy* 51 (4): 104484. https://doi.org/10.1016/j.respol.2022.104484.

Ter Wal, A. L. J., P. Criscuolo, and A. Salter. 2023. "Inside-Out, Outside-In, or All-In-One? The Role of Network Sequencing in the Elaboration of Ideas." *Academy of Management Journal* 66 (2): 432–461. https://doi.org/10.5465/amj.2020.1231.

Thompson, J. A., and J. S. Bunderson. 2003. "Violations of Principle: Ideological Currency in the Psychological Contract." *Academy of Management Review* 28 (4): 571–586. https://doi.org/10.2307/30040748.

Vallerand, R. J. 1997. "Toward a Hierarchical Model of Intrinsic and Extrinsic Motivation." In *Advances in Experimental Social Psychology*, 271–360. Vol. 29. Academic Press. https://doi.org/10.1016/S0065-2601(08)60019-2.

van de Burgwal, L. H. M., R. Hendrikse, and E. Claassen. 2019. "Aiming for Impact: Differential Effect of Motivational Drivers on Effort and Performance in Knowledge Valorisation." *Science & Public Policy* 46 (5): 747–762. https://doi.org/10.1093/scipol/scz027.

Van der Weijden, I., M. Verbree, and P. Van Den Besselaar. 2012. "From Bench to Bedside: The Societal Orientation of Research Leaders: The Case of Biomedical and Health Research in the Netherlands." *Science & Public Policy* 39 (3): 285–303. https://doi.org/10.1093/scipol/scr003.

Vroom, V. 1964. *Expectancy Theory*. New York: Wiley.

Walsh, J. P., and Y.-N. Lee. 2015. "The Bureaucratization of Science." *Research Policy* 44 (8): 1584–1600. https://doi.org/10.1016/j.respol.2015.04.010.

Wittmayer, J. M., and N. Schäpke. 2014. "Action, Research and Participation: Roles of Researchers in Sustainability Transitions." *Sustainability Science* 9 (4): 483–496. https://doi.org/10.1007/s11625-014-0258-4.

Appendix

Table A1. Factor analysis of research motivations.

List of items*	Uniqueness	Extrinsic	Prosocial	Intrinsic
Career improvement	0.4115	0.7472		
Working conditions	0.4553	0.7220		
Recognition from working colleagues	0.4546	0.7105		
Recognition from peers	0.4283	0.6861		
Societal recognition	0.4756	0.6150		
Job stability	0.6187	0.6046		
Address societal challenges	0.1779		0.8859	
Offer useful responses to societal problems	0.2078		0.8764	
Make an impact on non-academics	0.2925		0.8047	
Intellectual challenge	0.3082			0.8286
Greater autonomy	0.4287			0.7529
Knowledge advancement	0.4754			0.6624
Personal satisfaction	0.5914			0.5866

Notes: Rotated factor loadings and unique variances sorted. Method: principal-component factors with varimax rotation. Only factor loadings greater than 0.5 are reported in the table.

* The survey items are: Career improvement: 'Opportunities for advancement of my professional career'; Working conditions: 'My working conditions (salary conditions, social allowances); Professional recognition from work colleagues: 'Professional recognition from working colleagues'; Professional recognition from peers: 'Professional recognition from the academic community in my field'; Societal recognition: 'The social recognition obtained with my work'; Job stability: 'Job stability to develop my activity'; Address societal challenges: 'My contribution to responding to societal needs or addressing social challenges'; Offer useful responses to societal problems: 'The generation of useful responses to solve specific third-party problems'; Make an impact on non-academics: 'The potential positive impact of my research on non-academic actors'; Intellectual challenge: 'The intellectual challenge of better understanding the problems I face as a researcher'; Greater autonomy: 'The degree of autonomy to develop my work'; Knowledge advancement: 'My contribution to the advancement of knowledge in my discipline'; Personal satisfaction: 'The degree of personal satisfaction derived from my academic and/or research activities'.

Table A2. Correlations

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Joint research_with external partners	1.00																								
2	Joint_research_with industry	0.79*	1.00																							
3	Joint_research_with civil society	0.59*	0.24*	1.00																						
4	Joint_research_with public admin	0.67*	0.34*	0.27*	1.00																					
5	Prosocial res. motivation	0.14*	0.12*	0.10*	0.08*	1.00																				
6	Intrinsic res. motivation	0.02	−0.01	0.03*	0.00	0.30*	1.00																			
7	Extrinsic res. motivation	−0.01	−0.02*	0.00	−0.00	0.37*	0.36*	1.00																		
8	Networking skills	0.18*	0.13*	0.11*	0.12*	0.32*	0.29*	0.24*	1.00																	
9	Nº. publications (log)	0.08*	0.11*	−0.01	0.02*	−0.04*	0.11*	−0.05*	0.04*	1.00																
10	Top publications (ratio)	0.01	0.04*	−0.01	−0.01	0.01	0.05*	0.02	0.03*	0.55*	1.00															
11	Applied research (%)	0.20*	0.18*	0.11*	0.10*	0.28*	−0.16*	−0.04*	0.06*	−0.13*	−0.01	1.00														
12	Age	0.11*	0.08*	0.06*	0.09*	−0.06*	0.06*	−0.18*	0.00	0.32*	0.01	−0.07*	1.00													
13	Female	−0.06*	−0.09*	−0.01	−0.04*	0.14*	0.05*	0.13*	0.02*	−0.10*	−0.03*	0.02*	−0.13*	1.00												
14	Time for teaching	−0.06*	−0.07*	−0.01	−0.02*	−0.07*	−0.05*	−0.05*	−0.09*	−0.11*	−0.08*	−0.03*	0.13*	0.02*	1.00											
15	Time for research	−0.11*	−0.09*	−0.09*	−0.06*	−0.04*	0.06*	0.08*	−0.01	−0.03*	0.02*	−0.12*	−0.22*	0.03*	−0.56*	1.00										
16	Time for admin duties	0.07*	0.05*	0.05*	0.04*	0.00	−0.06*	−0.06*	−0.01	0.03*	−0.01	0.08*	0.09*	−0.05*	−0.19*	−0.49*	1.00									
17	Time for networking	0.14*	0.13*	0.10*	0.05*	0.13*	−0.04*	−0.04*	0.11*	−0.00	0.02	0.20*	0.00	−0.05*	−0.23*	−0.22*	0.04*	1.00								
18	Exp. outside Univ./PROs	0.09*	0.04*	0.10*	0.05*	0.05*	−0.04*	−0.03*	0.04*	−0.09*	−0.04*	0.15*	0.12*	−0.03*	0.05*	−0.09*	0.03*	0.11*	1.00							
19	PhD = Yes	0.02*	0.04*	0.02	0.02*	0.01	0.07*	−0.00	0.03*	0.17*	0.11*	−0.07*	0.26*	−0.02	0.15*	−0.20*	0.05*	−0.05*	−0.02*	1.00						
20	University	−0.04*	0.01	−0.01	0.00	−0.03*	−0.02*	0.00	−0.02	−0.20*	−0.10*	−0.06*	−0.01	−0.03*	0.35*	−0.18*	−0.02	−0.10*	−0.02*	0.10*	1.00					
21	Research centre	−0.00	0.00	−0.02*	0.01	0.04*	0.06*	0.03*	0.01	0.24*	0.13*	−0.09*	0.03*	0.03*	−0.38*	0.23*	0.00	0.04*	−0.05*	0.01	−0.75*	1.00				
22	Hospital	0.03*	−0.04*	0.03*	−0.03*	−0.00	−0.06*	−0.04*	−0.02*	−0.05*	−0.04*	0.19*	−0.06*	0.02*	−0.04*	−0.01	0.03*	0.08*	0.06*	−0.17*	−0.40*	−0.10*	1.00			
23	Hybrid	0.07*	0.02*	0.04*	0.02	0.00	0.00	−0.01	0.04*	0.05*	0.01	0.08*	0.03*	−0.02*	−0.03*	−0.01	0.00	0.05*	0.07*	−0.04*	−0.36*	−0.09*	−0.05*	1.00		
24	Team size	0.24*	0.22*	0.14*	0.13*	0.10*	0.06*	0.03*	0.17*	0.13*	0.05*	0.06*	0.06*	−0.03*	−0.10*	−0.02	0.05*	0.06*	0.01	0.04*	0.01	0.01	−0.06*	0.03*	1.00	
25	Nº. of disciplines in the team	0.20*	0.13*	0.17*	0.13*	0.17*	0.05*	0.01	0.19*	−0.00	0.02*	0.11*	0.01	−0.02*	−0.10*	−0.01	0.03*	0.10*	0.06*	0.00	−0.04*	0.05*	−0.03*	0.03*	0.38*	100

Notes: * $p < 0.05$. $N = 10{,}334$.