WHO ARE THE PROFESSIONALS AT THE INTERFACE OF SCIENCE WORKING AT RESEARCH FUNDING, SCIENCE POLICY MAKING, AND SIMILAR ORGANISATIONS?

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ABSTRACT

The scientific endeavour involves not only those working in research performing organisations—but also those in science funding, policy making, and think tank organisations, among others. The workforce in all these entities is composed of researchers, policy decision makers, managers, administrators, technicians, and other supporting staff. Within this community, professionals working at the interface of science (PIoSs) can be defined as those working in the research management and administration (RMA) domain, including varied areas such as science strategy and policy support, research funding procurement, project management, facilities management, communication and dissemination, knowledge and technology transfer, valorisation and impact, and related areas. Researchers have been often studied, namely regarding their job satisfaction, entrepreneurial spirit, and migration patterns. However, the PIoS community has seldom been studied, with only a few reports existing, for example on their profile and roles. Specifically, the PIoS community working at non-research performing organisations has not been explicitly addressed in the literature. This paper reports on the results of an ongoing project aimed at studying the profiles, roles, and functions of PIoSs working at organisations such as research funders, policy makers, and think tanks. The corresponding specificities of these professionals are highlighted and their involvement in professional associations is addressed. It is argued that they are intrinsically part of the wider PIoS (often called RMA) profession and that their full engagement in this community would benefit these individuals and the research and innovation ecosystem at large.

Keywords:

Professionals at the Interface of Science (PIoSs); Research Management and Administration (RMA); Research Funding Agencies; Science Policy Making Agencies

INTRODUCTION

Research and innovation (R&I) ecosystems can be seen as a complex network of stakeholders that cooperate towards the production of scientific and technological knowledge and its incorporation in the society at large, from productive firms to socially-driven enterprises and, ultimately, to citizens. Core institutions in the ecosystems

include policymaking, funding, research and innovation performing and interface organizations (e.g., science and technology parks), companies, and user associations, among others.

R&I ecosystems rely on the creation of knowledge, and this is centred on communities of specialised professionals that acquire the required skills and competences through formal education (e.g., PhD) and/or through experiential learning or professional qualifications. Focusing only on the research production subset of entities, these include policymakers, staff at policy implementation agencies (e.g., funders), researchers, and all the staff that does not perform research but interfaces with researchers at some point.

Research funding agencies take the role of science funding, and some employ their own scientists directly (e.g., the Centre National de la Recherche Scientifique, in France). Their activity is financed from budgets distributed by central government, according to programs and high-level science policies (Braun, 2003; Gulbrandsen, 2005). Therefore, they play an important part in the design and implementation of science and technology policies by translating political orientations into effective activities. They constitute operational pillars for policy makers and the research community.

Research funding agencies generally allocate funds on a competitive basis. Traditional academic research funders, such as research councils, often give precedence to fundamental, disciplinary-based research issues. Thus, they put emphasis on research topics from a bottom-up perspective (Benner & Sandstrom, 2000). Mission-oriented programmes, and agencies, are increasingly designed to deal with problem-oriented research. In this case, research funding is directed to certain communities of practice (e.g., cancer research), interest groups (e.g., space), and the society at large (e.g., sustainable development). Therefore, they encourage researchers to focus on socially relevant topics.

Generally speaking, in the public sector research policy covers the design, funding, assistance, and deployment of scientific and technological resources, in the context of the "knowledge economy". Typically, science policies emanate from governmental structures such as ministries. Some research funding agencies do however contribute to science policymaking e.g., by developing prospective reports. The intermediary role of research funding agencies and the intricacy of their mandates brings about frictions in their interactions with the state and the scientists (Veletanlić & Sá, 2020). These conflicts derive partially from safeguarding that policy objectives determined by governments are tackled while preserving scientific standards and complying with institutionalised practices.

Science policymaking is often supported by science and technology "observatories". These may take the form of science indicators units, research units on policy, or statistical offices. Moreover, "regulatory" agencies, defining and managing standards, norms and regulations for specific areas (e.g., the Food and Drug Administration agency in the United States) directly influence science policymaking and the research endeavour process itself.

The professionals that work in the above-described organisations are the main interface with the researchers' community. Researchers have been regularly studied, and issues such as their satisfaction at the job (Sabharwal, 2011), professional mobility (Scellato et al., 2015) and entrepreneurial spirit (Krabel & Mueller, 2009) have been addressed. However, the groups of professionals that "orbit" around researchers have seldom been studied and addressed in the literature. This is particularly evident for those professionals working at the interface of science, defined as those "working on the broader areas of the so-called research management domain, including communication and dissemination, knowledge and technology transfer, valorisation and impact, science strategy and policy support, research funding, project management, laboratory management, and other areas of research affairs" (Agostinho et al., 2020, p. 19). This definition somewhat extends the traditional concept of research managers and administrators (RMAs) to those professionals that typically are not always associated with this specific community such as science communicators and scientific facilities managers. Thus, the term 'professionals

at the interface of science' (PIoSs) is related to the roles these professionals fulfil within every institution that performs scientific research. This definition has been recently extended (Santos et al., 2021a) to include those professionals working at organisations that do not perform scientific research but that are an intrinsic part of R&I ecosystems, that is, PIoSs working at e.g., science policymaking, research funding, observation, think tanks, and the like. To the best of our knowledge this community of professionals has never been characterised in terms of their profile, roles, and functions.

Professional associations perform a key role in the development of communities of professionals that share a scope of action and intervention. This includes contribution to the formal/legal recognition of specific professions, professional accreditation, initial and continuous competencies development, information dissemination, job market promotion, among other activities. RMA associations have existed since the mid-20th century. The first professional association, the National Council of University Research Administrators was formed in the USA in 1959. Since then, many other national and regional associations have been created around the world and there is even an umbrella organisation—the International Network of Research Management Societies—that was established in 2001 seeking to share good practices around the world. These professional associations perform some or all the above-mentioned activities and have been fundamental for the formal recognition of RMA, for the definition of competences frameworks, and accreditation schemes.

PIoSs involved in these associations are mainly based in research-performing organizations (RPOs). Nevertheless, a few professionals from non-research-performing organizations (non-RPOs) do engage with RMA professional associations (Kerridge & Scott, 2018a; 2018b). This supports the idea that this subset of PIoSs are indeed part of the wider RMA community and instigated the initiation of a research project focused on the characterisation of these professionals, their identity, profile, roles, functions, and RMA community engagement.

In face of the above, the research questions addressed in this study are the following:

1. What are the similarities and differences in terms of profile, functions, and roles between non-RPO PIoSs working at science funding, policy organisations, and the like, and those RPO PIoSs working at higher education institutions, research centres, and other research-performing organisations?
2. Are these professionals actively integrated in existing formal and informal, national and international RMAs associations? If not, why? Should they?

To this end, an emergent, inductive qualitative approach was used as an exploratory study. The specific stages followed in addressing the research questions comprised an online survey and semi-structured interviews.

We will provide an overview of research funding, policymaking, think tanks, and related organisations, including existing research on these organisations. This is followed by an outline of existing studies on PIoSs. Next follow a description of the inquiry methods used, and the presentation and discussion of major findings. Finally, relevant conclusions are drawn and future research directions are indicated

RESEARCH FUNDING, SCIENCE POLICYMAKING, THINK TANKS, AND RELATED ORGANISATIONS

Research on funding agencies has been focused on varied topics. Cordero et al. (2008) discussed their role in encouraging knowledge translation and exchange through the research community. According to those authors, this includes the function of scientific information disseminators and, potentially, knowledge brokers, and promoters of end-users' involvement in prioritizing research areas. According to Kamenetzky & Hinrichs-Krapels

(2020), there is an increasing drive for these organizations to be responsible not only for research governance and administrative functions but also for the longer-term impacts of the supported research activities. This has been addressed by several other authors' research, e.g., Luukkonen & Thomas (2016), and Witty (2013). Veletanlić & Sá (2020) have discussed their role as occupying regions of contention between research and political actors. Additionally, research funding agencies have been described as key in the internationalisation of research, as a way to access complementary expertise, to discuss ideas, and to cooperatively resolve complex and inherently global issues in ways that go beyond what would be possible for individual researchers or national institutions (Lasthiotakis et al., 2013; Sergi et al., 2014). The contribution of these organisations in framing key societal issues such as sustainable development has also been addressed (Mobjörk et al., 2006). That author concluded that the focus has been on the environmental dimension, neglecting economic and social aspects. The impact on research funding of the increasing emphasis on commercial applications has also been addressed, for example by Ylijoki (2003), and Sá & Litwin (2011). However, to the best of our knowledge, no study on PIoSs at research funding, science policymaking agencies, and related organisations has yet been carried out.

PROFESSIONALS AT THE INTERFACE OF SCIENCE

Existing literature on studies focused on PIoSs is limited essentially to those working at RPOs. Nevertheless, it does provide useful general information on the profession and hints to the recognition of PIoSs working at non-RPOs. As an example Virág et al. (2020) conducted a survey and interviews to understand the training and education needs of RMAs specifically working with fundraising and implementation of EU-funded projects. The study concluded that the majority of the respondents were highly qualified, with 91.6% with at least a master's degree and 29.7% with a doctoral degree. In addition, the gender representation showed the same picture reported by others (Kerridge & Scott, 2018a; Shambrook, 2012) with a majority of female respondents (72.3%). The respondents also acknowledge the importance of networks for professional development and as a community of practice for daily jobs. The authors assert that certified training in Research Management and Administration contributes to the recognition of knowledge and competences which provides more visibility and better career development. In the interviews, RMAs testified that the lack of professional identity impacted on their recognition and career perspectives.

The professional frameworks, identity, functions and impact of PIoSs have been the subject of a relatively small but growing number of research projects. For example, Shelley (2010) conducted a survey to assess the changes of roles and functions of university RMAs in the United Kingdom, concluding that these professionals have a diversity of roles and a broad range of responsibilities. Schützenmeister (2010) conducted a literature review to understand the skills that researchers and RMAs may have in common, namely those brought from higher education management and from academia. It was noted that professionals with a scientific background are contracted as specialists in research management, making decisions with reference to scientific knowledge and the societal environment of research, in contrast with "pure" administrators. The author also points to the existence of a second form of research management, by referring to program managers at research funders that act as "mediators who observe scientific development closely and try to relate new research areas to political agendas" (p. 3). Poli (2018) delivered an extensive review of roles, professional development, and advancement of the research management profession, although reference to PIoSs at non-RPOs is absent.

References to PIoSs at non-RPOs are in fact rare. Authors such as Braun (1998), Wenneberg (2001), Schützenmeister (2010), Goldstein and Kearney (2020), and Arnott et al. (2020), address the roles of research management and administration at research funding entities, but not the professionals per se. In what concerns PIoSs at non-RPOs, the only published study where they could be identified is that of Kerridge and Scott (2018a). The authors developed the Research Administration as a Profession (RAAAP) survey aimed at obtaining a snapshot of the RMA profession around the world. The main objectives of the survey were to determine the perceptions of the importance of

technical skills and transferable skills of these professionals, and to collect demographic information. From the respondents, 0.7% and 0.6% could be identified as working in research funding and governmental departments, respectively. Professionals working at charities, private companies, and hospitals represented 0.3%, 0.9%, and 3.3%, respectively. Thus, a potential total of 5.7% of the 2,673 respondents worked at non-RPOs. However, this is an upper estimate as some of these latter categories could include RPOs, for example companies that perform research, charities that perform as well as fund research. Due to the nature of the survey methodology, this group is likely to be under-represented in the response set, because they may be unlikely to be members of the RMA associations that distributed the questionnaire to their members. Still, this clearly indicates that there is a possible key "hidden" community of PIoSs that needs to gain visibility in the RMAs professional context.

In face of the above, while incipient studies have been conducted, more research is needed to broaden the characterization and understanding of the scope and professional frameworks of PIoSs at non-RPOs.

METHODS

The methodology adopted was a mixed methods approach, consisting of quantitative and qualitative data based on an online survey and interviews. The authors selected mixed methods for a deeper understanding of qualitative and quantitative data collection and analysis (Saunders et al., 2009) of aspects such as demographic (age, gender), academic (qualifications, topics) and professional (career, tasks, roles) profiles, and involvement in professional associations (reasons, activities, interaction with colleagues, and training activities). The study was implemented in two stages. In the first stage, the authors conducted a survey targeting PIoSs working at government related ministries, agencies and institutions dedicated to research funding and/or policymaking in different parts of the world. The second stage was composed of interviews to all respondents who participated in the survey and agreed to be interviewed. Both phases of the study, the survey, and the semi-structured interviews, were exploratory and inductive in nature.

Surveys are the most widespread form of empirical social research for gathering data, knowledge, ideas, attitudes, or evaluations of social structures (Gaisch et al., 2019). Given that surveys tend to measure beliefs and not necessarily actions, they are subject to various response biases. Arguably, with a purposive sampling approach addressing a pre-selected expert cohort, cognitive and systemic biases are more likely to occur. For one, non-probability sampling draws on the subjective judgement of the researchers. In addition, the participants that represent the phenomena of interest may have been biased to provide predominantly positive responses. To minimize this bias, both structured and open-ended questions were asked. Also, all identified persons have experience in the investigated topic and draw on a variety of knowledge sources (academic, semi-formal, informal, tacit) that allow them to provide knowledgeable answers to all relevant questions and to make informed decisions about who to address in case of doubt. Arguably, the small sample size (n = 72) does not allow for a full breadth of views and limits the robustness of our analysis. It needs to be stated here that this investigation represents a preliminary, purely descriptive data analysis, which may form the basis for further analysis with a richer data set and a larger sample.

The survey was administered online, using the Qualtrics platform, and responses were collected between June 2020 and March 2021. Content validity of the questionnaire was ensured by means of careful definition of the research constructs through a literature review (Santos et al., 2021a) as well as using expert judgment (Saunders et al., 2009). The questionnaire was reviewed by a pilot group of respondents (PIoSs). Their feedback informed the final questionnaire instrument (Santos et al., 2023a).

The questionnaire was composed of six sections: profile, career, training and continuous professional development,

identity and role in R&I ecosystems, membership of professional networks, and interaction with other stakeholders in R&I ecosystems. Likert-type scales were employed when relevant. Open-ended responses were also utilised in order to collect additional information whenever the respondents considered it necessary to support their responses.

The questionnaire was disseminated among the authors' professional contacts at non-RPOs (e.g., research funders, innovation agencies, governmental offices) and through several existing RMA associations (ARMA, ARMS, BRAMA, CARA, EARMA, NCURA, NORDP, RMAN-J, SARIMA, and SRA-I). An invitation letter was sent via email including a link to the online survey. A series of reminders were sent to maximise the number of responses.

A total of 72 responses were obtained (Santos et al., 2021b). Data analysis was carried out using the SPSS software, version 26. Although it was made clear and stressed that the survey was aimed at PIoSs working at non-RPOs, a significant number of responses originated in RPOs (e.g., Universities, R&D laboratories). In total there were 37 responses from non-research-performing organisations and 35 from research-performing institutions. This may have been due to the wider dissemination through RMA associations. It provided the opportunity to contrast the profile of these two subsets of PIoSs, for the questions that were not specific for PIoSs at non-RPOs.

The survey data was coded, anonymised, and analysed using descriptive statistics methods. No inferential statistical analyses were undertaken as the response level was too low for this to be meaningful. Thus, this study is exploratory in nature.

The data collected were analysed and compared and contrasted, whenever possible, with data from two Research Administration as a Profession surveys—from its 2016 (RAAAP-1) and 2019 (RAAAP-2) iterations. In RAAAP-1 (Kerridge & Scott, 2018b) and RAAAP-2 (Kerridge et al., 2022) a total of 65 [2.4% of n=2,691] and 108 [2.5% of n=4,325] responses were obtained from PIoSs working at non-RPOs, respectively. The RAAAP-2 data were provided in draft status by the RAAAP task force and processed and analysed following the protocol described for the PIoS study. The RAAAP surveys were aimed at members of RMA associations. The present PIoS survey was disseminated directly among professionals at non-RPOs, and among RMA associations.

The framework that supported the interviews comprised four categories: "background/profile", "professional identity", "involvement in professional networks or associations of PIoSs", and "training and development needs". It was generally based on the Interview Protocol Refinement Framework (Castillo-Montoya, 2016). Care was taken to not restrict the interviewees' answers, and to allow for a free expression of opinion on the topics addressed. A total of six semi-structured interviews were conducted remotely using the Zoom platform. An informed consent form signed by the participants was collected prior to their interview. All the authors were present for each interview, and for consistency the first author led each one. An interview template (Santos et al., 2023b), which had been shared with interviewees beforehand in order that they could prepare, was used to guide the conversations. The characteristics of the interviewees can be seen in Table 1. The interviews were recorded using the Zoom platform, transcribed using Microsoft 365 Word and anonymised by the authors conducting the study. Each transcript was then checked and edited by one of the authors (the work was divided) and shared back with the interviewee for checking and correction. Text analysis was used to infer and collect information relevant to the research questions addressed in this study.

Table 1: Interviewees' Characterization

Ref.	Gender	Age range	Country	Job designation	Highest qualification	Seniority level	Tasks as PIoS
1	F	35-40	UK	Head of department	PhD	Junior	Open science services
2	M	25-30	PT	Team leader	MSc	Junior	Deploying research funding instruments
3	F	55-60	AU	CEO	PhD	Senior	Deploying research funding instruments
4	M	55-60	SP	Head of department	PhD	Senior	Science policy making
5	F	35-40	HU	Research officer	PhD	Junior	Supporting research funding acquisition
6	F	25-30	PT	Project manager	MSc	Junior	Deploying research funding instruments

RESULTS

In the following sections, the demographic, institutional, academic, and professional profiles of the survey respondents are presented, analysed, and discussed. The demographic profile provides an overview of the age range, gender, and country of employment of the respondents. The institutional profile provides information on the type of institution the respondents work for, namely research funding, science policymaking, observation (collection and analysis of statistical data), think tanks, among others. The academic profile covers the highest academic qualification and corresponding thematic area. The professional profile provides an insight on the professional activity before becoming a PIoS, seniority level, and tasks as a PIoS. Their involvement in professional networks is characterized in terms of the reasons for being or not being enrolled, relevance of activities, participation level, the influence of the highest academic qualification subject area, and of the tasks performed on membership.

Finally, the information compiled during the interviews is analysed in relation to the survey data, to clarify and detail aspects highlighted by the respondents.

The Figures presented show the data retrieved from the survey; they include responses from both PIoSs working at non-RPOs (referred to as "not@RPOs") and PIoSs working at RPOs (referred to as "@RPOs") are shown. In addition, a comparison is made between the collected data in the PIoS survey with corresponding data from the RAAAP-1 and RAAAP-2 surveys (referred to as "RAAAP-1" and "RAAAP-2", respectively), that is to say the subset of RAAAP responding RMAs working at non-RPOs (or to be fully accurate, including those organisations that are not predominantly RPOs as the RAAAP questionnaires did not directly differentiate).

DEMOGRAPHIC PROFILE

*Figure 1: Age Range of the Respondents*
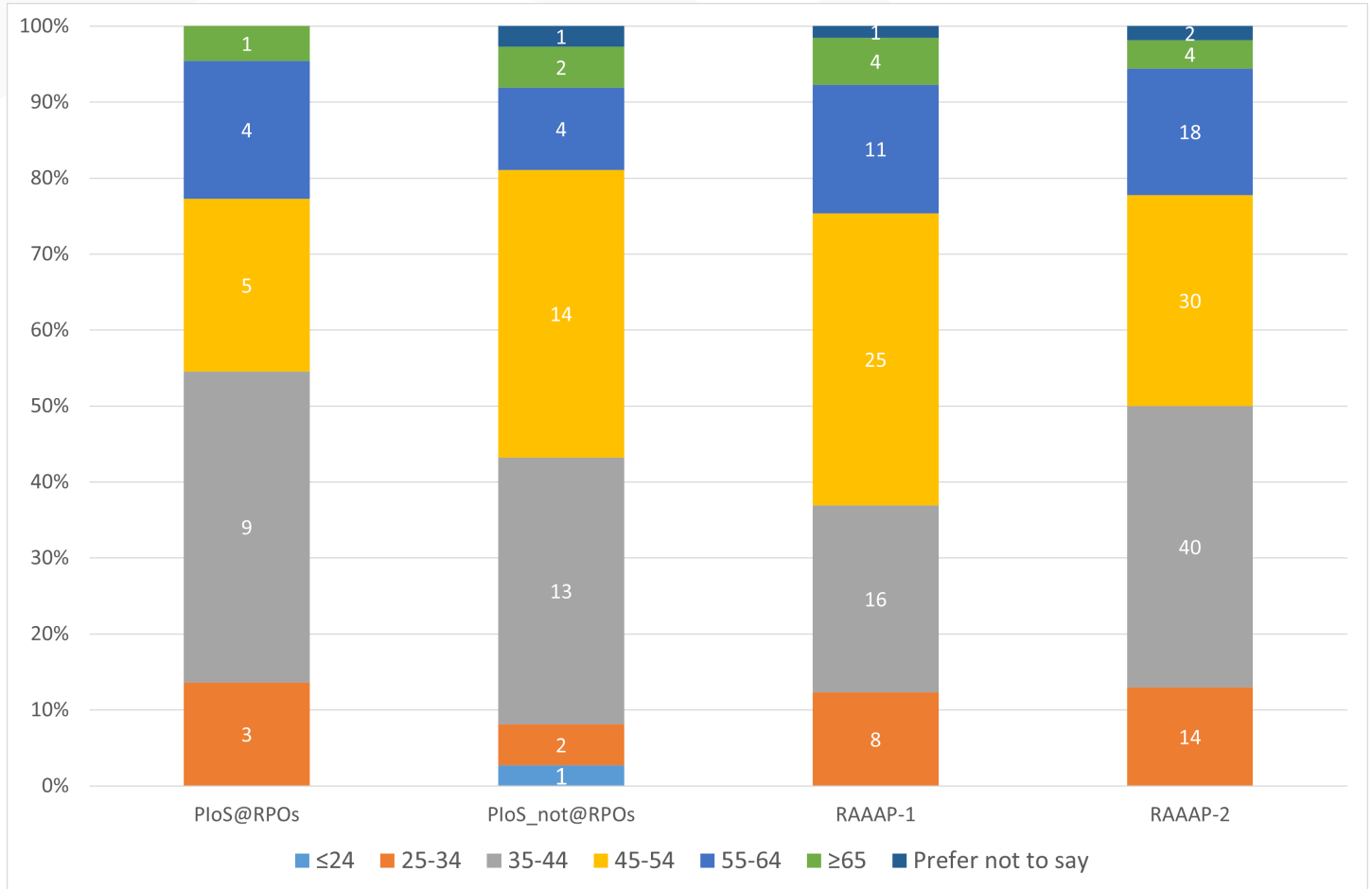
The majority of the respondents are between 35 and 54 years old, as shown in Figure 1. This applies to all the datasets analysed, indicating that professionals in this age range are predominant or more receptive to participate in these surveys. It suggests that few PIoSs find their way into the profession early in their life.

Figure 2: Gender of the Respondents
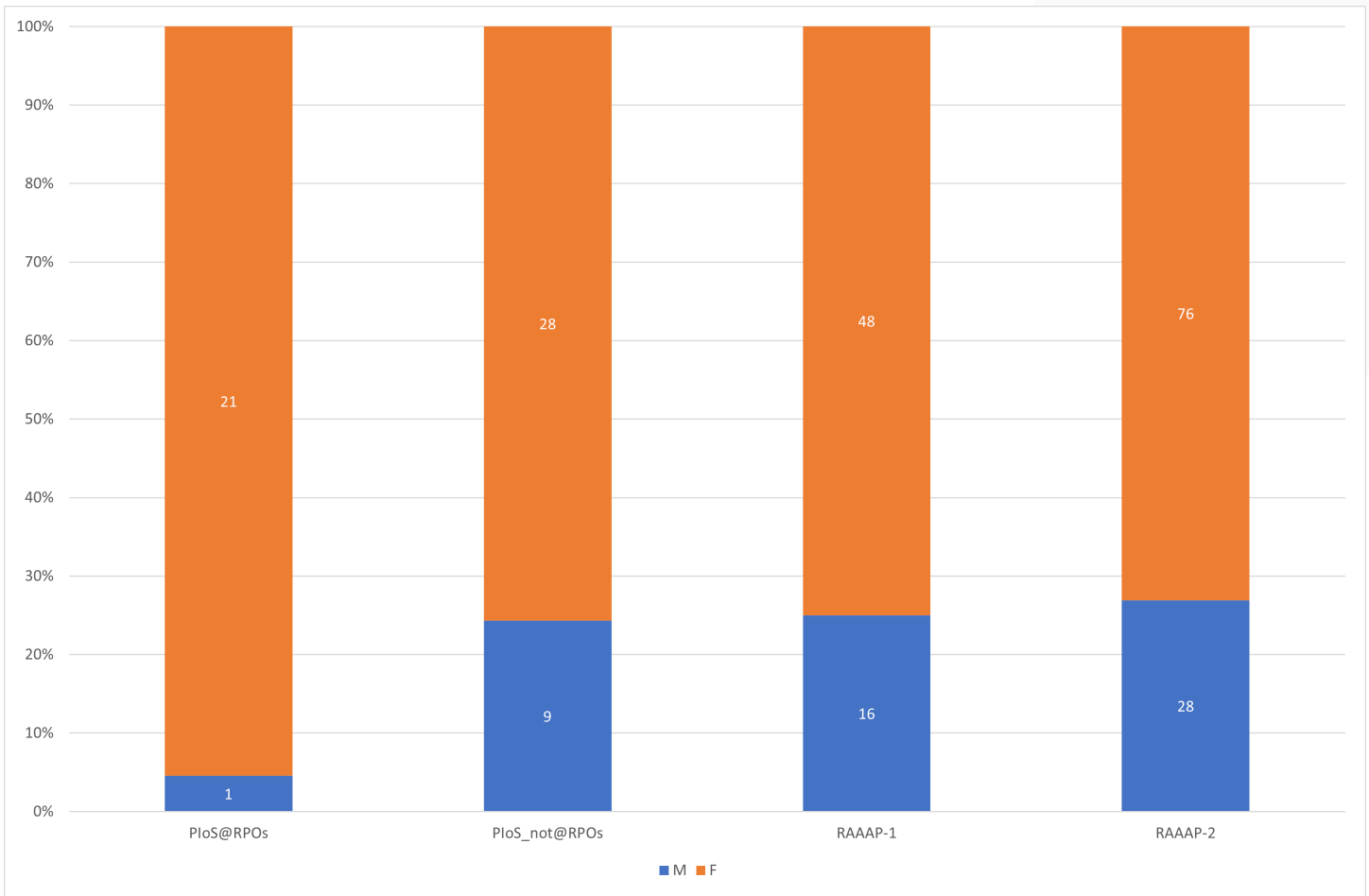
Approximately 75% of the PIoSs at non-RPOs that participated in the three surveys (PIoS, RAAAP-1, and RAAAP-2) are women. This proportion increases to 95% for PIoSs at RPOs. This gender split is also reflected in the worldwide average for RMA: 75.5% of n=4,286 in RAAAP-2 (2019), and 77.0% of n=2,677 in RAAAP-1 (2016).

Figure 3: Working Country of the Respondents
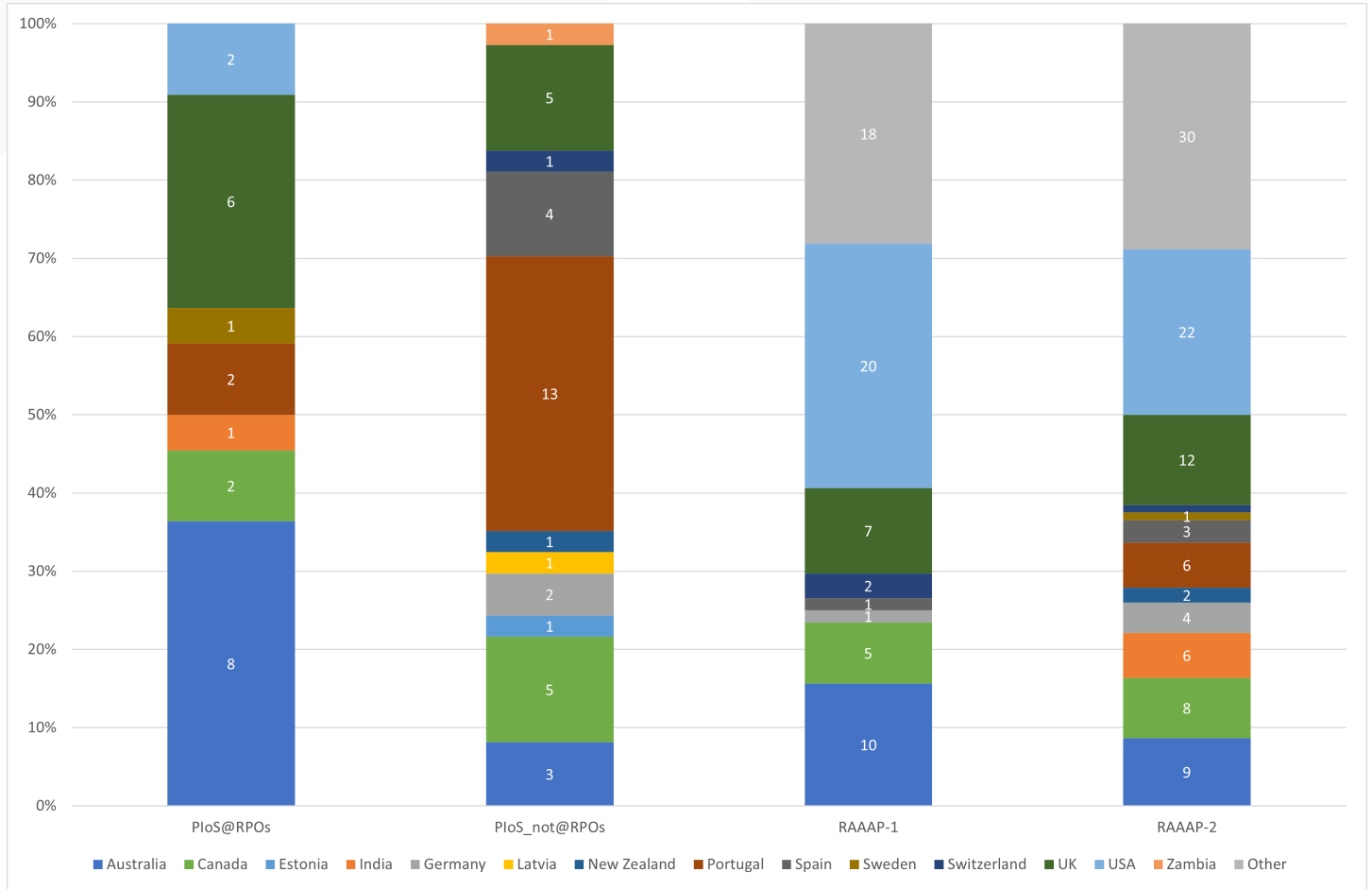
The working country of the respondents varies significantly among the different studies. This relates to the nationality of each survey team and the respective reach of respondents. The PIoS survey had a large presence of Portuguese and British nationals, and the RAAAP surveys had a large presence of North American and British nationals. Nevertheless, we consider that all surveys had an acceptable geographical representativeness of major regions worldwide.

INSTITUTIONAL PROFILE

Around half of the respondents (49%, 42% and 53% for PIoS, RAAP-1 and RAAAP-2, respectively) work at research-funding organisations (Figure 4). The remaining institutional categories considered vary between the PIoS and the RAAAP surveys. For the PIoS survey, the second most representative institution type is that of science policymaking, followed by think tanks, and other types of organisations (Figure 5).

Figure 4: Institution Type of the Respondents Working at Non-RPOs
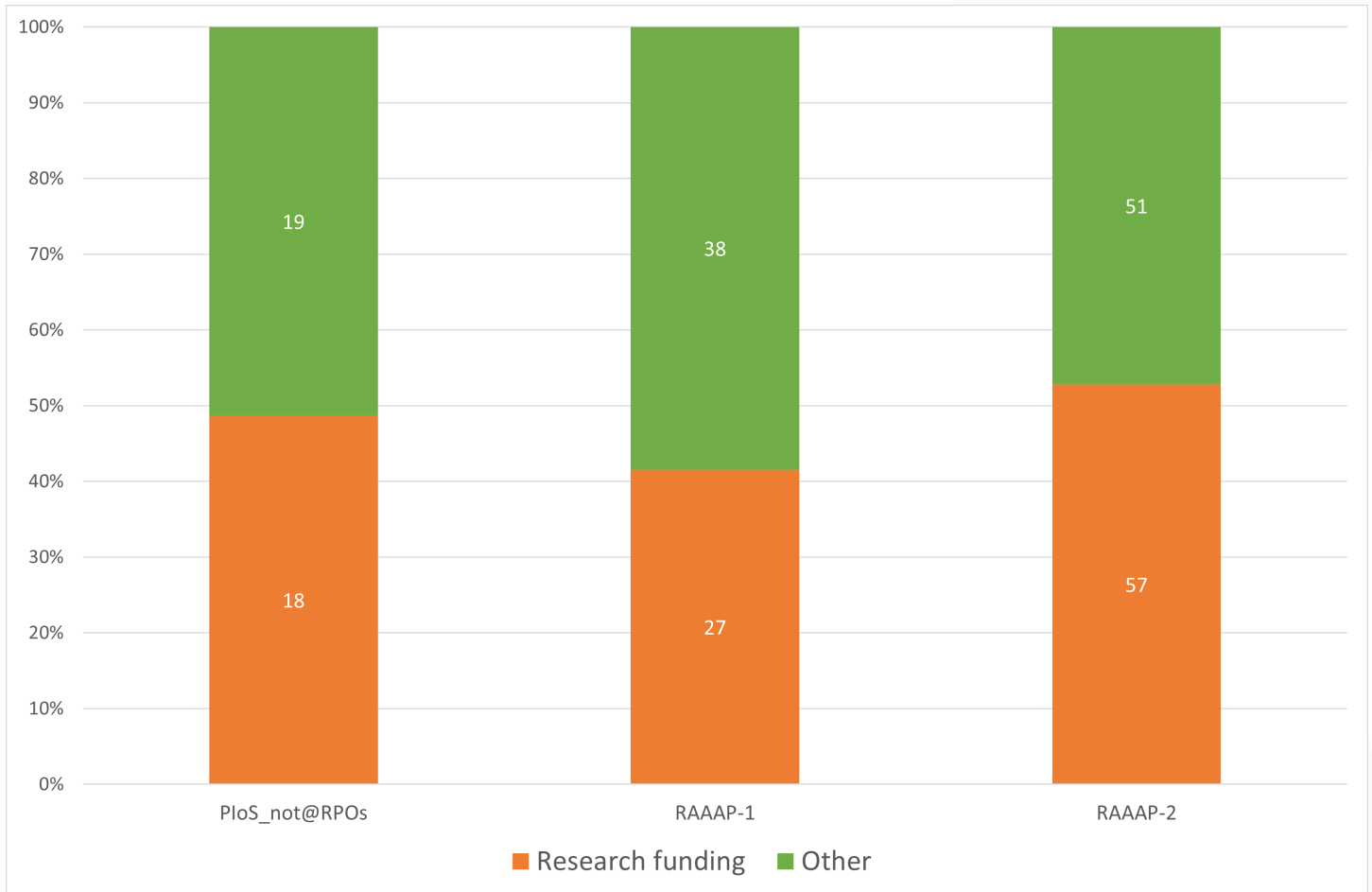
Figure 5: Detail of the Institution Type of the Respondents of the Pios Survey Working at Non-RPOss
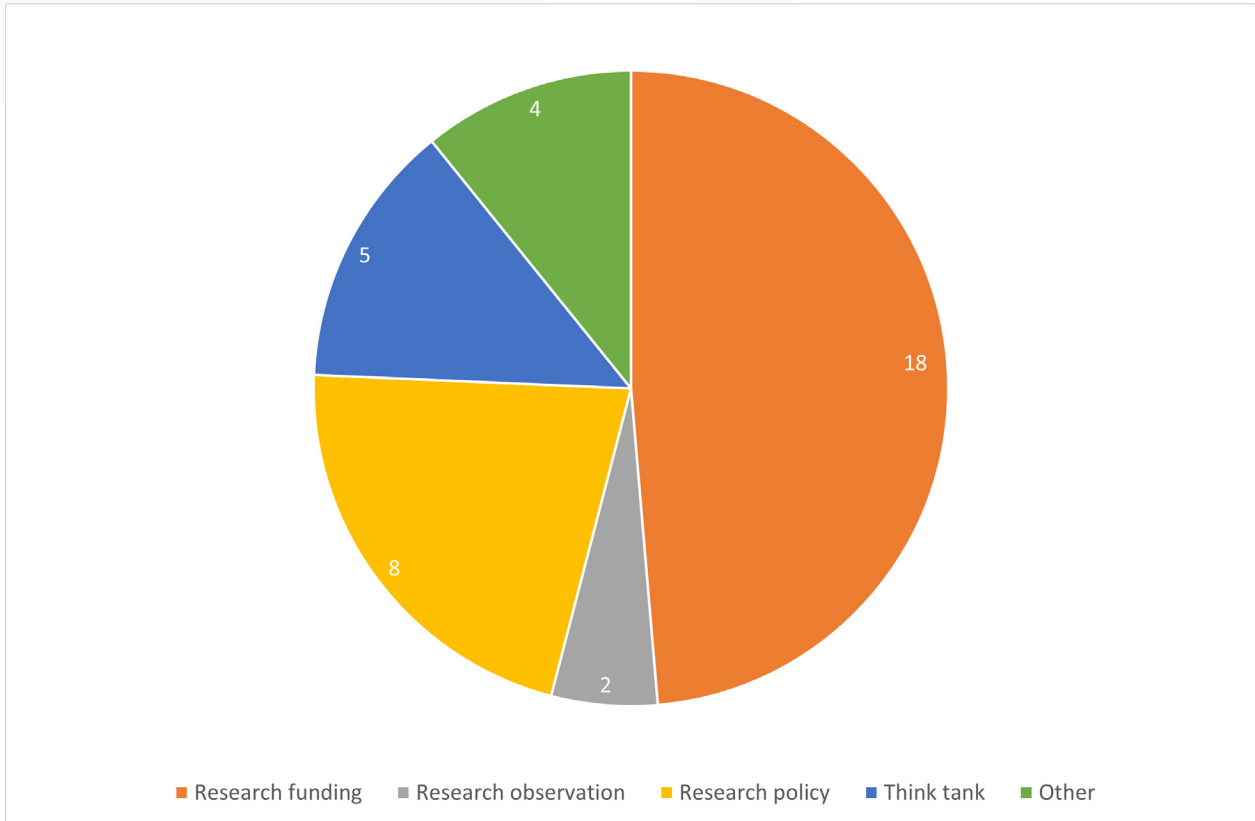
Figure 6: Academic Qualifications of the Respondents
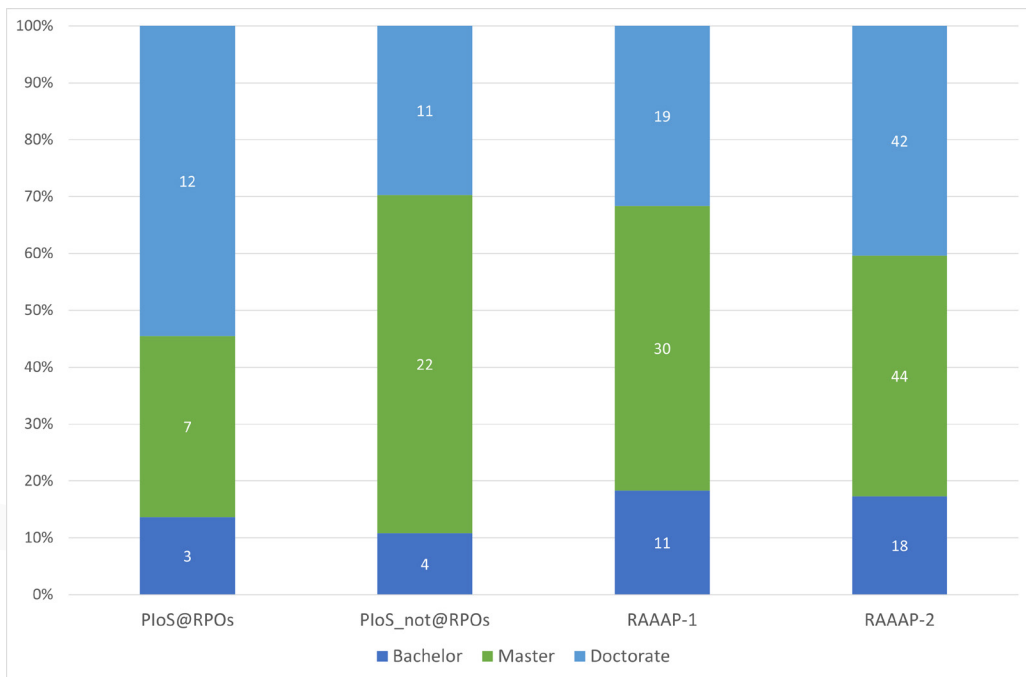
The professionals working at non-RPOs holding a doctorate represent 30%, 32% and 40% of the respondents of the PIoS, RAAAP-1, and RAAAP-2 surveys, respectively (Figure 6). This confirms that a significant share of these respondents has a research background but moved to managerial roles outside academia. The reasons why this may happen were further enquired in the interviews and are detailed in the corresponding section. In the PIoS study, 55% of the respondents working at RPOs hold a doctorate degree. This may derive from the fact that PIoSs working in RPOs have more employment opportunities in academic institutions than in e.g., research funders, or it could be derived from incentives to pursue doctorates due to the highly qualified environment they are integrated in.

The academic background of the respondents is diverse (Figure 7). An average 33% of the respondents that work at non-RPOs have Natural Sciences as the highest qualification area followed by Social Sciences (average 22%) and Business and Economics (average 18%). This demonstrates the variety of backgrounds of the PIoSs. This observation is reinforced by the variety of tasks that they execute (cf. Figure 11). The scenario does not change significantly for the respondents from RPOs: Natural Sciences and Social Sciences are still well represented (32% for each) but followed by Medicine and Health Sciences (27%).

*Figure 7: Highest Qualification Area of the Respondents*
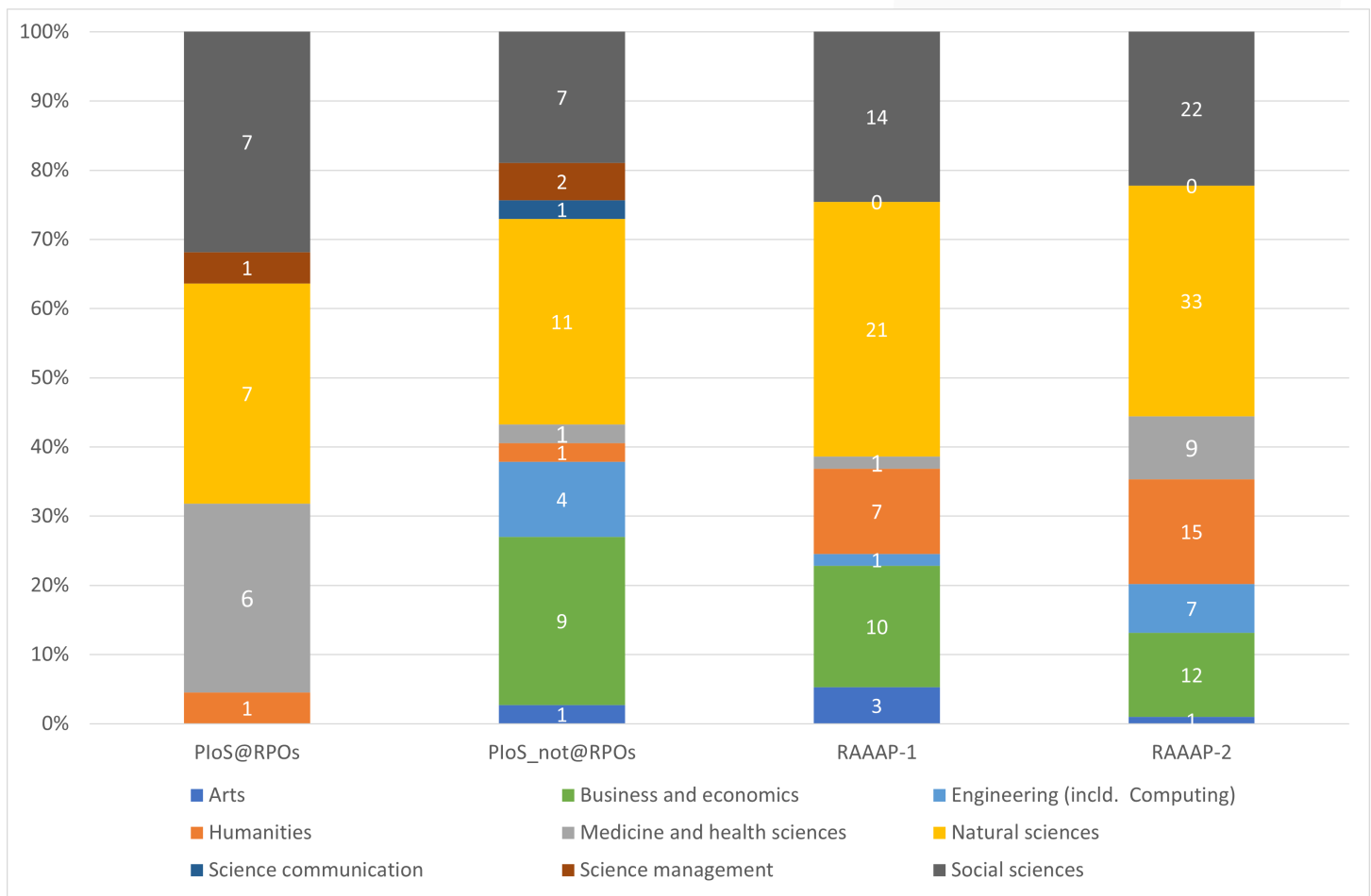
PROFESSIONAL PROFILE

*Figure 8: Profession Before Becoming a PIoS*
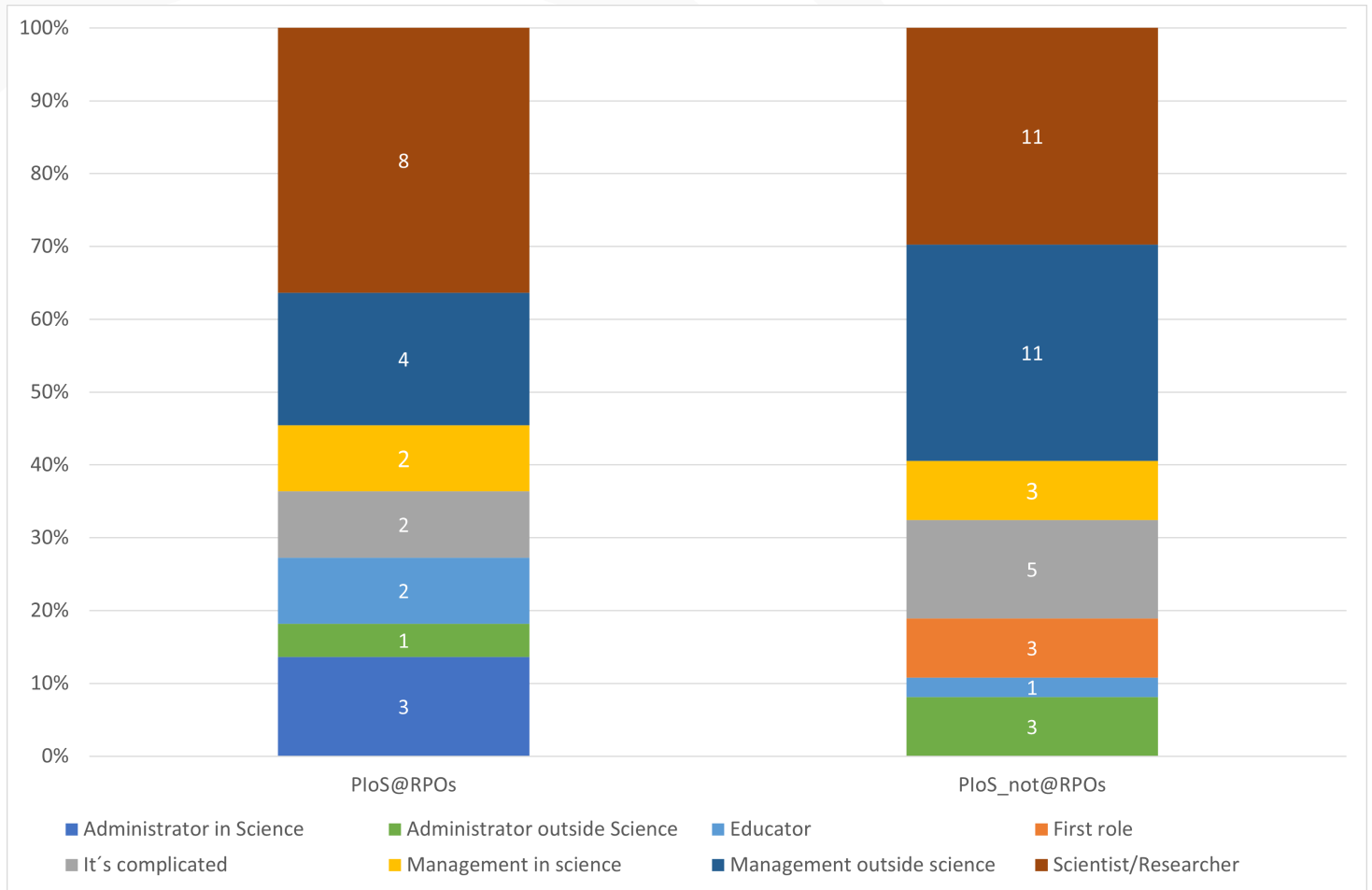
Most of the respondents of the PIoS study have a scientist/researcher or "management outside science" professional background, with the former being more representative for respondents from non-RPOs. This duality of quite different professional backgrounds is notable and could be attributable to lack of career prospects in the case of former scientists/researchers, and to the still emergent professional field of PIoSs in the case of professionals coming from a "management outside science" professional area. Being a researcher requires knowledge and critical thinking, comprehension ability, problem analysis, networking abilities, and, often, multidisciplinarity, ability to acquire and communicate scientific and technical jargon, and awareness, or ease of identification of scientifically relevant challenges and the constant update consequence of the competitiveness of the profession. It also involves a good understanding of the academic administrative procedures and routines. Management outside science involves e.g., a culture towards administrative practices, regulations, and a good knowledge of accounting and reporting systems. It is, therefore, complementary to the profile of former scientists. Indeed, the co-existence of these two profiles is highly desirable when interfacing researchers with funders, policymakers and the like. However, it is essential that PIoSs with a scientific background get training on management competencies, and that former managers outside science receive training on scientific culture and practices, in order to create bridges among these two profiles.

Figure 9: Former Researchers/Scientists Working at Non-RPOs
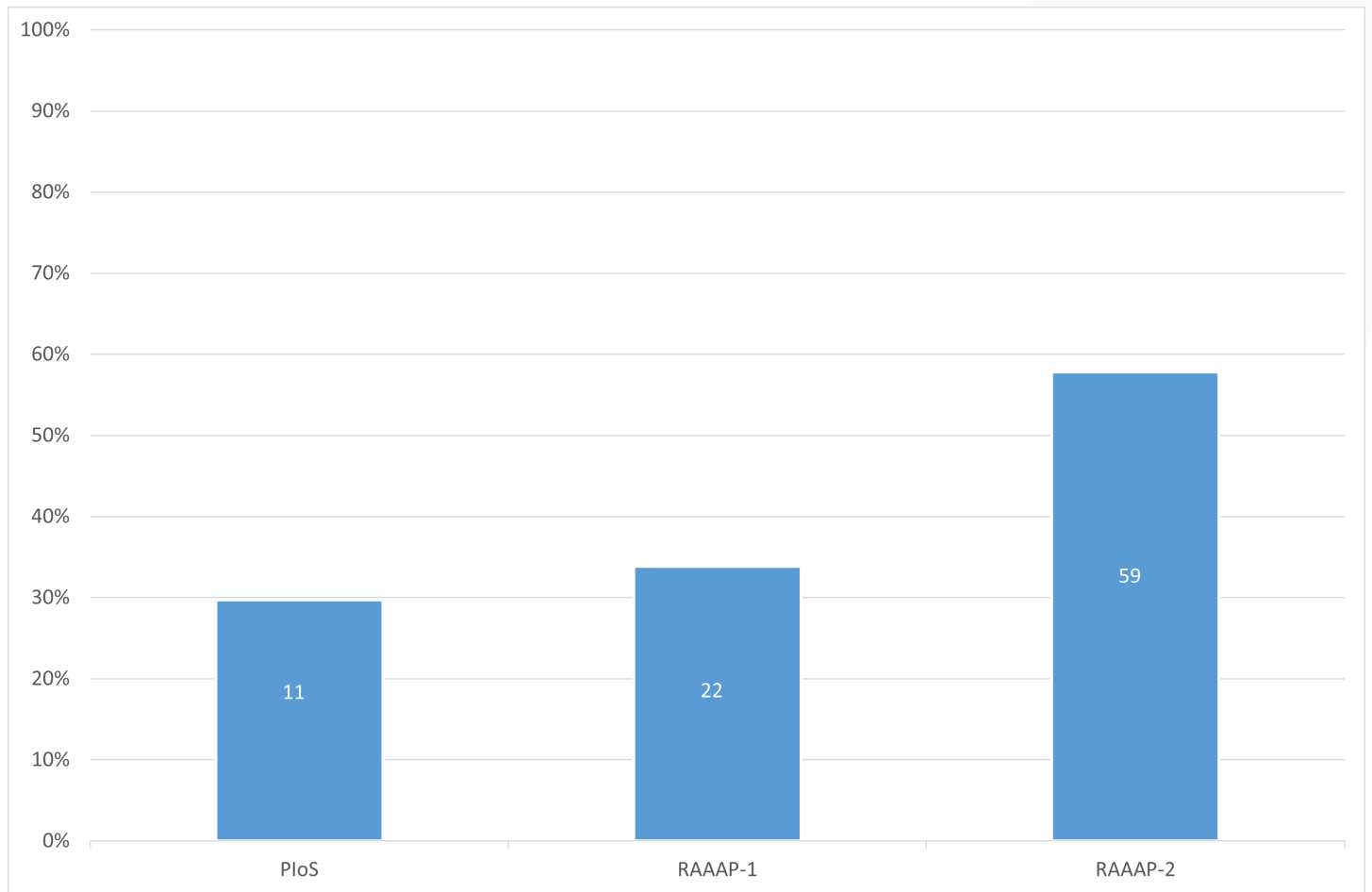
The number of responses of former scientists/researchers working at non-RPOs in the RAAAP surveys almost doubled, in terms of proportion of respondents, between 2016 and 2019 (Figure 9). This could be partially attributed to the greater number of responses in the RAAAP-2 survey along with a greater presence of these professionals in RMA associations and/or increased awareness about their professional identity.

Figure 10: Profession Years as PIoS
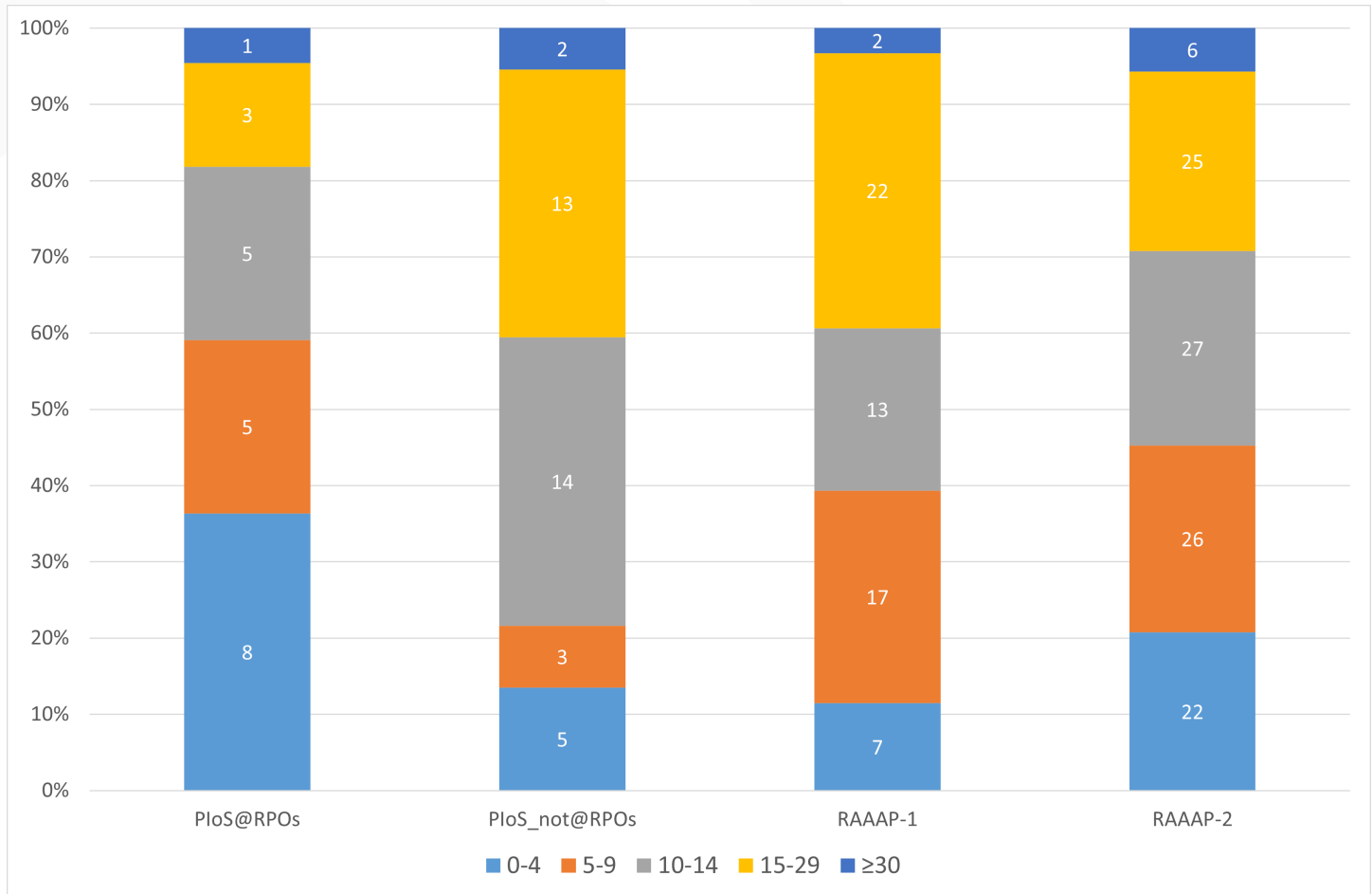
Note: the RAAAP-2 data excludes respondents from China (n=91) due to inconsistencies that inhibit a direct comparison with the majority of responses.

The respondents of the RAAAP surveys working at non-RPOs have a wider range of years in the profession than those from the PIoS survey. This could be a consequence of the wider distribution (greater number of potential respondents) of the latter. It is however notable that the RAAAP-2 included a good representativeness of all seniority levels considered. In what concerns the PIoS study, those at RPOs have a lower average level of seniority than those working at non-RPOs. This could indicate that in RPOs there are more professionals entering the profession than in non-RPOs.

The tasks performed by PIoSs working at non-RPOs are diverse and correlate with those attributed to PIoSs at RPOs (Figures 11 and 12). The main difference lies in tasks related with "definition" and "operationalisation" of research policies, strategies, and funding mechanisms, exclusive of PIoSs at non-RPOs. All the other tasks are common to both subsets of professionals. This shows that these professionals share a professional space, performing similar tasks, but from their unique perspectives (research performers vs. funders and others).

**Figure 11: Tasks Performed by PIoSs Working at Non-RPOs**
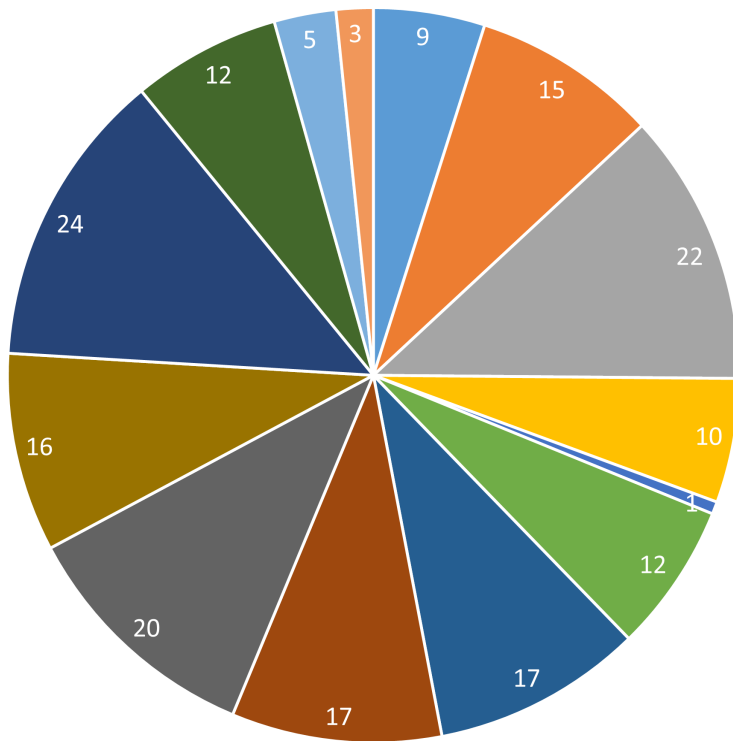
Legend:
- Advising Institutions/Researchers about administrative procedures
- Advising Institutions/Researchers about funding opportunities
- Advising Institutions/Researchers about programs and projects
- Advising Institutions/Researchers about science policies
- Conduct research
- Definition of science policies and strategies
- Definition of funding mechanisms
- Dissemination of funding opportunities
- Institutional liaison with stakeholders (Univs, Labs, etc.)
- Liaison activities with funding agencies (e.g. European Commission)
- Operationalisation of funding mechanisms or programmes
- Science communication and outreach
- Science observation activities
- Other

Figure 12: Tasks Performed by PIoSs Working at RPOs
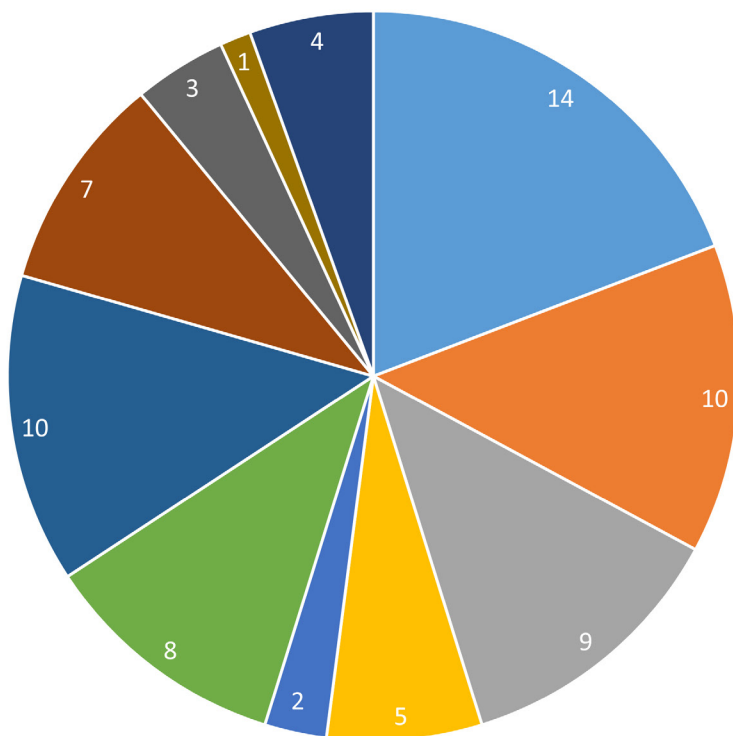
Legend:
- Advising Institutions/Researchers about administrative procedures
- Advising Institutions/Researchers about funding opportunities
- Advising Institutions/Researchers about programs and projects
- Advising Institutions/Researchers about science policies
- Conduct research
- Dissemination of funding opportunities
- Institutional liaison with stakeholders (Univs, Labs, etc.)
- Liaison activities with funding agencies (e.g. European Commission)
- Science communication and outreach
- Science observation activities
- Other

Figure 13: Frequency of Simultaneous Tasks Performed by Pioss at Non-RPOs
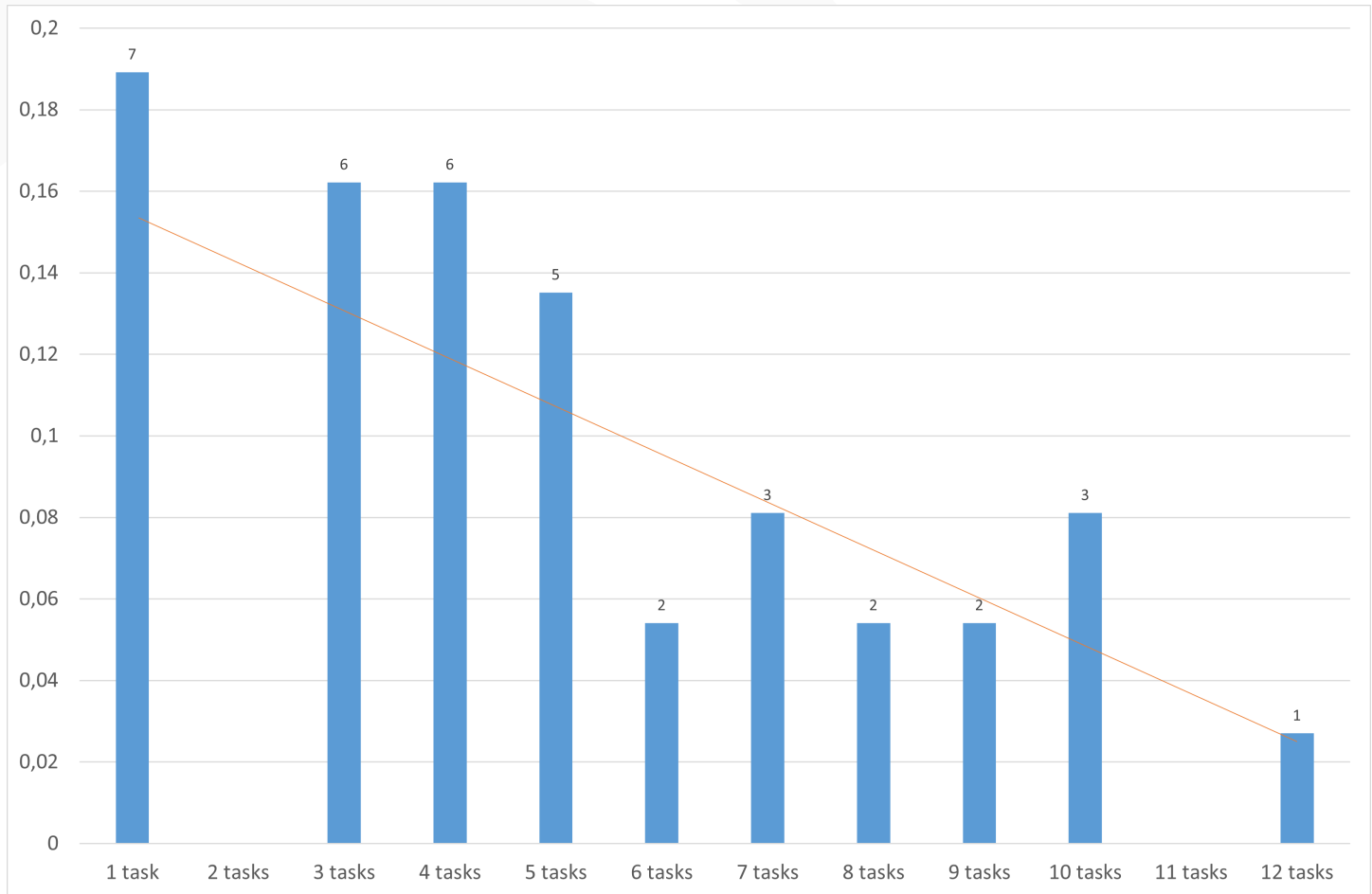
Most of the respondents from PIoSs at non-RPOs carry out multiple tasks. This evidences the multi-tasking nature of the RMA profession, in line with what can be observed in Figure 11. The observed variety of professional and academic backgrounds among PIoSs is considered an advantage in this regard as multidisciplinary teams are better equipped to perform diverse tasks than those composed of professionals from more homogenous backgrounds.

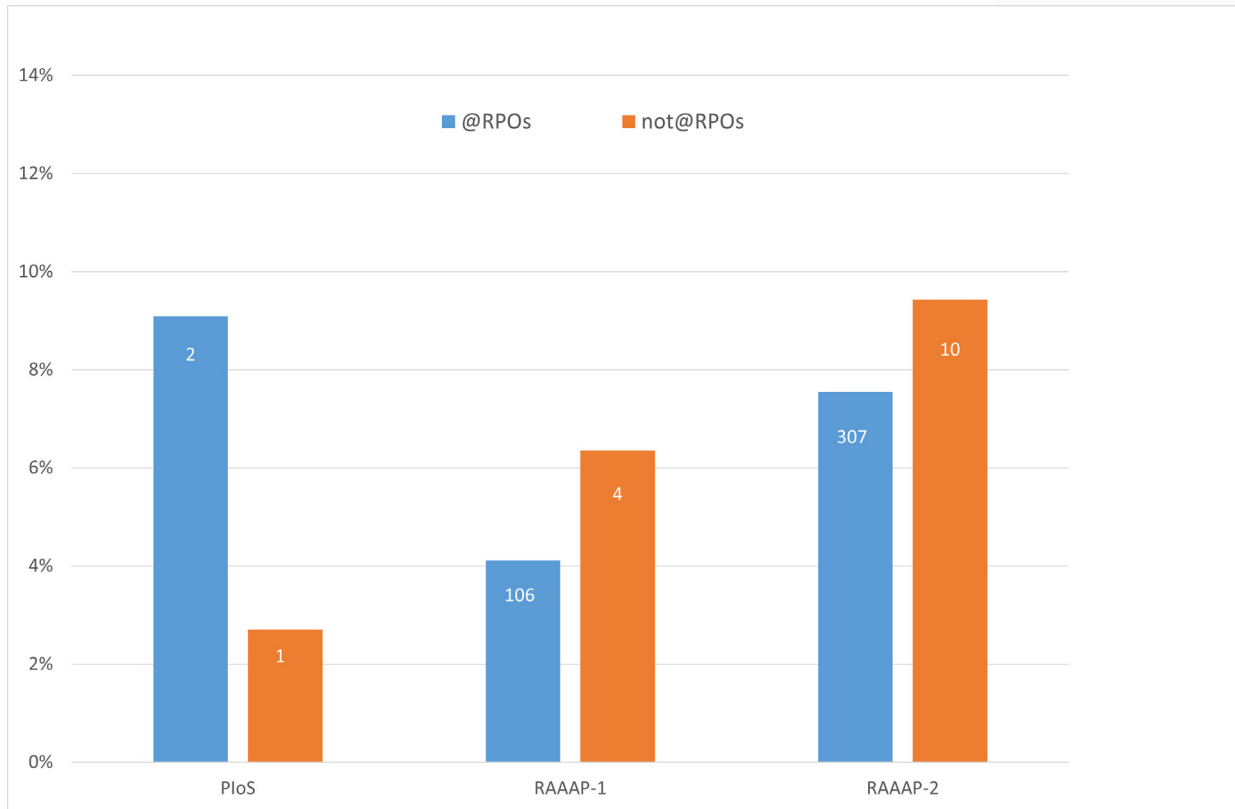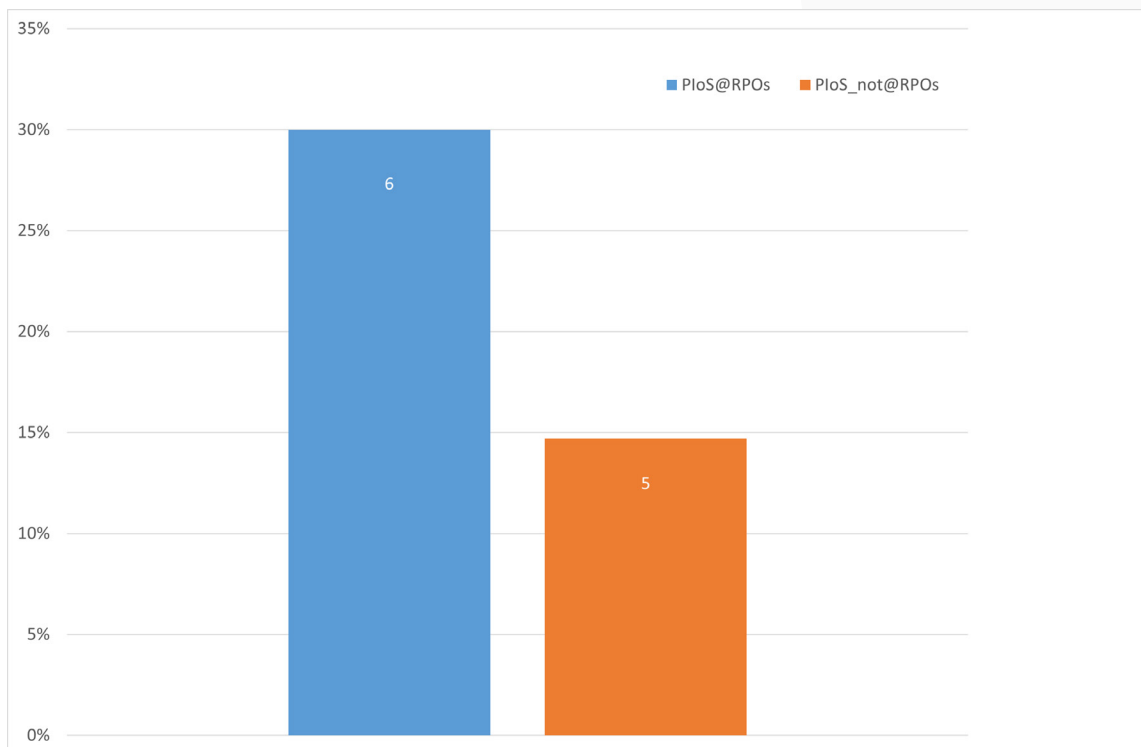*Figure 14: Respondents That Carry Out Research Activities*

Figure 15: Respondents to the PIoS Survey That Carry Out Lecturing or Research Activities

Only one respondent of the PIoS study working at non-RPOs informed that they carry out research activities. This representativeness is higher, 6% and 10% in the RAAAP-1 and RAAAP-2 surveys, respectively. Despite the differences among these surveys, it is noteworthy that some RMA professionals working at non-RPOs perform research along with research management activities. In the RAAAP surveys, the representativeness of RMA professionals that carry out research is greater for non-RPOs than for RPOs. This could be influenced by the substantially lower number of respondents from non-RPOs.

With regard to academic lecturing activities, no information can be derived from the RAAAP surveys, but the PIoS study (Figure 15) shows that around 30% and 15% of the professionals working at RPOs and non-RPOs, respectively, do have either lecturing or researching roles. This is thought to be related to their academic qualifications, namely at the doctorate level, and shows a significant "hybrid" profile, as advocated for these professionals by Whitchurch (2006). In fact, the majority of the respondents to the PIoS survey that carry out academic or research activities hold a doctorate (60% and 67% for those at non-RPOs and RPOs, respectively).

INVOLVEMENT IN PROFESSIONAL ASSOCIATIONS

In the PIoS study, almost 60% of the professionals working at non-RPOs are not involved in RMA associations (Figure 16). This decreases to 10% in the case of the professionals working at RPOs. In terms of the RAAAP surveys, it should be stressed that these were distributed through professional associations' communication channels, so it would be expected that 100% of respondents to those surveys would have indicated that they participate in those associations. However, around 10-15% did not—this is comparable with the PIoS survey respondents working at RPOs.
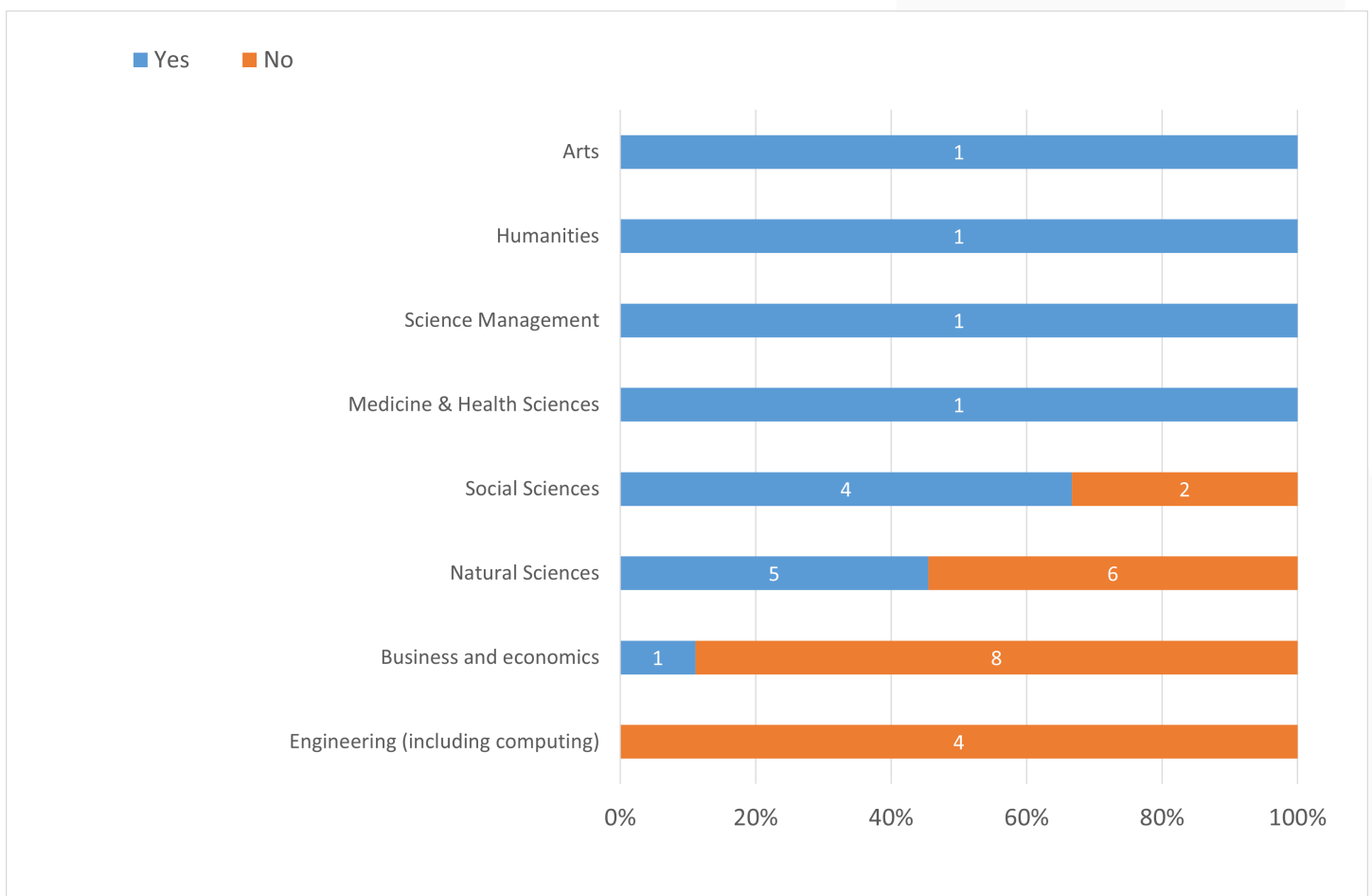
Figure 16: Involvement in RMA Associations
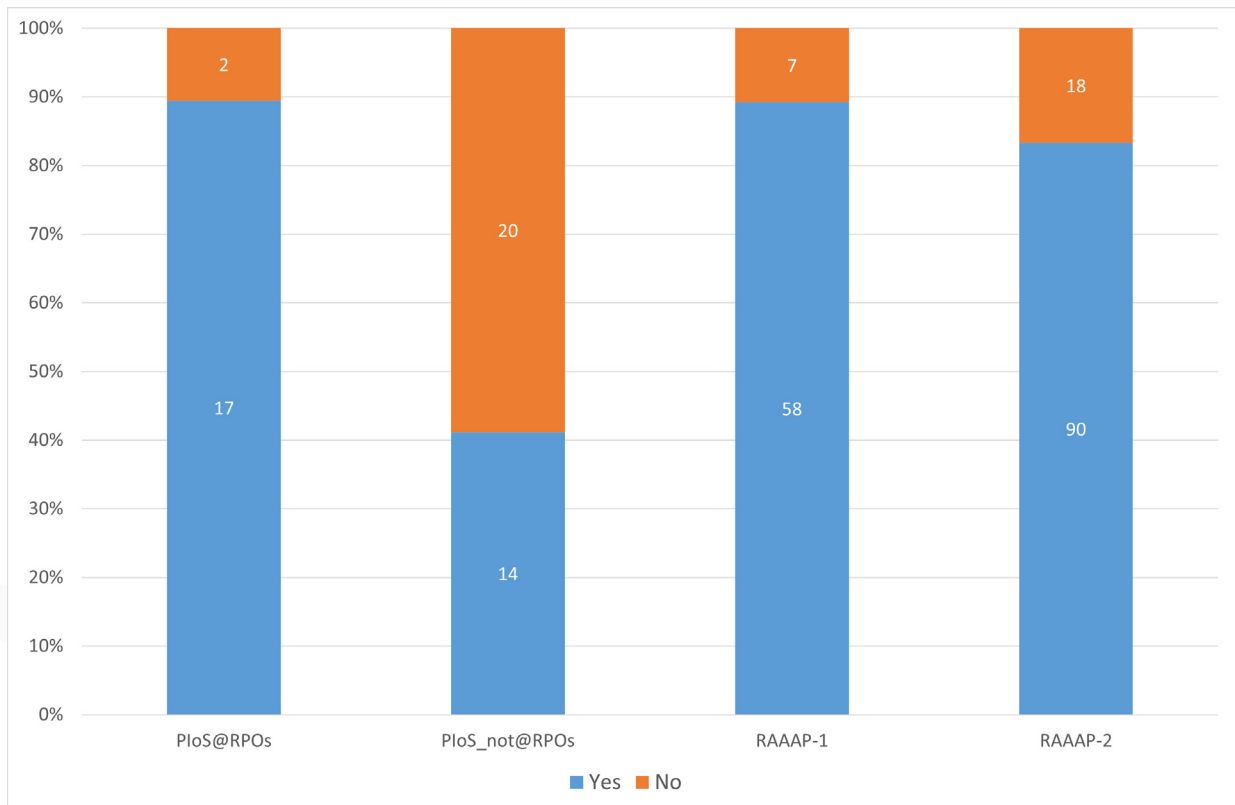
Bearing in mind that the PIoS survey was disseminated directly to professionals at non-RPOs and through RMA associations, it can be inferred that the majority of the respondents are not involved in networks. The reasons pointed out by PIoSs at non-RPOs include "not aware of existing networks" (58%), "employer provides networking activities" (21%), "existing networks not relevant" (11%), and "employer provides training activities" (11%). But 86% of those that participate do consider associations' activities relevant. When asked about examples of relevant activities the following were commonly mentioned: training, networking, accreditation, information dissemination (e.g., updates on latest developments in the field), online platform for sharing problems/solutions, working groups, events, and conferences. The majority (71%) consider their participation level as moderate. Examples of participation in professional networks activities include drafting of factsheets, attendance at and organising events, participation and trainer in training programs, roles on committees and boards, and sharing information. One respondent mentioned hosting a virtual visit of RMA from universities to their non-RPO. This is considered a very useful activity that contributes to facilitating cooperation and collaboration among PIoSs at RPOs and non-RPOs.

The involvement of PIoSs working at non-RPO in RMA networks is analysed next in face of their highest academic qualification subject area and tasks performed.

Figure 17: Involvement in Professional Networks (yes/no) vs. Highest Academic Qualification Subject Area

Those professionals with an Engineering or a Business and Economics background are expressively not involved in RMA associations (Figure 17). The professionals with a Social Sciences background are more involved than those with a Natural Sciences one. This is interpreted as being derived from different professional dynamics associated with these scientific areas. Possibly, professionals in the Social Sciences area are more aware of existing networks, while those with an Engineering or a Business and Economics background are more acquainted with networks in their own respective educational areas.

Figure 18: Involvement in Professional Networks (yes/no) vs. Tasks Performed
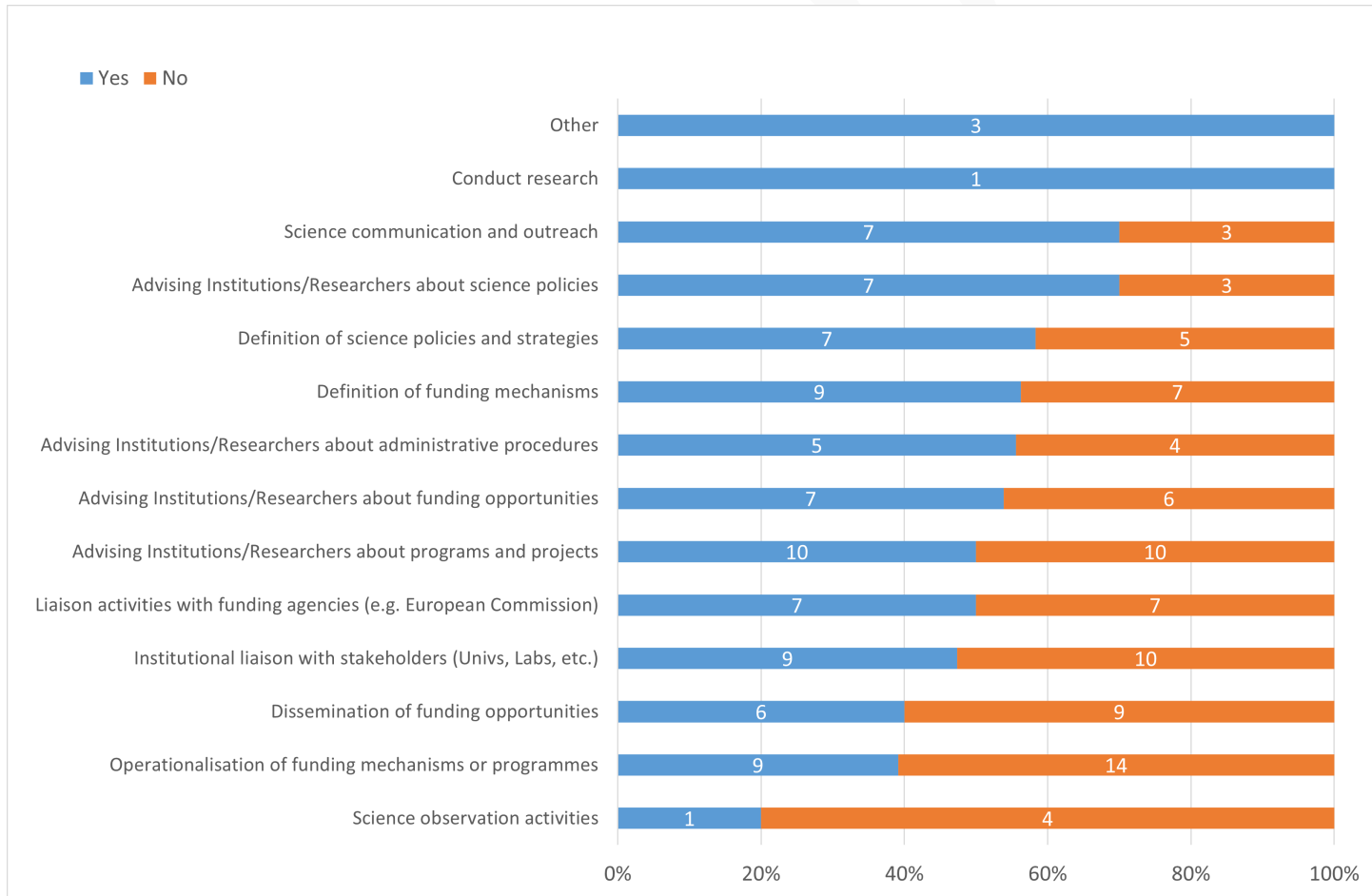
Only one respondent that "conducts research" answered this question and so it is not considered in this analysis. The tasks "science communication and outreach" and "advising institutions/researchers about science policies" are more common for those that participate in associations (Figure 18). The tasks "science observation activities", "operationalisation of funding mechanisms or programmes" and "dissemination of funding opportunities" are more common for those that do not. This is difficult to interpret but it could indicate that profiles related with more strategic and outreach roles are more aware of the relevance of participating in professional networks, while those related with more operational roles are not.

INTERVIEWS

The collected information provided further insights on their role as PIoSs and that of their employers in the overall R&I ecosystem, and about the profession itself. The interviews allowed for clarification of the reasons that led the interviewees to follow a PIoS career. Reasons range from first job opportunity to lack of research career in the public sector. Job positions include at research and innovation funding agencies, at science policymaking and diplomacy organisations, and other organizations at the interface of research practice and science. The text analysis was divided into three topics: background/profile, professional identity, and involvement in associations/networks following the major categories of the survey.

BACKGROUND/PROFILE

The existence of varied academic and professional profiles among PIoSs at non-RPOs was mentioned by one interviewee:

"Some are previously scientists, but many of them are like let's say, economists or…"

The scientific background was valued by several interviewees:

"… it is knowledge and experience of the research and Higher Education sector… just knowing. Is subconsciously understanding what the issues are . . . and hopefully most of the time not making unfounded assumptions about things, hopefully my assumptions are based on good knowledge and experience of the sector."

"I think it's important, I started my PhD exactly because I wanted to know more about science policy."

PROFESSIONAL IDENTITY

The interviewees showed, generally, to be unaware of the existence of a research management and administration profession. But in some cases, they described their profession as research "facilitator" or "enabler", and in other cases, mentioned the familiarity with scientific aspects as a common trait with PIoSs at RPOs. The following are example quotes:

"I actually don't believe that most of us, if even any of us, know that there is a name for what we do."

"I feel that it's a facilitator, mostly taking a bit of the project manager philosophy."

"…I would consider myself as a (part of the same professional body) because if I work in the [specific area], I always deal with scientific aspects."

The existence of cultural barriers in public administrations is mentioned to inhibit greater professional proximity between PioSs at RPOs and non-RPOs:

> "…on the other hand, here they work with lawyers and administrative people. It's not funny: it's a fight, it is a war when you try to bring new ideas."

But the sense of being part of the same endeavour is clear:

> "And when the project is approved, we do feel like we are part of the team, you know."

> "…we don't want to be just administrative machines…we want to be able to help you. And the only way you can do that is if there's this type of professionals inside these institutions."

INVOLVEMENT IN ASSOCIATIONS/NETWORKS

Most of the interviewees were not aware of the existence of RMA professional associations or networks, but acknowledged their importance to their professional development and to that of the profession itself:

> "I'm very pleased to know that these types of associations do exist, and I do hope that they are able to help share these good practices and best practices actually and experiences so that everybody can learn and develop and bring out the importance of this profession."

From the information provided by the survey respondents that were interviewed it can be concluded that i) reasons for joining the profession are varied and mostly not related with vocational calls; ii) prior scientific research experience is found to be valuable; and iii) the RMA associations should reach out to professionals working at non-RPOs. An increase of PIoSs from non-RPOs in RMA networks would improve their professional identity awareness, inter-institutional communication, competencies development, exchange of best practices, and would contribute to lower existing cultural barriers between this subset of PIoSs and those working at RPOs.

LIMITATIONS OF THE RESEARCH

A main limitation of the PIoS survey is the low number of responses obtained. This was due to the fact that the study was disseminated essentially through professional contacts and RMA associations. However, in what concerns the general demographic, institutional, academic and professional profiles, the results are broadly consistent with those of the RAAAP survey. This suggests that the sample was indeed representative of the community under study. It is foreseen that the publication of this first survey aimed specifically at PIoSs at non-RPOs will form the basis of follow-up surveys with a larger sample size and a more representative sampling strategy.

CONCLUSIONS AND IMPLICATIONS FOR FUTURE STUDIES

PIoSs working in science policymaking, funding and observation organizations (i.e. other than research-performing entities) have demographic, academic, and professional profiles similar to those working in research-performing

organizations. The most common respondent to the survey on PIoSs at non-RPOs was female, between 35 and 54 years old, holding a master's degree and working at a research funding agency. The academic background varies from natural and social sciences to business and economics. Previous professional experience includes management outside science and research activities. The majority of those PIoSs at non-RPOs holding a doctorate have academic teaching or research duties. The majority of female respondents and a high representation of female respondents and respondents with a PhD mirror the demographics from other studies such as Kerridge & Scott (2018b) and Virágh et al. (2020) that focused on RMAs working in RPOs.

PIoSs at non-RPOs perform a variety of roles/functions that can be classified as research management and administration. The tasks performed are multi-faceted and comparable to those performed by PIoSs at RPOs, but from a complementary perspective. This indicates that these PIoSs share a common professional space. The majority of PIoSs at non-RPOs are not involved in RMA associations, mostly due to not being aware of these existing networks. However, the fact that some of these professionals do participate in professional RMA networks does reinforce the perception of a shared professional space. The majority of those that are involved in networks do consider activities to be relevant. Differences in academic qualification subject areas seem to influence their positioning towards involvement in networks. Those with an Engineering or a Business and Economics background seem not to be involved in RMA associations. Also, professionals in strategic and outreach roles seem to be more involved than those involved in more "operational" tasks.

The interviews validated the survey findings, namely the existence of varied academic and professional profiles, with relevance to experience in the scientific research area. Although being mostly unaware of the existence of a research management and administration profession, most interviewees do express that there is at least a partial shared identity, even though from different perspectives. Institutional cultural barriers in public administration are mentioned as hindering communication and professional exchanges between PIoSs at RPOs and non-RPOs. The activities of RMA professional associations are considered crucial for their professional development and to that of the profession itself. Thus, it is argued that the involvement of these professionals in networks should be promoted as this would lead to improved fluidity of the research funders-research performers nexus, and ultimately to more agile, efficient, and effective research and innovation ecosystems. Existing studies in literature in Research Management and Administration (Shelley, 2010; Virágh et al., 2020) point to the lack of recognition in Research Management and Administration as a common problem in the profession, and formal training would contribute to increasing recognition. Virágh et al. (2020) refer to the low awareness of the profession as a result of the lack of recognition and professional identity. Shelley (2010) provides an example of the typical titles of RMAs in RPOs such as 'non-academic' or 'administrators' as contributing to the lack of the recognition of these professionals. The authors of the current study suggest that the inexistence of a role title and clear role as well as unawareness and/or connection with a professional network contribute to the lack of professional self-awareness and recognition to the RMA profession. Professional networks and/or associations contribute to professional empowerment, inter-institutional communication, competencies development, exchange of best practices, and would contribute to lower existing cultural barriers between this subset of PIoSs and those working at RPOs.

Final conclusions from the information provided by the survey respondents that were interviewed point at the reasons for joining the profession being varied and mostly not related with vocational calls. Evidence provided by Virágh et al. (2020) also points out that becoming a RMA is often non-intentional. Future work could include a thorough study on the sense of belonging of these professionals to the global PIoS community. This includes the differences between the career frameworks of PIoSs at RPOs and PIoSs at non-RPOs and the existing training for these professionals. The contributions of this study for the PIoS community are diverse. The most significant is the evidence that professionals at RPOs do share the same "professional space" as those working at non-RPOs. This opens the way to the promotion of an effective integration of these professionals, namely in networks and associations, ultimately leading to enhanced competencies, skills, and sharing of best practices. This may contribute

to the mitigation of the current divide between PIoSs at non-RPOs and RPOs, to improved communication and to more efficient and effective R&I ecosystems.

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

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