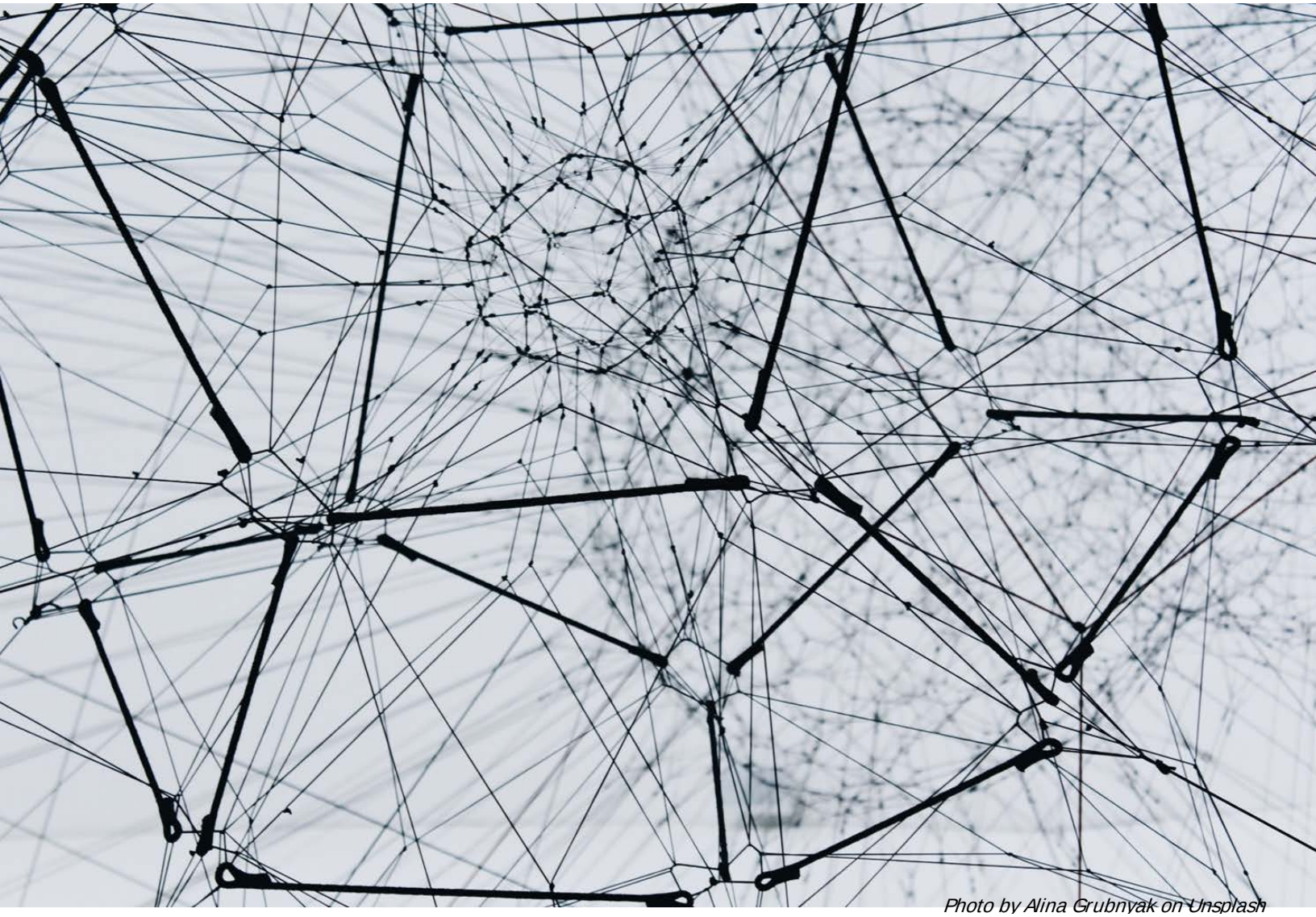

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TRESCA

Trustworthy, Reliable and Engaging Scientific Communication Approaches

D1.5 Overview of (Dis)Incentives for scientists to engage in SciCom

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 872855.

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Contributors: **Jenny Lee,** Science Business; **Gorazd Weiss,** ZSI

Reviewer: **Jason Pridmore,** EUR

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1. EXECUTIVE SUMMARY

This report presents the results of an online survey about scientists' motivations to engage with science inreach (communication between scientists) and science outreach activities (scientific communication with non-experts). The survey analysis offers a comprehensive view of attitudes and contextual factors perceived as relevant by the scientific community at the time of deciding whether or not to engage in SciCom.

The survey conducted between July and September 2020, was aimed at all researchers in Europe, irrespective of their specific scientific field, employing organisation or expertise level. The analysis of the survey is complemented with desk research on four institutional academic contexts, which are Austria, Hungary, the Netherlands and Spain. The analysis focuses on the priority given to SciCom by respondents, on the most frequently used communication methods, the main reasons for SciCom engagement, as well as the main challenges preventing such engagement and commitment. SciCom opportunities offered by employers and academic institutions and perceptions about the role of women in science and science communication are also discussed in this report.

Overall, more than 80% of the respondents claimed that science communication with fellow scientists is of very high or high importance during their daily work. 59% of respondents consider SciCom outreach activities also important. Only 51% of women, in comparison to 70% of men, say that outreach activities are highly relevant.

70% of all respondents say that they engage in outreach SciCom activities because they consider they have a duty to inform the public about their findings and also because they wish to contribute to shaping the public debate on relevant scientific issues (58%). 62% of respondents see SciCom inreach activities also as a duty to inform their colleagues and other fellow scientists; they also want to give visibility to their findings (77%) and gain new ideas and perspectives about their own research (68%).

The outreach methods more frequently used are: social media (50%); websites (42%); newspaper articles (33%); and blog posts (23%). The inreach methods more commonly adopted are: publications on scientific journals (85%); presentations during academic conferences (67%); exchange during networking events (42%).

The main barrier for scientists to engage in SciCom inreach activities seems to be the lack of time (69%). The main challenges to engage in science outreach activities are similar to those faced in the case of science inreach initiatives. 64% of respondents simply lack time for these

activities; the second most mentioned reason for non-engagement is the lack of financial incentives (22%).

These findings are intended to open a conversation about ways to align current incentives to foster academic and scientific excellence with new methods and instruments able to acknowledge the important social role science plays in current times. The present incentive system strongly relies on scientific publications (inreach activities) as a measure of scientific excellence. Despite its importance, lack of time and resources to communicate these findings to non-academic audiences limit the capacity of science to produce a positive effect on society. More vulnerable groups, such as female scientists and young scholars can feel under pressure to demonstrate their scientific excellence and be discouraged from engaging in important SciCom outreach activities. Lack of time and recognition can produce a negative effect on the type of groups represented in scientific circles. Young people, minorities, women and other marginal groups can perceive that science is not for them if it is not communicated by people like them.

By analysing the results of this survey, we thus come to the conclusion that by increasing the quality and quantity of SciCom outreach activities, policy-makers need to reflect on measures to compensate the time scientists spend on relevant and impactful outreach communication activities. Examples of these activities are: advice given to parliamentary committees, interviews given on mainstream media about issues of general public interest, creation of toolkits to improve people's awareness and literacy of specific scientific issues. In other words, not only the excellence of science, but also its impact on society needs to be better acknowledged along the career of a scientist and during the PhD training. For example, taking public relations and communication courses during the PhD can improve a scientist's self-confidence and communication effectiveness, which are transferable skills that are always useful. Regarding indicators of scientists' engagement with outreach SciCom activities, it is important to remember that in the current digital media environment these information are already available and considered in the elaboration of altmetrics indicators under development and that are trying to improve the accuracy of more traditional scientometric indicators.

2. OVERVIEW OF (DIS)INCENTIVES OF SCIENTISTS TO ENGAGE IN SCIENCE COMMUNICATION

2.1 Introduction

This report offers an analysis of the existing incentive (and disincentive) structures for scientists and other R&I stakeholders to engage in science communication, in terms of career and scientific reputation. The (dis)incentive structures are checked at a country level, for both science inreach and science outreach. For these purposes, a European-level survey was used, focusing on questions about scientists' science communication priorities, main communication methods, key engagement reasons (incentives), perceived barriers (disincentives) and existing or missing opportunities. A comparison between four different countries is carried out to identify beneficial and detrimental effects of different rewarding mechanisms in place in public and private research organisations - for a broader context, a short overview of these countries' academic systems is provided. Potential gender imbalances, affecting the representation of women in science and science communication in certain scientific areas or countries is also explored and acknowledged.

2.2 Methodology and data collection

The consortium partners involved in the elaboration of this report relied on desk research and on a survey to gather information about the most common motivations, incentives and disincentives motivating scholars' engagement with science inreach and outreach communication activities.

An electronic questionnaire was developed by WP1 LP ZSI with the collaboration of all partners involved in this task. The survey was made available on 7 July 2020 through alternative channels at country and EU level.

2.2.1 Questionnaire

The final version of the questionnaire is organised into four sections (see Annex 2):

Section one: background information, such as country, primary scientific field, organisation type, experience, gender. In case of the first three variables, a drop-down list was offered. Partners agreed to include the broadest possible target group to the survey in terms of scientific field and organisation therefore a wide range of options (with another option) was

offered in the survey. In case of 'experience' respondents could choose from options in a 5-year scale (ranging from 'less than 5' to 'more than 25' years of experience);

Section two: science inreach questions: priority given to science inreach (5-point Likert scale), science inreach communication methods (multiple-choice from a predefined list with an 'other' option), main reasons to engage in science inreach (multiple-choice from a predefined list with an 'other' option), main challenges preventing science inreach (multiple-choice from a predefined list with an 'other' option). In case of multiple-choice questions, respondents could choose as many answers as they deemed relevant therefore the final percentage might be higher than 100 percent in the analysis;

Section three: science outreach questions: priority given to science outreach (5-point Likert scale), science outreach communication methods (multiple-choice from a predefined list with an 'other' option), main reasons to engage in science outreach (multiple-choice from a predefined list with an 'other' option), main challenges preventing science outreach (multiple-choice from a predefined list with an 'other' option). In case of multiple-choice questions, respondents could choose as many answers as they deemed relevant therefore the final percentage might be higher than 100 percent in the analysis;

Section four: science communication in general: opportunities provided by employer organisations for science communication (multiple-choice from a predefined list with an 'other' option), the role of women in respondent's scientific field (three options: underrepresented, balanced, overrepresented) the role of women in science communication (three options: underrepresented, balanced, overrepresented), the best incentives in your region/country for science communication (free text), the biggest disincentives in your region/country for science communication (free text), additional (dis)incentives at European/international level for science communication (free text).

2.2.2 Invitation to participate in the study

The invitation to participate in the study was made public through the official TRESCA twitter account named @TrustSocialScience on 27 August.

Fig. 1 Twitter post with link to the survey

Each partner used their local networks (academic and research institutions and beyond) to promote the survey and gather data. In Austria, ZSI spread the information through its contacts at the Austrian Press Agency (APA), as well as via its academic network, contacting public relations offices and (vice-)deans responsible for internal research cooperation within the most relevant public and private universities early September. A two-language (German and English) news item on the survey was published on the organisation's official website (www.zsi.at) on 7 July.

In Hungary, ZSI used its pre-existing contacts in the academic and research sector (gained mostly through previous collaborations) to disseminate information on the project and the specific survey. Relevant researchers and officials at universities were individually contacted per e-mail during July and August. The news on the survey was re-shared on Facebook by CEU on 6 August and sent out in internal newsletters of other Hungarian universities, for instance Andrássy University or Moholy-Nagy University of Art and Design (MOME) on 6 August.

In Italy, Observa Science in Society disseminated the news on the survey in its academic and research network in July, and due to perceived non-interest at the holiday season, repeatedly early September.

In the Netherlands, dissemination efforts were similar. In July and August, invitations were shared within the professional networks of Erasmus University Rotterdam via e-mail, Twitter and LinkedIn. In addition, the Communication Officer of the Department of Media and Communication also shared the invite in the Intranet and on Twitter in early September.

Twitter posts were retweeted by the Erasmus Research Center for Media, Communication and Culture, as well as the central Erasmus University Twitter account.

In Spain, an invitation to participate in the study was sent through the mailing list of CSIC's Global Health Platform on 10 September 2020. The list has 479 subscribers; all of them are CSIC scientists coming from a variety of institutes and groups working in biology, computer science, social sciences and other disciplines and doing research on different aspects directly or indirectly associated with the COVID19 pandemic.

Science| Business ran two communication campaigns promoting the survey to its pan-European readership. The first campaign ran from 22 July to 2 August 2020, where visual assets were created for the Science| Business social media channels (Twitter and Facebook), newsletter and website.

Fig. 2 Twitter post published by @scibus with study invitation

Science| Business social media channels have a combined total following of 12,000 followers, and the social media promotion posts on Twitter took place on July 22, July 24, and July 27 and the Facebook promotion posts took place on July 24 and July 26. To further promote the survey, one promotional banner was placed in the Science| Business twice-weekly newsletter, which is sent to an opt-in list of 25,000 senior R&I decision-makers in industry, academia and research and public policy. This newsletter was sent out on 23 July. Finally, a

skyscraper banner promoting the survey was featured on the Science| Business website, appearing from 22 July to 2 August. The banner gathered 18,134 impressions and 15 clicks.

Fig. 3 TRESCA Skyscraper banner by Science| Business

A second small campaign was launched closer to the closing date of the survey. It involved one social media post via the Science| Business Twitter channel (which has just over 11,000 followers) on 7 September and one promotion banner insertion in one Science| Business newsletter, issued on 8 September.

2.2.3 Gathered responses and cross- country comparison

While the Science| Business communication channels had a true pan-European character, the dissemination actions of consortium partners were predominantly focused on national partners due to the available networks. In fact, the consortium encountered certain barriers in disseminating the survey in countries where partners did not have an extensive networking and partner database. Despite efforts to reach scientists in other EU countries, such as Slovakia, most answers came from countries where partners were based.

These countries, which are Austria, Hungary, the Netherlands and Spain, offer a balanced geographical coverage of Western, Southern, Central, and Eastern Europe. According to the European Social Survey[1], these four countries also represent a balanced mix in terms of high social trust (NL), medium trust (AT) and low trust (ES, HU). The in-depth analysis of these four institutional contexts also offer a better understanding of local R&D policies influencing science inreach and outreach communication activities. Finally, a comparable number of responses were collected in these four countries facilitating cross-country comparisons and reflections.

Besides the survey, a second source of information was obtained through secondary desk research. Specifically, ZSI collected and processed information about R&D policies in Austria and Hungary; EUR drafted the section on R&D policies in the Netherlands; and CSIC drafted the section about Spain. National policy documents and laws, and national statistics were consulted in order to offer an overview of the academic and research sector within which science communication operates in each country. Further desk research was conducted to put specific survey findings into perspective.

[1] European Social Survey (ESS) 2016.

3. OVERALL RESULTS

The results presented in this report come from opinion poll data collected between 7 July and 14 September 2020 through an online survey. The invitation to participate in the study was disseminated by TRESCA partners via various channels.

246 responses were collected in total. 80% of responses come from the four countries analysed (Spain: 71; Austria: 63; the Netherlands: 33; Hungary: 30). Other responses come from scientists based in Italy (10), Germany (9), Belgium (8) and in the United Kingdom (5).

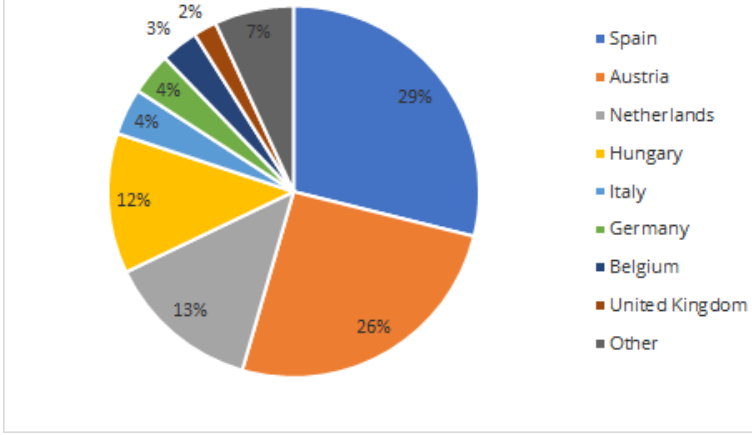


Fig. 4 Survey respondents per country

The aim of the study was to shed light on the motivations of scientists to engage in science communication (SciCom) activities regardless of the scientific field. Thus, the survey analysis covers a wide range of attitudes and contextual factors perceived as relevant by the scientific community when deciding whether or not to engage in SciCom. The overall results are presented following the survey logic detailed in the questionnaire structure in section 2.2.1. No country-level comparison is given within the overall analysis due to the overrepresentation of the separately analysed four countries in the European-wide sample. The in-depth analysis of the four countries and a comparative table is provided in the following Chapters, complementing the overall results.

3.1 Science Inreach

Overall, more than 80% of the respondents claimed that science communication with fellow scientists is of very high or high importance during their daily work. Low or very low importance was only signalled by a minority of all respondents (6%), indicating a high interest in SciComm across Europe. There are no significant differences regarding scientific fields, organisation types or gender with regard to priority given to science inreach among scientists interviewed. With regard to experience, it seems that the more experienced researchers (more than 10 years of experience) consider science inreach more relevant than junior scientists (those with less than 10 years of experience). Slightly more than two-thirds of less experienced researchers say that they give very high priority to SciCom (71% of respondents with 6-10 years of experience, 85% of those with 11-15 years of experience, 92% of those with 16-20 years of experience, 88% of those with 21-25 years of experience, and 90% of those with 25 years of experience) - see Fig. A4 in Annex 1.

Regarding the most frequently used **science inreach methods**, the overwhelming majority of scientists answering the survey mention the publication of articles in **scientific journals (85%) and the presentation of scientific findings during academic conferences or public lectures (67%).** Less than half of respondents say they prefer to communicate their results through informal exchanges within their network of peers (42%), through social media (39%), or other internated-based services and websites (32%). Other methods, such as blogs or science cafés were rarely mentioned.

Respondents (n = 246)	

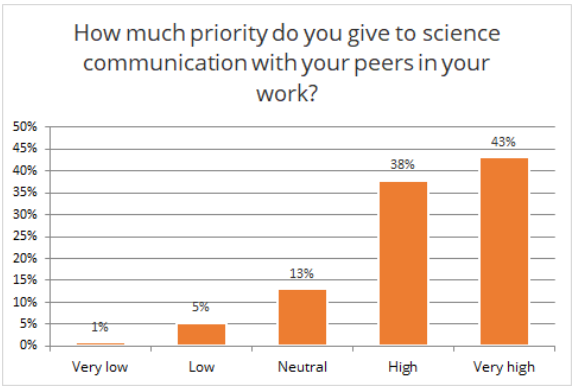
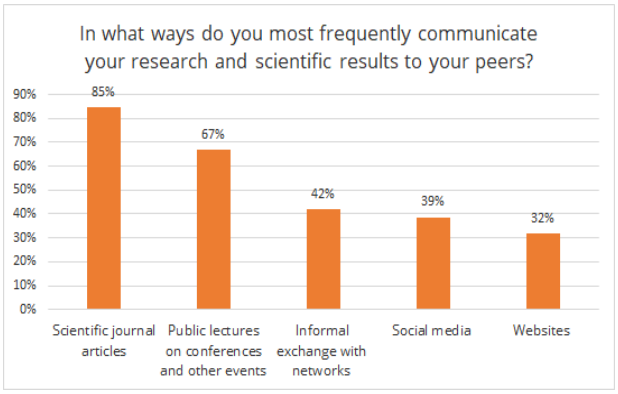

	

Fig. 5 Inreach priority	Fig. 6 Inreach medium

When asked about the reasons why they chose to engage in inreach SciCom activities, most respondents mentioned the motivation of gaining "better visibility for their research" (77%) or "gaining new ideas and perspectives" for their own research (68%); a large majority also consider SciCom inreach "a duty to inform" fellow scientists (62%). Interestingly the least mentioned options were related to improving the respondent's economic situation (20%) or funding opportunities (17%).

The main barrier for scientists to engage in SciCom inreach activities seems to be "lack of time" (69%), followed distantly by a lack of economic support (24%) and lack of career and financial incentives (23%). Other issues associated with technical skills or authorship do not seem to be a major hindrance.

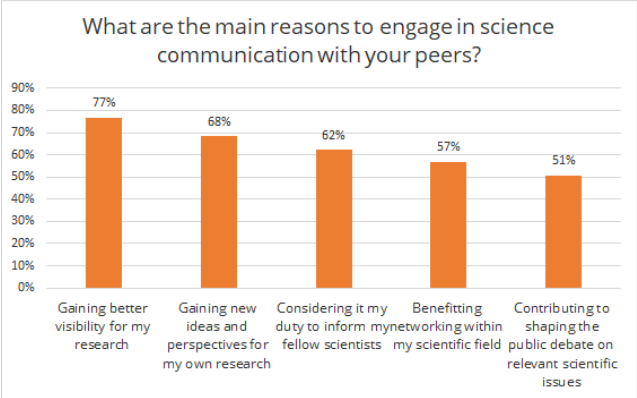


Fig. 7 SciCom rationale

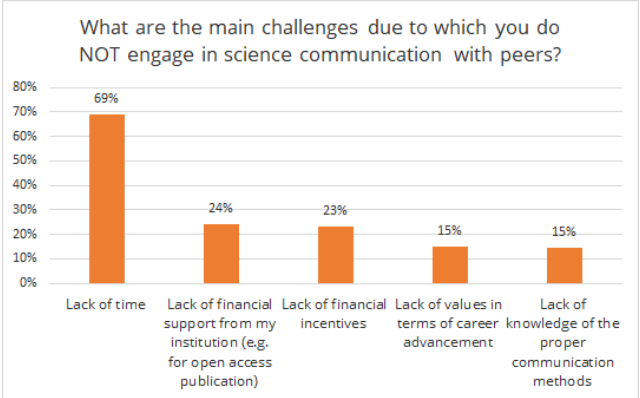


Fig. 8 SciCom barriers

3.2 Science Outreach

In comparison to science inreach, fewer respondents regard SciCom outreach, that is, science communication with the general public, as a high or very high priority. **59% of respondents consider outreach activities important, in comparison with 80% of respondents who consider SciCom inreach activities important.** Interestingly women seem to be even less inclined to give priority to communicate their findings to the general public. **Only 51% of women, in comparison to 70% of men, say that outreach activities are highly relevant.**

Similarly to the results seen in the case of SciCom inreach, **more experienced scientists consider SciCom outreach with non-experts very relevant.** The overall share of respondents assigning high priority to science outreach is generally lower than in case of

science inreach. However, in comparison to science inreach, there is a less significant difference among more and less experienced respondents on how relevant they perceive science communication. The cut-off date again seems to be around 10 years of experience, with less than 50% of researchers until 10 years of experience considering science outreach highly important (49%: 0-5 years, 45%: 6-10 years), with a constantly growing share of such scientists in the more experienced age groups (11-15 years of experience: 62%; 16-20 years of experience: 63%; 21-25 years of experience: 73%; more than 25 years of experience: 76%).

Among those who engage in science communication with laypersons, **the most frequently mentioned method is "social media" (50%), closely followed by "websites" (42%), and then newspaper articles (33%) and blogs (23%).** Interestingly television or citizen science projects were less frequently mentioned.

Respondents (n = 236)

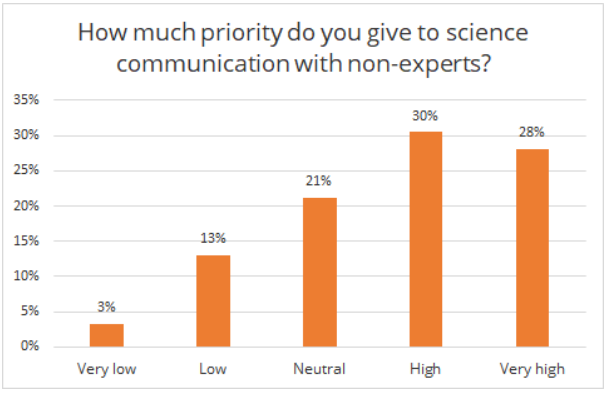


Fig. 9 Outreach priority

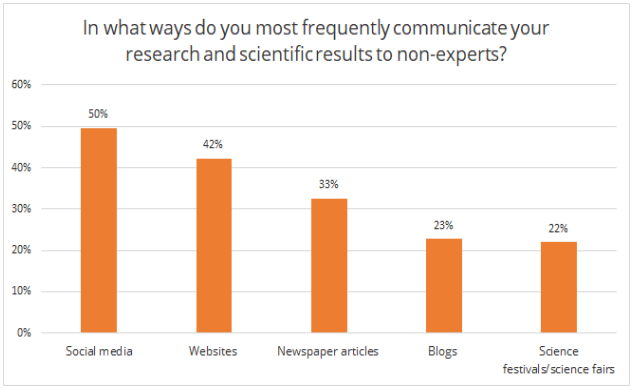


Fig. 10 Outreach medium

Concerning the motives behind the science communication engagement with non-expert groups, the sense of duty is much more important than in case of science inreach communication. **Almost 70% of the respondents claimed that they consider it their duty to inform laypersons, followed by a wish to "contribute to shaping the public debate on relevant scientific issues" (58%).** The reasons related to the benefits of one's own research - more prominently featured in case of science inreach - follow: 45% of the respondents mentioning "gaining better visibility for own research", and 24% mentioning

"gaining new ideas and perspectives for own research". The latter share showcases a growing acceptance of citizen science. Financial benefits are again the least mentioned.

The main challenges in front of science outreach are quite similar to those for science inreach. 64% of respondents simply lack time for these activities, and once again the second most mentioned reason for non-engagement is the lack of financial incentives (22%). However the lack of knowledge on proper communication channels (20%) and knowledge on how to best formulate the main message (19%) are also prominently featured as main reasons, indicating a potential lack of proper training in the field.

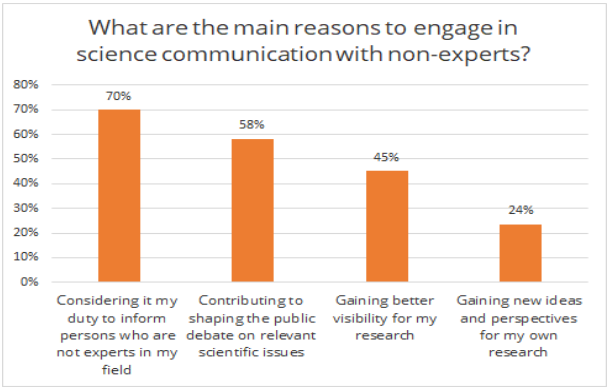


Fig. 11 SciCom rationale

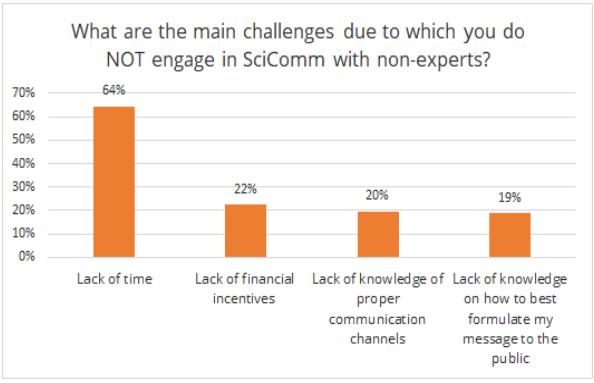


Fig. 12 SciCom barriers

As regards opportunities provided by employers, most respondents mentioned flexible working time (46%), as well as the use of online and social media communication channels (43%-37%), and public events (38%) as the most important institutional support provided for science communication. The few mentions of specific training on oral or written communication (28%-25%) or information on the available communication channels (21%) indicates a weakness. Specific funding for science communication were the least frequently mentioned support type (15%) - see fig. A1 in Annex 1.

When asked about the role of women in their scientific field and in SciComm, the majority of the respondents perceive a visible underrepresentation of women: **54 percent considers women as an underrepresented group in their own scientific area, and 51 percent do so in science communication.** Replying in more detail, several respondents (19) mentioned that women are underrepresented in the higher positions in their fields, while no such

imbalance can be seen in lower positions and/or at earlier career stages. Nevertheless, no such strong opinion was formulated concerning science communication.

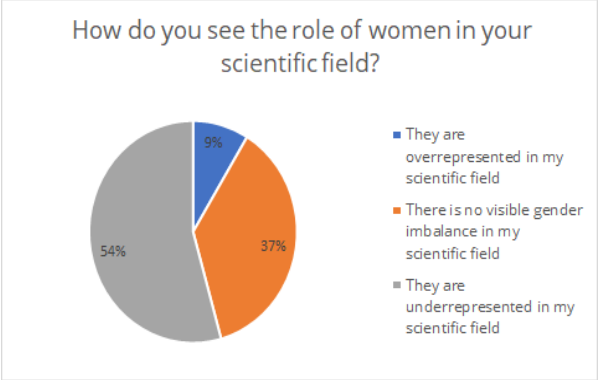


Fig. 13 Role of women in science

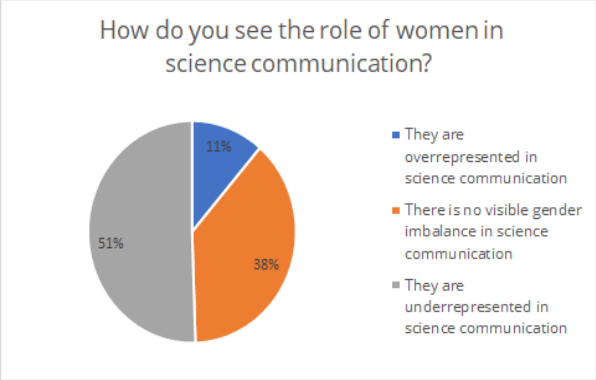


Fig. 14 Role of women in SciComm

Respondents also had the chance of further elaborating on the most important national or European (dis)incentives in science communication. Here, researchers cited **the importance of clear incentives for science inreach and outreach at an early career stage** - starting from PhD level - due to its usefulness in a direct (visibility to researchers themselves) and indirect (visibility to research leading to more work drawing on and citing studies) way. As one respondent formulated it, "*Obtaining a position and winning a project is almost always linked to a competitive publication and communication trajectory and agenda. Virtually any future career success is linked to science communication.*"

Interestingly, societal values (related to public duty of scientists) were mentioned by more respondents than financing where answers tend to focus on institutional incentives more professionally measured by key performance indicators (KPIs). Several scientists focused on **the relevance of** reaching the general population and **better citizen engagement** by stating that *"The best incentive for me would be the possibility to share the results of my research with those that concern the research or could benefit from it in one way or another"* or *"knowing that I can help solve problems for the benefit of people and society, and increase the involvement of science in society".* One researcher explicitly mentioned the outdated nature of the 'deficit model' and called for science outreach formats allowing for exchange and discussion.

When looking at the disincentives for SciComm in more detail, unsurprisingly lack of time is again the main culprit. As one respondent says: *"The problem is more that the pressure to do other things (publish, acquire grant money) is so strong that there is simply no time to do science communication, particularly with non-experts."* Respondents stress the importance of identifying institutional solutions able to offer the right conditions for scientists to engage in outreach SciCom activities. There are problems, for example, that emerge from the lack of recognition that outreach SciCom activities receive. A respondent explains that: "*Activities in science communication are not taken into consideration for evaluation of personal and institutional performance to an appropriate degree."* The problem of the limited recognition of outreach SciCom activities seems to require a systemic, rather than institutional, change. The same applies for the lack of financial incentives mentioned by a handful or respondents: some would like to see systemic changes in the way their countries or the EU finance SciCom activities, while other respondents stress the importance of changing the reward system within their own scientific institutions. Another frequently mentioned issue is the lack of communication skills, particularly suffered by foreigners who try to communicate their research in English.

3.3 Survey participants' characteristics

As regards the distribution of the respondents per scientific fields, natural sciences are the most represented: one-third of the scientists were engaged in this area. This was followed by sociology (9%), political and communication sciences (5-5%). 16 percent of the respondents put themselves to the 'Other' category which encompassed a diverse field of sciences that could be categorized to either natural sciences (e.g. mentions of life sciences, food science or nanotechnologies) or to social sciences and humanities (e.g. mentions of legal studies or theology). There were no visible differences in the scientific fields of the respondents per each country. Spain had the highest share of respondents with a background in natural sciences (representing in each country the largest respondent group) - see fig. A2 in the Annex.

Regarding the distribution of respondents per organisation types, half of the scientists were employed at academic institutions, and another 36% at research institutions, accounting for around 86% of all respondents. The remaining scientists were employed at public bodies (7%) or private businesses (3%). There were no visible differences in employment patterns per each country. The background overview of the academic and research sectors in each analysed country reveal that such a distribution of employers roughly correctly represents

the actual employment landscape with the overwhelming majority of researchers employed at (public) higher education, academic and research institutions - see fig. A3 in Annex.

In terms of participants' characteristics and gender the survey was almost perfectly balanced: 25% of the respondents have less than 5 years of experience, while 24% have more than 25 years of experience, with an almost equal distribution in-between. The sample was also balanced with respect to gender, with 50% of women answering questions - see fig. A4 and fig. A5 in the Annex.

4. COUNTRY- LEVEL FINDINGS

All the country chapters below start with a short overview on the national academic and research sector to place the issue of science communication and the related (dis)incentives into a broader context. Then a more granular picture is provided on science inreach and outreach in these countries, focusing on the following issues: science inreach and outreach priority, most relevant science inreach and outreach media used, rationale for science inreach and outreach, barriers in the way of science inreach and outreach, opportunities provided by the organisations (where researchers are employed), as well as the role of women perceived by respondents in their scientific fields and science communication.

The tables below offer an overview of the level of investments over time in research and development (R&D) over national GDP in Austria, Hungary, Netherlands, and Spain. As displayed in the following chart, in comparison with the average R&D expenditures in EU countries, Spain and Hungary invest less, while the Netherlands follows the trend of most European countries. Despite R&D investments in Austria have been growing between 2000 and 2017, the number of people employed in knowledge-intensive sectors in this country is below the EU average; something that happens also in Hungary and in Spain. The Netherlands is the only European country here analysed where almost 50% of its working population is employed in high technology manufacturing and knowledge-intensive service sectors. In terms of quality of the scientific outputs produced, data of the Research and Innovation Observatory (RIO)[2] presented in the last chart shows that in 2016 the percentage

[2] Highly cited publications: Number of scientific publications among the top 10% most cited, in fractional counting. Research and Innovation Observatory – Horizon 2020 Policy Support Facility. European Commission.

of scientific publications among the top 10% most cited outputs was: 15.3% in the Netherlands; 11.3% in Austria; 9.6% in Spain; and 6.2% in Hungary.

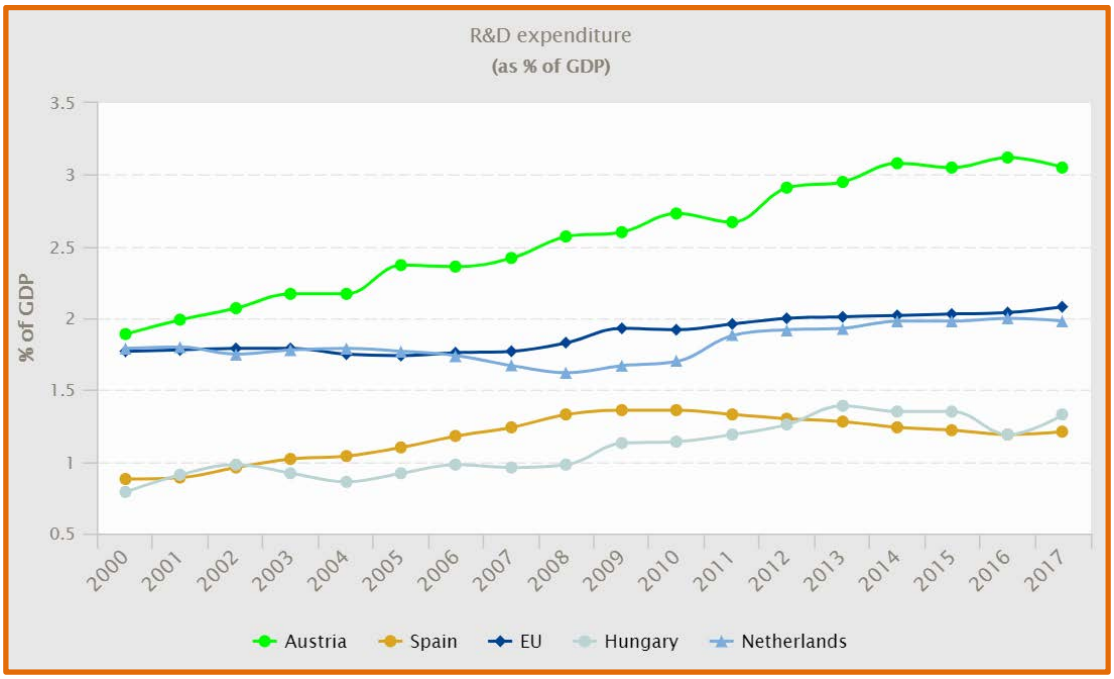


Fig. 15 R&D Expenditure as % of GDP (2000-2017) by EUROSTAT

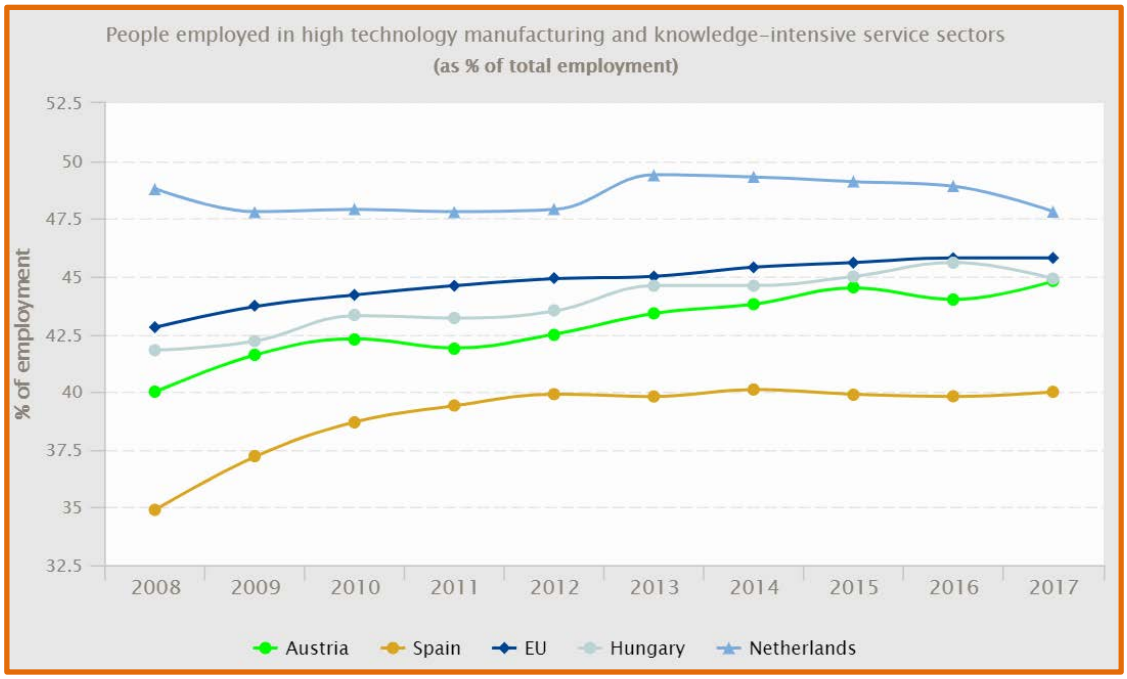


Fig. 16 People employed in high technology manufacturing and knowledge-intensive service sectors (2008-2017) by EUROSTAT

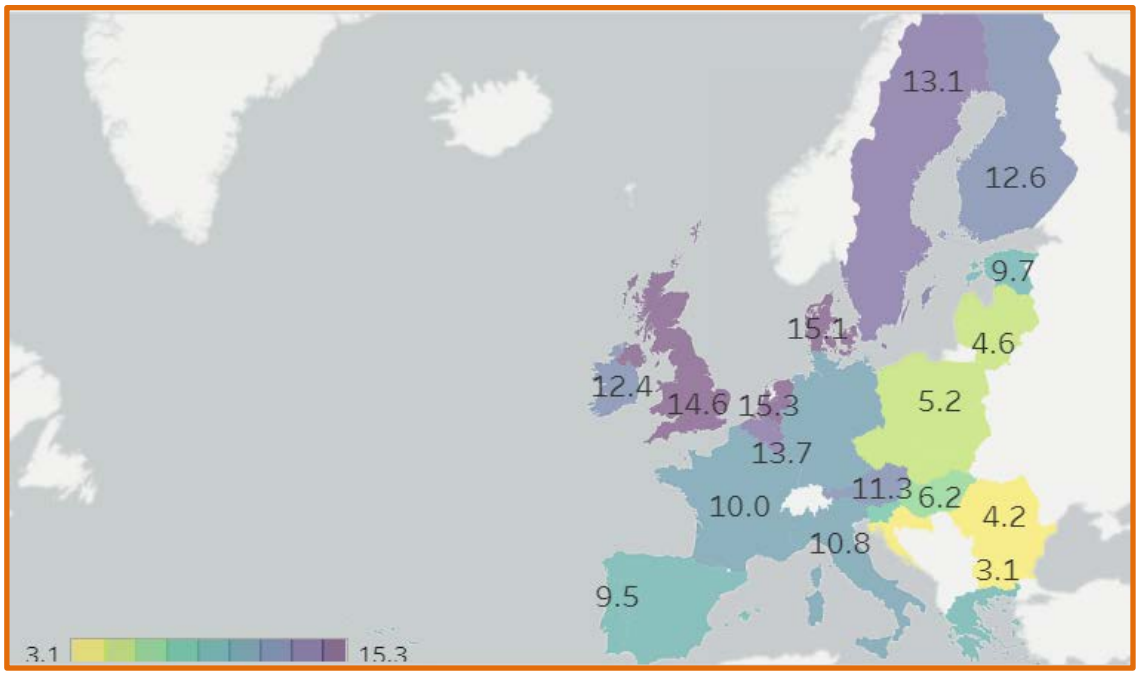


Fig. 17 RIO Indicator 2016: percentage of outputs amongst the top 10% most cited publications

4.1 Austria

Based on official data, there were 5,084 research-performing institutions in Austria in 2017, out of which 3,489 (69%) was in the business sector, employing 52,478 full-time equivalent researchers. The Austrian HEI sector consists of 22 public universities, 16 private universities, 14 university colleges for teacher education, as well as 21 universities of applied sciences (UAS). Vienna is the largest student city in the German-speaking world (more than 200 000 students in 2018), with some of the country's best universities, such as University of Vienna or TU Vienna. Other top-ranked universities include University of Innsbruck, Graz University of Technology and Johannes Kepler University in Linz.[3]

In 2018, around 18,200 full-time equivalent R&D personnel worked at HEI sector – including the Austrian Academy of Sciences (OeAW) and Institute of Science and Technology Austria (IST) even though the number of research institutes (1,259) was much smaller in this sector. A further 2,758 full-time equivalent personnel worked at the 288 R&D institutions in the government sector (including federal and state level). The smallest sector is the private non-

[3] Rankings: The 13 best universities in Austria for 2020/2021, Study.eu.

profit sector which had 48 institutions with 585 full-time equivalent researchers in Austria in 2017.[4]

In parallel with an expansion of its HEI sector (contributing to rising number of tertiary attainment and STEM graduates in the last decades), Austria started to invest heavily into its science, technology and innovation system since the 90s: between 1998-2016, only Korea showed a highest increase in investment in R&D, which stood at 3.19% in 2018 (second highest in EU-28).[5]

Concerning scientific fields, Austria has an excellent basic research structure: IST has a staff of 600, and OeAW has 1,600 employees, but together they have received 78 ERC grants – compared to 125 of all the other Austrian universities. As regards applied science, Austria is well-known for its research on quantum communication and information technologies. Different towns specialize in different scientific fields, with Vienna being an important biotech hub, Linz engaged in mechatronics and Graz in automotive and production. However, some key areas of specialization in Austria are linked to traditional sectors, which might be in the way of faster economic growth.[6]

One of the strengths of the Austrian research system is the close industry-science co-operation starting with the vocational school system, strengthened by the UASs focusing on application-oriented research – their share however remains low in total R&D expenditure of the HEI sector; i.e. 3.8% in 2013 – and several research and technology organisations (RTOs) fostering industry-science collaboration in various ways (e.g. joint research projects, common staff, joint supervision of PhD students), such as the Austrian Institute of Technology (AIT), Joanneum Research or the Austrian Cooperative Research. The higher-than-EU-average government research support also contributed to the intensive research-academia-business collaboration resulting in state-of-the-art public-private research centres, such as the Silicon Austria Labs.

[4] Statistical figures on entities conducting research, Austrian Federal Ministry of Education, Science and Research.

[5] Chart 'Gross domestic spending on R&D', OECD Data.

[6] OECD Reviews of Innovation Policy: Austria 2018, OECD.org.

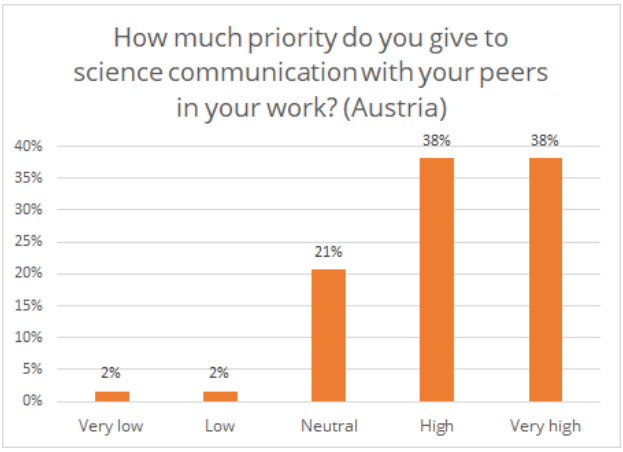
The most R&D&I-intensive companies in Austria were Infineon in 2013-14, and firms such as Borealis, Baxter, BMW, Bosch, Novartis , Siemens or Magna also had significant research activities in the country (Schuch and Testa, 2018).[7]

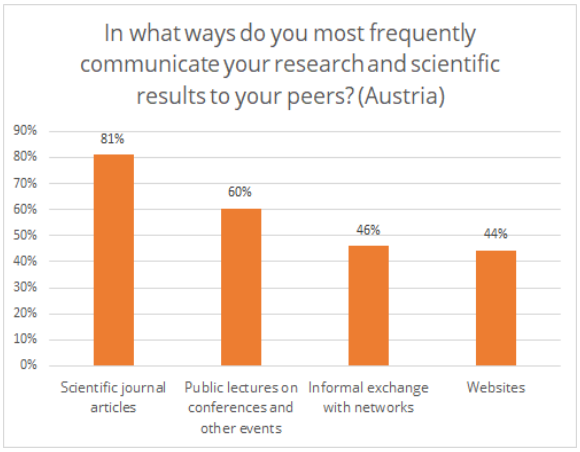
Regarding gender balance, Austria still lags behind. In 2017, the overall share of women researchers was 23% in all R&D-performing sectors. In contrast, Austria has an above-EU-average share of women leaders in HEIs and took important steps to address gender disparities in STEM in its latest strategies.[8]

4.1.1 Science Inreach

76 percent of Austrian scientists participating in the study (n = 63) gave high or very high priority (38-38% each) to inreach science communication. There was a considerable share of neutral answers (21%), while only a few persons indicated low priority to science communication. Publishing in scientific journals is the most common way (81%) to communicate scientific results, followed by lectures to scientific conferences (60%). A bit less than half of the participants indicated their reliance on informal networks (46%) or on websites (44%) to communicate with their peers. Other forms of social media are less commonly utilised in Austria (29%).

Austrian respondents (n = 63)



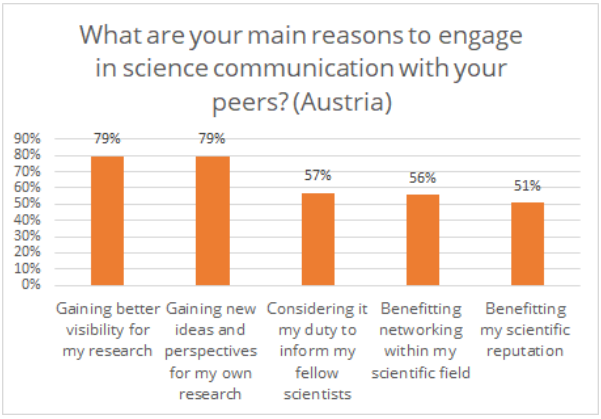


[7] Schuch, K., and G. Testa (2018) 'RIO Country Report 2017: Austria', Research and Innovation Observatory country report series. doi:10.2760/208250

[8] OECD Reviews of Innovation Policy: Austria 2018, OECD.org.

Fig. 18 Inreach priority	Fig. 19 Inreach medium

Respondents said that they intended to engage in SciComm due to better visibility to their findings and potential new ideas and perspectives to be gained through increach communication (79% each). A bit more than half of the Austrian researchers felt that it was part of their duties to inform their peers of their results (57%). Similar proportions of them underlined benefits gained through networking (56%) and an enhanced scientific reputation (51%). As for the main challenges preventing the use of SciComm with fellow researchers, the overwhelming majority mentioned the lack of time (79%), with other factors not being considered relevant by the majority - 22-22 percent mentioning lack of financial incentives and financial support (e.g. for open access publication), hinting at the significance of time and financial factors as the main barriers in front of inreach science communication.



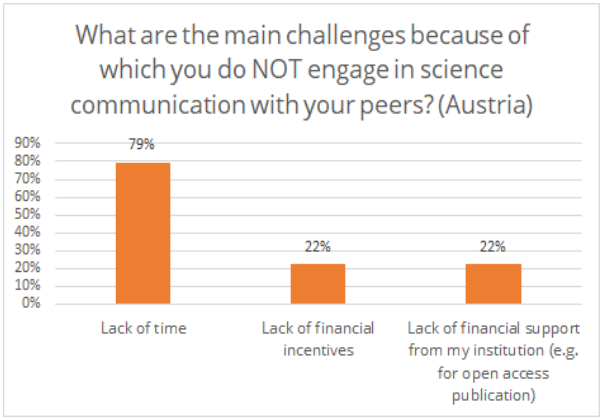


Fig. 20 SciCom rationale	Fig. 21 SciCom barriers

As regards incentives for science communication within the system, the Austrian Federal Government's Research, Technology and Innovation Strategy 2011-2020 ("FTI strategy")[9] has identified several barriers. Among others, the document highlighted the need for a new research strategy and stressed the importance of "creating an adequate environment for the

[9] Bundeskanzleramt et al., ed. 2011. Der Weg zum Innovation Leader. Potenziale ausschöpfen, Dynamik steigern, Zukunft schaffen. Strategie der Bundesregierung für Forschung, Technologie und Innovation.

dialogue between science and society." This included the generation of knowledge and its dissemination through social dialogue, participation and transparency in science. However, the FTI strategy noted that this field is still underdeveloped in Austria. In addition, there is a lack of "controlling coordination and public support for measures and projects aimed at communicating science."

4.1.2 Science Outreach

In comparison to science inreach, science outreach communication is considered less of a priority by Austrian respondents with 19% indicating it as a very high priority, and 38% (the relative majority) as a high priority. More respondents took a neutral stance than in case of science inreach (29%), with a few - but statistically insignificantly - more respondents not attaching relevance to science communication with non-experts. The most frequently used communication channels for science outreach included websites (52%), social media and newspaper articles (40% each) in Austria, with citizen science projects or science festivals used by less than one-quarter of the respondents.

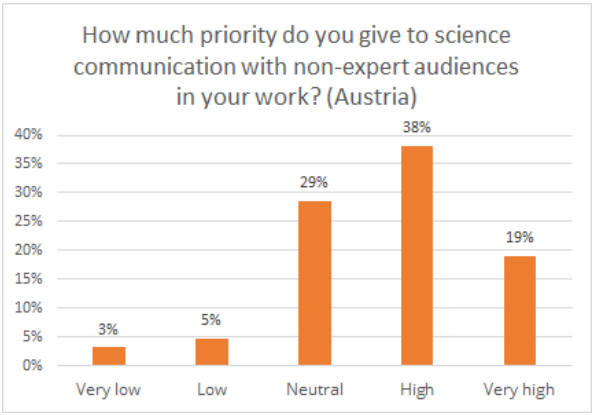


Fig. 22 Outreach priority

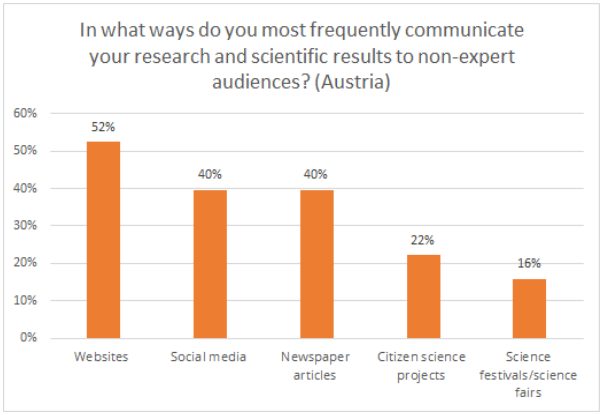


Fig. 23 Outreach medium

In 2013, the Federal Ministry of Science and Research commissioned its own study on the importance of science and research for the Austrian population.[10] According to this, about 80% of the respondents said that the promotion of science and research is an important task of Austrian politics. However, about 54% of respondents complained about a rather poor to

[10] Cited according to the report 2019 by "Rechnungshof Österreich": p.24

very poor level of subjective information; approx. 70% of the respondents said that scientists used a rather incomprehensible technical language, and 65% of the respondents criticised the fact that the complexity of the language made it impossible to understand it. The study identified a mediation problem between the scientific community and the general public, as well as the interested public.

The performance report of Austrian Council for Research and Technology Development pointed to similar conclusions in 2016 by stating that *"the low level of involvement, but also the lack of trust and interest on the part of the population in scientific topics"* poses a problem in science communication.[11] At a more systemic level, the lack of planning certainty, continuity of structures and budgeting, and the lack of coordination of dialogue campaigns have an unfavourable effect on effective science communication.

Since the key importance of an open information society and the transfer of knowledge from researchers to the interested population was also stressed in various studies and policy papers as a remedy to the above problems, the Federal Ministry of Science, Research and Economics in the administrative area of Science and Research made an action plan in 2015 to improve the dialogue between science and society. This action plan requested the opening up of communication processes between academia and interested society and the creation of opportunities for participation. The raising of public awareness of science and communication was supported through various projects, programmes and incentives to raise public awareness of science and research (within an overall budget of 61.84 million EUR within 2013-17). [12]

The European event format "**The Long Night of Research**" („Lange Nacht der Forschung") can be highlighted as a successfully cross-institutional effort in Austria: The Long Night of Research is a nationwide event in the field of research and science communication, which was held annually from 2005 onwards, and every two years from 2010. All research related ministries conducted these events with the Austrian Research Promotion Agency (FFG) and the Austrian Council for Research and Technology Development (Rat FTE). An evaluation over the years 2008 to 2014 showed a positive result. In 2018, approx. 228,000 visitors were counted.

[11] Rat für Forschung und Technologieentwicklung. 2016. "Bericht zur wissenschaftlichen und technologischen Leistungsfähigkeit Österreichs 2016".

[12] Rechnungshof Österreich. 2019. "Forschungs- und Wissenschaftskommunikation." Bericht des Rechnungshofes. Reihe Bund 2019/41.

Research and education-related ministries also supported research and science mediation programmes, such as the children's and youth universities ("Kinderuni" is an ongoing format, https://kinderuni.at/), "**Sparkling Science**" (2007-2019, https://www.sparklingscience.at/) or research internships. These programmes were effective instruments in the context of science outreach, embedded in the impact and strategic objectives of the ministries, and included guidelines, quality control and evaluation.

Furthemore, incentives (by different providers) aimed at supporting Austrian scientists and researchers to engage in (inreach and outreach) science communication (further incentives available are of more ephemeral character):

- Annual award "WissenschaftlerIn des Jahres in Österreich": The **Austrian Association of Education and Science Journalists** awards researchers who included a focus on easy-to-understand communication to their work and thus also raised the image of Austrian research among the general public.
- Academic research and education at the **Department of Science Communication and Higher Education Research** at the **University Klagenfurt**: The department was founded in 2007 and focuses on the social constitution of science in the broader German sense of Wissenschaft. Central themes are the interplay and boundaries between multiple practices and cultures of the social sciences, humanities, and natural sciences; the societal importance of universities as research and educational institutions; and the media-based communication of scientific knowledge.
- Science communication workshops with a focus on transdisciplinarity and/or interactivity for researchers and scientists - such as the **Communication Hub** 2017/18 open to students and researchers from all disciplines - are facilitated by an alternating joint venture of **WTZ Ost** (an academic service putting a focus on scientific entrepreneurship), the **Austrian Science Center Network** and the **University of Vienna**.

The **Austrian Science Fund** (FWF) provides a range of funding programmes with a focus on or a relevant relation to science communication. The programmes **WissKomm** and **Top Citizen Science** will be highlighted as good practice examples for science inreach and outreach at the end of the chapter.

Despite the large majority of respondents considering they have no time (79%) to engage in outreach SciCom, they think that informing the public about their findings is their duty (67%), as well as shaping public debates around scientific issues (57%). This is in line with the

findings of a 2017 report by the Austrian Science Centre Network[13] which highlighted "idealisme" (and pro bono activities) as one driving force for science outreach communication in Austria. Furthermore, only around half of the people (49%) see outreach activities as a way to gain better professional visibility. Similarly as in case of science inreach, Austrian researchers cite the lack of financial incentives (23%) as the second reason for non-engagement after time constraints. Relatively few people mentioned other challenges for non-engagement in science outreach communication: 16 percent each underlined the significance of the lack of reputational incentives, and the inadequate knowledge of proper communication channels towards laypersons.

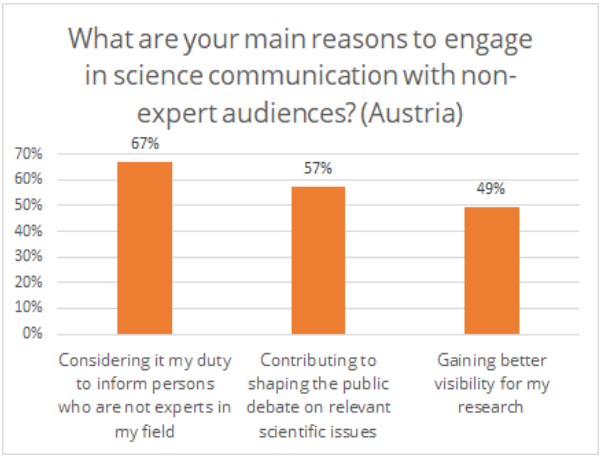


Fig. 24 Outreach rationale

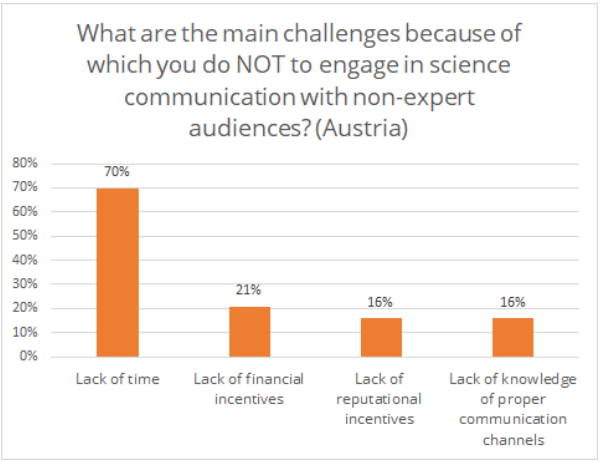


Fig. 25 Outreach barriers

The consideration of outreach science communication as a public duty is justified by recent Eurobarometer surveys showcasing that about 69% of Austrians did not feel informed about science and about 55% of Austrians did not have any interest in it. At the same time, about 70% of respondents lacked sufficient scientific information (last data: 2013).[14]

Interestingly there is no such SciComm opportunity which is provided by at least half of the organisations employing the respondents in Austria. Most commonly a flexible working time is offered to help engage in SciCom (49%), followed by the use of online communication

[13] ScienceCenter Netzwerk. 2017. "Erfolgsfaktoren für Empowerment und Mobilisierung von WissenschafterInnen hinsichtlich (interaktiver) Wissenschaftsvermittlung."

[14] European Commission, ed. 2013. Special Eurobarometer 401. Responsible Research and Innovation (RRI), Science and Technology.

channels (44%). Several Austrian organisations tend to provide specific training either on oral communication (43%) or on written communication (35%), thus supporting their researchers to be able to communicate their findings in a comprehensible way.

Fig. 26 Opportunities provided for science communication

4.1.3 Gender balance and SciCom

Most of the people (61%) interviewed in Austria consider that women are underrepresented in their area of study, and as a result they are underrepresented in SciCom (62%). There seems to be no difference in participation and visibility of women in science in general and science communication. Only a really few respondents said that women are overrepresented in science (3%) or in science communication (6%).

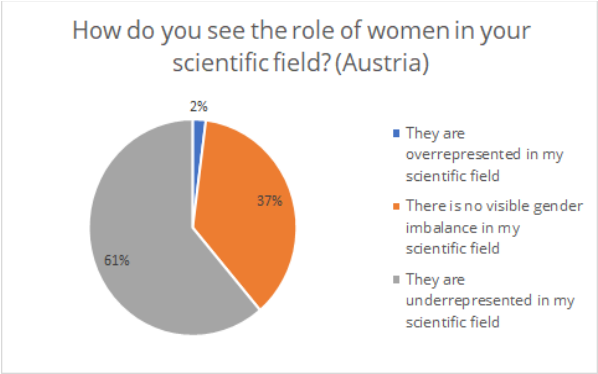


Fig. 27 Role of women in science

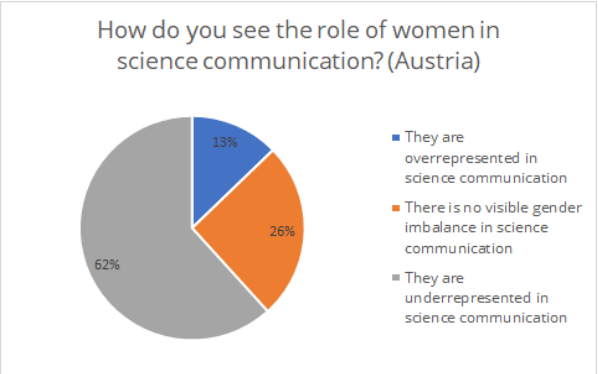


Fig. 28 Role of women in SciComm

4.1.4 Best case incentives for science communication

4.1.4.1 WISSKOMM (Science Communication Programme)

Short description of the program: WissKomm is coordinated and funded by the Austrian Science Fund (FWF), which is Austria's central funding organisation for basic research: the programme offers funds - up to 50.000 per application - to outstanding science communication activities that aim to communicate scientific content from FWF-funded projects to relevant target groups with a max. duration of 12 months.

WissKomm is addressed to researchers working in Austria who are or have been in charge of an FWF-funded project or who are or have been employed in an FWF-funded project. If the project has already been completed, the end of the project must not be more than three years before the submission deadline.

The programme started in 2013. In 2020, some elements of the Science Communication programme have been modified on the suggestion of the expert jury and the scientific community. Besides principal investigators, project staff members are now also eligible to subject applications. The WKP project must still be primarily carried out in Austria, but funding can also be used for activities abroad. Plus, the evaluation criteria have been revised and streamlined. 34 projects were funded so far as part of the Science Communication programme and are represented in the FWF Project Finder.

Scope: WissKomm offers incentives on a national level, projects have mainly to be implemented in Austria.

Target group: In general, the programme is open to all Austrian researchers from all disciplines with a focus on STEM, social sciences and humanities.

Subjects areas affected: All disciplines and subjects are covered reaching out for excellence in science communication.

Communication channel: The programme puts a focus on participatory and interactive formats and cross-channel approaches.

Impact: There is no public data available but project representatives are asked for a self-disclosure. A heuristic evaluation of funded projects (by authors) highlights the tendency regarding the participation of early career researchers and a tendency regarding an equal participation of female and male researchers.

Further information: The FWF is Austria's central funding organisation for basic research as well as arts-based research. Applying international quality benchmarks, the FWF provides funding for outstanding research projects and excellent researchers who work to generate, broaden, and deepen scientific knowledge.

Link to the WissKomm programme (FWF website)

4.1.4.2 TOP CITIZEN SCIENCE programme

Short description of the programme: For the fifth time, the FWF has issued the "Top Citizen Science" funding initiative (TCS) with a budget of EUR 250,000 in 2020. Under this call, funding will be made available for the expansion of FWF-funded research which is suitable in terms of content and methods and which is to be expanded to include "citizen science" components. In the context of this initiative, citizen science is understood as the active involvement of citizens and their knowledge, resources, and commitment in scholarly research and the generation of new scholarly insights. The initiative is designed to support research activities that enable citizens to contribute to generating substantial additional research results and insights on the basis of their abilities, expertise, curiosity, and willingness to participate – without sacrificing the excellence of the research work. The quality of the research underlying each expansion project is to be ensured by the project on which it is based ("main project"). 21 projects were funded so far as part of the Top Citizen Science programme and are represented in the FWF Project Finder.

Scope: TCS offers incentives on a national level, projects have to be implemented in Austria.

Target group: In general, the TCS programme is open to all Austrian researchers from all disciplines with a focus on STEM, social sciences and humanities.

Subjects areas affected: All disciplines and subjects are covered reaching out for excellence in public engagement, citizen science and science communication.

Communication channel: The programme puts a focus on participatory and interactive formats with a broad range of stakeholders and cross-channel communication.

Impact: There is no public data available but project representatives are asked for a self-disclosure. A heuristic evaluation of funded projects (by authors) highlights the tendency regarding the participation of early career researchers and a tendency regarding a roughly equal participation of female and male researchers.

Further information: The FWF is Austria's central funding organisation for basic research as well as arts-based research. Applying international quality benchmarks, the FWF provides funding for outstanding research projects and excellent researchers who work to generate, broaden, and deepen scientific knowledge.

Link to the Top Citizen Science programme (FWF website)

4.2 Hungary

Based on the official statistical data, there were altogether 3.491 Hungarian research-performing organisations that employed more than 31.000 researchers (in full-time equivalent) in Hungary in 2018. The share of researchers in total employment was 0.7%, which represents a decade-long rising trend in parallel with the increasing share of GDP spent on research and innovation (1.53% in 2018, which is still under the EU-28 or OECD average but comparable with Central-Eastern European countries).

Out of these 31.000 researchers approximately 6.600 researchers (in full-time equivalent) work in the higher education sector (within more than 1.300 smaller and larger research units), with an almost even distribution between social sciences (22%), medical sciences (21%) and natural sciences (20%) as the biggest scientific fields.

Taking the Academic Ranking of World Universities (ARWU) – using publication performance as a significant part of its measurement – as a benchmark, the most relevant higher education institutes in Hungary were Eötvös Lóránd Science University, Budapest University of Technology and Economics, University of Szeged, University of Debrecen and the Semmelweis University. The Central European University must be also mentioned since this was the only Hungarian university getting into the top 200 universities in the world in certain scientific fields (economics, political science, public administration) even though its overall

profile did not let it be featured among the top Hungarian higher education institutions in terms of scientific publications (within Scopus).[15]

In addition to higher education institutions, 4.700 researchers (in full-time equivalent) are employed at other public research institutions (altogether 127), out of the higher education sector: here the most relevant fields are natural sciences (48%), followed by medical and social sciences (15-15%) Among the 127 public research institutes, the 17 institutions under the Hungarian Academy of Sciences has a traditionally significant role: they employed 69% of all researchers in public institutions, corresponding to more than 3.200 persons.[16]

Since research institutes are not ranked by ARWU, therefore we used the number of awarded prestigious ERC grants as a benchmark for excellence, showing that the most relevant Hungarian academic research institutes in 2018 were the Institute of Experimental Medicine, the Alfréd Rényi Institute for Mathematics and the Biological Research Centre in Szeged.[17]

In addition to the bit more than 11.000 researchers working in higher education and other public research institutes, around 20.000 researchers were employed at the more than 2.000 R&D business R&D units. The comprehensive 'dual economy' phenomenon of the Hungarian economy is also visible in the R&D sector since the 1.690 Hungarian R&D-intensive (mostly micro-, small or medium-sized) firms employed around 8.000 researchers, while the 219 foreign-owned (mostly large multinational) R&D performing companies employed a bit less than 12.000 researchers, also being responsible for around 60% of all R&D expenditure. The smaller companies carried out significant research activities in the field of information and communication and natural sciences, but – due to the leading role of multinationals in R&D employment and expenditure – the most important R&D activities at businesses relate to the applied uses of chemistry (medicine) and manufacturing (vehicle industry).

The most significant R&D performing organisations are in this regard: Audi (17.6% of entrepreneurial R&D), Richter Gedeon (14.6%), Nokia Solutions and Networking (6.3%), Ericsson (5.4%) and Egis (2.8%). As visible, these five multinationals are responsible for almost half of the total R&D performed in private business settings in Hungary which shows a high level of sectoral concentration (IT, electronics, vehicle and medicine) and the lack of national capital required for R&D.[18]

[15] The publication performance of Hungarian universities in light of international university rankings: Challenges and possible solutions, semanticscholar.org.

[16] Research and Development in Hungary, 2018, ksh.hu.

[17] Élet a harmadik vonalban: a magyar kutatási teljesítmény számokban, index.hu.

[18] Magyarország a globális innováció segédmunkása, öt cég költi el az országos k+f felét, g7.hu.

With regard to gender balance within the academic and research sector, the least proportion of women (only around 23%) work at entrepreneurial R&D units, the situation is better in higher education (48%) and other public R&D institutes (47%). The biggest disparities are visible in medical sciences where only 30% of the scientists are women, while there is a gender balance in social sciences and slightly more women in agrarian sciences (54%).[19]

4.2.1 Science Inreach

As displayed in Fig. 29, more than two-thirds of the respondents (altogether 30) confirmed a high (41%) or very high priority (26%) to inreach science communication. Low rates were given by one scientist in the field of engineering and psychology. No respondent indicated a very low priority. Publishing in scientific journals is the most common method (74%), followed by public lectures on conferences and other events (66%). Social media and informal exchange is used by around one-third of all the respondents.

Hungarian respondents (n = 30)	

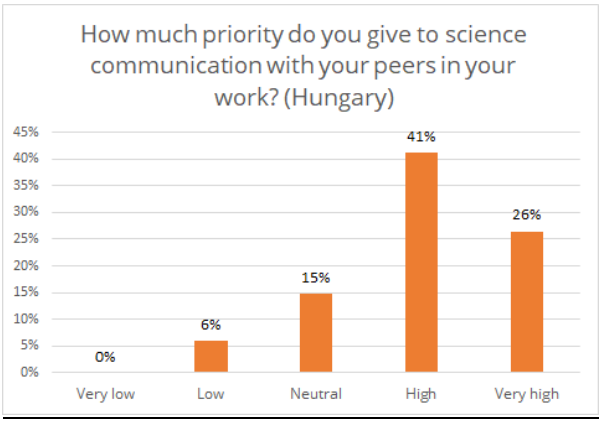
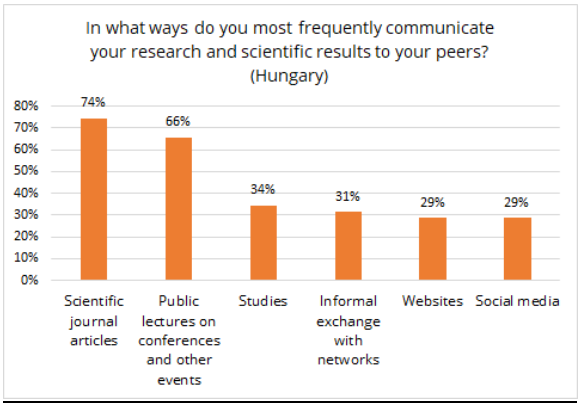

	

Fig. 29 Inreach priority	Fig. 30 Inreach medium

When looking at the public patterns, we can draw on data of scientific journal articles written in Hungarian or English languages. In case of books, journal articles, as well as conference

[19] Research and Development in Hungary, 2018, ksh.hu.

proceedings the higher education sector has a defining role with around **75% of all scientific work being published by researchers working in the higher education sector** (even though their total share among all researchers is only 15%). Scientists working in other research institutes are responsible for 24% of the whole scientific output, while the role of researchers working at private businesses is marginal (1% of all scientific publications even though they represent 50% of the total number of Hungarian researchers).[20]

Science communication is rather carried out in other ways than peer-reviewed publications in case of private R&D-intensive businesses (or their research units). One of the most important channels is the **official cooperation established between certain local universities and private companies**, such as the Széchenyi University in Győr and Audi or the Budapest University of Technology and Economics and Ericsson. In both cases, industry experts – from the field of vehicle manufacturing and electrical engineering – participate in the university education with the focus of aligning labour market needs and educational offers. This collaboration does not only manifest in common Hungarian and international projects and publications (statistically counted towards the higher education institutes), but also to an increased science communication between practitioners and scientists in the form of university lectures, common studies (e.g. in projects), science popularization events or other informal exchange methods within these networks.

The R&D intensive big companies in Hungary also tend to communicate their most relevant (applied) scientific results through **social media platforms**. Nevertheless, the main aim of this form of science communication is rather self-promotion than the popularization of science or exchange of information. This does not alter the fact that genuine scientific information is also shared with the interested public, e.g. currently, the large pharmaceutical companies served as an important source of information regarding COVID-19 (symptoms, rules of social and physical distancing, news on potential vaccines, etc.) on their social media platforms.

As regards rationales for engaging in inreach science communication, respondents say to engage in inreach SciCom mostly because they want to give visibility to their findings (63%) or they want to gain new ideas and perspectives (60%). Approximately half of the respondents see benefits in more extensive networking (54%) or consider it a duty to inform other scientists (51%). Interestingly, financial benefits or scientific reputation are not among the top 5 reasons in Hungary. The Hungarian researchers rather focus on the **benefits for**

[20] Research and Development in Hungary, 2018, ksh.hu.

their own ongoing research in terms of visibility, ideas and perspectives, as well as building networks.

The main obstacle to engage in inreach activities is the lack of time (60%), followed by the lack of financial incentives (34%) and lack of financial support to, for example, publish in open access journals (26%) - these are the two crucial factors hindering better uptake of science inreach communication.

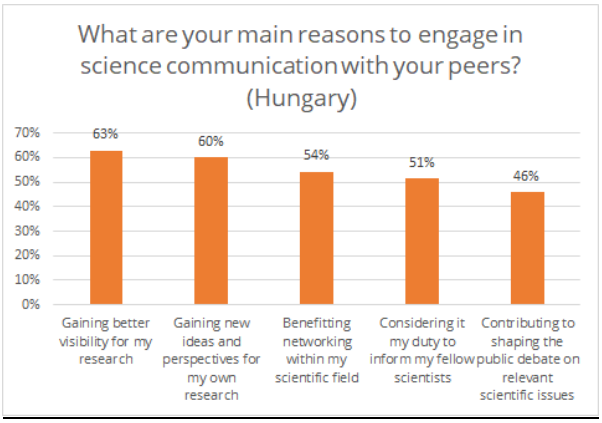


Fig. 31 SciCom rationale

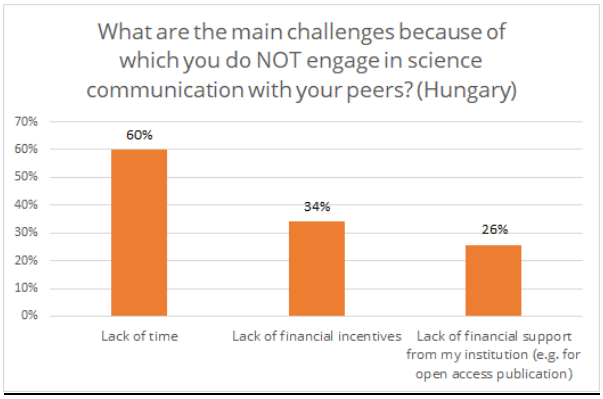


Fig. 32 SciCom barriers

When comparing these survey findings with expert opinion, we find that they list several more reasons for the 'semi-strong' science communication performance in Hungary (comparatively good within the narrow region, corresponding to the size of GDP and R&D expenses, but lagging behind Western European competitors). One of the most important objectives of science communication is making connections, building a network within and beyond the institutional and national borders. For this purpose, the adequate knowledge of English language, which has already become the lingua franca in science in recent decades, is essential. Unfortunately, many Hungarian scientists lack **proper knowledge of foreign language,** and even the most skilled ones may struggle with the strict requirements of publications (the use of 'fluent academic English' in writing). This might be worsened by institutional **financial barriers in ways of networking,** such as the lack of funding available for attending international conferences or for subscribing to costly state-of-the-art databases, such as Web of Science, ScienceDirect or Taylor & Francis.[21]

[21] The publication performance of Hungarian universities in light of international university rankings: Challenges and possible solutions, semanticscholar.org

Our survey analysis shows that the main reasons mentioned by respondents also feature the lack of financial support and incentives, which is connected to the issue of slow uptake of **open access** in Hungary. In addition, lack of time is mentioned as the most relevant barrier indicating overworking of scientists and the incapability of harmonizing research and teaching requirements.

4.2.2 Science Outreach

In comparison to science inreach, only half of the respondents indicated a high (23%) or very high priority (26%) for science communication with non-expert audiences, with a much higher share of **neutral opinion** (3), while low priority answers still remaining in the minority. In case of science outreach Hungarian scientists mainly use opportunities provided by **social media** (45%) and **websites** (38%). Around one-third of the respondents use newspaper articles, blogs or science festivals and similar events to communicate their scientific findings to non-experts.

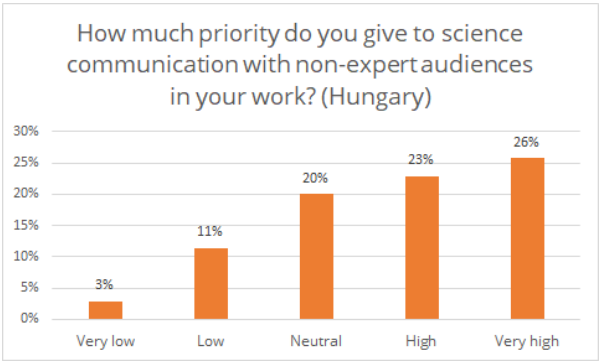


Fig. 33 Outreach priority

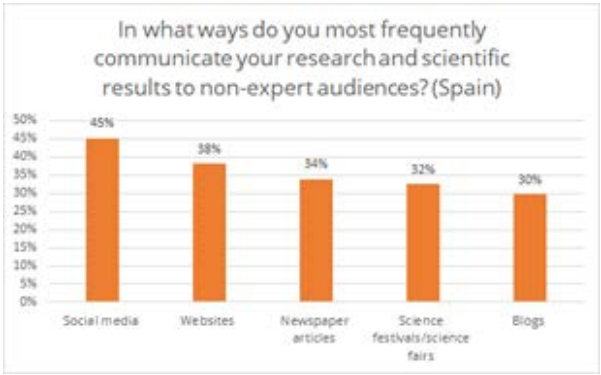


Fig. 34 Outreach medium

Science festivals and cafés were also mentioned in almost all scientific fields and experience levels: prominent examples with a high outreach include the following: the Csopa Science Centre (Palace of Wonders) is the oldest interactive area in Hungary showcasing the rules of natural science to all generations in an entertaining way. One of the institution's mission is to build and maintain connections with the Hungarian science sector to facilitate communication of the latest scientific breakthroughs in an easily digestible way. The institution started an educational science café series, Science Csopa Café in 2015 with the aim of bringing together scientists and the interested public in an engaging informal setting. The character of the science café was further broadened in 2020 by launching a grant

scheme to involve as many scientists as possible – until now 170 STEM and social scientists, practitioners and university students talked with the audience about their research pursuits.[22]

The aim of a newly established science communication agency, Vizio Budapest is to support all relevant stakeholders, such as research institutes, R&D-intensive firms and start-ups, education institutions, public bodies and non-profit organisations in improving and promoting their communication on science. Their most successful event is the series of science exhibitions, called the Capital of Sciences where the representatives of the most significant STEM areas could present their research findings in a direct and entertaining way, e.g. via a virtual tour through CERN or getting acquainted with the basics of robotics.

The highest share of researchers (57%) consider it their own duty to inform persons who are not experts in the field, which hints to strong intrinsic motivation even in lack of financial incentives. Fewer respondents see benefits of outreach science communication in shaping the public debate (43%) or gaining better visibility (40%). All in all, fewer respondents see the value of outreach communication than in inreach communication and no majority is behind one personal (career or networking) or financial incentives. The highest share of respondents in the latter category said that outreach science communication contributes to influencing the funding priorities (23%), which might hint at communication with relevant policy-makers, such as funding bodies in Hungary or abroad.

As regards the major challenges in the way of engaging in outreach science communication, the majority of the respondents stated lack of time as a hindrance (54%). No other challenges were mentioned by a majority of researchers, with lack of financial incentives (29%) and lack of knowledge of proper communication channels (20%) being the other most frequently cited barriers.

[22] „CSALÁDBAN MARAD" TUDOMÁNYKOMMUNIKÁCIÓS PÁLYÁZAT - EREDMÉNYHIRDETÉS, csopa.hu.

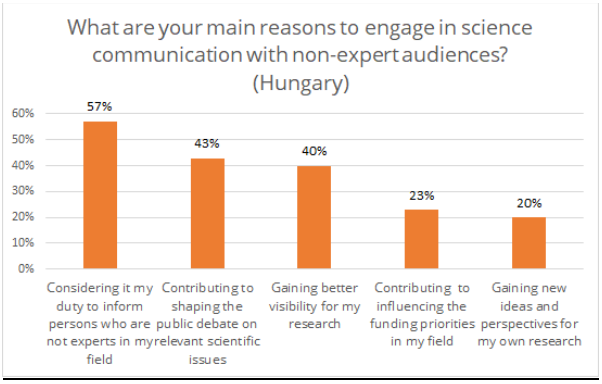


Fig. 35 Outreach rationale

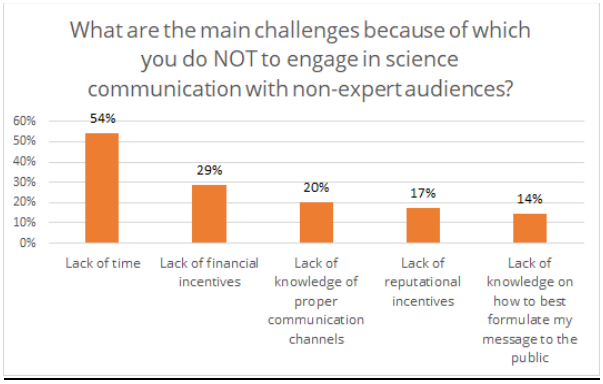


Fig. 36 Outreach barriers

Thinking about science communication in general, most organisations in Hungary provide opportunities for scientists for better science communication through flexible working time (49% - more common in research institutes than in universities), the use of public events or online communication channels (40-40%). Not mentioned among the top 5 reasons (less than one-quarter of respondents) are **specific training on written or oral communication or funding on science communication.** This suggests a lack of adequate training programmes organised by public or private bodies of utmost importance. Training is mostly offered by research institutes (but not universities) on written (but not oral) science communication but this is not as widespread as other opportunities.

Data shows that most of the Hungarian universities provide some courses on (written) science communication at least at PhD level but the unrecognized importance of the field can be observed by the 2018 suspension of the country's sole MSc Science Communication programme offered by ELTE.

This highlights the role of science communication initiatives, such as FameLab (under the auspices of the Hungarian Academy of Sciences and British Council) where professionals, lecturers, doctoral candidates, university students in all STEM fields should present their research in a strictly competitive environment (e.g. solo performance of max. 3 minutes) with the support of master courses on science communication.

SCIndicator is the first Hungarian science communication mentor programme run by the independent non-profit organisation, Women in Science (Nők a Tudományban) with the aim of providing early-stage (18-35 years old) STEM students and researchers with a chance of developing their communication skills. The scheme offers a unique opportunity to learn oral

and written science communication practices from the best communication experts and STEM practitioners (showcased as a best practice at the end of this chapter).

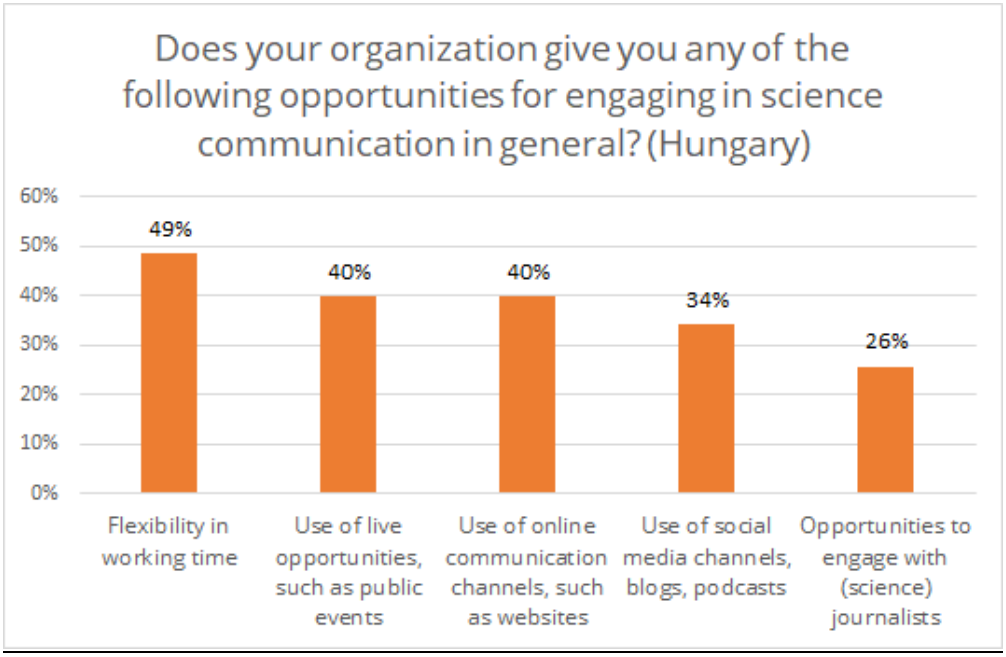


Fig. 37 Opportunities provided for science communication

4.2.3 Gender balance and SciCom

Most of the people (46%) interviewed in Hungary consider that there is no visible gender imbalance in their scientific field and therefore women are neither over- or underrepresented in their area of study, and as a result there is no visible imbalance in SciCom either (52%). The rest of the respondents pointing to some gender imbalance are rather leaning towards underrepresentation of women in both their own scientific field (33%) and in SciComm (37%).

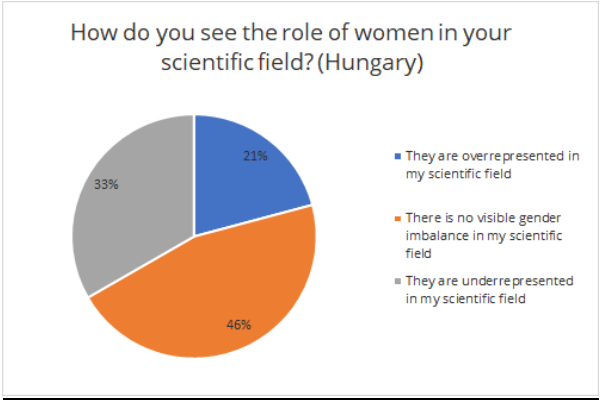


Fig. 38 Role of women in science

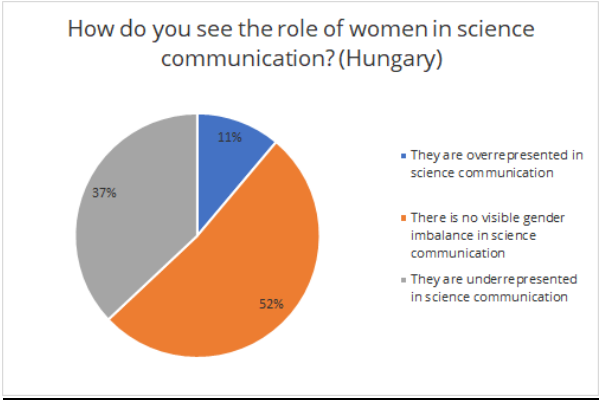


Fig. 39 Role of women in SciComm

4.2.4 Best case incentive for science communication

4.2.4.1 Scindikátor

Short description of the programme: Scindikátor science communication mentoring programme provides early-stage scientists and university students in all STEM fields (age 18-35) with a chance of developing and finetuning their science communication skills. The training is free of charge and includes a personal mentoring and group training provided by professional mentors, STEM lecturers and practitioners selected by a jury through strict eligibility criteria.

The programme starts with a 2-day online workshop, followed by a 2-day mentoring for successful applicants where many issues are covered, such as tricks and tips for science communication, the written communication of scientific results to press and workshops specifically designed to overcome the most common presentation mistakes.

This is followed by a 2-time trial presentation in secondary schools and a final presentation before a scientific audience. The programme also covers an alumni network to take care of sustainability of the network achieved and skills gained.

At the end of the mentoring programme, the participants will be able to express themselves in an engaging way by using various tools of improvisation, storytelling, presentation and speech techniques.

Scope: national

Target group: university students, PhD candidates and early-stage researchers (18-35 years)

Subjects areas affected: STEM fields

Communication channel: public lectures and presentations given to expert and non-expert audiences

Impact: better communication between scientists in STEM fields and with laypersons (inreach and outreach) through mentoring and workshops. Such opportunities for personal development are missing from the offer of Hungarian funding bodies, universities and other research organisations as also visible through the TRESCA survey answers.

Further information: the programme is implemented by the Women in Science Foundation, specifically taking care of the gender balance

4.3 Spain

Overview of the Spanish R&D sector

Gross Expenditure on Research and Development (GERD)[23] as percentage of GDP is 1.24[24] in 2019 in Spain. As shown in the chart below[25], GERD of Spain and Hungary is much lower than that of Austria and Netherlands and of the average value of OECD countries. Spain is one of just three eurozone states in the OECD to have invested less in R&D in 2016 than in 2008 (Total expenditure in R&D: -9.8; R&D intensity: -0.13)[26].

[23] Gross domestic expenditure on R&D (GERD) as a percentage of GDP is the total intramural expenditure on R&D performed in the national territory during a specific reference period expressed as a percentage of GDP of the national territory.

[24] Global Innovation Index 2020, Spain.

[25] Main Science and Technology Indicators, MSTI 2020-1 (4 August 2020). Data extracted on 28 Sep 2020 12:40 UTC (GMT) from OECD.Stat

[26] Ramon Xifré "Spanish investment in R&D+I in the wake of the crisis: Public versus private sector", COTEC Foundation for Innovation.

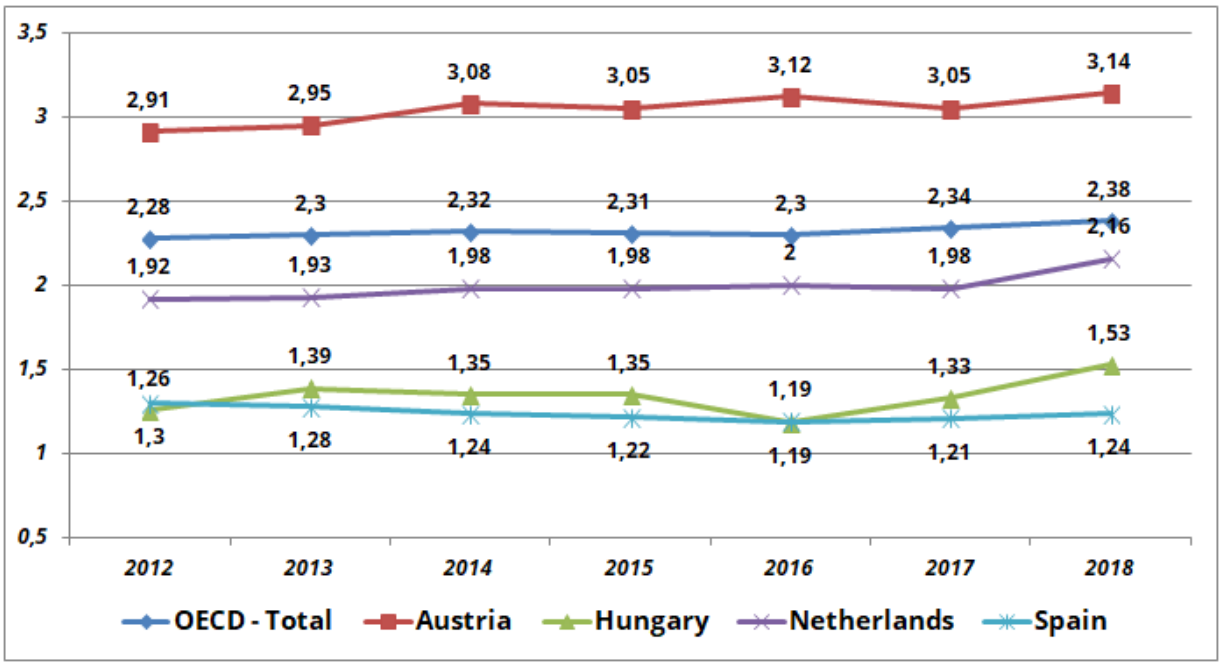


Fig. 40 Authors' elaboration of GERD as a percentage of GDP by OECD.Stat

Despite the slight increase in total GERD in 2016, R&D intensity has continued to fall since 2010 and remains below the 2007 level.

R&D and Higher Education policies are mostly managed by regional governments. The most attractive regions in terms of fundings are the Basque country and Catalonia. In 2007 The Basque Government created Ikerbasque, which provides a comprehensive offer that has long term stability, covering the different stages of the researcher's career. ICREA, which is the Catalan Institution for Research and Advanced Studies, is a foundation that offers permanent, tenured positions to researchers from all over the world to come and work in Catalonia.

Publicly funded scientific institutions

The Spanish System of Science, Technology and Innovation (SECTI) includes all public and private R&D entities as well as funding and executive agencies. According to the Law of Science, Technology and Innovation 14/2011[27], besides the National Health Institute Carlos

[27] Ley 14/2011, de 1 de junio, de la Ciencia, la Tecnología y la Innovación. Jefatura del Estado «BOE» núm. 131, de 02 de junio de 2011. Referencia: BOE-A-2011-9617

III (ISCIII), which also acts as a funding research agency, the following Public Research Organisms[28] operate in Spain. They are:

- Astrophysics Institute of Canarias (IAC)
- National Center for Energy, Environment and Technological Research (CIEMAT)
- National Health Institute Carlos III (ISCIII)
- National Institute for Aerospace Technology (INTA)
- National Institute of Agrarian and Agro-Food Technology (INIA)
- National Research Council (CSIC)
- Spanish Geological and Mining Institute (IGME)
- Spanish Institute of Oceanography (IEO).

All these institutes and centres pursue scientific excellence and knowledge transfer as their main goals. For example, according to its Statute (Article 4), CSIC has 4 main missions:

1. to foster multidisciplinary scientific and technological research;
2. to promote knowledge transfer to industry and society;
3. to enhance education and training of scientific and technical staff;
4. to support the creation of Technology Based Companies (spin-offs).

In 2016, the Higher Education Sector (HEIs) included R&D units in 48 public universities, 32 private universities and 90 other centres.

Private research centres

Research in Spain is not only carried out within public research centres, though. As reported in previous studies[29], Spanish companies have traditionally underinvested in R&D (0.74% of GDP in 2008 and 0.69% in 2012) and strong R&D and innovation activities are concentrated in four regions, which are Andalusia, the Basque Country, Catalonia and Madrid. These regions accounted for 68% of national R&D expenditure in 2008 and for 70% in 2012. Companies such as Tecnalia in San Sebastián, whose mission is to transform technology into GDP[30], serves as a bridge to transform applied research into technological development[31].

[28] Public Research Organisms (PROS), Ministry of Science and Innovation 2020.

[29] Cruz-Castro, Laura, Adelheid Holl, Ruth Rama, and Luis Sanz-Menéndez. 2018. "Economic crisis and company R&D in Spain: do regional and policy factors matter?" Industry and Innovation 25 (8): 729-751.

[30] See Tecnalia's MISSION.

[31] See INTEGRATING TECNALIA INTO THE VALUE CHAIN model.

According to the Spanish National Statistical Institute (INE)[32], between 2008 and 2016, there has been a 33.3% increase in the number of private universities and a 52.7% rise in the number of researchers employed by them.

Scientific productivity

Despite decreasing levels of investment over the last ten years, Spanish science is still competitive in specific areas of knowledge. According to the Compendium of Bibliometric Science Indicators[33], Spanish researchers were able to produce the larger proportion of scientific scholarly publications between 2003 and 2012. In 2016, according to the RIO indicator[34], Spain had 9.6 percent of its scientific publications among the top 10% most cited (Netherlands had 15.3%, Austria 11.3%, and Hungary 6.2%). As shown in the chart below, the number of Spanish scientific publications among the top 10% of most cited outputs has been constantly increasing between 2000 and 2016.

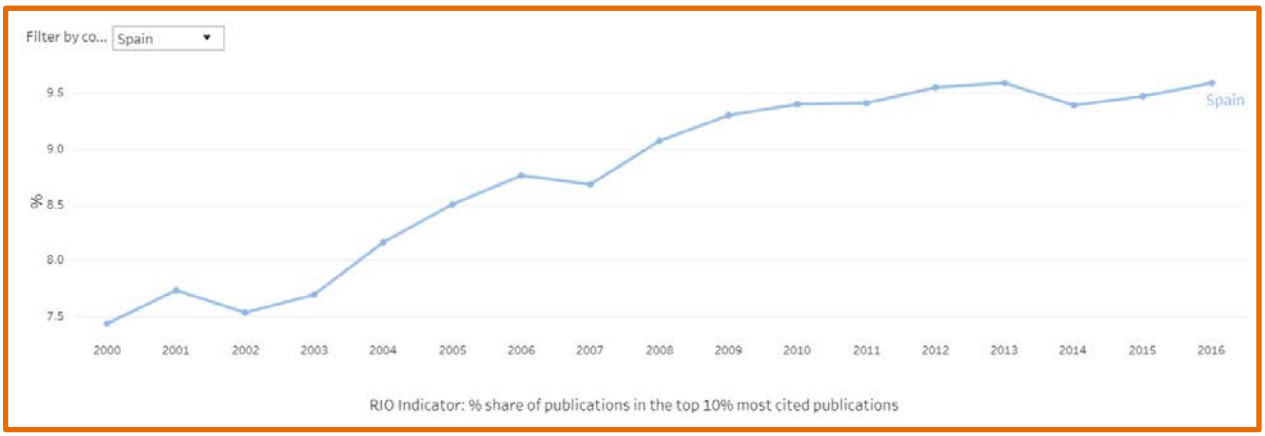


Fig. 41 RIO Indicator: Highly cited publications (2000-2016) - Spain

A brief overview of CSIC scientific production gives an idea of the contribution to science given by public research organisations. The CSIC produces 20% of the national scientific output (over 10 000 publications in high impact international journals in 2017) and remains the first institution in Spain in the generation of patents, with around 200 patent applications

[32] Estadística de I+D 2016. Sector Enseñanza Superior. Resultados en I+D por principales variables, disciplina científica y tipo de centro. Instituto Nacional de Estadística.

[33] OECD and SCImago Research Group (CSIC) (2016), 'Compendium of Bibliometric Science Indicators', OECD, Paris. Accessed from http://oe.cd/scientometrics.

[34] Highly cited publications: Number of scientific publications among the top 10% most cited, in fractional counting 2000-2016. Last update: 02/02/2018. European Commission.

in 2017. it provides services to the entire scientific community through the management of several Singular Scientific and Technological Infrastructures (ICTS) such as the "Calar Alto" Astronomical Observatory, the "Doñana" Biological Station, the European Synchrotron Radiation Facility, the "Hesperides" Ocean Research Vessel, the Integrated Micro and Nanoelectronics Clean Room, the "Juan Carlos I" Antarctic Base, the "Max Von Laue-Paul Langevin" Institute and the "Sarmiento de Gamboa" Ocean Research Vessel. As of December 2019, the CSIC has obtained 643 projects in H2020, with a total EU financial contribution of 270 million euros and is listed the 1st organisation in Spain and the 4th participant by number of projects (E-CORDA).

SciCom in Spain

SciCom is mostly promoted by the Spanish Foundation for Science and Technology (FECYT), which is a public foundation funded in 2001 and dependent on the Ministry of Science and Innovation whose mission is to strengthen the link between science and society through actions that promote open and inclusive science, culture and science education. FECYT funded a number of projects until 2007, which was the Year of Science in Spain and led to the creation of Units of Scientific Culture and Innovation (UCC+I) and the Spanish Network of Science Museums[35]. The SINC agency (acronym for Servicio de Información y Noticias Científicas) is the scientific news agency of the Spanish Foundation for Science and Technology (FECYT) operating since 2008. The agency has a team of journalists and communicators specialized in science, technology and innovation who produce news, reports, interviews and audiovisual materials (videos, photographs, illustrations and infographics). All contents are produced under a Creative Commons 4.0 licence.

After the 2008 economic crisis the field suffered budgetary restrictions and nowadays SciCom activities are mostly funded and carried out by universities and research centres with regional funds or promoted by specialised media outlets.

With respect to universities and research centres, the Instituto Galego de Física de Altas Enerxías (IGFAE) will organise in November 2020 the third edition of its Scientific Communication Competition (IGFAE C3) meant to stimulate the communication and learning of Physics. In 2020, CSIC set its own YouTube channel to broadcast webinars about a variety of scientific issues to respond to questions of public interest associated with the Covid19 pandemic.

[35] Lopez, L. and Olvera-Lobo, M. D. (2017). Public communication of science in Spain: A history yet to be written. Journal of Science Communication, 16(03), Y02. doi.org/10.22323/2.16030402

Other ongoing initiatives include Naukas, which is a famous SciCom online media platform (https://naukas.com) and a science festival in Bilbao. The conference 'X Campus Gutenberg – CosmoCaixa de la Comunicación y la Cultura Científicas' is held online on 3-5 November 2020 (https://gutenberg.bsm.upf.edu). Amongst the most active institutional players is worth mentioning the Spanish Science Communication Association (AECC - aecomunicacioncientifica.org), which had more than 400 members in 2018 and is part of the European Union of Science Journalists Association (EUSJA) and of the World Federation of Science Journalists (WFSJ). AECC participates in the H2020 CONCISE project (https://concise-h2020.eu/es/partners/). The experience of Big Van Ciencia, which is a group of scientists performing funny SciCom monologues appealing to the general audience, is also very interesting. Big Van Ciencia participates in the H2020 PERFORM project (perform-research.eu).

4.3.1 Science Inreach

As displayed in figure 42, 91 percent of Spanish scientists participating in the study (n = 71) say to give high (28%) or very high priority (63%) to inreach science communication. Publishing in scientific journals is the most common way (97%) to communicate results, followed by giving presentations to scientific conferences (77%). One third of participants say to rely on social media (35%) or on informal conversations with their peers to communicate their findings.

Spanish respondents (n = 71)

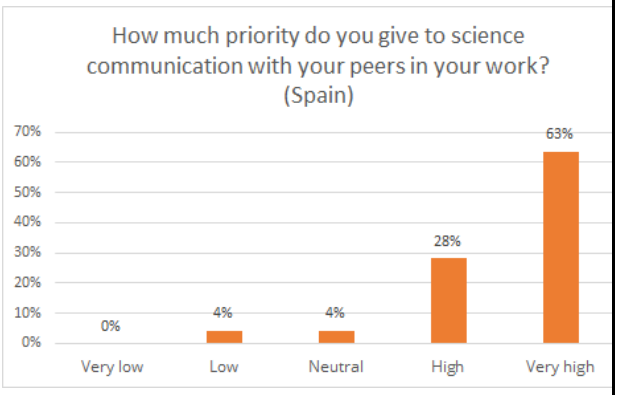


Fig. 42 Inreach priority

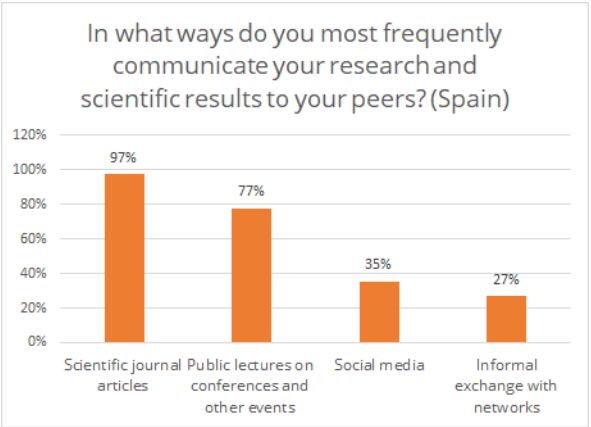


Fig. 43 Inreach medium

Respondents say to engage in inreach SciCom mostly because they want to give visibility to their findings (83%) and because they consider that it is part of their duties to inform them peers of their results (76%). Half of respondents also see personal benefits such as gaining new ideas (59%) or extending one's network (58%) as a result of inreach activities.

The main obstacle to engage in inreach activities is the lack of time (69%), followed by the lack of financial support to, for example, publish in open access journals (23%) and the lack of economic incentives (21%) associated with inreach activities.

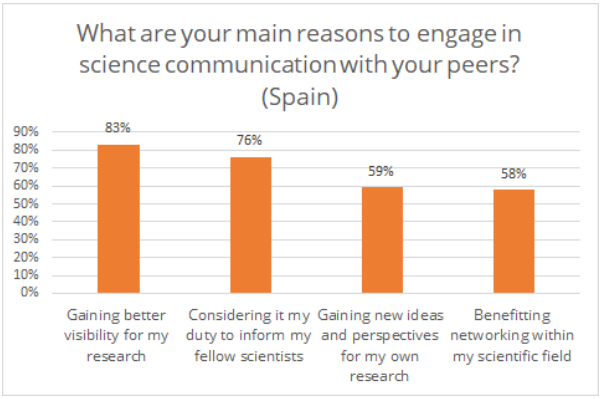


Fig. 44 SciCom rationale

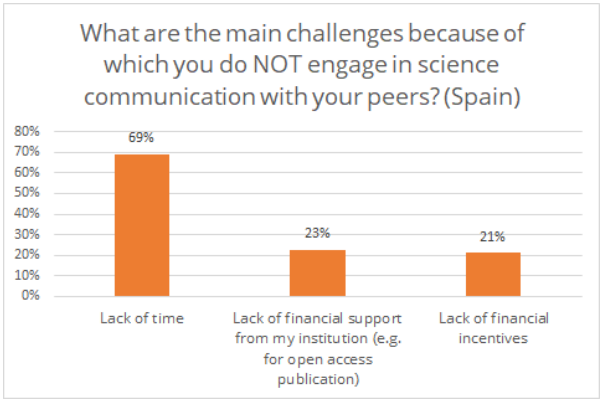


Fig. 45 SciCom barriers

4.3.2 Science Outreach

Science outreach activities are a priority only for 66 percent of study participants. The internet is the most common medium to engage in SciCom outreach activities, especially social media (45%), websites (38%), or blogs (30%). Traditional means such as newspaper articles (34%) or new initiatives such as science festivals (32%) are also mentioned by one third of study participants.

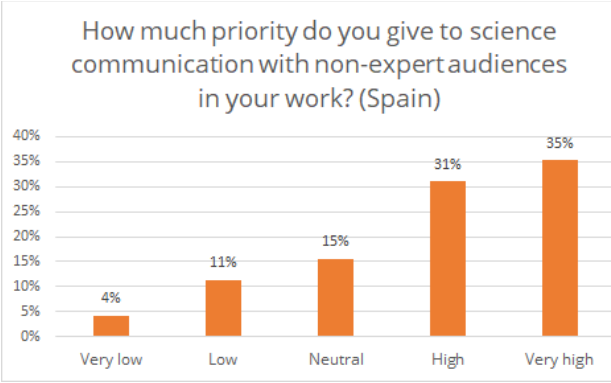


Fig. 46 Outreach priority

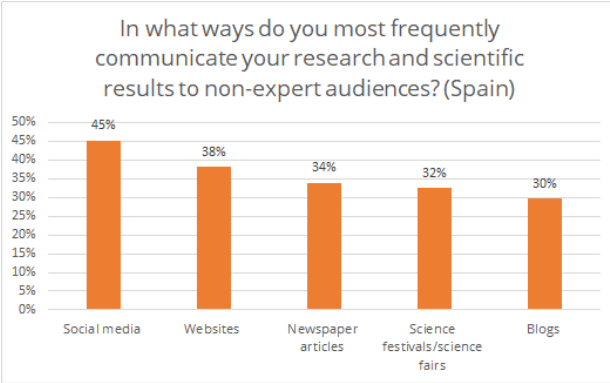


Fig. 47 Outreach medium

Despite the large majority of respondents considering they have no time (69%) to engage in outreach SciCom, they think that informing the public about their findings is their duty (79%) as well as shaping public debates around scientific issues (63%). Only a minority (31%) sees outreach activities as a way to gain better personal or professional visibility. A few respondents blame their ignorance about proper outreach communication channels (23%) or the lack of financial incentives (21%) as barriers to engage in outreach activities.

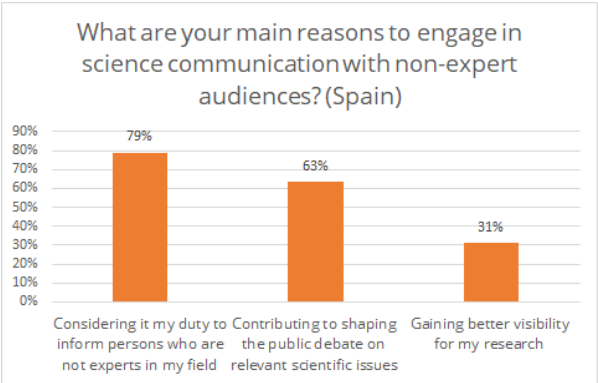


Fig. 48 Outreach rationale

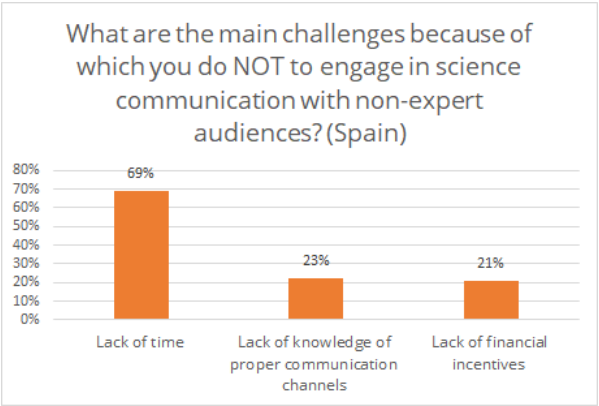


Fig. 49 Outreach barriers

As regards concrete incentives behind the rationale to engage in science inreach and outreach in Spain, the "sexenio" system of the *National Commission for the Evaluation of Research Activity* (CNEAI) is worth mentioning.

Within the framework of the European Higher Education Area (EHEA), the *National Agency for Quality Assessment and Accreditation of Spain* (ANECA) was established in 2002 in Spain. Since 2014[36], ANECA is an independent authority providing external quality assurance for the Spanish Higher Education System and contributing to its constant improvement through evaluation, certification and accreditation[37]. Ten out of seventeen Spanish regions also have regional quality assurance institutions. The *National Commission for the Evaluation of Research Activity* (CNEAI) assesses the research activity of university professors and researchers from all scientific fields working in public research centres of the Spanish Administration, with the aim of awarding them a productivity bonus called sexenio, which means "six years". The president of CNEAI is the Director of ANECA. The members of CNEAI are a representative with research and HE experience appointed by each Spanish Autonomous Region and twelve scientists or scholars appointed by the Secretary of State with competence in university matters. The Secretary of the CNEAI is the Director of the Division of Teacher Evaluation of the ANECA, who is also a full member. Various advisory committees, one per scientific or academic field, also form part of CNEAI.

There are two types of "sexenio" which researchers can apply for. One is "sexenio de investigación", which assesses a scientist'research productivity and trajectory, and the other one is "sexenio de tranferencia", which evaluates a scientist's knowledge transfer and innovation (KTI) capabilities. The first research productivity sexenio assesses the scientific production of a researcher over a period of six years chosen by the applicant. This evaluation only considers scientific articles, scholarly books, or patents as output. A researcher needs to have obtained one research sexenio in order to apply for the KTI sexenio.

The second and more recent KTI sexenio considers both inreach and outreach scientific activities. Since the pilot in 2018, the KTI sexenio has been opened in December 2019, in April 2020, and in May 2020. During these three rounds of applications, 16,844 applications in total were submitted. Of these, 15,388 (91%) met all the conditions and were evaluated[38]. Based on criteria published on the Official Gazette on 26 November 2018[39], of these 15,388 applications, 41.88 percent were successful, while 58.12 percent were unsuccessful. Besides

[36] See Act 15/2014 and the Statutes of ANECA (Royal Decree 1112/2015), .

[37] Barrera, Carlos, and Manuel Martín Algarra. 2019. "Spain: Journalism education between free initiative and government surveillance." Accreditation and Assessment of Journalism Education in Europe: Quality Evaluation and Stakeholder Influence 15: 163.

[38] *ANECA reports on the three rounds of six-year transfers*, ANECA 30/05/2020.

[39] Criterios publicados en el BOE número 285 del lunes 26 de noviembre de 2018 (Resolución de 14 de noviembre de 2018 de la Comisión Nacional Evaluadora de la Actividad Investigadora).

five relevant scientific publications published in the six years under evaluation, candidates will have to demonstrate merits in at least two of the following four areas[40]:

1) supervision of industrial doctoral students who have already submitted their dissertation; hiring of researchers paid by contracts or research project; creation of spinoffs or startups;
2) memberships or leadership roles in scientific committees; work as expert in international organisations or other government bodies;
3) royalties generated by commercial activities or patents; number of competitive projects obtained; number of patents obtained;
4) formal collaboration with non-profit or public entities; dissemination activities such as the publication of SciCom books or the realisation of podcasts or other SciCom activities.

The establishment of the KTI sexenio has been a way to recognise the importance of different forms of knowledge transfer, amongst which science communication. Overall, scientists have no other economic incentives to engage in SciCom besides gaining personal visibility. In general the Spanish system tends to focus on scientific excellence measured mostly through articles published in journals indexed in Scopus[41] or in the Web of Science (WOS)[42].

Thinking about science communication in general, a few respondents say that their institutions offer them opportunities to talk with science communication journalisms. Slightly less than the majority recognizes that they enjoy the flexibility (49%) to engage in science communication activities, as well as the fact that they have access to social media (48%), and other online channels (46%), and the opportunity to participate in face-to-face events (44%).

[40] Evaluation of Knowledge Transfer Activity and Innovation, 2018 Call, Frequently Asked Questions.

[41] See Scimago Journal & Country Rank (SJR).

[42] Access to the Web of Science (WOS) through the Spanish Foundation for Science and Technology (FECYT).

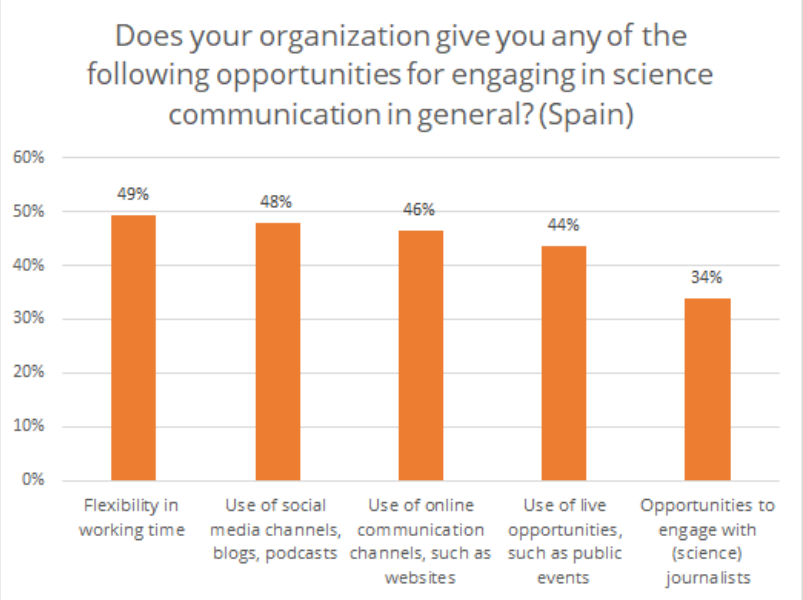


Fig. 50 Opportunities provided to science communication

4.3.3 Gender balance and SciCom

Most of the people (62%) interviewed in Spain consider that women are underrepresented in their area of study, and as a result they are underrepresented in SciCom (48%). The few women present in the field seem to have visibility, though, as 41% of respondents consider that women are equally (45%) or even more (7%) visible than men in SciCom.

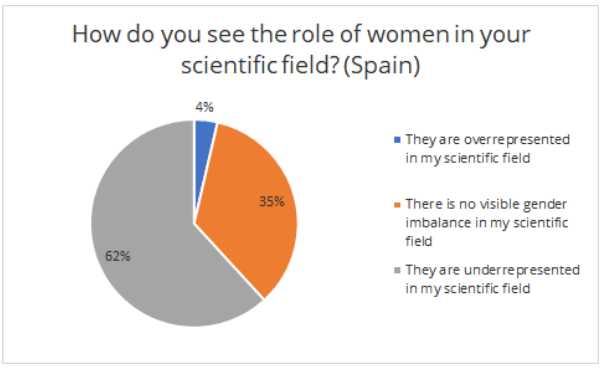


Fig. 51 Role of women in science

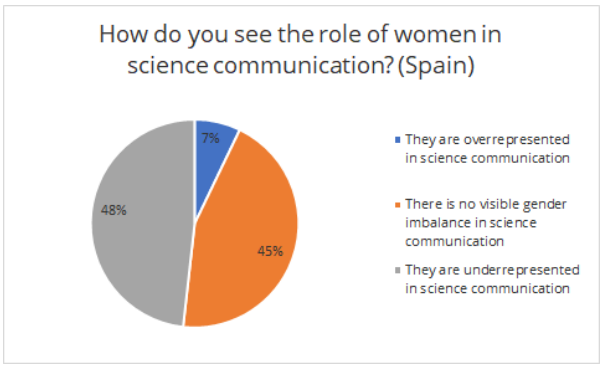


Fig. 52 Role of women in SciComm

4.3.4 Best case incentive for science communication

4.3.4.1 FGCSIC promotion of scientific culture grant

Short description of the programme: CSIC Foundation (FGCSIC)[43] launches every year a *Call for proposals of activities designed to promote scientific culture and enhance the social impact of science*. The fourth edition of the "Tell me about science" (Cuenta la ciencia) program adds to the traditional open call a specific call for proposals which focuses on SARS-CoV-2 and COVID19. The aim of the program is to support the realisation dissemination activities showing the cultural, social and economic value derived from scientific activity, as well as its impact and relevance for society. The grant covers the cost of organising the activity, such as venue preparation, technical support, advertising, equipment rental, etc.

Scope: National level.

Target group: The grant is aimed at scientists from all institutes and research areas working within CSIC. The Spanish National Research Council (CSIC) is Spain's largest public research institution and ranks third among Europe's largest research organisations. Attached to the Spanish Ministry of Science, Innovation and Universities through the General Secretariat for Scientific Policy Coordination, the CSIC plays a key role in scientific and technological policy in Spain and worldwide. The CSIC has more than 10 000 employees, including nearly 4 000 staff researchers. Currently it has 120 institutes spread across the country, of which 67 of them are fully-owned institutes and 53 are Joint Research Units in partnership with other Spanish universities or research institutions.

Subjects areas affected: All scientific areas represented within CSIC (e.g. Physics, Biology, Robotics, Neuroscience, Data Science, Social Science, Humanities, etc.).

Communication channel: a channel or a public venue suitable to a general audience. Each researcher is free to choose the format. If the activity has a presence in social networks, the label #ScienceAccount and @FGCSIC should be used to name the Foundation.

Impact: After the activity has been completed, the beneficiaries of the grants will have to submit a final report on the work carried out, which will include an assessment of the experience, its impact on the audience, a list of all those communications activities in which the collaboration of the Fundación General CSIC has been mentioned, and an economic justification of the costs incurred by the beneficiary's centre or institute.

[43] Webpage: www.fgcsic.es

Example of previous project funded: Elena Gómez Díaz, who is the Leader of the *Genomics and Epigenomics of Human Infectious Diseases* group in the *Institute of Parasitology and Biomedicine 'López-Neyra'* (IPBLN) in Granada. IPBLN members work on a variety of fundamental and applied aspects of biomedical research, which cover diverse topics in the field of immunology, molecular biology, cell biology and pharmacology of diseases of global health importance.

The *Genomics and Epigenomics of Human Infectious Diseases* group investigates which are the mechanisms underlying the rapid adaptation of pathogens to the environment, and how this potential impacts the emergence and reemergence of human infectious diseases, like malaria. To investigate these processes in natural conditions the group has worked in Africa, where they have contributed not only to the transfer of scientific knowledge, but also to capacity building, community education and engagement in malaria surveillance and prevention programs. In addition to the scientific activities undertaken in the parasitology and malaria fields, the group has acquired a strong experience in science communication and outreach thanks to this program.

Thanks to the support of FGCSIC, Elena launched and coordinated an initiative called 'Women In Malaria (WiM)' and became the PI of an outreach project funded by *Fundación General del CSIC* whose goal is to use gaming as a tool to communicate and create awareness about malaria. Elena is very active and also coordinates 'Pint Of Science' Spain and is member of the communication and outreach committee of the IPBLN-CSIC. As a woman in science she also tries to inspire future generations of young scientists while promoting diversity.

Further information: The total budget of this initiative is €110,000 in 2020. The amount awarded to each beneficiary cannot exceed €3,500 euros (including taxes). A maximum of one grant per research group can be awarded. All proposals submitted by 23 September 2020 and selected for funding will have to be executed by 31 December 2021.

4.4 Netherlands

Knowledge, research and education are drivers of the Dutch economy and society. In 2018, tertiary attainment in the Dutch population reached above 51% and as such it exceeded the EU and OECD averages.[44] According to the European Innovation Scoreboard (EU, 2020), the Netherlands ranks on 4th place among the research and innovation leaders in the EU.

[44] European Commission. 2019. "Education and Training Monitor 2019 - Netherlands." Luxembourg: Publications Office of the European Union.

Research and Innovation policies are implemented by the Netherlands Organisation for Scientific Research (NWO), the Royal Netherlands Academy of Arts and Sciences (KNAW), and the Netherlands Enterprise Agency (RVO). Responsibility for innovation policy is shared among two ministries, namely the Ministries of Education, Culture and Science and the Ministry of Economic Affairs and Climate.

The higher education sector is split in research universities and universities of applied sciences. There are a total of 14 research universities, four small denominational universities (e.g. theological universities), and 37 universities of applied sciences. More than 63% of students receive education at universities of applied sciences, and the rest is educated at universities.[45] According to Eurostat, ca. 21,600 researchers were employed in the higher education sector in 2017. Even though the number of researchers per 1,000 people was higher than the EU-average, the percentage of female researchers remained below average. In addition, only 20% of professors were female and if current trends continue, gender balance among professors will only be achieved in 2035.[46]

Universities of applied sciences contribute to about 25% of research conducted in the Netherlands. Other public research institutes contribute with 15%, and private entities with about 60%. The most important public research institutes are under the flag of two large intermediaries: the Netherlands organisation for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW). The largest institute for applied research is the Netherlands organisation for Applied Scientific Research (TNO). The majority of research in the Netherlands is carried out by larger companies. Five multinationals, Philips, Shell, Akzo Nobel, Unilever and DSM are the main research-performing enterprises in the industry sector.

Incentives and disincentives to engage in science communication will arguably depend on the type of organisation the researcher is employed at. In the case of the higher education sector, science communication with the general public (i.e., science outreach) is not a formal requirement for promotion or tenure. Science inreach on the other hand tends to play an important role, such that the number of publications and citations in academic journals serve as a proxy for a researcher's performance.

[45] Jongbloed, Ben. 2018. "Overview of the Dutch Science System." Center for Higher Education Policy Studies. https://doi.org/10.3990/4.2589-9716.2018.04.

[46] Van den Broek, Jos, Jasper Deuten, and Koen Jonkers. 2018. "RIO Country Report 2017: The Netherlands." LU: Publications Office. https://data.europa.eu/doi/10.2760/66601.

Even though science outreach might not be a formal requirement for promotion, there is an important indirect incentive to share research findings and engage with a broader audience: Researchers' positions and promotions increasingly depend on their ability to attract funding, and funding bodies increasingly evaluate research proposals in light of valorization. The *Netherlands Organisation for Scientific Research* (NWO) awards the most important, competitive research grants to researchers across career stages. One of three criteria they base their evaluation on is knowledge utilisation, of which science communication is a prominent example.

4.4.1 Science Inreach

Dutch researchers in our sample rate science inreach to be a high (48%) or very high (30%) priority (see Figure 53). As shown in Figure 53, they most frequently communicate their research findings to their peers via publications in scientific journals (85%), via informal exchange networks (67%), in public lectures (64%) or on social media (42%).

Dutch respondents (n = 33)

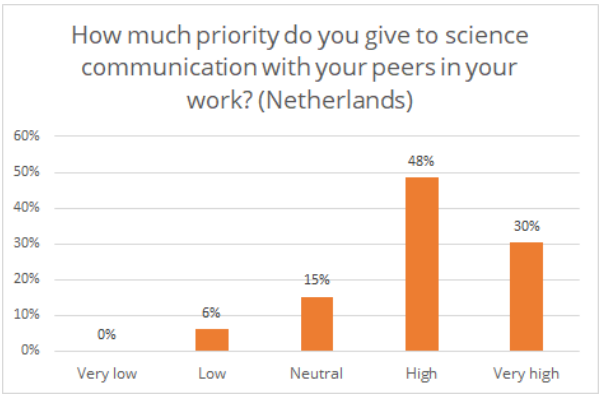


Fig. 53 Inreach priority

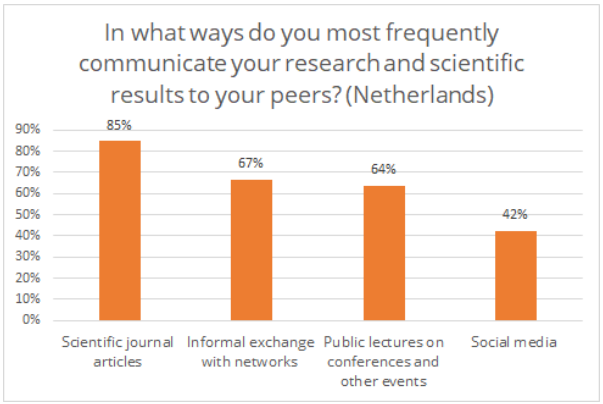


Fig. 54 Inreach medium

For Dutch researchers, the three main reasons for engaging in science inreach are to gain new ideas and perspectives on their work (76%), to gain better visibility for their research (70%), and to benefit from networking within their scientific field (61%). A little less than half the respondents also mentioned that science inreach helps them to contribute to shaping the public debate (48%) and that they consider it their duty to inform fellow scientists (45%). The one main barrier that prevents Dutch researchers from engaging in science inreach is a lack of time (79%). Only about a quarter of the respondents state that they see little value in

science communication for their career advancement (24%), or that they worry that their research might be inappropriately used (24%).

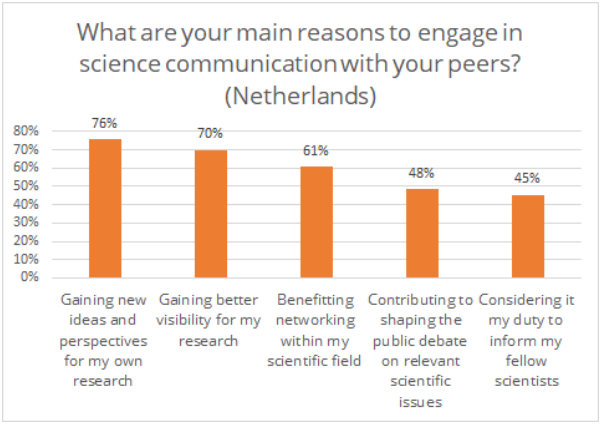


Fig. 55 SciCom rationale

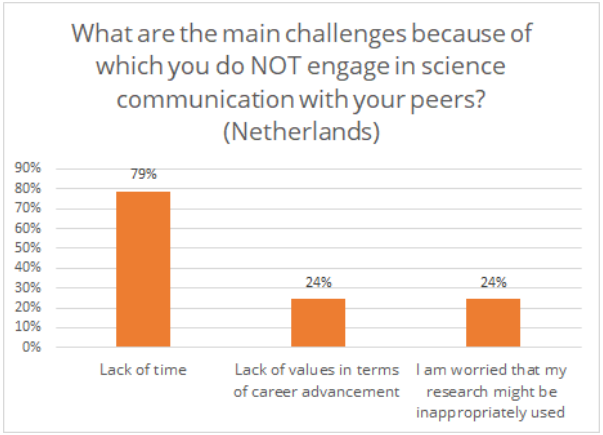


Fig. 56 SciCom barriers

4.4.2 Science Outreach

While Dutch researchers largely agreed that science inreach is important, the results for science outreach are more mixed. Science outreach receives very high priority from only 24%. The same percentage of Dutch researchers say that they are neutral or that they give very low priority to science outreach. When Dutch researchers communicate their findings to the broader public, they mostly do so online. Social media is the most popular channel used by 64% for science outreach. Websites and blogs are used only half as often (30% and 27% respectively).

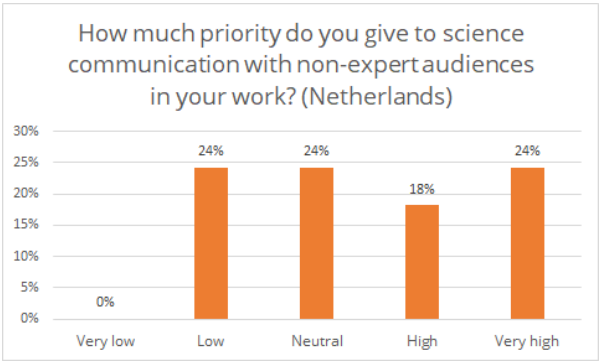


Fig. 57 Outreach priority

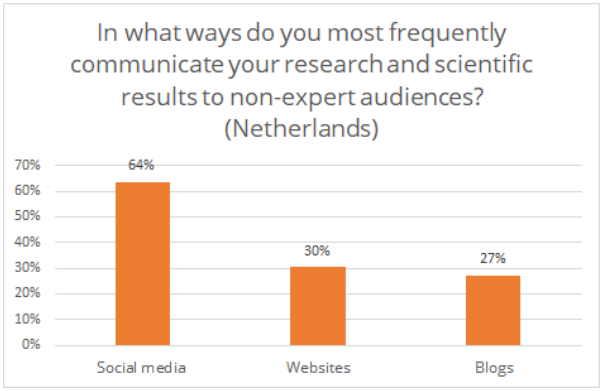


Fig. 58 Outreach medium

The main reasons for engaging in science outreach are exactly opposite to the main reasons for science inreach. While feelings of duty was among the least important reasons for engaging in science inreach, it ranks among the most important reasons for science outreach (79%). This is followed by gaining better visibility for their research (58%), contributing to shaping public debate (52%) and gaining new ideas (42%).

The main challenge for science outreach, just like for science inreach, is a lack of time as reported by 67% of Dutch researchers. A lack of knowledge on how to communicate as well as a lack of reputational incentives are brought up by 36% and 24% of respondents respectively.

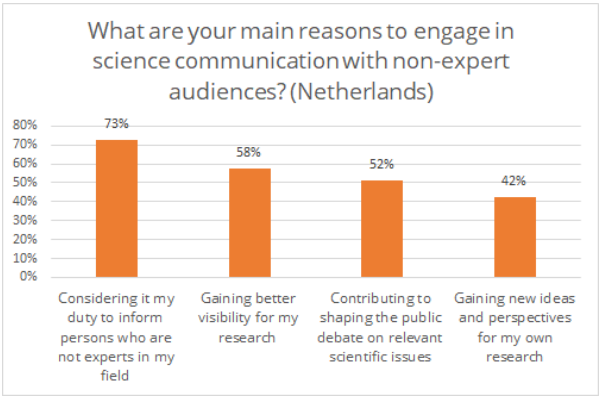


Fig. 59 Outreach rationale

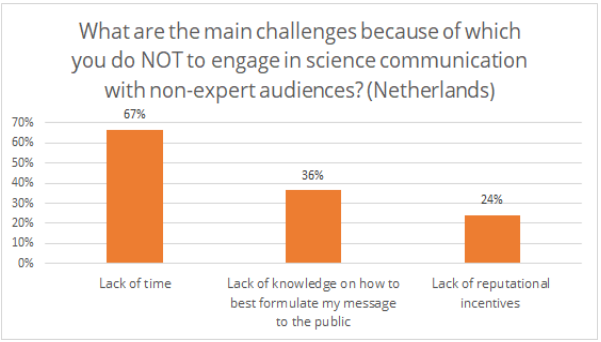


Fig. 60 Outreach barriers

4.4.3 Gender balance and SciCom

Regarding opportunities provided by organisations, more than half of Dutch respondents said that flexibility in working time (58%) promotes their ability to engage in science communication. Others responded that they received specific training for oral communication (42%) or written communication (30%). Several respondents said to receive support with online communication channels such as websites (39%) or social media channels, blogs and podcasts (30%).

Fig. 61 Opportunities provided by organisation

The majority of respondents said that women were underrepresented in their scientific field (55%) and that they were also underrepresented in science communication (54%). Only a minority of respondents said that women were overrepresented in their scientific field and that they were overrepresented in science communication (15% each).

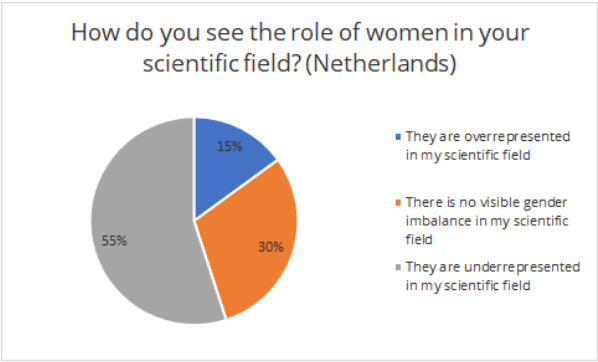


Fig. 62 Role of Women in Science

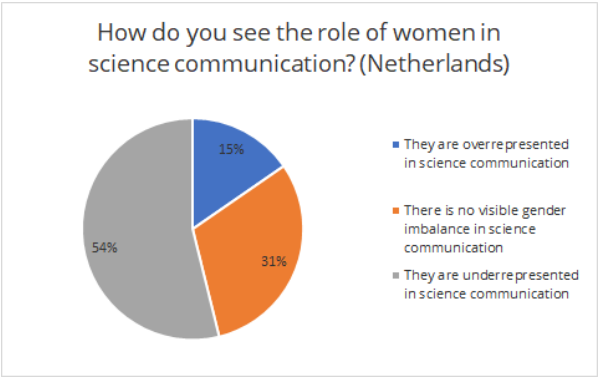


Fig. 63 Role of Women in SciCom

4.4.4 Best case incentive for science communication

4.4.4.1 Bessensap

Bessensap is a yearly science communication event by the Dutch Research Council (NWO) in collaboration with the Association for Science Journalism and Communication Netherlands (VWN). It typically brings together between 300 and 400 journalists, researchers, science communicators and other stakeholders. The event allows researchers to communicate their research to a non-academic audience. It provides networking opportunities where researchers and science journalists meet in so-called 'Speed-dating with journalists' sessions. The programme also contains workshops where researchers learn useful skills, such as how to give an engaging 1min pitch, or how to successfully vlog about research.

Scope: The scope is the national level and spans across research institutes (academic and non-academic).

Target group: The target group is researchers, science journalists, science communicators and other stakeholders.

Subjects areas affected: The event spans different subject areas, and hosts researchers from a variety of disciplines. In 2020, the panel discussants were social scientists, and the keynote speaker was a space scientist.

Communication channel: The event typically takes place offline, but was held online this year because of the COVID-19 pandemic. Talks were live-streamed and workshops were held via online conferencing tools.

Impact: It is challenging to assess the direct impact of *Bessensap*, however, the event offers a clear incentive to engage in science communication for three reasons: (1) it offers a platform to communicate to a non-academic audience, (2) it provides opportunities to catch the attention of science journalists and (3) it teaches relevant science communication skills. In this way, the event responds to many of the 'how'-questions that aspiring science communicators might face.

4.5 Cross- country analysis

If we check the survey results between the countries analysed, we observe that the researchers have given quite similar answers irrespective of their home country. The cross-country comparison concerning science inreach, science outreach, as well as organisational opportunities and gender balance is given in Tables 1, 2 and 3 below.

In each country at least two-thirds of the respondents indicated that science communication bears a high or very high importance in their activities; this is particularly true for Spain where more than 90 percent of scientists deemed science inreach a high priority, in contrast to Hungary where only 67 percent thought so. There are no great differences between the most frequent science inreach methods: scientific journals and public lectures, the most traditional ways of communication are still the most relevant. Again, in the case of Spain, almost all (97%) of scientists mentioned scientific journals, with a bit lower percentage in the other countries. The Netherlands is the only country where public lectures were not mentioned the most prominently following scientific journals; instead, the informal exchange with networks were quoted, suggesting a well-connected research community in the country. No great differences can be observed regarding the main engagement reasons of science inreach either: better visibility for own research, as well as new ideas and perspectives gained for own research are the most frequently mentioned reasons, with varying intensity (in Hungary scientists tend to mention more different motivations than in other analysed countries). Interestingly, Spain is the only country where – instead of the reasoning of gaining new ideas – the duty to inform fellow scientists was almost the most frequently mentioned. Such strong intrinsic motivation of sharing research results is not apparent in other countries. As regards the main challenges in front of science inreach, respondents in all countries overwhelmingly mentioned lack of time (with Hungarians the least likely to do so). Distantly following were financial barriers (except for the Netherlands).

Tab. 1 Cross-country comparison – Science inreach

Country	Austria	Hungary	Netherlands	Spain
High priority given	76%	67%	78%	91%
Most frequent communication method	Scientific journal (81%), public lectures (60%)	Scientific journal (74%), public lectures (66%)	Scientific journal (85%), informal exchange with networks (67%)	Scientific journal (97%), public lectures (77%)

Main engagement reasons	Better visibility for research (79%), New ideas for research (79%)	Better visibility for research (63%), New ideas for research (60%)	New ideas for research (76%), Better visibility for research (70%)	Better visibility for research (83%), **Duty to inform (76%)**
Main challenges	Lack of time (79%)	Lack of time (60%)	Lack of time (79%)	Lack of time (69%)

Respondents in each country considered science outreach less relevant than science inreach. However, while in Spain and Austria the majority of the scientists considered science outreach as a (very) high priority for their jobs, less than half of the scientists thought so in Hungary and the Netherlands. Dutch scientists tend to rather give a neutral view on the topic. In all four countries, social media and websites are the most frequently used science outreach channels – the Netherlands is the only country where there is a significant difference between the mentions of the two methods. Dutch scientists tend to rather focus on social media when considering science outreach. The main engagement reasons for science outreach are also quite similar: the intrinsic motivation for informing non-expert audiences plays the biggest role for scientists in each country. This is closely followed by the motivation for shaping the public debate in their own research area, apart from the Netherlands where a higher visibility for own research was the second most-frequently mentioned reason. Hungarian scientists tend to give the most diverse grounds, but a majority still considers science outreach a public duty in Hungary too. Again – as for science inreach – lack of time is the key reason why scientists do not engage (more) in science outreach. Distantly following were once again financial barriers (except for the Netherlands).

Tab. 2 Cross-country comparison – Science outreach				
Country	**Austria**	**Hungary**	**Netherlands**	**Spain**
High priority given	57%	49%	42%	66%
Most frequent communication method	Websites (52%), Social media (40%)	Social media (45%), Websites (38%)	Social media (64%), Websites (30%)	Social media (45%), Websites (39%)
Main engagement reasons	Duty to inform (67%), Shaping the public debate (57%)	Duty to inform (57%), Shaping the public debate (43%)	Duty to inform (73%), Better visibility for research (58%)	Duty to inform (79%), Shaping the public debate (63%)
Main challenges	Lack of time (70%)	Lack of time (54%)	Lack of time (67%), lack of knowledge on how to formulate (36%)	Lack of time (69%)

Most scientists mentioned flexible working time as an opportunity provided by their organisations for (better) engagement in SciComm. This is in spite of the fact that lack of time is the most frequently mentioned barrier in each country for both science inreach and outreach, indicating that flexibility is only a necessary, but not sufficient condition for effective science communication. However, the Netherlands is the only country where the narrow majority (58%) of all responding organisations have already introduced flexibility in their working time. In addition, the use of social media or online communication channels, such as websites, were the most frequently mentioned options that scientists can use by their employers. An important finding is that specific training on (oral) communication was only mentioned by Dutch and Austrian scientists as one of the top organisational

opportunities. This shows a lack of written training programmes in each country, and an overall problem in Hungary (Central-Eastern Europe) and Spain (Southern Europe). The underrepresentation of women in science (in general) and in SciComm also remains an overall problem. Hungary is the only country where the majority of respondents think that there is no visible gender imbalance in science and SciComm however this seems to be a culturally determined approach, dependent upon gender and age since men and scientists with at least 20 years of experience tend to observe no gender disparities.

Tab. 3 Cross-country comparison – Opportunities and Gender balance				
Country	**Austria**	**Hungary**	**Netherlands**	**Spain**
SciComm opportunities provided by org	Flexible working time (49%), use of online comm channels (44%)	Flexible working time (49%), use of online comm channels (40%)	Flexible working time (58%), specific training on oral comm (42%)	Flexible working time (49%), use of social media channels (48%)
Women underrep in scientific field	61%	33%	55%	62%
Women underrep in SciComm	62%	37%	54%	48%

5. CONCLUSION

Based on the analyses and reflections presented in this report, as well as on the best practices analysed in each country section, we come to the following conclusions and list of recommendations on how to improve SciComm outreach activities:

1. **New compensation and incentive schemes need to be envisioned to help scientists at the beginning of their academic career, women underrepresented**

in specific scientific fields, and other minority groups engage in SciCom outreach activities.

While there seems to be a general consensus on the importance of science inreach among researchers, especially amongst more experienced researchers, who consider outreach activities a high priority, currently there are no compensation schemes supporting the investment scientists made in SciCom outreach initiatives. As these activities do not help scientists advance in their career, there is a risk of lack of representation of these more vulnerable groups in the ivory tower of science. This lack of representation may discourage other people who feel unrepresented to learn about scientific findings relevant to their everyday life. Only 58 percent of all scientists consider this as highly relevant, with some differences amongst the four countries analysed. For instance, less than half of Dutch scientists think so. The more experienced are the scientists, the more relevant they consider science outreach, reaching 76 percent among scientists with more than 25 years of experience. This result shows that with experience scientists gain a better understanding of their social role and of their responsibilities to society. More experienced scientists have also already demonstrated their scientific excellence through inreach SciCom activities. Early-stage researchers seem to ignore these benefits, including better visibility and networking of research activities, and many of them cite the lack of financial incentives as a key issue, suggesting a lack of long-term focus on career benefits gained by science outreach. These results suggest that a higher level of awareness-raising on the beneficial effects of science outreach is needed already in the earliest career stages.

2. **Better SciCom training during PhD and early-state career**

Another frequently mentioned issue is the lack of adequate communication skills to deliver talks and write in plain language - a problem particularly acute for foreigners who try to communicate their results in another language such as English. This problem seems to be particularly serious amongst early-stage researchers. It could also explain their limited level of engagement in science outreach activities. Research and academic organisations should support their research staff with specific training programmes on how to produce effective written and oral communications about a scientist's activity. Higher education institutions could include these courses in their offer and in the curricula of their PhD students across all domains of science. An example of a scheme that recognises the value of acquiring good communication skills is a US grant system that assesses SciComm abilities creating incentives for institutions to offer SciComm training to their researchers.

3. Higher uptake of more interactive science outreach forms is needed (citizen science projects, science festivals)

Scientists predominantly use social media (50%) and websites (42%) when communicating with non-expert audiences. However – following the public duty rationale – the main motivation behind engaging in SciCom outreach builds upon a productive co-creation process with non-experts. According to our results, 58 percent of respondents hope to shape the public debate around a topic and 24 percent hope to gain new ideas and perspectives about their research. There is incongruence between the outreach media used (mostly social media and websites) and these motivations. Other, more interactive forms of science outreach could be more beneficial in this respect and help scientists and citizens collaborate with each other. Seemingly less known - and more expensive - science outreach formats such as science festivals and cafés, and in particular citizen science projects, if promoted, could help satisfy the need of researchers for higher visibility and feedback about the relevancy and impact of their research. Certain countries, such as Hungary, have only recently started to introduce similar types of formats.

4. Opening up and enriching the spectrum of indicators of scientific excellence and societal impact

Based on the responses, financial support is never mentioned as one of the main reasons to engage in SciCom inreach or outreach activities and it does not represent a serious barrier. However, the current structure of incentives and the reward system that lead scientists to tenure and stability offer no compensation for young scientists to engage in SciCom outreach activities. All incentives stress the importance of focusing on inreach SciCom, particularly on publishing on peer-reviewed, indexed, scientific journals. While we recognise the importance of first assessing the quality of a scientist's work, current altmetrics indicators also enable us to take into account its relevance and societal impact. The limited recognition given today to new forms of outreach SciCom engagement is something that could be reduced in the near future with the introduction of alternative ways to measure a scientist's impact on society. Of course we need to be aware that all quantitative systems can be gamed and, so we need to leave room to the establishment of proper evaluation tools and committees to avoid confounding visibility with quality or impact. As the main barrier to engage in both inreach and outreach SciCom activities is the lack of time, flexibility in working time and workload allocation is already provided by the majority of institutions to help researchers cope with these difficulties. This flexibility could be complemented with performance indicators that take into consideration SciComm activities during all career stages and which might also

envision financial incentives in the form of grants or prizes to especially active or successful communicators.

5. Limited presence and visibility of women in science and SciComm

Although the visibility of women in science and in academia depends on the field, female scientists are perceived as a generally underrepresented group in SciComm in this study. Many respondents mentioned that women are getting some visibility only after reaching a certain or higher career position, which is a general problem that affects young researchers in general. Based on our findings, women tend to give less importance to science outreach than men, which could lead to their early research success going unnoticed. The underlying (institutional, scientific, cultural) reasons of this phenomenon should be explored and tackled: if women realise early on the value of SciComm and participate in science outreach more frequently and successfully, this might help break the 'glass ceiling' in certain countries and scientific fields by offering role models to young girls and teenagers and motivate them to know more about science. From a feminist standpoint we may claim that the problem of the limited visibility of young researchers, women in particular, bring several drawbacks. Having more young researchers active in SciCom outreach activities would help increase the scientific literacy and awareness of science of younger generations who would feel more empowered by seeing role models of people like them. As young researchers need to give priority to inreach SciCom activities in order to demonstrate their scientific quality, they should be compensated for the time they spend on outreach SciCom activities. These compensations could take the form of prizes or awards that could be counted as a merit in their CV and so taken into account in career progression toward stability.

In conclusion and with regard to the future potential of recommendations (1-5) in this study, authors suggest to focus on respective national STI systems

- to define science communication as a core task in research and higher education;
- to increase participatory approaches and incentives based on Responsible Research and Innovation (RRI) or Responsible Science principles to boost interest and involvement of early career scientists and researchers in science outreach with a focus on dialogue and public engagement;
- to embed science communication as "third mission" in respective national research and science agenda; such an excellence strategy may contribute to increasing commitment within public scientific/research and educational institutions when also part of binding performance agreements;

- with regard to direct incentives to (female) early-career, mid-term and senior researchers, public tenders and vacancies for researchers may include science communication as a mandatory funding criteria or job requirement;
- to launch further specific public calls and awards for dialogue orientated and interactive formats or projects and exemplary achievements by researchers in the field.

6. ANNEX 1- TABLES AND GRAPHS

Tab. A1 Respondents' scholarly domain of study

Scientific domain	Country					
	Austria	Hungary	Netherlands	Spain	Others	Total
Business and Management	5	1	1	1	3	11
Economics	1	4	1	0	4	10
Sociology	2	1	8	1	12	24
Political Science	4	3	1	3	3	14
Psychology	3	1	3	0	2	9
Geography	0	4	2	2	0	8
Humanities	6	1	1	2	5	15
Communication Science and Media Studies	4	1	11	2	6	24
Law	9	0	0	0	0	9
Engineering and Technology	4	1	0	6	0	11
Computer Sciences	2	1	1	1	2	7
Mathematics	3	0	0	2	0	5
Natural Sciences (e.g. Biology, Chemistry or Physics)	20	12	4	51	12	99

Total	63	30	33	71	49	246

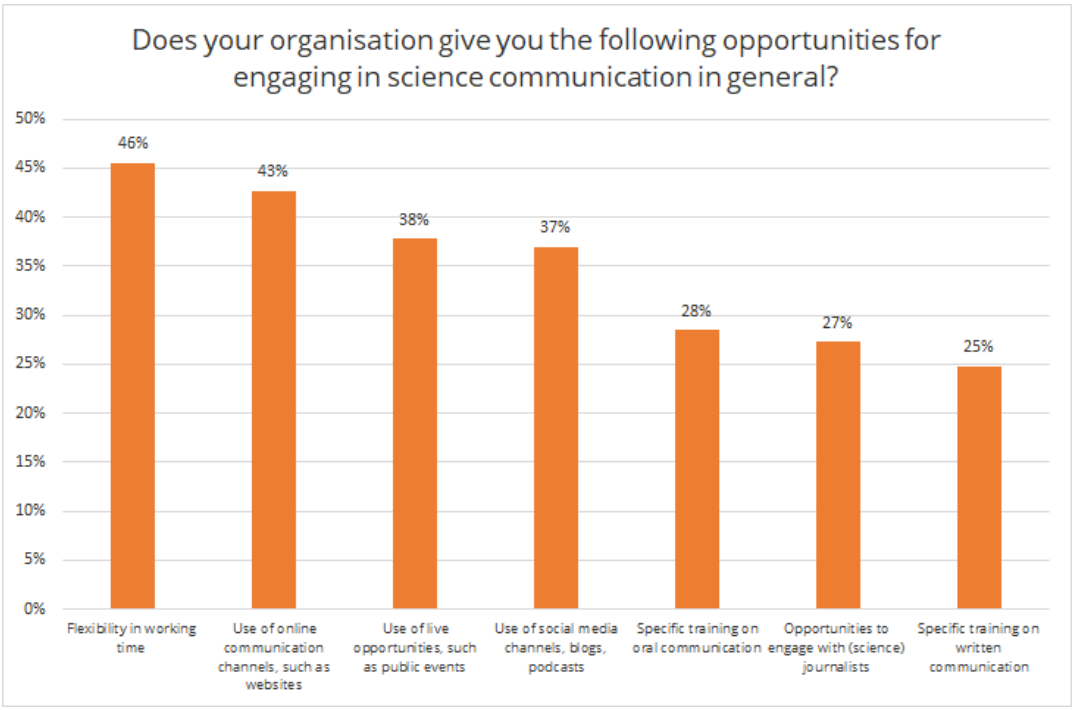


Fig. A1 Opportunities provided for science communication

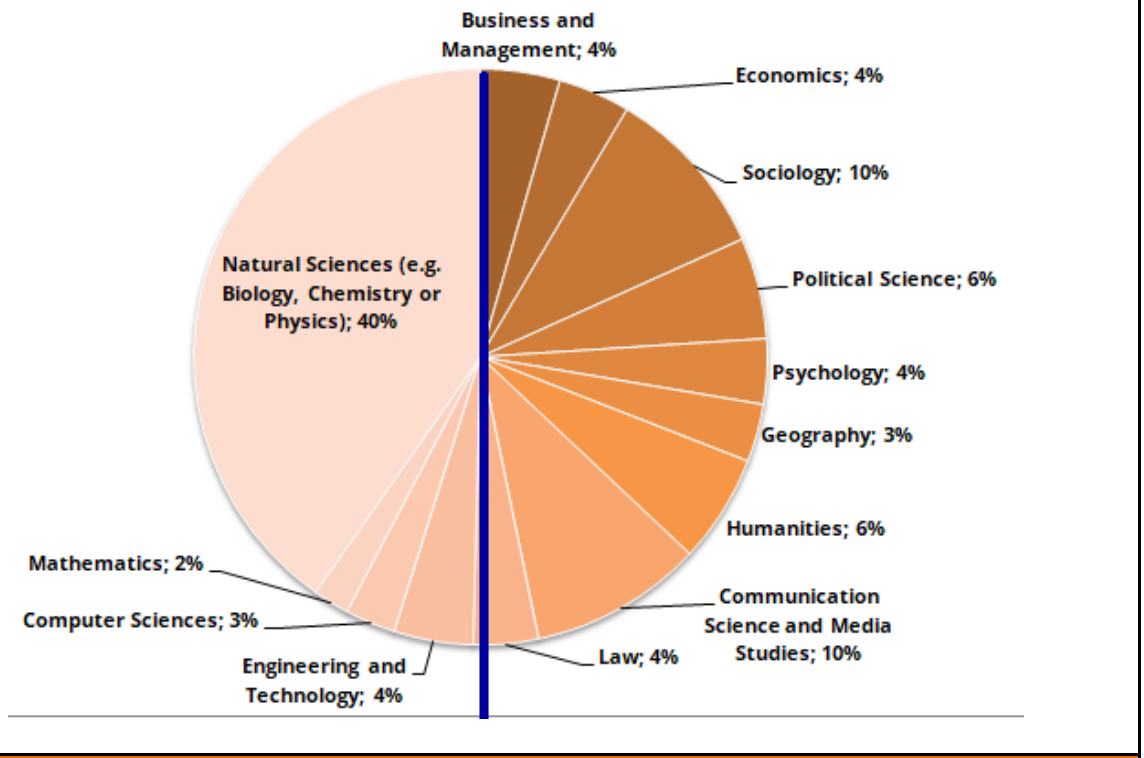


Fig. A2 Respondents' scholarly domains divided between SSH and STEM

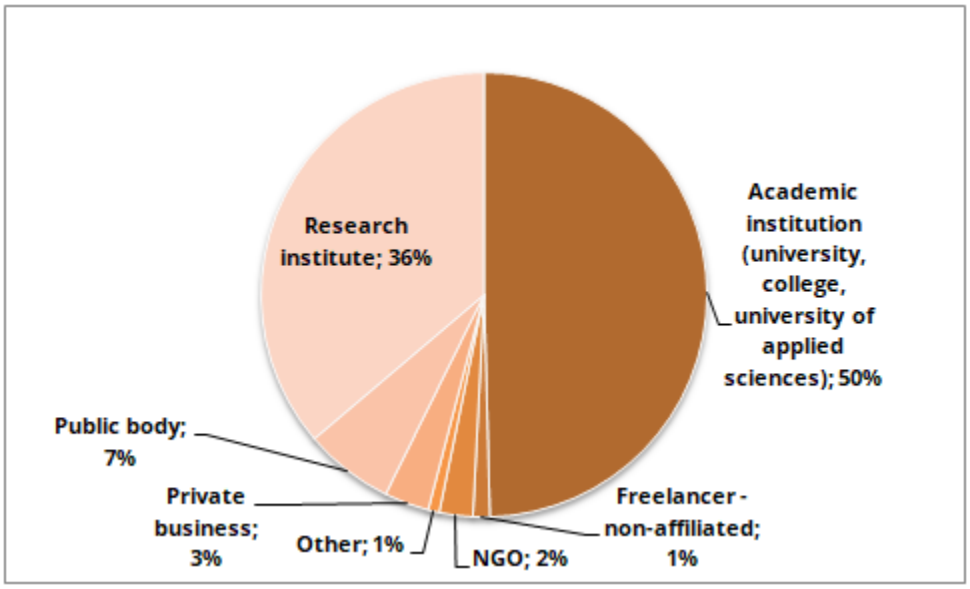


Fig. A3 Type of research institution where respondents work

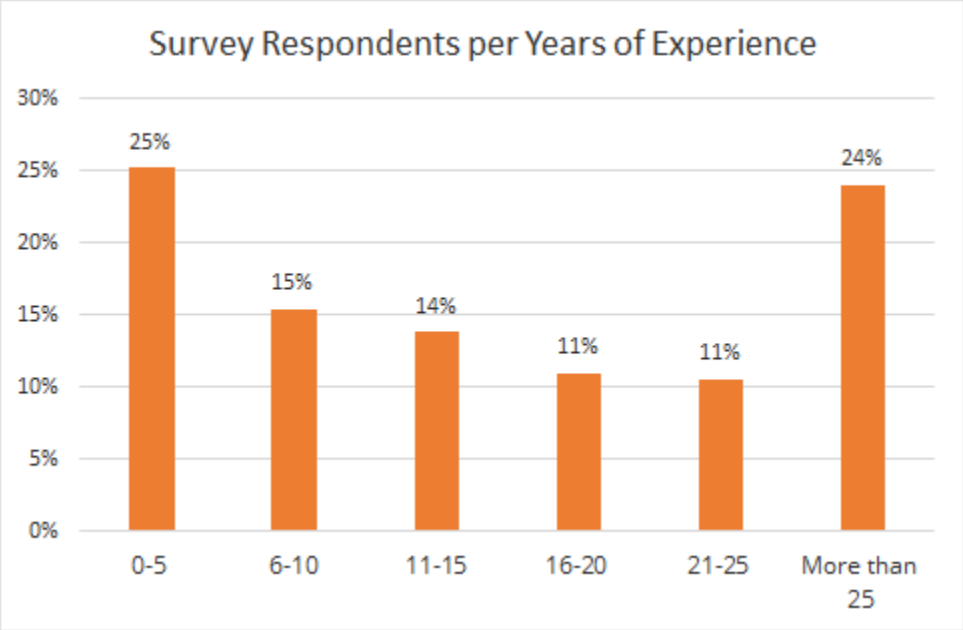


Fig. A4 Respondents' number of years of working experience

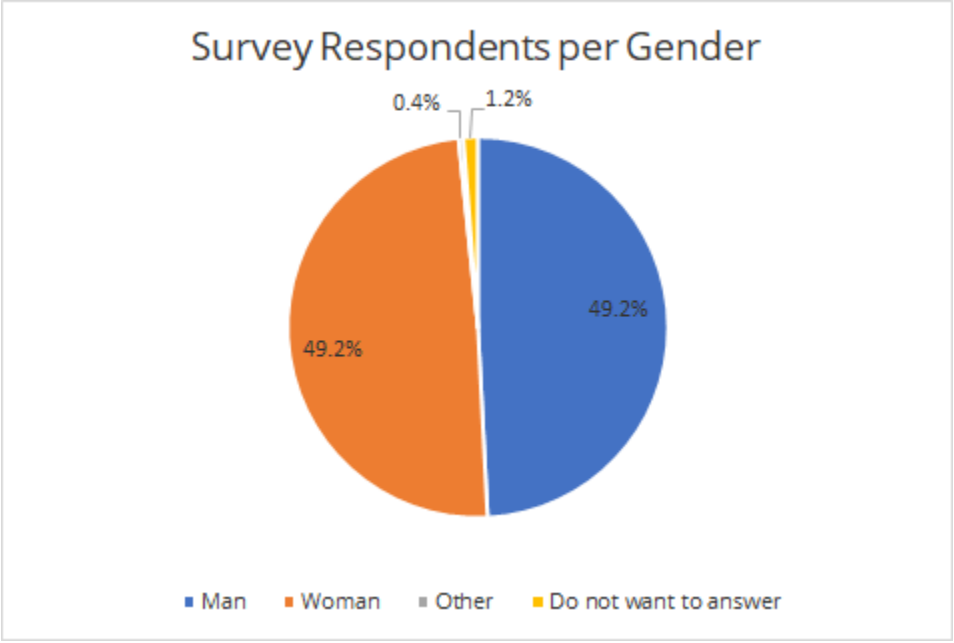


Fig. A5 Survey respondents per gender

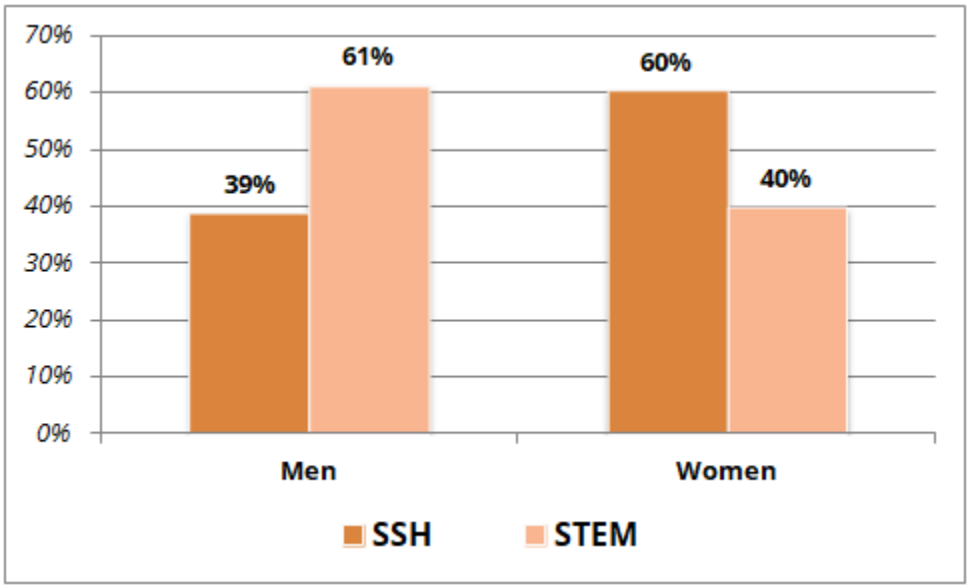


Fig. A6 Percentage of female and male respondents working in SSH or STEM

ANNEX 2 - QUESTIONNAIRE

Engagement in Science Communication across Europe

The **TRESCA project** (Trustworthy, Reliable and Engaging Science Communication Approaches) funded by the Horizon 2020 programme aims to develop trust in science through the innovation of communication practices of scientific researchers, journalists and policy makers.

As a valued member of the research and innovation community, **we would like to ask your help by filling out a short (10-minute) questionnaire.**

This questionnaire aims to support our work by **better understanding the existing incentive (and disincentive) structure for scientists to engage in science communication.**

When asking about science communication, we both refer to **science inreach,** i.e. expert-to-expert communication between scientists from similar or different backgrounds, and **science outreach,** i.e. science communication led by professional scientists addressed to non-expert audiences.

The study contains separate questions on the relevance, most commonly used channels, key incentives and disincentives of both communication categories.

Based on your answers, we will compare different research-performing organisations and seek to identify beneficial and detrimental effects of different reward mechanisms.

All responses are treated strictly confidentially.

Individual data will not be used in any project outcomes. Only aggregated data will be used for analytical purposes, taking into account relevant data protection legislation.

By clicking on the "Submit your survey" button at the end of the questionnaire you agree to these terms.

The deadline for completion is **14 September, 2020.**

For any questions on the language or any technical problems, please do not hesitate to contact **Gabor Szudi at** szudi@zsi.at**.** In case of questions or concerns related to data protection and security issues, please contact the project's Data Protection Officer, **Marlon Domingus at** dpo@eur.nl**.**

We thank you very much for the time you are taking to complete the questionnaire!

For the best display, please use the newest versions of web browsers Internet Explorer or Google Chrome. There may be visibility issues in other browsers.

There are 19 questions in this survey

Background information

Please provide short information on your background for statistical purposes.

Which country are you working in?*

Choose one of the following answers

Please choose **only one** of the following:

- ○ Austria
- ○ Belgium
- ○ Bulgaria
- ○ Croatia
- ○ Cyprus
- ○ Czech Republic

- ○ Denmark
- ○ Estonia
- ○ Finland
- ○ France
- ○ Germany
- ○ Greece
- ○ Hungary
- ○ Ireland
- ○ Italy
- ○ Latvia
- ○ Lithuania
- ○ Luxembourg
- ○ Malta
- ○ Netherlands
- ○ Poland
- ○ Portugal
- ○ Romania
- ○ Slovakia
- ○ Slovenia
- ○ Spain
- ○ Sweden
- ○ United Kingdom

- ○ Other

What is your primary scientific field? *

Choose one of the following answers

Please choose **only one** of the following:

- ○ Political Science
- ○ Sociology
- ○ Anthropology
- ○ Geography
- ○ Economics
- ○ Psychology
- ○ Communication Science
- ○ Media Studies
- ○ Cultural Studies
- ○ History
- ○ Business and Management
- ○ Philosophy
- ○ Natural Sciences (e.g. Biology, Chemistry or Physics)
- ○ Mathematics
- ○ Computer Sciences
- ○ Engineering and Technology
- ○ Other

In what kind of organisation are you employed? *

Choose one of the following answers

Please choose **only one** of the following:

- ○ Academic institution (university, college, university of applied sciences)
- ○ Research institute
- ○ Public body
- ○ Private business
- ○ NGO
- ○ Freelancer - non-affiliated
- ○ Other

How many years of experience do you have in your relevant scientific field? *

Choose one of the following answers

Please choose **only one** of the following:

- ○ 0-5
- ○ 6-10
- ○ 11-15
- ○ 16-20
- ○ 21-25
- ○ More than 25

What is your gender? *

Choose one of the following answers

Please choose **only one** of the following:

- ○ Man
- ○ Woman
- ○ Other
- ○ Do not want to answer

[Part 2] Science Inreach

Please provide answers about the communication of your scientific results and knowledge to other researchers and experts in the scientific community, i.e. **science inreach.**

How much priority do you give to science communication with your peers in your work?*

Please choose **only one** of the following:

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

1 - Not a priority 2 - Low priority 3 - Neutral 4 - Moderate priority 5 - High priority

In what ways do you most frequently communicate your research and scientific results to your peers? *

Check all that apply

Please choose **all** that apply:

- ☐ Scientific journal articles
- ☐ Popular articles
- ☐ Studies
- ☐ Public lectures on conferences and other events
- ☐ Blogs
- ☐ Vlogs
- ☐ Podcasts
- ☐ Websites
- ☐ Social media
- ☐ Science festivals/science fairs
- ☐ Science cafés
- ☐ Scientific diaries
- ☐ Informal exchange with networks
- ☐ None of the above
- ☐ Other:

What are your main reasons to engage in science communication with your peers?*

Check all that apply

Please choose **all** that apply:

- ☐ Considering it my duty to inform my fellow scientists
- ☐ Gaining better visibility for my research
- ☐ Gaining financial benefits from it
- ☐ Gaining new skills or improving my existing skill set
- ☐ Gaining new ideas and perspectives for my own research
- ☐ Contributing to shaping the public debate on relevant scientific issues
- ☐ Contributing to influencing the funding priorities in my field
- ☐ Contributing to better career opportunities
- ☐ Benefitting my scientific reputation
- ☐ Benefitting networking within my scientific field
- ☐ None of the above
- ☐ Other:

What are the main challenges because of which you do NOT engage in science communication with your peers?*

Check all that apply

Please choose **all** that apply:

- ☐ Lack of time
- ☐ Lack of financial incentives
- ☐ Lack of reputational incentives

- ☐ Lack of values in terms of career advancement
- ☐ Lack of knowledge of the proper communication methods
- ☐ Lack of financial support from my institution (e.g. for open access publication)
- ☐ Lack of technical skills (e.g. in manuscript formatting or setting up social media presence)
- ☐ Authorship issues
- ☐ Conflict of interest
- ☐ I am worried that my research might be inappropriately used
- ☐ None of the above
- ☐ Other:

[Part 3] Science Outreach

Please provide answers about communicating your scientific results and knowledge to non-experts, i.e. **science outreach.**

How much priority do you give to science communication with non-expert audiences in your work?*

Please choose **only one** of the following:

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5

1 - Not a priority 2 - Low priority 3 - Neutral 4 - Moderate priority 5 - High priority

In what ways do you most frequently communicate your research and scientific results to non-expert audiences? *

Check all that apply

Please choose **all** that apply:

- ☐ Blogs
- ☐ Vlogs
- ☐ Podcasts
- ☐ Websites
- ☐ Social media
- ☐ Newspaper articles
- ☐ Television
- ☐ Science festivals/science fairs
- ☐ Science cafés
- ☐ Scientific diaries
- ☐ Citizen science projects
- ☐ I do not communicate with non-expert audiences
- ☐ Other:

What are your main reasons to engage in science communication with non-expert audiences? *

Check all that apply

Please choose **all** that apply:

- ☐ Considering it my duty to inform persons who are not experts in my field
- ☐ Gaining better visibility for my research
- ☐ Gaining financial benefits from it
- ☐ Gaining new skills or improving my existing skill set
- ☐ Gaining new ideas and perspectives for my own research
- ☐ Contributing to shaping the public debate on relevant scientific issues
- ☐ Contributing to influencing the funding priorities in my field
- ☐ Contributing to better career opportunities
- ☐ Benefitting my scientific reputation
- ☐ Benefitting networking within my scientific field
- ☐ None of the above
- ☐ Other:

What are the main challenges because of which you do NOT to engage in science communication with non-expert audiences?*

Check all that apply

Please choose **all** that apply:

- ☐ Lack of time
- ☐ Lack of financial incentives
- ☐ Lack of reputational incentives
- ☐ Lack of values in terms of career advancement

- ☐ Lack of knowledge on how to best formulate my message to the public
- ☐ Lack of knowledge of proper communication channels
- ☐ I am worried that my research might be inappropriately used
- ☐ My institution takes care of science communication
- ☐ My institution advises against engaging in specific forms of science communication
- ☐ I have concerns regarding the idea of science communication with the public
- ☐ None of the above
- ☐ Other:

[Part 4] Science Communication in general

If your time allows, please provide answers to the following **optional** questions on various aspects of science communication in general.

Does your organization give you any of the following opportunities for engaging in science communication in general?

Check all that apply

Please choose **all** that apply:

- ☐ Specific training on oral communication
- ☐ Specific training on written communication
- ☐ Specific funding for science communication
- ☐ Flexibility in working time
- ☐ Information on available communication channels

- ☐ Use of live opportunities, such as public events
- ☐ Use of online communication channels, such as websites
- ☐ Use of social media channels, blogs, podcasts
- ☐ Opportunities to engage with (science) journalists
- ☐ Support for participating in projects with citizen engagement
- ☐ None of the above
- ☐ Other:

How do you see the role of women in your scientific field?

Choose one of the following answers

Please choose **only one** of the following:

- ○ They are overrepresented in my scientific field
- ○ There is no visible gender imbalance in my scientific field
- ○ They are underrepresented in my scientific field
- ○ It depends on the context:

How do you see the role of women in science communication?

Choose one of the following answers

Please choose **only one** of the following:

- ○ They are overrepresented in science communication
- ○ There is no visible gender imbalance in science communication
- ○ They are underrepresented in science communication

○ It depends on the context:

What are the best incentives in your region/country for science communication?

Please write your answer here: [free text]

What are the biggest disincentives in your region/ country for science communication?

Please write your answer here: [free text]

Do you know some incentives for science communication at the European / international level that you would like to see adopted in your region/country?

If yes, please specify which.

Please write your answer here: [free text]

Thank you once again for providing us with valuable information on the incentives, challenges and methods of science communication. Your answers have been saved.

If you are interested in our further project activities, please check our official website: http://trescaproject.eu

You can also follow us through our blog at https://trescaproject.eu/blog/, or via Twitter: @TrustSocialSci

The **TRESCA project** (Trustworthy, Reliable and Engaging Science Communication Approaches) funded by the Horizon 2020 programme aims to develop trust in science

through the innovation of communication practices of scientific researchers, journalists and policy makers.

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