Deliverable 1.2

Report on the Working Practices, Motivations and Challenges of those Engaged in Science Communication

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Executive Summary

The working practices of those engaged in the communication of science to non-expert audiences has important implications for the relationship between science and society. The research presented here explores these working practices and the motivations that underpin them across a wide range of science communicators in Europe. As such, it provides an insight into the nature of contemporary science communication and those who are involved with it.

To find out about the working practices of science communicators, an online questionnaire was distributed in seven European countries; Italy, The Netherlands, Poland, Portugal, Serbia, Sweden and the UK. The largest number of respondents were press officers, followed by freelance communicators/writers and journalists/editors. The survey also gathered responses from researchers, university lecturers and professors as well as some who communicate science predominantly online, such as bloggers, YouTubers and social media influencers.

Many of the science communicators who responded said they seek to 'inform' the public about science or, similarly, 'educate' the public. Two-thirds of questionnaire participants stated that they seek to create conversations between researchers and the public through their work. Some national differences are evident in the motivations of science communicators. For those in Poland and Portugal, for example, countering misinformation is an important motivation, whereas this is less important to those in The Netherlands and Sweden.

Writing for the public continues to be an important form of science communication across Europe. But many questionnaire respondents are understandably employing newer media, notably social media, to communicate science. However, some digital mechanisms such as podcasts have not been widely adopted. The relevance of research to society is an important factor that influences many communicators' decisions on what they communicate. The scientific merit of research is important too.

Across Europe, science communicators say a lack of time is the largest barrier to their activities. Lack of resources is another important and widespread barrier. There are also national differences: for example, many Polish communicators say they have insufficient support to communicate science from their managers or organisations they work for. Communicators in The Netherlands say there are not enough financial rewards for their efforts.

The questionnaire provides some insights into the nature of the science-society relationship. For some science communicators, those who seek to inform and educate about science, the questionnaire indicates there is still a clear distinction between science and society. Whereas for others, those who seek to facilitate conversations between researchers and the public, the line between science and society is much more blurred.

Relatively few respondents sought to reach underserved audiences. This has implications for the science-society relationship in that it has the potential to perpetuate inequalities in access to and engagement with information about science. As such, this warrants further exploration.

Other results from the questionnaire are presented in RETHINK deliverable D1.3, which explores the links science communicators have with their audiences. Reading deliverables D1.2 and D1.3 together provides a fuller picture of contemporary science communication across Europe.

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1. Introduction

To facilitate an open, reflexive relationship between science and society and meet the challenges and opportunities presented by digitization, it is important to understand how the working practices of those engaged in science communication[1] are evolving.

This report builds upon the findings of the online science communication scoping report conducted within RETHINK (Deliverable D1.1), which sought to map the nature of online science communication in seven European countries in terms of the actors and the platforms they are using. While the scoping report sought to map what is being communicated online, by whom and where, this report seeks to dig deeper by exploring the 'roles' and 'repertoires' of those communicating science.

Here the term 'role' is used to describe a characterisation of the activities of an individual engaged in science communication that seeks to encapsulate several aspects of what they do (Pielke, 2007). Role characterisations are often used to create typologies that describe different roles actors within a particular field of work enact and are often used to explore how roles are evolving. Fahy and Nisbet (2011), for example, explored the changing roles of science journalists online due to the growth in the number of actors such as amateur bloggers and scientists now engaging in online science communication. They developed a role typology for today's science journalists that included that of the watchdog; someone who holds scientists, scientific institutions and industry to account and the civic educator, who informs audiences about the methods, aims and limitations of research.

'Repertoires' are conceptualised as science communication actors' perspectives on the science-society relationship and a set of work-related activities that complement these. This draws on studies of the work of 'knowledge brokers' that similarly conceptualises repertoires as wider perspectives on knowledge production and use, and work-related activities that are deemed appropriate to these perspectives (Gilbert and Mulkay, 1984; Turnhout et al. 2013). Turnhout et al. 2013 describe three repertoires for knowledge brokers. At one extreme, the 'supplying' repertoire simply involves knowledge brokers supplying information, or supplying experts who can provide that information, to knowledge users, or audiences. Here there is a "…linear model of science-society relations in which knowledge production and use are considered separate domains." (Turnhout et al. 2013, p.361). At the other extreme is the 'facilitating' repertoire in which knowledge brokers see the boundary between knowledge production and use as blurred, such that everyone involved is considered to have relevant knowledge. Sitting between these extremes is the repertoire of 'bridging'.

This research provides an initial exploration of science communication actors' roles and repertoires by investigating what these actors are trying to achieve with their communication activities, what their motivations are, as well as what they communicate and how they communicate. It is important to recognise that science communication actors often undertake their activities within a wider organisational and structural context and so their incentives, limitations and disincentives to communicate about science that mediate their activities are

[1] We have not provided a prescriptive definition for science communication, as the research presented in this derivable encouraged individuals to self-select that they are engaged in a form of science communication.

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considered here too. The roles and repertoires of those engaged in science communication will be explored in greater depth in D1.4.

The impact of digitization makes contemporary research into science communication working practices essential. Existing roles have been evolving, boundaries between the work-related activities of different actors shifting and entirely new roles appearing.

Existing research into the working practices, motivations and barriers of those engaged in science communication is fragmented. Largely this is because of the range of actors now involved including scientists, individual bloggers and activists (as illustrated by Deliverable D1.1). Individual studies have understandably tended to focus on the working practices of specific actors, or a small group of actors. However, because of the interconnections and blurring of boundaries whereby actors now undertake activities that were once the domain of others (such as scientists who run blogs explaining research to non-experts), and are taking different approaches to communicating science, research that casts the net a little wider and draws in perspectives from a wide range of actors and explores the breadth of platforms they use for their communications is justified. This will enable overlaps and gaps between the activities of actors to be considered here and in further research.

Most previous studies of the working practices of science communicators have also tended to focus on one country, or a small number of countries. The data presented here was collected in seven countries - Italy, the Netherlands, Poland, Portugal, Serbia, Sweden and the UK. This will enable comparisons to be made between the activities and perspectives of those engaged in science communication across Europe.

A common theme in much research into the motivations of actors engaged in science communication is the question of whether the intended aim is a one-directional communication of science to society, or a two-way dialogic connection, what is often referred to as public engagement. The one-directional transmission of science to society is commonly referred to as the 'deficit model' approach, since it implies that non-scientists have a deficit in scientific knowledge that needs to be filled. Since the early 2000s, approaches to science communication that foster a two-way dialogue, and the participation of society in the research process, have been adopted by science communication scholars and some institutions as the preferred form of science communication. This approach engenders a more reflexive, open science-society relationship in which citizens are considered as "...active interlocutors and worthy of consideration" (Casini and Neresini, 2012, p.38) and fits within a wider Responsible Research and Innovation (RRI) agenda (Wilkinson and Weitkamp, 2016). Though the extent to which this ethos is implemented in practice is variable.

Historically, surveys of scientists across Europe and elsewhere have tended to demonstrate motivations to communicate science that are often inspired by one-directional communication methods. A major survey of researchers in science, technology, engineering and maths (STEM) in the UK commissioned by funders led by the Wellcome Trust and conducted by TNS BMRB and University of Westminster (2015), found that many researchers (56%) viewed informing the public and/or raising awareness of science as one of the principle benefits of science communication (TNS BRNB and University of Westminster, 2015). Contributing to public debates and learning from public groups, benefits that imply a two-way dialogue between science and society, were considered important by relatively few researchers (18% and 20% respectively). Such findings echoed those of earlier, similar studies (Wellcome Trust, 2000;

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Royal Society, 2006; BBSRC, 2014). The TNS BMRB and University of Westminster (2015) study did show, however, that a high proportion of researchers (41%) recognised that 'public engagement' involves interacting with an audience, a two-way dialogue, while a lower proportion (34%) stated it involves talking to/disseminating to the public.

In other research, scientists and heads of communication/PR at research centres across Europe agreed on the importance of communicating the results of research to the public, often using terms such as "duty" and "responsibility" (Casini and Neresini, 2012). However, participatory or dialogue-based perspectives on science communication were found to be less prevalent here too (Casini and Neresini, 2012).

A global survey of science journalists found that many (43%) saw their work as informing others about science, followed by 'translating complex material' (23%) and educating (13%) (Bauer et al., 2013). Such perceptions of their work have been found in other studies involving journalists. A metasynthesis of research into science journalism working practices and motivations spanning several countries and continents including The Netherlands, the UK and North America, found that studies used terms such as 'informers', 'advocates' and 'translators' to describe science journalists' self-perceived identities (Amend and Secko, 2011).

While there are societal-level motivations to communicate science, many who engage in science communication do so because of perceived personal benefits, such as helping towards career aspirations as well as providing personal enjoyment (Wilkinson, Bultitude and Dawson, 2011). Similarly, participants in studies by the Wellcome Trust and Biotechnology and Biological Sciences Research Council (BBSRC) identified personal satisfaction as an important motivation (Wellcome Trust, 2000; BBSRC, 2014).

The growth in digital mechanisms of communication through online media has offered the potential for transformation in science-society relations. Many, but by no means a majority, of researchers are now employing social media platforms such as Twitter and Facebook to communicate their research. In their study of UK researchers' public engagement activities, TNS BRNB and University of Westminster found 57% of all participants to have communicated using social media at least once in the past twelve months (Wellcome, 2015). However, more traditional engagement methods, such as public lectures and working with schools, were still prevalent. Similarly, an international study of scientists' social media use found 50% of scientists to be using Twitter, Facebook and LinkedIn. Other social platforms were used even less, including Instagram (21%) and Reddit (13%) (Collins, Shiffman and Rock, 2016).

Digitization has led to profound changes in working practices in science journalism. Even in 2013, the relatively distant past when considering the evolution of science communication online, 55% of science journalists around the world said the number of web stories they had written had grown in the preceding five years (Bauer et al., 2013). However, at that time, only 9% and 7% respectively said they were making more podcasts and vodcasts (Bauer et al., 2013). More recent studies of journalism practices demonstrate an expectation within many editorial teams that journalists integrate the use of social media into the way they disseminate content and some media organisations employ social media specialists (Neuberger, Nuernbergk and Langenohl, 2019).

The digitization of science communication has not only changed the media science journalists are employing to disseminate content, it has also been the catalyst for changes in what they

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communicate – at least for some. Where once they were "…the principle arbiters of what scientific information enters the public domain and how it does it" (Trench, 2007, p. 141), now that is no longer the case. It means that rather than being the first with science news as they were in the past, they are now having to adopt new roles such as being 'curators' of scientific content and 'explainers' of existing science stories (Fahy and Nisbet, 2011). In some instances, this is leading to a more two-way collaborative relationship with audiences (Fahy and Nisbet, 2011).

If there was one form of science communication that is symbolic of the transformation brought about by digitization it is blogging. Traditional media organisations, research institutions, charities and scientists (Riesch and Mendel, 2013) blog alongside individual enthusiasts. Their motivations are as varied as are the actors engaged in blogging. Some blog for the wider societal good, as they see it, such as their frustration at poor quality science reporting (Riesch and Mendel, 2013). Others say they do it to explain or 'translate' science to non-experts (Jarreau, 2015). Whereas for some their motivations are more personal, such as blogging providing scientists with an opportunity to practice their communication skills (Riesch and Mendel, 2013).

While the development of new means of communication such as blogs has widened opportunities to communicate science, there are still barriers that stand in the way of an open science-society relationship. What these barriers are depends on the actor. For scientists, a lack of time frustrates the science communication efforts of many (TNS BRNB and University of Westminster, 2015). Science communication is perceived to be peripheral to the working lives of some researchers (Casini and Neresini, 2012; Royal Society, 2006) who may view science communication "…as an adjunct to their research work, something that takes up time and resources that could instead be devoted to research" (Casini and Neresini, 2012, p.58). It is perhaps a reflection of this perception of science communication being peripheral to the working life of scientists that public engagement enablers within institutions report a difficulty in encouraging researchers to get involved in science communication activities as a significant barrier to their efforts (TNS BRNB and University of Westminster, 2015).

For those working within research centres, institutional perceptions of the value of science communication can present a barrier; manifesting itself as a lack of funding and a lack of recognition of the value of public engagement (TNS BRNB and University of Westminster, 2015). At some European research institutions, public engagement activities may not be considered essential (Neresini and Bucchi, 2011).

Concerns about the 'appropriate' work-related activities of a scientist have been found elsewhere to, such as in the blogosphere. A study of female science communicators' experiences of online science communication found that some participants reported having a hard time convincing their male supervisors and colleagues of the value of science communication and its merits as a career path (AbiGhannam, 2016).

In science journalism, while roles of journalists have evolved and new ones emerged, there is still evidence of "a strong continuation of the traditional journalistic role conceptions of conduit and agenda setter," (Fahy and Nisbet, 2011, p.790), the conduit being someone who explains scientific research to non-scientists and the agenda setter someone who draws attention to new important areas of research and trends. At the same time, increasing competition and fragmentation of the market means media organisations have shed specialist journalistic staff,

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such as science journalists, resulting in remaining journalists facing a higher workload. In Europe and other Western regions such as USA and Canada, this has left science journalists concerned about the growth of 'churnalism' (Bauer et al., 2013); with journalists expected to write more stories leaving them less time to check facts and conduct in-depth research.

Since science communication is in such a dynamic phase of its evolution, the importance of contemporary research into working practices has never been greater. The research presented here explores not only the current practices of actors engaged in science communication but also their motivations and the constraints they face.

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2. Methodology

This study was conducted by means of a survey in seven partner countries - Italy, the Netherlands, Poland, Portugal, Serbia, Sweden and the UK. The questionnaire for the survey was developed by Elena Milani, Clare Wilkinson and Emma Weitkamp at UWE Bristol. The development of the questionnaire and its distribution are described in the following paragraphs. The English version of the questionnaire is available in Appendix C.

The survey aimed to investigate the working practices of actors communicating science, technology and/or health. It also analysed what motivations and barriers they face when carrying out science communication. Several questions in the questionnaire were adapted from previous surveys and studies of scientists, those who enable science to be communicated, such as press officers, as well as science journalists (NCCPE, 2019; Royal Society, 2006; Wellcome 2015). Other questions were informed by observations made during the scoping study outlined in Deliverable 1.1.

The questionnaire was developed in Qualtrics, an electronic survey tool for designing and distributing surveys online. The questionnaire was pilot-tested between the 28th of August and the 7th of September 2019. Thirty-four professionals who were representative of the target participants were contacted by the UWE Bristol research team to complete the pilot questionnaire. Twenty-two of these respondents completed the questionnaire and after editing to incorporate the pilot feedback, the questionnaire was then translated by each partner organisation into their national language. The translations were uploaded to Qualtrics to collate the responses from the seven countries in the same dataset.

The final questionnaire was distributed between the 30th of September and the 1st of November 2019. The survey was distributed through official mailing lists, networks, associations, and societies of journalists, writers, press officers, communication officers, scientists, and public events organizers that communicate science. These types of groups and organisations were identified and contacted in each country. Snowball sampling was also applied to enrich the diversity of participants; respondents were asked to pass the survey to other potential participants. Individuals identified in the scoping study described in Derivable 1.1 who had a public email address were also contacted to increase the variety of participants. By distributing the questionnaire in these ways, the diversity of participants increased. However, it also made difficult to obtain a response rate.

The questionnaire received ethical approval from UWE Bristol, and respondents were provided with GDPR compliant consent and information materials.

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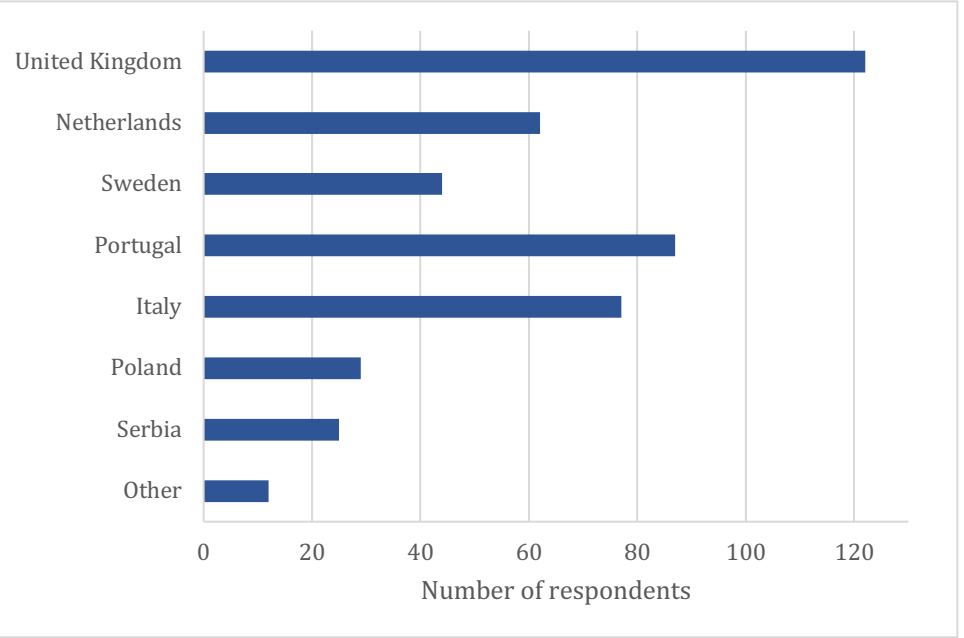
3. Results

778 responses were collected to the questionnaire in total[2]. Figure 1 shows the complete responses collected in each country. Though we targeted participants from seven countries, twelve responses were completed from other countries - Belgium, Ireland, Germany, Spain, France, Mexico or Canada (Figure 1). These responses were included in the analysis.

Figure 1 Complete responses received from each country.



3.1 Respondent demographics

Of the respondents (total n=459) to the questionnaire, over half were female (59.3%, n=272) and 39.7% (n=182) were male. As shown in Figure 2, the higher response rate from females occurred for most countries, except Poland, where females accounted for 37.9% (n=11) of the respondents.

Across all of the responses, in all of the countries, most of the respondents (83.6%) were under 45 years old; 30.8% (n=141) were 35-44 years old, 29.7% (n=136) were 25-34 years old, and 2.6% (n=12) were 18-24 years old. Again, similar patterns occurred across most countries: in Italy, the UK and Portugal, 60-70% of respondents were under 45 years old. In Poland and Serbia this percentage 80% were under 45 years old. Sweden was the only country where most respondents were older than 45 years old (75.0%, n=33) (Figure 3).

[2] 465 questionnaire respondents completed every section of the questionnaire. Response rates vary on some questions and % and numbers are provided for all data.

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Figure 2 Percentage of respondents by gender across countries

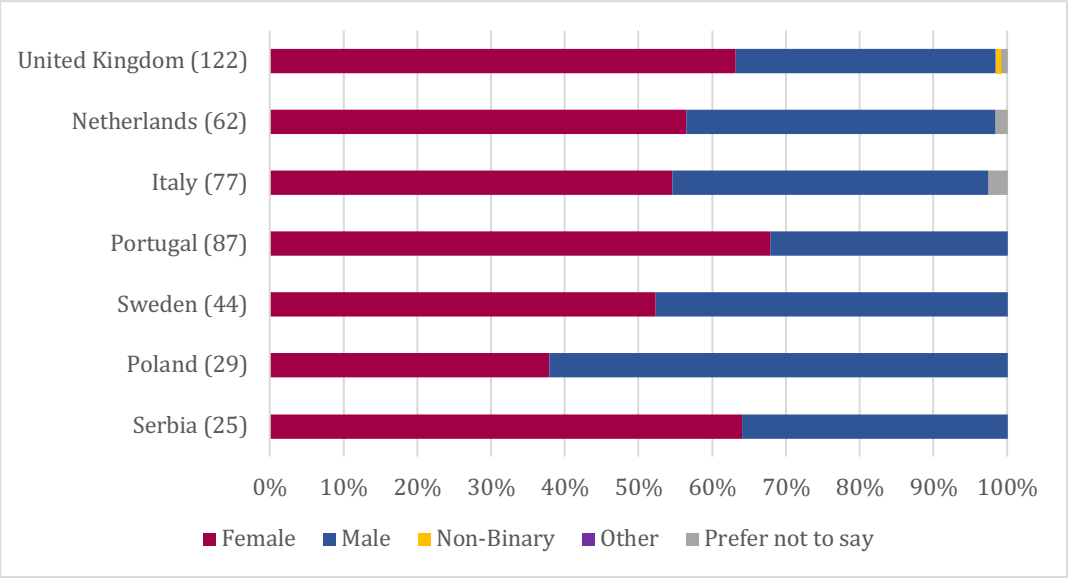
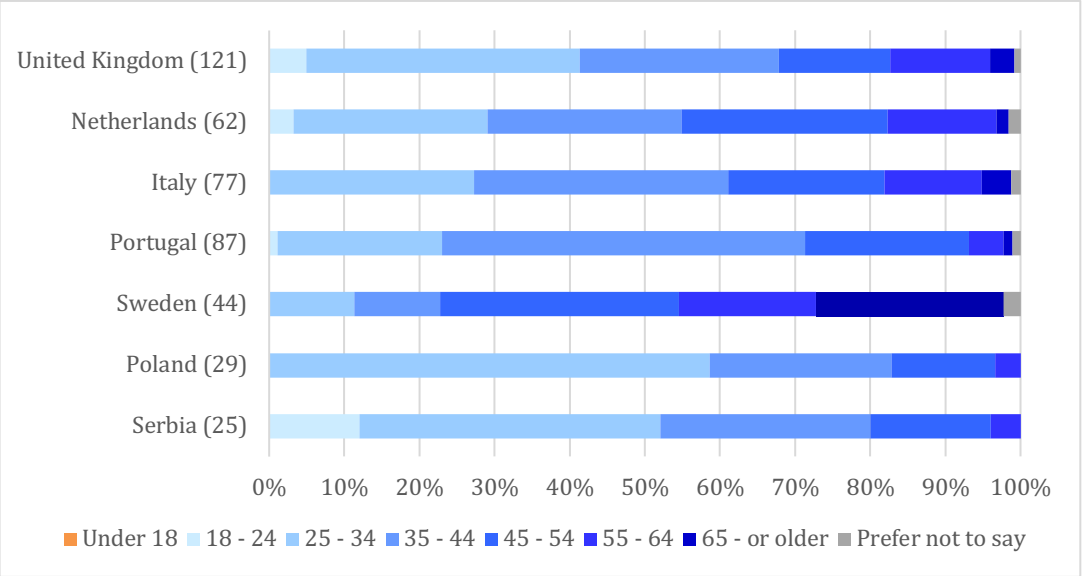


Figure 3 Percentages of respondents by age for each country



When asked about their professional roles, many respondents described themselves as working as press officers or communication officers, freelance communicators or writers, journalists, and/or researchers (respondents could select more than one answer). The survey also reached actors who might be considered relatively recent additions to the science communication landscape, such as bloggers and social media influencers, activists, illustrators and designers (Figure 4).

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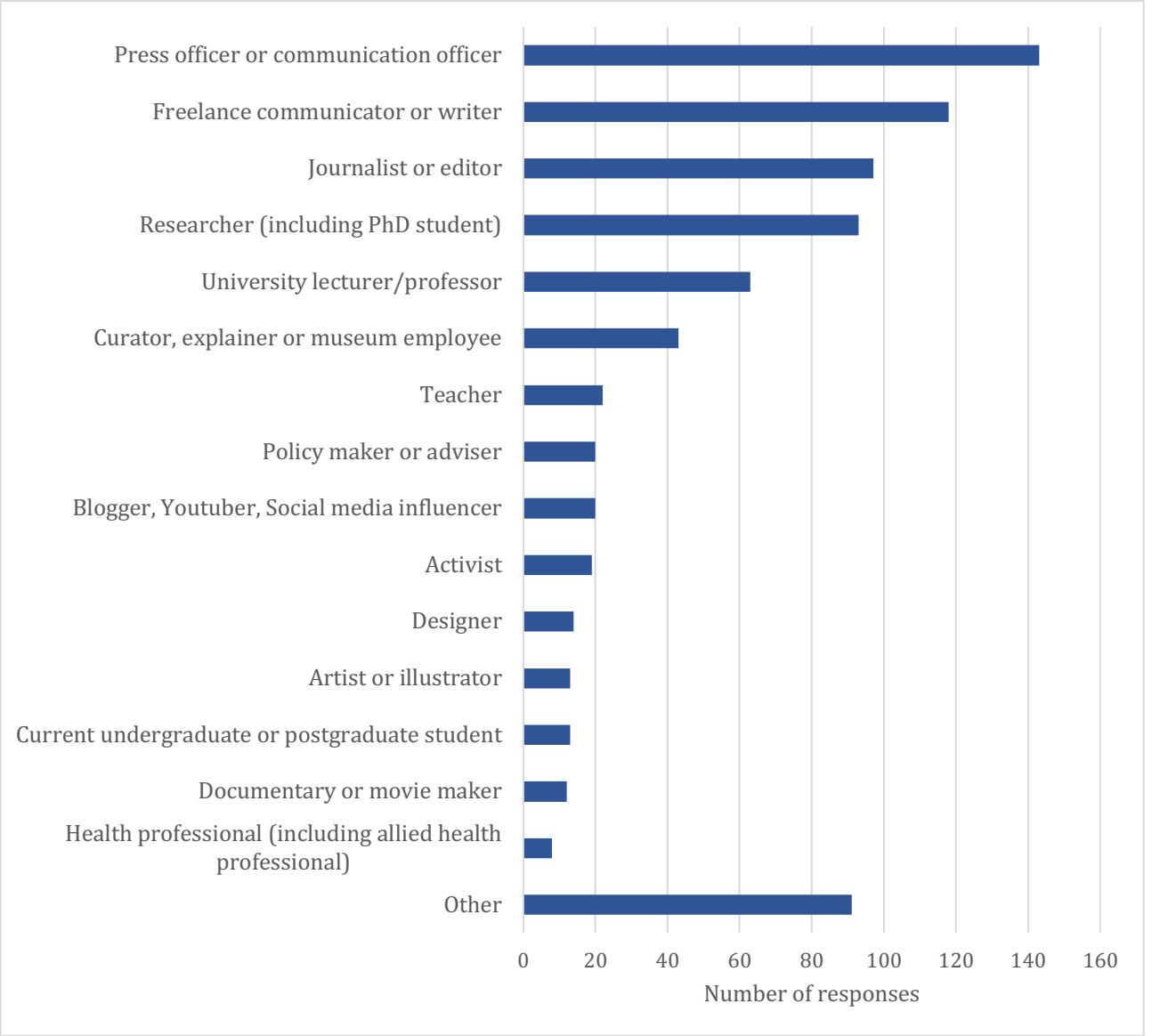
Figure 4 Frequency of responses for each category of professional roles.
Q) How would you describe yourself? Please, select maximum three answers.



85.1% (n=388) of respondents worked for an organisation rather than individually. Of these, 52.1% (n=202) worked for universities and research centres, 13.9% (n=54) for museums and science centres, 10.3% (n=40) for non-profit organisations and charities, 5.9% (n=23) for media and publishers, 4.9% (n=19) worked in the business sector and 3.1% (n=12) for professional associations and learned societies. 62.7% (n=74) of the freelance communicators or writers said they work for an organisation as well; with universities and research centres being the most common sources of employment.

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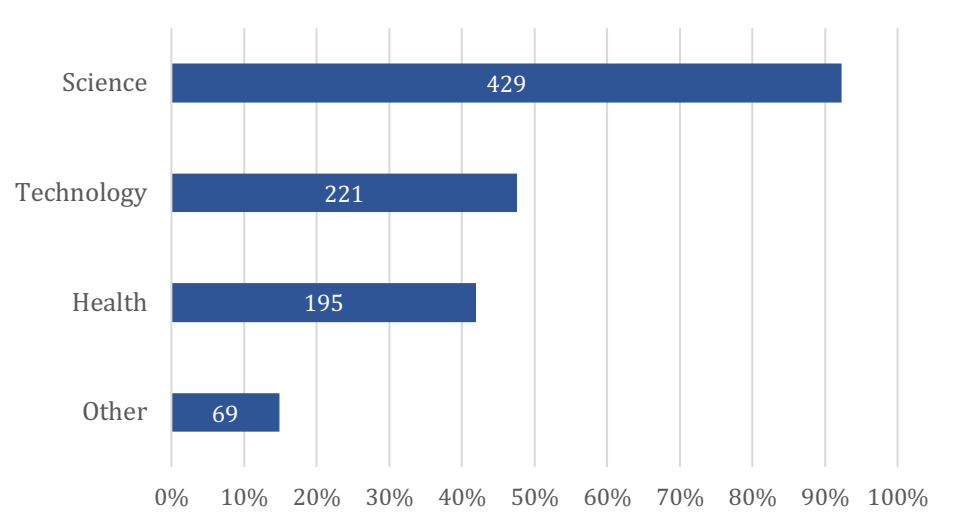
3.2 What is communicated and why

Almost all respondents communicate about science (92.3%, n=429), while 47.5% (n=221) and 41.9% (n=195) communicate about technology and health topics, respectively (Figure 5). Most of the respondents communicating about technology (97.7%, n=216) or health (90.8%, n=177) also communicate about another topic (e.g. science). Among those communicating about science, 64.8% (n=278) also communicated about another topic. Some respondents said they also communicate about other topics that were not listed in the question, such as sustainability or the environment, and many of these topics overlapped with science, technology and health issues.

Figure 5 What topics the respondents communicate.
Q) Do you communicate any of these subjects? Tick all that apply.
Total respondents: 465. Dark blue bars – percentage of respondents who ticked the choice.
The frequency of responses for each category is shown in the labels.



We asked respondents why they communicate science, technology or health, to help us understand their perspective on science communication repertoires (specifically motivations that align to one-way and two-way modes of communication).

When asked what they are trying to achieve when they communicate about STEM topics, 90.9% (n=420) of respondents said they want to inform the public about science, technology and/or health (Figure 6). **'Inform'** was the most frequent answer in every country, except Poland, where it was ranked fourth. In Poland, 96.6% (n=28) of respondents said they want to **'Educate'** the public. Inform and educate suggest modes of communication more oriented to deficit model framings of science communication (Wilkinson and Weitkamp, 2016). Furthermore, 61.5% (n=284) of respondents said they communicate about STEM to **'Counter misinformation'**. While the approach to counter misinformation could be a dialogic one, it does suggest that the science communicators in our sample see at least some members of the public as being misinformed or lacking scientific knowledge and were actively seeking to counter that.

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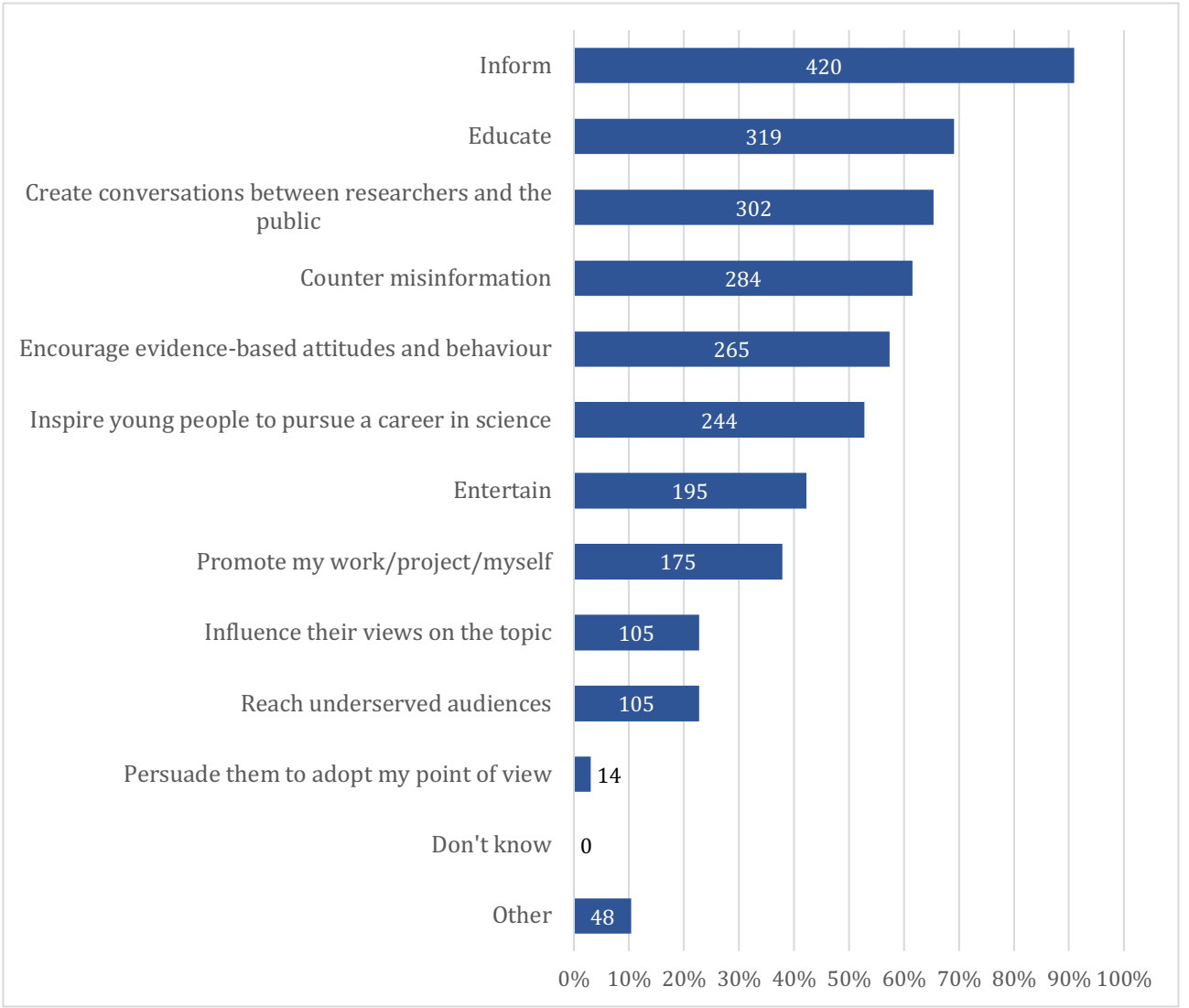
Nevertheless, science communicators in our sample also recognise the value of dialogue, with around two-thirds indicating that they sought to **'Create conversations between researchers and the public'** (65.4%, n=302). **'Encourage evidence-based attitudes and behaviours'** was also selected by 57.4% (n=265) of respondents.

Figure 6 What the respondents are trying to achieve when they communicate about science, technology and/or health topics. Q) When you communicate about science, technology, and/or health, what are you trying to achieve? Tick all that apply. Total respondents: 462. Dark blue bars – percentage of respondents who ticked the choice. The frequency of responses for each category is shown in the labels.



Other common reasons for communication included: 52.8% (n=244) of respondents who selected that they communicate about science topics to **'Inspire young people to pursue a career in science'** and 42.2% (n=195) of respondents said they want to **'Entertain'**. The responses **'Influence their views on the topic'** and **'Reach underserved audiences'** were both selected by under a quarter of respondents (22.7%, n=105). Very few said they aim to **'Persuade their audiences to adopt their point of view'** (3.0%, n=14).

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There were variations around the priorities expressed in each of the different countries and these are indicated in Table 1.

Table 1 Priority of replies for each country about what the respondents are trying to achieve when they communicate about science, technology and/or health topics.
Legend: Italy Netherlands Poland Portugal Serbia Sweden UK

Priority of replies	1st	2nd	3rd	4th	5th
Inform	IT, NL, PT, RS, SE, UK	PL			
Educate	PL	PT, RS, SE, UK		IT	NL
Create conversations between researchers and the public		PL	IT, NL, SE, UK	RS	PT
Encourage evidence-based attitudes and behaviour			PL, RS	PT, SE, UK	IT
Counter misinformation		IT, PL	PT	NL	RS, SE, UK
Entertain		NL			PL, RS
Inspire young people to pursue a career in STEMM		RS		PL	NL, PT
Promote my work/project/myself			NL		

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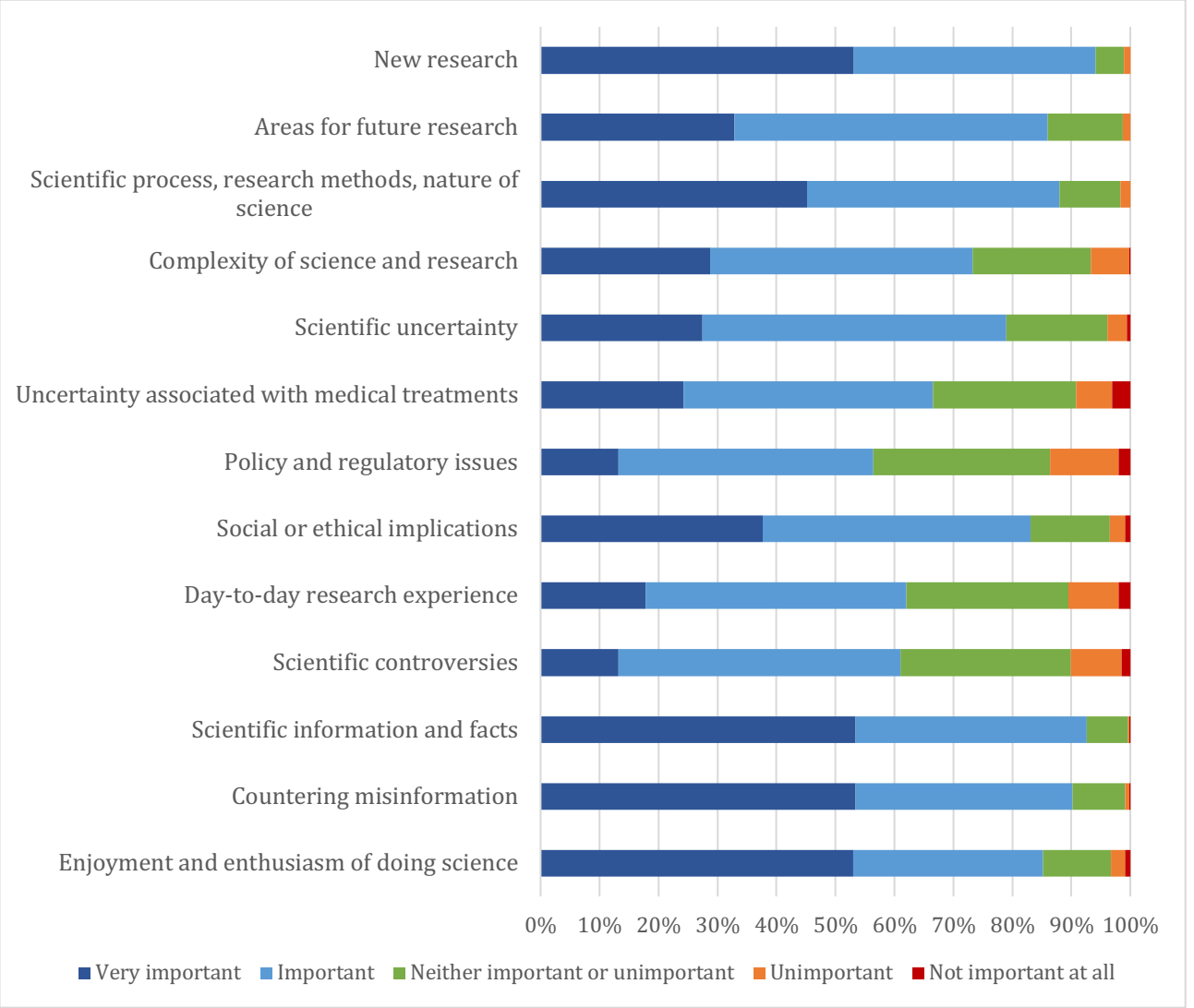
When it comes to what our respondents actively communicate (Figure 7), the vast majority (94.1%, n=431) indicated that **'New research'** is an important or very important aspect of science, technology and/or health to communicate, and 53.1% (n=243) of these indicated that as being very important. **'Scientific information and facts'** were considered important or very important to communicate (92.6%), and 90.2% thought it was important or very important to **'Counter misinformation'**. Several aspects of science, technology and health were considered important, though not all of them were very important. For example, **'Areas for future research'** (32.8%, n=149) and **'Social or ethical implications'** (37.7%, n=171) were deemed very important aspects to communicate for around a third of respondents.

Figure 7 What aspects of science, technology and health are important to communicate.
Q) In your communication, how important do you think it is to include the following aspects of science, technology and/or health? Total respondents: 458.



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'Enjoyment and enthusiasm of doing science' was considered a very important aspect of science to communicate by 53.0% (n=242) of the respondents and important by 32.2% (n=147), whereas **'Day-to-day research experience'** was considered very important by the 17.8% (n=81) of respondents, and important by the 44.2% (n=201).

'Scientific controversies' were considered important or very important aspects to communicate by 61.0% (n=277) of the respondents overall, whereas 28.9% (n=131) considered them neither important nor unimportant even though misinformation often arises around scientific controversies (e.g. climate change, vaccines, and genetically modified organisms).

While communicating about **'scientific uncertainty'** was seen as important or very important by 78.9% (n=360) of respondents, communicating the **'uncertainty associated with medical treatments'** was considered important or very important by slightly fewer respondents, 66.5% (n=296). These percentages varied somewhat depending on the discipline participants primarily communicate. For example, 79.9% (n=155) of the respondents communicating about health considered **'uncertainty associated with medical treatments'** important or very important, whereas 65.8% (n=269) of those communicating about science also thought this. Finally, **'Policy and regulatory issues'** were considered important or very important by 43.2% (n=256) of respondents.

Figure 8 shows the differences of the aspects of science, technology and health that respondents consider important to communicate.

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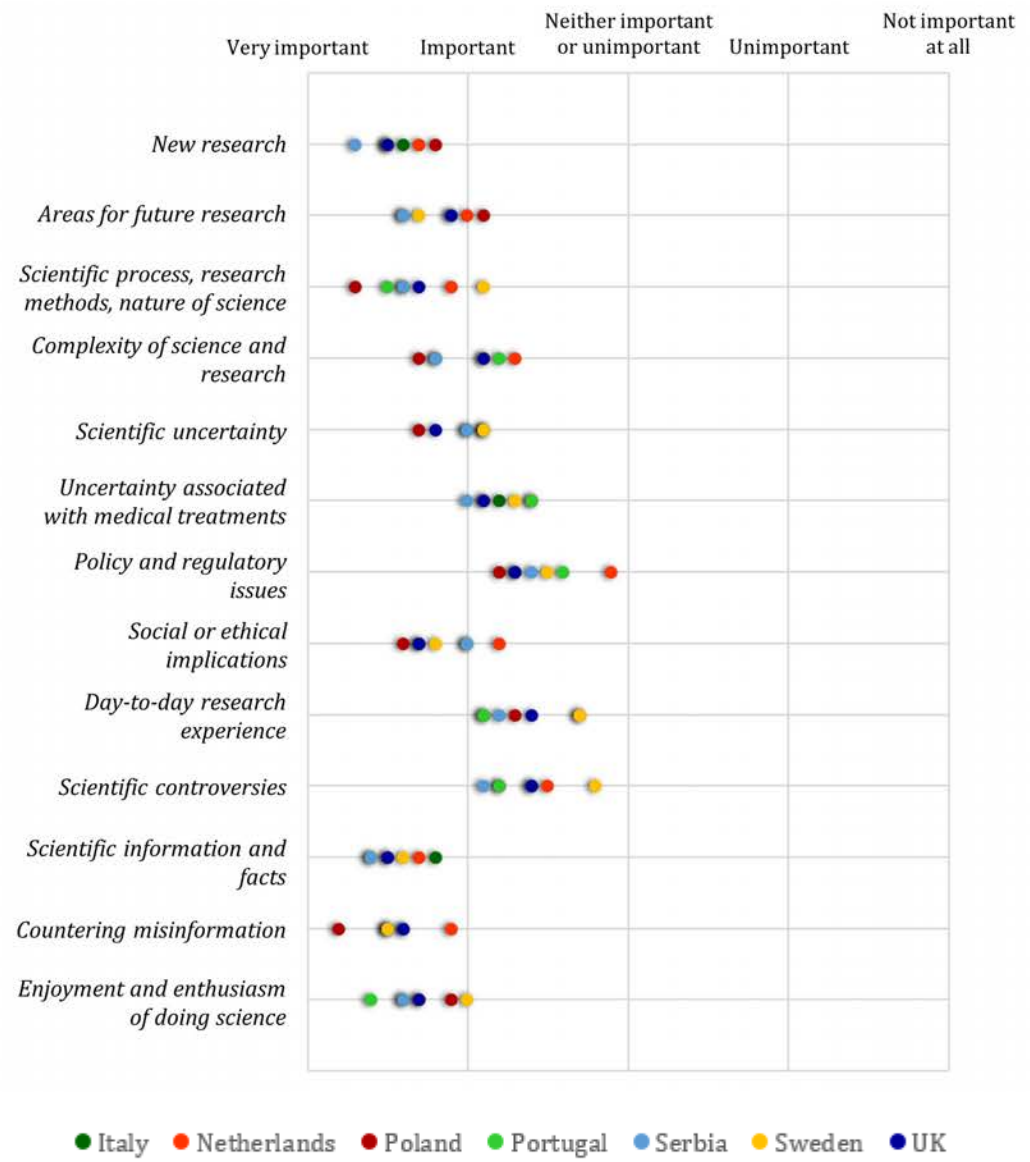
Figure 8 National differences of what aspects of science, technology and health respondents think are important to communicate.



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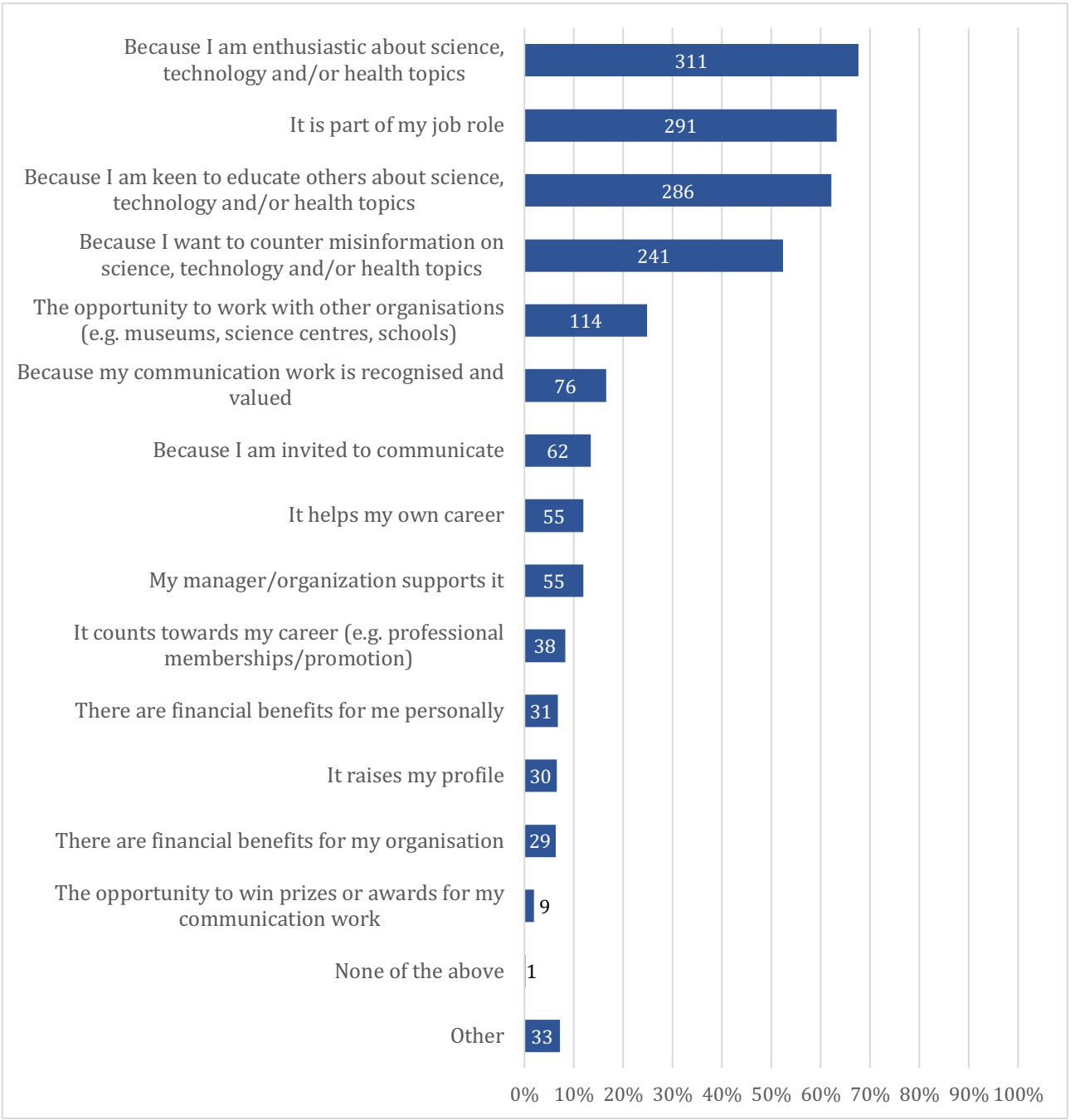
3.3 Motivations and barriers

As shown in Figure 99Figure 9, the top motivations to communicate about science, technology and/or health topics were often individual rather than institutional. Most of the respondents said they were motivated to communicate about science, health and technology because they are **'enthusiastic about these topics'** (67.6%, n=311). The majority also communicate about science as **'part of their job role'** (63.3%, n=291), and/or because they are **'keen to educate others about science, technology and/or health'** (62.2%, n=286).

Figure 9 Motivations to communicate science, technology and/or health topics.
Q) Which of the following are the most important reasons you communicate science, technology and/or health topics? Select maximum three choices. Total respondents: 460. Dark blue bars – percentage of respondents who ticked the choice. The frequency of responses for each category is shown in the labels.



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Misinformation was once again a relevant motivating factor, and 52.4% (n=241) selected **'to counter misinformation on science, technology and/or health topics'** as a reason for communicating. These motivations (with the exception of **'It is part of my job role'**), were very much in line with the respondents' answers to previous questions about their communicative intentions and practices (see Sections 3.2 and 3.4). Moreover, the four motivations **'Because I am enthusiastic about STEM topics'**, **'It is part of my job role'**, **'I am keen to educate others about STEM'**, and **'Because I want to counter misinformation'**, were the top motivations to communicate about science across all countries, though with different prioritisations (Table 2).

Table 2 Priority of replies for each country of the motivations to communicate science, technology and/or health topics

Legend: Italy Netherlands Poland Portugal Serbia Sweden UK

Priority of replies	1st	2nd	3rd	4th	5th
It is part of my job role	IT, SE	NL, PL, PT, UK		RS	
Because I am keen to educate others about STEM topics	RS	IT, SE, UK	NL, PL, PT		
Because I want to counter misinformation on STEM topics	PL, PT		IT, RS, UK	NL, SE	
Because I am enthusiastic about STEM topics	NL, UK	PL, RS	SE	IT, PT	
The opportunity to work with other organisations				PL, RS, UK	IT, NL, PT
Because my communication work is recognised and valued					NL, PL, UK
There are financial benefits for me personally					NL, PL
It counts towards my career (e.g. promotion)					PL
My manager/ organization supports it					RS
Because I am invited to communicate					SE

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'Lack of time' (47.0%, n=211) and **'lack of resources'** (29.8%, n=134) were the main barriers that prevent respondents from being more involved in science communication activities (Figure 1010). 19.2% of respondents (n=86) mentioned that they are prevented from doing more science communication activities because it is **'difficult to get others involved'**, such as researchers, and 16.5% (n=74) said there is **'insufficient encouragement from funders'** for science communication work.

Respondents also agreed they do not do more science communication work because there is **'not enough financial reward'** for it (16.9%, n=76) and there is a **'lack of reward and recognition'** for science communication work (15.8%, n=71). Only 6% of respondents mentioned that the **'negative perception towards the role of science communication from their peers'** prevents them from being more involved in science communication activities.

Some barriers were related to the respondents' organisational role. 14.7% of respondents said they receive **'insufficient support from their manager or organisation'** (n=66), and 9.4% receive **'insufficient support from other staff at their organisation'** (n=42). Respondents also mentioned that the **'insufficient communication specialists at their organisation'** (13.4%, n=60) prevents them for being more involved in science communication activities.

Among all respondents, 12% (n=54) said that there were **'no barriers'** that prevent them from being more involved in science communication work, and 16.7% (n=75) said they are **'happy with the amount they do'**. Three respondents said they do not want to get more involved.

Unlike the motivations to do science communication activities, the reasons not to get involved in science communication ranked differently in each country (Table 3), except for lack of time. Lack of resources was an important barrier in the UK, Portugal, Italy and Sweden. In the Netherlands, insufficient financial reward for science communication work was important, whereas in Poland it was insufficient support from their managers and organisations, and in Serbia was the insufficient support from other staff at the organisation.

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Figure 10 Barriers to communicating science, technology and/or health topics.
Q)Which of the following are the most important reasons that prevent you from getting more involved in activities to communicate science, technology and/or health topics? Select maximum three choices.
Total respondents: 449. Dark blue bars – percentage of respondents who ticked the choice. The frequency of responses for each category is shown in the labels.

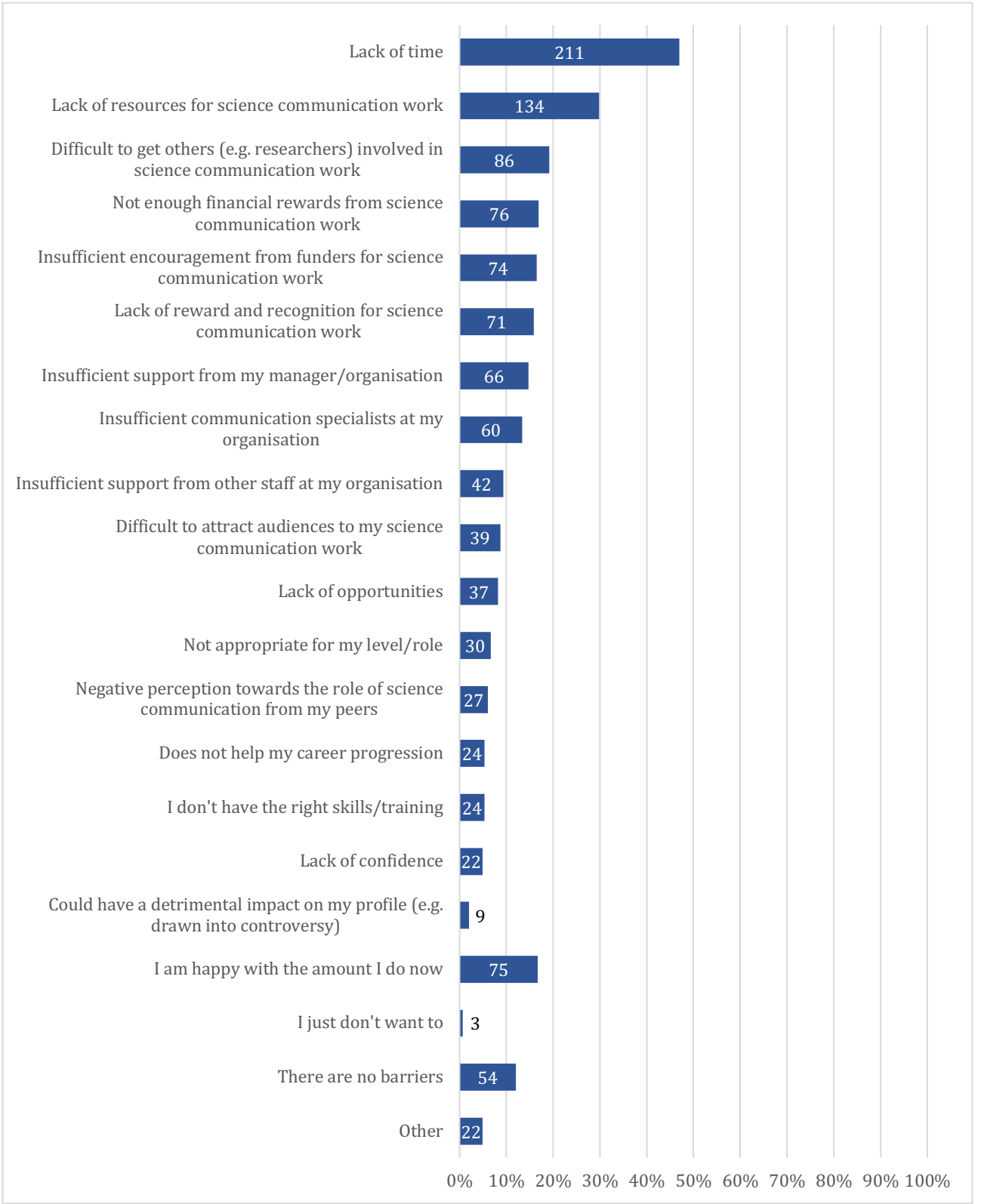

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Table 3 Priority of replies for each country of the barriers to communicating science, technology and/or health topics.
Legend: Italy Netherlands Poland Portugal Serbia Sweden UK

Priority of replies	1st	2nd	3rd	4th	5th
Lack of time	IT, NL, PL, PT, RS, SE, UK				
Lack of resources for science communication work		IT, PT, SE, UK	NL, PL	RS	
Not enough financial rewards from science communication work		NL	IT		
Difficult to get others involved in science communication work			RS, UK	IT	PL, PT
I am happy with the amount I do now			SE	IT, UK	NL
Insufficient encouragement from funders for science communication work			PT		IT, UK
There are no barriers				NL, UK	
Insufficient support from my manager/ organisation		PL			RS, SE
Insufficient communication specialists at my organisation			RS	PL	
Lack of reward and recognition for science communication work				PT, SE	UK
Difficult to attract audiences to my science communication work				RS, SE	
Insufficient support from other staff at my organisation		RS			SE

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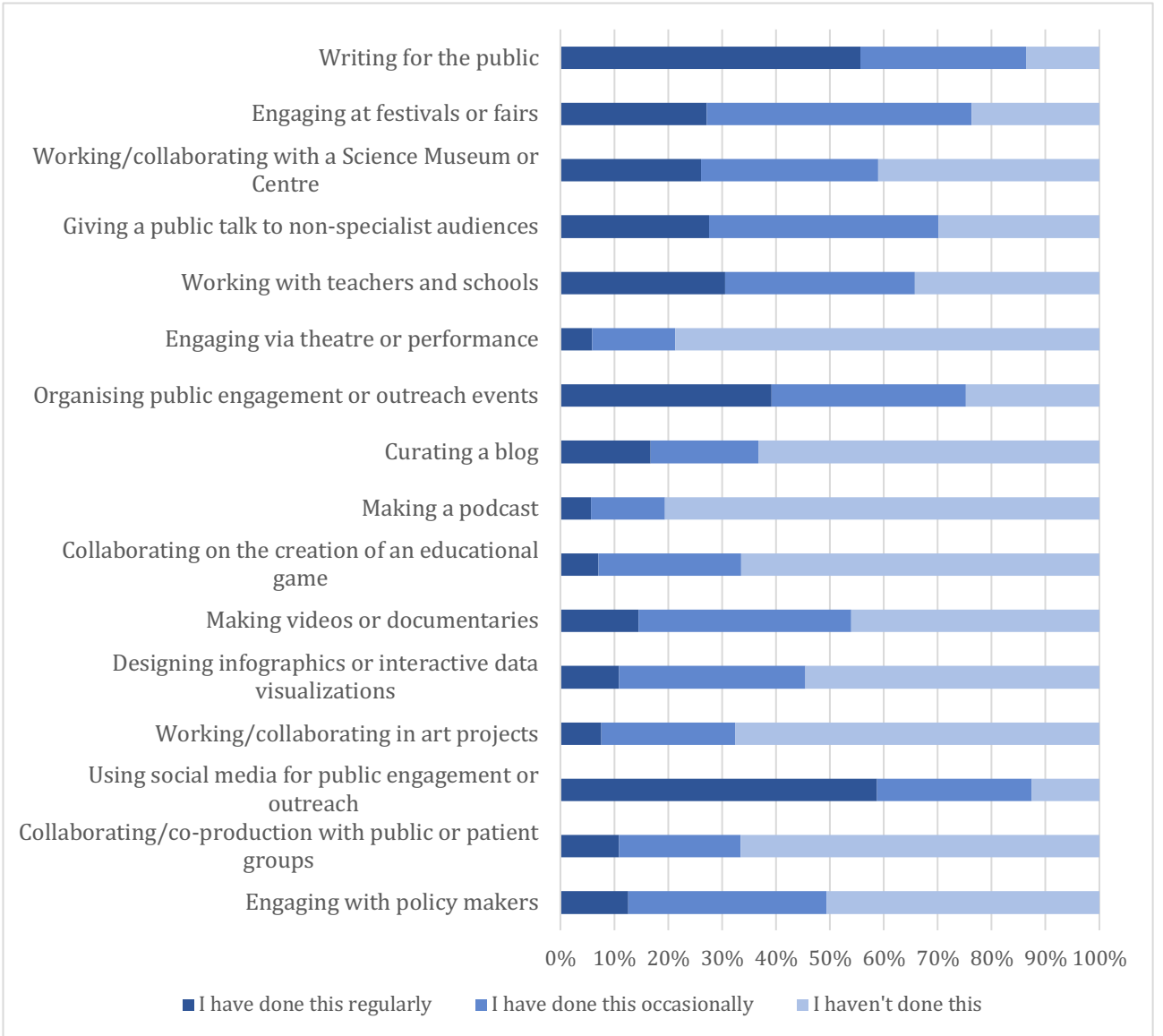
3.4 Communication practices

When asked how they have communicated about science, health and technology-related topics, 58.7% (n=266) and 55.6% (n=253) of respondents said they have regularly used '**social media for public engagement or outreach'** and **'written for the public'**, respectively. These percentages rose to 87.4% (n=396) and 86.4% (n=393) when including those who have communicated about sciences in these ways occasionally. Many respondents said they have engaged in several other activities to communicate about science-related topics, such as **'taking part in festivals'** or **'organising public events'** (Figure 111). Some activities, though, were less common; for example, less than 40% have ever '**worked or collaborated in art projects'** (n=145), **'collaborated with public or patient groups'** (n=150), **'collaborated on the creation of an educational game'** (n=148) or **'curated a blog'** (n=165). Moreover, only 19.4% (n=86) have ever **'made a podcast'** and 21.3% (n=94) have **'engaged via theatre and performances'**.

Figure 11 How respondents communicate about science, technology and/or health topics.
Q) We would like to know about how you communicate science, technology and/or health topics. Tell us which communication activities have you done on behalf of an organisation or community and/or for yourself in the last 12 months. Tick all that apply. Total respondents: 455.



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Though most respondents use social media, the type of digital media outlets they use is highly varied (Figure 122). Respondents use **'websites'** to communicate about science topics more than **'blogs'** on behalf of an organisation or in another professional capacity (e.g. curating a blog as part of a professional role (e.g. freelancer) but not within an organisation). Only 7.3% (n=47) of respondents have not used websites in the last 12 months. Among the social media platforms, **Facebook** and **Twitter** are used the most. While the UK and Sweden respondents use **Twitter** more than **Facebook** on behalf of their organisation and/or in another professional capacity, in all of the countries **Facebook** is the most used outlet. **LinkedIn** is also used to communicate about sciences in a personal and/or professional capacity in every country; only 16.6% (n=100) of respondents have not used it (n=418).

In comparison to **Pinterest** and **Flickr**, **Instagram** is the most common visual platform used to communicate about science-related topics on behalf of an organisation or in another professional capacity; especially in Portugal, Italy and the UK. This platform is also used personally by actors in all countries, whereas only 25.0% (n=103) and 19.8% (n=83) of respondents have used **Pinterest** and **Flickr**, respectively, either personally or professionally.

Respondents are slightly more likely to have used online video platforms such as **Vimeo** or **YouTube** to communicate about science topics either on behalf of an organisation or themselves than **Instagram** – only 20.8% (n=121) have not used video platforms while 30.4% (n=168) have not used Instagram. Podcast platforms have been used by 39.1% (n=179) of respondents to communicate about science topics, and 19.4% (n=86) of them have made a podcast in the last 12 months (Figure 122Figure 11). Respondents had often communicated via podcasts more in a personal than on behalf of an organisation or in another professional capacity.

Digital media platforms such as **forums** (e.g. Quora), **Reddit** and **Snapchat** were amongst the least used digital platforms. Among the respondents, 75.5% (n=311) have not used **Reddit**, 80.5% (n=331) have not used **forums** and 89.8% (n=371) have not used **Snapchat** to communicate about science topics. Moreover some, questionnaire respondents did not know what Reddit (10.9%, n=45) and forums (9.3%, n=38) were.

Respondents have used **Instant Messaging (IM) apps**, such as WhatsApp or Telegram, mostly in a personal capacity, though some have used them in a professional capacity too. These apps offer the possibility to open 'channels' to broadcast public messages to audiences, however, only 6.2% (n=34) of respondents use them on behalf of an organisation.

Only 15.4% (n=71) of respondents have used **other apps** (e.g. games, news) to communicate about science topics on behalf of an organisation or in another professional capacity, though more used them in a personal capacity (32.1%, n=148). There is relatively little use of **virtual reality** and **virtual museums** in either a personal or professional capacity (22.4%, n=48), and these tools were not used by any respondents from Sweden or Poland in a professional capacity. Most of the respondents have not used **MySpace** (90.8%, n=376) or **SecondLife** (79.0%, n=376) and several did not know what these were (7.0% and 16.8% respectively). It is possible that the popularity of these outlets has declined over recent years.

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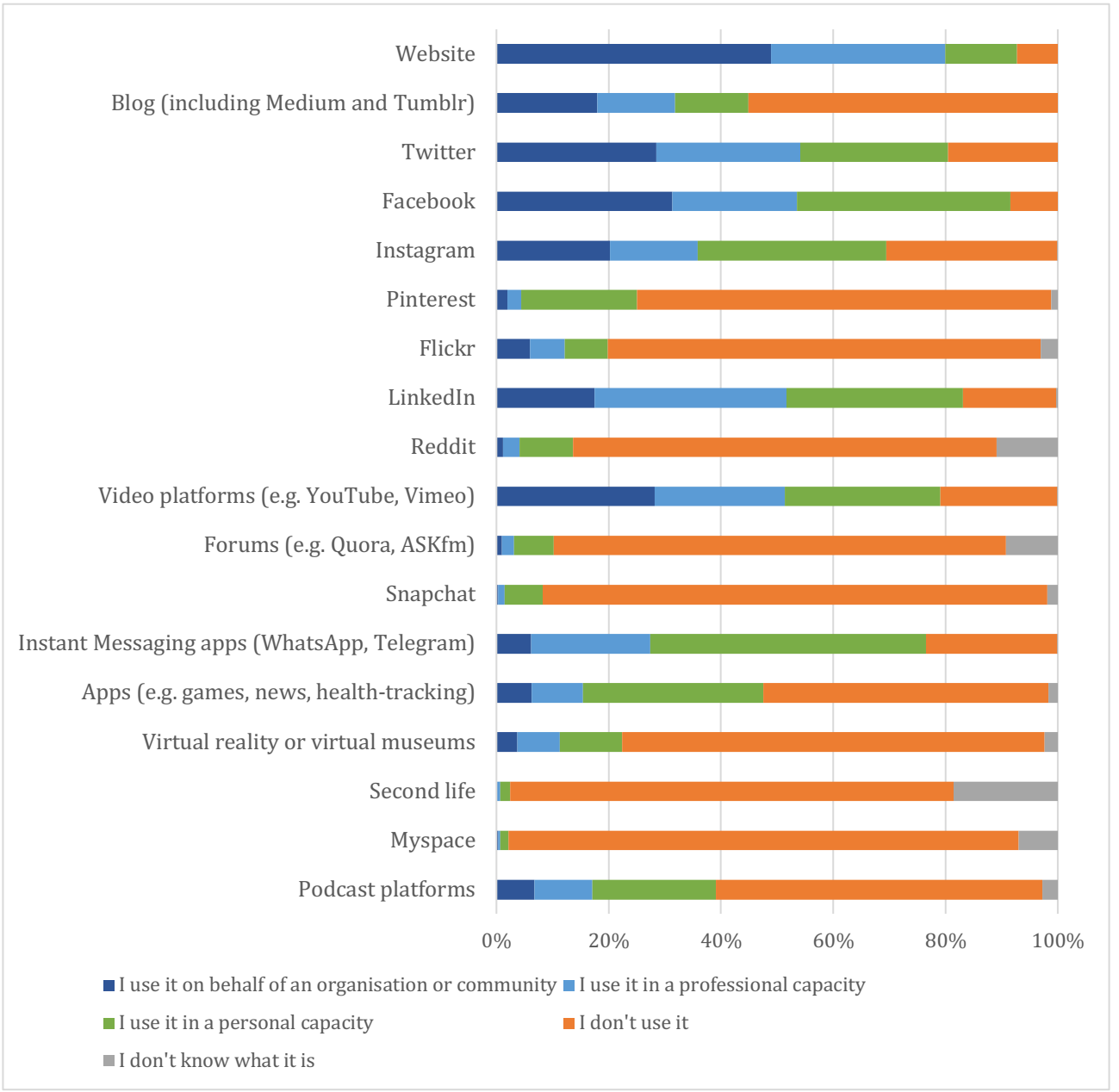
Figure 12 What digital media the respondents use to communicate about science, technology and/or health topics. What digital media outlets do you use to communicate science, technology and/or health topics? Tell us which outlets have you used on behalf of an organization or community and/or yourself in the last 12 months. Tick all that apply. Total respondents: 418.



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3.5 Choice of content

In terms of choices made on the types of content communicated, **'relevance to society'** was the most important factor to consider when choosing a story to cover; 61.2% (n=163) and 30.9% (n=140) replied that this factor was very important and important respectively. Two other important factors were the **'scientific merit'** and the **'human interest of the story'** (Figure 13). The factors which were deemed most important demonstrated some variations by country (Figure 14).

The **'relevance of the story to the business sector'** (7.6%, n=34), its **'potential to go viral'** (10.1%, n=45) or the fact that it was already **'the focus of social media attention'** (8.2%, n=37) were not considered important factors at all when choosing a story by the majority of the respondents. Only half of the respondents said that the **'entertainment value of the story'** or the fact that it was **'attracting media attention'** were factors they consider important.

A few respondents said they were told by their managers/editors to focus on specific factors when choosing a story to communicate. In particular, they were told to focus on **'breaking news, stories with scientific merit'** or that **'attract social media attention'** (2.5% each, n=11), and to lesser extent on stories responding to an emergency (1.8%, n=8). This was slightly more often the case for Swedish and Dutch respondents.

Figure 13 How the respondents choose what science story to cover.
Q) How do you choose which science, technology and/or health story to cover? Tell us how important each factor is in determining how you select a story. Total respondents: 449.

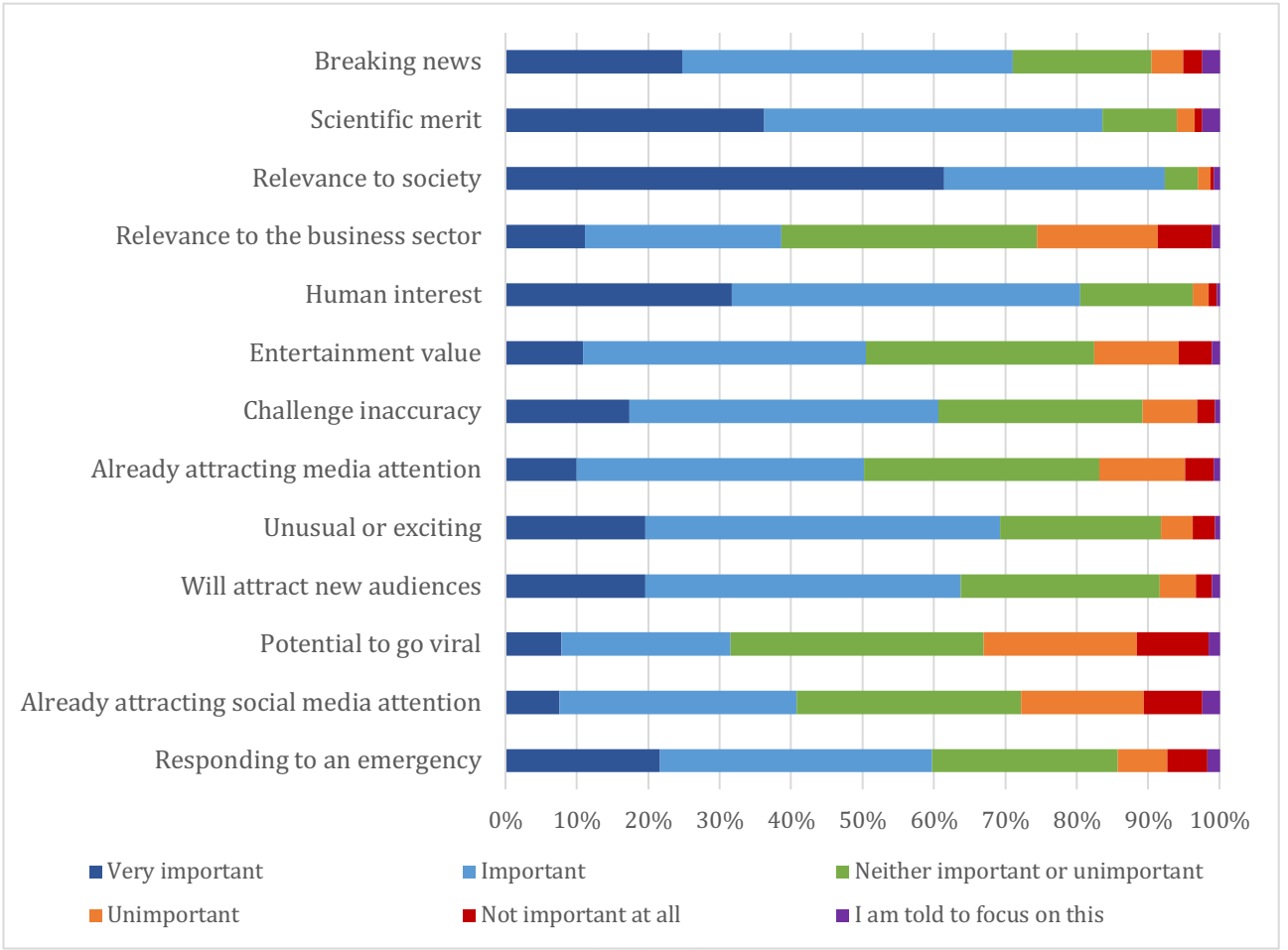

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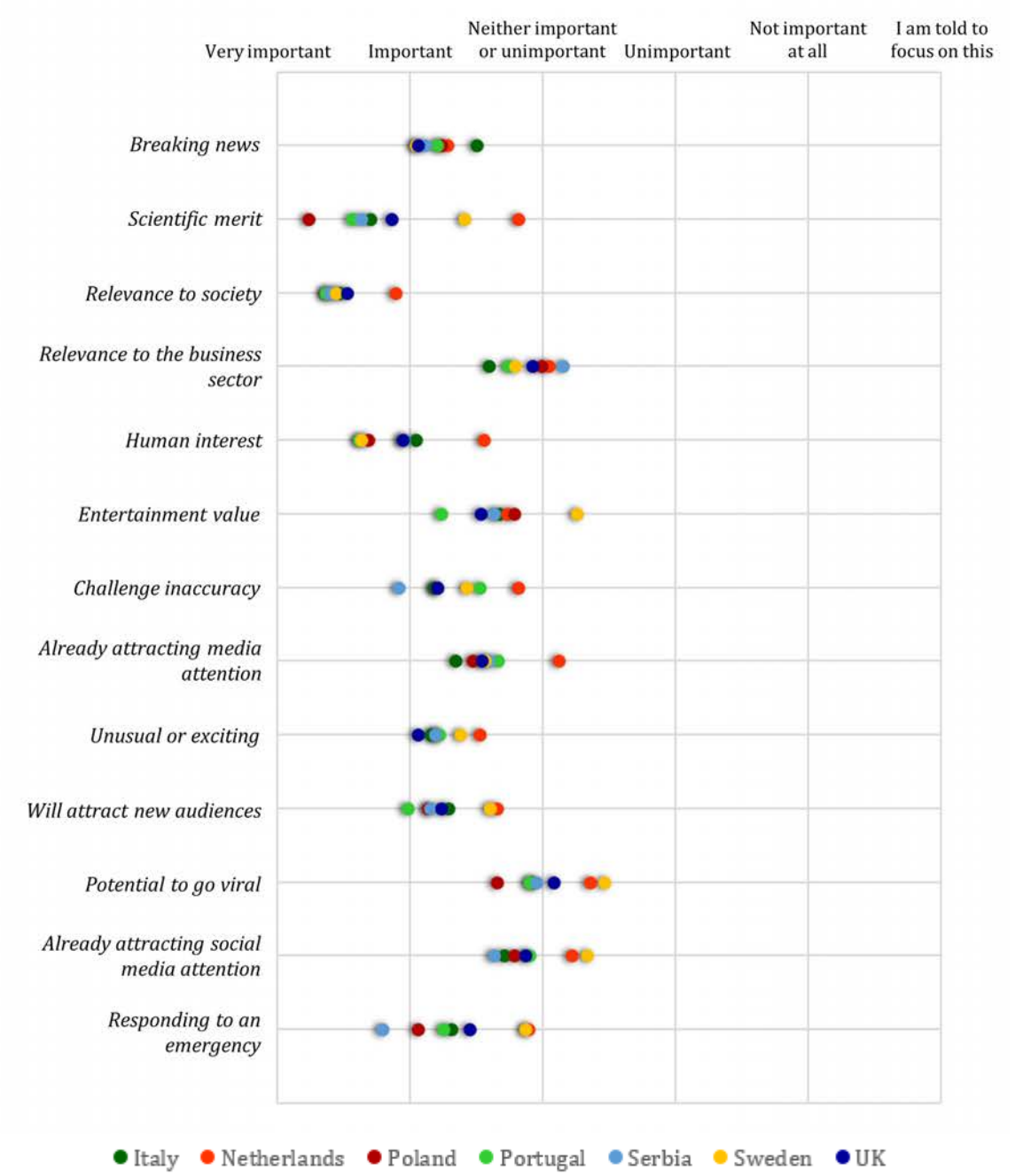
Figure 14 National differences about how the respondents choose what science story to cover.



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When asked how they position themselves, in terms of which sources they consult and/or trust when communicating science, health and/or technology, 97.3% (n=369) of respondents said they trust **scientific journals** and 79% (n=357) of them also consult this source. 2.7% (n=12) of respondents consult this source but say they do not trust them (Figure 155). Among the other sources that were trusted and consulted, respondents mentioned their **network of personal contacts** (71.6%, n=318), **science magazines** (60.9%, n=271), and **press releases and blogs from universities and research centres** (61.4%, n=274). **Scientific conferences and medical congresses** were also trusted by most of the respondents, but only 51.6% (n=229) also used them as a source of information for science communication activities. **Newspapers** were consulted by 85.6% (n=379) of respondents, but were not particularly well trusted, with 28.4% (n=126) trusting this source. **Wikipedia** was another source of information that was often consulted (80.0%, n=351), but only 30.1% (n=132) of respondents trusted it.

59.4% (n=262) of respondents consulted **press releases and blogs from non-governmental organisations, charities, and think tanks**, and 57.8% (n=256) consulted those from **government ministries**. **Press releases and blog posts from non-profit organisations** (18.6%, n=82), and those from **government ministries** (27.3%, n=121) were less well trusted in comparison. Similarly, **press releases and blogs from businesses** were also consulted by fewer respondents (44.0%, n=195), only 7.2% of whom trusted them (n=32).

Respondents also consulted **platforms such as ResearchGate or Academia.edu** (55.3% n=238, though 10.0% of respondents have never heard of them), **researchers' blogs** (50.9%, n=221), and **journalists' blogs** (40.3%, n=174). Among those who consulted these platforms, ResearchGate or Academia.edu, were trusted more than researchers' blogs.

LinkedIn, **Twitter**, **social media (e.g. Facebook)** and **YouTube** were consulted by around half of respondents (45.4-53.3%), though were less trusting of these platforms. Among these, **LinkedIn** was the most trusted (12.9%, n=55 of those who consulted it), while **social media** were the least trusted (6.7%, n=28 of those who consulted them). Overall, most respondents, including those that do not consult these platforms, said that they do not trust **Twitter** (79.6% n=339), **YouTube** (80.6% n=340) and other social media (83.7% n=350). 50.6% (n=212) of respondents neither consulted nor trusted **Reddit**, and 19.3% (n=81) had never heard of it.

A small number of respondents (14.7%, n=64) had not heard of **science news release sites, such as EurekAlert or BioMedNet**. Among those who were aware of them, 59.5% (n=259) trusted them but only 36.1% (n=157) also consulted them.

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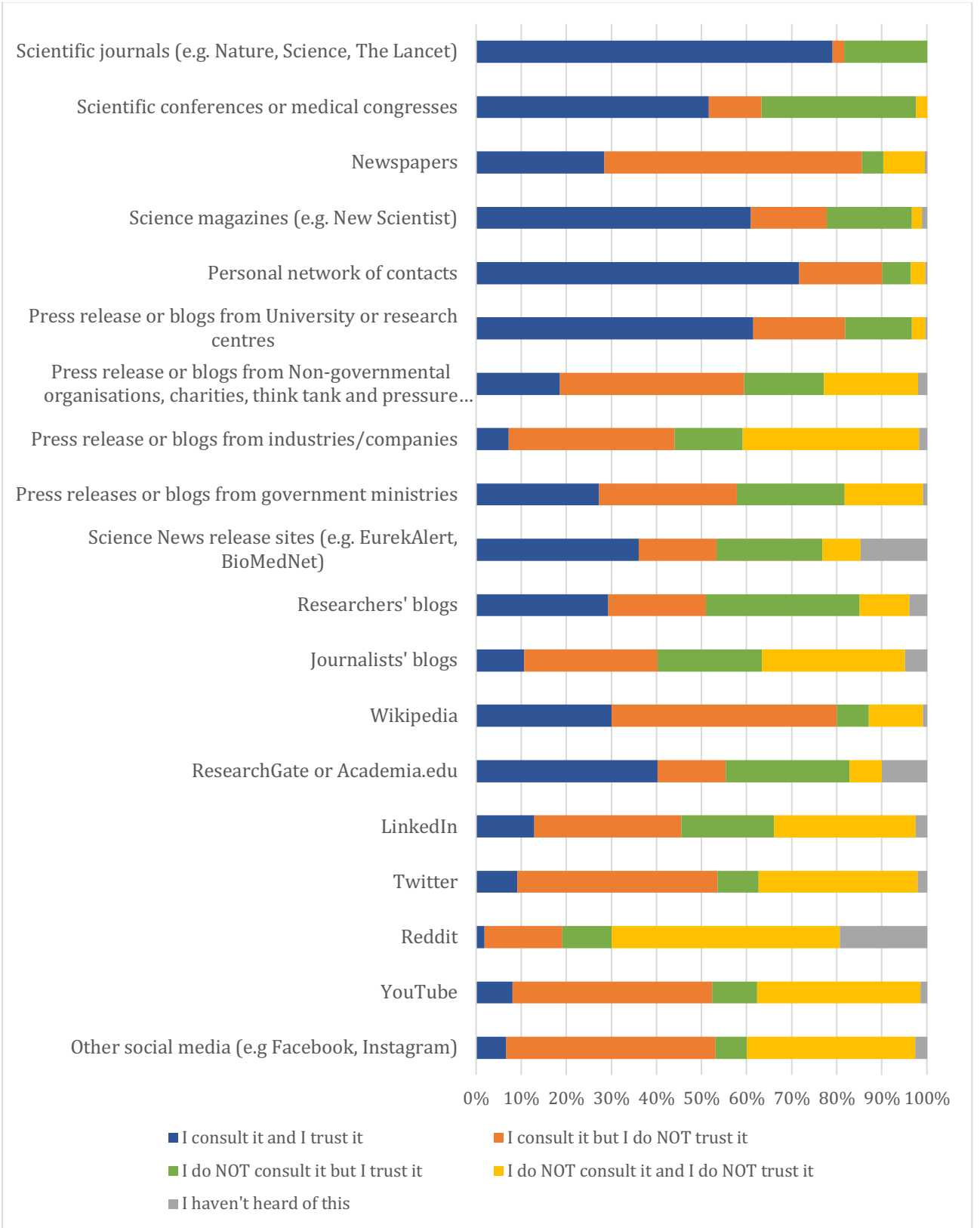
Figure 15 What sources of information the respondents trust and/or consult when choosing a science story to cover. Q) Which sources of information or platforms do you consult and which do you trust? Total respondents: 436.



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4. Conclusions

This survey captures the working practices, motivations and barriers of a variety of science communicators from seven different European countries. Many of the respondents were 'traditional' science communicators, such as journalists, press officers, freelance communicators, researchers, and university lecturers. A smaller number represent the relatively recent arrivals to the sector enabled by digitization, such as bloggers, YouTubers and social media influencers.

For some of the actors included in this research, communicating about science will occupy all of their working day. For others, science communication will only occupy a proportion of their working lives. As such, they are a diverse group. However, a collective approach to considering the work and the perspectives that underpin that work of all actors who communicate about science, health and technology allows us to consider the implications of this for the science-society relationship.

Many respondents across all the European countries included in the survey, except Poland, described 'informing the public about science' as their primary aim when communicating about STEM topics. Educating the public was also common. Such 'conduit' roles to use Fahy and Nisbet's (2011) role typology imply a deficit model of communication found in previous studies of science journalists (Bauer et al., 2013), researchers (TNS BRNB and University of Westminster, 2015) and bloggers (Jarreau, 2015). These aims were also reflected in the nature of what survey respondents communicate, as well as their motivations, with 'new research' and 'scientific information and facts' being common.

However, around two-thirds of survey participants said they aim to create conversations between researchers and the public when they communicate about science, what may be considered a 'convener' role (Fahy and Nisbet, 2011). This reflects a wider acknowledgement within the science communication sector that activities such as public engagement can take the form of dialogue rather than the dissemination of facts (TNS BRNB and University of Westminster, 2015; NCPPE, 2019). There were some national differences in the relative importance applied to creating conversations. It was deemed the third most important factor in several countries, namely Italy, The Netherlands, Sweden and the UK. In Poland it was second in terms of priority and in Portugal fifth.

There is evidence of many science communicators taking on a 'civic educator' role (Fahy and Nisbet, 2011), seeking to inform people about the way science is done, as well as its limitations. Many survey respondents stated that communicating scientific processes, communicating scientific uncertainty and communicating the 'enjoyment and enthusiasm of doing science' were important.

Countering misinformation was important to survey respondents in terms of what they are trying to achieve in their communications, providing evidence also of a 'watchdog' role for science communicators (Fahy and Nisbet, 2011). There were national differences in the extent to which countering misinformation was a motivating factor for science communicators. It was deemed to be the main motivation for communicators in Poland and Portugal and the fourth priority in The Netherlands and Sweden. There were large national differences in the other motivating factors; an enthusiasm for STEM topics was the most important motivation in the Netherlands and the UK, and the fourth most important in Italy and Portugal.

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When viewed through the lens of repertoires (Gilbert and Mulkay, 1984; Turnhout et al. 2013) the work and motivations of the survey respondents demonstrates differing conceptions of the science-society relationship. The aspirations of these science communicators to inform and educate, is what may be considered a 'supplying' repertoire (Turnhout et al. 2013) in which knowledge production (by scientific research) is distinct from knowledge use (by society). There is also evidence however, of conceptions of a more blurred line between science and society from the respondents who say they aim to facilitate conversations between researchers and the public, which may be considered a 'bridging' repertoire (Turnhout et al. 2013). Though this was somewhat less prevalent among the survey respondents.

In terms of the formats in which the science is communicated, the science communicators in our survey rely on written formats (books, web articles) and social media. Organising public events, giving public talks, participating in science festivals and working with schools are also common. Few respondents have participated in science-themed theatre, or collaborated in the creation of an educational game or science and art project. In part, this is likely to be a reflection of the fact that many survey respondents were press officers and journalists. Social media has become an important means of communication for journalists (Neuberger, Nuernbergk and Langenohl, 2019) and researchers (TNS BRNB and University of Westminster, 2015). However traditional forms of science communication, such as public lectures, continue to play an important role (TNS BRNB and University of Westminster, 2015; Royal Society, 2006). Some digital forms of communication, such as podcasts and videos, continue to be less commonly used by today's science communicators, echoing earlier studies of journalists (Bauer et al., 2013), and researchers (Collins, Shiffman, and Rock, 2016; TNS BRNB and University of Westminster, 2015).

A lack of time was the biggest barrier to undertaking more science communication activities among survey respondents – this was the case in all European countries surveyed. A lack of resources was also problematic for many respondents. Time and resources have been found to be the largest barriers to science communication in previous studies of researchers and those working in other organisations such as museums (NCPPE, 2019; TNS BRNB and University of Westminster, 2015). Our respondents also identified a difficulty in encouraging others, such as researchers involved in science communication activities, as a barrier. Similar challenges have been mentioned in previous reports (NCPPE, 2019; TNS BRNB and University of Westminster, 2015). These barriers indicate continuing questions around the perceived value of science communication by some individuals as well as its institutional support; replicating the findings of earlier studies (TNS BRNB and University of Westminster, 2015; Neresini and Bucchi, 2011; AbiGhannam, 2016).

It is notable that relatively few science communicators who completed the survey stated that reaching underserved audiences is something they are trying to achieve in their activities. This in itself presents a challenge to a close science-society relationship in that it indicates there are likely to be continuing inequalities in access to scientific information within society based on socio-economic background, gender and ethnicity (Dawson, 2018). The factors that underlie this low prioritisation among science communicators warrant further exploration within the RETHINK project, as do the successes of those who do reach out to underserved audiences.

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Appendix A

Contact email

The email below was sent to the participants to invite them to take part in the survey. This is the English version and it was translated in the language relevant to the country where participation was sought.

Dear [name],

I'm getting in touch with the hope you can help. Here at [name of the institution] we are working in collaboration with the University of the West of England (Bristol) on a European on a European Commission-funded research project called RETHINK, which is exploring how science-related topics are communicated across Europe – predominantly online. As part of this research, we have developed a survey aimed at those involved in communication of science, technology and/or health topics in some way, exploring what they do and why. Given your contribution to the communication field, we are hoping that you can spare a little time to complete the survey.

The survey shouldn't take any more than 15 minutes to complete. You can access the survey using this link: https://uwe.eu.qualtrics.com/jfe/form/SV_ai4iDeugRSAE4Ch

Please, can you also pass the survey onto anyone else in your networks in the [country], to whom you think the survey is relevant/pertinent?

The survey will close on **the 21st of October 2019**. Details of the ethical considerations are outlined in the survey.

Thank you in advance for your time.

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Appendix B

RETHINK survey invitation

Welcome to the RETHINK project questionnaire.

This questionnaire is part of RETHINK, a Horizon 2020 project funded by the European Commission. The data gathered will be collected and analysed by researchers based at the Science Communication Unit, University of the West of England, Bristol. This study aims to explore the current practices, motivations, incentives, responsibilities as well as limitations such as time, skills, and resources, of actors engaged in the public communication of research, science and health. It will also capture how these actors engage with their audiences and who their target audiences are.

The data we collect are processed, stored and shared in accordance with the European Data Protection Regulation. This means that your data will not be identified in any reports or publications and any data extracts will be carefully reviewed to ensure you are not identifiable. Any sensitive or identifiable data will be kept confidential, whereas aggregated and pseudonymised data will be shared with our project partners and third parties. The information gathered will be used for the purposes of the study report, academic dissemination, and potentially as a basis for future guidelines on best practices in science communication. The final report will be published online and will be publicly available.

Participation is voluntary. You may ask for your contribution to be withdrawn from the study by the 27th of October 2019 and you will be asked for a memorable word within the questionnaire to facilitate this.

The questionnaire will take approximately 15 minutes to complete, and it is entirely your choice as to whether to complete it or not. When you click the SUBMIT button at the end of the survey, you give your consent for any answers you have given to be included in the study. Additional information on Data Protection is also provided.

If you have any question on the questionnaire or would like more information on the study, please contact Elena Milani via email elena.milani@uwe.ac.uk or telephone 0117 32 81994.

Thank you for participating to this questionnaire.

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APPENDIX C

This Appendix includes the full version of the questionnaire. However, this report only includes some of the findings of the survey. Other findings, such as those relating to the audiences of science communicators, are reported in Derivable 1.3.

Communicating science, technology and/or health

This first section is about how you communicate publically (e.g. on social media) about science, technology and/or health topics.

Q1) Do you communicate any of these three subjects?
Tick all that apply.

- □ Science
- □ Technology
- □ Health
- □ Other. Please specify

Q2) We would like to know more about how you communicate science, technology and/or health topics. Tell us which communication activities have you done on behalf of an organisation or community (e.g. university, company, association) and/or for yourself in the last 12 months.
Tick all that apply.

	I have done this regularly	I have done this occasionally	I haven't done this
Writing for the public (news media, articles, newsletters, books)	O	O	O
Engaging at festivals or fairs (science, literary, arts)	O	O	O
Working/collaborating with a Science Museum or Centre	O	O	O

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Giving a public talk to non-specialist audiences	O	O	O
Working with teachers and schools	O	O	O
Engaging via theatre or performance (e.g. dance, science comedy)	O	O	O
Organising public engagement or outreach events	O	O	O
Curating a blog	O	O	O
Making a podcast	O	O	O
Collaborating on the creation of an educational game	O	O	O
Making videos or documentaries	O	O	O
Designing infographics or interactive data visualizations	O	O	O
Working/collaborating in art projects (e.g. Science&Art, graphic novels, comics)	O	O	O
Using social media for public engagement or outreach	O	O	O
Collaborating/co-production with public or patient groups	O	O	O

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Engaging with policy makers	o	o	o

Q3) What digital media outlets do you use to communicate science, technology and/or health topics? Tell us which outlets have you used on behalf of an organisation or community (e.g. university, company, association) and/or for yourself in the last 12 months.
Tick all that apply.

	I use it on behalf of an organisation or community	I use it in a professional capacity	I use it in a personal capacity	I don't use it	I don't know what it is
Website	☐	☐	☐	☐	☐
Blog (including Medium and Tumblr)	☐	☐	☐	☐	☐
Twitter	☐	☐	☐	☐	☐
Facebook	☐	☐	☐	☐	☐
Instagram	☐	☐	☐	☐	☐
Pinterest	☐	☐	☐	☐	☐
Flickr	☐	☐	☐	☐	☐

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LinkedIn	☐	☐	☐	☐	☐
Reddit	☐	☐	☐	☐	☐
Video platforms (e.g. YouTube, Vimeo)	☐	☐	☐	☐	☐
Forums (e.g. Quora, ASKfm)	☐	☐	☐	☐	☐
Snapchat	☐	☐	☐	☐	☐
Instant Messaging apps (WhatsApp, Telegram)	☐	☐	☐	☐	☐
Apps (e.g. games, news, health-tracking)	☐	☐	☐	☐	☐
Virtual reality or virtual museums	☐	☐	☐	☐	☐
Second life	☐	☐	☐	☐	☐
Myspace	☐	☐	☐	☐	☐

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Podcast platforms	☐	☐	☐	☐	☐

Q4) Are there any other communication activities or digital media outlets that you use to communicate science, technology and/or health topics?

Q5) When you communicate about science, technology and/or health, what are you trying to achieve?
Tick all that apply.

- ☐ Inform
- ☐ Educate
- ☐ Entertain
- ☐ Inspire young people to pursue a career in science, health, technology
- ☐ Create conversations between researchers and the public
- ☐ Counter misinformation
- ☐ Promote my work/project/myself
- ☐ Encourage evidence-based attitudes and behaviour
- ☐ Persuade them to adopt my point of view
- ☐ Influence their views on the topic
- ☐ Encourage underserved audiences (e.g. ethnic minority groups, LGTBQ+ community)
- ☐ Don't know
- ☐ Other. Please, specify

Q6) In your communication, how important do you think it is to include the following aspects of science, technology and/or health?

	Very important	Important	Neither important or unimportant	Unimportant	Not important at all
New research	O	O	O	O	O

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Areas for future research	O	O	O	O	O
Scientific process, research methods, nature of science	O	O	O	O	O
Complexity of science and research	O	O	O	O	O
Scientific uncertainty	O	O	O	O	O
Uncertainty associated with medical treatments	O	O	O	O	O
Policy and regulatory issues	O	O	O	O	O
Social or ethical implications	O	O	O	O	O
Day-to-day research experience	O	O	O	O	O
Scientific controversies	O	O	O	O	O
Scientific information and facts	O	O	O	O	O
Countering misinformation	O	O	O	O	O

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Enjoyment and enthusiasm of doing science	O	O	O	O	O

Q7) Are there any other aspects of science, technology and/or health that you consider important to communicate?

Creating and curating content

In this section, we will ask you about the content you produce or curate (e.g. articles, infographics, videos, activities) and how you create your content starting from the story you decide to cover. As a story, we mean an event, discovery, or topic about science, technology and/or health that you choose to communicate.

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Q8) Do you create any original content (e.g. articles, graphics, videos) or curate content produced by others on science, technology and/or health topics?

- □ I produce content
- □ I curate content (e.g. reshare, repost content I think it is relevant for my audience)
- □ I both produce and curate content
- □ I don't produce or curate content

Q8.1) Do you carry out any evaluation of the content you produce (e.g. check data analytics, carry out questionnaires, work with external evaluators)?
Tick all that apply.

- □ Yes, I do this personally
- □ Yes, I work with others to gather this information
- □ No, not relevant to my work
- □ No, I don't have the skills to
- □ No, I don't have the time to
- □ Not sure

Q9) How do you choose which science, technology and/or health story to cover? Tell us how important each factor is in determining how you select a story.

	Very important	Important	Neither important or unimportant	Unimportant	Not at all important	I am told to focus on this
Breaking news	O	O	O	O	O	O
Scientific merit	O	O	O	O	O	O
Relevance to society	O	O	O	O	O	O
Relevance to the business sector	O	O	O	O	O	O

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Human interest	O	O	O	O	O	O
Entertainment value (e.g. quirky, funny)	O	O	O	O	O	O
Challenge inaccuracy	O	O	O	O	O	O
Already attracting media attention	O	O	O	O	O	O
Unusual or exciting	O	O	O	O	O	O
Will attract new audiences	O	O	O	O	O	O
Potential to go viral	O	O	O	O	O	O
Already attracting social media attention	O	O	O	O	O	O
Responding to an emergency (e.g. Ebola outbreak, earthquakes)	O	O	O	O	O	O

Q10) Do you consider any other important factors in determining how you select a story about science, technology and/or health?

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Q11) Which sources of information or platforms do you consult and which do you trust?

	I consult it and I trust it	I consult it but I do not trust it	I do not consult it but I trust it	I do not consult it and I do not trust it	I haven't heard of this
Scientific journals (e.g. Nature, Science, The Lancet)	O	O	O	O	O
Scientific conferences or medical congresses	O	O	O	O	O
Newspapers	O	O	O	O	O
Science magazines (e.g. New Scientist)	O	O	O	O	O
Personal network of contacts	O	O	O	O	O
Press release or blogs from University or research centres	O	O	O	O	O
Press release or blogs from Non-governmental organisations, charities, think tank and pressure groups	O	O	O	O	O
Press release or blogs from industries/companies	O	O	O	O	O
Press releases or blogs from government ministries	O	O	O	O	O

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Science News release sites (e.g. EurekAlert, BioMedNet)	O	O	O	O	O
Researchers' blogs	O	O	O	O	O
Journalists' blogs	O	O	O	O	O
Wikipedia	O	O	O	O	O
ResearchGate or Academia.edu	O	O	O	O	O
LinkedIn	O	O	O	O	O
Twitter	O	O	O	O	O
Reddit	O	O	O	O	O
YouTube	O	O	O	O	O
Other social media (e.g Facebook, Instagram)	O	O	O	O	O

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Q12) Do you consult any other sources of information that we have missed?

Q13) Do you trust any other sources of information that we have missed?

Q14) Are there any other comments you would like to make on the sources and platforms you trust and/or consult?

About your audiences

In this section, we would like to know more about the audiences you want to reach.

Q15) Which audiences do you aim to reach?
Tick all that apply.

- ☐ Non-specialist audience
- ☐ General journalists (i.e. press, TV, radio)
- ☐ Popular magazine journalists (e.g. New Scientist)
- ☐ Others in the media such as writers, documentary and other programme makers
- ☐ Press officers and communication officers
- ☐ School teachers
- ☐ University students
- ☐ Young people in school
- ☐ Young people outside of school
- ☐ Researchers
- ☐ Policy makers and politicians
- ☐ Industry/business
- ☐ Charities/NGOs/Other non-profit organisations
- ☐ Potential funders
- ☐ Patients/Patient groups
- ☐ Underserved audiences (e.g. ethnic minority groups, LGTBQ+ community)
- ☐ Local communities
- ☐ I don't know
- ☐ Other. Please, specify

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Q16) In your view, are your audiences already interested in science, technology and/or health?

- ☐ Yes, they are already interested in these topics
- ☐ Some of them are interested in these topics others are not
- ☐ No, they are not interested in these topics yet
- ☐ I don't know

Q17) Are your audiences from...

- ☐ Your town or surrounding area
- ☐ Your region
- ☐ Your country
- ☐ Everywhere (national and international)
- ☐ I don't know

Q18) In what language do you write or speak to your audience?
Tick all that apply.

- ☐ My first language
- ☐ Other. Please, specify

Motivations and barriers

In this section, we would like to know more about what motivates or discourages you from communicating about science, technology and/or health.

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Q19) Which of the following are the most important reasons you communicate science, technology and/or health topics?
Please select a maximum of three responses

- ☐ Because I am enthusiastic about science, technology and/or health topics
- ☐ Because I am keen to educate others about science, technology and/or health topics
- ☐ Because I want to counter misinformation on science, technology and/or health topics
- ☐ It raises my profile
- ☐ It helps my own career
- ☐ It is part of my job role
- ☐ My manager/organization supports it
- ☐ It counts towards my career (e.g. professional memberships/promotion)
- ☐ The opportunity to win prizes or awards for my communication work
- ☐ Because my communication work is recognised and valued
- ☐ The opportunity to work with other organisations (e.g. museums, science centres, schools)
- ☐ There are financial benefits for my organisation
- ☐ There are financial benefits for me personally
- ☐ Because I am invited to communicate
- ☐ None of the above
- ☐ Other. Please specify

Q20) Which of the following are the most important reasons that prevent you from getting more involved in activities to communicate science, technology and/or health topics? Please select a maximum of three responses

- ☐ Not appropriate for my level/role
- ☐ Insufficient support from my manager/organisation
- ☐ Insufficient support from other staff at my organisation
- ☐ Insufficient communication specialists at my organisation
- ☐ Negative perception towards the role of science communication from my peers
- ☐ Difficult to get others (e.g. researchers) involved in science communication work
- ☐ Difficult to attract audiences to my science communication work
- ☐ Lack of reward and recognition for science communication work
- ☐ Insufficient encouragement from funders for science communication work

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- ☐ Not enough financial rewards from science communication work
- ☐ Lack of resources for science communication work
- ☐ Lack of time
- ☐ Does not help my career progression
- ☐ Lack of opportunities
- ☐ Lack of confidence
- ☐ Could have a detrimental impact on my profile (e.g. drawn into controversy)
- ☐ I am happy with the amount I do now
- ☐ I just don't want to
- ☐ I don't have the right skills/training
- ☐ There are no barriers
- ☐ Other. Please specify

Training and skills in communication

This section will explore how you have acquired your skills in communicating science, technology and/or health topics.

Q21) How have you developed your communication skills to convey science, technology and/or health topics?
Tick all that apply.

- ☐ I have / I am completing a degree in journalism, media or science communication
- ☐ I have received training in public engagement or communication (e.g. writing, public speaking, social media)
- ☐ I have experience in public engagement or communication (e.g. writing, public speaking, social media)
- ☐ I have consulted resources on how to communicate with non-specialist audiences (e.g. books, handbooks, blogs, YouTube videos...)
- ☐ I have watched how other people (either professionals or amateurs) communicate with non-specialist audiences
- ☐ I have been informally mentored by other communicators/journalists
- ☐ None of the above
- ☐ Other, please specify

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Q21.1) What type of training have you received?
Tick all that apply.

- ☐ Media training
- ☐ Writing for non-specialist audiences
- ☐ Public speaking
- ☐ Social media
- ☐ Storytelling
- ☐ Public engagement
- ☐ Visual communication
- ☐ Organising public events
- ☐ Curating exhibitions (e.g. museum-related)
- ☐ Making videos or podcasts
- ☐ Performance (e.g. acting, dancing, comedy)
- ☐ Other, please specify

Q22) Are there areas of training in communication and public engagement that you would be interested to undertake?

	Interested	Already confident	Not interested
Media	O	O	O
Writing for non-specialist audiences	O	O	O
Public speaking	O	O	O
Social media for public engagement or outreach	O	O	O
Storytelling	O	O	O
Public engagement	O	O	O

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Visual communication	O	O	O
Organising public events	O	O	O
Curating exhibitions (e.g. museum-related)	O	O	O
Making videos or podcasts	O	O	O
Performance (e.g. acting, dancing, comedy)	O	O	O

Q23) Are any types of communication/public engagement training that we have missed? If so, please write your suggestions in the box below.

Your thoughts on science, technology and/or health

In this section, we would like to know more about your opinion towards experts, science, technology and health.

Q24) How much do you trust each of the following? Do you trust them a lot, some, not much, or not at all?

	A lot	Some	Not much	Not at all	Don't know
Your national government	O	O	O	O	O
Scientists working in the public sector (e.g. colleges, universities)	O	O	O	O	O
Scientists working in	O	O	O	O	O

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the private sectors (e.g. industry)					
Medical and/or health professionals	O	O	O	O	O
Journalists	O	O	O	O	O
Science as a discipline	O	O	O	O	O

Q25) In general, do you think the work that scientists do benefits most, some, very few people or no one in your country?

- □ Most people
- □ Some people
- □ Very few people
- □ No one
- □ Don't know

Q26) Overall, do you think that science and technology will help improve life for the next generation?

- □ Yes
- □ No
- □ Don't know

Q27) Is there anything you would like to add on your thoughts on science, technology and/or health?

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About yourself

We would like to ask you a few more questions about you and your role.

Q28) How would you describe yourself?
Please, select maximum three answers.

- ☐ Researcher (including PhD student)
- ☐ University lecturer/professor
- ☐ Health professional (including allied health professional)
- ☐ Journalist or editor
- ☐ Documentary or movie maker
- ☐ Freelance communicator or writer
- ☐ Press officer or communication officer
- ☐ Curator, explainer or museum employee
- ☐ Policy maker or adviser
- ☐ Artist or illustrator
- ☐ Designer
- ☐ Current undergraduate or postgraduate student
- ☐ Teacher
- ☐ Activist
- ☐ Blogger, Youtuber, Social media influencer
- ☐ Other. Please, specify

Q29) In the above capacity, do you work for an organisation or institution?

- ☐ Yes, I do
- ☐ No, I don't

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Q29.1) Which of the following best describes the organisation you work for?
(If you work for more than one organisation, tick the one for which you spend most of your time).

- ☐ Museum, Science, Discovery centre, Planetarium or Observatory
- ☐ University or Research Institute
- ☐ Learned society or professional association
- ☐ Library
- ☐ Festival/Cultural event
- ☐ Arts/Culture organisation
- ☐ School or College
- ☐ Media, Broadcast or publisher
- ☐ Non-governmental organisation, no-profit organisation, think tank, charity, foundation
- ☐ Private business or industry
- ☐ Governmental organisation or ministry
- ☐ Funding body (e.g. research councils)
- ☐ Consultancy
- ☐ Other. Please, specify

Q30) We would like to know about your level of education in science, technology and/or health.
Tick all that apply.

	Science, Technology, Engineer, Maths or Health	Other
I have studied these subjects at school	☐	☐
I have / am completing an undergraduate degree	☐	☐
I have / am completing a postgraduate degree	☐	☐

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I have / am completing a doctorate	☐	☐
I am self-taught	☐	☐

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Q31) Are you...

- □ Male
- □ Female
- □ Non-Binary
- □ Other (please self-identify here if you would prefer to):
- □ Prefer not to say

Q32) How old are you?

- □ Under 18
- □ 18 - 24
- □ 25 - 34
- □ 35 - 44
- □ 45 - 54
- □ 55 - 64
- □ 65 - or older
- □ Prefer not to say

Q33) Where do you live?

- □ United Kingdom
- □ Netherlands
- □ Sweden
- □ Portugal
- □ Italy
- □ Poland
- □ Serbia
- □ Other. Please specify.

Q34) What nationality are you?

Submission and consent

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By submitting this information you are consenting for your questionnaire answers to be included in the study.

Data Protection Privacy Notice

All data will be treated as personal under the Data Protection Act 2018 and the General Data Protection Regulation 2016 (GDPR).The data controller for this project will be the University of the West of England, Bristol. Your personal data will be processed only for the purposes outlined in this questionnaire. The legal basis that we will rely on to process your personal data is that it is necessary for the performance of a task carried out in the public interest.

Personally, identifiable raw data will only be processed for the duration of the study and subsequent analysis of results. Anonymised data will be kept for a longer period for the purposes of RETHINK project; for example to compare findings with subsequent study.

Your personal data, provided in this questionnaire, is not shared with our partners or third parties.

What are your rights?

You have a number of qualified rights including a right to access your personal information. Please visit the University Data Protection webpages for further information in relation to your rights. Any requests or objections should be made in writing to the University Data Protection Officer: dataprotection@uwe.ac.uk

How to make a complaint

If you are unhappy with the way in which your personal data has been processed you may in the first instance contact the University Data Protection Officer using the contact details above. If you remain dissatisfied then you have the right to apply directly to the Information Commissioner for a decision. The Information Commissioner can be contacted at: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF www.ico.org.uk

If you would like more information on this study, to withdraw your data (before the 27th of October 2019) or to see the final report, please contact Elena Milani (email elena.milani@uwe.ac.uk; telephone 0117 32 81994).

Thank you for participating in this questionnaire.

Please, write in the box below a memorable word to facilitate the process in the case you want your contribution to be withdrawn from the study. _____

We would like to contact you for a follow up interview. If you are interested in participating, please write your email address in the box below. Your email will be separated from your survey responses. _____

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