Communicating the most accurate and reliable science on climate change to society: A survey of editors from the Intergovernmental Panel on Climate Change

Tomas Molina[1]& Ernest Abadal[2]

[1]Applied Phisics, Universitat de Barcelona

[2] Ernest Abadal, Universitat de Barcelona

Correspondence to: Tomas Molina (tomasmolinabosch@ub.edu)

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Abstract. This study focuses on the perspectives of scientists involved in the IPCC AR5 and AR6 synthesis reports, examining their views on the communication of climate change knowledge and its dissemination to the public. The objectives include understanding scientists' opinions on the state of climate change knowledge, the effectiveness of current communication strategies, and recommendations for improving public engagement. A survey was conducted among 72 IPCC scientists, assessing their perceptions on various aspects of climate communication, including the use of media, educational integration, and challenges like misinformation. Results show that scientists generally rate the scientific community as well-informed, policymakers as moderately informed, and the public as only acceptably informed about climate change. Many respondents suggested improvements in the clarity and accessibility of IPCC reports, emphasizing the role of media, social networks, and education in better informing the public. The study concludes that trust in information sources is vital for effective climate communication and that a more tailored, empathetic, and solutions-based approach is necessary to bridge the gap between scientific knowledge and public understanding.

Keywords: communication, climate, IPCC, survey, public

1 Introduction

The challenge posed by climate change to society is immense. The overwhelming evidence that human reliance on fossil fuels has led to atmospheric warming, which in turn is altering weather patterns and the global climate, highlights the need for widespread social awareness on a global scale. Few times in human history has there been such an urgent need for a shared global consensus among all inhabitants of the planet (Somerville & Hassol, 2011). Addressing and adapting to climate change requires not only agreement on a transition to new energy paradigms but also discussions on the future of economic growth, or even potential degrowth (Hansen et al., 2008; Howes et al., 2013). This consensus must be grounded in scientific knowledge, its credibility, and the broad agreement within the scientific community (Buttel et al., 1990; Change, 2011; Fuhrer et al., n.d.).

The losses and damage already being caused by climate change, as well as those anticipated in the future, highlight the fact that there will inevitably be both winners and losers in this global crisis. This reality extends

the discussion beyond the realm of science, touching on ethics, politics, ecology, sociology, and even religion (Francisco, 2015). Addressing these multifaceted impacts requires an interdisciplinary approach that recognizes the complex and far-reaching consequences of climate change on all aspects of society (Molina & Abadal, 2024).

In this highly complex context, science is expected to play a critical role in guiding decision-making and shaping a unified global strategy for humanity's adaptation to these changes (Cutter et al., 2012). The Intergovernmental Panel on Climate Change (IPCC) has emerged as the leading authority on expert knowledge related to climate change. However, it is not without controversy (De Pryck, 2018). The influence of its scientific reports on national and global policies often blurs the line between politics and epistemology, creating tensions around the intersection of science and policy (Beck, 2012; Hermansen et al., 2021).

From its first report in 1990 to its sixth in 2023, the IPCC's level of certainty in its findings has steadily increased. As a result, the urgency for action among decision-makers and society at large has intensified, giving rise to terms like "climate emergency" and global agreements such as the Paris Agreement. The latter aims to limit emissions and keep global temperature rise well below 2°C compared to pre-industrial levels (Höhne et al., 2021; Molina & Abadal, 2021; Ripple et al., 2022).

The scientific foundation of the IPCC reports is derived from research published in peer-reviewed scientific journals, which undergoes rigorous scrutiny by independent experts. Only knowledge that passes this demanding review process is included in these reports. However, determining which findings are ultimately incorporated into the reports that inform policymakers is itself a subject of analysis, attention, and, at times, controversy (Beck & Mahony, 2018a).

Ultimately, the knowledge and strategies for mitigation and adaptation outlined in the IPCC reports are handed over to policymakers, whose decisions impact society at large. The global strategy to combat and adapt to climate change targets individuals across all social, cultural, and religious backgrounds, as well as those from diverse economic and educational levels. The public's perception of the urgency, as well as the mitigation and adaptation strategies outlined in the IPCC reports, extends beyond policymakers (Gemeda et al., 2023). These reports form a key part of the information that reaches global society, which must ultimately support the decisions made by political leaders. The popularization of the IPCC's findings—making complex scientific and technical information accessible to the general public—requires an effective communication strategy. This strategy should ensure that people of all knowledge levels can understand and engage with the content (Doran et al., 2023; Rödder & Pavenstädt, 2023).

2 Objectives

Our study group consists of scientists who were part of the writing teams for the IPCC5 and IPCC6 synthesis reports. We are interested in their perspectives on the communication aspects of current climate change knowledge, as well as their views on how effectively this information is being conveyed to the public.

The specific objectives are as follows:

1. To understand the perspectives of IPCC scientists on the current state of climate change and their role in efforts to reduce and mitigate its impacts.
2. To gather opinions from IPCC scientists on how best to communicate the scientific content of IPCC reports to the public.
3. To collect proposals from IPCC scientists on how to improve the dissemination of this scientific information to society at large.

The scientific knowledge about climate change that reaches society must be both up-to-date and supported by the broadest possible consensus within the scientific community. Additionally, this knowledge should be presented in a way that is not only rational and easy to understand but also resonates with people on emotional and spiritual levels across different cultures (Bolisani & Bratianu, 2018).

3 Methodology

The IPCC reports are published approximately every seven years, which can make it challenging to stay in contact with the scientists who contributed to them. For this reason, we have focused our study on the two most recent reports: IPCC AR6 and IPCC AR5. Our sample includes members of the Scientific Steering Committee for the IPCC AR6 synthesis report (IPCC, n.d.), as well as the Chairs and Vice-Chairs of the IPCC AR5 synthesis report.

The fifth IPCC report was published in 2014, nine years before we launched our survey. As a result, some of the scientists involved were no longer reachable at their original contact addresses. To address this, we searched research publication databases for up-to-date contact information for both the IPCC AR5 and AR6 synthesis report writing teams. After accounting for deceased individuals, we obtained a final sample of 28 contacts from the IPCC AR6 and 44 from the IPCC AR5, resulting in a total of 72 contacts across the two reports.

The survey was structured into four sections: general information about the scientists, their perception of the current level of knowledge on climate change, their views on the IPCC reports, and opinions on the communication of these reports to society. We used closed-ended questions with a Likert scale, along with open-ended options for questions related to communication.

The survey questions were reviewed by a scientist who contributed to both the IPCC AR6 and AR5 reports. To rate the responses on the Likert scale, we assigned numerical values to each option, with 1 representing the lowest value and 5 representing the highest. We then averaged the responses for each question or survey section.

The resulting average reflects the respondents' positions based on the following scale: 1 = very low, 2 = low, 3 = neither high nor low, 4 = high, 5 = very high.

To enhance the clarity of the results, we multiplied the average by two, converting the values to a scale of 1 to 10. The results were then classified using standard educational labels: "Very poor / F" from 0 to 2.9
"Insufficient / E from 3 to 4,9
"Sufficient / D" from 5 to 5,9
"Good / C" from 6 to 6,9
"Notable / B" from 7 to 8,9
"Excellent / A" from 9 to 10

The survey was distributed via email using a Google Forms format, with English as the language of communication. It was initially sent out in February 2023, coinciding with the approval phase of the IPCC's Sixth Assessment Report, which took place at the 58th panel session in Interlaken, Switzerland, in March of the same year. A reminder was sent in April, after the approval process had been completed.

4 Results and discussion

The scientists who responded to the survey (figure 1) were aged 51 and older, with a significant portion (58.4%) over 61. Although only one respondent explicitly identified as retired, the CVs of those who provided their details indicate that some hold emeritus professor positions at their respective universities. The majority of respondents were men (75%) and from academic institutions (83,3%). The representation of women, at 25% of responses, aligns with the published gender demographics of IPCC report authors (Liverman et al., 2022). The age distribution of our respondents is also consistent with findings from other studies on IPCC authors (Gay-Antaki, 2021).

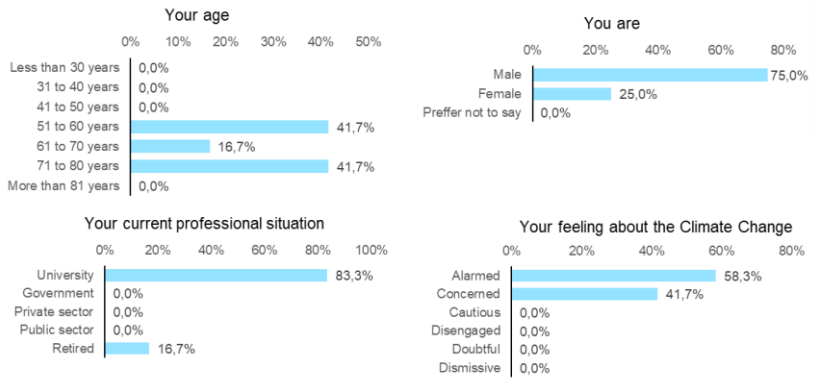

Figure 1. Age, Gender, Profession & Feelings about Climate Change

The majority of participants feel alarmed (58,3%) or concerned (41,7%) about climate change. Those with a deeper understanding of the current climate situation tend to view its potential future with greater concern and alarm. This aligns with the evolution of the "Global Warming's Six Americas" framework, which illustrates a growing concern about climate change and a shift in public attitudes over time (Leiserowitz et al., 2021).

Responses indicate that participants (figure 2) view the scientific community as highly informed about climate change (rated 8,7) while they consider policymakers only moderately informed (rated between 6,3 (world) and 7,7 (local)). In contrast, the general public is seen as being only "acceptably" informed (rated between 6,2 (local) and 5,5 (world)). Participants also identified misinformation and biased information as notable issues (rated 8,3) The literature on climate change communication highlights several key points: explaining its causes enhances science acceptance, emphasizing scientific consensus counters misinformation, culturally aligned messaging is more effective, and inoculating against misinformation works best, though debunking can also be successful.

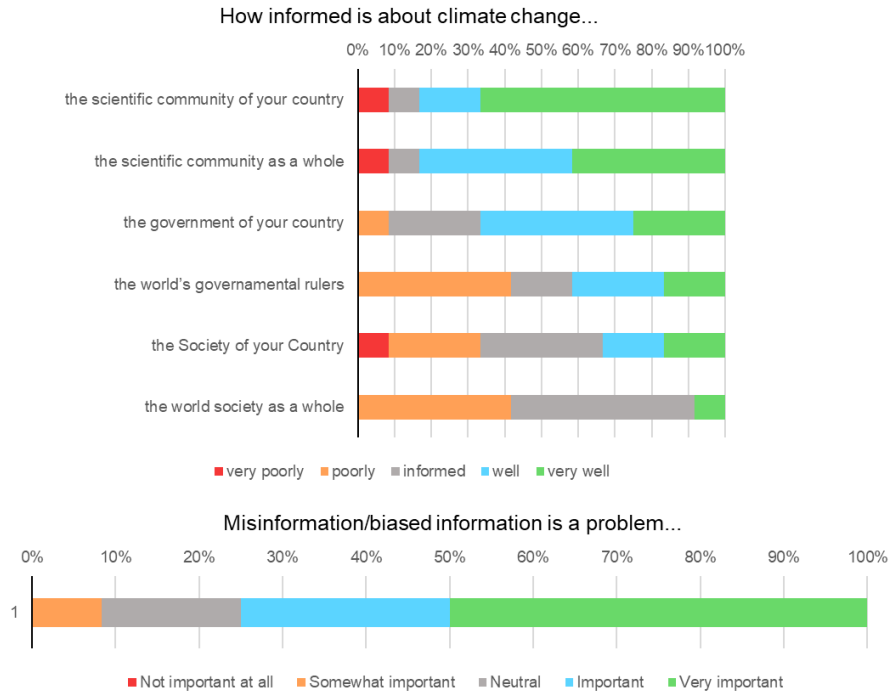

Figure 2. Information Status, and Biased information

Eliminado: worried

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Regarding the IPCC reports (figure 3), the majority of participants believe they demonstrate notable scientific objectivity (rated 8,8) and reflect the best available knowledge on climate change (rated 7,8). While respondents feel that the reports have a notable impact on society as a whole (rated 7,5), opinions vary more widely in this area.

The use of graphs and tables to enhance comprehension is highly appreciated (rated 9), as these visual aids make the reports more understandable (Harold et al., 2020). Many respondents see the primary role of the IPCC reports as providing the best possible information to decision-makers, rather than directly to the general public. They believe that the public often accesses these reports through other interpretive channels, as expressed in open-ended responses.

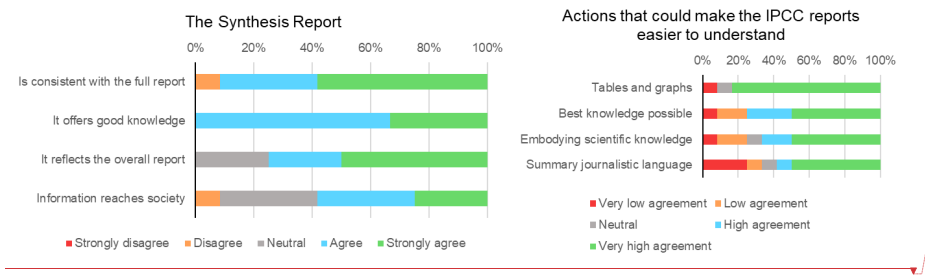

Figure 3. About Summary Reports & Understanding of Reports

Many respondents suggested the possibility of creating a more concise version of the IPCC summary report specifically for the general public. Our survey findings align with the discussions and recommendations from the IPCC's February 2016 Expert Meeting on Communications and their ongoing implementation. The goal is to deepen understanding of the IPCC's communication efforts within the broader context of climate communication and policy. This may also inspire further ideas on how to strengthen the IPCC's communication strategies (Lynn, 2018).

When discussing how to communicate the contents of IPCC reports to the public, the majority (rated 9,2) believe it is appropriate for these reports to be integrated into university curricula and school education (rated 9,2). The strong agreement among our survey respondents aligns with literature indicating that university students believe climate change is real and primarily human-induced, with the majority expressing concern. However, the studies also reveal misconceptions about the fundamental causes and consequences of climate change (Wachholz et al., 2014).

Respondents also emphasized the importance of making the reports fully accessible to everyone via the internet (rated 9). Social networks (rated 9,3), along with media outlets like television (rated 9) and radio (rated 9), were seen as the most suitable platforms for informing the public. The written press was rated slightly lower (rated 8.8), but still viewed as an important channel. Overall, respondents rated highly the effectiveness of these

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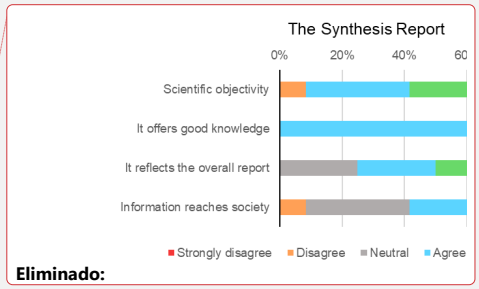

channels for informing the population. The use of new media aligns with studies suggesting that non-elite actors, such as individual bloggers and concerned citizens, are effective climate change advocates. While mainstream media remains the most frequently discussed, new media and science information sources are strong competitors for audience attention (Newman, 2017).

It is worth noting that some respondents expressed dissenting opinions on the use of journalistic language, political debates, and religious or spiritual sermons in the communication of these reports. The simplification of scientific information often risks undermining its credibility, largely due to a failure to recognize the tensions between scientific and public interpretations. Maintaining scientific credibility requires balancing it with meaningful social and political dialogue about the values we hold and the actions we take to protect them. Strengthening the link between the theory and practice of climate science communication is essential (Hollin & Pearce, 2015; Pidcock et al., 2021).

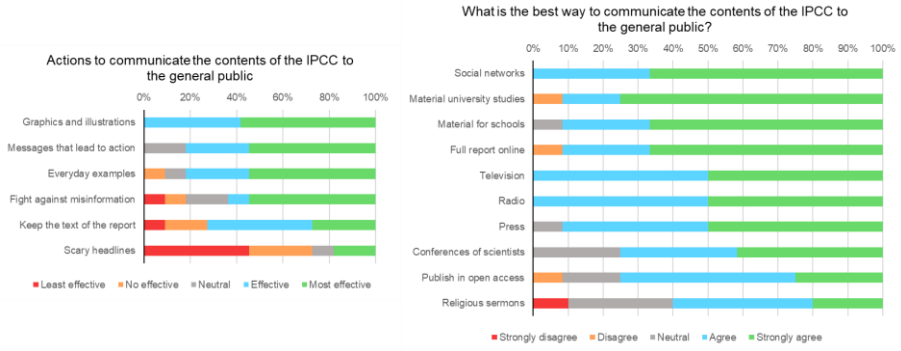

Figure 4. Public Communication and Channels

Misinformation is broadly recognized as a serious problem (rated 7,8). This issue was raised three times throughout the survey and in both instances where respondents were asked whether misinformation was a concern, the responses were remarkably consistent. There was even stronger agreement on the need to actively combat misinformation. Our survey results align closely with published viewpoints on the matter (Sanford et al., 2021) (Lewandowsky, 2021).

According to respondents, the biggest challenge in communicating climate change is not the difficulty of understanding its scientific aspects (rated 6,5), nor simply the need to convey clear and relevant information to users (Adler & Hirsch Hadorn, 2014). Instead, the primary challenge lies in the complexity of decision-making within social and economic contexts (rated 8,3). As highlighted in the literature, this complexity reflects an evolving relationship between climate science and policy, which is undergoing a significant transformation (Beck & Mahony, 2018b).

Eliminado: is widely seen as a significant problem

Con formato: Inglés (Estados Unidos)

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Additionally, the vast majority of participants provided comments and suggestions in the open-ended questions. Among the most commonly suggested solutions were:

- Short, simple, and easy-to-understand messages, that may help in making IPCC a power communicating tool (Stocker & Plattner, 2016).
- Demonstrating empathy towards individuals and communities by linking climate change to everyday life and focusing on the future of new generations, while staying true to the content of the reports (McBeth et al., 2022).

One notable response from Ethiopia highlighted the need to improve the training of those responsible for informing the public about climate change.

Conclusions

Participation in our survey was relatively low, with only 16.6% of the sample responding. The lack of engagement from key IPCC scientists, who are responsible for preparing the institution's most widely read reports, aligns with findings from previous studies highlighting the difficulty that the average reader has in comprehending these reports (Dormer, 2020; Jos Delbeke et al., 2019).

One lead author of IPCC AR6 WGII declined to participate in the survey because it did not allow the option to leave questions blank or to skip options, they felt were insufficiently detailed. Another scientist, a vice-chair of the IPCC AR6, completed the survey but expressed, both in the open-response section and via email, their disagreement with several concepts and requested that some of his responses be disregarded.

The disparity in participant behavior in our survey is evident: while some respondents scored highly on questions involving concepts such as journalistic language, religion, or politics, others either refused to participate or expressed dissatisfaction with the inclusion of these topics. This highlights the need for a revised communication strategy that addresses these concerns and enhances the impact of the IPCC report content (Anseel et al., 2010; Bhandari, 2022; Solecki et al., 2024).

Trust in the source of information is crucial for that information to influence decision-making. This relationship between trust and decision-making has been extensively studied in medicine, particularly in managing the delivery of "bad news" and the need for patients to make significant decisions. Informed decision-making is now a well-established practice in medical fields (Chandra et al., 2018; Musmade et al., 2013).

Information about climate change often represents "bad news" for much of society, requiring careful communication and informed decision-making. Trust in the source of climate information is just as essential as it is in medicine. Similar to medical contexts, recipients of climate information often lack the full capacity to understand highly technical or scientific content, especially during times of emotional stress. Therefore, this

information needs to be adapted to the audience's level of understanding. The scientists' responses in our survey, which emphasize the need for empathy and a solutions-based approach, reflect this mindset. While the diagnosis and proposed solutions must come from science, their implementation requires clear communication to society, which must ultimately make the final decision—ideally, with widespread social consensus (Goldberg et al., 2020).

The open-ended responses to our survey also highlight the critical role of trust in the information source (Goodwin & Dahlstrom, 2014). National Meteorological Services serve as key guarantors of the accuracy and reliability of past climate data, which underpins their credibility when comparing past and present data to confirm that climate change is occurring. They also play a vital role in explaining the new climate realities to society, allowing people to comprehend and contextualize the future climatology they will face (Molina & Abadal, 2024).

Communication is a broad concept that encompasses the sender, the receiver, and the message. However, it also involves the action (or inaction) of communicating, beyond the mere intentions of those sending and receiving information (Charles Bazerman, 2019; Luhmann, 1992). In the case of climate change, where the active participation of the public is crucial, a proliferation of diverse and engaging narratives around the topic is necessary to inspire action and understanding.

These narratives must be tailored to the diverse cultures, beliefs, and values of different human communities worldwide, offering a moral framework that is acceptable to all (Hulme, 2009). Climate change communication involves many stakeholders with varying levels of expertise and perspectives, yet all rely on the scientific foundation of climate knowledge. How this knowledge reaches and resonates with society is crucial, and the process of popularizing it should involve the scientists who created it. Developing a methodology within the IPCC itself to produce texts written in clear, accessible language—akin to journalistic style (Smith & Higgins, 2020) —could help reduce the contradictory and confusing headlines that often reach the public. Some IPCC scientists who responded to our survey suggested that this could be an innovation for future cycles, proposing ideas such as creating a summary text for the general public, approved by scientists rather than governments, to eliminate concerns about politicization and preserve trust in both the message and its source.

The role of the media and social networks in interpreting and delivering IPCC information to the public is vital, as reflected in the opinions of our respondents. Media coverage and social media discussions shape public opinion on climate change (Pearce et al., 2019; Sarathchandra & Haltinner, 2023). The media's portrayal of the Conferences of the Parties (COP), where decision-makers, government representatives, and non-governmental organizations gather, also influences societal perceptions of climate action and the acceptance of measures to mitigate climate change, whether current or forthcoming (Sisco et al., 2021).

In recent years, significant research has explored the role of emotions, empathy, and affect (Brosch, 2021) in climate change communication, aiming to inspire societal action. However, the gap between climate scientists and the delivery of their findings to the global public remains unresolved. More efforts are needed to create content that can be directly communicated to society without the often inaccurate interpretations introduced by intermediaries who currently serve as the public's source of climate information.

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Author Note

+ Tomas Molina, MSc (corresponding author)
Universitat de Barcelona
ORCID 0000-0001-8127-6401

Facultat de Física

Departament física aplicada

Martí Franquès 1-11

08028 Barcelona

Spain

+34 629741334
tomasmolinabosch@ub.edu

Tomas Molina

Physicist and Journalist, now involved in his PhD in communication of Climate Change.

Chief Meteorologist of Televisió de Catalunya, where he has been presenting the weather information since 1987.

Associate Professor since 2000 at the University of Barcelona teaches the subjects of Analysis and Meteorological Forecast, and Meteorology and the Media.

He is a member of the Board of Directors of the Meteorological Service of Catalonia, European Climate Pact Ambassador, and member of the Board of Directors of the International Association of Broadcast Meteorology, IABM, former chairman for 5 years. IABM has Observer status in the World Meteorological Organization.

In the past, he has also been the President of the Catalan Council for Scientific Communication C4, a member of the Advisory Council of the Parliament in Science and Technology, CAPCIT and director of environmental information programs such as "Espai Terra", and others.

He has been Reviewer of the Synthesis report of the 5th and 6th IPCC reports.

He has written several books on Climate Change such as "The year my grandfather saw it rain", "You, me and the environment" and several children's story books.

+ Ernest Abadal, Full professor
Universitat de Barcelona
ORCID 0000-0002-9151-6437

Facultat d'Informació i Mitjans Audiovisuals

Melcior de Palau 140

08014 Barcelona

Spain

+34 681303048

abadal@ub.edu

Código de campo cambiado

Ernest Abadal

Professor at the Faculty of Information and Audiovisual Media at the University of Barcelona. Degree in Philosophy, diploma in Librarianship and Documentation and doctorate in Information Sciences.

My area of teaching is technologies applied to documentation and, in a special way, digital publications. Principal researcher of several projects of the State R+D+I Plan dedicated to open access and open science in Spain. I have also coordinated the Consolidated Research Group "Culture and digital contents", recognized by the Generalitat de Catalunya.

I have written several books and numerous articles on document technologies, scientific publishing, science communication and open science. (More details at: https://fima.ub.edu/pub/abadal/)

Member of the advisory board of "El professional de la información", "AIB Studi", "Hipertext.net" and reviewer of several scientific journals in my specialty.

I am currently Vice-Chancellor Assistant to the Rector and of Teaching and Research Staff at the University of Barcelona. Previously, I was dean of the Faculty of Librarianship and Documentation (current Faculty of Information and Audiovisual Media) (2012-18) of the University of Barcelona, director of the Center for Research in Information, Communication and Culture, head of studies of the degree in Librarianship and Documentation, head of studies for the degree in Documentation, director of the Department of Librarianship and Documentation, coordinator of the doctoral program, Deputy for Information and Documentation Systems at the Vice-Rectorate for Teaching Policy of the University of Barcelona (2005-08) and vice-president of the Consortium of University Libraries of Catalonia (2005-08).

I have collaborated with assessment agencies in Catalonia (AQU, AGAUR), Spain (AEI, ANEP, ANECA, ACSUCYL), Italy (ANVUR) and Greece (HQA).

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