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Final Deliverable Work Package 6 – Policy briefs for policy recommendations

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List of abbreviations used in the document

HEIs: Higher Education Institutions
RFOs: Research Funding Organisations
RPOs: Research Perfoming Organisations
STI: Science, Technology and Innovation

Executive summary

This final deliverable on work package 6 (WP6) presents a comprehensive analysis and a set of policy recommendations to promote trust in science. WP6 aimed to translate the IANUS project's findings on science, technology and innovation policy into evidence-based policy recommendations. This was done by organising policy labs that brought together relevant stakeholders from the fields of higher education, research and European policy to discuss the challenges and opportunities for strengthening trust in science. The results of the policy labs are presented in the form of policy briefs that reflect the different perspectives of the participating organisations and offer concrete recommendations for action to improve the science system.

A key outcome of the Policy Labs was the realisation that trust in science is not only influenced by the quality of research, but also by the way in which scientific results are communicated. Participants emphasised the need to present science as a dynamic and collaborative process and to bridge the gap between science and the public. To promote trust in science, measures are needed on various levels that support greater involvement of (civil) society into the research process, improved co-operation with the media and consistent promotion of transparency and accountability in research. These recommendations aim to improve the trustworthiness of science and to strengthen the social relevance of scientific work.

1. Introduction and methodological approach

This report summarises the main results and outputs of Work Package 6. In principle, WP6 aimed to ensure that the overall key insights, concepts and knowledge generated in the IANUS project are turned into policy recommendations for the future government of science, technology and innovation (STI) policy. Specifically, WP6 should identify the key findings and concepts relevant to STI governance and policy, differentiated by level of government and STI actors, drawing on the findings and results generated in the other Work Packages, namely WP2 (Reconnaissance), WP3 (Conceptual framework and key mechanisms of trust), WP4 (Learning from case studies and co-creation) and WP5 (Strengthening co-creation). This was done by constantly researching and harnessing the knowledge generated in the other work packages and evaluating this insight with regard to its relevance for science policy. This was achieved through many WP meetings, steering committee meetings, as well as the review of all deliverables evolving throughout the IANUS project. The basis for this was a close link between WP6 and the other WPs at the working level. All WP6 partners were intensively involved in other work packages. In addition, the (lead) partners of the other work packages were regularly informed about the analyses and evaluations of the key insights of the IANUS project carried out in WP6 and asked for their validation and feedback. These validated key insights were then prepared for the external stakeholders.

Further objectives of WP6 were to develop government and target group-specific recommendations for policy and decision-making bodies that can effectively shape and influence STI processes, institutional arrangements and activities with the aim of to increase the trustworthiness of the research system and to validate these recommendations by external stakeholders. Policy recommendations need to be evidence-based in order to give legitimacy to policy decisions (Van Veenstra, 2017, McGann, 2017). In addition, it is often criticized that evidence-based recommendations are developed in a highly unidirectional manner and disseminated to the target group without involving them properly in the process. This increases the risk that such policy recommendations are ultimately not suitable and are not or only insufficiently implemented (Hadorn, 2022). Consequently, comprehensive involvement of key stakeholders / policy makers in the process is of great importance. For these reasons, policy labs were chosen as the central methodological approach. A policy lab can be seen as an environment that works to develop, test, and implement policies. A key feature of policy labs is the involvement of many different stakeholders and experts to weigh in on the topic and a focus on evidence-based and data-driven discussion and recommendations (van Veenstra, 2017, Mc Gann, 2017).

The basic methodology of the policy labs was already set out in Deliverable D6.1 Policy Brief in the first reporting period (May 2023). It relies fundamentally on the involvement of key stakeholders in the European science system and their expertise and thus corresponds to the overall co-creative approach of the IANUS project.

A total of four policy labs were organised, each of which was aimed at a specific, central group of stakeholders in the science system: Research Performing Organisations (RFOs), Research Performing Organisations (RPOs), Higher Education Institutions (HEIs) as well as well as European policy makers within the TrustOn event in Brussels 2024. During the policy labs, the key insights of the IANUS project prepared for the respective stakeholder group were presented and introduced into the joint discussion with the stakeholders. However, all stakeholders involved in the policy labs contributed their own topics, problems and proposed solutions that they considered relevant with regard to the topic of trust in science. As a result, the stakeholders acted as a focal empirical basis for the development of policy recommendations.

The policy briefs listed here represent the central output of the four policy labs conducted between June 2024 and February 2025. They all highlight the key insights and policy recommendations from the respective organisational perspective. They have all been validated by external stakeholders and were presented and discussed at the final event in Brussels in May 2025.

2. Policy briefs

2.1 Policy brief: Trust in science – The perspective of Research Funding Organisations (RFOs)

Executive Summary

In the IANUS project, Policy Labs are used to collaboratively develop policy recommendations to foster trust in science. This brief summarises insights from the Policy Lab focusing on Research Funding Organisations (RFOs), where experts from funding bodies across Europe discussed challenges and potential strategies to strengthen public trust in science from a funder's perspective.

In the current landscape, public trust in science faces complex challenges, driven by misinformation, political polarization, social media dynamics, and concerns over research integrity. Research funding organizations (RFOs) play a pivotal role in influencing the research ecosystem and have substantial leverage in enhancing public trust.

Key issues discussed included the balance between scientific excellence and research integrity, the role of science communication, the influence of political and social dynamics, and the importance of stakeholder engagement in defining funding priorities. Recommendations emphasize enabling responsible, inclusive research practices, transparency in funding decisions, proactive science communication and redefining evaluation frameworks to better align science with societal needs.

1. Introduction

Trust in science is crucial for societal resilience, informed public decision-making, and effective democratic governance. Although general trust levels in science remain relatively high across Europe, recent societal crises, notably the COVID-19 pandemic, have revealed vulnerabilities in public trust, showing fluctuations driven by misinformation, perceived political influence on science, and concerns about the integrity and transparency of the scientific process.

Goals of the IANUS project

- **Enable societal stakeholders** to distinguish valid from unsubstantiated trust, healthy from unfounded distrust
- **Enable societal stakeholders** to deal with the uncertainties, incompleteness and epistemic pluralism inherent in scientific knowledge
- **Enable researchers** to foster trust in science through methodological transformation (making research inclusive, transparent and responsible to societal needs and concerns)
- **Enable researchers** to conduct relevant, engaged and value-driven research while foregoing partiality, ideological biases and conflicts of interests

Research funders occupy a critical position in shaping the landscape of trust by determining which research gets funded, how it is communicated, and how integrity standards are maintained. This brief synthesizes insights gathered from the "IANUS Policy Lab on Research Funders," highlighting key trust-related challenges and opportunities.

2. The role of of Research Funding Organisations (RFOs) in the European Union

In the European science and innovation ecosystem, Research Funding Organisations (RFOs) play a pivotal role in shaping the direction, quality, and societal relevance of scientific research. Unlike Research Performing Organisations (RPOs) and Higher Education Institutions (HEIs) that conduct research directly, RFOs act as key enablers by allocating financial resources, defining strategic priorities, and setting the framework conditions for research activities.

RFOs in the EU vary significantly on their mandates, governance structures, and funding mechanisms. Some operate at the national level as public agencies under government bodies (e.g., the Research Council of Lithuania or the Austrian Science Fund), while others function at the European level, such as the European Research Council (ERC) under the Horizon Europe framework. Despite this diversity, they share the core mission

of supporting excellent, responsible, and impactful research through competitive funding mechanisms.

A fundamental function of RFOs is to translate policy goals into research agendas. Through calls for proposals, RFOs set thematic priorities that signal what types of knowledge are needed, thereby indirectly steering scientific inquiry. In this role, they are not neutral financiers but active architects of the research landscape, with the ability to incentivize interdisciplinary collaboration, societal engagement, open science, and ethical conduct.

In addition, RFOs serve as gatekeepers of scientific integrity and accountability. Their assessment criteria, peer review standards, and reporting requirements shape researcher behavior and institutional practices. As such, RFOs have a unique leverage point to promote trust in science by embedding principles of transparency, inclusivity, and integrity in their funding processes.

Given their central role, RFOs also face growing expectations to act as intermediaries between science and society. They are increasingly called upon to align research funding with societal needs, foster citizen engagement, and ensure that publicly funded research delivers public value. These responsibilities make RFOs not only funders, but also strategic actors in building and maintaining public trust in science.

Because of their unique position at the intersection of policy, research, and society, RFOs were selected as a focal actor group within the IANUS project. The Policy Lab on RFOs brought together experts from various European funding bodies to explore how RFOs can contribute to fostering trust in science. Despite institutional diversity, the discussions revealed common challenges and opportunities, underscoring the crucial influence of RFOs in shaping trustworthy and socially responsive research systems across Europe.

3. The View on Trust in Science from RFOs' Perspective

a. Problem Situation

In the Policy Lab on Research Funding Organisations (RFOs), participants from various European funding bodies shared their perspectives on the evolving dynamics of trust in science. Across all contributions, a consensus emerged that while public trust in science remains relatively high in many European countries (e.g. 88% in Poland, 75% in Luxembourg), this trust is often fragile. It was characterised by several participants as "uninformed trust" – a trust not grounded in a deeper understanding of scientific methods or processes, but rather in general sentiment or societal reputation.

Social media and digital platforms were identified as major factors shaping public perceptions. Participants highlighted how sensationalist or emotionally charged content spreads rapidly online, often undermining scientific credibility. Especially during the COVID-19 pandemic, these platforms served as key channels for science sceptics to disseminate distrust and disinformation. Researchers, as noted by several speakers, have

become increasingly hesitant to engage publicly due to experiences of backlash, polarisation, or even hate speech.

Research integrity was also identified as a central pillar of trust. While trust in science does not typically erode due to minor issues, participants agreed that scandals or perceived conflicts of interest could trigger significant public backlash. In this context, the transparency of funding decisions and the robustness of integrity frameworks become key for maintaining credibility.

Interestingly, the issue of administrative burden emerged as a dual-edged sword. Many of the processes and requirements imposed by RFOs are designed to ensure transparency, integrity, and accountability. However, the participants also emphasised that excessive bureaucracy and over-regulation can be counterproductive. They may foster resentment within the research community, thereby undermining internal trust between funders and researchers.

Science communication was widely discussed as an essential tool for building informed trust. However, the task is increasingly complex: researchers must communicate uncertainty without eroding credibility and disseminate findings amid a flood of online misinformation. Communicating nuanced or evolving evidence – a hallmark of science – often clashes with public demand for clarity and finality.

Participants also noted the increasing politicisation of science. Particularly in controversial areas like climate change or public health, scientists are sometimes portrayed as ideological actors or members of an out-of-touch elite. These portrayals can erode trust in both scientific findings and institutions, especially when science is seen to align with specific political agendas.

The discussion extended to the role of Artificial Intelligence (AI) in research. While AI was acknowledged as a valuable tool, participants warned against over-reliance on automated systems. The opaqueness of AI-generated outputs and the potential loss of human judgment in scientific work were seen as new risks to trust in research processes.

Finally, the group discussed the role of RFOs in defining research priorities. As institutions that shape scientific agendas through funding calls, RFOs carry significant influence. Yet, societal needs are often underrepresented in these priorities. Economic or industrial objectives tend to dominate, leaving civil society perspectives under-integrated. This disconnection between public expectations and funded research risks reinforcing scepticism and reducing the perceived relevance of scientific inquiry.

b. Solutions to Tackle the Problem of Trust in Science

In response to the challenges identified, the participants outlined several strategic fields of action for RFOs. A shared view emerged that trust must be addressed across multiple levels – from policy frameworks and institutional processes to the empowerment of individual researchers.

At the **macro level**, participants stressed the need for structural reforms. These include advocating for Europe-wide guidelines on transparent and responsible funding practices, and for consistent standards in research integrity. Ensuring that integrity mechanisms are embedded and visible across all funded projects was seen as essential to preventing conflicts of interest and reinforcing public trust.

At the **meso level**, RFOs should refine institutional practices. Simplifying application procedures and reducing excessive bureaucracy could improve trust within the research community. Moreover, evaluation criteria should shift away from overly quantitative measures (such as citation counts) toward more qualitative assessments that capture research relevance and societal value.

Another key recommendation was the integration of **mandatory public communication plans** in funding applications. This would ensure that researchers consider societal engagement from the outset of their projects. Similarly, involving civil society actors in the design and priority-setting of funding programmes would enhance the alignment of research agendas with real societal needs. By enabling more participatory processes, RFOs can help bridge the gap between science and society.

The role of **emerging technologies**, particularly AI, also requires proactive attention. RFOs should support research on the ethical implications of AI and provide guidance on its responsible use within the scientific process.

At the micro level, the focus was on supporting researchers directly. Participants called for more capacity-building initiatives in science communication and public engagement. Equipping researchers with the skills and confidence to navigate complex public discussions is increasingly essential. In parallel, RFOs should recognise and reward scientists who actively contribute to public dialogue and transparent knowledge-sharing.

Importantly, several participants raised concerns about the mental health and well-being of researchers. The pressures of "publish or perish" culture and increasing administrative workload can lead to burnout and disillusionment. Addressing these concerns through sustainable funding models and institutional support mechanisms was deemed critical for maintaining both scientific quality and trust.

4. Policy Recommendations

From the discussion, the following preliminary policy recommendations for RFOs and other relevant actors can be derived:

- **Promote structural integrity and transparency at the macro level**: Establish consistent European-wide guidelines for responsible research funding and enforce standards to ensure integrity, openness, and accountability.
- **Simplify processes and rethink evaluation metrics**: Reduce bureaucratic complexity and reward qualitative dimensions such as ethical conduct, societal relevance, and responsible innovation.

- **Involve civil society in agenda-setting**: Actively include citizen groups, NGOs, and other non-academic stakeholders in designing funding calls and evaluating proposals to ensure research priorities reflect broader public interests.
- **Mandate and support effective science communication**: Require applicants to develop meaningful communication plans that target the general public, and offer training to improve outreach skills.
- **Anticipate technological impacts**: Develop clear guidance for the ethical and transparent use of AI in research, and fund studies examining its effects on trust and knowledge production.
- **Support researcher well-being and career sustainability**: Recognise the human dimensions of research by addressing mental health, workload, and the need for more secure and fulfilling research careers.

By implementing these measures at multiple levels, RFOs can help reinforce public confidence in the scientific system, ensure research is more responsive to societal needs, and support researchers in maintaining the credibility and relevance of their work.

5. Conclusion

The role of research funding organizations extends far beyond financial support for scientific projects. As stewards of trust, RFOs must actively foster environments that prioritize integrity, transparency, and effective public communication. By embracing the recommended strategies at macro, meso, and micro levels, RFOs can significantly enhance societal trust in science, enabling the scientific community to better address contemporary global challenges.

These recommendations were distilled from a collaborative dialogue involving European RFO representatives and reflect a shared commitment to advancing both science and public trust.

2.2 Policy brief: Trust in science – The perspective of Research Performing Organisations (RPOs)

Executive Summary

In the IANUS project, we are using the Policy Lab tool to develop and validate science policy recommendations on trust in science with European science experts from key organisations involved in shaping science and innovation systems. In the Policy Lab on Research Performing Organisations (RPOs), experts from different research institutions in Europe discussed the issue of trust in science from their organisational perspective and developed policy recommendations both for this type of organisation and for the science system in general. A key aspect discussed in the Policy Lab was the insufficient focus of RPOs on real societal needs. For example, RPOs are often primarily oriented towards the interests of industry, while the interests of the general public are less taken into account. According to the participants, a stronger focus on societal interests and greater involvement of civil society actors would have a positive impact on the societal perception of RPOs and public trust in science.

1. Introduction

A key objective of the IANUS project is to translate the insights, knowledge and concepts generated into accessible and effective recommendations for the future governance of science, technology and innovation (STI) and the design of STI policies. In order to ensure that the IANUS findings are translated into tailor-made policy recommendations for key organisations involved in shaping science and innovation systems, the development of policy and governance recommendations was carried out in parallel streams, each

focusing on a specific type of actor. This policy **brief focuses on the perspective of Research Performing Organisations (RPOs).**

Goals of the IANUS project

- **Enable societal stakeholders** to distinguish valid from unsubstantiated trust, healthy from unfounded distrust
- **Enable societal stakeholders** to deal with the uncertainties, incompleteness and epistemic pluralism inherent in scientific knowledge
- **Enable researchers** to foster trust in science through methodological transformation (making research inclusive, transparent and responsible to societal needs and concerns)
- **Enable researchers** to conduct relevant, engaged and value-driven research while foregoing partiality, ideological biases and conflicts of interests

Regarding the methodological approach, we used the concept of Policy Labs to develop policy recommendations in a co-creative way together with experts from the respective types of organisations. Specifically, Policy Labs were conducted in the parallel streams for the different types of organisations according to a standardised scheme (see info box). The Policy Labs took the form of focus group discussions.

The Policy Lab on RPOs took place in virtual form on 10 October 2024. Representatives from the Austrian Institute for Technology AIT (Austria), the French National Centre for Scientific Research CNRS (France), the Fraunhofer Society (Germany), the Luxembourg Institute of Socio-Economic Research LISER (Luxembourg), the Netherlands Organisation for Applied Scientific Research TNO (Netherlands), and the Technical Research Centre of Finland VTT (Finland) discussed the topic of trust in science from the perspective of their organizational background and jointly developed policy recommendations.

Methodological approach of the policy labs

1. Identification and structuring of key policy-relevant insights from the IANUS project for the respective target group
2. Focus group discussion in parallel streams with representatives from the respective types of organisation; division of the discussion into two parts: (1) defining the problem and (2) developing solutions
3. Deriving policy recommendations;

2. The Role of Research Performing Organisations

In addition to higher education institutions (HEIs), research performing organisations (RPOs) are another important pillar of the science system. As there is no universally agreed definition of RPOs, we use a rather broad understanding of this type of research organisation, which includes different forms of RPOs. In particular, RPOs differ in terms of their legal form or ownership (OECD 2011, Racine et al. 2009), or their research mission in terms of basic research or application-oriented, industry-related technology development. RPOs can be subdivided into scientific research institutes or public research centres of considerable size, which - similar to universities - are mainly engaged in basic or applied research. Examples are the CNRS in France or the Max Planck Institutes in Germany. Another group are government laboratories, sometimes called 'sector institutes', which are usually state-owned and/or run by government ministries or departments, and which conduct research in specific sectors (e.g. energy, health, environment) and provide services and policy-relevant information to governments. Research Technology Organisations (RTOs) are a third group of RPOs. These are predominantly applied research institutes that generate a large part of their funding through competition and largely meet the needs of industry for knowledge-based services. Examples of this type of RPO are Fraunhofer in Germany, VTT in Finland and TNO in the Netherlands.

Different types of RPOs

- **Scientific research institutes** or **public research centers**
- **Government laboratories**
- **Research Technology Organisations (RTOs)**

Because of the great diversity of RPOs and the different science systems in Europe, we invited representatives from all types of RPOs to our Policy Lab. Despite possible differences and a high degree of institutional diversity, RPOs differ from universities in that they focus primarily on research and – unlike HEIs – are exempt from teaching. In terms of the specific role in the science system, we were able to generate interesting and unique insights on trust in science from a RPO's perspective.

3. The View on Trust in Science from RPOs' Perspective

a. Problem situation

In their discussion on trust in science, the participants touched on many aspects specific to RPOs. Despite all the recent political and social crises, **public trust in RPOs is considered** to be **relatively high** across Europe. RPOs were established with a clear mission. According to the participants, they are being trusted because **they are seen as neutral actors who don't take sides or serve special interests**. It was also felt that HEIs are generally more affected by the debate on trust in science than RPOs, which participants attributed in particular to the **specific focus and mission of RPOs**. RTOs were said to produce more **'tangible' research results due to their focus on**

technology development. Their application-oriented and technology-oriented research is less theoretical than that of universities and therefore seems to be better understood by lay people. Nevertheless, it is pointed out that even tangible technologies (e.g. GMOs, nuclear energy) can raise fundamental societal debates and questions of trust in science.

Another relevant aspect in the view of the participants is the **different funding structure of RPOs**, in particular of application-oriented RTOs. Due to their **comparatively high share of and dependence on third party funding**, the participants expressed the concern that there is sometimes not the necessary time to carry out research with the highest methodological rigour. This is related to the **logic of contract research**, where clients expect results quickly. In addition, the **high dependence on third party funding might lead an overemphasis on positive impacts** or potential impact of the research and the **risk of 'hype writing'**. This refers to the **exaggeration and sensationalism of scientific discoveries** both when submitting papers to scientific journals and when publishing results in science communication, an aspect that has already been addressed in other IANUS project activities. In particular, the high level of competition for research funding leads to overpromising and to inflating research results and applications with expectations that can hardly be fulfilled and are therefore likely to lead to disappointment. In fact, the use of positive words such as "unprecedented", "novel" or "remarkable" in scientific publications has increased massively in recent years, giving greater significance to the findings than what is actually supported by the research results. **Hype** also **relates to the influence of research funders**. As research funders influence the research agenda through their calls for research proposals, certain topics can be considered "trendy". Topics thus receive much more attention than the scientific community itself would give them if it were setting the research agenda independently. Due to the high dependence on third-party funding, researchers tailor their proposals to the topics of the respective calls, which can lead to tensions within the scientific community in reconciling their individual research interests with the expectations of the research funders. Such hypes then also lead to scientific overproduction in certain scientific fields.

Another RPO-related aspect of trust in science highlighted in the Policy Lab is the **stakeholder structure**, which differs significantly from that of HEIs. **Companies** (in the case of RTOs) **or ministries and government agencies** (in the case of government laboratories) are the **key stakeholders and addressees of RPO's research results**. Because of the focused target groups, their needs and interests are easier for RPOs to address. On the other hand, the **interests of the wider public are taken into account**. This is particularly true of the end customers and users of the technologies that RPOs help to develop. One participant asked:

"*We only address the needs of industry, but we leave out large parts of society […]. We develop technologies for industry and are approached by industry as contractors. We claim to address socio-technical needs but are we really addressing societal needs?*".

The lack of a broader societal perspective, the absence of citizens or laypersons in evaluation or assessment is recognised by the participants as a key issue that can also negatively affect public trust in science.

In addition, the Policy Lab participants discussed aspects of trust in science that affect not only RPOs, but also the entire science system. In particular, the dangers of **social media** for the public perception of science were highlighted. Participants noted that **radical, emotional and non-mainstream contributions** tend to **gain more attention on social media and are often taken seriously**. Social media allow for the **mass publication of unscientific claims**. It is then difficult for the broader public to **distinguish between serious and dubious or 'alternative' scientists**. However, the latter often receive proportionately more attention. This assessment is in line with similar findings from the IANUs project, according to which it is much easier in social media to generate outreach with contributions that question and criticise research findings than with statements that defend existing knowledge. In addition, social media can promote the profiling of individual scientists and the **personalisation of science**, even though research results are usually team efforts.

The role of **Artificial Intelligence (AI)** in science was also discussed. Participants agreed that generative AI will increasingly find its way into science, as it has in other areas of society, and saw risks that could also affect trust in science. For example, **decisions made by AI systems are often difficult to understand**, which can **affect the transparency of research**. In particular, participants highlight that **over-reliance on AI can reduce critical thinking and creative problem-solving skills**, leading to a **loss of key skills** that are important for science.

The discussion also revolved around the **role and self-image of scientists** in times of **increasing politicisation of science**. One participant noted that science sceptics focus their criticism of scientists less on aspects of research integrity and/or issues of research misconduct. Rather, the independence and thus the **credibility of the scientists themselves is called into question**. Scientists are accused of **paradigm selection bias**. According to this accusation, **scientists are biased in their choice of paradigms and societal needs.** They are convinced that certain issues need to be researched, and they influence the results of research in a way that is consistent with their ideological beliefs. These accusations are made particularly in relation to topics that are the subject of controversial public debate, such as climate change. The aspect of science activism has also been discussed critically in this context. Especially in the course of the climate change debate, new science activist groups have emerged that are also strongly networked internationally (e.g. March for Science, Scientist Rebellion). Several participants were critical of the **strong involvement of scientists**, as it becomes more difficult for the public to **distinguish between personal opinion and ideology** on the one hand, and empirically valid findings on the other. In addition, this form of scientist activism could further promote the politicisation of science.

A particularly relevant issue, which is also relates to the discussion of RPO-specific stakeholders, is the **role of social impact**. Several **participants observe a disconnect or a gap between perceived societal needs and perceived societal relevance on the one hand and the de facto societal relevance and needs**. This perception of needs varies considerably within science. According to participants, funding strategies tend to focus on economic goals, while societal goals are perceived to be addressed less frequently. One explanation for this could be that technology-oriented

impact or industrial interests are easier to grasp and translate into feasible goals of research funding strategies than societal needs. The discussion also revolved around the question of **who actually defines these needs.** Again, it was pointed out that RPOs - and RTOs in particular - tend to focus on the interests of industry, and that a deeper exchange with the wider public, going beyond unidirectional forms of science communication, is not usually part of RPOs' key performing indicators (KPIs). The **missing link to society is clearly identified as a problem** with relevance to the issue of trust in science. At the same time, the responsibility of research funders to interpret societal needs and define calls for research programmes accordingly, thus pre-selecting research directions, is addressed.

Another aspect that was discussed was the role of **research integrity**. Greater transparency and a supporting structure for research integrity at the level of research institutions could make an important contribution, particularly with regard to research misconduct or questionable research practices (QRP). However, the participants differed in their assessment of the importance of research integrity for the issue of trust in science. Some questioned whether these issues have a major impact on public trust in science, seeing it more as a discussion of quality management in science.

b. Solutions to tackle the problem of trust in science

After describing the problem from the perspective of RPOs, the participants discussed possible solutions and fields of action. This applies first and foremost to the **role of RPOs in the science system** and their relationship with social partners. The basic tenor was that **RPO in general should engage more with the wider public**, beyond singular science communication events such as science fairs or open days. RPOs would need a better match-making between society at large and RPOs. This engagement could be an important seed for inclusiveness and openness in science, which would also lead to a better understanding of the de facto needs of (civil) society and a trusting relationship between RPOs and society.

Regarding the **identification of wider societal needs**, the **participants emphasise that RPOs and research funders have an equal obligation**. Both should step up their activities to better integrate the perspectives of societal stakeholders into their processes in order to adequately serve societal interests and needs. According to the participants, much more progress has already been made in this area at the European level than at many national funding organisations.

For **scientists at the individual level**, the participants see the **need to learn how to use AI responsibly in scientific work**. This **requires guidance from RPOs and universities alike**. At the same time, the participants believe that scientists have a duty to **reflect critically on their role and self-image**, especially if they are involved in civil society engagement activities as scientists.

4. policy recommendations

From the description of the problem and the proposed solutions outlined, recommendations for action can be derived for various actors and levels of the science

system. These recommendations address the question of what is needed to make research more responsive to societal needs:

- **RPOs should increase their engagement with the wider public to better address societal needs and interests:** In general, RPOs should give a more prominent role to civil society actors in their stakeholder management in order to better address societal interests and needs. This will require RPOs to engage more with societal stakeholders at different levels. Greater opening of research and innovation processes beyond mere industrial cooperation and contract research for industrial partners - e.g. through citizen science, multi-stakeholder engagement in living labs, etc. - or the integration of exchanges with societal stakeholders into the key performance indicators of RPOs could help to bring societal needs more into the focus of the strategic orientation of RPOs. However, this requires structural changes, in particular with regard to the specific funding structure of this type of scientific organisation, allowing for a more diversified funding base.
- **Research funders should also make greater efforts to integrate the needs of civil society into research funding:** Research funders are key actors in the science system, as they define research topics and directions through their funding. They set guidelines and conditions to which scientific organisations such as RPOs and universities orient their research focus. A stronger dialogue with civil society actors could help to better identify societal needs and integrate them into the design of funding calls. One possible approach would be to involve civil society actors and non-scientists in the formulation of funding programmes. Research questions and research needs should not be developed exclusively by scientific or business actors. Opening up research assessment processes more to civil society and non-scientific actors could also help to better align research with real societal needs. This could also counter the accusation by many science sceptics of an alleged paradigm bias among scientists.
- **Universities and RPOs alike should focus more on the opportunities and risks of social media as part of science communication in the training of (young) scientists:** social media are playing an increasingly important role in science communication. At the same time, the business models and algorithms on which social media are often based promote a non-objective and polarising discourse. Raising awareness of this in the training of young scientists could help researchers to use social media in a more professional and confident way in their research activities.

2.3 Policy brief: Trust in science – The perspective of Higher Education Institutions (HEIs)

Executive Summary

In the IANUS project, Policy Labs are conceived as a tool to develop and validate science policy recommendations on trust in science with European science experts from key organisations involved in shaping science and innovation systems. In the Policy Lab on Higher Education Institutions (HEIs), experts from different higher education institutions in Europe discussed the issue of trust in science from their perspective as researchers and academics and developed policy recommendations both for this type of social actors and for the science system in general.

A key aspect discussed in the Policy Lab was the contrast between media and public understanding of science versus scientists'. According to the participants, a stronger focus should be put on communicating science as a collaborative and constantly changing process rather than something always right or set in stone.

1. Introduction

The IANUS project strengthens warranted trust in science, research and innovation at a systemic level by encouraging participation in research as a co-creative and inclusive process, sensitive to societal values, concerns and needs. IANUS envisions researchers as engaged and sensitive to societal needs and values, and acknowledges their mission of helping society deal with urgent global challenges. A key objective of the IANUS project is to translate the insights, knowledge and concepts generated into accessible and effective recommendations for the future governance of science, technology and innovation (STI) and the design of STI policies.

Concretely, IANUS aims to:

- map the landscape of projects and discourses relevant for trust in science
- develop its conceptual framework
- conduct participatory research into conditions of trust in science
- initiate concrete actions for strengthening trust through co-creation and engagement
- provide policy recommendations to key stakeholders in science and society (e.g. funding bodies, universities, research teams, educators, media)
- create platforms for interaction and engagement between scientists and societal stakeholders to foster trust

In order to ensure that the IANUS findings are translated into tailor-made policy recommendations for key organisations involved in shaping science and innovation systems, the development of policy and governance recommendations was carried out in parallel streams, each focusing on a specific type of actor. This policy brief focuses on the perspective of Higher Education Institutions (HEIs).

2. Methodology: co-creation and policy labs

IANUS sets forth to involve both key policy-makers and stakeholders in developing recommendations, consistently with the co-creative nature of the IANUS project, and thus envisions the policy labs as a methodlogical approach fit to developing recommendations through a participatory and co-creative process.

The core of this endeavour is to investigate critical issues, identified by the reconnaissance work carried out by other WPs, that lay at the intersection between scientific inquiry and societal needs (es. nuances of (mis)trust in science, desired changes at the institutional level, balance between confidence and humility in scientific claims, the public's misunderstanding of scientific skepticism, the perceptions of mistrust within the scientific community itself etc.). In order to address these, IANUS employs a co-creative methodology.

Co-creation is an increasingly popular concept in research and innovation, often seen as a precondition to create impact. The concept's popularity, however, has contributed to turning co-creation into a buzz-word of sorts, that is "assumed to be able to achieve a variety of positive effects," from reforming the public sector, to enabling creativity and innovative solutions (Puerari & De Koning, 2018). As a result, IANUS partners studying co-creation highlight that scholars and even EU-policies have hardly problematized the concept, contributing to a tendency to regard co-creation as an exercise of merely including stakeholders into processes but without implementing deeper changes. This often results in neglecting the full potential of co-creation (Meister-Broekema, Bulder, & Horlings, 2023). As a result, our work with the policy labs and, more broadly, within the IANUS project, aims at advancing the knowledge on existing evaluation frameworks and indicators that analyze co-creation processes in various contexts and that try to assess its impact. Via co-creation and validation, we strengthen the relevance and external validity

of our recommendation to ensure that they provide relevant input and guidance well after the project has expired.

In order to assess the current status of trust in science, and to open up practical and feasible pathways for restoring and maintaining trust in science, IANUS has organized four 'policy labs,' that is special focus groups (Stewart & Shamdasani, 2014) whose goal is to unveil the underlying elements of trust in science and improve our understanding of (dis)trust through the direct involvement of specific categories of experts. Policy labs have become a popular instrument for the co-creative development of policy recommendations, albeit the definition of what counts as policy lab often remains vague. Overall, policy labs reunite the parties involved in a specific issue with the aim of working together to develop, test, and implement ideas related to policies.

Within the IANUS project, such process consists of several stages:

1. Identification and structuring of key policy-relevant insights from the IANUS project for the respective target group
2. Focus group discussion in parallel streams with representatives from the respective types of organisation; division of the discussion into two parts: (1) defining the problem and (2) developing solutions
3. Deriving policy recommendations; comparison with other IANUS results
4. Validation of recommendations by Policy Lab participants and translation of the results into a policy brief

For the purpose of this brief, the co-creative process focuses on stakeholders of Higher Education Institutes (HEIs) with experience in Research Integrity and Research Ethics. Consistent with our co-creative, explorative, and bottom-up research approach, participants were not given a set of specific questions but rather guided through specific areas of inquiry through broad prompts. They were free to explore additional topics and suggestions emerging organically from the discussion.

UNIROMA1 together with Fraunhofer ISI identified 7 stakeholders and set up a two-hour policy lab in the form of an online focus group, held on December 18th 2024. Representatives from University of Zagreb School of Medicine; Amsterdam University Medical Centers and Amsterdam Public Health research institute; University of Split School of Medicine, Split, Croatia; Department of Arts and Humanities, Universitat Oberta de Catalunya; University for Continuing Education Krems; University of Erfurt, Germany; Leiden University discussed the topic of trust in science from the perspective of their scholarly background (and jointly developed policy recommendations).

The results produced during the discussion are discussed in the following sections.

3. The Role of HEIs

IANUS' aim is to generate a corpus of knowledge and insights concerning the characteristics of trust in science, and the requirements for trustworthy practices and institutional arrangements. The meso-level of science governance addresses scientific

organisations like universities, universities of applied science, research performing organisations, but also groups of research organisations (like Fraunhofer Society), professional associations (such as IEEE) or academic associations (like the European Sociological Association).

HEIs are a key pillar of the science system. According to the International Encyclopedia of Education (2010), HEIs are systems that support economic growth and poverty reduction by equipping students with skills and knowledge. Because of system differences, there is no consistent typology of HEIs across EU states. Still, the process of 'working with knowledge' is considered the general characteristic that connects different European HEIs (Clark 1983; Becher & Kogan 1992). This can include research (the discovery of new knowledge), dissemination (its transfer to parties inside and outside the institution), and education (dissemination to specific groups of learners). The European University Association (EUA) Trends 2024 report proposes a categorization of different types of HEIs:

1) "comprehensive universities, which award degrees in all three cycles and are multidisciplinary (i.e. programmes in more than two subject areas/fields of science)
2) specialised universities award degrees in all three cycles and are specialised in a particular subject area/field of science
3) technical universities award degrees in all three cycles and are specialised in technology, engineering and natural sciences
4) universities of applied sciences, or university colleges, offer more profession-oriented studies, usually at the first and second degree cycles only
5) music and art schools specialise in arts and/or music
6) open universities offer mainly distance learning, granting access to students without the formal entry requirements requested by conventional universities" (2024, p. 17)

Consistent with the scope of the policy labs and in order to provide 1) better consistency throughout the discussion and results and 2) a more seamless interaction with research already conducted within the other WPs, this policy lab involved representatives from Higher Education Institutions of the first three categories, with the addition of one participant who was working at an open university (Universidad Oberta de Catalunya). It focused on researchers with a specific expertise on Research Integrity and Research Ethics.

4. The view on trust in science from HEI's perspective

The virtual focus group discussion allowed experts to exchange their ideas and co-create recommendations focusing on several different topics. First, the participants assessed main trends and characteristics of the debate on trust in science and the main problems related to this theme. Second, they started identifying possible solutions and areas for intervention, highlighting key stakeholders that could play a significant role.

a. Problem situation

In their discussion on trust in science, the participants touched on many aspects specific to HEIs. Despite recent political and social crises, participants concluded that public trust in HEIs is still relatively high across Europe. In the Netherlands, for example, bi-annual national surveys tend to rank politicians at the bottom in terms of trust and scientists at the top. However, the participants observed that this kind of data is not necessarily indicative of a perfect societal trust in scientific institutions, because it is really difficult to establish trust in society and, from their experience and from data gathered during EU projects like MoRRI and SUPER_MoRRI, public distrust is growing.

The issue, then, seems to shift from scientists being the top-trusted source to general public distrust, so that if, comparatively, trust in science and scientists is still high, overall trust in institutions is still decreasing. The participants questioned how this could be the case and convened that this might not only be dependent on surveyed audiences but also on the responsibilities of the scientific world, which often lacks openness and transparency. These tendencies are further exacerbated by the perceived inaccesibility of academic language and jargon, which are hardly understandable by the outside world.

Another major issue stemmed from how performing science has gone from being a privilege to being a job in its own right. While this has contributed to lowering the barriers to academia and generally democratized knowledge, it has also demystified science to the point that many professionals within HEIs do not fully grasp the responsibility they hold toward civil society. More and more people, in the face of an increasingly precarious job market and dwindling funds, scramble to publish as many papers and gather as many grants as possible, often paying a huge price in quality, research-impact, and replicability of results. The increasing over-specialization of scientists and the pressure to produce results at all costs is reminiscent of the issue previously underscored by the work within WP3, which the team has named ‘the neo-liberal university model’. In the neo-liberal university market economy, the performance of universities, departments, and individual researchers is audited with a variety of metrics that feed league tables. Research quality and impact are converted into funding levels. Productivity and entrepreneurial flair are rewarded, job insecurity is rife and those who fail are discarded. This contributed to the research results’ replication crisis, the withdrawal of academic articles and, by researchers’ own admission, questionable research practices.

Furthermore, scientists are increasingly specialized, so that the lay person will find it more difficult to acquire the necessary knowledge to access a research report or an academic paper. As a result, people have no choice but to ‘blindly’ trust scientists and scientific knowledge as it is communicated on the outside, because in most cases they won’t be able to fully understand it or to evaluate it by themselves.

Indeed, poor science communication was also underscored as an increasingly timely issue for HEIs. In particular, the participants observed that scientists should do a better job at communicating the social construction of knowledge, that is how science can be contextual and constructed through time, constantly changing and evolving. On the contrary, the public often has the impression that science is ‘objective’ per se and this is

often dependent on how the media portrays science and academia. When people cannot access research papers and briefs, they will look into what is the most available source to them and that is often the information presented by media outlets. These kinds of communication channels have a very important role in how people trust science, but they are often imprecise, so HEIs need to develop better relationships with media professionals and curate a more accurate representation of the production of knowledge. Additionally, the participants stressed that their task is to be as objective and balanced as possible when speaking with the media. Yet, "many scholars don't understand that: they just want to be famous and have a pitch on the news that's nice to tell to their relatives." A need emerged then to better educate people in academia on how to communicate and avoid making unbalanced or personal claims when speaking as a scientist and not as a citizen.

Directly connected to this last point about the media, the participants highlighted another major issue, that is poor handling of misconduct cases. According to them, there is often a lack of full accountability and rigorous consequences for those scientists that perform their mission poorly. While it is a scientist's job to "make mistakes" and "improve by making mistakes," that is difficult to understand for lay people. As a result, universities tend to respond with institutional silence in cases of research misconduct, because they want to maintain HEIs' reputation rather than investigate the researchers who perform poorly to the full extent. Yet, this often has the opposite result, as the public still sees the research misconduct case reported in the media and sees that the institutions are unwilling to take on responsibility, with the result of further jeopardizing trust in science and HEIs.

b. Solutions to tackle the problem of trust in science

After describing the main issues HEIs face in terms of trust in science, the participants discussed possible solutions and fields of action. These concerned first and foremost HEIs' role in civil society.

Similarly to what the policy lab with RPOs highlighted, HEIs emphasized the need for better engagement with lay people and the media as an important starting point for better inclusiveness and openness in science, which would directly fuel better trust in science. The participants observed an increasing need to both "explain to people" and "to listen to people in society" in order to fulfill their mission to improve society and educate the general public. Relationships with the media should be strengthened, making science more accessible to all through better science communication, able to explain not only research results but also the constructed nature of the scientific process. Additionally, HEIs should also engage in public communication and stimulate citizen science through national organizations and projects to help bridge the gap between society and academia. This will also help academia learn from new perspectives, improve, and produce results that align better with the needs of civil society.

Another central take-away was that the key to gaining trust or being trustworthy is transparency and accountability. This resonates with the results already underscored by

IANUS' WP5, which highlighted the prime importance of Open Science (through access to research, better transparency, and accountability) in addressing conflicts of interests. Transparency and accountability were seen as areas in which scholars can and should do "much better," especially because the general public and civil society do not always have the tools to interpret academic research without intermediaries. In order to tackle issues of misconduct and personal responsibility, the participants suggested better auditing and controls be put in place by both HEIs and policy-makers. This would allow better handling of incidents and overall better quality of research performance and communication. Additionally, they also foresaw the creation of a supportive structure for researchers at universities in general. This notion effectively dialogues with findings from other WPs within IANUS and refers to the idea that the responsibility of dealing with research misconduct should be at the organisational level rather than mostly at the individual level. Participants thus advocated not only for punishing individual researchers liable for research misconduct, but also for implementing the necessary structures within the organisations that support researchers to prevent them from choosing the wrong path. Overall, participants observed an increasing number of threats to the scientific production of knowledge, from a shifting political climate to pressures within institutions and the role of digital media in fueling skepticism and misinformation. As a result, quality management of research processes and outputs is paramount, as is the handling of incidents through consistent safety precautions.

5. Policy recommendations

From the description of the problem and the proposed solutions outlined, we derive the following recommendations for action. These recommendations address the question of what scientists can do to make research more accessible and trustworthy to society, as well as handling threats to integrity both within and outside of HEIs:

- **Better citizen science:** citizen science and further approaches of integrating societal stakeholders into research processes should be stimulated at all levels, through national and international coordinated actions, funding projects and seminars to allow scholars to get the expertise on how to run citizen science within their specific HEIs. Good citizen science will help bridge the gap between society and academia by involving citizens in the design of research and in research analysis and dissemination. On the one hand, this will allow citizens to gain knowledge on how science is a collaborative and constantly changing process rather than something set in stone. On the other, this will allow HEIs to better understand the needs of civil society and produce research that is better aligned with them.
- **Strengthening relationship with the media:** with the increasing predominance of digital media and AI, quality science communication is paramount. HEIs and single scientists should work hand in hand with media

practitioners and science journalists to communicate how science and research are conducted and help educate society. Public engagement is something that most universities do not devote significant attention to and this was seen as an area in which HEIs can improve. Good science communication will help lay people access academic research even without formal academic education and be able to trust the results of the scientific process.

- **Improving research quality:** more robust quality standards and quality assurance measures should be implemented at all levels, starting with crucial stakeholders like research performing organizations, funding organizations and academic journals and publishers. Possible consequences for misconduct and poor research quality should be foreseen. HEIs should develop criteria to support ethically credible partnerships between different stakeholders, emphasizing transparency and accountability. As a corollary, performance metrics (such as number of publications and citations) should also be revised, so as not to penalize HEIs with smaller funding and to ensure quality is preferred over quantity.

- **Prevention is the best cure**: participants emphasized individualism as a threat within HEIs, resulting in single scientists pursuing fame and media celebrity. This can lead to distrust and to research misconduct. In order to prevent this, better quality management should be developed at the HEIs level, improving the environment in which research is taking place. The current focus on recognition and reward should be accompanied by a stricter focus on accountability and responsiveness. While this issue could also be tackled by employing stricter laws and regulations at the national and international levels, the participants highlighted that, in countries where this has happened, addressing misconduct has become a very lengthy procedure. Prevention of misconduct and better education on research integrity (starting from PhD programs all the way to the highest levels of HEIs governance) was considered a more effective strategy.

- **Never waste a good crisis:** While prevention and the promotion of research integrity were considered important, misconduct can still happen. In this case, the best course of action is to tackle the accident openly and transparently. This can prevent miscommunication and preserve trust in HEIs in the long run. Additionally, accountability will help scholars learn from their mistakes and keep "each other and ourselves on the straight track."

2.4 Policy brief: Trust in science – The perspective of European policy makers

Executive Summary

In the fast-changing digital environment of today, the challenges posed by disinformation and the decline of public trust have become critical. While digital platforms and artificial intelligence offer significant potential, they have also facilitated the widespread dissemination of false and misleading information like never before. This policy brief, which summarizes the main results from the TrustOn Workshop and the Science Summit during the 79th United Nations General Assembly session titled "Fostering Trust in the Digital Age" in 2024 aims to tackle these urgent concerns. Both events gathered experts to discuss strategies for combating disinformation and enhancing trust in science and digital ecosystems.

1. Introduction

In today's rapidly evolving digital landscape, the challenges of disinformation and the erosion of public trust have reached critical levels. The rise of digital platforms and artificial intelligence, while offering tremendous potential, has also enabled the proliferation of false and misleading information on an unprecedented scale. The disinformation crisis is not a standalone problem—it is a shared challenge that demands global solutions. Whether tackling climate change, public health, or social justice, we cannot succeed if disinformation persists in eroding public trust and democratic systems. As this policy brief demonstrates, addressing disinformation necessitates innovative

solutions, participatory governance, a human-centered approach, and community support.

In Claire Wardle and Hussein Derakshan's report published in 2017 by the Council of Europe, there are mainly three different types of information inside the bigger idea of "information disorder":

- Dis-information. Information that is false and deliberately created to harm a person, social group, organization or country.
- Mis-information. Information that is false, but not created with the intention of causing harm.
- Mal-information. Information that is based on reality, used to inflict harm on a person, organization or country. (Wardle, Derakhshan, 2017, p. 20).

The struggle against disinformation is not a new phenomenon. Historically, misinformation has threatened societal stability, but today's digital tools enhance its reach and effect. With just a few clicks, harmful content can circulate worldwide, shaping opinions and decisions, often with perilous outcomes.

Tackling disinformation is vital for realizing the United Nations Sustainable Development Goals (SDGs). Reliable and inclusive digital spaces are essential for ensuring fair access to quality education (SDG 4), advancing gender equality (SDG 5), decreasing inequalities (SDG 10), and creating peaceful and inclusive societies (SDG 16). Additionally, global partnerships for sustainable development (SDG 17) rely on our capacity to cultivate trust and integrity in the digital world.

To address disinformation and building trust in the digital age holistically, the TrustOn Workshop in Brussels in June 2024 was organized in three distinct yet complementary tracks: (1) science, (2) infrastructure, and (3) mediation. Each track identifies a different approaches to the issue, recognizing that solutions must be multi-faceted and interconnected to effectively combat disinformation:

(1) **Science – Ensuring credible and transparent knowledge:** The Science track highlights the importance of credible research in building public trust, especially as disinformation increasingly targets scientific information. Research institutions and universities must produce peer-reviewed content while actively combating the spread of false information. This track promotes open and ethical research practices that enhance the accessibility and clarity of scientific findings for the public. Key efforts include open access publishing and collaborative research, which aim to disseminate academic knowledge transparently and without manipulation. By adhering to strong ethical standards, this track seeks to counter the negative impact of disinformation on public perceptions of science.

(2) **Infrastructure – Building a trustworthy foundation:** The Infrastructure track focuses on the essential components that enable a secure and effective digital ecosystem. It emphasizes the development of digital infrastructures that promote the transparent and trustworthy sharing of information, such as those provided by OPERAS, which offers reliable scholarly content. This infrastructure extends beyond physical elements to include protocols and governance structures aimed at mitigating disinformation. Initiatives like data cooperatives, ethical AI development, and digital literacy are crucial for fostering trust and reducing vulnerabilities to misinformation. By providing the necessary tools and frameworks to identify and correct false information, this work is vital for the long-term sustainability of the digital ecosystem and the integrity of knowledge sharing.

(3) **Mediation – Addressing disinformation through communication and engagement:** The Mediation track explores how to engage the public and manage the flow of information in order to combat disinformation and build trust. It emphasizes the roles of media professionals, educators, and communication strategies in creating environments where individuals can critically assess information and distinguish between reliable sources and misleading content. This track highlights the importance of journalists, media literacy initiatives, and public information campaigns in fostering a more informed society. By equipping citizens with skills to evaluate information critically and encouraging constructive dialogue, mediation is essential in shaping a trustworthy information ecosystem through fact-checking and public awareness efforts.

According to the focus on the IANUS project on trust in *science*, this policy brief will concentrate on the key insights of the first science track. The policy brief will first summarise the key findings of the science track and then draw conclusions and recommendations for science policy

2. Fostering trust in the digital age – the focus on science

The Science track at the TrustOn 2024 event centered on mis- and disinformation within the realm of science, specifically focusing on building trust in scientific information. It was informed by the experiences of four EU-funded Horizon Europe Projects: COALESCE, IANUS, POIESIS, and VERITY. Adopting a practical approach, this track aimed to develop policy recommendations to tackle mis- and disinformation by enhancing trust in science. The track included three sessions that addressed the topic from different perspectives: (1) identifying key audiences for mobilizing science communication; (2) using participatory methods to navigate online mis- and disinformation; and (3) fostering collaboration among stakeholders to build trust in science - referred to as Stewards of Trust. To deepen understanding, the sessions featured science-based presentations and discussions on the challenges related to trust in science.

The skepticism surrounding the COVID-19 vaccine rollout mirrors the resistance to climate science observed in recent years, highlighting science's vulnerability to mis- and

disinformation. However, the pandemic has also increased public awareness of the vital role science plays in combating global diseases and its significance in everyday life (Wellcome Global Monitor, 2021). Science is essential for addressing major contemporary challenges and contributing to the achievement of Sustainable Development Goals (SDGs) related to global health, climate change, sustainability, and inequalities. Yet, scientific progress must be accompanied by an understanding of societal perceptions, public support, and trust in science. Although trust in science and scientists is generally high worldwide (European Commission, 2021; Wellcome Global Monitor, 2020), this does not necessarily translate into adherence to science-based recommendations on specific issues (Ratner & Riis, 2014). Trust in science is not static; it is a dynamic and fluctuating phenomenon. Hesitancy or reluctance to follow scientific recommendations can stem from various factors, including (1) the inherent nature of science; (2) the interplay between science, politics, and the economy; (3) evolving research environments; and (4) the shifting landscape of trust.

a. The Role of Collaboration in Science Communication

In today's digital landscape, establishing trust in science and ensuring the dissemination of reliable information has become increasingly challenging, particularly highlighted by the COVID-19 pandemic. This crisis illustrated how swiftly misinformation can spread and significantly impact public perceptions of science and health. A recent science media panel in Lithuania, organized by the Research Council of Lithuania, engaged various stakeholders—including science communicators, journalists, scientists, and students—in exploring the complexities of trust in scientific communication. Key insights revealed that while artificial intelligence (AI) can aid research, it also raises concerns about the authenticity of information, making it harder for the public to differentiate between credible sources and misleading narratives. Furthermore, the importance of clear communication about scientific expertise emerged, emphasizing that scientists should refrain from commenting outside their areas of competence to maintain public trust.

The dialogue also highlighted the critical role of science journalists in bridging the gap between scientific communities and the public. Ethical journalism that prioritizes accuracy is essential to avoid exacerbating distrust and misinformation. Collaborative efforts between journalists and scientists can enhance the public's understanding of complex scientific concepts by contextualizing findings within broader societal issues. Additionally, improving public literacy regarding scientific processes is crucial, as many individuals lack a comprehensive understanding of how science operates, which can lead to skepticism. Social media's influence on public perceptions was also acknowledged, with calls for tech companies to collaborate with scientific communities to develop tools that help users identify credible sources. Ultimately, fostering trust in science amidst

disinformation requires a collaborative effort from scientists, policymakers, educators, and communicators to build an ethical framework for knowledge sharing.

b. Re-defining the ecosystem of trust in science – the role of stewards of trust in changing research environments

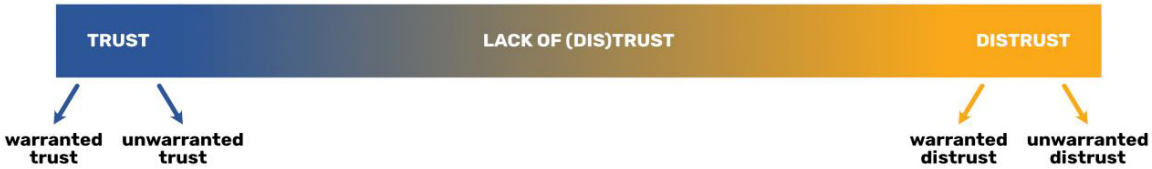
Science, technology, and innovation are vital for achieving Sustainable Development Goals (SDGs) and fostering sustainable societies. However, to build public trust in scientific advancements, it is essential to consider societal perceptions and support. Trust in science is influenced by historical, social, economic, and political contexts and is a crucial aspect of democratic governance. Although there is a narrative of a crisis of trust in science, survey data indicates that while general trust exists, it does not guarantee adherence to science-based recommendations. The evolving landscape of research and innovation, characterized by globalization, interdisciplinary collaboration, and the integration of AI technologies, complicates the trust dynamics, particularly as science becomes increasingly intertwined with politics and the economy.

The traditional ecosystem of trust in science has shifted to include a diverse array of stakeholders, such as companies, public-private partnerships, and citizen science participants, alongside traditional institutions. This transformation reflects a move from "institutional trust" to a more "distributed trust" model, enabled by the digital revolution. In this new environment, "Stewards of Trust"—who may come from various sectors—play a critical role in nurturing trust. Effective communication, transparency, and equitable distribution of benefits are essential components of this trust-building process. The VERITY research project highlights the need for collaborative relationships within the trust ecosystem, advocating for continuous support of open science approaches and public engagement initiatives. It calls for transparency in roles and responsibilities, particularly concerning the connections among stakeholders, to ensure that scientific progress serves the public interest and enhances trust in science.

c. Responsible science communication for trustworthy science

In general, trust (in science) is a complex mental state which involves vulnerability and risk-taking by consciously giving up (some) control and being ready to feel betrayal. Thus, trust acts as a mechanism that aids us in navigating through uncertain scenarios. It involves a conscious decision to take a leap of faith without an assured safety net. Public trust in science can mean several things: trust in what scientists say (epistemic trust) and what they do, trust in a specific method (e.g. with regard to questions of reproducibility and replication of their work), trust in research results, trust in individual scientists or research organisations, as well as trust in science as a system. Both trust and mistrust may be rational or irrational. Perhaps we have no reason to trust, but we trust anyway, irrationally. This kind of trust is unwarranted. Alternatively, there may be reasons to

trust, but we refuse them and distrust. This kind of distrust is unwarranted. Irrational trust or irrational mistrust means that we are not fully cognizant of risks; that we do not have sufficient knowledge of the trustee; that we do not fully take evidence or previous experience into account. Whereas irrational trust ignores the risks that something could betray trust, irrational mistrust overestimates the possibilities of betrayal. Both trust and distrust have a gradual nature. Mere lack of trust doesn't automatically translate to active distrust; it could mean a neutral stance of neither trust nor distrust. Absence of trust should not be equated with distrust. Rather, absence of trust describes the centre stage of this continuum between trust on the one hand and distrust on the other hand, where a trustor neither trusts nor distrusts a trusting object. Distrust or the absence of trust can be described as an attitude of healthy skepticism, as the following graphic shows:



Furthermore, trust is a relationship, as it involves a positive attitude of the trustor towards the trustee. As a trustor you trust (attitude) the trustee to do something (activity or commitment). Also, trust is influenced by many personal characteristics such as personal values, education, socio-economic status, world view, information sources but also previous experiences with the trustee.

The IANUS project highlights the role of science communication as a vital intermediary between science and society, facilitating dialogue and participatory interactions. However, the project identifies systemic challenges within both the science communication system and the scientific system, including the prevalence of misinformation, the pressure for sensationalism, and the politicization of science, all of which complicate the public's trust in scientific discourse.

d. Fact or fiction – The battle against scientific disinformation in the social media arena

Statistics reveal the growing importance of social media in daily life, with 59% of EU individuals using social networks in 2023, and many relying on these platforms for news about science and technology. However, traditional media is still perceived as more trustworthy compared to social media. The VERITY project employs a comprehensive methodology to assess the credibility of information on social media, particularly concerning COVID-19 vaccination messaging. This includes evaluating the sources of

posts, analyzing engagement metrics, conducting social network analyses, and employing AI techniques for sentiment analysis.

The VERITY project's findings reveal significant insights into the credibility of information on Online Social Networks (OSNs) during the COVID-19 vaccination period. An evaluation of information credibility indicated that 25% of messages on social media were sourced from unreliable outlets, as assessed by fact-checking platforms. While trustworthy messages generally received more likes and shares than untrustworthy ones, it is noteworthy that at the onset of the vaccination period, untrustworthy messages garnered significantly higher engagement. Furthermore, social network analysis illustrated that users who engaged with trustworthy sources were more likely to explore information from multiple outlets, whereas those interacting with untrustworthy sources tended to cluster around fewer sources.

Additionally, content analysis revealed the presence of specific conspiracy theories and disinformation accounts, highlighting public concerns and engagement patterns. Advanced methodologies, including deep learning techniques for sentiment and subjectivity analysis, were employed to understand public sentiment, revealing key users and messages that provoked negative reactions linked to disinformation. Furthermore, a Eurobarometer analysis provided demographic insights, indicating that younger individuals are more inclined to use social media for science and technology news, and are also more susceptible to believing in disinformation and conspiracy theories. Collectively, these findings underscore the complexities of trust in science as influenced by social media dynamics and highlight the need for effective strategies to combat misinformation.

e. Guidelines on the Ethical Use of Artificial Intelligence in Education and Research

The "Guidelines on the Ethical Use of Artificial Intelligence in Science and Studies," issued by the Ombudsperson for Academic Ethics and Procedures of Lithuania, address the transformative role of Artificial Intelligence (AI) in the digital age, particularly its implications for trust and disinformation in scientific research and education. While AI, especially generative AI, enhances the efficiency of content creation, it also poses significant risks by enabling the spread of disinformation, including fake news and deepfakes, which can undermine public trust in information and institutions. The guidelines emphasize the need for transparency in the use of AI, requiring a clear distinction between human and AI-generated content, and advocate for the implementation of robust verification processes to ensure the authenticity and reliability of AI outputs in academic settings.

To combat disinformation effectively, the guidelines recommend a multi-faceted approach that includes critical evaluation of AI-generated content to recognize inherent biases, enhancing AI literacy among stakeholders to foster responsible use, and ensuring compliance with legal frameworks like the GDPR. Institutions are urged to maintain a culture of transparency and ethical responsibility, viewing AI as a tool that complements human judgment rather than replacing it. By adhering to these principles, academic institutions can mitigate the risks associated with AI-generated disinformation and contribute to a digital environment that preserves and strengthens trust in information. The guidelines thus provide a comprehensive framework for the ethical use of AI, highlighting the importance of accountability and critical evaluation in maintaining academic integrity and public confidence in scientific outputs.

f. Science hoaxes, diminishing trust

The spread of science hoaxes and misinformation, especially during crises like the COVID-19 pandemic, presents significant threats to public health and safety, highlighting the urgent need for effective strategies to combat misinformation. With the rise of private messaging platforms, verifying information has become increasingly challenging, making it essential to provide the public with accurate, scientifically grounded information. While there is a general trust in scientists, this trust is not uniform and tends to be politically polarized, with conservatives showing lower levels of trust compared to progressives. The continued dissemination of disinformation exacerbates the erosion of confidence in science and its institutions, necessitating a focus on reliable, evidence-based information derived from empirical research.

The ScienceFlows research team at the University of Valencia analyzed hoaxes circulated via WhatsApp during the early months of the pandemic, revealing a substantial number of messages that promoted false COVID-19 prevention methods and cures. These hoaxes often claimed authority from self-proclaimed medical professionals and exploited scientific terminology to appear credible, ultimately encouraging harmful practices. In this context, the COALESCE Project, funded by the European Commission, aims to rebuild trust in science by establishing a European Competence Centre for Science Communication. This initiative seeks to mainstream knowledge in science communication through transparent practices that connect scientific information to individuals' experiences and values. By providing tools to combat misinformation, COALESCE aspires to enhance public understanding of science and ensure its role in shaping EU policies and addressing global challenges in the future.

g. Public and mediator perspectives on responsible science communication and participation – Implications for navigating online science (mis)information

The POIESIS project, funded by the European Commission, is a three-year research initiative aimed at exploring the intricate relationships between research integrity, societal integration, and public trust in science. Led by Aarhus University with six partner institutions across Europe, the project investigates how various stakeholders, including funding bodies and communication entities, can foster an environment that enhances societal trust in research. The project operates under the premise that increased integration of social actors in the research process, coupled with responsible research practices, can lead to higher public trust. Its objectives include understanding how factors like scientific misconduct and misinformation impact public perception, and developing recommendations to address societal mistrust and improve public engagement in research.

To achieve its goals, the POIESIS project conducts a variety of empirical studies, including public deliberative workshops, focus group interviews with institutional actors, and expert interviews with science mediators. The studies reveal that while citizens generally support public involvement in research, they express concerns about the expertise and capabilities of laypeople, suggesting that citizen engagement is most appropriate at early implementation stages rather than in decision-making processes. Furthermore, the findings show that effective science communication is critical for building trust, with citizens favoring traditional, reputable media over social media as sources of scientific information. Institutional actors also emphasize the need for comprehensive training for scientists in public engagement and the importance of mobilizing all stakeholders to create a culture of social integration. Overall, the POIESIS project aims to provide empirical insights that can inform strategies for enhancing trust in science and improving science communication in the context of evolving science-society relations.

h. Changing the communication paradigm – from influencing to enabling public debate

The decline in trust towards governments and public institutions has highlighted the need for a re-evaluation of public communication strategies, especially as the information environment becomes increasingly chaotic and overwhelming. The report "Trustworthy Public Communication - How communicators can strengthen the future of democracies" aims to provide evidence-based insights and recommendations to help public communicators navigate this complex landscape. It emphasizes the importance of effective communication for promoting democracy and discusses various modes of public communication, which can range from press releases to direct interactions with citizens. The report underscores that successful communication is contingent upon building and

maintaining public trust, encouraging communicators to act in trustworthy ways and invest in effective listening to enhance their credibility.

The report further delves into the dual paradigms of public communication: the "marketer," who focuses on spreading information and influencing behavior, and the "enabler," who facilitates public dialogue and empowers citizens to make informed decisions. It outlines the need for public agencies to clarify their communication goals and adapt their methods accordingly. The report also highlights the vital role of behavioral sciences in understanding citizen values and tailoring effective communication strategies that resonate with the public. Additionally, it warns against the dangers of a communication style that avoids public engagement, which can create information vacuums that allow disinformation to thrive. Instead, public communicators are encouraged to proactively address public concerns and combat misinformation before policy solutions are developed.

In light of the rapidly evolving information ecosystem, the report calls for public communicators to develop new skills and competencies to meet these challenges. It emphasizes the importance of transparency, ethical considerations, and meaningful engagement with citizens to foster trust in public administration. The report also introduces the TARES test as a practical ethical framework for communicators to assess their work in promoting democracy and public trust. Overall, it advocates for a shift towards more open and transparent communication practices that genuinely consider citizen input and foster a collaborative environment, ultimately strengthening the relationship between public institutions and the communities they serve.

3. Policy Recommendations

To combat mis- and disinformation in science, a comprehensive approach is essential to build trust in scientific endeavors, involving collaboration among all stakeholders within the trust ecosystem. This collaboration must occur at macro, meso, and micro levels to address the interconnected nature of science, politics, and economics, ensuring that everyone has an equal right to access and benefit from scientific advancements and their applications (Article 27(1) UDHR; Article 15(1)(b) ICESCR).

At the **macro level**, we aim to establish Global Governance solutions to promote responsible global research and the role of policymakers, including the UN, in coordinating efforts to tackle misinformation and disinformation on a global scale to ensure accountability. This includes regulating social media and industry players who significantly influence science production, funding, implementation, and communication (monetization of science). We are optimistic about the impact of EU regulations, such as the Brussels effect, and anticipate similar outcomes with the forthcoming Digital Service

Act, Digital Markets Act, Code of Practice on Disinformation, and Political Advertising Act. Additionally, we need a global strategy to safeguard the freedom of science and protect researchers, particularly through research-performing organizations (RPOs) like universities.

At the **meso level**, directed towards research funding organizations (RFOs) and research RPOs, there is a pressing need to develop guidelines for responsible science communication that clarify the roles of different stakeholders and assist citizens in assessing trustworthy communications. These organizations should also promote more accessible communication of scientific findings, including implementing reward and recognition systems, as well as providing training and resources.

Finally, at the **micro level**, all actors involved in the trust ecosystem for science bear responsibilities. We advocate for (1) diversifying the presentation of facts and values in narratives to better represent the population's diversity; (2) implementing incentives to encourage innovative hybrid collaboration methods that actively engage diverse communities and cultural groups, aiming to establish sustainable public engagement activities; and (3) committing to evidence-based practices, critically applying methods, and enhancing science communication for various audiences.

The research findings and insights from the TrustOn2024 event highlight the collaborative essence of science and trust. Science is a collective endeavor that extends beyond scientists to encompass the entire scientific community and the public. It requires inclusive and meaningful relationships within the trust ecosystem, engaging all actors and communities involved.

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