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Deliverable 5.1 – Digital handout with best practices and recommendations for aligning research efforts with societal needs and concerns

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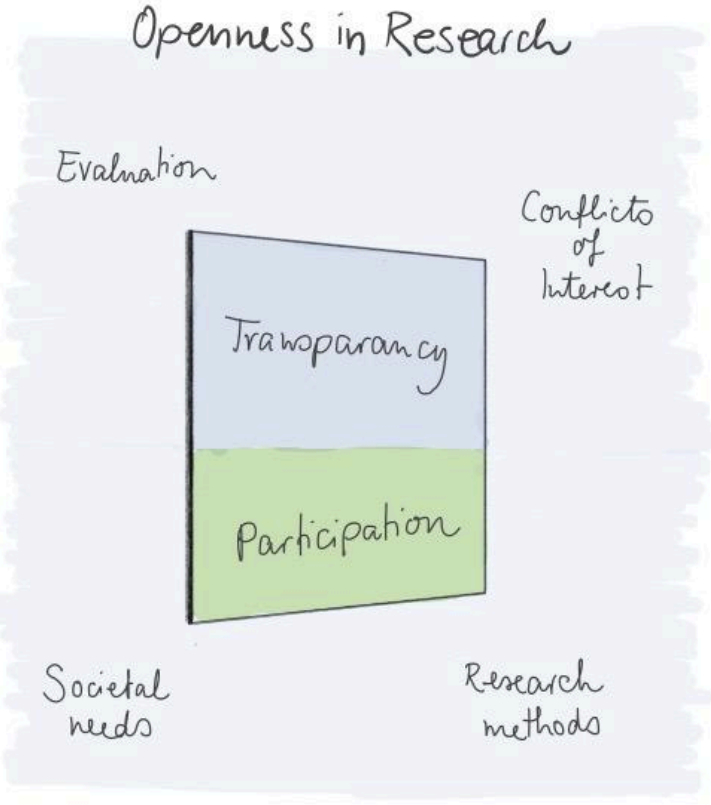
1. Introduction

This document offers an exploration of how co-creation and participatory methods shape Open Science, particularly in the context of the IANUS project. Aimed at both researchers and general audiences interested in science's role within society, it brings together multiple perspectives on Open Science's potential to make research more inclusive, transparent, and responsive to public needs.

Using the 'window' metaphor, we illustrate Open Science as a two-way process, where the public can gain insight into research practices, and researchers can see and respond to societal needs. The conclusions in this handout stem from research (via a content analysis, observations and workshops) carried out in the IANUS project's work package on Strengthening Co-Creation. These research efforts showed how Open Science, as a concept and perspective, served at and as the core of the different co-creation methods observed. It frames Open Science not as a toolbox, but as a conceptual contribution that integrates different participatory approaches and emphasises transparency, accountability and collaboration.



Each concept is elaborated on in one-page texts: First, we lay out how we perceive Openness as Participation, as it helps to share knowledge and benefits of research. Then, we describe Openness as Transparency, attributing to the accountability of research(ers). This allows us to discuss Participatory Research Methods next, particularly approaching how these are tinkered with. Thereafter, we focus on Open Science and Societal Needs, emphasising benefits and harms for researchers and the public. This is followed by a discussion of (potential) Conflicts of Interest, which can arise when conducting Open Science in co-creation settings. Last, we focus on how to Evaluate Participatory Methods effectively.

2. Openness as Participation

Openness fosters trust but is not a universal fix nor does a more open science automatically align with societal needs and values. Scientists are open to audiences when they involve them in the research process, either as **expert informants** or as **co-creation partners**. By being open and inclusive, scientists aspire to incorporate both the knowledge and the needs and values of citizens into the research process. In other words, open science **looks outward** toward societal stakeholders to learn from them and collaboratively guide research and innovation toward socially desirable outcomes.

Participation can take many forms, each with its own **conceptual and practical challenges** related to objectives, timing, representation, and problem framing. Moreover, despite best intentions, in practice, public participation often falls short of its promises, lacking meaningful impact or failing to challenge predefined agendas.

Why should scientists open up to societal stakeholders in the first place? A participatory turn in science can be motivated by different rationales. Substantive arguments acknowledge the limits of the scientific perspective and suggest that the outcome of a research endeavour will be improved when **multiple perspectives** are included. Normative arguments acknowledge that research and innovation significantly affect the lives of citizens and stress the importance of an **inclusive and democratic process.** Instrumental arguments see participation as a necessary means to achieve one's ends, including **increased public acceptance** of a scientific or technological development.

The **framework of Open Science** – as promoted by the EU and UNESCO – encourages openness as participation. Both institutions place emphasis on public engagement with societal actors beyond the scientific community. A prominent example is **citizen science,** where scientific work is conducted by actors who are not professional scientists. Citizen science can be understood in two ways: as a **democratised approach** that highlights the active role of the public in decision-making, and as a **contributory approach**, where citizens support scientists by gathering and analysing data. Both reflect an increased involvement of citizens in the scientific process albeit in different roles or with different responsibilities.

3. Openness as Transparency

Openness in science or by scientists can also be understood in terms of **transparency**. In this context, scientists are open to audiences when they are transparent about their processes and work, i.e. when they provide complete and accurate information about their actions in scientific research. By being transparent, scientists enable others to **have an unobstructed view** into their research process. Various aspects of the scientific process - from research design to data collection and analysis to publication - are thus made available for others to see, inspect, and

review. Ideally, this should foster public trust in science by **supporting citizens to rationally evaluate** the actions and claims of scientists. Moreover, exposure to a watchful gaze (of either peers or citizens) should have a **corrective function**: it should reduce misconduct and questionable research practices, leading to more reliable science. Finally, by providing sufficient information to citizens, scientists show a **willingness to be held accountable** by a broader public.

Core principles of good scientific conduct already establish an obligation for scientists to be transparent. In Europe, the "European Code of Conduct for Research Integrity" specifies the core principle of ***Honesty*** as operating in "a transparent, fair, full, and unbiased way". In the USA, the National Academies of Sciences, Engineering, and Medicine (NASEM) name both ***Honesty*** **and** ***Openness*** as core values of responsible scientific conduct. Typically, researchers (in their various roles) as well as research institutions and publishers are urged to be transparent over the following aspects:

- Data, methods, findings and other daily aspects of scientific practice, e.g. authorship
- Conflicts of interest
- The limits of one's research, including uncertainties
- Organisational procedures, such as procedures for addressing misconduct, procedures related to the promotion of academics, or procedures for granting access to open data and materials
- Problematic events or incidents, such as the case of misconduct or retractions

The **framework of Open Science** – as promoted by the EU and UNESCO – encourages scientists to be transparent, either for the sake of **quality control** or as their **social duty**. Strategies such as open data, open notebooks, preregistration, or open peer review facilitate quality control via scrutiny and inspection. Strategies such as open access to publications treat scientific knowledge as a common good that was previously obscured but is now openly accessible. While Open Science encapsulates more norms than the norm of transparency, **Open Science is, to a large extent, *transparent* science.**

4. Participatory Research Methods

Research methods that involve participation from stakeholders beyond the scientific community face **various complexities and tensions**. When assessing emerging participatory approaches to public engagement with science, technology, and innovation (STI), **four key challenges** stand out: digital engagement, inclusion of underserved audiences, cultivating appropriate scepticism, and emotional responses to differing perspectives. **Methodological innovation** can be seen as one way of addressing these challenges.

Through a **meta-analysis** of project deliverables and evaluative reports derived from EU-funded projects and initiatives, we conclude that innovation in participatory research does not typically stem from the development of entirely new methods. Instead, it emerges through ***tinkering***—the **adaptation and creative refinement of established methods** to suit specific contexts. This process of tinkering is central to addressing the unique challenges of a project. It ensures that participatory methods are both **innovative** and **sustainable** over time. It allows researchers to creatively respond to the specific needs of their projects while maintaining the **legitimacy and robustness** of their methods.

Tinkering **stems from** one of the challenges of employing participatory methods, namely **balancing *methodological conservatism***—the use of established, reliable methods—with the need for creativity and adaptability. While established methods provide stability, **reflexive practices** are necessary for ongoing adaptation. Reflexivity ensures that participatory methods remain responsive to the evolving socio-political contexts in which they were applied, thereby **promoting sustainability**.

Sustainability can be seen as a critical factor in the assessment of participatory research methods. The meta-analysis identified that sustainable participatory processes extended beyond the initial project funding and **created lasting structures** or communities of practice. One way of fostering sustainable participatory research is laying emphasis on the creation of **community-driven initiatives** designed to endure after a project's conclusion.

Therefore, striking a balance between methodological conservatism and creative adaptation ensures that participatory methods remain both **innovative and socially relevant**. Ultimately, this dynamic approach to research is vital for addressing the complex societal needs that participatory methods are designed to tackle.

Interested in reading more? Read our article on Understanding Methodological Innovation in Participatory Research.

5. Conflicts of Interest

Conflicts of interest in research pose a significant problem for scientific integrity but can be addressed through the principles of Open Science. Conflicts—arising from competitive pressures in academia and untransparent external financial influences—can undermine trust in research findings. However, **Open Science**, by promoting transparency and accountability, **helps mitigate these risks**.

Scientific misconduct, including falsification, fabrication, and plagiarism, results in research integrity violations that can undermine the principles of honesty and accountability. Open Science practices, such as open data and open methods, help to **counter questionable research practices** like selective reporting or inadequate oversight, enhancing research

quality. By fostering a culture of transparency, Open Science **can alleviate pressures** to publish or secure funding that often drive such misconduct.

Insufficient public research funding can increase the risk of conflicts of interest due to a lack of transparency in external funding sources. Financial dependence on external funders can influence research outcomes, with industry funding bodies potentially shaping research directions. Open Science encourages open dialogue about funding and financial disclosure, which helps to **mitigate these risks** by making funding sources and conditions more **transparent**.

Review systems in academia also present challenges, as bias in peer review can affect evaluations based on factors like affiliation, gender, or nationality. Open peer review, aligned with the principles of Open Science, **promotes accountability and reduces these biases** by making the review process more transparent and inclusive, thereby resolving conflicts of interest.

Research with dual-use potential requires careful oversight to prevent harmful applications. Open Science **emphasises stakeholder involvement** throughout the research process, ensuring ethical considerations are integrated from the outset. Participatory methods in all scientific fields foster transparency and prevent conflicts of interest that might arise from the dual-use potential of research.

Addressing these conflicts requires **promoting transparency, accountability, and a culture of shared responsibility**. Expanding the role of ethics committees from mere approval to active oversight aligns with Open Science principles. Promoting open research practices and stakeholder engagement throughout the research lifecycle ensures that ethical decisions are made with diverse input, consistent with participatory research methods and the goals of Open Science.

6. Open Science and Societal Needs

Openness fosters trust but is not a universal fix; scientists must **balance transparency with other values**, especially when public interests are at risk. For example, scientists need to evaluate the necessity for transparency in different contexts. In some cases, ***secrecy*** may be the trustworthy thing to do, e.g. when confidentiality is due or when public interests are at risk. Scientists regularly need to navigate this tension between openness, on the one hand, and privacy and security, on the other. Similarly, while sharing research with other stakeholders is crucial, ***seclusion*** can facilitate reflection and quality control; determining the right timing for opening up one's research is not always straightforward. Finally, ***excessive transparency*** may promote public distrust if it results in a flood of unintelligible information, i.e. if no effort is made to provide audiences with relevant and usable information. This indicates an important

role for **science communication** but raises ethical questions about decisions made about disseminating research results.

Despite its advantages in many contexts, not all types or aspects of research should, or can, be made open. An excessive emphasis on Open Science could lead to the misconception that legitimately 'closed' research is untrustworthy. This could foster *unwarranted* distrust toward reliable findings. Additionally, public trust in science can be harmed through ***Open washing***. This concept describes the risk of using open science strategies as signs of trustworthiness even if they do not correspond with reliable practices. Even if the discourse on openness and related rhetorical framing for opening up research are increasing, this does not imply actual changes in the research practices and institutions. This could result in *unwarranted* trust, i.e. trust in untrustworthy research.

Open Science aspires to **benefit society either directly** (e.g. by sharing the research results), **or indirectly** (by facilitating better science and innovation). However, adopting open science principles means engaging in ongoing **reflexivity** in order to maintain the legitimacy of the research and simultaneously promote transparency and accessibility. Research must be conducted according to open science principles by remaining flexible, inclusive, and capable of addressing complex problems, whether these are scientific or societal problems. Open science research projects that extend beyond the initial project funding can create **long-lasting structures** or communities of practice, **enabling continued societal impact** and fostering collaborative knowledge-sharing.

While inclusivity and societal engagement are fundamental to open science, this should not be done in a way that detracts from the **autonomy and independence of researchers**. While recognising the interconnections between scientists and the social contexts in which they develop and do their work, at times, researchers have to be able to keep a distance from the social and political pressures that might impede on their efforts. Participatory methods, largely aimed at aligning research with societal needs, should not subject scientists to external pressures that could compromise their **academic freedom**. Instead, participatory (or co-creation) approaches should serve as tools to strengthen the relevance and external validity of research, while encouraging researchers to contribute to a more resilient society.

7. Evaluating Participatory Methods

Co-creation is an **increasing demand** in publicly funded research and innovation projects. This has led to stakeholder engagement becoming an important concept in academic research and public policy. In a sense, co-creation is increasingly seen as a magical concept or panacea, assumed to help achieve a variety of positive effects. However, the concept of co-creation has neither **been sufficiently problematised** in academic literature or thoroughly defined for instance within EU policy documents. This has created a tendency to regard co-creation as just a

formality, turning co-creation into an exercise of merely including stakeholders neglecting the full potential of co-creation (Meister-Broekema, Bulder, & Horlings, 2023). In order to analyse the actual effect of co-creation, various evaluation approaches have been developed in recent years that themselves place a strong **focus on stakeholder engagement**. The following table briefly presents the different evaluation approaches to consider the impact of participatory practices:

Evaluation framework	**Key elements**
Participatory Impact Pathways Analysis (PIPA) *(Douthwaite et al. 2008)*	PIPA is designed to identify and analyse the pathways through which research leads to impact, with a strong emphasis on participatory methods. It helps stakeholders visualise the connections between research activities, outcomes, and impacts, facilitating better understanding and planning. The concept involves stakeholders and maps the steps from research outputs to eventual societal impacts (impact pathways).
Participatory Impact Assessment & Learning Approach (PIALA) *(Heinemann et al. 2017)*	PIALA is a participatory approach to assessing project impacts and promoting learning in development practice. It aims to incorporate the perspectives of those affected into the assessment process while creating a continuous learning environment. Stakeholders are engaged throughout the evaluation process.
Social Impact Assessment through Productive Interactions (SIAMPI) *(Spaapen & van Drooge 2011)*	SIAMPI focuses on the social impact of projects by analysing productive interactions between different stakeholders. It emphasises that the influence of a project depends heavily on the relationships and cooperation between the parties involved. The concept therefore evaluates the quality and outcomes of these interactions rather than just measuring traditional outputs of a project.
Contribution mapping *(Smit & Hessels 2021)*	Contribution mapping is a methodological approach to evaluating the contributions of projects to specific outcomes or changes. It aims to clearly identify and document the specific contributions that a project makes to the observed effects.
Payback framework *(Donovan & Hanney 2011)*	The Payback Framework is a model designed to evaluate the impacts of research, particularly in health and social sectors. It focuses not only on financial returns but also on broader societal and health benefits derived from research activities. The framework emphasises policymakers as main recipients of research and includes interfaces for interaction between researchers, policymakers, and potential users of research.
Socio-Economic Analysis of the Impact of Public Agricultural Research (ASIRPA) *(Joly et al. 2015)*	The ASIRPA concept examines how public agricultural research has social and economic impacts. It aims to assess the efficiency and usefulness of this research by analysing the interactions between research, innovation and agricultural practice. By emphasising stakeholder engagement, ASIRPA increases the relevance and effectiveness of agricultural research, leading to more sustainable and beneficial outcomes for society.

8. Final Notes and Further Reading

For readers interested in exploring the described concepts further, a list of resources is provided underneath. This additional reading expands on the theoretical and practical applications of co-creation, participatory methods, and Open Science, offering case studies and advanced analyses that deepen understanding of the concepts.

ALLEA (2023) The European Code of Conduct for Research Integrity – Revised Edition 2023. Berlin. DOI 10.26356/ECOC https://allea.org/code-of-conduct/

Barbosa Mendes, A., Bruns, C., Mahr, D. and Driessen, S. (2024). Understanding methodological innovation in participatory research: insights from participatory EU-funded projects *JCOM* 23(06), N03. https://doi.org/10.22323/2.23060803

Berti Suman, A., Toietta, A., and Mahr, D. (2022). A colourful toolbox: Health Citizen Science under the GDPR. DOI: 10.53962/rq8g-a6kd

European Commission on Open Science: https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

National Academies of Sciences, E. (2017). Fostering Integrity in Research. https://doi.org/10.17226/21896

Unesco's website on Open Science: https://www.unesco.org/en/open-science

Appendix

Short, accessible, designed version of the deliverable

CO-CREATION AND OPEN SCIENCE

Perspectives on Participatory Methods and Transparency

Introduction

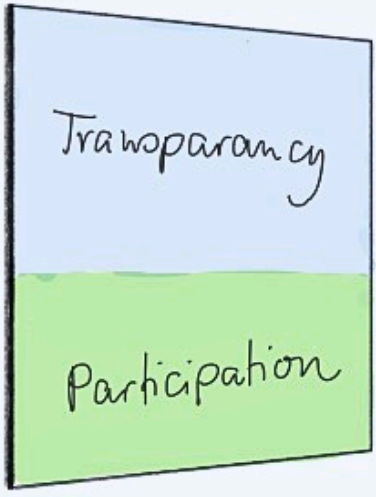
This document offers an exploration of how co-creation and participatory methods shape Open Science, particularly in the context of the IANUS project. Aimed at both researchers and general audiences interested in science's role within society, it brings together multiple perspectives on Open Science's potential to make research more inclusive, transparent, and responsive to public needs. Readers will gain insights into how Open Science principles are implemented, the value of co-creation, and how these practices address societal expectations of accountability and transparency.

Using the 'window' metaphor, we illustrate Open Science as a two-way process, where the public can gain insight into research practices, and researchers can see and respond to societal needs. This document frames Open Science not as a toolbox, but as a conceptual contribution that integrates different participatory approaches and emphasises transparency, accountability and collaboration. Each concept is elaborated on in short texts. For readers interested in a deeper context, a more extensive version can be found here, and further reading is recommended at the end of this document for those seeking additional resources.

Openness in Research

Evaluation

Conflicts of Interest



Societal needs

Research methods

Openness as Participation

Open Science prioritises public participation, engaging societal stakeholders as either contributors or collaborators throughout the research process. This participatory openness ensures that scientific inquiry is not isolated but enriched by diverse perspectives, aligning research objectives with societal needs. Citizen science, a prominent example, embodies this engagement: citizens might contribute by gathering data, helping analyse findings, or even taking part in the decision-making process. These roles not only democratise science but also increase its relevance and impact.

Three primary motivations support the participatory turn in Open Science:
Substantive - Enhancing research outcomes by integrating varied perspectives.
Normative - Upholding democratic principles in research that affects public life.
Instrumental - Fostering public acceptance and support for scientific endeavours.

Despite the advantages, public participation in science involves challenges, such as timing, representation, and the depth of stakeholder involvement. Effective participation requires strategies tailored to specific contexts, ensuring inclusivity and balancing differing interests. Open Science frameworks, promoted by the EU and UNESCO, highlight the role of public engagement in bridging science and society, helping to steer research toward socially desirable outcomes.

Openness as Transparancy

Transparency is a cornerstone of Open Science, facilitating public trust and enabling scrutiny of the research process. Through open data, preregistration, and open access publishing, scientists make their methods and results accessible, allowing the public to evaluate research independently.

This transparency ensures accountability and supports responsible research conduct, aligning with the European Code of Conduct for Research Integrity and guidelines from the National Academies of Sciences.

While transparency provides critical checks and balances, it requires a thoughtful balance with confidentiality, particularly when managing sensitive data. Over-sharing can lead to confusion or public distrust if information is overly technical or challenging to interpret. Therefore, transparency should be part of a broader strategy of effective communication that makes science comprehensible and actionable for all stakeholders.

Participatory Research Methods

Participatory methods in research bring together various stakeholders, blending established scientific techniques with innovative approaches to meet unique contextual challenges. Rather than introducing entirely new methods, participatory research often relies on tinkering—adjusting existing methods to enhance inclusivity and responsiveness.

This adaptable approach addresses challenges such as reaching diverse audiences, managing digital engagement, and fostering respectful discourse on contentious issues.

Meta-analysis of participatory projects reveals that sustainable impact stems from continuous engagement and adaptability. Projects that prioritise reflexivity, where researchers routinely reassess their methods to align with stakeholder feedback and evolving contexts, often achieve more lasting societal benefits. Sustainability is further strengthened when participatory projects cultivate communities of practice that endure beyond the project's lifespan, fostering ongoing knowledge exchange and public engagement.

Conflicts of Interest and Risks in Open Science

Conflicts of Interest (COIs) are a critical consideration in Open Science, arising when external pressures compromise scientific integrity and accountability. Funding dependencies, publishing pressures, and institutional biases can create COIs that undermine transparency. By involving public stakeholders at multiple research stages, Open Science and participatory methods provide a framework to identify and mitigate these risks, enhancing ethical oversight and ensuring that research remains aligned with societal values.

COIs often manifest as issues such as selective reporting, publication bias, or skewed peer review processes. Open peer review, financial disclosure, and expanded roles for ethics committees are strategies that Open Science adopts to counter these risks. Open peer review, for example, increases accountability, reduces biases in evaluations, and aligns with Open Science's core principles of transparency and inclusivity.

COIs also highlight the importance of clear ethical guidelines for research with dual-use potential—where findings could have both beneficial and harmful applications. Through stakeholder involvement, participatory research can preemptively address ethical considerations, ensuring that the research aligns with public interests and minimises potential misuse.

Open Science, Societal Needs, and Potential Risks

While transparency promotes trust, Open Science also introduces unique challenges when navigating between openness and the protection of public interests. For instance, sharing information prematurely or without sufficient context can result in misunderstandings or even warranted distrust. Open washing—presenting superficial transparency without genuine substance—risks public trust by masking untrustworthy practices under the guise of openness.

Open Science aspires to societal benefits, achieved directly through data sharing and indirectly by cultivating an informed, engaged public. Yet, these benefits are only realised when transparency practices are reflective, adaptable, and aligned with ethical considerations.

Reflexivity—actively assessing the appropriateness and impact of transparency—ensures that Open Science practices remain responsive to changing societal needs. This flexibility, inclusivity, and ethical consideration allow Open Science to address complex societal challenges while fostering long-lasting community engagement.

Evaluating Participatory Methods

Evaluating participatory research methods is essential for understanding their impact on both science and society. Effective evaluation requires frameworks that assess not just outcomes but also the interactions between stakeholders, supporting an iterative process of reflection and refinement. Several established frameworks guide these assessments:

1. Participatory Impact Pathways Analysis (PIPA) - Maps research activities to societal impacts, helping stakeholders understand the pathways through which their participation leads to change.
2. Social Impact Assessment through Productive Interactions (SIAMPI) - Prioritises the quality of relationships and interactions among stakeholders, recognizing these as key drivers of impact.
3. Contribution Mapping - Clearly identifies a project's unique contributions to broader social objectives, clarifying its societal role.
4. Payback Framework - Assesses the societal and financial returns of research, particularly relevant in health and social science fields.

These frameworks provide tools for measuring the varied impacts of participatory methods, offering a comprehensive view of how Open Science and co-creation approaches enhance societal relevance and inclusivity.

Further Reading

For readers interested in exploring these concepts further, a list of resources is provided at the end of this document. This additional reading expands on the theoretical and practical applications of co-creation, participatory methods, and Open Science, offering case studies and advanced analyses that deepen understanding. Acknowledgments are also given to the team members who contributed to the development of this document, celebrating the collaborative effort behind this exploration of Open Science.

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National Academies of Sciences, E. (2017). Fostering Integrity in Research. https://doi.org/10.17226/21896

Unesco's website on Open Science: https://www.unesco.org/en/open-science

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