

# research waste

## Table of Contents

summary

Types of Research Waste

- Methodological Research Waste

- Invisible Research Waste

- Negligible Research Waste

- Underreported Research Waste

- Structural Research Waste

Causes of Research Waste

- Categories of Research Waste

  - Question Selection

  - Study Design

  - Publication

  - Reporting

- Implications of Research Waste

Impacts of Research Waste

- Economic Consequences

- Social Implications

- Influence on Scientific Quality

Strategies to Reduce Research Waste

- Understanding Research Waste

- Frameworks for Improvement

- Enhancing Research Design

- Ethical Oversight

- Open Research Practices

- Collaboration and Capacity Building

Case Studies

- Overview of Research Waste in Different Fields

- Methodological Studies

- Case Studies in Ecological Research

- Open Science Initiatives

Objectives of Open Science Initiatives  
Impact on Research Waste  
Collaborative Frameworks and Policies  
Lessons Learned from Success Stories

Lessons Learned

Open Science Initiatives

Objectives of Open Science Initiatives  
Impact on Research Waste  
Collaborative Frameworks and Policies  
Lessons Learned from Success Stories

Influence on Policy and Funding

Funding Sources and Research Outcomes  
Importance of Transparency in Funding  
Stakeholder Engagement in Policymaking  
Challenges to Evidence Utilization

Check <https://storm.genie.stanford.edu/article/250657> for more details

Stanford University Open Virtual Assistant Lab

The generated report can make mistakes.

Please consider checking important information.

The generated content does not represent the developer's viewpoint.

## summary

Research waste refers to the inefficiencies and misallocation of resources within the scientific research process, particularly in biomedical and ecological fields. Estimates indicate that up to 85% of research funding may be wasted due to various factors, including inadequate study design, poor question selection, and ineffective reporting practices.<sup>[1][2]</sup> This pervasive issue not only undermines the integrity of scientific inquiry but also has profound economic and social implications, leading to significant financial losses and hindered advancements in public health and environmental sustainability.<sup>[3][4]</sup>

The classification of research waste can be divided into four primary categories: Question Selection, Study Design, Publication, and Reporting.<sup>[1][4]</sup> Each category highlights different stages where inefficiencies can occur. For instance, poor planning may result in redundant studies, while flawed methodologies can compromise the validity of findings.<sup>[2]</sup> Additionally, many studies fail to reach publication, a phenomenon known as publication bias, which skews the scientific literature and obscures valuable insights.<sup>[3]</sup> Underreporting of results further complicates the landscape, limiting the reproducibility and utility of research outputs.<sup>[2]</sup>

Controversies surrounding research waste have sparked calls for reform across the scientific community. Critics argue that systemic changes are necessary to enhance the efficiency of research practices, including the adoption of open science initiatives and improved ethical oversight by research committees.[\[4\]\[2\]](#) These reforms aim to foster transparency, promote collaboration, and ultimately ensure that research efforts contribute meaningfully to scientific knowledge and societal well-being.

In summary, addressing research waste is critical for maximizing the value of research investments and improving outcomes in both health and environmental fields. The commitment to reforming research practices not only stands to enhance the integrity and effectiveness of scientific inquiry but also to safeguard public trust in research as a tool for social progress.[\[3\]\[2\]](#)

## Types of Research Waste

Research waste in the biomedical field has been categorized into various types that contribute to inefficiencies in the research process. According to a study by Chalmers and Glasziou, it is estimated that 85% of funds allocated to research are wasted due to inadequate production and reporting of results[\[1\]](#). The different types of research waste can be broadly divided into four primary categories: Question Selection, Study Design, Publication, and Reporting.

### Methodological Research Waste

Methodological research waste includes flaws in the study design, conduct, or analysis of research projects. A scoping review categorized research waste into five aspects, referred to as MINUS waste: methodological, invisible, negligible, underreported, and structural[\[3\]](#). Methodological waste constitutes a significant portion, with over half of the reviewed reports indicating issues in study design that hinder the reliability and validity of findings. These methodological flaws can lead to misleading conclusions and ultimately diminish the overall value of research outputs[\[4\]](#).

### Invisible Research Waste

Invisible research waste pertains to research that remains unpublished or is discontinued before completion, leading to a loss of valuable data and insights. This aspect of waste also includes the lack of data-sharing among researchers, which can further exacerbate the inefficiencies in the research ecosystem. According to the aforementioned scoping review, this category highlights the importance of transparency and dissemination in maximizing the value of research efforts[\[3\]](#).

### Negligible Research Waste

Negligible research waste primarily arises from unnecessary repetitions in studies, often due to the absence of thorough literature reviews prior to conducting new trials. This type of waste can dilute the scientific rigor of a field, as it leads to overlapping findings that do not contribute additional knowledge[\[3\]](#). Addressing this issue requires

better planning and awareness of existing research to ensure that new studies are genuinely novel and necessary.

## Underreported Research Waste

Underreported research waste involves poor reporting practices, resulting in incomplete or unclear findings that can mislead future research and policy decisions. This aspect of waste emphasizes the need for adherence to established reporting standards to enhance the clarity and utility of research outputs[3][2]. Inadequate reporting can obscure significant results, thereby limiting their impact on the scientific community and public health initiatives.

## Structural Research Waste

Finally, structural research waste arises from systemic issues such as inadequate management, collaboration, and prioritization of research efforts. These inefficiencies can result in underpowered studies and a lack of coordination among researchers, undermining the potential benefits of collective research efforts[2]. Addressing these structural barriers is essential for improving the overall efficiency and effectiveness of research practices.

## Causes of Research Waste

Research waste is a significant issue across various scientific fields, particularly in biomedicine and ecology, where inefficiencies can lead to substantial resource loss. Several factors contribute to this waste, which can be categorized into distinct types.

## Categories of Research Waste

Research waste can be broadly divided into four primary categories: Question Selection, Study Design, Publication, and Reporting[1]. Each of these categories reflects different stages of the research process where inefficiencies can arise.

### Question Selection

Poor planning and prioritization of research questions often lead to duplicative studies that fail to advance scientific understanding[2]. Researchers may choose questions that are either redundant or of low importance, thereby squandering resources that could be allocated to more meaningful inquiries[2].

### Study Design

Inappropriate study design is another major contributor to research waste. Flaws in the methodology can result in uninformative or misleading results. Common issues include inadequate sample sizes, lack of control groups, and improper statistical analyses[2]. These design shortcomings not only affect the validity of individual studies but can also misguide future research directions.

## Publication

The publication process can also foster waste. Many studies fail to reach publication due to perceived lack of novelty or significance, despite potentially valuable findings[3]. This publication bias skews the scientific literature, leaving important results unpublished and unrecognized[1]. Moreover, the increasing volume of research articles may overwhelm researchers, making it challenging to stay current and thus potentially leading to redundant studies[3].

## Reporting

Finally, the way research is reported plays a critical role in research waste. Inadequate or unclear reporting can hinder the reproducibility of studies, which is essential for validating findings and advancing knowledge[2]. Researchers may fail to share their data or methodologies adequately, limiting the ability of others to build upon their work. Additionally, a lack of coordination among studies within the same institution can undermine participant recruitment and result in terminated or underpowered studies[2].

## Implications of Research Waste

The implications of research waste are profound. It is estimated that a staggering 85% of research investment may not contribute meaningfully to scientific advancement or social good[2][5]. As ecological and biomedical challenges grow, addressing the causes of research waste becomes increasingly critical for the efficient use of resources and the enhancement of research value[4].

## Impacts of Research Waste

Research waste has significant implications across various scientific fields, particularly in biomedical and ecological research. It not only undermines the integrity of the research process but also leads to considerable economic and social costs.

## Economic Consequences

The economic impact of research waste is substantial. A study by Chalmers and Glasziou (2009) estimated that up to 85% of funding in biomedical research is wasted due to inefficiencies in production and reporting[1]. In ecological research, it has been found that only 11-18% of conducted studies reach their full informative value[4]. This indicates a severe loss of resources, as funds spent on ineffective research could have been directed towards more valuable scientific endeavors. Additionally, the absence of FAIR (Findable, Accessible, Interoperable, and Reusable) data practices has been estimated to cost the European economy at least €10.2 billion annually[6].

## Social Implications

The social ramifications of research waste are equally concerning. Studies lacking sufficient scientific and social value expose participants to risks without advancing scientific understanding[2]. Research ethics committees could play a critical role in minimizing waste by evaluating the potential value of studies before granting approval. However, they face challenges, including insufficient scientific expertise and time to conduct thorough evidence reviews[2]. This situation highlights the need for collaboration among funding agencies, researchers, and ethics committees to ensure that studies contribute meaningfully to scientific knowledge and public welfare.

## Influence on Scientific Quality

The pervasive issue of research waste also threatens the overall quality of scientific output. Historical predictions have suggested that the exponential growth of research could lead to a decline in quality control within the scientific community[7]. Concerns regarding commodification and the outsourcing of research to profit-driven entities further exacerbate this decline, indicating a need for systemic changes to uphold the integrity of scientific research.

# Strategies to Reduce Research Waste

## Understanding Research Waste

Research waste is a significant issue across various scientific disciplines, particularly in biomedical and ecological research. Estimates suggest that up to 85% of research funding may be wasted due to factors such as inadequate study design, poor question selection, and ineffective reporting practices[8][1]. Recognizing and addressing these inefficiencies is critical to maximizing the value of research and ensuring that resources are used effectively.

## Frameworks for Improvement

To combat research waste, several frameworks and guidelines have been proposed. For instance, the INQUIRE framework offers a structured approach that can be operationalized at multiple levels, including the study level, to assess and improve research quality[9]. This framework can serve as a common language among stakeholders, fostering discussions on how to enhance research practices and reduce waste across academia and other sectors.

## Enhancing Research Design

A robust research design is essential for minimizing waste. Flaws in the design phase can lead to unreliable results and decreased overall value[10]. Researchers are encouraged to invest time in developing thorough research plans that clearly outline objectives, methodologies, and potential limitations. By doing so, they can enhance the quality and reliability of their findings.



## Ethical Oversight

Research ethics committees play a crucial role in minimizing waste by evaluating proposed studies for their potential value. Salman et al. suggest that these committees could take a more proactive approach by approving or rejecting studies based on their perceived utility[2]. However, there are challenges to implementing this strategy, such as the need for clear criteria to assess the potential wastefulness of research projects.

## Open Research Practices

Adopting open research practices, including open data initiatives and open peer review, is another strategy for reducing waste. Sharing data and methodologies publicly can enhance transparency, facilitate reproducibility, and encourage collaboration within the research community[11]. Such practices can also help mitigate the replication crisis by making it easier for other researchers to validate findings and build upon existing work.

## Collaboration and Capacity Building

Investment in research infrastructure and collaboration among stakeholders is vital for improving research uptake and reducing waste, especially in low- and middle-income countries (LMICs)[12]. Engaging diverse stakeholders can foster partnerships that promote the use of research findings in policymaking and support capacity-building efforts. This collaborative approach can help address structural barriers that hinder effective research translation.

## Case Studies

### Overview of Research Waste in Different Fields

Research inefficiencies, often labeled as "research waste," can lead to significant financial losses and hinder scientific progress. Various studies illustrate the extent of waste across different research disciplines. For instance, a 2009 study by Chalmers and Glasziou revealed that as much as 85% of research funding in the biomedical field is squandered due to poor production and reporting practices[1][2]. This alarming statistic underscores the need for a critical examination of research methodologies and their impacts on the scientific community.

### Methodological Studies

Methodological studies serve as a vital tool in identifying and addressing research waste. These studies report on the design, conduct, analysis, or reporting of both primary and secondary research, thereby allowing for an appraisal of the quality and consistency of health research[13]. Analyzing specific fields, journals, and geographical regions can highlight systemic issues contributing to waste. For example,

researchers have investigated the adherence to reporting standards, such as the CONSORT guidelines in randomized trials, which shed light on how reporting practices influence the integrity of scientific findings[13].

## Case Studies in Ecological Research

One of the more recent investigations into research waste focused on ecological studies, which are crucial given their relevance to global sustainability challenges. This study estimated that only 11-18% of ecological research achieves its full informative value[4]. By conducting a literature review and meta-analysis, researchers were able to quantify waste components and emphasize the necessity for improved research practices in ecology.

## Open Science Initiatives

Open science initiatives have emerged as a pivotal movement aimed at enhancing the transparency, accessibility, and reproducibility of research practices. By embracing the principles of openness, these initiatives seek to democratize knowledge, encourage collaboration, and reduce research waste in various scientific fields.

## Objectives of Open Science Initiatives

Open science aims to make research outputs, including data, methodologies, and publications, more readily available to the public and the scientific community. The fundamental goals include improving accessibility to scientific knowledge, fostering collaboration among researchers, and enhancing public engagement with scientific research. This alignment with the broader goals of societal benefit has driven the rapid adoption of open science practices over the past decade[14][15].

## Impact on Research Waste

One of the critical challenges that open science initiatives address is the issue of research waste. Evidence from biomedical research has indicated that a significant portion of research findings is avoidably wasted due to inefficiencies in study design, reporting, and dissemination[4][3]. Open science practices, such as preregistration of studies and sharing raw data and methodologies, have been proposed as solutions to mitigate this waste by promoting better planning and transparency in research processes[11][4].

## Collaborative Frameworks and Policies

The advancement of open science policies and mandates by governments, funding agencies, and academic institutions plays a crucial role in this movement. As these policies become more comprehensive—encompassing open access to publications, open data, and open methodologies—they are expected to drive a more universal commitment to the principles of open science[14]. Advocacy organizations like



SPARC and Open Knowledge International have been instrumental in promoting these policies and raising awareness of the benefits of open science practices[15].

## Lessons Learned from Success Stories

The exploration of successful open science initiatives reveals several key lessons for the scientific community. These initiatives demonstrate the importance of fostering a culture of transparency and collaboration, which can lead to diverse, just, and sustainable research outcomes. Additionally, the journey of these initiatives underscores the necessity for continued commitment and innovation in order to fully realize the potential of open science in advancing research and societal contributions[14][6].

## Lessons Learned

Through the evaluation of various research practices, several key lessons have emerged. It is essential for institutions to support changes in reward and incentive structures that prioritize responsible research. Engaging researchers, clinicians, and administrators through both top-down and bottom-up approaches can foster a community commitment to reducing waste[16]. This holistic engagement is critical in building a sustainable research culture that values transparency and integrity in scientific inquiry.

## Open Science Initiatives

Open science initiatives have emerged as a pivotal movement aimed at enhancing the transparency, accessibility, and reproducibility of research practices. By embracing the principles of openness, these initiatives seek to democratize knowledge, encourage collaboration, and reduce research waste in various scientific fields.

## Objectives of Open Science Initiatives

Open science aims to make research outputs, including data, methodologies, and publications, more readily available to the public and the scientific community. The fundamental goals include improving accessibility to scientific knowledge, fostering collaboration among researchers, and enhancing public engagement with scientific research. This alignment with the broader goals of societal benefit has driven the rapid adoption of open science practices over the past decade[14][15].

## Impact on Research Waste

One of the critical challenges that open science initiatives address is the issue of research waste. Evidence from biomedical research has indicated that a significant portion of research findings is avoidably wasted due to inefficiencies in study design, reporting, and dissemination[4][3]. Open science practices, such as preregistration of studies and sharing raw data and methodologies, have been proposed as solutions to mitigate this waste by promoting better planning and transparency in research processes[11][4].

## Collaborative Frameworks and Policies

The advancement of open science policies and mandates by governments, funding agencies, and academic institutions plays a crucial role in this movement. As these policies become more comprehensive—encompassing open access to publications, open data, and open methodologies—they are expected to drive a more universal commitment to the principles of open science<sup>[14]</sup>. Advocacy organizations like SPARC and Open Knowledge International have been instrumental in promoting these policies and raising awareness of the benefits of open science practices<sup>[15]</sup>.

## Lessons Learned from Success Stories

The exploration of successful open science initiatives reveals several key lessons for the scientific community. These initiatives demonstrate the importance of fostering a culture of transparency and collaboration, which can lead to diverse, just, and sustainable research outcomes. Additionally, the journey of these initiatives underscores the necessity for continued commitment and innovation in order to fully realize the potential of open science in advancing research and societal contributions<sup>[14][6]</sup>.

## Influence on Policy and Funding

### Funding Sources and Research Outcomes

The source of funding for research plays a critical role in determining the quality and integrity of the findings. Some studies suggest that industry-funded research may report more favorable outcomes compared to non-industry-funded studies, potentially due to conflicts of interest inherent in such funding arrangements. For instance, Kaiser et al. found that while the reporting quality of obesity and nutrition randomized trials was comparable regardless of funding source, other research, such as that by Thomas et al., indicated that industry-funded studies had better reporting quality in long-term weight loss trials<sup>[13]</sup>. Furthermore, Kan et al. identified a strong correlation between industry funding and the likelihood of trials reporting significant positive outcomes, a finding echoed by a Cochrane Methodology Review by Hansen et al.<sup>[13]</sup>.

### Importance of Transparency in Funding

Transparency in research funding is crucial for maintaining the integrity of scientific inquiry. Many journals require funding statements, although this practice is not universally adopted. Ensuring that all research publications include detailed funding statements can promote transparency and foster a better understanding of the relationship between funding sources and research outputs. This transparency may also facilitate future meta-research on funding allocation and its effects on research quality<sup>[17]</sup>.

# Stakeholder Engagement in Policymaking

The active engagement of stakeholders, including funders, community organizations, and local leaders, is essential for effective research implementation and policy development, particularly in low- and middle-income countries (LMICs). By involving these stakeholders from the inception of research projects, researchers can better align their work with local needs, foster collaboration, and enhance the uptake of evidence for policymaking<sup>[12]</sup>. Despite the complexities of the bureaucratic environments in LMICs, establishing strong partnerships and communication channels among stakeholders can mitigate barriers to evidence utilization and improve health policy outcomes.

## Challenges to Evidence Utilization

A significant portion of research resources is wasted due to various barriers, including poor access to high-quality research, inadequate timeliness of evidence delivery, and misaligned priorities between researchers and policymakers. According to the World Health Organization (WHO), implementing evidence-informed decision-making is vital for enhancing the effectiveness and equity of health policies. However, many decision-makers do not receive timely access to relevant research, leading to inefficient use of resources<sup>[12][2]</sup>.

To address these challenges, building strong networks and relationships among stakeholders is paramount. Collaboration among researchers, policymakers, and community representatives can facilitate the effective communication of research findings and foster a culture of evidence-informed policymaking<sup>[18][2]</sup>.

By focusing on clear communication strategies and fostering stakeholder engagement, researchers can increase the impact of their work on public policy, ensuring that it is rooted in the best available evidence<sup>[18]</sup>.

## References

- [1]: [Before You Start Your Research : How to Avoid Research Waste](#)
- [2]: [Five aspects of research waste in biomedicine: A scoping review](#)
- [3]: [Quantifying research waste in ecology - PubMed](#)
- [4]: [Reducing Research Waste | Bioethics - Harvard University](#)
- [5]: [Research waste is still a scandal—an essay by Paul Glasziou and Iain ...](#)
- [6]: [Open Science Success Stories](#)
- [7]: [Replication crisis - Wikipedia](#)
- [8]: [How to increase value and reduce waste when research ... - PubMed](#)
- [9]: [Academic response to improving value and reducing waste: A ...](#)
- [10]: [Design Flaws to Avoid - Organizing Your Social Sciences Research Paper ...](#)
- [11]: [Open science saves lives: lessons from the COVID-19 pandemic](#)
- [12]: [Challenges for research uptake for health policymaking and practice in ...](#)

- [13]: [A tutorial on methodological studies: the what, when, how and why](#)
- [14]: [Case Studies in Open Science: Success Stories and Lessons Learned](#)
- [15]: [Improving the trustworthiness, usefulness, and ethics of biomedical ...](#)
- [16]: [25 Best Open Science Initiatives and Practices - SCI Journal](#)
- [17]: [Community consensus on core open science practices to monitor in ... - PLOS](#)
- [18]: [Ten things to know about how to influence policy with research](#)