

Tables

Table 1. The nine emerging challenge areas identified in the stakeholder interviews, including illustrative quotes

Challenge area	Illustrative quotes
Reproducibility crisis	
	"I would prefer to have much more quality and less quantity. When I look at how much the researchers at my faculty are publishing, it's a lot. And I guess it's because it's how you get promoted. So you want to publish. So that's kind of the motivation for the individual. I mean... you can, of course, look at different perspectives. But for the individual researcher, a young postdoc or PhD, if you want to have a career as a researcher, you need to publish to show that you are ready to go to the next step of your career. And in that way, I think we have a system where publications are too important." Lilian, university administrator "You might say, I don't want to publish for a certain publisher because they make huge profits... However, you have to publish with a journal belonging to their portfolio because it's a high-ranking journal, and to advance your career or your research funding, you need to publish in that journal." Timothy, publishing consultant "The only currency that counts in 2025, 2024, etc., is publishing. That's the only thing that counts. So the way you get hired is by how many papers you publish. The way you get promoted: How many papers have you published? Tenure: How many papers have you published? So that is the centrality of everything." Patrick, senior researcher "High-power academics will say: Well, I'm doing this for my students, because I need to encourage them to publish in high-ranking journals, because that's the way things are, and that's the way things can only be, and we can't change the system, we can only adapt to it or navigate it. And of course, low-power individuals in the lower rungs of the hierarchy will say: Well, I'm doing this because I don't have power and I need to find a job... so academia has become extremely precarized, you know... jobs are becoming scarcer..." Barbara, senior researcher
Academic career progression and precarity	
Research	"[...] don't you think that every scientist dreams of making a huge discovery, something that basically changes the way

integrity and misconduct	<i>that we think about stuff, a paradigm shift? I mean, this is the most beautiful thing that you can do as a scientist. I think most people think so. And this is what people strive for. And this is the product that the big journals are looking for. They are looking for unique stories, stuff that has not been published previously, something that potentially could make a leap forward in understanding of biology. And that's all very good. The problem is that most of these studies are never replicated. And another problem is that, okay, I want to replicate what these guys did. Yes, I could do that. Fantastic. Do you think anybody's interested in publishing that? No, that's not interesting. It's not novel. It's already been published. So we have created a situation where robust science, which really is necessary, that is, the replication of data, is not deemed as impactful." Salem, editor-in-chief</i> <i>"The primary function of the biomedical publishing system is to act as a scholarly record, as a persistent, enduring record of science to support the current and ongoing scientific endeavour, and that scientific publications have a role to filter and to accredit content that is published, and to ensure that that content fully meets obligations around ethics and research integrity. Probably the biggest challenge at the moment - not just for biomedical publishers but for all publishers - is challenges to research integrity. And that's where there's an even greater focus now on the due-diligence process around editorial peer review." Timothy, publishing consultant</i> <i>"The underlying motivation is still there within academic communities and authors to commit fraud because of the downward pressure on research assessment... the pressure on career progression." Timothy, publishing consultant</i>
Journal prestige hierarchy and bibliometrics	<i>"Well, I think by necessity, we rely quite a lot on publications. Just because it's a unified medium, so to speak, across all the grantees. So it meets the same standards, and it's relatively easy to synthesize." Tomas, funder</i> <i>"I think as an editor, you're aware of the impact of the journal. And you know for a fact that replication studies will not be cited as much. So you're reluctant to publish that because it will hurt your impact factor. [...] So our citation curve is hyperbolic. We have a few papers each year that are cited a lot. They are in the hundreds. And then there's a long tail of papers which may be only cited once or twice, or maybe not even once. So, as an editor, you need to find those blockbusters so that you can publish all the rest of the papers that you think are really good. So that there is space for more esoteric [...] studies." Salem, editor-in-chief</i> <i>"However, the other driver for researchers is still the Journal Impact Factor. So, this is the 50th anniversary of the Journal Impact Factor, and Eugene Garfield launched that with an editorial, saying: Do not use this to evaluate the</i>

	quality of a journal. Nobody's listened for 50 years. It's used as a proxy for quality." Timothy, publishing consultant "These journal metrics were initially developed by some independent corporation [...]. Anyway, one of these scores was eventually bought by the big publishing corporations, and the metric became the goal, and that was very good for the corporations because they sort of controlled both the metrics and the things to which the metrics were associated." Barbara, senior researcher "Number of publications and metrics of publications are quite easy to measure, and, of course, scientific production is of ultimate value for many industries and many academic institutions. These two have resulted in that shift toward higher focus on these metrics and the number of publications compared to other aspects of academic work." Samuel, senior researcher
Peer review crisis	
	"So there's a fatigue within the peer review community, simply by the huge exponential growth in open access publications and open access journals over the last 10-15 years. So that has created the bottleneck, the pressure point, because there are limited numbers of peer reviewers who are willing to allocate their own time because it's unpaid time from a commercial publisher's point of view." Timothy, publishing consultant "Most papers that are published today have more authors than readers. And many are read only by machines, so they're good for meta-analysis and aggregation, but nobody reads them, or extremely few people read them. And so, it's a waste of resources to peer review that kind of thing." Lucy, editor-in-chief "I think there are probably too many publications that don't really add anything to our scientific body of knowledge but still satisfy the needs of researchers to publish to secure their own career. [...] also for the research funders to see that there's an impact of their funding and so it satisfies the needs of actors within the system without adding anything significant to the scientific body of knowledge." Giovanni, senior researcher
Systemic overproduction of scientific output	
Peer review capacity and quality	"It may be a surprise to you, but sometimes in journals, we may have to invite 100 people to peer review. It is not uncommon. I'm sure that in some journals it's easier, and in some journals it's harder." Trent, publisher "There are a lot of people who submit papers who never peer review." Trent, publisher

	<i>"There are thousands of ways in which peer review can fail. I mean, one thing would be that you recommend your best friends, and they will give you a glowing review report, and the journal has no way of finding out." Salem, editor-in-chief</i> <i>"[Peer review] is, honestly, one of the biggest weak points of the commercial publishing system, right? Because it's still free labor, and because it's anonymized, you can always say no. Even though it's rarely the case. [...] people have this fear that if you don't peer review, you'll suffer in your academic career." Barbara, senior researcher</i> <i>"And as an example, if I'm giving a talk and there are 100 people, and I ask how many of you have training, formal training, in peer review? Usually, one hand goes up; 99 hands don't go up. [...] A systematic review from, I don't know, maybe two years ago, showed that there are almost no online free resources for people to have peer review training." Patrick, senior researcher</i> <i>"How do you define manuscript peer review? In 2025, we do not have an agreed-upon global consensus perspective on what manuscript peer review is." Patrick, senior researcher</i> <i>"Another thing that is a lot less developed but there are conversations around is whether all of these four-million-plus papers need peer review. And the idea there is, of course, that if a paper's readership is mostly its field, then every reader will be a peer reviewer. And if it is your field, you will know whether you can trust this or not, whether controls are missing, how conclusive it is, whether the techniques used are appropriate..." Lucy, editor-in-chief</i>
Artificial intelligence as a double-edged sword	<i>"We have policies saying you can't create images, you can't create data, using AI, you can't create figures and tables, because you know... they're often not correct... and that goes back to, like, why it's so important to have rigorous peer review, right? Because there's no way that that rat image was rigorously peer reviewed." Trent, publisher</i> <i>"Something we've seen recently is that some reviewers get fed up and basically have ChatGPT or another LLM write the review reports for them. We've had one or two of those cases. I think that's also a misuse of peer review." Salem, editor-in-chief</i> <i>"It's a double-edged sword, absolutely. The problem at the moment is that because of the ubiquitous access to</i>

	generative AI tools [...], it's too easy for companies that offer fraudulent publication services to amplify their process, and to conflate an existing problem of fraudulent publication [...]. And publishers trying to address that problem by creating tools that are counter to that is short-termism because they will never keep up... Because those who want to fraudulently publish are commercial entities, they're driven to be well ahead of the processes and practices of a publisher or publication." Timothy, publishing consultant "The issue with me with AI is even if it's doing something good, like, I don't know, a person in an impoverished country is asking for information about medical advice... and even if they receive the accurate information, the fact that they've asked, that they're forced to ask a prompt for this, sort of evinces that we're not actually going to solve the problem itself. We're not going to solve the issue that this person doesn't have access to a hospital or to a doctor... instead, we're going to give them a robot." Barbara, senior researcher
Accessibility crisis	
	"[...] the publisher tells us that we're not making any money anymore. They say we're actually [...] losing money. I'm not entirely sure that that's correct, but it's very difficult for us to check numbers. That will require audits, which I think is beyond our capacity." Salem, editor-in-chief "And I know for a fact that most societies have been very naive, particularly in the old days. So basically, they signed everything over to the publisher. They were just really happy that somebody took care of the practical side of publishing. And they felt that they had scientific control over the journal. And that was enough. If you're in that situation, you have very little leverage in negotiating with the publisher. They can basically do whatever they want. They can replace the whole editorial board and throw everybody out and have other people doing it. There's basically nothing you can say." Salem, editor-in-chief "For the larger commercial shareholding companies that are obviously obliged to deliver profits and dividends to their shareholders, the commercial player pressures are obviously there. [...] As a public company, the pressure will be on to increase profits, increase dividends, and also ensure that those profits and operating margins are in the public domain." Timothy, publishing consultant "[For-profit publishers] act within the scientific system, and they go to all our conferences, but they also act within the business system of them having to really stand up to their shareholders." Jonathan, librarian
Academic publishing as a commercial industry	

	<i>"Even the lower fee, like 3,000 dollars or euros... It's quite low, but it's already one month's salary... So if you add up all the papers and everything, that's a lot of positions that could be open to have more researchers. And it's something we're all lacking: budget. So that's clearly a budget that can go somewhere else." Ali, early-career researcher</i>
Open science and alternative models for dissemination	<i>"I think maybe one thing that we tend to take for granted, but that we might need to be cautious about or be sure that we nurture is that we can, at least for biomedical papers, look up in PubMed and we can then get a really good overview of the literature [...] I saw somewhere that with the new American administration, funding for PubMed was sort of questioned, but also that we might see some kind of censoring there, so if you publish on equity, diversity, or inclusion, then papers might suddenly not be searchable in PubMed anymore. I mean, that would be a true disaster." Giovanni, senior researcher</i> <i>"I think, ideally, if we want to make the academic system, and specifically the publishing system, a lot more democratic, it should be about the democratization of knowledge sharing. It should be about having those who produce the content, having control over how that content is delivered, and who gets to access that information." Barbara, senior researcher</i> <i>"So there are no good proxies to see how open your science is, and has that therefore led to reuse? [...] Have people used your software, your data, your materials? This is not really valued unless they also cite your thing, right?" Lucy, editor-in-chief</i>
Power relations and asymmetries	<i>"[Regarding open access...], the thing is, I feel like we're not first movers in general. I think we're sometimes a bit reactionary to some points." Tomas, funder</i> <i>"I don't see academia as a first mover in anything." Barbara, senior researcher</i> <i>"[Regarding academic evaluation processes that focus on quality rather than quantity...], if it were implemented here at the institute, it wouldn't make much of a difference because people wouldn't be able to get funding for their work, and they probably wouldn't be able to get a job elsewhere. So that wouldn't really change anything quickly. For it to really work, it would need to be implemented not just at universities, but also with the funders and [...] the government bodies, the European Commission, and all that... so it really needs to be integrated in all the research evaluation</i>

	landscape." Giovanni, senior researcher "Who can counter... who can have the muscles to go against big multinational companies? It must be a state." Nela, librarian "But because we don't talk to each other, we don't collectively organize, we're all stuck in this, sort of, individualized, shady situation where we could have a better system, but we don't coordinate, we don't move towards it." Barbara, senior researcher "[Funders...] I see their role as... they also drive subject areas... they also put pressure in different areas to get published more, but they also define how the quality of these works is assessed if they put a high pressure or high focus on publication metrics or number of publications. Then they would drive further the production, they also have a role in changing the publishing culture and publishing norms." Samuel, senior researcher
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Table 2. Potential leverage points across Action Scales Model domains relevant to the reproducibility crisis

	Academic career progression and precarity	Journal prestige hierarchy and bibliometrics	Research integrity and misconduct
Events	Transparency around hiring and assessment practices by academic institutions (e.g., which criteria are actually used by hiring committees).	Public reporting of journal-level indicators beyond impact factor (e.g., retraction rates, time-to-decision, replication publication rates, transparency of peer review, reporting guideline compliance).	Mandate public disclosure of integrity-related indicators at the journal and publisher level (e.g., retraction rates, time-to-retraction, use of transparent peer review, completeness of reporting checklists). Mandate public disclosure of peer-review metrics (e.g., review duration, rejection rates, use of reporting guidelines).
	Reform of academic assessment criteria to reduce reliance on publication counts and journal prestige. Implement and enforce structured assessment frameworks (e.g., CoARA) with clear guidance and accountability mechanisms. Formal recognition and crediting of non-publication activities such as peer review, data sharing, mentoring, and teaching. Alignment of hiring, promotion, and funding assessment practices across institutions to reduce competitive disadvantage for early adopters. Reduce reliance on short-term contracts and competitive funding mechanisms that amplify risk aversion and productivity pressure.	Reform hiring, promotion, and funding assessments to explicitly decouple researcher evaluation from journal impact factors and journal brand. Formally adopt and enforce assessment frameworks that prohibit the use of journal prestige as a proxy for research quality (e.g., DORA, CoARA). Remove publisher-owned metrics from institutional and national evaluation systems.	Require preregistration and the use of reporting guidelines (e.g., CONSORT, STROBE, PRISMA) as conditions for publication. Mandate data and code sharing as default publication requirements. Introduce formal monitoring of research quality and integrity by funders and institutions, beyond publication counts. Establish clear standards to identify and exclude predatory journals from funder and institutional recognition systems. Reform journal incentives that reward novelty and citation potential over robustness and reproducibility (e.g., systematic support for replication and null results). Compensate, formally recognize, or institutionally support peer review and research integrity work.
Structures			

	Reframe academic career progression goals from maximizing publication output toward supporting research quality, sustainability, and long-term societal value. Treat publication as a means of communicating research rather than the primary purpose of academic work.	Reorient the goal of research evaluation from signaling excellence via journal prestige to assessing substantive contribution, rigor, and relevance. Shift publisher and editorial goals away from maximizing citation concentration toward supporting cumulative, methodologically sound knowledge. Redefine success for journals as contribution to knowledge quality and integrity rather than impact factor growth. Realign career goals at senior career stages to reward stewardship roles (e.g., mentoring, peer review, replication, methodological rigor) rather than continued accumulation of high-impact publications. Explicitly redefine early-career success criteria to prioritize research quality, openness, and learning over publication volume and journal prestige.	Align funder, institutional, and publisher goals around research quality, transparency, and long-term usability rather than output metrics.
Goals	Challenge the belief that higher productivity and publishing in journals perceived as more prestigious equals better scientists. Reframe success in academia as collective and cumulative rather than individual and competitive. Normalize the idea that scientific contribution extends beyond papers and includes data, methods, mentoring, peer review, and societal engagement. Question the assumption that objective evaluation requires quantification.	Challenge the belief that journal prestige reliably signals research quality or truth. Disrupt the belief that publishing in a high-impact-factor journal automatically reflects excellence and scientific importance. Address disciplinary and geopolitical biases embedded in prestige perceptions (e.g., older, Western, English-language journals as inherently superior). Challenge the belief that academic quality and contribution must be quantified through simple metrics to be evaluated efficiently.	Challenge the belief that publication in high-impact journals guarantees research quality or truth. Legitimize replication, null results, and error correction as core scientific contributions. Question the assumption that peer review alone is sufficient to guarantee integrity. Shift from “thinking in papers” toward thinking in terms of cumulative evidence.
Beliefs			

Table 3. Potential leverage points across Action Scales Model domains relevant to the peer review crisis

	Peer review capacity and quality	Artificial intelligence as a double-edged sword	Systemic overproduction of scientific outputs
Events	Public reporting of peer-review performance indicators at the journal or publisher level (e.g., review time distributions, reviewer acceptance rates, use of transparent or open peer review). Visibility of review histories where transparent peer review is adopted.	Public disclosure of AI use in manuscript preparation, peer review, and editorial decision-making (e.g., AI-assisted writing, AI-written reviews). Transparency about which integrity checks (plagiarism detection, image manipulation detection) are applied to submissions by journals/publishers.	Mandate formal institutional limits on publication output per researcher (e.g., maximum publication quotas).
	Introduce portable or reusable peer review systems that allow review reports to travel with manuscripts across journals and publishers, reducing duplication and waste. Formally recognize and reward peer-review contributions in hiring, promotion, and funding assessments. Compensate peer review through financial payment, institutional workload allocation, or formal academic credit. Integrate peer-review training into doctoral education and researcher development programs. Establish shared peer-review quality standards and reviewer qualification criteria, supported by technical tools. Use AI selectively for screening, triage, and administrative support (e.g. guideline compliance, reviewer matching), without replacing substantive human judgment.	Establish clear, enforceable guidelines for acceptable and unacceptable uses of AI by authors, reviewers, editors, and publishers. Require FAIR-compliant data standards as a condition for publication, reuse, and AI-assisted analysis. Constrain AI use to defined support functions (e.g., screening, formatting checks, plagiarism checks, reviewer matching) at journals. Require human oversight and accountability for all AI-assisted editorial or review decisions. Regulate the use of scholarly content as training data for AI models, including governance of licensing, consent, and compensation.	Reform academic hiring and promotion criteria to reduce reliance on publication counts. Introduce structured incentives that explicitly reward fewer, higher-quality research outputs. Implement explicit funder policies that limit the role of publication volume in grant evaluations and assessments. Modify publisher-level editorial performance metrics so that editors are not evaluated or incentivized based on the number of articles published.
Structures			

	Decouple journal prestige from perceived thoroughness of peer review. Reorient the goal of peer review from maximizing throughput to ensuring scrutiny and research robustness.	Treat AI as a tool to support research quality and sustainability, not as a means to increase throughput. Explicitly reject the goal of replacing human judgment in validation, review, and evaluation processes. Prevent the redefinition of scientific publishing as a data-extraction pipeline for business analytics and surveillance. Align AI deployment in publishing with goals of research quality, reproducibility, and trust, rather than efficiency, throughput, or labor substitution.	Reframe academic career progression goals from maximizing publication output toward supporting research quality, sustainability, and long-term societal value.
Goals			
	Challenge the belief that “peer reviewed” automatically means high quality or truth. Reframe peer review as a collective scholarly responsibility that requires time, resources, and support, not an unpaid moral obligation. Legitimize alternative review models (e.g., preprint review, post-publication review, open review, community review).	Challenge the belief that technological automation can substitute for human judgment and collective responsibility. Address emerging distrust between researchers caused by uncertainty about AI use in writing, reviewing, and evaluation. Reject the assumption that more automation necessarily improves objectivity or fairness. Reassert the role of scientific publishing as a human, interpretive, and accountable process.	Challenge the belief that higher productivity equals better scientists. Challenge the belief that publications are an efficient way to evaluate scientific careers. Challenge the belief that the most important scientific contributions are publications.
Beliefs			

Table 4. Potential leverage points across Action Scales Model domains relevant to the accessibility crisis

	Academic publishing as a commercial industry	Open science and alternative models for dissemination	Power relations and asymmetries
	Public reporting of publisher-level financial indicators (e.g., profit margins, pricing structures, cost breakdowns, revenue from analytics services).		
Events	Transparency about ownership structures, conflicts of interest, and secondary business activities (e.g., ties to fossil fuel or surveillance industries).	Mandate public disclosure of openness-related indicators at the journal, funder, and institutional level (e.g., proportion of preregistered studies, preprint use, data/code availability, transparent peer review use, publication of null results).	No credible leverage point identified here.
	Reform or regulate APC-based open access business models that directly incentivize higher publication volume.		
	Apply competition and antitrust regulation to reduce market concentration and monopolistic control by large publishing conglomerates.	Make preregistration, data sharing, and code availability default requirements for funding and publication.	Strengthen collective bargaining and coordination mechanisms among universities, libraries, and national consortia in negotiations with publishers.
	Reallocate control of scholarly infrastructure (e.g., identifiers, metadata, indexing, repositories) from commercial publishers to public or community-governed institutions.	Integrate open science indicators (e.g., preregistration, reporting guideline completion, data reuse) into formal research assessment and funding decisions.	Increase transparency of institutional agreements with publishers.
	Strengthen collective negotiation and purchasing agreements among universities, libraries, and national consortia to counter publisher leverage.	Support and stabilize community-governed open infrastructures (e.g., preprint servers, repositories, diamond open access journals) through sustained public or funder financing.	Increase funder and governmental regulation of publishing practices (e.g., pricing, open access requirements).
	Support non-commercial and community-governed publishing models (e.g., society journals, diamond open access) through stable public funding.	Reform journal policies to explicitly accept and value null results, replication studies, and methodologically sound research independent of novelty.	Support and scale community-governed publishing models (e.g., diamond open access, society journals) through public funding.
	Limit publishers' ability to bundle publishing services with analytics, ranking, and surveillance products used in research evaluation.	Decouple open access from APC-based business models by expanding diamond open access and non-commercial publishing arrangements.	Reallocate ownership and governance of scholarly infrastructure (e.g., intellectual property, metadata, identifiers, repositories) from commercial publishers to public or community-governed institutions.
Structures	Shift responsibility for funding and maintaining preprint and dissemination infrastructure from academic institutions to publishers.	Clarify and standardize author agreements to prevent conflicts between copyright transfer and open science practices.	Apply antitrust and competition regulation to reduce market concentration and monopolistic control by large publishing conglomerates.

	Enable funders to set enforceable caps or pricing criteria for APCs eligible for reimbursement. Reorient the purpose of academic publishing away from shareholder value and growth toward stewardship of the scholarly record and public knowledge. Align institutional and governmental goals to treat publishing as public infrastructure rather than a profit-generating market. Explicitly decouple research evaluation and institutional ranking from publisher-controlled metrics and analytics products. Reorient the goal of editorial practice from maximizing revenue and throughput for publishers toward curating, filtering, and validating reliable scientific knowledge.	Reframe the primary goal of scholarly communication from producing journal articles to enabling open, reusable, and cumulative knowledge generation. Align funder, institutional, and journal goals around openness, accessibility, and long-term usability rather than visibility, speed, or revenue. Explicitly recognize dissemination to appropriate audiences (scientific, clinical, public) as a core objective of research communication. Treat publications as secondary to data and methods.	
Goals	Challenge the normalization of paywalls and author-facing fees as legitimate mechanisms for disseminating publicly funded scientific knowledge. Challenge the belief that commercial publishers are necessary for scholarly communication. Question the normalization of high profit margins in publicly funded knowledge production. Disrupt the narrative that efficiency, scale, and professionalism necessarily require corporate ownership.	Reframe openness (data sharing, preregistration, preprints) as markers of research quality rather than optional add-ons. Question the assumption that peer review must precede public dissemination to ensure legitimacy. Address fears that openness undermines competitiveness, priority, or career advancement. Normalize the idea that research value lies in reuse, scrutiny, and cumulative learning rather than novelty alone. Challenge the belief that journal articles are the primary or sole legitimate research output.	Challenge the belief that the current distribution of power in publishing is inevitable or immutable. Reframe collective action as feasible, countering beliefs about individual powerlessness and first-mover disadvantage. Question assumptions about commercial publishing structures within academia. Expand education about how the publishing system operates, particularly in researcher training.
Beliefs			