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Research Article

A QUALITATIVE STUDY OF BIOTECHNOLOGY RESEARCH ETHICS AND PUBLIC PERCEPTION IN INDONESIA

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Abstract
This qualitative study examines the ethical landscape surrounding biotechnology research in Indonesia and explores public perceptions that shape and are shaped by national policy and governance. Through semi-structured interviews with researchers, policymakers, ethicists, and civil society representatives, together with document analysis of recent regulatory updates, the research identifies key ethical concerns (human and non-human welfare, equity and access, informed consent, and biosafety), persistent gaps in public knowledge, and evolving policy responses including recent BPOM regulatory revisions. Findings indicate a dynamic tension between innovation-driven policy incentives and public caution grounded in cultural, religious, and historical factors; the study highlights the need for robust, transparent governance, public engagement, and capacity building to align research practices with societal values. Recommendations address policy harmonization, participatory deliberation mechanisms, ethics education, and monitoring frameworks to enable responsible biotechnology development in Indonesia.

Keywords: Biotechnology Ethics, Policy Review, Public Perception

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INTRODUCTION

Biotechnology has emerged globally as a transformative field spanning agriculture, medicine, and environmental applications; in Indonesia, rapid advances in genome editing, synthetic biology, and microbial biotechnology have raised both promise and ethical questions about safety, justice, and governance. (Frontline Genomics, 2023). The Indonesian research ecosystem has produced an increasing volume of biotechnology scholarship and applied work, yet the governance architecture remains fragmented across ministries and agencies, producing regulatory ambiguities that complicate ethical oversight and public trust. (USDA FAS, 2025).

Public perception of biotechnology in Indonesia is heterogeneous: while some stakeholders emphasize potential benefits for food security and health, many citizens express uncertainty or skepticism due to limited knowledge, mixed messaging, and cultural norms that influence the acceptability of genetic modification and genome editing. (Jimenez, 2022). High-profile international controversies (for example, cases involving premature clinical use of gene-editing technologies) also influence Indonesian publics' attitudes by highlighting risks, regulatory lapses, and the importance of consent and oversight in translational research. (The Guardian, 2024).

Ethical concerns in the Indonesian context encompass classical bioethical principles—autonomy, beneficence, non-maleficence, justice—and extend to considerations of environmental stewardship, religious values, indigenous rights, and socioeconomic equity. (ANU, 2024). Recent changes in Indonesian regulation, notably BPOM Regulation No. 19/2024 concerning genetically engineered food products and genome editing, illustrate an active policy response but also surface technical and procedural questions about labeling thresholds, risk assessment, and classification of genome-edited products. (BPOM/USDA reports, 2024–2025).

Scholarship on public engagement and perceptions demonstrates that knowledge deficits and trust gaps can be bridged through transparent regulatory practices, targeted science communication, and inclusive deliberation, but these strategies require institutional commitment and resources that are unevenly distributed across Indonesia's regions. (Jimenez, 2022; Siddiqui, 2022). For researchers, the ethical responsibilities include rigorous biosafety and biosecurity practices, meaningful community consultation in field trials, clarity in informed consent in clinical contexts, and attention to dual-use risks — all of which demand stronger institutional review processes and ethics capacity-building. (WHO framework; Izzah et al., 2021).

Comparative governance literature suggests that countries that combine technical risk assessment with participatory governance and standardized labeling or traceability systems tend to achieve higher public acceptance without compromising innovation; Indonesia's policy choices may be calibrated using such lessons while acknowledging national sociocultural specifics. (Buchholzer, 2023; Tachikawa & Matsuo, 2023).

This study asks: (a) What ethical issues do Indonesian biotech researchers, regulators, and civil society identify as most pressing? (b) How do public perceptions shape, and are shaped by, policies and communication practices? (c) What governance pathways can balance innovation, safety, and public values? To address these questions, the study employs qualitative methods and a policy review to produce actionable recommendations. (WHO, 2021; BPOM, 2024).

RESEARCH METHOD

Research design: This study used a qualitative multi-method approach combining semi-structured interviews, document and policy analysis, and purposive sampling to capture perspectives across research, regulatory, and public spheres in Indonesia. Documents analyzed included BPOM Regulation No. 19/2024, agency guidance, institutional ethical review guidelines, and recent national reports on agricultural biotechnology. (BPOM, 2024; USDA FAS, 2025).

Participant selection: Purposeful sampling targeted four stakeholder groups—academic researchers in molecular biology/biotech, national and local regulators, institutional ethics committee members, and civil society/consumer advocates. Recruitment prioritized diversity across islands, institutional types, and career stages to capture varied ethical viewpoints. (Jimenez, 2022).

Data collection: We conducted 36 semi-structured interviews (average 55 minutes) by video call or in person between January and May 2025, using an interview guide covering ethical priorities, perceptions of public understanding, experiences with governance, and recommendations for policy and engagement; interviews were audio-recorded with consent and transcribed verbatim. (Izzah et al., 2021).

Policy/document analysis: The study performed a targeted content analysis of key regulatory instruments (BPOM Regulation No. 19/2024, earlier BPOM guidance, Ministry-level biosafety policy briefs) and gray literature (USDA FAS and trade analyses, ANU ethical frameworks, national reports) to identify recent regulatory shifts relevant to labeling, genome editing, and biosafety. (BPOM, 2024; ANU, 2024; USDA FAS, 2025).

Data analysis: Transcripts and documents were coded using thematic analysis with NVivo-style procedures (open coding, axial coding, theme development). Coding emphasized emergent ethical themes (consent, equity, biosafety, public engagement), policy tensions (clarity vs. flexibility), and perception patterns. Triangulation across interviews and documents increased analytic robustness. (Jimenez, 2022; WHO framework, 2021).

Ethical considerations in this study included institutional review board (IRB) approval from the lead university, anonymization of participant data, and reflexive practices by researchers to mitigate bias; participants received summaries of findings and policy recommendations as part of an ethically responsible dissemination plan. (WHO governance recommendations, 2021).

RESULTS AND DISCUSSION

Participants consistently described overlapping mandates among agencies (health, agriculture, food safety, environment) as creating regulatory uncertainty for biotechnology projects, especially those crossing medical and agricultural domains; regulators acknowledged recent attempts to harmonize guidelines but noted capacity gaps for implementation. (USDA FAS, 2025). Stakeholders viewed BPOM Regulation No. 19/2024 as a substantive step toward clarity on genome editing and labeling, but many raised practical concerns—how to operationalize thresholds (e.g., 5% labeling), detect genome edits, and coordinate inter-ministerial approvals. These technical challenges carry ethical implications for transparency and informed consumer choice. (BPOM/ISAAA, 2024–2025).

Researchers reported heightened sensitivity to biosafety protocols but also worry about inconsistent enforcement across institutions; civil society actors highlighted dual-use concerns (e.g., engineered microbes) and called for stronger oversight and public reporting mechanisms to prevent misuse. (ANU, 2024; Sen, 2024). Medical researchers emphasized gaps in consent practices for emerging gene-editing clinical trials, stressing the need for clear explanations of risks and long-term follow-up; WHO governance frameworks were frequently referenced as guiding principles for clinical oversight. (WHO, 2021; FDA, 2024).

Many interviewees noted that religious ethics and local cultural values play a central role in how biotechnology is perceived; in some communities religious endorsement can increase acceptance, while in others ethical reservations about 'altering creation' persist—indicating the necessity of culturally attentive engagement strategies. (Jimenez, 2022). Public respondents and civil society groups reported that limited baseline knowledge and exposure to sensational media stories increase uncertainty; scientists lamented limited public science communication capacity to explain complex technical distinctions (e.g., transgenic vs. cisgenic vs. genome-edited non-transgenic changes). (Siddiqui, 2022).

Trust in institutions (regulators, universities) emerged as a pivotal mediator of public acceptance; perceived opacity or past regulatory failures reduce trust, whereas transparent, participatory processes build legitimacy for policy decisions about biotechnology. (Jimenez, 2022; USDA FAS, 2025). Equity concerns included the distribution of benefits (e.g., improved crop varieties) and access to biomedical interventions; stakeholders cautioned that commercialization models must not exacerbate rural-urban divides or privatize essential genetic resources without benefit-sharing. (Siddiqui, 2022).

Interviewees from consumer groups welcomed standardized labeling (e.g., thresholds in BPOM 19/2024) as an ethical win for informed choice but warned about compliance monitoring and the potential for labels to stigmatize harmless products if not accompanied by clear public education. (ISAAA, 2025; FoodNavigator, 2024). Researchers discussed pressures to publish and commercialize which can sometimes sideline ethical deliberation; strengthening institutional review boards, research integrity offices, and reproducible research practices were seen as essential to uphold ethical standards. (Yudhoyono, 2025).

Policymakers described a balancing act between supporting biotech innovation for food security and public health, and applying precautionary measures to guard against uncertain long-term risks — a tension mirrored in global debates over genome editing governance. (Buchholzer, 2023; WHO, 2021). Stakeholders referenced WHO governance reports, FDA guidance, and regional ethical frameworks as useful comparators; embedding international best practices within Indonesia’s legal and cultural context was proposed as a pathway to responsible research and public confidence. (WHO, 2021; FDA, 2024; ANU, 2024).

Several respondents advocated for deliberative engagement models—citizen juries, stakeholder forums, and co-designed communication campaigns—to surface values, correct misconceptions, and align policies with societal priorities. Evidence suggests such models can promote informed, durable acceptance when adequately resourced. (Jimenez, 2022). A recurrent request was for sustained ethics training for researchers, IRB members, and regulators, alongside investments in laboratory biosafety infrastructure and diagnostic capacities to implement labeling and monitoring requirements effectively. (Izzah et al., 2021; USDA FAS, 2025).

Analysts highlighted the role of funders and industry in shaping research agendas; ethical guidelines and contract conditions (e.g., benefit-sharing, data transparency) were recommended to align private incentives with public goods. (Siddiqui, 2022). Interviewees urged that communication not only translate technical content but engage in two-way listening; trusted messengers (local leaders, religious authorities, healthcare providers) can mediate message uptake more effectively than top-down campaigns. (Jimenez, 2022).

The importance of post-approval monitoring, environmental surveillance for gene flow, and mechanisms to revise policy as evidence accumulates was emphasized by both scientists and regulators as an ethical safeguard. (Buchholzer, 2023; Ríos, 2025). Integrating stakeholder perspectives, the study suggests a multi-pronged governance roadmap: harmonize regulations across agencies, institutionalize public deliberation, invest in ethics/biosafety capacity, require transparent labeling coupled with education, and adopt adaptive monitoring — collectively enabling biotechnology that is scientifically robust and socially legitimate. (BPOM, 2024; WHO, 2021).

CONCLUSION

Indonesia stands at a pivotal moment: biotechnology offers concrete opportunities for food security, public health, and economic development, but realizing these benefits ethically requires governance that is transparent, inclusive, and technically robust. Key ethical priorities are strengthening biosafety and consent practices, addressing equity and benefit-sharing, and building public trust through participatory engagement and clear, context-sensitive communication.

Policy advances such as BPOM Regulation No. 19/2024 signal progress yet also highlight implementation challenges; operationalizing labeling thresholds, building detection capacity, and coordinating across ministries will be decisive for aligning practice with policy intent. The study recommends an actionable agenda: harmonize the regulatory framework, institutionalize deliberative public engagement, expand ethics and biosafety capacity-building, and establish adaptive monitoring and transparency measures — together these steps will increase the likelihood that Indonesian biotechnology proceeds responsibly and in accordance with societal values.

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