



Paper: “Impact of Metaverse Technologies Integration on Biotechnological Innovation: A Literature Review”

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Peer review:

Reviewer 1: Jozsef Zoltan Malik
Budapest Metropolitan University, Hungary

Reviewer 2: Pietro Braione
University of Milano-Bicocca, Italy

Reviewer A:

Recommendation: Accept Submission

The TITLE is clear and it is adequate to the content of the article.

The title is accurate, informative, and well-aligned with the article's content. It indicates the scope of the review and reflects both the technological and disciplinary focus.

The ABSTRACT clearly presents objects, methods, and results.

The abstract effectively introduces the main technologies discussed and the relevance of their integration into biotechnology. The research aim and approach are clearly stated. Nonetheless, the abstract is somewhat dense and could be streamlined to better distinguish objectives, methodology, and key findings. Additionally, implications for practice and future research are touched upon but deserve clearer framing.

There are a few grammatical errors and spelling mistakes in this article.

While the article demonstrates a generally high level of academic English, it contains several stylistic issues. A careful language and style edit is recommended.

The study METHODS are explained clearly.

The methodology section is thorough and transparent, outlining a systematic literature review complemented by case study analysis. The use of the PRISMA model and thematic analysis lends credibility. However, the justification for choosing particular case studies is not entirely clear, and the review process (e.g., inclusion/exclusion criteria, number of sources reviewed) could be elaborated further to enhance replicability.

The body of the paper is clear and does not contain errors.

The article presents its findings in a well-organized thematic structure, integrating literature and case studies to substantiate key points. However, the narrative is occasionally repetitive, and some sections (especially on educational VR applications) read more like promotional summaries than critical syntheses. A greater emphasis on limitations and contradictory findings would improve the scholarly balance.

The CONCLUSION or summary is accurate and supported by the content.

The conclusion effectively summarizes the main arguments and identifies major technological, ethical, and regulatory challenges. Nevertheless, it is somewhat optimistic in tone and could be strengthened by more clearly distinguishing evidence-based claims from future-oriented speculations. The policy and regulatory discussion, though touched upon, remains a bit surface-level and would benefit from more engagement with existing legal frameworks.

The list of REFERENCES is comprehensive and appropriate.

The article draws on a wide array of recent, peer-reviewed, and interdisciplinary sources. References are appropriate and well-integrated into the analysis. The inclusion of both scientific literature and institutional reports is commendable.

Please rate the TITLE of this paper.

[Poor] 1-5 [Excellent]

5

Please rate the ABSTRACT of this paper.

[Poor] 1-5 [Excellent]
4

Please rate the LANGUAGE of this paper.

[Poor] 1-5 [Excellent]
4

Please rate the METHODS of this paper.

[Poor] 1-5 [Excellent]
4

Please rate the BODY of this paper.

[Poor] 1-5 [Excellent]
5

Please rate the CONCLUSION of this paper.

[Poor] 1-5 [Excellent]
4

Please rate the REFERENCES of this paper.

[Poor] 1-5 [Excellent]
5

Overall Recommendation!!!

Accepted, minor revision needed

Comments and Suggestions to the Author(s):

This manuscript provides an ambitious and forward-looking analysis of how metaverse technologies can reshape biotechnological innovation. Its strengths lie in the breadth of topics covered, the structured synthesis of current literature, and the integration of illustrative case studies. The use of digital twins, AI, and immersive technologies is explored in depth and linked convincingly to applications in drug development, education, and virtual collaboration.

That said, the paper would benefit from a more critical tone, particularly in evaluating the limits of current metaverse implementations and the institutional readiness of the biotech sector. Further attention should be paid to refining the language for conciseness and clarity, especially in the abstract and findings. A clearer methodological justification for the selection of sources and case studies would also improve transparency. The authors are encouraged to elaborate on, or at least point to, regulatory, legal, and socio-economic constraints in greater depth to complement the technical discussion.

Reviewer B:

Recommendation: Revisions Required

The TITLE is clear and it is adequate to the content of the article.

Yes

The ABSTRACT clearly presents objects, methods, and results.

Yes

There are a few grammatical errors and spelling mistakes in this article.

Yes

The study METHODS are explained clearly.

Yes

The body of the paper is clear and does not contain errors.

Section 2.4 is missing, and Section 4 states "The findings are organised into five major areas", when the areas are four.

The CONCLUSION or summary is accurate and supported by the content.

Yes

The list of REFERENCES is comprehensive and appropriate.

Apparently, I was not able to check them thoroughly

Please rate the TITLE of this paper.

[Poor] 1-5 [Excellent]

4

Please rate the ABSTRACT of this paper.

[Poor] 1-5 [Excellent]

4

Please rate the LANGUAGE of this paper.

[Poor] 1-5 [Excellent]

5

Please rate the METHODS of this paper.

[Poor] 1-5 [Excellent]

4

Please rate the BODY of this paper.

[Poor] 1-5 [Excellent]

3

Please rate the CONCLUSION of this paper.

[Poor] 1-5 [Excellent]

Please rate the REFERENCES of this paper.

[Poor] **1-5** [Excellent]

4

Overall Recommendation!!!

Accepted, minor revision needed

Comments and Suggestions to the Author(s):

The paper is mostly OK, I found only two mistakes:

- Section 2.4 (literature review about data privacy, security and integrity, and ethical issues related with virtual environments of biotechnological resources) is missing, notwithstanding the fact it is listed at the beginning of section 2;
- The beginning of Section 4 states "The findings are organised into five major areas", when the areas of Section 4 are four.
