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Original Research Article

Exploring the intersection of agritech business, sustainability, and the sustainable development goals (SDGs): A bibliometric perspective

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Abstract

The nexus between agritech innovations and sustainability is increasingly significant in global discussions on achieving the Sustainable Development Goals (SDGs). This study conducts a bibliometric analysis of scholarly publications from 2010 to 2024 to examine research trends, intellectual structures, influential sources, and thematic directions in the field of agritech and sustainable agriculture. Using Scopus-indexed articles and tools like VOS viewer, the study identifies prolific authors, countries, and journals contributing to the discourse. Results highlight increasing scholarly attention post-2015, with dominant contributions from countries like the United States, China, and the United Kingdom. Thematic clustering reveals strong linkages between agritech, SDG 2 (Zero Hunger), climate-smart agriculture, and food security. The study also identifies gaps related to inclusivity, technology adoption in low-income countries, and private-sector engagement, offering valuable insights for future academic and policy-oriented work.

Keywords: Sustainable, Agriculture, Sustainable, Development and Goals

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1. Introduction

Agricultural transformation is critical for addressing hunger, climate resilience, and sustainable resource management, particularly in the context of the United Nations' Sustainable Development Goals (SDGs). Agritech—defined as the application of advanced technology in agriculture—has emerged as a key driver in this transformation. However, scholarly exploration of its impact on sustainability remains fragmented. This study bridges that gap through a bibliometric analysis, offering insights into the evolution, focus, and gaps in research linking agritech and sustainability.

2. Key Objectives

1. To perform a bibliometric analysis of scholarly publications on agritech, sustainability, and SDGs to identify major research trends, influential authors, key journals, and geographical distribution.
2. To map the intellectual structure and thematic evolution of research on agritech and sustainable development using keyword co-occurrence and citation analysis.
3. To identify knowledge gaps and emerging themes in the intersection of agritech business, sustainability, and SDG research for future scholarly exploration.

3. Methodology

A bibliometric analysis was conducted using data extracted from the Scopus database. The search string used was:

The resulting dataset included peer-reviewed journal articles in English from the social sciences subject area. VOS viewer was used for co-authorship analysis, citation analysis, and keyword co-occurrence mapping.[1-6]

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4. Results and Discussion

4.1. Documents by Year

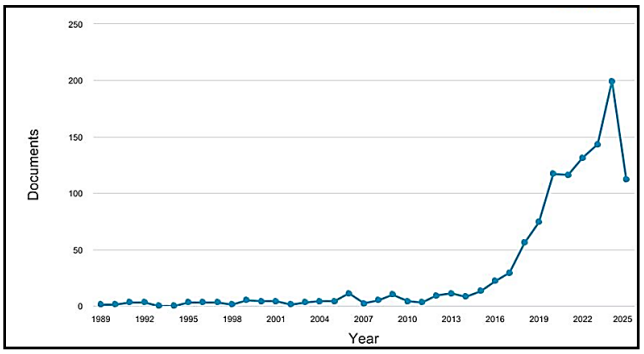

Figure 1: Documents by year

Between 1989 and 2015, the number of publications remained relatively low and flat, averaging fewer than 10–20 documents per year. A gradual uptick begins around 2015, likely influenced by the launch of the United Nations SDGs in the same year. This marks the beginning of increased scholarly interest in aligning agritech innovations with sustainable development. There is a steep and consistent increase in publication volume starting around 2018, peaking at around 200 documents in 2024. This surge indicates: Growing relevance of climate-smart agriculture, digital farming, and sustainable food systems, Increased funding, global policy emphasis, and technological advancements fueling academic interest, Cross-disciplinary integration of agriculture, technology, environmental studies, and development economics.[7] There is an opportunity to contribute to a fast-growing field, especially in under-researched regions or emerging agritech themes.

4.2. Documents per year by source

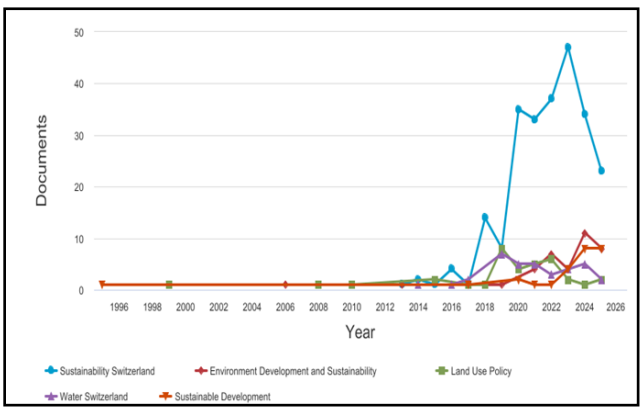

Figure 2: Documents per year by source

It clearly dominates the landscape, indicating that *Sustainability (MDPI)* is the most preferred outlet for research at the intersection of agritech and sustainable development. Sustainability (MDPI) is the primary journal driving scholarly output in this field, likely due to:Its broad thematic scope, Rapid peer-review and open access model, High submission rates globally.8 Environment, Development and Sustainability (red line) shows moderate but growing activity, especially post-2020, with about 10–15 articles per year by 2024–2025.Sustainable Development (orange line) and Water (Switzerland) (purple line) follow similar patterns, show increasing contributions, particularly in recent years.

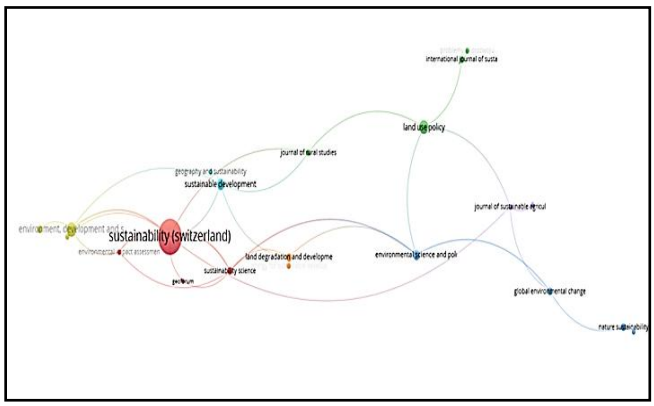

Figure 3: Network Visualisation of Co Citation of Journals

The figure indicates, Sustainability (Switzerland) is the dominant node, indicating it's the most frequently cited journal in this field. Heavily linked with journals like Environment, Development and Sustainability and Sustainable Development, forming a foundational hub.Other distinct but connected clusters are represented by journals such as Global Environmental Change and Land Use Policy.[9-13]

4.3. Documents by Author

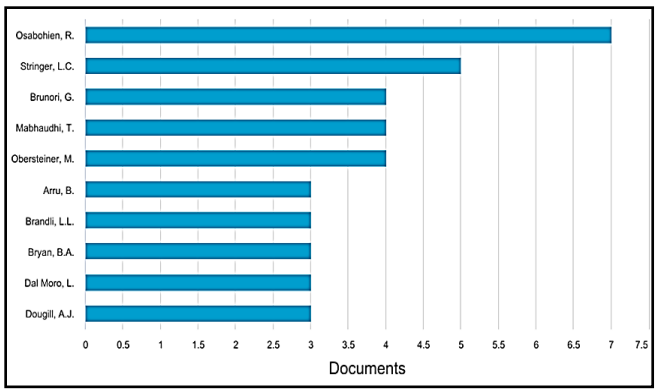

Figure 4: Documents by author

Osabohien stands out as the leading author in this area.Likely focuses on the intersection of agriculture, economic development, and policy analysis. . Stringer, L.C.Close behind with 5 publications, Stringer is a prominent voice, likely working in areas like land degradation neutrality, climate resilience, or ecosystem services in agricultural systems. The bibliometric analysis reveals that *Osabohien, R.* is the most prolific author in the field of agritech and sustainability with 7 publications, followed by *Stringer, L.C.* with 5. Other notable contributors include *Brunori, G.*, *Mabhaudhi, T.*, and *Obersteiner, M.*, each with 4

publications. These authors have significantly shaped the discourse around sustainable agriculture, policy interventions, and climate-resilient farming systems.[14,15] Their work underscores the field's interdisciplinary nature, spanning sustainability science, development policy, and agribusiness innovation.

4.4. Documents by country

Table 1: Documents by country

Rank	Country	Approx. Documents
1	United States	175
2	China	160
3	United Kingdom	110
4	India	100
5	Italy	85
6	Germany	65
7	South Africa	60
8	Australia	55
9	Netherlands	53
10	Spain	50

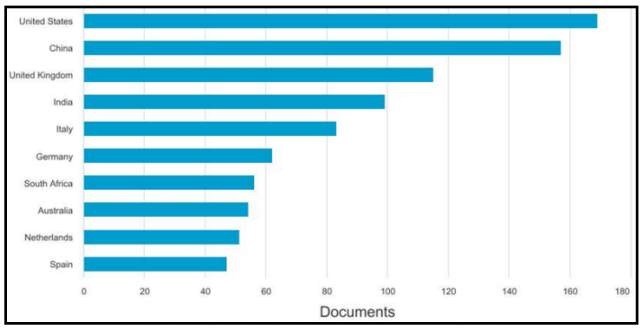

Figure 5: Documents by country

Figure 4: *Network Visualisation of Documents by Country*

United States (Rank 1), Leads the field with the highest volume of documents.This reflects strong academic funding, institutional presence, and interdisciplinary work across agriculture, climate, and sustainability. China and the UK ranks 2 & 3.China's position reflects rapid agritech growth, especially in precision farming, AI in agriculture, and rural transformation. The UK shows a consistent and mature contribution, likely focused on policy frameworks, ecological sustainability, and development studies.Geographic analysis shows that the United States leads the global research landscape in agritech and sustainability, followed by China, the United Kingdom, and India. While the dominance of high-income countries reflects institutional capacity and funding access, the rising output from India and South Africa signals increasing engagement from emerging economies.I ndia's growing share suggests rising academic and policy interest in agritech adoption, climate-resilient agriculture, and smallholder empowerment—critical for achieving SDG 2 and 13. This trend is critical, as these regions are often most affected by agricultural sustainability challenges. Their growing scholarly output suggests a shift toward more globally inclusive research on agritech's role in achieving the SDGs.

4.5. Documents by funding sponsor

Funding agency analysis reveals that the National Natural Science Foundation of China is the leading sponsor of research at the intersection of agritech and sustainable development, supporting over 50 scholarly publications. The Horizon 2020 Framework Programme and European Commission follow closely, reflecting Europe's coordinated investment in SDG-aligned technological innovation. The presence of agencies from the UK, Germany, and China indicates a strong alignment of national priorities with global sustainability agendas, particularly in the domains of climate-smart agriculture, digital transformation, and sustainable resource management.

Table 2: Documents by funding sponsor

Rank	Funding Sponsor	Approx. Documents
1	National Natural Science Foundation of China	53
2	Horizon 2020 Framework Programme (EU)	40
3	European Commission	35
4	UK Research and Innovation	25
5	National Key Research and Development Program of China	20
6	Chinese Academy of Sciences	18
7	Natural Environment Research Council (UK)	16
8	Bundesministerium for Bildung und Forschung (Germany)	15
9	Fundamental Research Funds for the Central Universities (China)	15
10	Horizon 2020	14

Source:Scopus DataBase Analysis

4.6. Documents by subject area

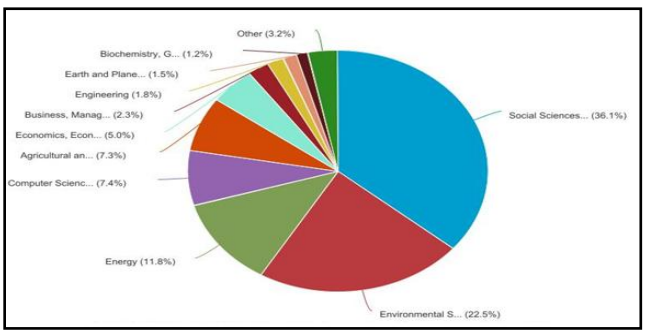

Figure 6: Documents by subject area

The subject area distribution reveals that Social Sciences (36.1%) dominate the scholarly discourse on agritech and sustainability, followed by Environmental Science (22.5%)

and Energy (11.8%).The largest share of Social Sciences reflects a strong focus on policy, governance, rural development, and social impact of agritech in achieving SDGs. A significant portion deals with ecological sustainability, climate-smart agriculture, and resource management—directly linked to SDG 13 (Climate Action), SDG 12 (Responsible Consumption), and SDG 15 (Life on Land).[16,17] This trend underscores a holistic academic interest that spans beyond technological solutions to include governance, behavioral, and ecological perspectives. The presence of Computer Science (7.4%) and Agricultural Sciences (7.3%) also highlights the interdisciplinary nature of the field, as digital innovations and biological research converge to address global sustainability challenges.

4.6. Citation overlay analysis

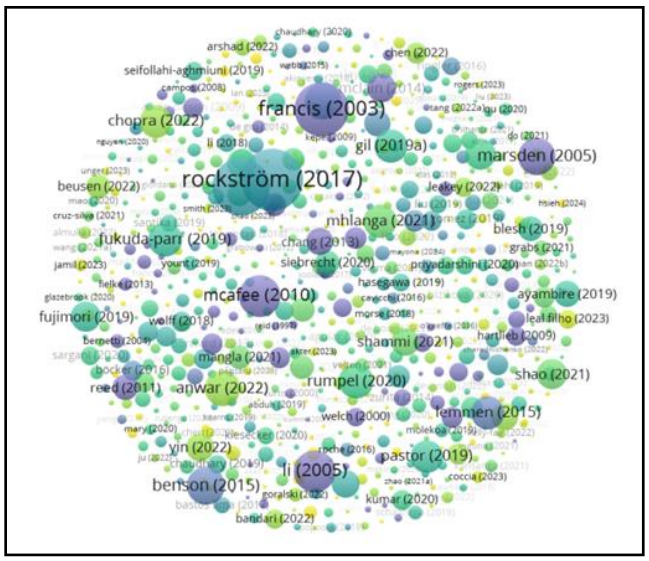

Figure 7: Network visualisation of author citation

Citation overlay analysis highlights the foundational role of works by *Rockström (2017)* and *Francis (2003)* in shaping the sustainability discourse in agritech research. Rockström (2017)[18] serves as the intellectual backbone of sustainability-oriented agritech research. The presence of widely cited authors like *McAfee (2010)* and *Marsden (2005)* illustrates the continued relevance of critical development and food systems literature. Recent citations from 2021 onward, shown in yellow, indicate a growing interest in digital agriculture, circular economy, and SDG-localized innovations. This evolution underscores the field's progression from foundational ecological theories to application-driven and policy-aligned frameworks.[18]

4.7. Citation by countries

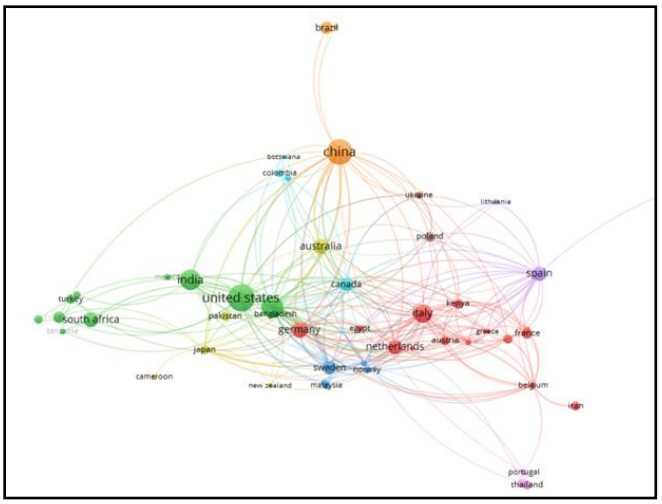

Figure 8: Network visualisation of citation by countries

The above figure shows

Cluster 1 –USA-Centered Network: Key countries involved are United States, South Africa, Germany, Canada, Turkey, and Pakistan.The United States is the most central and interconnected node, indicating its global leadership and frequent cross-country collaborations.

Cluster 2 – China-Led Network: Key countries involved are China, Colombia, Botswana.China shows strong bilateral collaborations, especially with Australia, Germany, and USA.This suggests a growing influence in agritech and sustainability research, supported by major national funding.

Cluster 3 – Europe-centric collaboration: Key countries: Italy, Netherlands, France, Austria, Greece, Kenya.This group reflects strong EU-linked academic partnerships with participation from Africa (Kenya).This Indicates emphasis on policy, food systems, and climate resilience.

Cluster 4 – Spain-Peru Link.A small but specific collaboration between Spain and Peru, indicating regional or project-based research focus.

Cluster 5 – Asia-pacific links: Key countries involved are Australia, New Zealand, Japan, Cameroon. A more distributed collaboration pattern, often around digital agriculture and innovation themes.

4.8. Keyword Occurences

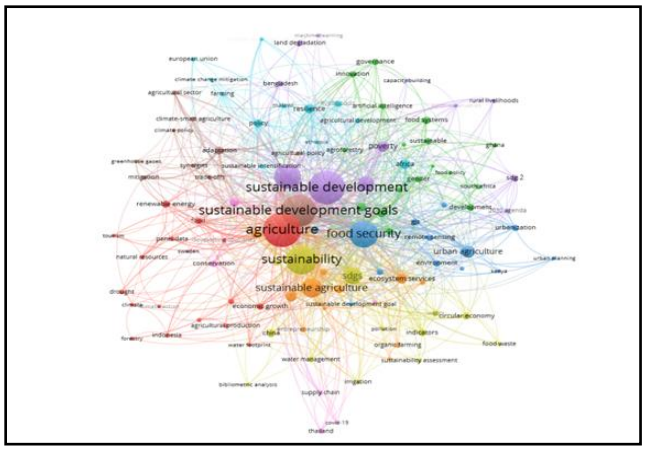

Figure 9: Network visualisation of keyword occurences

5. Core Keywords (Largest Circles) are Sustainable Development, Sustainable Development Goals, Agriculture, Food Security, Sustainability, Sustainable Agriculture.

5.1. Cluster 1 (Red) – Climate & resource management focus

Keywords involved are: climate, drought, forestry, renewable energy, natural resources, developing countries.This represents research on environmental risks, resource stress, and climate-smart strategies.

5.2. Cluster 2 (Green) – Technological and policy integration

Keywords involved are: agroecology, artificial intelligence, development, food policy, innovation, governance.This Indicates technology-driven solutions and policy frameworks that enable sustainable agricultural development.

5.3. Cluster 3 (Blue) – Urban & african context

Keywords: urban agriculture, food systems, Kenya, Ghana, SDG 2.This Focuses on urban food resilience, African country case studies, and localized SDG implementation.

5.4. Cluster 4 (Yellow) – value chains and metrics

Keywords involved are: supply chain, food waste, organic farming, pollution, sustainability assessment.This Emphasizes agricultural value chains, sustainability metrics, and waste management.[19-22] So There is a clear blend of technical, environmental, and governance-related themes, reflecting the interdisciplinary nature of the field.India, Ghana, Kenya, Bangladesh show the growing relevance of agritech in developing economies. Emerging trends include artificial intelligence, urban agriculture, resilience, and climate-smart practices.

6. Key Authors, Focus Areas, and Research Gaps

Table 9: Table showing key authors, focus areas, and research gaps

Author	Year(s)	Focus Area	Major Research Gaps
Brunori, G.	2018–2024	Sustainable food systems, agroecology, rural development	Limited focus on scalability and digital integration in smallholder contexts
Bartolini, F.	2019–2023	Policy frameworks for sustainable agriculture	Lack of practical implementation strategies in emerging economies
Pardossi, A.	2018–2022	Water-efficient agriculture, smart irrigation	Limited social science integration; weak coverage of behavioral adoption
Moschitz, H.	2020–2024	Organic farming, sustainability assessments	Under representation of techno-economic perspectives
Verburg, P. H.	2017–2022	Land use change, urban-rural dynamics, environmental systems modeling	Few connections to agritech entrepreneurship and policy impacts
Mabhaudhi, T.	2016–2023	Climate-resilient crops, water-scarce agriculture, African food systems	Weak policy influence; limited cross-regional generalizability
Osabohien, R.	2019–2024	Agricultural policy, economic development, African sustainability pathways	Gaps in tech-based intervention studies and empirical validation
Stringer, L. C.	2015–2023	Land degradation neutrality, ecosystem resilience	Not deeply tied to agribusiness innovations or market integration
Bryan, B. A.	2016–2022	Climate-smart farming, integrated modeling, Australia-focused studies	Lacks application to low-income, small-scale agrarian settings
Brandli, L. L.	2020–2024	Higher education for sustainable development, SDG localization	Weak linkage to agritech and farming sector application

Dougill, A. J.	2016–2021	African drylands, farmer engagement, participatory approaches	Need for deeper integration of digital tools in participatory frameworks

7. Literature Review: Influential and Recently Cited Authors in Agritech and Sustainability Research

Rockström et al. (2017)[18] presented the Planetary Boundaries framework, which has become foundational in the discourse around sustainable development and agriculture. The concept emphasizes maintaining Earth system stability to support humanity, making it a cornerstone for SDG-aligned agricultural innovation. This work is frequently cited in studies linking agritech with global ecological thresholds.

Francis et al. (2003)[7] contributed significantly to the field of agroecology by defining it as an integrated approach that links ecology, agronomy, and social science. Their work emphasized participatory and interdisciplinary frameworks, making it a touchstone for agroecological approaches in agritech research.

McAfee (2010)[13] provided a critical analysis of market-based environmentalism and its implications for global food security. Her work remains influential in critiquing neoliberal approaches to agricultural development, especially within global North–South dynamics.

Marsden (2005)[12] explored rural development and the restructuring of agri-food systems. He highlighted the transition from productivist to post-productivist landscapes, contributing to a deeper understanding of place-based and local food economies.

Benton et al. (2015)[2] emphasized sustainable intensification as a means to balance food production with environmental preservation. Their work is increasingly cited in recent studies on climate-smart agriculture and sustainable technology adoption.

Recent works, such as Yuvaraj et al. (2022)26, have focused on digital transformation in agriculture, examining how AI, IoT, and blockchain technologies contribute to food system sustainability and traceability.

Trumpler et al. (2021)[24] analyzed the effectiveness of circular economy models in agriculture, emphasizing the potential of waste reduction and closed-loop systems in aligning with SDG 12 and 13.

Mihaljaga et al. (2021)[14] explored resilience in agricultural livelihoods, particularly in climate-vulnerable regions, highlighting policy and infrastructural gaps in the implementation of adaptive strategies.

7.1. Directions for future research

This study highlights several avenues for future research. There is a critical need to understand the socio-technical dynamics of agritech adoption, especially in marginalized communities. Governance models, financing mechanisms, and impact measurement frameworks remain underexplored. Moreover, interdisciplinary studies linking climate science, digital innovation, and rural development are essential to realize the full potential of agritech in achieving the SDGs. Further bibliometric and comparative analyses can deepen our understanding of geographic and thematic disparities in the literature.

7.2. Technology adoption and inclusivity

Investigate barriers to agritech adoption among smallholders, particularly in low- and middle-income countries (LMICs).Explore gender-sensitive and youth-inclusive models of digital farming and climate-smart agriculture.Study the digital divide and the role of literacy, affordability, and infrastructure in technology diffusion.

7.3. Policy and governance mechanisms

Analyze the effectiveness of agritech-related policies and regulations in achieving SDGs at local and national levels.Explore multi-level governance frameworks and their capacity to support sustainable agriculture transitions.

7.4. Cross-sector integration

Study how agritech interfaces with other sectors (e.g., energy, water, health) to create resilient agri-ecosystems.Examine public-private partnerships and their role in financing and scaling agritech innovations.

7.5. Impact Assessment and Metrics

Develop and test impact assessment models that measure the contribution of agritech to specific SDGs such as SDG 2, 12, 13.Conduct longitudinal case studies to track the socioeconomic and environmental outcomes of agritech implementation.

7.6. Indigenous and local knowledge integration

Explore how traditional agricultural knowledge can be integrated with digital or smart farming tools for sustainable outcomes.Study contextualized innovations that respect local ecosystems and farming traditions.

7.7. Climate resilience and sustainability synergies

Investigate agritech's role in mitigating and adapting to climate change, especially in climate-vulnerable regions.Explore innovations that optimize both productivity and sustainability, minimizing trade-offs.

8. Entrepreneurship and Innovation Ecosystems

Examine the development of agritech startup ecosystems in emerging economies.Identify scaling pathways, investment challenges, and innovation bottlenecks in sustainable agri-businesses.

9. Source of Funding

None.

10. Conflict of Interest

None.

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