



ADVANCING SUSTAINABLE DEVELOPMENT THROUGH OPEN SCIENCE: A CASE STUDY OF CONTRIBUTIONS TO UN SDGS

Temitope D. Timothy Oyedotun¹

¹Department of Geography, Faculty of Earth and Environmental Sciences (FEES), University of Guyana, P O Box 10 1110, Turkeyen Campus, Guyana

ARTICLE INFO	ABSTRACT
Article History: Received 15.12.2024 Accepted 15.02.2025 Published 15.03.2025 Keywords: Climate Change, Circular Economy, Data Integration, Global Partnership, Open Science, Sustainable Development Goals (SDGs)	<i>In recent years, the open science movement has gained momentum as a catalyst for addressing global challenges and advancing the United Nations Sustainable Development Goals (SDGs). This presentation highlights the significant contributions to open science, specifically through the publication of five impactful open-access articles with Elsevier between 2020 and 2022. The research articles referred to in this study look at critical issues at the intersection of environmental sustainability, public health, and circular economy. The presentations here are directly linked to various UN SDGs, illustrating how open science can play a very important role in achieving a sustainable and equitable future. The outlined articles cover a range of topics, including the integration of data to address climate change challenges on the Guyana coast (SDG 14 and SDG 17), the correlation between household waste generation, waste composition, and COVID-19 exposure in Guyana and Nigeria (SDG 3, SDG 8, SDG 11, SDG 12, and SDG 17), and the importance of linking national policies to beneficiaries through geospatial and statistical focus in waste and sanitation planning (SDG 12 and SDG 17), among others. These referred articles explore the broader implications of open science in driving societal progress. This presentation emphasises the collaborative and transparent nature of open-access research, showcasing how academic research is contributing to a more inclusive and sustainable world. It is expected that this write-up underscores the need for continued support and advocacy for open-access initiatives to ensure a more transparent and collaborative future in research.</i>

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1. Introduction

The open science movement has gained significant traction in recent years, emerging as a key driver in tackling global challenges and promoting inclusivity in research (Albornoz, et al.

2018). The key to this movement is its focus on the principle of transparency, collaboration, and unrestricted access to knowledge, which has empowered researchers across disciplines to address complex, transboundary issues (Hall, et al. 2022). One of the most impactful ways open science contributes to global progress is by advancing the United Nations Sustainable Development Goals (SDGs), a framework aimed at promoting a more sustainable, equitable, and prosperous world by 2030 (Baltrusaitis, et al. 2024). By providing open access to scientific outputs, this movement accelerates the integration of research into real-world applications, fostering international cooperation to address pressing societal issues such as environmental sustainability, public health, and urban development (United Nations, 2022; Bengtsson, 2023).

A notable contribution to open science can be seen in the publication of five key open-access articles authored or co-authored by Oyedotun, T. D. T. with Elsevier between 2020 and 2022 which were recognised as supporting the UN's SDGs in helping to tackle some of the world's greatest challenges. These five sampled studies address critical issues at the intersection of environmental and urban challenges, directly supporting various SDGs. The main aim of this paper is to highlight how these five sampled open-access publications exemplify the transformative potential of open science in advancing the UN SDGs and emphasise the need for continued support of open-access initiatives to ensure that research serves as a catalyst for global progress, particularly in the pursuit of the SDGs.

2. Key contributions to the SDGs and the impact of the open-access

The five sampled studies, whose publications as open access articles, are summarily described in this section. The increasing adoption of open access (OA) publishing has transformed the accessibility of scientific research, democratising access to knowledge and enabling a broader audience, particularly in fields that contribute to global sustainability initiatives such as the United Nations Sustainable Development Goals (SDGs). These are summarily described in this section.

2.1 The Need for Data Integration to Address Climate Change Challenges on the Guyana Coast (Oyedotun and Burningham, 2021)

The impact of climate change on coastal regions is among the most urgent global challenges, particularly for low-lying coastal areas like Guyana. Rising sea levels, increased storm surges, and coastal erosion threaten both the environment and human settlements. In this context, data integration is essential for formulating effective adaptation and mitigation strategies, aligning with SDG 13: Climate Action. This article emphasises the need for improved data collection and analysis to enhance decision-making processes that support coastal resilience. Climate data integration involves the amalgamation of various data sources—satellite imagery, hydrological models, and local environmental data—into a unified system that provides comprehensive insights into climate impacts. This approach not only enables precise forecasting of future risks but also informs infrastructure development, disaster risk reduction strategies, and resource management. Additionally, the collaboration between local governments, international organisations, and

research institutions aligns with SDG 17: Partnerships for the Goals, as cross-sector partnerships are critical for addressing transboundary environmental challenges (UNEP, 2021).

In Guyana, integrating data from remote sensing technologies and on-the-ground environmental monitoring allows policymakers to develop targeted adaptation strategies for vulnerable coastal communities. Such strategies can enhance flood resilience, improve land-use planning, and support sustainable coastal resource management (Oyedotun and Burningham, 2021). The synthesis of data and its application to real-world challenges exemplifies how research can drive actionable solutions for climate change mitigation. There were nine (9) other research works that benefit from the publication of the work as an open access journal and these also have a wider influence on other SDGs, as of 16 September 2024 (<https://scholar.google.com/citations?user=wF88Q28AAAAJ&hl=en&oi=ao> – Accessed on 16 September 2024), five (5) of these examples are summarily presented below.

i. *Albahri et al. (2024)*'s work addressed the following SDGs: SDG 13: Climate Action: The use of artificial intelligence (AI) to respond to natural disasters aligns with strengthening resilience and adaptive capacity to climate-related hazards; SDG 9: Industry, Innovation, and Infrastructure: Leveraging AI promotes technological innovation in disaster preparedness and response.

Influence of Open Access Publication (Oyedotun and Burningham, 2021): The paper highlights the importance of integrated data systems, which are crucial for AI applications in disaster management. By being open-access, Oyedotun and Burningham (2021) made the insights more easily accessible, potentially inspiring the authors to explore AI-driven solutions in climate-vulnerable regions.

Spiral Effects: Trustworthy AI applications, informed by integrated data systems, could accelerate innovation in disaster response globally, contributing to better implementation of SDGs 9 and 13 in various regions.

ii. *Sovacool et al. (2023)*'s work addressed the following SDGs: SDG 7: Affordable and Clean Energy: The paper addresses policy drivers for decarbonisation; SDG 13: Climate Action: Decarbonization is critical to reducing the impact of climate change; SDG 16: Peace, Justice, and Strong Institutions: Discussing the political economy of net-zero transitions promotes just and inclusive climate governance.

Influence of Open Access Publication (Oyedotun and Burningham, 2021): The work on data integration provided foundational knowledge for understanding coastal vulnerabilities, which could shape the discourse on equitable transitions in climate policy.

Spiral Effects: Insights into climate justice, influenced by open-access research, may help refine global decarbonisation strategies, ensuring that they are both effective and equitable.

iii. *Gardel et al. (2022)*'s work addressed the following SDGs: SDG 14: Life Below Water: Remote sensing technology helps monitor coastal and marine ecosystems; SDG 13: Climate Action: Understanding coastal dynamics helps predict and manage climate change impacts on coastlines.

Influence of Open Access Publication (Oyedotun and Burningham, 2021): The research on data integration may have informed Gardel et al.'s methodology, particularly in combining different data sources for coastal analysis

Spiral Effects: Improved understanding of coastal systems through integrated data could enhance policies on marine ecosystem protection, driving progress on SDG 14 in other vulnerable coastal regions.

iv. *Subiyanto (2023)* addressed the following SDGs: SDG 8: Decent Work and Economic Growth: Focuses on the relationship between economic growth and environmental sustainability; SDG 13: Climate Action: Analyses the potential to decouple economic growth from environmental degradation, crucial for climate resilience.

Influence of Open Access Publication (Oyedotun and Burningham, 2021): The paper's focus on integrating data to address climate change challenges could have provided insights into the environmental constraints of economic growth, particularly in developing economies.

Spiral Effects: By making this knowledge widely accessible, more studies can explore sustainable growth models, contributing to global strategies for balancing economic and environmental needs.

v. *Holtzman (2024)*'s work on Warrau Dugout Canoe and Cultural Heritage addressed SDG 11: Sustainable Cities and Communities: By preserving cultural heritage, this study contributes to sustainable communities, and SDG 13: Climate Action: Traditional knowledge systems, like the Warrau watercraft, often offer sustainable solutions to environmental challenges.

Influence of Open Access Publication (Oyedotun and Burningham, 2021): The emphasis on integrated data systems for climate resilience could have underscored the importance of traditional knowledge in sustainable practices, influencing this ethnographic study.

Spiral Effects: Preserving indigenous knowledge systems can inspire sustainable development practices in other regions, promoting cultural sustainability alongside climate action.

2.2 Household Waste Generation, Change in Waste Composition, and Exposure to COVID-19 in Guyana and Nigeria (Kasim, Oyedotun, et al. 2021)

The COVID-19 pandemic significantly altered waste generation and management practices, as demonstrated in this study on household waste in Guyana and Nigeria. The shift in consumption patterns during the pandemic, including increased reliance on packaged goods and personal protective equipment (PPE), led to a surge in plastic waste, posing challenges to waste management systems. This study addresses SDG 12: Responsible Consumption and Production by exploring how these changes necessitate adaptive waste management strategies to ensure environmental sustainability. The study advocates for the promotion of sustainable waste management practices, such as recycling and reducing plastic use, in line with the objectives of SDG 12. The study's focus on COVID-19 exposure through improper waste disposal highlights its relevance to SDG 3: Good Health and Well-being. Improper handling of contaminated waste can increase the risk of disease transmission, particularly in densely populated urban areas. Therefore, the research calls for heightened public awareness and policy interventions aimed at improving waste segregation and treatment practices to safeguard public health.

As of 16 September 2024, there were sixteen (16) other works that referenced this open access publication. Five (5) of these include:

i. *Mahyari et al. (2022)*'s study addressed the following SDGs: SDG 12: Responsible Consumption and Production: Focuses on sustainable waste management practices, and SDG 13: Climate Action: Adapting waste management in response to pandemic-related changes helps mitigate climate impacts.

Influence of Open Access Publication (Kasim, et al. 2021): This paper provided critical insights into how waste composition changed during COVID-19, influencing Mahyari et al.'s examination of post-pandemic waste management strategies.

Spiral Effects: This research helps drive sustainable waste practices post-pandemic, potentially influencing global waste policies and advancing SDGs 12 and 13.

ii. *Kurniawan et al. (2022)* addressed the following SDGs: SDG 9: Industry, Innovation, and Infrastructure: Digital technologies promote innovation in waste recycling and circular economy models; and SDG 12: Responsible Consumption and Production: A shift toward a circular economy directly supports sustainable consumption and waste reduction.

Influence of Open Access Publication (Kasim, et al. 2021): The research on changes in waste composition during the pandemic likely highlighted the need for innovative recycling solutions, which influenced Kurniawan et al.'s focus on digital technologies for waste management.

Spiral Effects: The paper encourages technological advancements that can reduce waste and promote resource efficiency, contributing to SDGs 9 and 12 on a broader scale.

iii. *El Bilali et al. (2023)* addressed the following SDGs: SDG 2: Zero Hunger: The paper examines the impacts of COVID-19 on food systems, contributing to food security strategies; and SDG 12: Responsible Consumption and Production: Examines how disruptions in food systems affect consumption patterns and waste.

Influence of Open Access Publication (Kasim, et al. 2021): The paper provided insights into how the pandemic influenced resource use and waste in agricultural contexts.

Spiral Effects: By linking pandemic-related waste patterns to food security challenges, the research can influence policies aimed at reducing food waste and improving resilience in agri-food systems, promoting SDGs 2 and 12.

iv. *Mokhtari & Salemi (2023)* - contributed to the following SDGs: SDG 11: Sustainable Cities and Communities: The study focuses on how cities managed municipal waste during the pandemic; and SDG 12: Responsible Consumption and Production: Highlights the need for sustainable waste management strategies during crises.

Influence of Open Access Publication (Kasim, et al. 2021): This work likely informed Mokhtari and Salemi's systematic review, offering a case study on how pandemics affect urban waste systems.

Spiral Effects: Insights from this study can support cities worldwide in developing resilient waste management systems, promoting sustainable urban living in line with SDGs 11 and 12.

v. *Aleisa & Al-Jarallah (2024)* addressed the following SDGs: SDG 11: Sustainable Cities and Communities: Characterizing waste composition helps in designing sustainable urban waste

management systems, and SDG 12: Responsible Consumption and Production: Understanding waste streams contributes to better waste reduction strategies.

Influence of Open Access Publication (Kasim, et al. 2021): This paper's analysis of waste composition shifts during the pandemic provided a framework for analysing Kuwait's waste patterns.

Spiral Effects: Improved waste characterisation, informed by open access research, leads to more efficient waste management practices that contribute to SDG 11 and 12 in both local and international contexts.

2.3 Linking National Policies to Beneficiaries: Geospatial and Statistical Focus on Waste and Sanitation Planning (Oyedotun and Moonsammy, 2021)

This article highlights the role of geospatial and statistical analysis in aligning national waste and sanitation policies with local needs, contributing to SDG 6: Clean Water and Sanitation. Geospatial tools like GIS enable the visualization of sanitation infrastructure and service gaps, helping prioritize investments. Integrating statistical analysis improves the monitoring and evaluation of waste management policies. This approach promotes equitable access to sanitation services, benefiting public health and environmental sustainability. It also supports SDG 17 by encouraging collaboration among governments, research institutions, and the private sector. Five (5) of the examples of the eight (8) other works which benefited from this work that was published Open Access include:

i. *Du et al. (2023)* - addressed the following SDGs: SDG 12: Responsible Consumption and Production: Focuses on the sustainable management of transnational waste flows; and, SDG 17: Partnerships for the Goals: Highlights international cooperation in waste management and recycling.

Influence of Open Access Publication (Oyedotun and Moonsammy, 2021): The paper provided a framework for linking national policies to real-world waste management outcomes, which is essential for understanding transnational waste flows and their governance. This influenced Du et al.'s exploration of the recycling of export waste.

Spiral Effects: By contributing to discussions on global waste management and policy, this research enhances the promotion of SDG 12 and 17, encouraging international collaboration for sustainable waste practices.

ii. *Olawade et al. (2024)* - addressed the following SDGs: SDG 9: Industry, Innovation, and Infrastructure: Focuses on leveraging AI to improve waste management infrastructure; and, SDG 11: Sustainable Cities and Communities: AI-driven smart waste management contributes to cleaner, more sustainable urban environments.

Influence of Open Access Publication (Oyedotun and Moonsammy, 2021): The emphasis on geospatial and statistical tools likely informed Olawade et al.'s focus on applying AI to optimise waste management systems, providing valuable data-driven insights.

Spiral Effects: This research promotes smart technologies for waste management, helping cities become more sustainable and efficient, in line with SDGs 9 and 11.

iii. *Adebisi et al. (2023)* - addressed the following SDGs: SDG 7: Affordable and Clean Energy: Focuses on waste management related to renewable energy resources; and, SDG 12: Responsible Consumption and Production: Addresses the sustainable disposal of waste from renewable energy systems.

Influence of Open Access Publication (Oyedotun and Moonsammy, 2021): The work on sanitation planning and waste policy helped Adebisi et al. design frameworks that incorporate national policies into the disposal of renewable energy waste.

Spiral Effects: This paper informs ESG (Environmental, Social, and Governance) frameworks for sustainable waste management, which contributes to responsible consumption patterns and the circular economy, supporting SDGs 7 and 12.

iv. *Alausa et al. (2023)* - addressed the following SDGs: SDG 9: Industry, Innovation, and Infrastructure: Explores how geospatial technology enhances utility management systems, including waste management; and SDG 11: Sustainable Cities and Communities: Uses geospatial tools to optimize urban infrastructure management, making cities more sustainable.

Influence of Open Access Publication (Oyedotun and Moonsammy, 2021): The focus on geospatial technology likely informed Alausa et al.'s work on how geospatial tools can be applied beyond waste management, such as in utilities, including waste disposal.

Spiral Effects: The integration of geospatial technology into utility management strengthens urban planning efforts, enhancing infrastructure resilience and supporting SDGs 9 and 11.

v. *Chao et al. (2023)* - addressed the following SDGs: SDG 16: Peace, Justice, and Strong Institutions: Examines how national policies influence research and governance; and SDG 9: Industry, Innovation, and Infrastructure: Investigates the impact of policies on research and development, promoting innovation.

Influence of Open Access Publication (Oyedotun and Moonsammy, 2021): The work on linking national policies to real-world outcomes could have provided a framework for analysing how policies impact research, as discussed by Chao et al.

Spiral Effects: This research strengthens the understanding of how effective policy-making drives innovation and sustainable development, promoting SDGs 9 and 16 by improving institutional governance and research priorities.

2.4 Accelerating Circular Economy Solutions to Achieve the 2030 Agenda for Sustainable Development Goals (Khajuria, et al. 2022)

The transition to a circular economy represents a critical pathway for achieving sustainability, as it reduces resource consumption, minimises waste, and fosters innovation in industrial practices. This article examines the role of circular economy principles in supporting multiple SDGs, particularly SDG 12: Responsible Consumption and Production and SDG 9: Industry, Innovation, and Infrastructure. By showcasing successful case studies, the article highlights the potential for innovative circular solutions to address environmental challenges, such as waste reduction and resource efficiency. The circular economy also contributes to SDG 8: Decent Work and Economic Growth by creating green jobs and fostering sustainable industries.

This work, which was published as an Open Access paper, and was short-listed by Elsevier as one of the five (5) papers published or co-published by Oyedotun, T. D. T. that contribute significantly to the United Nations Sustainable Development Goals, helping to tackle some of the world's greatest challenges as recognised on 14 November 2023. Of the 153 citations or references to the work as of 18 September 2024, five (5) of these include:

i. *Liu et al. (2023)* - addressed the following SDGs: SDG 12: Responsible Consumption and Production: Focuses on reducing waste and improving recycling systems for electronic waste (e-waste), and SDG 13: Climate Action: Addresses the environmental impacts of improper e-waste disposal.

Influence of Open Access Publication (Khajuria, et al. 2022): The paper (Khajuria, et al. 2022) provided key insights into how circular economy models can be applied to complex waste streams like e-waste. Liu et al. build on these concepts, contributing to better global recycling practices.

Spiral Effects: This paper fosters more sustainable consumption and production practices, advancing SDG 12, while also mitigating climate impacts by improving e-waste management under SDG 13.

ii. *Yao et al. (2023)* - addressed SDG 9: Industry, Innovation, and Infrastructure: Which focuses on innovative methods for recycling complex materials, and SDG 12: Responsible Consumption and Production: Which examines how to improve the recycling of waste printed circuit boards.

Influence of Open Access Publication (Khajuria, et al. 2022): The emphasis on innovative circular economy solutions informed Yao et al.'s exploration of advanced recycling techniques for printed circuit boards, contributing to SDG 9 by promoting industrial innovation.

Spiral Effects: This study contributes to cleaner production methods and waste reduction, supporting SDGs 9 and 12 by addressing critical waste recycling challenges.

iii. *Wang et al. (2023)* - study addressed SDG 7: Affordable and Clean Energy: Focuses on improving the recycling of spent lithium-ion batteries, critical for renewable energy technologies, and SDG 12: Responsible Consumption and Production: Seeks to enhance the circular economy approach to battery recycling.

Influence of Open Access Publication (Khajuria, et al. 2022): The work on circular economy solutions has helped shape the understanding of how battery waste can be recycled, contributing to energy storage sustainability and SDG 7.

Spiral Effects: This research promotes the development of sustainable recycling infrastructure, supporting the clean energy transition and furthering SDGs 7 and 12.

iv. *Danish & Senjyu (2023)* - addressed SDG 9: Industry, Innovation, and Infrastructure: Explores the role of AI in optimizing circular economy models, and SDG 12: Responsible Consumption and Production: Focuses on AI-driven waste management solutions.

Influence of Open Access Publication (Khajuria, et al. 2022): The open-access research on circular economy principles paved the way for the integration of AI into circular policies, influencing the application of technology to enhance resource efficiency.

Spiral Effects: This study furthers innovation in circular economy policies, advancing SDGs 9 and 12 through technological solutions for sustainable consumption.

v. *Sánchez-García et al. (2024)* - contributed to SDG 9: Industry, Innovation, and Infrastructure: Discusses the transformative role of new technologies in CE models, and SDG 12: Responsible Consumption and Production: Explores how technological advancements can improve resource use and waste reduction.

Influence of Open Access Publication (Khajuria, et al. 2022): The research on CE solutions may have inspired Sánchez-García et al. to explore how new technologies, such as AI and IoT, can revolutionise resource management and waste reduction.

Spiral Effects: This paper contributes to technological innovation in CE, driving forward the practical implementation of SDGs 9 and 12.

2.5 Environmental Issues and Challenges Confronting Surface Waters in South America: A Review (Oyedotun & Ally 2021)

This review article highlights the degradation of surface waters in South America, posing threats to ecosystems and human populations. It discusses challenges related to pollution, deforestation, and urbanization, aligning with SDGs 6 (Clean Water) and 15 (Life on Land). The authors emphasize the need for integrated water resource management to address water quality and quantity issues, linked to SDG 13 (Climate Action) due to climate-induced changes. It provides a valuable resource for developing strategies to preserve freshwater ecosystems, benefiting both the environment and human well-being. Of the 28 studies that referenced this work as of 16 September 2024, five (5) of such advanced SDGs are summarily presented here.

i. *Papa et al. (2023)* - addressed SDG 6: Clean Water and Sanitation: Which focuses on monitoring surface water in Africa to ensure sustainable water resource management; and SDG 13: Climate Action: Which addresses the impact of climate change on water resources and the need for adaptation strategies.

Influence of Open Access Publication (Oyedotun & Ally 2021): The paper's comprehensive review of surface water challenges in South America possibly offered a foundational understanding that helped inform remote monitoring techniques applied to African water bodies.

Spiral Effects: By promoting remote sensing as a tool for monitoring water resources, this study helps improve water resource management and climate resilience, furthering the goals of SDGs 6 and 13.

ii. *Bilal et al. (2023)* - addressed SDG 3: Good Health and Well-being: Explores the relationship between surface water quality and public health, and SDG 6: Clean Water and Sanitation: Assesses water quality risks in Bangladesh, contributing to better water management practices.

Influence of Open Access Publication (Oyedotun & Ally 2021): The accessible publication of the work allowed Bilal et al. to integrate knowledge about water contamination and its effects on human health from South America into their meta-analysis of Bangladesh.

Spiral Effects: This study supports SDGs 3 and 6 by identifying the ecological and health risks associated with surface water pollution, contributing to more informed public health and water management policies.

iii. *Mishra (2023)*'s study addressed SDG 6: Clean Water and Sanitation: Focuses on global freshwater availability and the management challenges associated with surface waters; and, SDG 2: Zero Hunger: Connects water availability to agricultural production and food security.

Influence of Open Access Publication (Oyedotun & Ally 2021): The review on South American water issues possibly informed a global context for Mishra's exploration of water scarcity, highlighting cross-regional challenges and solutions.

Spiral Effects: This global review strengthens efforts to improve water management practices that impact food production and sanitation, promoting the realization of SDGs 2 and 6.

iv. *Mashala et al. (2023)*'s work addressed SDG 15: Life on Land: Focuses on using remote sensing to assess land-use changes and their impacts on surface water, and, SDG 6: Clean Water and Sanitation: Supports better monitoring and management of surface water resources using advanced technology.

Influence of Open Access Publication (Oyedotun & Ally 2021): The detailed review of surface water challenges provided Mashala et al. with a comparative foundation for how remote sensing can monitor similar issues in semi-arid environments.

Spiral Effects: The study advances the practical application of remote sensing in monitoring water resources, promoting more sustainable land and water management strategies that support SDGs 6 and 15.

v. *Musie & Gonfa (2023)* - addressed SDG 6: Clean Water and Sanitation: Investigates freshwater scarcity and salinity as critical water challenges, and SDG 13: Climate Action: Examines how climate change exacerbates water scarcity and salinity.

Influence of Open Access Publication (Oyedotun & Ally 2021): The research highlighted similar water scarcity issues in South America, which Musie & Gonfa expanded upon in other regions by addressing the impact of water salinity.

Spiral Effects: The paper contributes to strategies for water scarcity adaptation, aligning with SDGs 6 and 13 by addressing both the causes and consequences of water resource challenges.

3. Conclusion

Open-access (OA) publishing has expanded access to scientific research, especially in fields supporting global sustainability efforts like the UN SDGs. The five OA articles published between 2020 and 2022 show varied citation impacts, reflecting their relevance to global challenges. OA fosters collaboration by making research accessible to all, especially in developing regions with limited access to paid journals. Widely applicable research, such as on circular economy practices, benefits from increased usage through OA. As global challenges grow, OA will play a crucial role in sharing solutions. Continued support for OA is essential for advancing the SDGs and global sustainability.

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