European Commission

Research and Innovation

Final Report on Circular Bioeconomy: Insights from the Thematic Working Group of the Circular Cities and Regions Initiative

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Table of contents

List of acronyms

BIC	Bio-based Industries Consortium
CBE JU	Circular Biobased Europe Joint Undertaking
CCRI	Circular Cities and Regions Initiative
CCRI-M	CCRI Methodology
CEAP	Circular Economy Action Plan
CSS	Circular Systemic Solution
DG RTD	European Commission’s Directorate-General for Research and Innovation
EBRD	European Bank of Reconstruction and Development
ECBF	European Circular Bioeconomy Fund
EIB C3	European Investment Bank Circular City Centre
GA	Green Assist
PDA	Project Development Assistance
R&I	Research and Innovation
SME	Small and Medium-sized Enterprise
TRL	Technological Readiness Level
TWG C-BIO	Thematic Working Group on Circular Bioeconomy

About this Report - Informing, Inspiring, and Enabling Circular Actions

The circular bioeconomy is unlocking new opportunities for cities and regions to turn organic waste and bio-based residues into sustainable value, but scaling these innovations requires technical know-how, tailored support, and access to financing. This report presents the insights and outcomes of the Circular Cities and Regions Initiative (CCRI) Thematic Working Group on Circular Bioeconomy (TWG C-BIO) from January 2023 to October 2025.

The TWG C-BIO focused on advancing bio-based innovation through technical expertise, tailored advisory support, and facilitation of connections with financing institutions. This hands-on approach helped cities and regions identify practical pathways for accelerating circular bioeconomy transitions.

The report brings together circular solutions, good practices, and thematic insights developed during the three-year process, alongside key barriers and enablers. It also provides policy recommendations and forward-looking suggestions to strengthen future peer-learning formats.

Targeted at local and regional authorities, policymakers, business support organisations, researchers, and other circular economy stakeholders, the report offers guidance, practical inspiration, and strategic perspectives to accelerate the circular bioeconomy in cities and regions.

1. Chapter I: Looking back – Achievements of the TWG

1.1 Introduction / About the support provided by the TWG to its Members

1.1.1 Scope and mission of the TWG C-BIO

The TWG C-BIO was established to support CCRI Stakeholders in advancing Circular Systemic Solutions (CSSs) within the bioeconomy domain. Its mission is to foster inclusive collaboration across all stakeholder types, including Pilots, Fellows, (CCRI and non-CCRI) Projects, Partners, and relevant external actors. The aim was to achieve this through the identification of needs and offers, the facilitation of knowledge exchange, and the enabling of targeted cooperation.

The scope included:

- **Supporting CSS design, implementation, and maturation** across diverse regional contexts.
- **Promoting thematic focus areas** aligned with stakeholder expertise and CSS potential.
- **Facilitating demand-offer matchmaking** to connect policymakers with technical and advisory support.

These support mechanisms enabled cities and regions to mature their CSSs, address technical and financial challenges, and move closer to implementation.

1.1.2 Thematic focus areas

Based on feedback from members during the start of the activities, three thematic focus areas were defined. The purpose of defining them was to ensure that the focus of the activities was targeted towards their expertise. In this way the focus was on areas with the highest potential for CSS implementation. Each of the three focus areas was led by a member with recognised expertise in the respective domain:

- **Bio-based fertilisers.**
- **Food and feed ingredients.**
- **Innovative bio-based products**, including bio-based plastics**.**

1.1.3 Approach and methodology

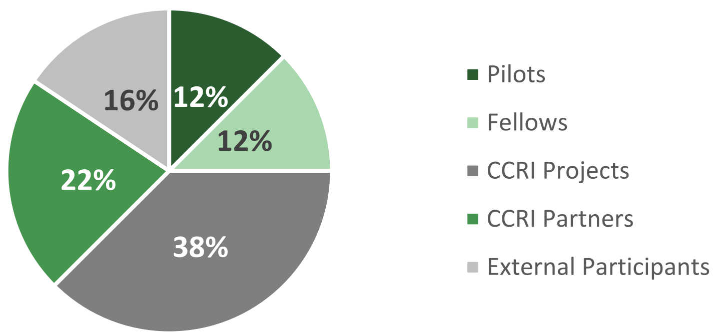
A collaborative, impact-driven approach was adopted to help members advance CSSs. Its work combined regular interaction, targeted matchmaking, and coordination with advisory and financial support services to create tangible results.

The methodology centred on three thematic focus areas, supported by surveys to identify evolving needs and shape agendas. Close cooperation with Pilot Companions and CCRI Task Leads ensured alignment with Pilot priorities and enabled tailored advisory support through services such as Green Assist and the European Investment Bank Circular City Centre (EIB C3). To foster collaboration, a matchmaking database of offers and demands was developed, leading to over 50 potential partnerships and targeted ad-hoc meetings.

By integrating expert knowledge, financial advisory services, and peer exchange, the technical maturity and bankability of members' circular solutions was strengthened. This inclusive, data-driven approach proved effective in connecting policymakers, advisory services, and investors, translating bioeconomy ambitions into concrete regional action.

1.1.4 Composition of the TWG members

The TWG C-BIO brought together 30+ stakeholders, with representatives across all four categories of CCRI Stakeholders as well as a wide range of external experts with deep knowledge of innovative CSSs (see figure below). This balanced composition has been instrumental in fostering inclusive dialogue and collaboration. A particularly valuable contribution has come from the active involvement of several CCRI Projects focused on bio(-based) economy, which enabled the effective transfer of knowledge from innovative Horizon Europe projects to policymakers.



1.2 Achievements of the CCRI Thematic Working Groups

1.2.1 Key actions and support activities

Strengthening knowledge transfer and peer learning: Provision of relevant examples/best practices of CSSs that have either been successfully implemented or are currently under development by policymakers, especially under CCRI Projects. These examples served not only as practical references but also as sources of inspiration for members seeking to replicate or adapt similar approaches within their own regional or organisational contexts.

Creating matchmaking and collaboration pathways: By connecting Pilots and Fellows with CCRI Projects and other experts, opportunities were created for knowledge exchange. This matchmaking process has been instrumental in identifying synergies and potential future cooperation among the members.

Enhanced access to tailored advisory support: Recognising the importance of tailored guidance, own (in-house) support activities were integrated with additional and external advisory services, particularly those offered by Green Assist (GA) and the European Investment Bank Circular City Centre (EIB C3). These services have provided some members with expert advice on project development, financial structuring, and implementation planning, thereby enhancing the maturity and setting the basis for future bankability of CSS initiatives.

Unlocking investment opportunities for Circular Bioeconomy projects: The bridging of the gap between the members and potential investors was facilitating by introducing investors to the members, and vice versa. This has facilitated meaningful future cooperation aimed at securing funding for CSS-related projects.

Shaping the policy and funding landscape for greater impact: Members contributed to shape the broader policy and funding landscape by maintaining close collaboration with key European actors such as the BIC (Bio-based Industries Consortium) and the CBE JU (Circular Biobased Europe Joint Undertaking). These partnerships ensured that their voices and needs were reflected in EU programmes and strategic initiatives, thereby reinforcing the systemic impact of its support activities.

1.2.2 Results and impact

Matchmaking: Promising matches between stakeholder needs (‘demand’), available support (‘offer’) and advisory services were identified, laying the groundwork for collaboration on knowledge and further support. This led to new advisory trajectories and early collaboration discussions. Contact between Pilots and investors were also initiated, marking a significant step toward unlocking funding opportunities. Notably, the EBRD began exploring cooperation with a member, demonstrating the growing interest of financial institutions in supporting circular bioeconomy projects.

Progress in the implementation of CSSs: Concrete cases of CSS implementation were shared by CCRI Projects with Pilot Members, enabling practical learning and inspiration. This included information on innovative valorisation of human urine for fertilisers, concrete results of advisory support activities and tools developed. Additionally, advisory facilities such as GA and the EIB C3 provided tailored support to several members, helping to improve the maturity and feasibility of their CSS initiatives.

Knowledge sharing and technology transfer: By sharing best-case examples of innovative technologies and CSSs implemented, concrete collaboration efforts between members took place. For example, members investigated the potential to adapt and apply a CCRI Project’s innovative technologies for producing bio-based fertilisers within their local context. Such efforts reflect the collective commitment to enabling CSS implementation through strategic support, cross-sectoral engagement, and the mobilisation of advisory and financial resources. Additionally, the dissemination of several tools and resources developed by CCRI and CBE JU projects was facilitated, enabling members to access practical guidance, replicate proven approaches, and accelerate the implementation of circular solutions.

1.3 Enablers and obstacles

1.3.1 Barriers to circular bioeconomy

The identified barriers were grouped into regulatory, financial, and technical barriers however, they rarely exist in isolation. Instead, they are closely interconnected, with one amplifying or reinforcing another. Recognising these links is crucial for understanding the challenges in CSS implementation. For instance, regulatory uncertainty can deter private and public investment, which in turn limits the financial resources available for scaling up promising technologies. Without sufficient funding, research and demonstration activities remain constrained, leaving technical barriers unresolved. This, again, makes regulators more hesitant to establish clear frameworks, creating a self-reinforcing cycle.

Barrier 1: Regulatory uncertainty for fertilisers and bio-based 'waste' streams

Overview: The implementation of Circular Solutions in the field of the Circular Bioeconomy is still facing significant regulatory and governance barriers. The main difficulty lies in the absence of a clear and coherent multi-level governance and policy framework. At the regional level, bioeconomy strategies are often designed in silos (within the regional context) and, as a result, they are often insufficiently aligned with national or EU-level strategies and directives, such as the EU Green Deal or Circular Economy Action Plan (CEAP).

Examples: This fragmented approach creates complexity and misalignment, particularly in the regulations that influence the treatment of bio-based side and waste streams. The most forthcoming example is the inconsistent application of end-of-waste criteria for bio-based streams such as compost and nutrients, which leads to divergent standards across countries. This makes it challenging to create a circular solution that is replicable and transferable beyond the local context.

The lack of alignment also influences the permitting and certification of circular products derived from waste streams. Currently, these processes often prove to be complex, time-consuming and expensive. As in the case of fertilisers, the newly developed product had to receive approval from each Member State.

Streamlined permitting procedures and harmonised criteria for the definition and use of side streams are therefore essential steps towards creating a more supportive environment. In this context, the role of local authorities should not be underestimated. As decisive enablers or barriers, they have the capacity to either reinforce silos or to bridge them by coordinating across departments and providing coherent guidance. Their actions often determine whether circular bioeconomy solutions can be implemented effectively on the ground.

Barrier 2: Limited long-term financing options for circular (bioeconomy) business models

Overview: Two key challenges emerged regarding the financial barriers to the uptake of circular solutions in the bioeconomy. On one hand, local actors often face a lack of tailored, long-term financing options. On the other hand, this financial gap contributed to lower perceived maturity and the feasibility of circular business models compared to more traditional linear approaches.

Examples: The current funding landscape consists of financing streams that are often fragmented, short-term, and administratively complex, which discourages smaller actors (such as Small and Medium-sized Enterprises (SMEs) and farmers) from launching or scaling up projects beyond a local pilot. Financial support is largely focused on early Technological Readiness Level (TRL) projects, with funding directed towards idea development rather than industrial upscale. As a result, many promising initiatives stall at the pilot stage due to the absence of region-specific investment tools, while public procurement systems rarely integrate circular bioeconomy priorities, limiting market incentives for sustainable products and services. However, upscaling is essential to prove market viability and to attract private investment. Without demonstrable scalability, investors are reluctant to take on the risks associated with new circular products, creating a critical gap between innovation and commercial deployment.

Access to finance remains particularly difficult because circular business models do not align easily with traditional financial valuation methods. Circular Solutions often require significant upfront capital, while financial returns (ROI) are more delayed and often undervalued due to the absence of mechanisms to account for environmental and social benefits. Conventional investors remain cautious, perceiving circular economy funds as untested and the responsibility of public actors. The lack of innovative financial instruments, such as leasing schemes, performance-based financing, blended capital, or fund-of-funds structures, further constrains growth. Moreover, the difficulty of securing cornerstone investors slows momentum, while internal constraints within industrial players limit their engagement in specialised funds.

Barrier 3: Data gaps and fragmented bio-waste availability limit replication potential

Overview: A key barrier to advancing circular systemic solutions in the bioeconomy is the combination of fragmented resource availability, insufficient data and monitoring systems, and limited access to test and demonstration environments. The challenges are often situation-specific, but together, these factors hinder the efficient valorisation of bio-based side streams, slow down technological progress, and restrict the transition from pilot initiatives to large-scale implementation.

Examples: In many regions, biomass side streams are geographically dispersed, particularly across rural areas, where processing installations are often concentrated elsewhere. This spatial mismatch leads to high transport costs and limits the economic potential of otherwise abundant resources, especially where decentralised infrastructure is lacking. Compounding this issue is the absence of reliable and interoperable monitoring systems, which makes it difficult to track side streams and nutrient flows in these areas effectively. As a result of the lack of data, smaller actors, who often play key roles in regional bioeconomy ecosystems, frequently lack the technical means and knowledge to measure environmental impacts or conduct material flow assessments, which are essential for designing CSSs.

Moreover, limited access to testbeds and demonstration environments hampers innovators' ability to validate and refine solutions under real-world conditions. Without stronger demonstration capacity and supportive digital frameworks, many technologies remain confined to pilot projects, unable to mature technically or commercially. At the same time, retrofitting existing linear systems is both costly and complex, and the absence of standardised assessment and monitoring tools complicates evaluation processes and slows the wider adoption of circular practices.

1.3.2 Enablers for circular bioeconomy

Several key enablers are already driving progress in the circular bioeconomy across Europe. These enablers, such as local innovation, advisory support, and emerging investor interest, are not isolated; rather, they reinforce one another and collectively contribute to the maturity and scalability of circular solutions.

Enabler 1: Local innovation and technological solutions

It became very apparent that at the local level, there is strong momentum around valorising biomass waste and side streams across the different cities and regions in Europe. Many innovators are developing technological solutions tailored to regional circumstances, ranging from small-scale processing to digital monitoring tools. While these solutions are often designed for local application, several have demonstrated potential for replication in other regions.

This directly addresses Barrier 3 on data gaps and fragmented bio-waste availability, as it allows for the improvement of traceability, demonstrating scalability, and facilitating replication of circular technologies across regions.

Enabler 2: Advisory services

Advisory services have also played a key enabling role, supporting mainly pilots in mapping their territorial waste streams and identifying circular opportunities within the region. This has helped local authorities mature in their approach to implementing circular solutions and business models, for example, by building a clearer picture of resource flows, which is essential for planning infrastructure, prioritising investments, and creating conditions for innovative circular solutions to develop.

This directly addresses Barrier 2 on limited-long term financing, by guiding them with compliance readiness and strengthening investments cases and business models.

Enabler 3: Emerging investor interest

In addition, new investors have begun to show interest in financing circular bioeconomy initiatives. Their involvement is an important step in bridging the gap between pilot projects and commercial deployment, as it provides not only capital but also validation that circular business models can attract private sector commitment. The presence of such investors strengthens the ecosystem, offering pathways to maturity for technologies and business cases that would otherwise struggle to advance.

This directly addresses Barrier 2 by improving access to long-term capital, validating the economic potential circular bioeconomy business models and helping initiatives to move from pilot to market stage.

Enabler 4: Connecting and scaling local efforts

Taken together, these developments demonstrate that significant technical and entrepreneurial activity is already underway on the ground. Local initiatives, sometimes already supported by advisory services and emerging investor interest, are generating innovative and practical solutions for circular bioeconomy challenges. The key task now is to connect and scale these efforts, ensuring that successful innovations can move beyond local contexts to deliver impact across regions and the EU as a whole.

This helps addressing Barrier 1 by promoting consistent approaches and knowledge exchange to support policy alignment, and Barrier 3 by enhancing knowledge and resource sharing to tackle the fragmentation of data.

1.4 Inspiring success stories

The success stories presented in this chapter were chosen because they perfectly illustrate the vision and approach of the TWG C-BIO: fostering concrete cooperation among regions, projects, and external actors while accelerating the implementation of CSSs. They embody how shared vision, facilitation and cooperation at multiple levels can overcome barriers and move CSSs from concept to reality.

1.4.1 How strategic matchmaking enabled circular fertiliser innovation

Challenge: Two CCRI Pilots needed new technologies to convert residual organic waste and wastewater into compliant bio-based fertilisers, but existing processes were unable to do so due to complex regulations and limited technical options.

Solution: The Pilots were matched with a project funded by the Bio-based Industries Joint Undertaking which had successfully demonstrated an innovative process using purple phototrophic bacteria and ANPHORA technology to extract value from wastewater sludge. The TWG Leads together with the Pilot Companions facilitated contact, organised joint meetings, and created a channel for technical exchange between the project and the Pilots.

Impact: This collaboration sparked tailored discussions on how to adapt the process within local regulatory and infrastructural contexts, enabling both Pilots to explore circular fertiliser production models aligned with EU standards. The cooperation remains active, showing strong potential for transferability.

What others can learn?

- **Strategic matchmaking can bridge the gap between Research and Innovation (R&I) projects and local implementation**.
- **Successful replication doesn't always require copying a model one-to-one**, it depends on adapting technologies to local conditions, available feedstock, and governance frameworks.

1.4.2 Advisory supporting accelerating circular solutions

Challenge: Two CCRI Pilots faced difficulties in maturing their circular systemic solutions on technical feasibility and financial viability. These challenges reflected the broader issue of limited in-house capacity to prepare complex bioeconomy projects for funding and implementation.

Solution: After repeated promotion of advisory facilities, both Pilots requested tailored support from GA and EIB C3. The These connections were facilitated together with the Pilot Companions, aligning the advisory focus with each Pilot's local context.

Impact:

- One Pilot received high-intensity GA support for its composting plant producing biofertilisers from biowaste, including technical studies, a feasibility study, and business model reviews, reducing expected production costs.
- The other obtained a techno-economic analysis, including a cost–benefit analysis, and financing strategy, forming a solid base for future funding applications (such as Horizon Europe).

What others can learn?

- **Advisory services can act as catalysts that transform promising local initiatives into mature, finance-ready projects.** They should be engaged early in the process to build technical and financial robustness, and to bridge the gap between concept and investment.

1.4.3 Engaging investors and funders

Challenge: Most circular bioeconomy solutions were technically promising but struggled to attract private capital. Investors often perceived such projects as high-risk due to their novelty, limited scale, and unclear business models.

Solution: To overcome this, external stakeholders were actively involved, notably CBE JU, BIC, and private investors such as EBRD and Banca Intesa. A dedicated Investor Arena session gave members the opportunity to pitch projects, engage with financers, and discuss investment-readiness.

Impact: These exchanges led to ongoing cooperation discussions between a CCRI Pilot and the EBRD, with two potential collaboration pathways identified. They also helped strengthen links between investors and the wider TWG C-BIO community, fostering a more informed and confident financing environment for circular bioeconomy initiatives.

What others can learn?

- **Early engagement with investors helps align project expectations with funding requirements** and builds trust among financial actors who are new to circular models.

1.5 Recommendations to policymakers

Recommendation 1: Strengthen local teams to accelerate circular bioeconomy implementation

While external support and expertise proved to be very valuable, it became clear that **the success of any CSS initiative ultimately depends on the strength of the local team driving it.** The most successful members all had a capable, committed, and available team that was the cornerstone of effective implementation. Especially in the bioeconomy, where available feedstocks and resources are heavily depended on local conditions, local teams are best positioned to coordinate stakeholders, adapt solutions to these conditions and **maintain momentum** throughout the project lifecycle.

Their ability to manage day-to-day operations, respond to challenges, and engage with external partners, including advisory services and investors, is critical to translating plans into impactful results.

Policymakers should invest in building internal capacity, ensuring that the team has the necessary skills, resources, and mandate to lead the CSS initiative. This includes technical expertise, project management capabilities, and a clear understanding of the circular economy principles. Moreover, **continuity and availability are key.** CSSs often span multiple years and require sustained effort. A stable team with long-term commitment can ensure consistency, build trust with stakeholders, and drive the initiative forward even in the face of unforeseen challenges.

Recommendation 2: Carefully map and design a bioeconomy CSS

Designing a bioeconomy CSS requires an **in-depth understanding of the type, quality, seasonality and geography of the biomass side streams that are available**. Moreover, it is very important to **understand the relevant regulations** such as: *transposition of the EU Waste Framework Directive, EU Landfilling Directive, EU Animal by Products, EU-wise End of waste Criteria*, that are influencing the use of these side streams. These have an impact on the use cases of biowaste in applications for fertilisers, food or feed and bio-based materials.

Successful CSS implementation thus **begins with a well-structured planning phase**, for which the methodology developed by the CCRI (CCRI-M) provides a key guide. Policymakers should start by clearly defining the scope, objectives, and expected outcomes of their CSS. This includes identifying the types of bio-based or biodegradable waste streams available locally, such as food waste, green waste, or wastewater sludge, and assessing their potential as feedstock for circular processes. A robust planning process should also include a **stakeholder mapping** exercise to understand who needs to be involved, from local authorities' waste management operators to technology providers and community organisations. **Early engagement** with these actors helps build ownership and ensures that the CSS is grounded in local realities.

Policymakers are encouraged to adopt a **systemic approach that considers the entire value chain**, from waste collection and processing to product development and market integration. This includes evaluating the regulatory environment, potential barriers, and opportunities for innovation. Tools such as the Bio-circularity Label, Circular Valuation Method, and Project Maturity Level can support this process by helping assess the readiness and circularity potential of proposed solutions. Moreover, it is essential to **align CSS planning with broader urban and regional strategies**, including climate action plans, resource efficiency goals, and economic development agendas. This alignment ensures long-term sustainability and facilitates access to funding and political support.

Recommendation 3: Embed strong stakeholder engagement across the bio-based value chain

Bioeconomy CCS involve diverse stakeholders including farmers, waste management companies, bio-based industries, SMEs, technology providers and more. Mobilising these actors early and effectively and giving them a clear role in the implementation is essential for successful CSS implementation.

Policymakers should adopt **inclusive and transparent engagement strategies** that bring together public authorities, private sector actors, civil society, and academia. **Early and continuous involvement** of stakeholders helps build trust, ensures that diverse perspectives are considered, and fosters co-ownership of the solution. **Structured engagement** has been shown to lead to meaningful cooperation and innovation through thematic workshops, matchmaking sessions, and informal meetings. Policymakers should create spaces for dialogue and co-creation, where stakeholders can jointly identify challenges, propose solutions, and commit to shared goals. It is also important to **tailor**

engagement strategies to the local context. This may involve using participatory tools, citizen consultations, or pilot demonstrations to raise awareness and gather feedback. Clear communication of the CSS's benefits, economic, environmental, and social, can help mobilise support and overcome resistance. Finally, stakeholder engagement should be **embedded in the governance structure** of the CSS initiative. Establishing steering committees, working groups, or advisory panels can formalise collaboration and ensure accountability throughout the project lifecycle.

Recommendation 4: Leverage advisory services and support for technical and financial challenges

Policymakers should actively seek out advisory services that can help refine their CSS concepts and improve project maturity. The value of **integrating support from initiatives such as GA, the EIB C3, and Project Development Assistance (PDA)** facilities was demonstrated. These services offer tailored guidance on technical feasibility, financial structuring, stakeholder engagement, and implementation planning. Policymakers should not hesitate to reach out to these facilities early in the planning process to benefit from their expertise and networks. Especially because most of the circular bioeconomy projects and innovations are still not in a commercial phase.

In addition to advisory services, **identifying suitable funding opportunities is critical.** Policymakers should explore both public and private financing options, including EU programmes, national grants, and investment from financial institutions. First contacts between Pilots and investors such as the EBRD, Banca Intesa, and the European Circular Bioeconomy Fund (ECBF) were facilitated, demonstrating the importance of proactive engagement with the investment community. To maximise the impact of advisory and financial support, **policymakers should ensure that their CSS proposals are well-documented, evidence-based, and aligned with the priorities of potential funders**. This includes presenting clear business models, measurable outcomes, and pathways to scalability.

Recommendation 5: Promote peer-to-peer learning to support replication of bioeconomy solutions

Peer-to-peer exchange is a powerful enabler of CSS implementation. Policymakers are encouraged to actively participate in networks where they can share experiences, learn from others, and identify opportunities for collaboration. These can facilitate the transfer of knowledge and technologies across regions. Exchanging information with peers helps policymakers avoid common pitfalls, accelerate learning curves, and adapt proven solutions to their own contexts. It also fosters a sense of community and shared purpose, which is essential for driving systemic change. To support this exchange, **policymakers should document their experiences, participate in workshops and thematic meetings, and contribute to shared repositories of tools and case studies**. Platforms such as the CCRI intranet and TWG-led databases can serve as valuable resources for storing and accessing this information.

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