EXECUTIVE SUMMARY

Elements for a National Strategy to Implement

Biorefineries in Brazil

UNDP

MINISTRY OF DEVELOPMENT, INDUSTRY, TRADE AND SERVICES

BRAZILIAN GOVERNMENT

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Biorefineries in Brazil

Brasília, April 2025

TECHNICAL SHEET

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The diagnosis, mappings, and proposals presented in this document were developed with the collaboration of various entities and bioeconomy experts, whose contributions were essential in advancing the understanding of opportunities for the sustainable valorization of biomass in the country.

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FOREWORD

Brazil holds a prominent position on the global stage when it comes to bioeconomy. With its vast biodiversity, extensive agricultural areas, and renewable energy grid—among the most advanced in the world—the country possesses unique potential to develop a thriving bioindustry rooted in a systemic vision of biorefining.

In addition to showcasing national and international experiences, this publication examines technological innovation, public policies, and business models that can drive growth in this sector. It aligns fully with the New Industry Brazil (*Nova Indústria Brasil—NIB*) framework—particularly Mission 5, "*Bioeconomy, Decarbonisation, and Energy Transition and Security for Future Generations*", launched in December 2024—and with the national bioeconomy and circular economy strategies.

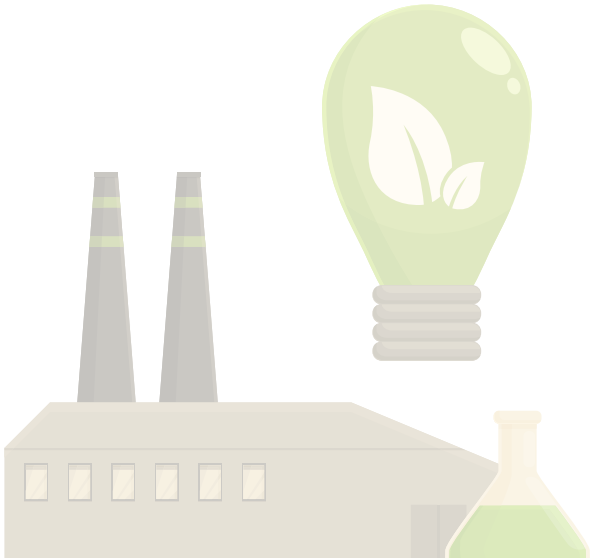
As one of the outcomes of Project BRA/18/023—*Modernisation of the Economy and Qualified Expansion of Brazil's Trade Insertion*, this publication highlights the importance of cooperation between the United Nations Development Programme (UNDP Brazil) and the Ministry of Development, Industry, Trade and Services (MDIC) in advancing Brazil's development on strategically significant issues related to sustainability and the country's 2030 Agenda.

More than merely a repository of knowledge, this publication serves as a call to action. Companies, researchers, policymakers, and society at large have the opportunity to contribute to a more sustainable and competitive future, with bioindustry playing a leading role in a new cycle of development.

MDIC and UNDP Brazil extend their gratitude to all those who contributed to this initiative—collaborators, partners, industry representatives, and members of academia. May this publication provide enriching insights, inspire action, and strengthen Brazil's commitment to an innovative and sustainable bioindustry.

Ministry of Development, Industry, Trade and Services

United Nations Development Programme Brazil



EXECUTIVE SUMMARY

The relevance of biorefining and biomass-based biorefineries lies in the opportunities they offer for the sustainable valorisation of Brazil's diverse biomass resources. The aim of this report is to assess the current stage of biorefinery development in Brazil and based on this assessment, provide insights to support the formulation of biorefinery strategies for the country.

This study is grounded in the perspective of sustainably valorising Brazil's natural resources to generate economic, social, and environmental benefits. As such, it serves as a key contribution to advancing the objectives and outcomes of Project BRA/18/023—*Modernisation of the Economy and Qualified Expansion of Brazil's Trade Insertion*, a partnership between the United Nations Development Programme in Brazil (UNDP Brazil) and the Ministry of Development, Industry, Trade and Services (MDIC) of the Brazilian government.

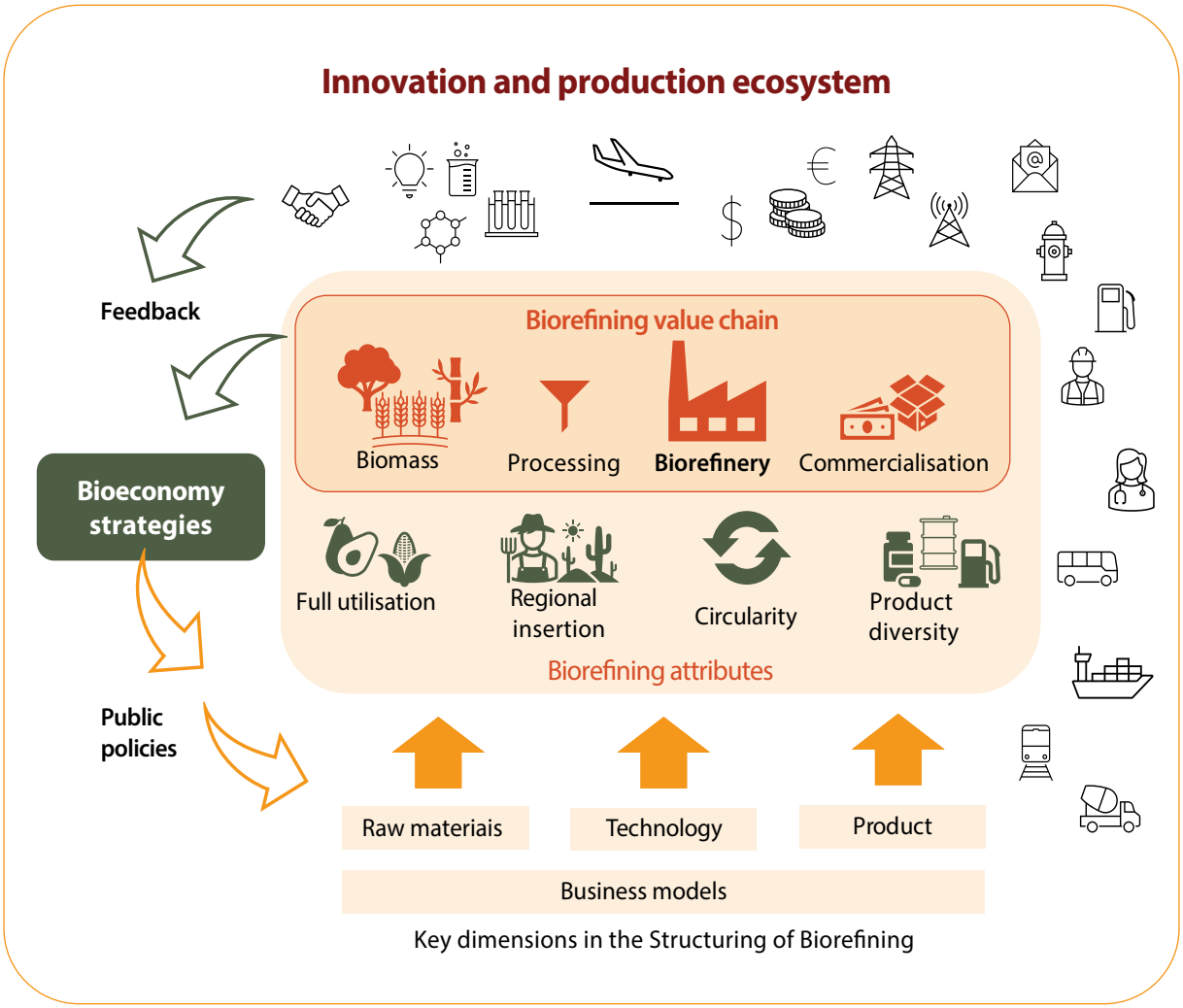
This report is also aligned with Mission 5 of the New Industry Brazil Plan (*Plano Nova Indústria Brasil*), led by the MDIC: *"Bioeconomy, Decarbonisation, and Energy Transition and Security to Guarantee Resources for Future Generations"*. Among other initiatives, this Mission aims to achieve a 50 per cent increase in the use of biofuels within the transportation energy matrix. Accordingly, the report presents a comprehensive assessment of the current stage of biorefinery development in Brazil and offers insights to support the formulation of biorefinery strategies in the country.

To this end, the paper proposes a systemic view of biorefining that extends beyond the industrial unit or biorefinery itself. This systemic vision can be summarised as follows:

Biorefining: Biorefinery + Production Chain + Innovation and Production Ecosystem

To address the challenges of the bioeconomy, biorefining must aim to achieve four key attributes: product diversification, full utilisation of biomass, circularity, and regional/territorial integration. The figure below illustrates the systemic vision of biorefining and its connection to these attributes.

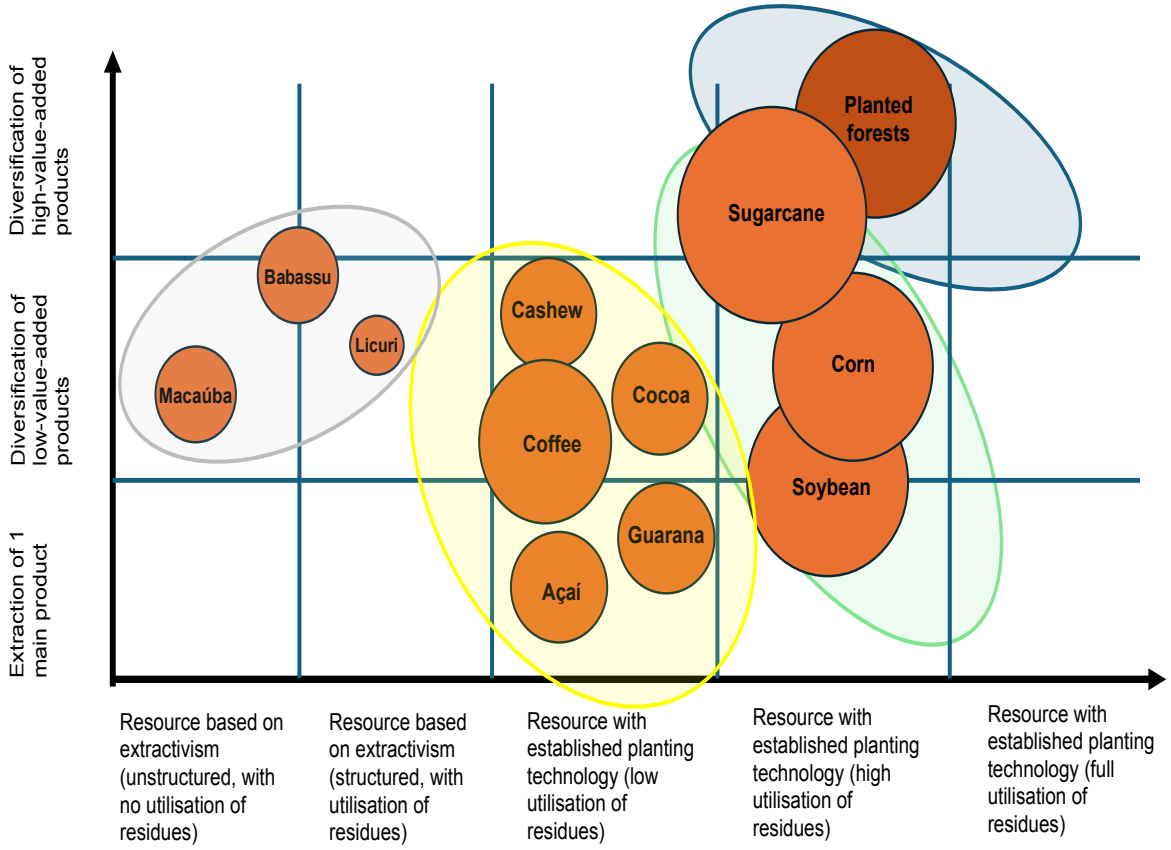
The diversity of biomass available in the country must be understood in relation to the variety of products, the level of added value, the degree of utilisation of the biomass, and the biomass supply model (extraction or cultivation). These parameters allow for the identification of four distinct biomass groups, each with its own internal logic regarding exploitation and valorisation. The groups identified in the study were: planted forests (Group 1), sugarcane (Group 2), coffee and *açaí* (Group 3), and babassu and *macaúba* (Group 4).



Source: Elaborated by the consultant.

The following figure presents a situational analysis of biorefining in Brazil, highlighting the four distinct biomass groups.

Biorefining situational matrix in Brazil



Source: Elaborated by the consultant.

The proposed integrated vision for biorefining highlights that the development of industrialisation through biorefineries depends on overcoming challenges present at the early stages of production chains, which vary in their level of structuring. Advancing the industrialisation phase within the biorefining production chain requires addressing challenges related to primary processing—considered the pre-industrialisation stage—for both resources derived from Brazilian biodiversity and lignocellulosic biomass.

This publication presents a comparative study of the main instruments identified and the policy orientations observed in six selected countries (Australia, China, the USA, Finland, France, and Thailand). Overall, the strategies and policies identified are diverse, reflecting various approaches to bioeconomy and biomass valorisation. One of the study's key conclusions is that the countries analysed lack a systemic vision of biorefining. Of the references examined, the vision and structuring of the Biomass Board in the USA stands out as the best example of a systemic approach to biorefining.

The following key points emerge from the situational diagnosis of biorefining in Brazil:

As a general rule, Brazilian biorefining does not achieve full utilisation of available resources.	Product diversification is limited, with a tendency toward low-value products and infrequent production of high-value-added goods.
Many types of biomass are exploited for the extraction of a single main product and would be more accurately described as pre-biorefineries.	The supply of biomass involves both extraction (structured and unstructured) and cultivation, each presenting distinct challenges for the development of biorefineries.
Industrialisation must be carefully examined, particularly to understand the development of dynamic biomass-based sectors, such as planted forests and sugar cane.	The evolution and maturity of biorefining processes based on biodiversity must be studied in depth, as the future of Brazilian biorefining may rely on the pillars of both agribusiness biomass and biodiversity biomass.

Regarding the cross-cutting policies examined in this study, important lessons emerge concerning weaknesses in Brazilian public policies, particularly in the areas of programme and call-for-tender development, coordination and governance, and the integration of policies and processes.

Key conclusions of the report include:

The systemic vision of biorefining (Biorefining = biorefinery + production chain + production and innovation ecosystem) is crucial for the formulation of effective public policies	
Regarding biomass, the study outlines 15 recommendations. The implementation of each recommendation is influenced by the production chain—covering biomass supply, processing, industrialisation, and marketing—as well as key business dimensions in the bioeconomy, including raw materials, technology, products, and business models.	All recommendations and the policy instruments used to implement them must always consider the key attributes of biorefining: product diversification, full utilisation of biomass, circularity, and regional/territorial integration.
Both the systemic vision and the attributes of biorefining are concepts that are not yet widely disseminated in academic, industrial, and government circles. Efforts should be made to promote and discuss these concepts, as this could lead to a better understanding of the opportunities and challenges associated with biorefineries.	Public policy proposals for the development of biorefining must consider the different stages of biomass supply chain development and incorporate sustainable production models that prioritise environmental and social aspects.
Policies and strategies for developing biorefining in Brazil should consider international benchmarks in two key areas: governance and coordination, and the processes for designing and monitoring programmes and calls for tenders.	The establishment of a coordination body, similar to the Biomass R&D Board in the USA, capable of guiding initiatives involving government, research, and industry through integrated programmes, appears to be a crucial first step toward fostering the development of biorefining in Brazil. Given the strong connection between biorefining, the bioeconomy, and the circular economy, establishing links between these agendas and their respective coordination and governance bodies is essential.

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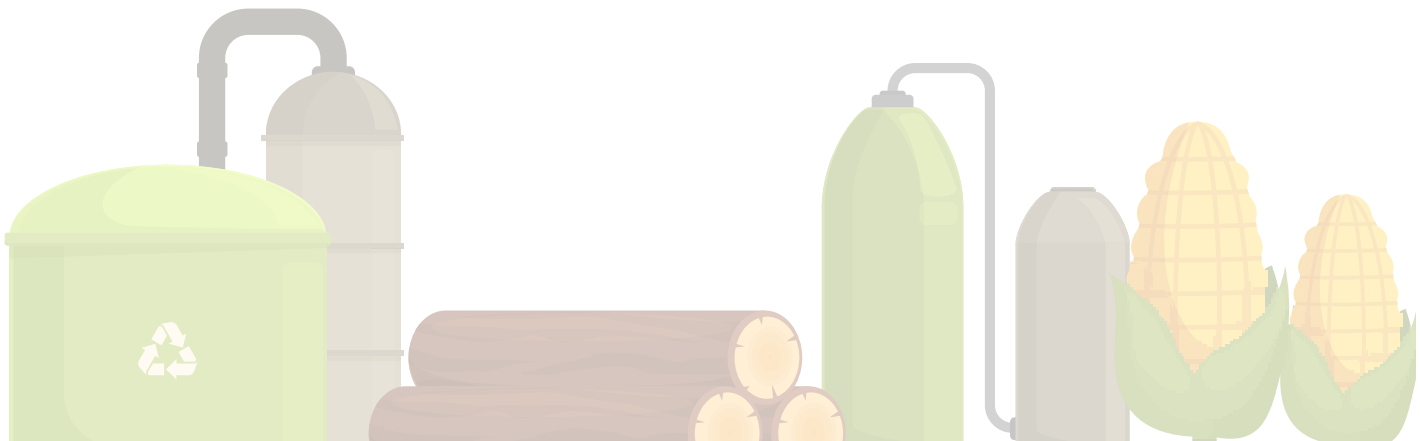

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