

IV SUCCESSFUL CASES CONTEST

INNOVATIONS WITH IMPACT ON BIOECONOMY



Lessons in Bioeconomy to improve sustainable development in Latin America and the Caribbean



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Innovations with impact on bioeconomy. Lessons in bioeconomy to improve sustainable development in Latin America and the Caribbean. This publication is made within the framework of the Fourth Successful Cases of Innovation Contest and this time with a focus on innovation in Bioeconomy.

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We want to express a special thanks to the producers, both men and women, who chose to participate in the competition with their valuable initiatives. Thanks to their effort, dedication, and persistence, they have managed to implement innovations that not only benefit the territory and the community but also promote sustainability, strengthen food security, and improve their quality of life.

To all the rural farmer institutions and organizations that have worked tirelessly in their respective territories of Latin America and the Caribbean. They have not only taken the initiative to develop significant projects in bioeconomy but have also taken the time to

document each step of their process. Their willingness to openly share their experiences and lessons learned is invaluable. These contributions not only enrich the community in general but also serve as a guide and source of inspiration for future generations seeking to make a positive change in the agricultural world.

We extend our recognition to the researchers and technicians for their constant dedication and effort. Despite facing territorial and political challenges, they have persevered in their mission to develop innovations. They have always had the collective well-being as their guiding principle, striving to foster the development of territories harmoniously with the environment. Their commitment to sustainability and food security is a testament to their passion and determination.

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Bioeconomy as an opportunity for a future with complex challenges

In the coming decades, the global agro-bioindustrial system will face unprecedented challenges, testing its responsiveness and resilience. It is estimated that by the year 2050, it will be necessary to increase food production by more than 50%. This challenge is conditioned by the impact of climate change and variability in traditional food production, potential conflicts, migrations, and the high cost of fossil energy, among other factors.

Bioeconomy and sustainable intensification can provide the necessary tools to meet future food demand. Bioeconomy consists of the sustainable production of goods and services through the use or transformation of biological resources, offering a productive model based on knowledge and that reduces dependence on fossil resources. This model seeks the sustainable supply of goods and services for production, based on the use of resources, processes, and biological methods to provide goods and services sustainably in various economic sectors such as bioenergy, food production, fibers and biologicals, health products, industrial products, and bioplastics. It also significantly contributes to human well-being and the "decarbonization" of the economy, aligning with global environmental agreements for sustainability.

In this context, FONTAGRO, as a cooperation mechanism that includes countries in Latin America, the Caribbean, and Spain, and sponsored by the IDB and IICA, positions itself as a key actor to support agricultural research and development systems. Its role is crucial to address the challenges of bioeconomy in the region.

The IV Contest, developed between 2023 and 2024 and detailed in this publication under the title "Innovations with impact on bioeconomy. Lessons in Bioeconomy to improve sustainable development in Latin America and the Caribbean", aims to identify and document successful

experiences and lessons learned that illustrate how the generation of knowledge, technology, and innovation can be catalysts for bioeconomy strategies in the agro-bioindustrial sector of Latin America and the Caribbean. This contest has opened its doors to three types of actors in the region: producer associations and other private sector organizations, including NGOs working with producers; Science and Technology institutions; and the public sector at all levels of government, thus promoting the development of the bioeconomy.

As we move towards a future marked by complex and changing challenges, bioeconomy not only offers innovative solutions but also represents a promise of sustainable and equitable development. Through initiatives like this contest, we seek not only to highlight and share these solutions but also to inspire and foster broader collaboration among diverse actors in Latin America and the Caribbean.



Juan Cruz Molina Hafford
President of FONTAGRO



The strategic role of IICA in consolidating Bioeconomy in the region

The Inter-American Institute for Cooperation on Agriculture (IICA) is the agency of the Inter-American System specialized in agriculture. Throughout its more than 80 years of history, IICA has worked to stimulate, promote, and support the efforts of its member states to achieve agricultural development and rural well-being through international technical cooperation of excellence.

Its work is based on a platform of human resources, specialized tools, and processes capable of mobilizing the knowledge available in the region and around the world, with the aim of achieving competitive, inclusive, and sustainable agriculture that takes advantage of opportunities to contribute to economic growth and development, as well as to promote greater rural well-being and the sustainable management of its natural capital.

Considering the significant productivity, trade, environmental, and social gaps in the agri-food systems of Latin America and the Caribbean (LAC), and also the new possibilities offered by science, technology, and innovation, at IICA we have embraced bioeconomy as a development model to increase efficiency and sustainability not only in biomass production but also in its use, valorization, and industrialization. The new industries of biological products and services offered by bioeconomy promote increased production, value addition, and efficient use of biological resources, while generating new development opportunities in rural-agricultural territories and contributing to environmental sustainability and decarbonization goals.

IICA promotes bioeconomy in the region through a program that assists countries in raising awareness and building capacities, as well as in designing and

implementing policies, strategies, and investments that promote bioeconomy innovations, entrepreneurship, and businesses. The IICA Innovation and Bioeconomy Program currently supports technical cooperation actions in more than 18 countries in the region.

In 2023 alone, thanks to the efforts made by the IICA Innovation and Bioeconomy Program together with regional and national partners, 8 countries in LAC advanced in the formulation and implementation of strategies, policies, and regulations for the promotion of bioeconomy and its pathways. A total of 400 entrepreneurs had greater business, technological, and commercial capacities to boost their bioenterprises, and more than 10,500 researchers, producers, and entrepreneurs obtained tools, resources, and knowledge that allowed them to promote the use of bioeconomy from their value chains. In addition, LAC countries had greater participation and prominence in the discussions and decisions of the main global spaces of bioeconomy and had collective actions and regional mechanisms to promote South-South cooperation on policies, projects, and investments for bioeconomy. This was evidenced by the creation of the Latin American Bioeconomy Network, the Pan-American Liquid Biofuels Coalition, and the Hemispheric Platform for Biologicals.

At IICA, we are committed to continue working with countries and regional partners in promoting bioeconomy as a driver for the strengthening and transformation of our agri-food systems.

Manuel Otero
General Director of IICA



Bioeconomy in Latin America and the Caribbean

On a planet with limited resources, it is urgent to implement efficient and reasonable alternatives to address climate change, food and nutritional security, as well as the serious situation of deterioration, depletion, and environmental pollution caused by human activity. It is essential to shift away from dependence on linear production systems based on fossil energy and move towards the use of renewable, environmentally friendly energies. This bioeconomy approach integrates human and planet welfare objectives, in line with the Sustainable Development Goals (SDGs), and implies conservation, management, and sustainable use of biodiversity.

Bioeconomy is a productive and economic strategy that promotes the efficient and sustainable use of resources, technologies, and biological processes for the supply of processes, goods, and services required by society. It requires a broad vision that seeks to take advantage of scientific advances and technologies that converge and enhance each other to offer new options. This model encompasses the environment (the natural world, renewable biological resources, their interactions with human activities, as well as life support systems: water, soils), with biotechnologies as its main tools. Bioeconomy depends on the application of new frontiers of science and technology and their convergences, and traditional knowledge to use biological resources more efficiently and sustainably. The application of scientific knowledge within the framework of bioeconomy constitutes a transformative approach to redefining the relationships between agriculture, biomass, and industry, making it the ideal instrument to address the interconnected challenges of food security, resource depletion, and climate change.

The circular bioeconomy approach involves an economic system based on the sustainable management of natural resources promoting the production, transformation, and use of biomass in all economic sectors. This approach encourages integrated, sequential, and waste-free value chains, where discarded materials are used as inputs for other processes in a cascade. It endeavors to maintain the value of the system's components efficiently and sustainably, contributing to the transformation of scientific knowledge into new, competitive, and eco-efficient products that improve global quality of life. In summary, it strives to maximize the comprehensive use of biomass to achieve greater production with less environmental impact.

For the countries of Latin America and the Caribbean, these trends represent a new opportunity and a need for sustainable, inclusive, and competitive rural and agricultural development in circular and integrated value chains. This contributes to job creation and greater local well-being, adjusted to regional conditions and favoring the decarbonization of productive systems. The region has a great source of biomass and significant developments in its scientific-technological capacities, as well as in its industrial infrastructure.

Bioeconomy is developing in the region. Several countries have political, legal, institutional, and national strategies, as well as business experiences in issues related to bioenergy, biotechnologies, sustainable use of biodiversity and ecosystem services, as well as in the development of circular bioeconomy. These countries have been pioneers and leaders in various fields of bioeconomy, with numerous success stories that can serve as examples and motivation. In particular, the region has been a pioneer in the development of bioenergy (bioethanol, biodiesel, biogas, biochar, and pellets), where today it is one of the main actors in international markets.

Bioeconomy not only provides a conceptual framework for the development of strategies aimed at addressing major social challenges and sustainable development concerns but also favors rural development with greater social inclusion. For this reason, it is strategic to continue strengthening all efforts made in the region to expand activities in this regard.

The IV Successful Cases of Innovation Contest, launched by FONTAGRO in cooperation with the Inter-American Institute for Cooperation on Agriculture (IICA), presents the 16 cases that were pre-selected for their quality, projection, and environmental, technological, and social impact, as well as overall contribution to the Sustainable Development Goals. Each and every one of them presents significant efforts that must be maintained and expanded to favor sustainability and the well-being of the planet.

Dr. Elizabeth Hodson de Jaramillo

Emeritus Professor of the Pontifical Javeriana University, Bogotá, Colombia



Foreword

Since 2013, FONTAGRO has frequently held the Successful Cases of Innovation in Agriculture Contest, with the aim of identifying and documenting successful experiences that could be scaled up in the future by other financing actors within the global innovation system. The first Successful Cases Contest was "Innovations for Family Farming," held in 2012, and three cases emerged as winners: "The Huancaro producers Market, Cusco" by Agronomists and Veterinarians Without Borders and the Cusco Producers Association, Peru; "The beekeeping case in Argentina and the Dominican Republic" by INTA, Argentina, and the Center for Agricultural Development, Dominican Republic; and "The Andean Potato Project" by the International Potato Center (CIP), Peru.

In 2015, a second contest was held, "Innovations for family farming adaptation to climate change." On this occasion, there was support from the Global Environment Facility (GEF). Eleven cases were preselected for publication, and five emerged as winners: "Adapta Sertão. Social technologies for climate change adaptation" (REDEH, Brazil), "Fish for life. Improving food security and the economy of farming families" (CEPAC and APNI, Bolivia), "Food security in family producers of Argentine Patagonia: use of local genetic resources and adaptation to climate change" by the National Institute of Agricultural Technology (INTA and SAF, Argentina), "Confronting poverty and climate change with agricultural innovations for family farming in the Peruvian Altiplano" (CIP and CIRNMA, Peru), and "Transition from dryland to irrigation livestock farming through rainwater harvesting in Nicaragua and Mexico (FLAR, Colombia). The following case received an honorable mention: "Transition of bovine livestock towards the future we want in the Chorotega region" by the Chorotega Agroforestry Association (UNAFOR), Costa Rica. In 2019, FONTAGRO held the third contest "Agriculture and Nutrition through innovation in family farming," resulting in

the winners: "Sowing nutritional and agroecological diversity in the Colombian páramo" (Páramo Farms, Colombia), "Biofortification tackles hidden hunger in Panama" (IDIAP, Panama), "Dissemination of the BRS Amélia cultivar in southern Brazil" (EMBRAPA, Brazil) and "BioFORT Platform: The nutritious route to the tables of Guatemalans" (ICTA, Guatemala).

The fourth Contest, developed in 2023, is presented in this publication and deals with "Innovations with impact on bioeconomy. Lessons in Bioeconomy to improve sustainable development in Latin America and the Caribbean". The objective of this contest was to identify and document successful experiences and lessons learned that contribute to understanding how science, technology, and innovation can catalyze bioeconomy strategies in the agro-bioindustrial sector of Latin America and the Caribbean. Sixteen cases were preselected, which are presented in this document, based on their most relevant aspects in terms of the description of their context, the results achieved, their potential impact on the territory, the obstacles and challenges they faced, as well as their replicability and scalability.



Bioeconomy as a sustainable change factor in Latin America and the Caribbean

The IV Contest, held between 2023 and 2024 under the title "Innovations in Bioeconomy to Improve Sustainable Development in Latin America and the Caribbean," aims to identify and document successful experiences and lessons learned that illustrate how the generation of knowledge, technology, and innovation can be catalysts for bioeconomy strategies in the agro-bioindustrial sector of Latin America and the Caribbean.

Bioeconomy is defined in very different ways around the world, and the terminology used also differs: bioeconomy, biological-based economy, green economy, green growth, circular economy. The common aspects of the various definitions of bioeconomy are its relationship with knowledge and science, technology and innovation, the application of biotechnology, and the reduction of dependence on fossil fuels, as well as the added value of products, and the concepts of sustainability and eco-efficiency (Hodson, Henry, and Trigo, 2019). The central elements of bioeconomy are biological resources, processes, and principles, as well as all technologies (conventional and modern) associated with their knowledge, development, transformation, or regeneration (Rodríguez, Mondaini, and Hitschfeld, 2017).

The recently adjusted global definition at the 2018 Global Bioeconomy Summit is: "Bioeconomy is the production, utilization, and conservation of biological resources, including related knowledge, science, technology, and innovation, to supply information, products, processes, and services in all economic sectors, in pursuit of a sustainable economy" (Global Bioeconomy Summit, 2018). For Latin America and the Caribbean, it is a very relevant approach, given its privileged position with an abundance of natural resources (Hodson, Henry, and Trigo, 2019). For Henry *et al.* (2017), bioeconomy represents a socioeconomic model that not only reduces dependence on non-renewable fossil resources but also promotes the

production and use of knowledge about natural resources, the processes that operate in the natural environment, and useful biological principles, all renewable, for the sustainable supply of goods and services in all economic sectors (bioenergy, agriculture and biologicals, food, fibers, health products, industrial products, and bioplastics) (Gaviria *et al.*, 2021).

Bioeconomy recognizes the primordial role of scientific-technological knowledge as a fundamental driver to redefine the relationships between agriculture, biomass, and industry. The primary objective of bioeconomy is to reduce the use of non-renewable fossil energy and replace it with renewable resources in a context of environmental, social, and economic sustainability, through the production, transformation, and consumption of biological materials while minimizing the generation of polluting waste (Henry *et al.*, 2017).

According to Hodson, Henry, and Trigo (2019), bioeconomy is a response to four emerging and converging global challenges: 1) global population increase; 2) increase in global demand for biomass, which exacerbates the scarcity of natural resources; 3) growing evidence that the era of cheap oil and energy is coming to an end, and 4) concerns about climate change. This situation shows that continuing with the same development model is not an option and that bioeconomy will be an indispensable tool to meet the United Nations Sustainable Development Goals (SDGs).

Strategies based on biological resources change established balances regarding access patterns, resource use, and distribution of benefits, to promote increased productivity and competitiveness of the economy's products in a given territory. This creates the need for a better understanding with clear decision-making processes to identify and manage



the emerging advantages and disadvantages between old and new activities, between different scales of application, and between the short and long term. A key strategy is the strengthening of training at all levels, the promotion of entrepreneurial skills, and communication and decision-making processes. Additionally, it is essential to promote the articulation of various institutional actions under principles of competitiveness, equity, sustainability, multisectorality, and decentralization (Hodson, Henry, and Trigo, 2019).

The region of Latin America and the Caribbean is particularly well-positioned to contribute to and benefit from the emerging bioeconomy. Its extensive and diverse base of natural resources, land, water, and biological diversity, together with an emerging economy and the growth of human resources, provide the region with the essential foundations for a solid bioeconomy. As a whole, it is very well-positioned in terms of agricultural availability with more than 50% of agricultural potential (Cepal 2007), and a per capita land availability significantly higher than the world average of 0.2 ha/cap. The projection for 2050 shows that, even considering a significant increase in population, more than 300 million hectares across South America and Central America can be produced without affecting natural forests (Hodson, 2014).

A second set of key resources for the development of bioeconomy in the region is its biodiversity endowment. Latin America concentrates seven countries considered "megadiverse" (no other region of the world includes so many countries within this category). The region is also a center of origin and diversity of a series of species that sustain the world's food supply (potato, maize, tomato, bean, cassava, and cocoa, among others). Likewise, the region represents a global resource, since it contains more than 30% of the planet's freshwater according to UNEP (2000) (Hodson, 2014).

In Latin America and the Caribbean, there is still a need to give greater visibility to bioeconomy strategies, regulatory frameworks, and other policy programs (fiscal, financial, productive) that allow for their greater expansion (FONTAGRO, 2023). In this sense, the productive paths of bioeconomy emerge, which have

been and continue to be defined by the contribution of institutional and academic actors at the global and regional levels and which aim to promote bioeconomy in the region. These paths are:

Use of Biodiversity Resources: Latin America's biodiversity translates into an economic asset when unique species are domesticated, transformed, and marketed, taking advantage of their unique properties for specific sectors. The region, rich in underutilized crops due to challenges such as toxicity and logistics, is positioned to revolutionize the bioeconomy through current science and technology. These crops can become new raw materials for emerging industries such as phytotherapy and cosmetics, transforming biological raw materials into pillars of a sustainable and diversified regional economy (Trigo *et al.*, 2013).

Eco-intensification: Eco-intensification seeks to harmonize agricultural productivity with environmental sustainability, using practices such as conservation agriculture and precision agriculture to optimize resource use. This approach extends beyond primary production, integrating clean technologies and biological processes into industry, such as



Author: CORPOVALLE

wastewater treatment, to achieve positive and tangible environmental outcomes (Trigo *et al.*, 2013).

Biorefineries and Bioproducts: Biorefineries in Latin America have the potential to transform biomass into a variety of energy and material products, redefining the relationship between agriculture and industry and addressing economic and environmental challenges. However, the region has not yet fully exploited this potential, mainly limiting itself to the production of biofuels. A deeper focus on biorefineries and a better biomass production strategy could strengthen value chains and benefit agricultural producers and rural communities (Trigo *et al.*, 2013).

Biotechnological Applications: Modern biotechnology is redefining the boundaries of interaction between biological processes and natural resources, offering innovative solutions in agriculture, natural resource management, and sectors such as food, energy, and pharmaceuticals. Despite its transformative potential, biotechnology requires significant investments and institutional adjustments, including a favorable regulatory environment, to be fully leveraged (Trigo *et al.*, 2013).

Ecosystem Services: Ecosystem services are fundamental to a sustainable bioeconomy, as they provide essential resources such as clean air and water. Strategies such as the development of carbon credits, ecotourism, and water management are vital to integrating ecosystem services into the bioeconomy and ensuring that economic and social activities maintain environmental integrity (Trigo *et al.*, 2013).

Value Chain Efficiency: Value chain efficiency is crucial for the bioeconomy, especially in reducing post-harvest losses and developing markets for innovative biological products. Bioeconomy is not inherently sustainable and must be carefully managed to avoid overuse of resources. The transition to bioeconomy involves balancing the growing demand for food and fuels with forest and land conservation, using strategies that diversify biomass sources and improve the efficiency of their use and processing (Trigo *et al.*, 2013).

The last three decades have been key in finding strategies to reduce the environmental costs of economic activities in general. In particular, there is a need to reduce the environmental costs generated by traditional agri-food and agro-industrial systems, while promoting the creation of new markets based on "bio" products and services. In this sense, bioeconomy strategies enable, based on the advancement of sciences and new disciplines, the leveraging of biomass in products and services with a reduced environmental impact, while adding value, diversifying income, promoting greater competitiveness, and increasing demand for new jobs. For example, recycling waste or by-products from industrial processes (FONTAGRO, 2023).

In order to achieve the Sustainable Development Goals (SDGs) set out in the 2030 Development Agenda, bioeconomy provides a conceptual framework for the development of policies that pursue these objectives. Since the basis of bioeconomy is biological resources,



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it presents a concrete alternative for the substitution of fossil resources (non-renewable) with renewable sources and contributes to SDG No. 13 "Climate Action," promoting the adoption of urgent measures to combat climate change and its effects, thus decarbonizing economies. Although this is the main contribution, to some extent, bioeconomy contributes to all 17 SDGs (FONTAGRO, 2023).

In view of the above, it is imperative to strengthen capacities in science, technology, and innovation (STI) and promote technological cooperation in Latin America and the Caribbean. The implementation of robust public policies and effective strategies is

essential to promote the advancement of bioeconomy in the region. This requires effective integration between institutions, as well as coordination and governance that promote the necessary developments in the agri-food and agro-industrial fields.

In this context, FONTAGRO has taken the initiative with the realization of the IV Contest of Successful Cases of Innovation in Bioeconomy . The contest, sponsored by the Inter-American Institute for Cooperation on Agriculture (IICA), is a step forward in the consolidation of knowledge and practices that promote sustainable development in the region.

Contest Methodology

This contest was organized by FONTAGRO, with the support of the Inter-American Development Bank (IDB) and the Inter-American Institute for Cooperation on Agriculture (IICA). The contest called for three types of actors from the region, generating the following contest categories:

I. Producer associations and other private sector organizations, including NGOs, working with producers in the region;

II. Science and Technology institutions and organizations in Latin America and the Caribbean;

III. Public sector at all levels of government, promoting the development of bioeconomy.

A total of 64 cases were submitted to the contest, of which, after a meticulous technical evaluation carried out by a panel of internationally renowned evaluators with extensive experience in the field, 16 cases were preselected. These 16 cases represent a diversity of approaches and cover various geographical regions, including Argentina, Bolivia, Colombia, Costa Rica, the Dominican Republic, Ecuador, Mexico, Nicaragua, Paraguay, and Venezuela. The cases address topics including the cultivation of cocoa, coffee, vegetables, fruit, rice, and dairy

products, as well as the development of biologicals and organic agriculture. Also highlighted are themes of associativity, cooperativism, agricultural extension, sustainability, ecology, and technological development, among other relevant aspects. The efforts of territorial leaders in generating social and environmental responses with an economic focus, thus driving territorial development, are especially valued. These experiences will undoubtedly serve as inspiration for the entire region.



Author: Secretariat of Economic Development. Government of the state of Zulia, Venezuela.

Lessons learned

The Regional Fund for Agricultural Technology (FONTAGRO) and the Inter-American Institute for Cooperation on Agriculture (IICA) have marked a milestone with the conclusion of the IV Contest of Successful Cases of Innovation in Bioeconomy 2023-2024. This event not only celebrates innovation and sustainability but also represents a source of valuable lessons for the future of bioeconomy in Latin America and the Caribbean.

Bioeconomy, which encompasses the production, use, and conservation of biological resources, has emerged as a pillar for sustainable development. The 16 preselected cases in this year's contest are a testament to the diversity and richness of approaches that can be taken in this field. From cocoa cultivation to organic agriculture, through the development of biologicals, dairy products, and fruit growing, each case offers a unique and enriching perspective.

One of the most significant lessons emerging from these cases is the importance of associativity and cooperativism. Collaboration among producers, NGOs, scientific institutions, and the public sector has proven to be a driver for success. The synergy generated by these groups has allowed not only the exchange of knowledge and experiences but also the creation of innovative solutions to common challenges.

Another lesson is the relevance of adaptability and local responses. Territorial leaders have played a crucial role in generating social and environmental responses tailored to their specific contexts. This underscores the need for approaches that are not only sustainable but also sensitive to the cultural, economic, and ecological particularities of each region.

The contribution of these cases to the Sustainable Development Goals (SDGs) is another area of learning. Alignment with global goals such as "Climate Action,"

"Zero Hunger," "Responsible Consumption and Production," and "Life on Land" demonstrates that bioeconomy is an effective way to address global issues through local and regional action.

Promoting sustainability through bioeconomy has also proven to be a path to resilience. In a world where environmental and social challenges are increasingly complex, bioeconomic practices offer solutions that help communities adapt and thrive.

Finally, the importance of effective communication and knowledge dissemination is evidenced by these cases. The publication of these studies, along with the discussion forums that will be held, represents a crucial opportunity to extend the reach of the lessons learned. Additionally, the possibility of mobilizing additional resources to support the featured projects promises not only to inspire future initiatives but also to consolidate and enhance the impact of the current 16 cases. These actions are fundamental to fostering a solid and dynamic community of practice, which continues to enrich the fabric of bioeconomy with sustainable and replicable innovations.

FONTAGRO expresses its gratitude to each of the participants in this contest for their dedication to bioeconomy and for sharing their valuable experiences and knowledge with great enthusiasm and dedication. The lessons learned from this process not only pay tribute to the achievements made but also establish a firm foundation for future innovations. These will help to continue the progress towards sustainable development in the region, guided by the principles and practices of bioeconomy.



Winning cases

From the 64 cases submitted to the contest, the evaluation panel selected one winner from each category:

- Category I: Producer associations and other private sector organizations, including NGOs, working with producers in the region: "Integrated Fruit Production Program, Valle del Cauca department" by CORPOVALLE, Colombia.
- Category II: Science and Technology institutions and organizations in Latin America and the Caribbean: "Increased agricultural productivity through the development and successful industrial scaling of a bio-activator additive for fertilizers based on naturalized microbiomes" by MicroBios S.A., Paraguay.
- Category III: Public sector at all levels of government, promoting the development of bioeconomy: "Productive Lake. Blue economy strategy for the productive use of the Maracaibo Lake Basin System" by the Secretariat of Economic Development (SDE), Zulia state government, Venezuela.

The "Integrated Fruit Production Program, Valle del Cauca department" benefited more than 7,000 producers, increasing yields by 29%, improving profitability, and enhancing well-being in 38 municipalities. This case integrates biotechnologies and advanced agricultural practices to reinforce production, competitiveness, and access to national and international markets, while promoting associativity and strengthening the regional social and economic fabric, emphasizing the importance of environmental sustainability and social inclusion.

The case "Increased agricultural productivity through the development and successful industrial scaling of a bio-activator additive for fertilizers based on naturalized microbiomes" is an outstanding example of advanced bioeconomy, using cutting-

edge biotechnology to develop bioactivators that enhance fertilizers and reduce greenhouse gas emissions. It represents an innovative fusion of microbiological knowledge and state-of-the-art technologies, resulting in industrial-scale products that foster more regenerative and sustainable agriculture.

The presentation of the winners concludes with "Productive Lake. Blue economy strategy for the productive use of the Maracaibo Lake Basin System," which represents a visionary and structured strategy that addresses challenges of pollution and overexploitation in a balanced and sustainable manner. Its collaborative approach incorporates local communities, governmental entities, and academic and business sectors, promoting knowledge networks and business clusters for innovation and technological development.

Additionally, the evaluation panel deemed it appropriate to award two special mentions to the following cases:

"Food security with forest products" by the Challuwa Mikuna Food Production Association, Ecuador, for valuable lessons on how organizational innovation, combined with a focus on bioeconomy, can address critical challenges such as food security and sustainable development of a territory and community.

"Chinampa Model, refuge as a strategy for the conservation and economic reactivation of the Xochimilco wetland" by the National Autonomous University of Mexico (UNAM), which includes, on the one hand, the reconditioning of canals, as well as the social and economic empowerment of the chinamperos and the revitalization of traditional food production in the area.

PRESENTATION OF WINNING CASES AND FINALISTS BY CATEGORY





WINNER



CATEGORY I: Producer associations and other private sector organizations, including NGOs, working with producers in Latin America and the Caribbean.

Case 1. Integrated Fruit Production Program, Valle del Cauca Department, Colombia.

Organization: CORPOVALLE

Authors: Adrián Zamora, General Director, José Erlin Pulido, Technical Support Supervisor. CORPOVALLE.

This case, recognized as a winning case in its category, adopts a comprehensive approach to circular bioeconomy that drives sustainability and resilience in agri-food and agro-industrial chains in the Valle del Cauca. Benefiting more than 7,000 producers, it has increased yields by 29%, improving profitability and well-being in 38 municipalities. It integrates biotechnologies and advanced agricultural practices to strengthen production, competitiveness, and access to national and international markets, while promoting associativity and strengthening regional social and economic fabric through technical assistance and training, emphasizing the importance of environmental sustainability and social inclusion.

Bioeconomy Pathways:



Use of resources of biodiversity



Eco-intensificación



Biotechnological applications



Biorefineries and bioproducts



Efficiency of value chains

Project summary

Among the main difficulties faced by fruit and vegetable producers in the Valle del Cauca department, organizational, productive, and commercial barriers were identified that prevented them from improving their yields, accessing the market, and generating sufficient income to reinvest and increase their competitiveness. Looking to address these barriers, the Integrated Fruit Production Program (PIF, by its Spanish acronym) was launched. This initiative aims to increase access to new agricultural technologies, improve organizational capacities, and elevate the market presence of horticultural products from rural producer organizations.

The program has had several phases of implementation and is structured around four key components:

- Accompaniment and Access to Technical Productive Knowledge: This includes the provision of technical assistance services, training, and tailored accompaniment

to organizations and their associates, seeking to facilitate their access to and appropriation of technical productive knowledge.

- Organizational and Business Strengthening: This acknowledges that organizations face challenges not only in their production processes but also in human resource and strategic and financial planning to manage and optimize their production processes.

- Access to assets to improve yield, quality, and price: This supports access to specific assets that allow improvements in production and organizational processes to translate into better results.

- Management of commercial alliances: This seeks to ensure that productive and organizational strengthening and access to assets result in commercial alliances that generate income efficiently and sustainably.



Left. Citrus producers associated with ASOQUIFA. Author: CORPOVALLE.
Right. Agricultural products offered in a business roundtable. Author: CORPOVALLE.



WINNER



CATEGORY II: Science and Technology institutions and organizations of Latin America and the Caribbean.

Case 8. Industrial Scaling of Fertilizer Bioactivator Based on Naturalized Microbiomes, Paraguay.

Organization: MicroBios S.A.

Authors: :Walter Sandoval, Chief Science Officer, MicroBios S.A.

This case, winner in its category, is a standout example of advanced bioeconomy, utilizing cutting-edge biotechnology to develop bioactivators that enhance fertilizers and reduce greenhouse gas emissions. It represents an innovative fusion of microbiological knowledge and state-of-the-art technologies, producing, on an industrial scale, products that foster more regenerative and sustainable agriculture. The use of specific soil microorganisms promotes not only healthy agriculture but also soil vitality through carbon capture. Socially and economically beneficial, the project increases yields, reduces fertilizer costs, and generates employment, demonstrating its success across a wide range of crops and its great replicability potential.

Bioeconomy Pathways:



Biorefineries and bioproducts



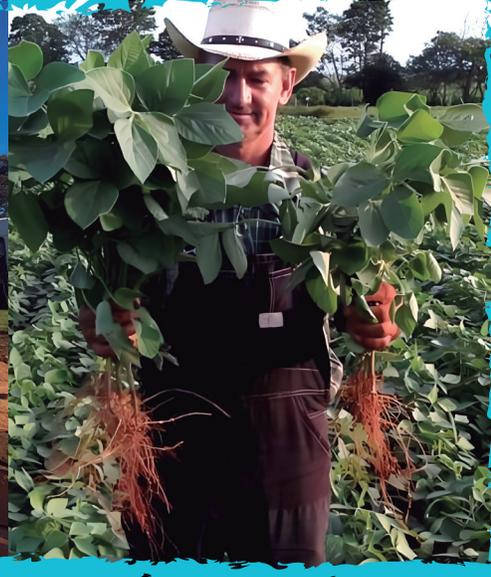
Biotechnological applications

Project summary

The agricultural industry in Paraguay is a crucial economic pillar; however, it is also a significant source of greenhouse gas emissions, largely due to the use of chemical fertilizers. To address this issue, an innovative project has been launched that utilizes a biotechnological approach to develop fertilizer bioactivator additives. These additives are designed to enhance the efficiency of traditional fertilizers and reduce greenhouse gas emissions. Initial results are promising, showing a 12% increase in crop yield with a 30% reduction in fertilizer use, and the technology has been successfully applied to over 800,000 hectares of arable land.

The project also has social and cultural implications, as agriculture is an integral part of Paraguay's identity. The successful implementation of this technology could not only make Paraguay a leader in sustainable agricultural practices but also serve as a model for other countries. Inter-institutional collaboration and the ability to scale the technology have been key factors in the project's success so far.

In summary, the project represents a significant advancement at the intersection of biotechnology and sustainable agriculture, offering a balanced approach to addressing both economic and environmental needs.



Left. Mixing process of the bioactivator with NPK fertilizer for subsequent application in the field. Author: Roberto Sens.
Right. Producer who used the Humus Microbioma Plus bioactivator Additive. Author: Roberto Sens.



WINNER



CATEGORY III: Public sector (at all levels) in Latin America and the Caribbean.

Case 15. Productive Lake - Blue Economy in Zulia, Venezuela.

Organization: Secretariat of Economic Development. Government of the State of Zulia, Venezuela.

Authors: Fernando Torres Granadillo, María del Pilar González Guerrero, ((Secretariat of Economic Development. Government of the State of Zulia), and Néstor Pereira (Director of Fisheries and Aquaculture, Directorate of Fisheries and Aquaculture. Government of the State of Zulia).

The winning case in this category is a blue bioeconomy model for Lake Maracaibo and represents a visionary and structured strategy that addresses pollution and overexploitation challenges in a balanced and sustainable manner. Its collaborative approach involves local communities, government entities, and academic and business sectors, promoting knowledge networks and business clusters for innovation and technological development. With initial success and promising proposals, this strategy aims to create a prosperous environment through economic diversification and strengthening of the local bioeconomy, with potential for adaptation to other aquatic ecosystems.

Bioeconomy Pathways:



Ecosystem Services



Efficiency of value chains

Project summary

The "Productive Lake" project is a blue economy initiative in Lake Maracaibo, Venezuela, that seeks to balance economic development with environmental sustainability. The strategy focuses on strengthening local capacities and promoting sustainable economic activities such as tourism, fishing, and renewable energies. Multiple economic axes of work have been established, and collaborative participation of local communities, government entities, and academic and business organizations is encouraged.

The project's impact is already notable in several aspects. Environmentally, it has promoted more sustainable management of the lake's natural resources and the adoption of renewable energies.

Socially, it has achieved broad participation in its first blue economy meeting, with commitments from various sectors to engage in the initiative. This has resulted in a diversification of economic activities in the region, contributing to socio-economic well-being and environmental health.

However, the project faces several challenges, such as coordination among multiple actors, resource mobilization in a difficult economic context, and resistance to paradigm change in some sectors. To overcome these obstacles, dialogue tables have been established, alternative sources of financing are being sought, and awareness and education campaigns are being conducted.

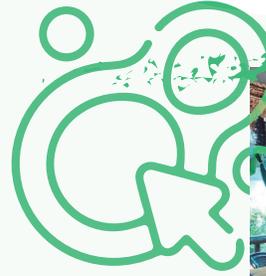


Left. Diagnosis session on rural living conditions in agricultural communities of the Lake Maracaibo Basin. Author: Directorate of Fisheries and Aquaculture.

Right. Boats in the Lake Maracaibo Basin. Author: Secretariat of Economic Development.



SPECIAL MENTIONS



CATEGORY I: Producer associations and other private sector organizations, including NGOs, working with producers in Latin America and the Caribbean.

Case 2. Bioeconomy and traditional food security in the Ecuadorian Amazon.

Organization: Challuwa Mikuna Food Production Association

Authors: Janett Torres, Alicia Mercedes Illanes Santamaría, Hermelinda Rocío Alvarado Licuy, Mercedes María Alvarado Licuy, Yesseña Fernanda Balladares Illanes. Challuwa Mikuna Food Production Association “ASOPACHM”.

The success of the Challuwa Mikuna organization in the city of El Coca in the province of Orellana, Ecuador, offers valuable lessons on how organizational innovation, combined with a focus on the bioeconomy, can address critical challenges such as food security and sustainable development of a territory and community.

Bioeconomy Pathways:



Use of resources of biodiversity



Efficiency of value chains

Project summary

In Ecuador, the growing demand for food security is combined with the need for sustainable agricultural practices, especially in biodiverse regions like the Amazon. The Challuwa Mikuna Association in the province of Orellana is an example of how a community can adapt to these challenges. Originally focused on hunting and fishing, the association has transformed to focus on sustainable gastronomy, even founding the restaurant "Maitos del Yasuní," which has become a symbol of resistance, adaptation, and prosperity.

Challuwa Mikuna's transformation was supported by collaborations with government entities and international organizations. This change in focus has not only benefited the association but has also had a positive impact on the local economy and the conservation of the Amazonian ecosystem. The association has managed to balance tradition and innovation, offering gastronomy that is both authentic and sustainable, and that also complies with environmental regulations.

From an economic and social perspective, the transformation has been significant. The "Maitos del Yasuní" restaurant has generated employment and strengthened the local economy, while the association has empowered women in the community. The initiative has had an impact beyond the economy, strengthening the social and cultural fabric of the community and contributing to environmental conservation.

The Challuwa Mikuna case offers valuable lessons on how innovation and collaboration can address complex challenges such as food security and sustainability. Despite obstacles such as cultural adaptation and legal restrictions, the association has shown that it is possible to transform challenges into sustainable opportunities. This model is not only replicable but also offers a path to sustainable development that balances economic, social, and environmental needs.



Left. Challuwa Mikuna partners. Author: Challuwa Mikuna Association.
Right. Gathering Chonta. Author: Challuwa Mikuna Association.



SPECIAL MENTIONS



CATEGORY II: Science and Technology institutions and organizations in Latin America and the Caribbean.

Case 9. Sustainable chinampas, refuges in Xochimilco, Mexico.

Organization: Institute of Biology, National Autonomous University of Mexico (IB-UNAM).

Authors: Luis Zambrano, Denise Arroyo Lambaer, Carlos Uriel Sumano, Miguel Rivas Bejarano, Diana Vázquez Mendoza, Alumna and posgrado. IB-UNAM.

The initiative consists of restoring and conserving the chinampa system, through the “Chinampa refuge” model, which includes on one hand the refurbishment of canals, through floodgates with natural filters that clean the water and prevent exotic species such as carp and tilapia, as well as the social and economic promotion of chinamperos and the revitalization of traditional food production in the area. The reason behind this approach lies in previous phases of the project, where it was demonstrated that traditional chinampa farming, free from agrochemicals, not only favors biodiversity in Xochimilco but also contributes to a sustainable economy, protecting the cultural and ecological heritage of the region, promoting the resilience of Mexico City.

Bioeconomy Pathways:



Eco-intensification



Ecosystem Services

Project summary

The "Chinampa refuge in Xochimilco" project is a decade-long initiative that seeks to revitalize the iconic wetland of Xochimilco in Mexico City. This project focuses on the creation of "chinampa refuges," which are designed to restore natural conditions that support the growth of endemic flora and fauna, while also improving water quality for agriculture. Additionally, the "Chinampa Label" has been introduced, a distinctive label that seeks to position and differentiate products from these areas in the market, contributing to biodiversity conservation and improving the economic conditions of the owners.

However, the project has faced several challenges, such as biodiversity loss, water pollution, and the initial resistance of some chinamperos to adopt new practices. To address these issues, biofilters have been implemented and a canal rehabilitation process has been carried out. Furthermore, efforts have been made in education and consumer awareness to ensure the economic viability of the initiative.

From a results and impact perspective, the project has had a significant effect in both agroecological and socio-economic spheres. It has improved water quality, protected endemic species such as the axolotl, and has allowed producers to access new markets, thanks to the "Chinampa Label." It has also reinforced community unity and been a catalyst for the adoption of sustainable agricultural practices.

Regarding replicability and the future of the project, active community participation and government support have been key to success. The model could be replicated in other regions when adapted to local traditions and practices. To ensure its long-term viability, it is crucial to establish partnerships with local organizations and government authorities, as well as to implement robust monitoring and evaluation mechanisms.



Left. Author: Luis Zambrano.
Right. *Amystoma mexicanum*. Author: Roberto Sens.

Finalist Cases

Among the 64 presented cases, there are also 16 finalists, each offering valuable lessons.

In category I, in addition to highlighting the Integrated Fruit Production Program of Valle del Cauca, Colombia, and the Bioeconomy and traditional food security in the Ecuadorian Amazon, the contribution of the Nucleus of Technological and Social Innovation INNOVAKIT is also considered, as they have managed to advance technological uptake and produce significant impacts on the bioeconomy of Colombian coffee growers and the territories in which this initiative has been replicated. Cooperative ALAGRO is also highlighted as an example of associativity and economic sustainability that demonstrates the impact on the bioeconomy of the creation of collaborative societies. The Villa Poppy case also does this, in particular highlighting the success of associativity in family farming. Other cases of pioneering development are Gexus, a company that designed biostimulants based on microalgae, and the Guanacasteca Agro-organic Association, which not only promotes organic agriculture but also offers certification and continuous training to its members.

In category II, in addition to the cases of Industrial scaling of fertilizer bioactivator based on naturalized microbiomes and Sustainable chinampas, among the finalists, biological control in vegetables, developed by INTA Argentina, is highlighted. This initiative minimizes environmental impact and generates notable improvements in health conditions, both for

the communities near these productions and for the consumers who acquire these products. Another case of great value is the case of Agribusiness of bio-inputs cooperatives of the mining triangle of the Central American University of Nicaragua, which promotes the efficiency and profitability of cocoa producers through the application of biologicals based on the fungus *Trichoderma* spp. On the other hand, the KOCOLATL case of the BIOS center stands out, in which the waste from cocoa cultivation is reused, diversifying the income among producers. A case that exemplifies strategic alliances with local communities is that of Andean biodiversity products to generate bioeconomy from the University of La Salle, Colombia, which focuses on valuing ancestral Andean roots and tubers. An example of innovation is the case of the Alliance Bioersity International - CIAT with the development of a new variety of biofortified rice with higher levels of zinc to combat hunger in Bolivia.

In category III, along with Productive lake - Blue economy in Venezuela, there is the finalist case Galileo: Integrated Network of School Gardens in Bolivia. This initiative, through an integrated approach that combines technology, education, and social welfare, successfully established school gardens in 56 municipalities of Santa Cruz.

The 16 preselected cases, including the winners, are presented in the following chapters.



Left to right: Case 4. Case 6. Case 12.



CATEGORY I: Producer associations and other private sector organizations, including NGOs, working with producers in Latin America and the Caribbean.

Case 3. Technological and Social Innovation Nuclei - INNOVAKIT, Colombia.

Organization: INNOVAKIT

Authors: Hugo López, CEO, INNOVAKIT. Collaborators: Juan Carlos Villanueva, COOMFUTURO; Danilo Miranda, BLOOMSPAL Global Agricultural Trade; y Angelica Cárdenas, AGROTRANSPARENT SAS y BIOHEXA SAS.

The implemented technological innovation nuclei have been developed considering the social dynamics specific to the producers and regions, achieving advancements in technological adoption and producing notable impacts on the bioeconomy of coffee farmers in Colombia and the territories where this initiative has been replicated.

Bioeconomy Pathways:



Eco-intensification



Biotechnological applications



Efficiency of value chains

Project summary

The global coffee industry is valued at 3 trillion US dollars annually, including 25 million farmers in more than 80 countries and over 1.5 million coffee shops. The water, carbon, and social footprints of this industry are unsustainable. Every time we drink a cup of coffee, 1,040 cups of water are used in its production. Additionally, one of the reasons coffee producers do not earn higher incomes is the lack of cup consistency that allows for stable customers. Their incomes are limited, receiving only 4% of the value throughout the supply chain.

Due to the segregation of the value chain extremes, INNOVAKIT developed a social business model based on technological solutions for producers, marketers, roasters, and end customers, called Technological Innovation Nuclei, which includes:

- Technological tools and simple training.
- Technical assistance with digital technologies.
- Traceability: digital presence of producers on the internet.

-An ecosocial component with a view to carbon, water, plastic, and labor neutrality.

Through the technological innovation nuclei model, we have managed to reduce water consumption by 90%, save more than 4.5 million m³ of water, capture more than 90,000 tons of carbon, install two community nurseries, plant more than 2,500 trees, all from the use of innovative and economical tools and techniques that improve coffee production. At INNOVAKIT, we are interested in collective well-being, when a coffee producer grows their business, production costs and environmental impact are reduced.

Approximately 3,000 coffee farmers have directly benefited from this initiative. Furthermore, it is estimated that around 2,000 additional coffee farmers have been indirectly impacted. This approach has improved the lives of farmers and their communities, especially in rural areas.

The uptake of simple and accessible technologies has been essential for the rapid acceptance by producers. The observation of positive results by other producers has driven technological adoption in the community.



Left. Solar marquee for coffee drying during the training process. Neiva, Huila, Colombia. Author: Hugo López.
Right. Refractometer for process control. Author: Hugo López.



Case 4. ALAGRO Cooperative, an example of associativity and economic sustainability, Colombia.

Organización: : ALAGRO Cooperative.

Authors: Tatiana Gálvez Quintero; Viviana Torrenegra Lesmes, Juan David Zuluaga López, María Ofelia Guarín, President, ALAGRO Cooperative.

The cooperative has demonstrated that joint efforts and the creation of collaborative partnerships can generate a significant impact on improving the bioeconomy. This lesson is especially relevant for other contexts where smallholders face similar challenges.

Bioeconomy Pathways:



Eco-intensification



Efficiency of value chains

Project summary

The Alliance for Agriculture Cooperative (ALAGRO Coop.) is a cornerstone in the agricultural development of Eastern Antioquia, Colombia. Founded in 2017, this entity was created to address the challenges faced by smallholders, such as the lack of access to technical services and union representation. Thanks to the leadership of Juan David Zuluaga and the support of organizations like the Colombian Cooperatives Confederation, ALAGRO has managed to unite 200 producers in the region.

ALAGRO is an example of how bioeconomy can be transformed through innovation. The cooperative has implemented services and initiatives ranging from technical assistance and free veterinary services to the commercialization of innovative products such as lechenela and melitos. These actions have directly benefited more than 250 families, created more than 60 jobs, and established 26 milk collection points in the region.

ALAGRO's impact goes beyond the economic; it has also had a positive effect on environmental and socio-economic aspects. The cooperative has formed

strategic alliances that have allowed it to diversify its offerings, including the production of high-quality Dutch cheese and the provision of food for school programs. Additionally, it has been recognized by the Ministry of Agriculture and Rural Development and actively contributes to eight Sustainable Development Goals (SDGs).

However, the road has not been without challenges, such as resistance to change and insecurity of some participating organizations. Nonetheless, ALAGRO has shown that tenacity and cooperation are crucial for overcoming such obstacles. Looking forward, the cooperative aims to expand both nationally and internationally by strengthening ties with various institutions to develop projects benefiting rural communities.

ALAGRO is an exemplary model of how solidarity economy and cooperation can be powerful tools for transforming the lives of smallholders and contributing to regional economic and social development.



Left. Community milk cooling tank in the Municipality of Abejorral - Vereda, Colombia. Author: ALAGRO Cooperative.
Right. Abejorral - Vereda, Colombia. Author: ALAGRO Cooperative.



Case 5. A success story for family farming, Dominican Republic.

Organization: : Cooprovipo (Villa Poppy Multi-Service Production, Work, and Services Cooperative).

Authors: Miguel Angel Rosario, Alexandra Custodio, Nelvin Tejeda. Cooprovipo.

The case of Villa Poppy in Constanza stands out as an outstanding example of successful family farming associativity and effective implementation of public policies by the state to comprehensively address both the social problems faced by producers and the environmental challenges caused by their pressure on natural resources.

Bioeconomy Pathways:



Eco-intensification



Efficiency of value chains

Project summary

The Villa Poppy case in Constanza, Dominican Republic, represents a successful model of family farming and sustainable development. Originating as a relocation of families from the Valle Nuevo National Park to protect its biodiversity, Villa Poppy has transformed initial challenges into growth opportunities and well-being for its community. Through the formation of a cooperative, Cooprovipo, residents have formalized and improved the production and marketing of agricultural products, benefiting over 52 families and creating employment in the community.

The implementation of advanced technologies such as weather stations and drip irrigation systems has optimized water use and increased production efficiency. The cooperative has been a pioneer in obtaining financing and certifications that allow them to access competitive markets, including the State. This development has been possible thanks to the support of various governmental and non-governmental institutions, which have provided financial, technical, and logistical support.

The impact of Villa Poppy extends beyond the local economy, contributing to several Sustainable Development Goals (SDGs) such as no poverty, zero hunger, and life on land. Despite initial challenges, such as adapting to a new environment and lack of resources, the community has shown that cooperation and adaptation are key to sustainable development.

The Villa Poppy model has great potential to be replicated in other communities and scaled up nationally and internationally. Essential to this scaling is the continuous support of institutions and adaptation to the specific needs of each community. With the right support, it is possible for other regions and countries to replicate Villa Poppy's success, improving their agricultural production, economy, and well-being.



Left. Strawberry production in macro-tunnels. Author: Cooprovipo.
Right. Family Farming in Villa Poppy. Author: Cooprovipo.



Case 6. Agricultural biostimulants based on microalgae, Mexico.

Organization: : Gexus

Authors: Daniel Garza García, Fernando Flores García, David Ponce Téllez, Alejandro René González and Eduardo García Luna. Gexus.

Gexus, a biotechnology company whose mission is to design, develop, and apply products based on microalgae, has been a pioneer in creating environmentally compatible solutions that improve the productive conditions of farmers in the region.

Bioeconomy Pathways:



Eco-intensification



Biorefineries and bioproducts



Biotechnological applications

Project summary

In the era of sustainable development, the agricultural sector of Michoacán, Mexico, stands out for its production of avocados and berries but faces challenges such as the excessive use of agrochemicals. Research focuses on the use of biostimulants, based on microalgae, to improve the sustainability and productivity of crops. This approach has the potential to transform agriculture in Michoacán and serve as a model for other places.

Gexus, a biotechnology company, has led the implementation of microalgae in Michoacán's agriculture. Microalgae biostimulants offer multiple benefits, including reducing the use of agrochemicals and improving crop quality. The initiative was carried out in two phases: research and practical application, with notable improvements in crop quality and resistance.

The adoption of microalgae technology has greatly impacted the region's sustainability and economy, resulting in a 70% reduction in pesticide use and a 25% increase in production. Furthermore, the initiative has had an impact on several Sustainable Development Goals (SDGs), benefiting both the environment and local communities.

Despite initial difficulties such as farmers' skepticism and the need to adapt to different climatic conditions, the technology has proven effective. Collaboration among all involved actors and support from authorities have proved vital to success. The Michoacán model offers a pathway to expand this innovation to other regions, provided solid partnerships are established and adjustments are made according to the specific needs of each place.



Left. Science and education are key to the adoption of new technologies. Author: Daniel Misael Garza García.

Right. Microalgae possess mucilage that contributes to restoring the natural conditions of the soil. Author: Daniel Misael Garza García.



Case 7. Guanacasteca Agro-organic Association, Costa Rica.

Organization: Guanacasteca Agro-organic Association.

Authors: Oksan Aju, Irene Burgés Arrea. Guanacasteca Agro-organic Association.

Bioeconomy, understood as the production, utilization, and conservation of biological resources to provide products, processes, and services in all economic sectors, has experienced a remarkable boost in the province of Guanacaste, thanks to the actions of the Guanacasteca Agro-organic Association.

Bioeconomy Pathways:



Eco-intensification



Efficiency of value chains

Project summary

The Guanacasteca Agro-organic Association was formed in response to the challenges faced by small farmers in the province of Guanacaste, Costa Rica. The association not only promotes organic agriculture but also offers certification and continuous training to its members. Its holistic approach spans from production to marketing and has enabled farmers to access broader and more lucrative markets, including luxury hotels and specialty stores in organic products.

Since its inception in 2009, the Association has grown significantly and has had a transformative impact on the local bioeconomy. Associated farmers have experienced an increase in their income and have adopted more sustainable practices. Participatory certification has been a key element, allowing for a more accessible transition to organic agriculture and eliminating the need for costly private certifications.

In addition to the economic impact, the Association has had positive effects on the environment and

social cohesion of the community. The transition to organic practices has led to a reduction in the use of pesticides and chemical fertilizers, benefiting water conservation and biodiversity. Socially, the Association has strengthened the community and promoted gender equality and inclusion.

Though faced with obstacles such as resistance to change and lack of funding, the Association has managed to overcome them through mutual cooperation and long-term vision. The Association's experience offers valuable lessons for replication in other contexts, including the importance of cohesion among producers, institutional support, and adaptability. With a solid foundation and a well-defined strategy, the Association is well positioned to expand and contribute to sustainable agricultural development globally.



Left. Association producers at the Samara Fair. Author: Marco Nilo.

Right. Product sales. Author: Guanacasteca Agro-organic Association.

CATEGORY II: Science and Technology institutions and organizations in Latin America and the Caribbean.



Case 10. Biological control in vegetables in Argentina.

Organization: : INTA.

Authors: Luis Andrés Polack, Mariel Silvina Mitidieri, Silvia Noemí López (INTA).
Carlos Silvestre (Brometan SRL).

The initiative arises from the need to improve the environmental and health conditions of the population, adopting an agroecological approach in the greenhouse production of tomatoes and peppers in the provinces of Corrientes, Salta, and Jujuy, Argentina. As a result of this strategy, there has been a significant reduction in pesticide use, minimizing the environmental impact. This change has brought notable improvements in health conditions, both for the communities near these productions and for the consumers who purchase these products.

Bioeconomy Pathways:



Eco-intensification



Efficiency of
value chains

Project summary

In Argentina, greenhouse horticultural production has experienced significant growth, especially in the provinces of Buenos Aires, Corrientes, Salta, and Jujuy. Although this intensification has led to higher yields, it has also resulted in environmental and health problems due to the excessive use of pesticides. In response, INTA-Argentina and other institutions have developed an agroecological approach to integrated pest and disease management, with an emphasis on biological control. This approach has been particularly effective in tomato and pepper crops, reducing pesticide use and minimizing environmental impact.

The strategy focuses on three pillars: optimizing pesticide use, promoting more sustainable alternatives, and using natural enemies for pest control. Monitoring methods and management

protocols have been developed, and farmers have been trained in their implementation. The impact has been significant, both economically and environmentally, and the technology has gained the trust of producers.

However, the uptake of these practices has faced several difficulties, including initial skepticism and the high cost of biologicals. In addition, climate change presents new challenges by creating favorable conditions for the proliferation of certain pests. Despite these obstacles, the experience in Argentina offers valuable lessons for the adaptation and replicability of these innovations in different contexts, emphasizing the importance of inter-institutional collaboration, continuous training, and adaptability to local conditions.



Left. Biological control in peppers. Author: INTA.
Right. Adult of *Tupaocoris cucurbitaceus*. Author: INTA.



Case 11. Agribusiness of Biologicals: Cooperatives of the Mining Triangle, Nicaragua.

Organization: Central American University.

Authors: María Teresa Blandino Ramírez, Oswalt Jiménez Caldera, Amalia Carolina Bornemann López, Yelzen Elena Medina Peña, y Kendipher Sleyder Romero Castillo. CIDEA – UCA.

The Procacao project promotes the efficiency and profitability of producers through the application of biologicals based on the fungus *Trichoderma* spp. This initiative seeks to improve the quality of cocoa, benefiting both cooperatives and communities, with special attention to the inclusion of women. Its comprehensive approach, which includes local adaptation and technical training, positions it as a replicable model and provides valuable lessons for promoting sustainable agricultural practices in diverse contexts.

Bioeconomy Pathways:



Use of resources of biodiversity



Biorefineries and bioproducts



Biotechnological applications

Project summary

Nicaragua has gained international recognition as an outstanding producer of fine and aromatic cocoa. In particular, the Autonomous Region of the North Caribbean Coast has become the epicenter of the country's cocoa production, with a special focus on the "Mining Triangle". Here, the Procacao Program and the Central American University are collaborating to improve the efficiency and profitability of cocoa producers, through the implementation of biologicals based on the endophytic fungus *Trichoderma* spp. These biologicals not only act as biological control agents but also improve plant health and, therefore, cocoa quality.

The case of the Mining Triangle illustrates how artisanal biologicals can offer a sustainable and economically viable solution to the challenges faced by cocoa producers in the region. These biologicals have proven to be effective in combating common cocoa diseases such as monilia and black pod. Additionally, a market study revealed high interest among producers in purchasing these biologicals. The project has had a notable impact, benefiting multiple cooperatives and dozens of producers, and has been funded and supported by various organizations, including the Swiss Agency for Development and Cooperation.

The project's results show a substantial impact on the local bioeconomy, with improvements in cocoa production of over 20%. The initiative has also had a positive social impact, benefiting a wide range of producers, including women and agricultural communities. Technical training and collaboration with cooperatives and smallholders have been key to the project's success. Furthermore, the initiative has proven to be replicable and offers valuable lessons for the implementation of sustainable agricultural practices in other contexts.

Regarding challenges, the project has faced obstacles due to the pandemic and climate variability; however, adaptability and collaboration have facilitated its advancement. A comprehensive strategy is proposed for successful scaling, which includes local adaptation, community collaboration, technical training, and economic evaluation. This multidimensional approach ensures not only the economic viability of the project but also its environmental and social sustainability, opening doors for its implementation in new regions and agricultural contexts.



Left. Author: Central American University.
Right. Author: Central American University.



Case 12. Valorizing Cocoa Waste, Colombia.

Organization: BIOS - Center for Bioinformatics and Computational Biology of Colombia.

Authors: Jorge William Arboleda Valencia, Scientific Director 2018 – 2020, Center for Bioinformatics and Computational Biology of Colombia – BIOS; Paula Arenas, Researcher, FEDECACAO; Ana María Castro, Researcher, Hands and Crops; and Angela Romero Vergel, Researcher, NIAB.

The KOCOLATL Project represents an important contribution to cocoa cultivation in Colombia by addressing the challenges associated with timely harvesting and utilization of crop residues. This project opens opportunities for income diversification among producers. The integrated approach of the project is generating substantial changes in the cocoa value chain in the Belalcázar region.

Bioeconomy Pathways:



Eco-intensification



Biorefineries and bioproducts

Project summary

In the agricultural realm of Colombia, cocoa cultivation is a vital economic pillar, especially in regions like Belalcázar, in the southwest of Caldas. Here, the KOCOLATL project emerges as an innovative initiative that tackles the challenges of timely harvesting and the utilization of cocoa waste. Developed by the BIOS Center and other entities, the initiative focuses on optimizing the cocoa value chain, benefiting ASOPROBEL, a local producers' association, in particular. KOCOLATL not only focuses on advanced agricultural techniques but also encompasses business management and marketing, empowering farmers to access more lucrative markets and promoting environmental sustainability.

The KOCOLATL project has implemented a series of strategies that include the calibration of crop models, the identification of valorization strategies for cocoa husks, and the strengthening of scientific capacities. It has had a significant impact on promoting more sustainable agriculture and improving the quality of life of the agricultural community in Belalcázar. The project's implementation has been led by ASOPROBEL and has included a series of workshops and training sessions aimed at cocoa producers in the region.

Additionally, the project has generated great interest among companies in the sector and has resulted in the joint presentation of follow-up projects.

In terms of impact, KOCOLATL has been a catalyst for significant changes in the cocoa value chain in the Belalcázar region. It has proposed innovative solutions for cocoa waste treatment and has provided valuable information on optimal cocoa harvesting stages. The project has benefited 200 cocoa producers in the region and has an impact on six Sustainable Development Goals (SDGs). Additionally, it has generated a scientific publication in an A1 category journal, marking a milestone in agricultural research and circular economy.

Finally, the KOCOLATL project offers valuable lessons for replicability and scaling. The importance of producers' organization, building multidisciplinary partnerships, and commitment to education and training are critical elements for success. The model is flexible and adaptable, facilitating its replication in different contexts. However, it also faces challenges such as internet access and farmer training, which require continuous focus and effort to overcome.



Left. Practical training sessions. Author: BIOS.
Right. Theoretical training sessions. Author: BIOS



Case 13. Andean biodiversity products for generating bioeconomy, Colombia.

Organization: La Salle University (UNISALLE), Colombia.

Authors: Elsa Beatriz Fonseca Santanilla, Andrés Fernando Zapata Ramírez, Ruth Rodríguez Andrade, Javier González (UNISALLE), Armando Romero (ASOBOSQUE).

The project in Pasca represents a meaningful contribution to the local bioeconomy by enhancing the value of ancestral Andean roots and tubers. This initiative has been consolidated through strategic alliances with local communities, giving them a central role and empowering them in the process. The active participation of women has enriched the diversity of perspectives, and the results obtained are not only positive from an economic standpoint but also generate favorable environmental impacts.

Bioeconomy Pathways:



Use of resources of biodiversity



Eco-intensification



Ecosystem Services



Efficiency of value chains

Project summary

The project in Pasca, Colombia, led by La Salle University, aims to improve the local bioeconomy through enhancing the value of ancestral Andean roots and tubers. The initiative addresses economic and environmental challenges, such as genetic erosion and soil degradation, by transforming these tubers into value-added products. Alliances have been formed with the local community, and innovative technologies have been implemented for starch and prebiotic extraction, benefiting both the economy and the environment.

The project has had a notable impact on several fronts. Economically, it has enabled the creation of a women-led enterprise and has improved farmers' incomes. Environmentally, it has contributed to sustainability by reducing water consumption and transforming waste into biochar. An additional positive impact has been on animal health, optimizing productivity indicators and reinforcing immune systems.

Despite the successes, the project has faced several complications, such as genetic erosion of species and resistance to technological adaptation. However, collaboration with academic institutions and the adoption of circular economy-based approaches have been key to overcoming these obstacles. Training in areas such as administration, finance, and entrepreneurship has also strengthened the community.

To ensure the long-term growth and consolidation of the initiative, it is crucial to implement a well-structured scaling strategy. This includes geographical expansion, adapting the business model to new regions, and diversifying the product portfolio. Continuous collaboration among rural communities, academic institutions, and other stakeholders will be vital for the future success of the project.



Left. Group on the first section of the agrotourism corridor. Author: Elsa Beatriz Fonseca.

Right. Signage of the first section of the agrotourism corridor installed in Vereda San Pablo. Author: Elsa Beatriz Fonseca Santanilla.



Case 14. Biofortified rice to combat hidden hunger in Bolivia.

Organization: Alliance Bioversity International - CIAT

Authors: Fátima Baqueros Ballón, Juana Viruez Justiniano, Jaime Borrero C. (CIAT), Roger Taboada Paniagua (HarvestPlus- Bolivia), Cecile Grenier (CIRAD).

The project represents a valuable contribution both to Bolivian smallholders and to the diet of their population. In this context, the development of a new variety of biofortified rice with higher levels of zinc has been carried out, comprehensively addressing both food security and nutritional deficiencies in the region.

Bioeconomy Pathways:



Biotechnological
applications

Project summary

Rice is a fundamental staple in the diet of Bolivians and a source of income for thousands of smallholders. However, rice production faces challenges such as lack of financing and climate variability. Additionally, Bolivia suffers from nutritional deficiencies, particularly zinc, affecting almost 37% of the population. In this context, Alliance Bioversity International - CIAT in Bolivia, in collaboration with Harvest Plus and CIAT-Colombia, has developed biofortified rice varieties with higher zinc content, addressing both food security and nutritional deficiencies.

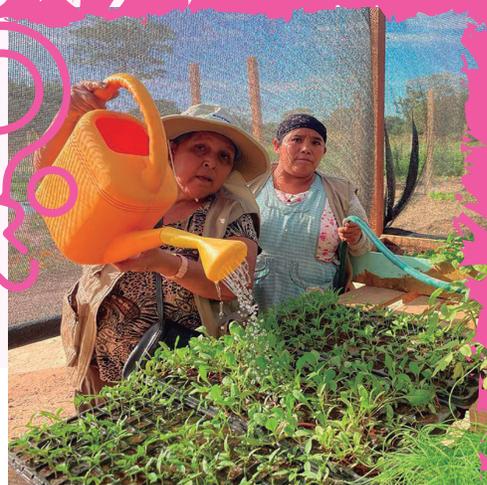
The key innovation is the CIAT BIO 44 + Zinc rice variety, developed to improve nutrition and health in Bolivia. This rice is not only rich in zinc but also has high yield and disease resistance, benefiting both producers and consumers. The biofortification strategy is sustainable and has the potential to positively impact the global economy. To ensure the effective adoption of this variety, training and awareness programs for farmers and consumers have been implemented.

However, the project faced several hurdles, including resistance to change from farmers and consumer acceptance. Initial funding and climate change also presented difficulties. Despite these challenges, the project has proven to be a replicable model, although it requires specific adaptations for each new context and significant initial investment. Lessons learned include the importance of community participation and the need for effective dissemination strategies.

To scale up this success, it is recommended to establish partnerships with local organizations, research institutes, and governments. It is crucial to adapt biofortified varieties to local conditions and provide training and technical assistance to farmers. Additionally, seed distribution systems should be established, and promotion and awareness campaigns should be conducted. Continuous monitoring and evaluation are essential to ensure the long-term impact of the project in new regions.



Left. Field day. Author: CIAT-Communication Department-Municipality of Yapacaní.
Right. CIAT-BIO 44 fortified variety. Author: Juana Viruez J. Municipality of Saavedra.



**CATEGORY III: Public sector
(at all levels) of Latin America
and the Caribbean.**

Case 16. Galileo: Integrated School Gardens Network, Santa Cruz, Bolivia.

Organization: : Santa Cruz Agricultural Department Service.

Authors: Felipe Mendieta Kramer (Director General, Santa Cruz Agricultural Department Service), Natalia Stepp y Ricky Arias (Directorate of Extension and Technology Transfer of the Santa Cruz Agricultural Department Service).

The "Galileo" Integrated School Gardens Network project constitutes a valuable contribution to food security. This impact is achieved through an integrated approach that brings together technology, education, and social welfare by implementing school gardens in 56 municipalities of the Santa Cruz department, Bolivia.

Bioeconomy Pathways:



Efficiency of
value chains

Project summary

The “Galileo” Integrated School Gardens Network project in Santa Cruz, Bolivia, addresses the issues of food security and seasonality in vegetable production. Using a comprehensive approach that combines technology, education, and social welfare, the project establishes school gardens in 56 municipalities in the department. These gardens not only provide a source of nutritious food but also offer training in sustainable horticulture and marketing techniques, enabling families to generate additional income.

The project has had a meaningful impact in several areas. On the environmental front, it promotes bioeconomy and sustainability by teaching environmentally friendly agricultural practices. Economically, it has empowered local communities by providing them with the necessary skills to produce and market vegetables, thereby contributing to the economic strengthening of the region. The project also has a strong social component, offering occupational therapy and creating

an interconnected network of gardens through a mobile application.

However, the project faces several challenges, such as adverse weather conditions, the need for funding, and a lack of technical knowledge in the communities. Nonetheless, the Galileo Integrated School Gardens Network stands out as a successful model that could be replicated in other contexts. The key to its success lies in inter-institutional collaboration, adaptability to local conditions, and active community participation.

Regarding the future, the project seeks to scale its model to more municipalities and adapt to climate change. Sustainability and adaptability are crucial for its long-term success, which implies the need for a monitoring and evaluation system, as well as an effective communication strategy to share successes and lessons learned.



Left. Evaluating the harvest. Author: Ricky Arias.

Right. Aerial view of an integrated school garden. Author: Ricky Arias / Natalia Stepp.



IV SUCCESSFUL CASES CONTEST

INNOVATIONS WITH IMPACT
ON BIOECONOMY

