



Bioeconomy and
Production Development



Bioeconomy and Production Development Program

Conceptual and
methodological
approaches for
technical cooperation



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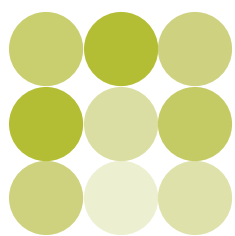
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List of Acronyms

CAC	Central American Agricultural Council
CARDI	Caribbean Agricultural Research and Development Institute
CAS	Southern Agricultural Council
CATIE	Tropical Agricultural Research and Higher Education Center
CDB	Convention on Biological Diversity
CPB	Cartagena Protocol on Biosafety
FONTAGRO	Regional Fund for Agricultural Technology (FONTAGRO)
GDP	Gross domestic product
GHG	Greenhouse gases
GM	Genetically modified
ICT	Information and communication technologies
IICA	Inter-American Institute for Cooperation on Agriculture
LAC	Latin America and the Caribbean
MTP	Medium Term Plan
NP-ABS	Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity
NKLP	Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety
PROCI	Cooperative Agricultural Research and Technology Transfer Program
SDG	Sustainable Development Goals
SICA	Central American Integration System



Introduction: bioeconomy - a necessity and opportunity

There is widespread consensus today that climate change and natural resource degradation are creating increasing challenges and limitations for the world. In light of population, income and urbanization projections that forecast a sharp increase in the global demand for goods and services, adjustments must be made in the current development model, which was first applied during the Industrial Revolution and continued to be implemented as petroleum was incorporated into the energy matrix. Given the need to adequately address new challenges, it is critical that we substantially increase the production of food, energy, fibers and animal feed, even amidst a scenario marked by increased degradation of and competition for natural resources, as well as the obligation to abide by international environmental commitments.

We must now identify and promote a cleaner and more sustainable economic development model. The convergence of the biological sciences, physics, chemistry, engineering, social sciences and information and communication technologies (ICT) allows us to rise to this challenge, by creating alternative pathways to established strategies.

Within this framework, the concept of the bioeconomy has been incorporated into the economic reality of different societies at the global level, initially with the aim of harnessing the social and economic benefits gained by taking advantage of opportunities for innovation that these new technologies offer (European Commission 2005). More recently, the approach to the bioeconomy has evolved into a broader and more ambitious vision of development that is increasingly relevant for the achievement of the 2030 Sustainable Development Goals (SDGs) and the implementation of strategies to decarbonize the economy, which is critical to reducing greenhouse gas (GHG) emissions, so as to ensure that the planet's average increase in temperature does not exceed 2°C by the end of this century.

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What is the bioeconomy?

The bioeconomy is the intensive and knowledge-based use of biological resources, processes, technologies, and principles, for the sustainable provision of goods and services in all sectors of the economy (IICA 2018).

This concept proposes a range of possible production scenarios: from those that involve better use of underutilized resources or production capabilities to opportunities arising from the emergence of disruptive technologies. New production uses and opportunities are now possible with the convergence of new advances in the biological sciences and engineering, which are further enriched by developments in other fields. This allows us to capitalize on opportunities based on the specificities of each production-institutional area (Bisang and Trigo 2017). Therefore, the bioeconomy has the ability to transform the status quo and also offers an option for sustainable development.



This points to the opportunities provided by the bioeconomy to design new economic and social development strategies. Not only does the field seek to restructure historical relationships between various traditional sectors of the economy—such as the competition between agriculture and the manufacturing industry—but it also offers new possibilities for the use of biomass in the manufacturing of products for the medical field, human and animal health, and the development of completely new value chains, which incorporate value-adding through the sustainable use of agricultural waste, by applying a circular economy approach.

Through the use of new sciences and technologies, the bioeconomy allows for more productive and sustainable use of biological resources, generating plant and animal materials that are more productive, disease-resistant and environmentally-friendly. It facilitates the use of biomass (including residue and waste) to produce new high value-added bioproducts, such as food, bioenergy and other biomaterials for the cosmetic, pharmaceutical and chemical industries, among others. It also spawns a range of new services (applied in the fields of human, plant and animal health, environmental bioremediation and in various preexisting activities) and increases the value of biodiversity.

The expectation is that these new frontiers of knowledge to utilize and capitalize on biological resources, processes and principles will open up greater opportunities for economic growth, job creation and territorial development, including increased possibilities for revitalizing rural areas, thereby expanding their role in economic and social development activities.

The bioeconomy represents a new and powerful opportunity for countries in Latin America and the Caribbean (LAC), where 8 of the 17 most megadiverse countries on the planet are located. The region possesses more than one fourth of the world's arable land and one third of its fresh water resources (UNDP 2010). In addition to being one of the primary producers of sustainable biomass, LAC possesses the necessary scientific-technological expertise, industrial infrastructure and entrepreneurial base to mobilize that potential. Regardless of the direction taken with respect to any of the projected future scenarios, the region will play a strategic role in striking a global balance between food, fibers and energy, as well as in improving environmental sustainability. The bioeconomy provides new opportunities to achieve equitable growth across the region—through improved agricultural and biomass production – and to increase job opportunities.

Need



-  A larger, wealthier and more urban population.
-  Greater food needs and changing food preferences.
-  Increased impact of climate change and increased NR degradation.

Opportunity



-  LAC is the region with the greatest biological wealth.
-  New frontier of technology and expertise.
-  Opportunities for greater efficiency and sustainability.
-  Major growth in bioproduct markets.

These possibilities for transformation are already becoming evident in the region in various activities that utilize sustainable agricultural intensification, biotechnology applications, bioenergy production, production using biomass residue, biodiversity-based agribusinesses, and the development of markets for ecosystem services. Although all of these areas demonstrate the significant progress that has been made, much remains to be done to increase efficiency and sustainability in harnessing LAC's biological wealth.

How do we utilize LAC's biological wealth in an efficient and sustainable manner? Some illustrative data.

- LAC has more than 300 million hectares of degraded land: 48%, 50% and 18% of land in the Caribbean, Mesoamerica and South America, respectively, are areas with high or very high levels of degradation (UNEP - WCMC 2016).
- In most cases, waste agricultural biomass is not utilized for productive purposes; on the contrary, it represents a high financial and environmental cost for producers.
 - What is waste agricultural biomass and what percentage does it represent? Rice hulls (20% of harvested rice); waste from slaughtered cattle (12% of their live weight); coffee and cocoa husks, mucilage, pulp and grounds (80% of the bean); sugarcane waste (66% of the product); citrus fruit peel (50% of the weight of the fruit); potato waste (13% of the product); pineapple waste (between 40% and 45% of the product); milk serum (more than 70% of the product), etc.
 - Based on new knowledge, technologies and information, in what ways can we utilize waste biomass in production? Bioenergy (ethanol, biodiesel, biogas, syngas and pellets); bioinputs (fertilizers, control agents, stimulants, etc.); food products for humans and animals; polymers; fibers for textiles; construction materials; inputs for the medical, pharmaceutical, cosmetics and chemical industries; etc.
- A total of 127 million tons of food are wasted each year in LAC, which is equivalent to the amount needed to satisfy the dietary requirements of 300 million people. Of the total amount of food lost, 28% is wasted during production, 21% during handling and storage, 6% during processing, 17% during distribution and 28% at the consumption stage. At the global level, food waste generates approximately 3.3 gigatons of GHG emissions, representing the world's third largest source of emissions, surpassed only by China and the United States (FAO 2016).
- Agricultural yields vary greatly between and within LAC countries. For instance, rice yields of countries in the region range from 0.9 to 8.6 t/ha; sugarcane yields range from 20 to 129 t/ha; corn yields range from 1 to 11 t/ha; and wheat yields range from 0.6 to 6 t/ha (FAO 2018).
- Whereas 3.2 kg of domestic resources are required to produce one dollar of Gross Domestic Product (GDP) in LAC, less than 1 kg is required to produce one dollar of GDP in Europe and North America (the global average is 1.8 kg per dollar). (Friends of the Earth Europe n.d.).

The bioeconomy seems to offer alternatives and to provide concrete solutions for the production, environmental and social challenges of our time. However, to fully avail ourselves of its potential, this new vision must be reflected in strategies, policies and programs that promote a more inclusive and sustainable agricultural and rural model that does not sacrifice growth, efficiency or profitability. This is the logic behind and the objectives that drive the Bioeconomy and Production Development Program, which the Inter-American Institute for Cooperation on Agriculture (IICA) proposed to its member countries in its 2018-2022 Medium-Term Plan (MTP).



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Bioeconomy and the circular economy

The circular economy is defined as a way of organizing economic activities, so that the value of products and material inputs is maintained within the economic cycle for as long as possible, thereby minimizing waste discarded into the environment. Its fundamental principles are to reduce, recycle and reuse all types of materials, including metals, minerals and biological resources. Therefore, the circular economy seeks to replace the typical linear cycle of “extracting-processing/transforming/utilizing-discarding” that characterizes processes derived from the Industrial Revolution. In this regard, the bioeconomy and the circular economy share a common objective: to contribute to creating a more sustainable world with a lower carbon footprint.

Evidently, the bioeconomy is a concept that falls within the framework of the circular economy. However, it goes one step further by focusing on the “biologization” of industrial and consumption strategies, increasing efficiency in the use of fossil carbon (in addition to promoting its replacement by sustainable carbon) and reducing negative environmental impacts. Although these concepts have different origins, they must be regarded as complementary and synergistic when defining development strategies aligned with the SDGs (EEA 2018).

Potential benefits and implementation pathways

The option to capitalize on the bioeconomy is available to economic agents in well-established value chains in territories, including those involved in agriculture and other related areas. The more intensive and efficient use of biological resources and processes will foster greater economic density in territories and will strengthen the interaction between existing chains, by offering new ways to make use of the raw material generated by agriculture (biomass). This will:

- Increase the production development of value chains, which, in turn, will boost the income of economic agents and the capitalization on local income, as well as facilitate the creation of new linkages with chains outside of agriculture.
- Generate multiplier effects in rural areas through the relocation of investment and the creation of new types of businesses in areas where biological resources are located, which will then increase opportunities for traditionally marginalized groups, such as youth and women.
- Contribute to processes geared toward decarbonization and pollution reduction, as a result of reduced waste and emissions, as well as toward the undertaking of activities that facilitate carbon sequestration and the creation of bioproducts that assist in transforming the energy matrix.

It is clear that not all countries will utilize and capitalize on the bioeconomy in the same way. Some will do so by introducing production-commercial models that employ state-of-the-art technology to make intensive use of biological resources and principles (such as biofactories that use genetically modified crops or animals to produce new products, biorefineries that use biomass to produce bioenergy and biomaterials, the biohealth industry that modifies pre-existing health models or bioeconomic services). On the other hand, others will opt to apply traditional technology models that make greater use of the abundance of biological resources in the territory and in the chain (such as traditional production activities that incorporate biological inputs; agricultural products that utilize resources from the farm to offer ecotourism services, or



agricultural and livestock industries that utilize residue or waste to generate bioenergy for personal consumption, bioinputs, food products, to name just a few examples).

Consequently, there is no single pathway to capitalize on the bioeconomy. The path chosen will depend, on the one hand, on the specific characteristics of different chains and territories (biological resource base; business network; production-commercial structure; infrastructure and logistics; technical and scientific capabilities; market size, etc.), and, on the other hand, on the manner in which actors utilize them (use of residue/ waste, productivity gaps, use of fossil resources and the possibility of replacing them, the current condition of technologies in use, the use of biodiversity, etc.).

In general, the pathways to capitalize on the bioeconomy are those listed below:

Table 1. Pathways to capitalize on the bioeconomy

Pathway	Definition	Practices (examples)
Use of biodiversity resources	<p>Identification of functional traits related to specific uses and sectors.</p> <p>Development of new products through innovation, strategic transformation, market development for local products, etc.</p>	<ul style="list-style-type: none"> ● Identification and domestication of local biodiversity (species and ecosystem genetics). ● Transformation of distinctive biodiversity resources into value-added products (harvested, transformed). ● Market incorporation of distinctive biodiversity products (environmentally-friendly, organic or value-added).

<p>Eco-intensification (or sustainable intensification)</p>	<p>Agronomic practices geared toward improving the environmental performance of agricultural activities without sacrificing existing production/ productivity levels. Balance of agricultural, environmental, economic and social benefits, aiming for more efficient use of energy resources and a reduction in the use of fossil fuels, pesticides and other pollutants.</p>	<ul style="list-style-type: none"> ● No-till agricultural practices. ● Precision agriculture strategies. ● Integrated pest and nutrient management. ● Sustainable land management. ● Clean technologies for processing/industrialization (water, waste, etc.). ● Bioinputs: biostimulants, bioregulators, etc.
<p>Biorefineries and bioproducts</p>	<p>Use of biomass to produce bioenergy and processes aimed at substituting fossil fuel-based industrial inputs.</p>	<ul style="list-style-type: none"> ● Biofuels (ethanol, biodiesel, biogas, rosin, etc.) ● Biomaterials (polymers, composites, elastomers, resins, textiles, soaps, cosmetics).
<p>Biotechnology applications</p>	<p>Biotechnology products, tools, and processes, including industrial tissue culture, marker assisted selection in crops and animal husbandry, genetically modified (GM) seeds/ plants, molecular-based diagnostics, animal reproduction improvement through molecular techniques, modified enzymes, microorganisms and yeasts, etc.</p>	<ul style="list-style-type: none"> ● Plant genetic engineering (accelerated production of new plant varieties with improved nutritional characteristics that are more tolerant to adverse conditions and more resistant to specific pests and herbicides). ● Biotechnology applications in human and animal health (diagnosis of diseases, vaccines, gene therapy, molecular identity, etc.). ● Environmental biotechnology (bioremediation, waste management, bioleaching, diagnosis and detection of substances, etc.). ● Functional foods (nutraceuticals, dietary supplements, designer foods, pharma foods, fortified foods, medifoods, vitafoods, etc.).

Improved efficiency of value chains	Greater quantity and/or production or market value, as a result of the use of biomass residue and the development of market linkages for innovative bio-based products.	<ul style="list-style-type: none"> ● Practices to reduce postharvest losses (trade in food that is about to perish, sale of defective products). ● Use of residue and waste (energy for personal consumption, sale of by-products, raw material for other production chains, etc.). ● Short circuits/niche markets, linkages with sustainable/ ethnic/fair/organic markets, etc.
Ecosystem services	Economic and cultural benefits that human beings derive from ecosystems.	<ul style="list-style-type: none"> ● Support services (nutrient cycles, pollination, symbiosis, preservation of genetic diversity, payment for environmental services, etc.). ● Provisioning services (raw materials for construction, chemical products, biological products, genetic resources, biopharmaceuticals for humans and animals, etc.). ● Regulation services (climate, disease and water regulation; water purification, shadow prices, carbon credits, wastewater treatment, etc.). ● Cultural services (spiritual and religious enrichment, recreation, amusement, ecotourism, aesthetics, inspirational services, education, cultural heritage, ecotourism, landscaping, etc.).

Source: Prepared based on Trigo *et al.* 2013.



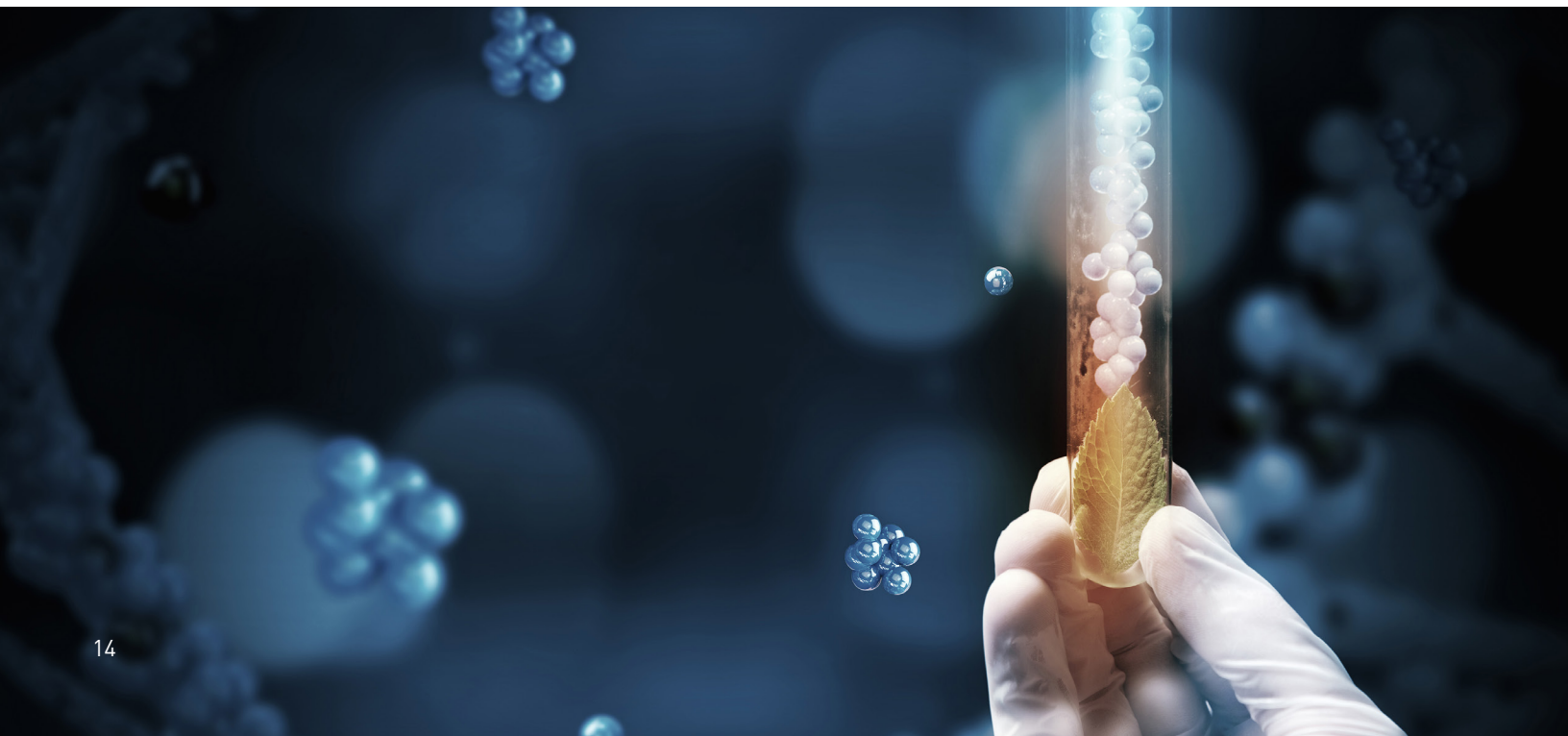
Challenges in transitioning toward the bioeconomy

As mentioned in the 2018-2022 MTP (IICA 2018), the shift toward an economy that utilizes biological resources more efficiently and sustainably in production development and that, in turn, reduces fossil fuel dependence, will require new policies, institutions and capabilities that prompt and guide the behavior of stakeholders, in a bid to maximize potential benefits and minimize the costs involved in transitioning toward this model, for all parties involved. The strategies to be implemented must include not only general policies, but also new approaches in areas such as science, technology and innovation. There will also be a need to strengthen the human resource (talent) component needed to undertake new bioeconomy activities and to devise various rules, regulations and market instruments to guarantee the sustainable and safe development of these new opportunities to capitalize on the bioeconomy.

Policies and institutions: Much like what has taken place during other economic turning points, the shift towards a new bioeconomy-based production model will call for regulatory and policy frameworks to support scientific and technological developments. Inclusive market approaches and mechanisms will also be necessary to create incentives that encourage economic agents to utilize knowledge regarding biological resources, processes and principles in their production, processing and marketing models, in a more efficient and sustainable manner.

Thus, the new model must at least include: a) regulatory and policy frameworks for environmental, health and agricultural issues that facilitate and foster the safe use of the bioeconomy, based on the pathways described in Table 1; b) tools that drive the creation or growth of markets for bioeconomy products, such as incentives in public purchasing systems, labeling programs and standards, as well as mechanisms for market regulation and transparency, etc.; and c) services that provide economic, financial and tax assistance to strengthen bioeconomy value chains, such as funding systems, tax credits, investment funds, assistance programs, etc.

A new scientific and technological foundation: Greater use of biological resources, processes and principles in production development in LAC is contingent on the use of new knowledge, technologies and information. Despite the fact that, in the long term, the greatest potential will be offered by advances in biological sciences and ICTs that facilitate the development of improved



varieties and new ways of utilizing biomass, in the short and medium term it is still possible to better utilize conventional technology. This will necessitate the development of an approach that could be characterized as technological “hybridization,” in which traditional technologies are coupled with new biotechnologies to facilitate the development of more efficient and environmentally friendly production models. Achieving both objectives will require greater and more precise expertise to manage processes involving the transformation of different resources such as water, nutrients and solar energy into biomass, on which human beings can capitalize through biological entities. This shift will also depend on our ability to increase and redirect investment into innovation and development (I&D) and to put scientific results into practice. To this end, consideration must be given to technology, innovation, extension and scientific-technological capacity-building programs; cluster-based development strategies; assistance programs; and the generation of enabling technologies, among other measures.

Human resources and social participation: In addition to the enabling policies and the new scientific-technological foundation, capitalizing on the bioeconomy will also require economic agents in value chains to possess the capabilities necessary to manage new processes, which are generally much more knowledge-intensive than conventional approaches. In the case of most bioeconomy activities, the success of technological innovation will depend on capabilities in biological sciences and on the extent to which human resources have sufficient training in production-, processing- or marketing-related matters, to be able to understand and manage the intrinsic dynamics of biological processes.

Furthermore, ensuring maximum use of biological resources and principles in production will require new organizational approaches that enable more efficient and equitable access to these resources and to the ways in which they are utilized, as well as to the benefits derived from them. More effective participation in these new dynamics will hinge on strengthening the capacities of stakeholders across all areas, including formal education, rural agricultural extension services, business capabilities, mass communication, decision-making and territory and chain governance, among others areas.

Social inclusion through improved opportunities for rural development: The bioeconomy offers greater opportunities for small-scale producers, primarily by fostering sustainable, intensive practices that enable them to increase the quantity and quality of their production, while also improving environmental sustainability. It also allows them to boost the efficiency of their processes, thanks to decreased product losses and the use of waste or residue to



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Bioeconomy and the SDGs

Due to its ability to generate new sources of inclusive and sustainable economic growth, as well as to contribute to the decarbonization of the economy, the bioeconomy is regarded as one of the most promising strategies for achieving those Sustainable Development Goals (SDGs) that seek to:

- reduce poverty (Goal 1);
- achieve food security and improve nutrition (Goal 2);
- guarantee health and well-being (Goal 3);
- ensure access to clean water and sanitation (Goal 6);
- ensure access to affordable and clean energy (Goal 7);
- create new sources of income and employment (Goal 8);
- foster industrial innovation and renovation (Goal 9);
- achieve greater sustainability in cities and communities (Goal 11);
- ensure responsible production and consumption (Goal 12);
- drive climate change mitigation and adaptation (Goal 13);
- conserve and sustainably use marine resources (Goal 14);
- foster the preservation of terrestrial ecosystems, the sustainable use of forests, the fight against desertification and land degradation, as well as the sustainable use of biodiversity (Goal 15); and
- drive the establishment of partnerships and associations for development (Goal 17).

generate bioenergies and other bioproducts. These practices, which expand and diversify sources of income for producers and increase their food and energy autonomy, can prompt new economic activities in rural areas, in turn, leading to job opportunities for poor or marginalized groups within rural populations. By offering a broader range of linkages between agriculture and the rest of the economy, the bioeconomy also provides the possibility to reassess poverty relief and new rural development strategies, making a valuable contribution to the achievement of the SDGs.

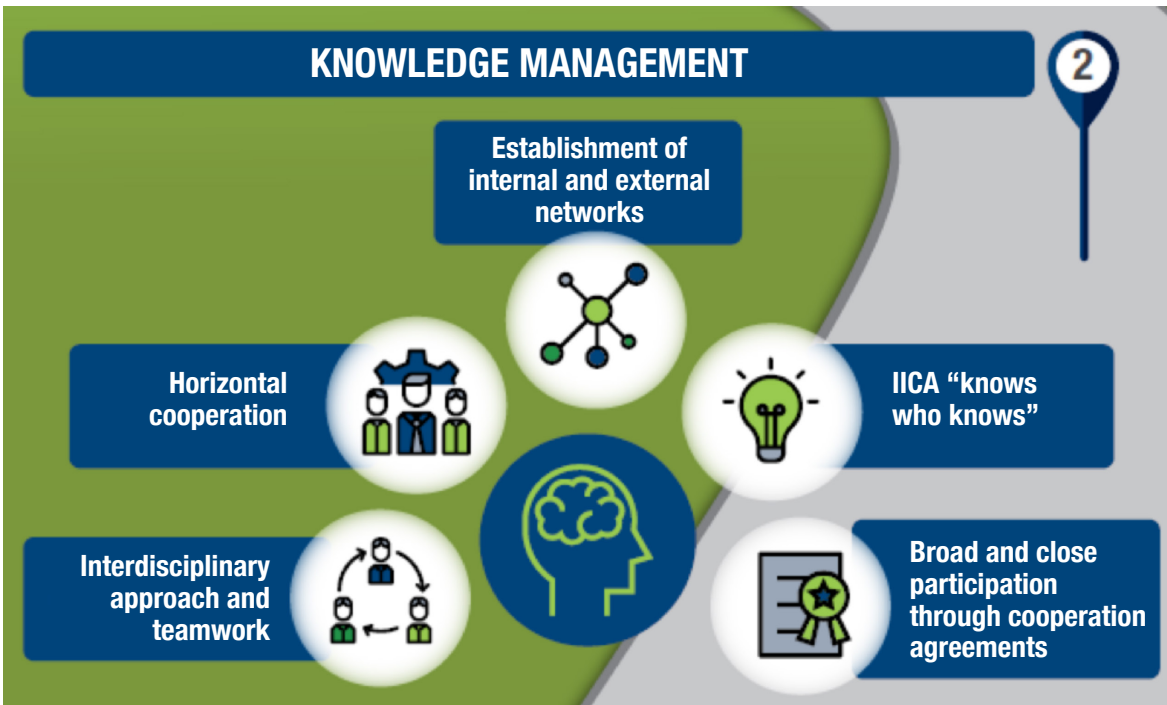
In order for the bioeconomy to facilitate greater social inclusion, it will be necessary to draft new policies that allow for localized investment in rural territories (attraction of investment, rural infrastructure, cluster promotion, local capacity building, technology transfer, etc.), and which subsequently make it possible to retain the added value that is generated at the local level and to distribute it in an equitable manner.

IICA's proposal to promote greater exploitation of the bioeconomy in LAC

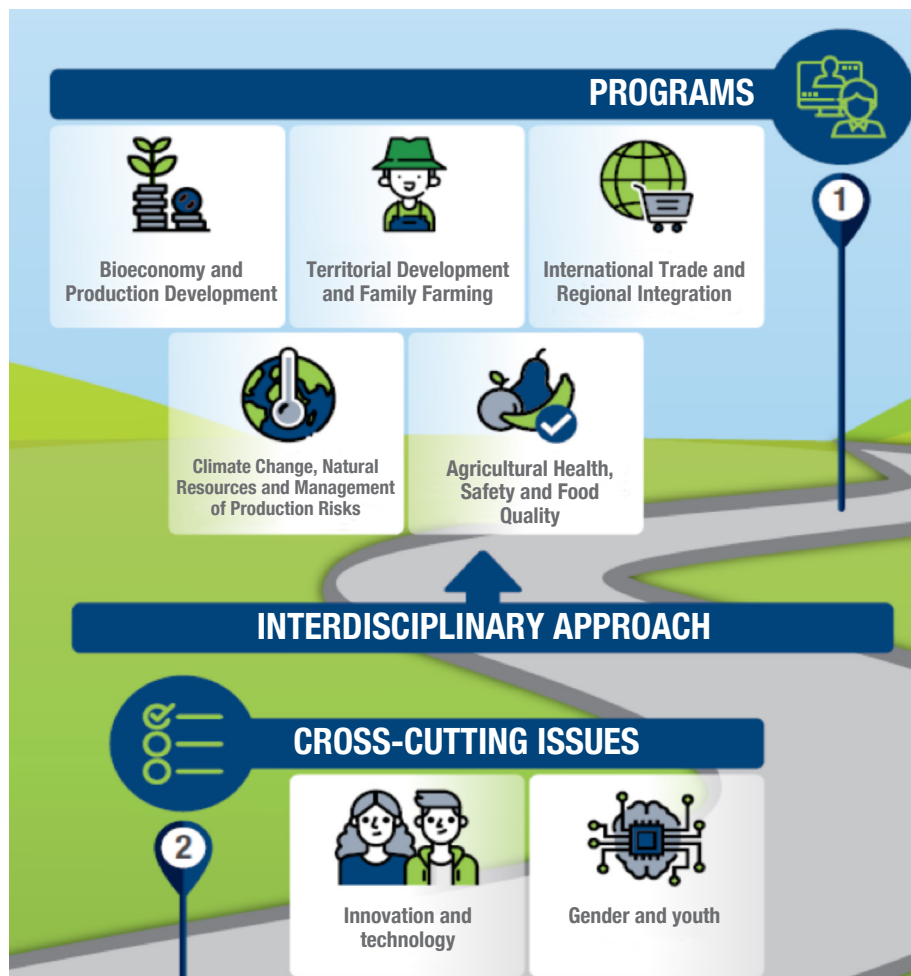
In an effort to better respond to the challenges and opportunities of its member countries, IICA defined a renewed vision for its technical cooperation model, as detailed in its 2018-2022 MTP. This vision acknowledges the organization's technical and institutional strengths, while also proposing a new way of managing knowledge.

As indicated in the 2018-2022 MTP, in its role as knowledge manager, IICA is required to work with its member countries to identify their needs and demands with respect to technical cooperation, as well as to provide the most adequate responses to those demands through the leadership and coordination of its technical personnel, in collaboration with partner institutions and external professionals. The primary objective of knowledge management is to

increase and improve the efficiency and effectiveness of the technical cooperation that IICA provides to its member countries, as well as the cooperation actions undertaken with regional cooperation and integration mechanisms and institutions (IICA 2018). The pillars of IICA’s knowledge management-based cooperation model are detailed in the following diagram:



IICA’s technical cooperation model consists of five hemispheric programs, which are responsible for coordinating and incorporating knowledge management into each of their thematic areas. Its primary objective is to provide adequate responses to problems and objectives that have been jointly identified with the countries and detailed in the IICA Country Agendas. Therefore, the delegations in the member countries will serve as implementation units for technical cooperation at the national level, acting as bridges or platforms for knowledge management and sharing between regions, countries and thematic areas, in coordination with the technical programs.



IICA will officially venture into promoting the bioeconomy through a program that will assist countries in designing specific strategies, policies, investments and regulations that allow the region to fully capitalize on the potential of the bioeconomy, in an inclusive and sustainable manner (IICA 2018).

The Bioeconomy and Production Development Program of IICA will be based on the following guidelines:

1. Promote an approach, policies and innovations that facilitate bioeconomy-based development, seeking to expand knowledge about what the bioeconomy is and what it offers as a production development approach.
2. Foster production development based on bioeconomy production chains, channeling efforts toward promotion (based on experiences at the international level and within the region itself), institutional mechanisms, policies and investments required to implement a bioeconomy-based production development strategy.

The Bioeconomy and Production Development Program will conduct its work based on four strategic areas:

Strategic area 1: *Contribute to disseminating the concept of bioeconomy, providing evidence and a better understanding of the bioeconomy's potential for development:* In order to successfully capitalize on the bioeconomy in production, demonstrating its potential and building capacities in countries and territories will be critical. It will also depend on having a group of stakeholders who are convinced of its potential as a model for efficient use of biological resources, process and principles for the sustainable production of not only food, energies and fibers, but also of other value-added products and services.

To this end, the program will focus, among other things, on: a) developing material for publicity and awareness-raising (documents, working papers, brochures, infographics, videos, etc.) for authorities and technical specialists from public institutions related to this topic, as well as civil society, private companies and partner organizations; b) conducting research and technical studies to analyze the economic, environmental and social results of bioeconomy practices (generating evidence); c) creating opportunities to analyze and discuss the potential of the bioeconomy and requirements to harness its benefits (seminars, forums, workshops, etc.); and d) generating products to build and strengthen capabilities (virtual and in-person courses, training programs, workshops, etc.).

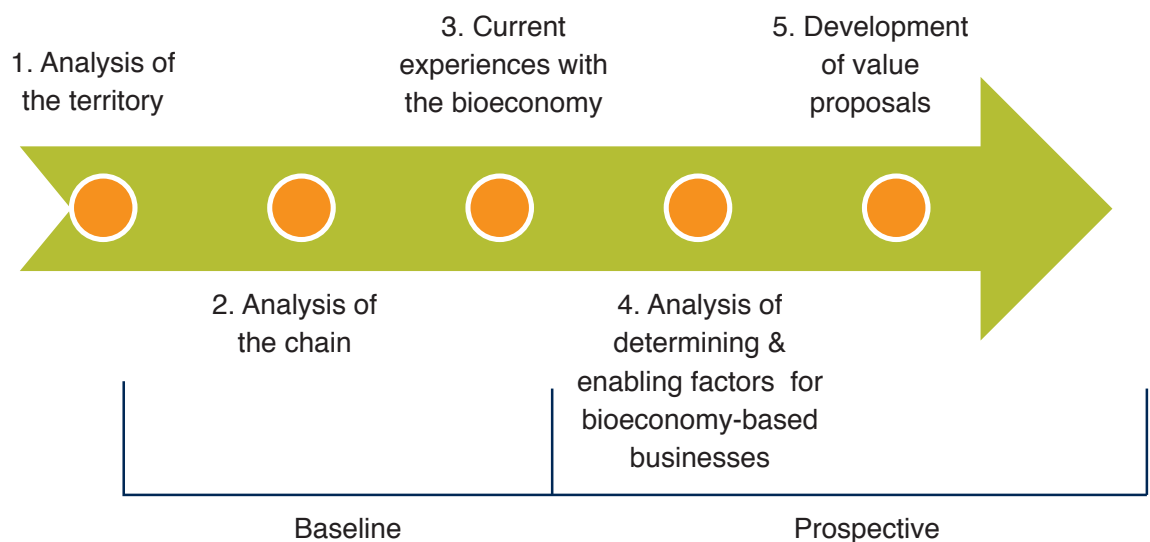
Strategic area 2: *Contribute to identifying the challenges, potential and courses of action needed to better capitalize on the bioeconomy* (based on the unique conditions of each territory or country): Once the decision-makers and stakeholders of the sector have a better understanding of and improved capabilities in this area, the program will work with stakeholders and institutions in the countries and territories to develop differentiated roadmaps to capitalize on the bioeconomy model, in keeping with the specific potential of each territory and value chain.

To develop the differentiated roadmaps, the program will provide countries and territories with a methodological guide that will assist them in responding to the following questions:

- Which bioeconomy pathways are economically, socially and environmentally viable in the different countries, territories and value chains?

- What factors facilitate, make viable and determine the socioeconomic and environmental use of each bioeconomy pathway identified in the previous step?
- Given the factors that facilitate, make viable or determine the use of the bioeconomy, which bioeconomy model is most suited to the specific characteristics of each country, territory and/or value chain, and what are the primary limitations, potential areas and gaps in each case?
- What steps or procedures did certain reference countries follow to capitalize on the bioeconomy pathways identified (best practices and lessons learned)?

The methodological guide begins by characterizing the economic, social and environmental conditions of the territory and the value chain, to then undertake a more in-depth analysis of the determining and enabling factors of each bioeconomy pathway. The results then inform the development of value proposals for those bioeconomy business models that offer potential for the territories and value chains under analysis.



Strategic area 3: Contribute to developing and/or strengthening policy and regulatory frameworks to capitalize on the bioeconomy: Once countries and territories have developed the abovementioned differentiated roadmaps, the program will assist in processes to formulate and implement policies and regulations, as well as market approaches and mechanisms to

facilitate and enable new types of bioeconomy-based production (including trade in national and international markets).

To this end, the program will provide the following inputs: a) methodologies to enable countries to assess their level of preparedness at the institutional, policy and regulatory levels to promote new uses of the bioeconomy; b) guides to assist in the formulation of public policies and required strategies (to allow countries to benefit from best practices and lessons learned from those countries that are more advanced in this area); and c) methodologies for the development, implementation and administration of bioeconomy observatories. These tools will be just some of the inputs used to support and guide the countries.

Strategic area 4: Provide support for the design and implementation of investments and specific policy instruments to develop and/or strengthen bioeconomy production chains: In addition to fostering a framework of policies that enable, facilitate and promote a paradigm shift toward more efficient,



sustainable and inclusive production, processing, marketing and consumption models (Strategic area 3), the program will work with countries to design and implement plans, programs, projects, strategies and investments that enable and foster the use of bioeconomy-based production and trade practices in value chains (taking into account the effective inclusion of family farming).

Bioeconomy and Production Development Program Activities in 2019

During 2019, the Bioeconomy and Production Development Program of IICA has been developing projects in 14 countries of the hemisphere, all of them related to its strategic areas. Moreover, it has been an active participant in international discussions about the bioeconomy and its potential as an approach to sustainable development, particularly at the Global Bioeconomy Summit, where it was part of the International Advisory Committee. It was also instrumental in the creation of the Latin American Bioeconomy Network.



As a result of the collaborative efforts between IICA delegations in the countries and the Program, the following products are in the pipeline:

Dissemination, evidence, awareness- and capacity-building

- Methodology to assess the contribution of the bioeconomy to development. The pilot program will be implemented in Ecuador.
- Open access, free online course, “Potential and challenges in capitalizing on the Bioeconomy in LAC”, which will be offered in tandem with demonstration tours in 14 countries in the region.
- Documents and technical notes on challenges, potential, policies and strategies in relation to the bioeconomy, for distribution in different forums, workshops, media, etc.
- International LAC Bioeconomy Seminar at IICA Headquarters, in conjunction with Allbiotech.
- Series of online seminars on the LAC bioeconomy.
- International Online Seminar (asynchronous) on the Bioeconomy as a new development paradigm for the Americas.
- Online knowledge platform Infoagro Bioeconomy <http://infoagro.net/bioeconomia>.
- Workshops, seminars and policy discussions on the bioeconomy, agriculture and rural development in 14 countries in the LAC region.

Roadmaps to capitalize on the bioeconomy

- Guide for the identification and development of roadmaps to capitalize on the bioeconomy in agriculture and rural areas in LAC.
- Support in defining roadmaps for the bioeconomy in six countries in LAC (Uruguay, Bolivia, Costa Rica, Mexico, Belize and Ecuador).

Institutional, regulatory and policy frameworks

- Guide for the formulation of policies and regulations to foster the bioeconomy in agriculture and rural areas.
- Guide for the establishment and management of bioeconomy observatories, which will serve as input for processes in Uruguay, Argentina and Costa Rica.
- Support for the development or strengthening of policies and strategies to foster the bioeconomy in Argentina, Belize, Costa Rica, Ecuador, Bolivia, Mexico and Uruguay.

Investments and strategies for bioeconomy value chains

- Guide to assess the feasibility of bioeconomy business models in agricultural and rural value chains and to develop related proposals.
- Catalogue of prospective technologies that facilitate new applications of the bioeconomy, using biological resources and principles.
- Support in identifying potential applications of the bioeconomy and developing strategies for new businesses in the coffee, cocoa, avocado and honey chains in eight LAC countries.



Rural youth and the bioeconomy

The aging of the population is one of the most pressing problems facing rural areas, prompting many young people to flee to urban areas in search of better opportunities. The bioeconomy can provide alternatives to reverse these economic trends. New business models offer innovation, calling for creativity and leadership, and without a doubt, provide new opportunities to satisfy the aspirations of young people. Naturally, employment opportunities increase, not only because of the greater “densification” of economic activity, but also because of the quality of the opportunities.

In support of these processes, the BE&PD Program will aim to execute the following actions:

- Explicitly incorporate the youth employment dimension in activities to support the identification of opportunities and design of strategies and policies for development of the bioeconomy.
- Inspire young people involved in agriculture and other rural economic activities by documenting, publicizing and discussing success stories in which the bioeconomy helped to improve initiatives and businesses in different value chains.
- Provide greater visibility to and improve the positioning of the bio-based enterprises of rural young people, contributing to raising awareness about the role that these actors can play in promoting the bioeconomy as a new production, trade and consumption paradigm.
- Facilitate collaboration, networking and interaction among young rural LAC leaders with a particular interest in the bioeconomy, its applications and possible business ventures.
- Assist public and private actors in the countries to formulate and implement support services that promote youth-based bio-businesses.



Technology, innovation and the bioeconomy

Innovation, in all its dimensions (technology, institutes, public policy, markets, etc.), is an intrinsic component of the bioeconomy, particularly if we are aiming to fully exploit its potential, not only for production, but also for its ability to contribute to the environment and health.

Thus, the Bioeconomy and Production Development Program in collaboration with the other programs, cross-cutting areas of focus and IICA Delegations in the member countries, will work to build innovation capacities, taking care to preserve the biological resource base in specific territories, as much as possible. In particular, joint efforts will focus on:

1. Raising awareness and strengthening capacities to support innovation processes that will enable societies to exploit the production opportunities offered by the bioeconomy.

- Prioritizing the need to support R+D in development-oriented strategies and policies in support of development.
- Incorporating critical innovation- and technology-related variables into guides, methodologies and roadmaps to capitalize on the bioeconomy.
- Assisting in promoting innovation in the processes and organization of support services, such as advisory and rural extension services, to encourage bioeconomy-based innovation.

5

INSET

What is innovation in agriculture?

In agriculture, innovation is the implementation, for the first time and in a specific context, of a new or improved product or process designed to bring about positive changes that make it possible to meet needs, tackle challenges, or tap opportunities. The innovator is the decision-maker in the unit implementing the change. In agribusiness chains, for example, the innovator may be a farmer, a processor, a group of producers or any decision-maker. There are different types of innovations:

- A product is a good (for example, polymers for industry) or a service (for example, ecosystemic services) that is provided.
- A process is the way in which actors produce goods or offer services, market their goods or services, organize themselves, or interact with others, etc. (Digitalization is an example.)

Innovations may be technological, social, organizational, and/or institutional.

Source: Taken from IICA 2019.

2. Driving innovation processes and systems to capitalize on the bioeconomy.
 - Fostering the use of scientific evidence as a basis for formulating or strengthening policy, regulatory and legislative frameworks for application of the bioeconomy in different value chains.
 - Improving the technical and functional innovation capacities of stakeholders in specific chains and territories, so that they may better exploit the opportunities of the bioeconomy.
 - Facilitating the implementation of bioeconomy-based product and production process innovations, in order to increase productivity and the sustainability of businesses and producer organizations.
3. Identifying and analyzing experiences that provide evidence and convey lessons learned.
 - Analyzing, systematizing and facilitating access to information on innovations, whether technological or otherwise (available or prospective), that would facilitate a) new production applications for biodiversity, b) intensification of sustainable production, and c) reduction of post-harvest and food losses.

Gender and bioeconomy

The new developmental paradigm offered by the bioeconomy provides a window of opportunity to balance the economic-social, environmental and political participation of men and women in agricultural and rural areas in the region. In order for the new sciences, technology and expertise to prompt more efficient and sustainable use of biological resources, we must redefine the roles, inter-relationships and synergies between all actors involved in the socio-productive systems of territories and agricultural value chains.

In this scenario, rural women play a critical role as the custodians of knowledge, guardians of biological resources and the advocates for innovation for sustainable production, which are important pieces of the bioeconomy matrix. However, strengthening the position of women in the new bioeconomy businesses and increasing their potential earnings will hinge on the following:

- a. Strengthening their associative and political capacities to enhance their involvement in the institutional structures and public policies that are being created to foster the bioeconomy.
- b. Strengthening their role in production and civil society organizations that are leading the adaptation and transformation process of the agriculture sectors and territories.
- c. Building their human (educational, technological, management, leadership, etc.) and social capacities to enable them to enjoy more equitable participation in economic activities spawned by new applications of the bioeconomy.
- d. Fostering support services (primarily financial, technological, commercial, etc.) with respect to new applications of the bioeconomy, taking into account their needs and potential. The Bioeconomy and Production Development Program will undertake all of these areas of activity in collaboration with the other programs, cross-cutting areas of focus and IICA delegations in the countries.



Capitalizing on IICA's experiences, knowledge and tools

As previously mentioned, in order to take advantage of the opportunities afforded by the bioeconomy as a viable development model for the different types of agriculture, as well as to generate linkages with other sectors of the economy, scientific and technological developments must be supported by market approaches and inclusive mechanisms that guarantee not only the establishment of linkages with value chains, but also the participation of small-scale farming and this sector's ability to capitalize on the bioeconomy.

Consequently, IICA's experience in matters related to the strengthening of agroindustrial chains, the inclusion of small-scale farming in markets, and support in the development of differentiated policies for family farming will serve

as the Institute's primary strength in addressing the issue of the bioeconomy and production development. Although there are many knowledge providers in the fields of science and technology, certain knowledge gaps have yet to be filled in matters related to chains, markets, the inclusion of small-scale farming and policies for the bioeconomy and production development, thereby providing an opportunity for IICA.

The following are some of the Institute's conceptual and methodological approaches on which it may be possible to capitalize further in order to create greater linkages with the program:

- Conceptual and methodological approaches to improve the competitive and sustainable performance of agricultural chains as a whole and of all of their links, through policy management, the strengthening of institutions and public-private capabilities, and support for technological, business, institutional and commercial innovation processes. The Institute has experience in the following areas:
 - Strengthening institutional capacities for the development and management of results-based policies and financial inclusion.
 - Strengthening capacities for the negotiation, management and fulfillment of commitments undertaken in international agreements, as well as for participation in and establishment of successful relationships with international or multinational networks (or forums) and institutions.
 - Managing agricultural chains through processes aimed at establishing and strengthening committees and opportunities for collaboration, as well as developing strategic plans and business plans.
 - Strengthening business, associative, commercial and value-adding management, with a view to improving linkages between producers and chains
 - Managing technological innovation throughout agricultural chains in matters related to production management, good agricultural and manufacturing practices, safety, management of pests and diseases, use of bioinputs, processing technologies, antimicrobial resistance, energy efficiency, water footprint, carbon footprint and the reduction of food losses.

- Fostering market access and linkages by disseminating and supporting compliance with requirements, fostering innovative marketing schemes and supporting the internationalization of agrifood products.
- Conceptual and methodological approaches to contribute to establishing the conditions that countries require to design and manage integrated policies for social, economic and citizen inclusion, in a participatory manner, while addressing the needs of rural populations where family farming is prevalent. The Institute possesses experience in the following areas:
 - Strengthening institutional capacities for the design, implementation and participatory management of institutional frameworks, policies and instruments for inter-institutional and intersectoral dialogue, in order to foster coordinated actions for the inclusive development of agriculture and rural areas; and
 - Bolstering the capacity of family farming stakeholders to participate in decision-making processes led by coordination and consensus-building entities with respect to inclusive territorial development, by fostering affirmative actions and best practices, such as the establishment of criteria for the equitable participation of vulnerable groups; the creation and strengthening of networks, associations and cooperatives for women, youth, family farmers, artisans, indigenous populations, people of African descent, individuals with special needs and the elderly; as well as assisting in the development of business plans and implementation of entrepreneurship projects aimed at income generation and food security.
- Conceptual and methodological approaches for the strengthening of public-private institutional frameworks to increase participatory management and gear strategies toward improving the impact of differentiated public policies; as well as for the development of expertise and the sharing of information related to sustainable production, food security and socioeconomic participation in territorial dynamics and production linkages. The Institute possesses experience in the following areas:
 - Institutional strengthening via strategic processes implemented in the countries to develop differentiated and innovative public policies geared toward sustainable production, as well as the food and nutritional security of family farming; and

- Capacity building in matters related to agricultural health and food safety, the use of native species and genetic resources with food potential, the management of production systems, the sustainability of family farming production systems, the reduction of postharvest losses, organizational and commercial management, market intelligence, rural youth enterprises, the implementation of differentiation seals, as well as the improvement of support services and management of extension services in matters related to sustainable production, funding, marketing, as well as agricultural health and food safety in family farming.

It is also important to recognize that before the creation of the Bioeconomy and Production Development Program, IICA already possessed recognized expertise in conceptual and methodological approaches to strengthen policy and institutional frameworks and to foster the development of the biotechnology, bioinput and bioenergy markets, for example, by:

- Strengthening the public institutional framework, supporting the formulation and implementation of regulations, in addition to bolstering the capacity of countries to participate in international forums, and of national capacities (the public, private and academic sectors, and civil society) in the field of biotechnology;
- Strengthening biosafety regulations and policies in line with well-established international standards, such as the Convention on Biological Diversity (CBD), the Cartagena Protocol on Biosafety (CPB), and subsequently within the framework of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (NP-ABS) and the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress to the Cartagena Protocol on Biosafety (NKLP);
- Evaluating and strengthening the political-institutional framework to create or foster markets for bioinputs in the countries; and
- Strengthening institutional capabilities and providing support for the development and implementation of projects, in order to generate and make use of renewable bioenergy.

The Institute is aware that it must expand its operational capabilities in order to better leverage the potential of the bioeconomy for the production development

of agriculture and rural areas. Consequently, the new cooperation model is structured around the creation of networks of specialists, the development of strategic partnerships with similar institutions and collaborative work with the private sector and civil society organizations.

One of our objectives is to become a technical cooperation platform that is based on knowledge management and particularly on the sharing of experiences and lessons learned between regions and countries (horizontal cooperation and South-South cooperation), which would allow us to take advantage of all that we have achieved as a region.

To this end, the Bioeconomy and Production Development Program will capitalize on IICA's technical-political relationships with a large number of sub-regional cooperation institutions and mechanisms, including some in which IICA serves as Secretariat, such as the Southern Agricultural Council (CAS), the Regional Fund for Agricultural Technology (FONTAGRO), the Central American Integration System (SICA), the Central American Agricultural Council (CAC), the Caribbean Agricultural Research and Development Institute (CARDI) and Cooperative Agricultural Research and Technology Transfer Programs (PROCI), among many others.

The potential for collaboration between the Program and the Tropical Agricultural Research and Higher Education Center (CATIE) is particularly promising, given the latter's technical and scientific capabilities, which afford natural possibilities for cooperation in matters related to research, awareness- and capacity-building, as well as the formulation and implementation of strategies to capitalize on the bioeconomy in value chains with potential.

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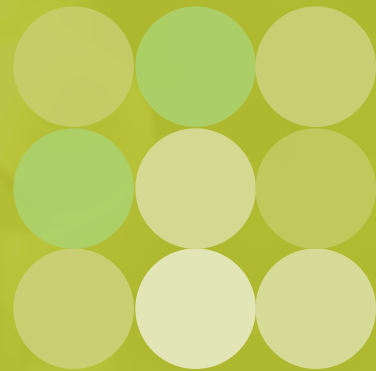
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