

# BIOECONOMY

---

## AS A SOURCE OF NEW INDUSTRIES BASED ON THE NATURAL CAPITAL OF COLOMBIA PHASE II

Situation analysis  
and policy recommendations in bioeconomy

EXECUTIVE SUMMARY

Medellín, Colombia  
June, 28th 2018

# ESTUDIO DE BIOECONOMÍA

LEADING ENTITIES



---

## SUPPORT ENTITIES

---



---

## SPONSORING ENTITIES

---



## EXECUTIVE SUMMARY

### Presentation

Within the framework of the Green Growth Mission (*Misión de Crecimiento Verde*), an initiative led by the National Planning Department (*Departamento Nacional de Planeación*, DNP) which seeks to define the public policies and guidelines to guide the country's economic development towards green growth by 2030, in 2017 eight studies were proposed to be carried out, one of which was “**Bio-economy as a source of new industries based on the natural capital of Colombia**” that was coordinated by BIOINTROPIC in partnership with EAFIT University, the Spanish company Silo and the support of LaSallista University Corporation and University of Medellín.

The bio-economy study was developed in two phases: the first, focused on the prioritization of strategic sectors of the bio-economy with potential for growth and impact on national production; the second, focused on the analysis of critical factors and the review of strategies and recommendations of short, medium and long-term bio-economy policies.

This report presents the results of the second phase of the study, which conducted an analysis of the situation through the identification and prioritization of critical factors based on the understanding of the 6 sectors prioritized in 2017 (phase one) and the review of strategies and bio-economy policy recommendations to contribute to the green growth agenda by 2030. The analysis also included a review of the long-term economic impact.

According to the OECD, bio-economy is “Transforming the knowledge of life sciences into new, sustainable, eco-efficient and competitive products. The application of biotechnology to primary production, health and industry could lead to an emerging bio-economy contributing to economic production”<sup>1</sup>. In phase one of this study, it was established that the economic growth strategy for Colombia, based on the bio-economy, should meet several conditions: starting from an efficient and sustainable management of biodiversity and residual biomass; focus on generating new products, processes and value-added services, based on knowledge and innovation; leverage growth, development and progress in the regions of Colombia<sup>2</sup>, starting with prioritized sectors including Agriculture and livestock, Food and beverages, Chemical, Pharmaceutical, Cosmetic and Health Industries.

The main findings grouped in 4 chapters of the second phase of this study are summarized below.

### Chapter 1. Analysis of the situation and sectors

This chapter includes an analysis of the country's situation with regard to the bio-economy under a seven-dimensional analysis (technological, regulatory, market, financing and investment, human talent, infrastructure and environment) and an understanding of the challenges and opportunities of the six sectors prioritized to boost the bio-economy. This information is the input used to identify critical factors.

It is highlighted that Colombia is a country with a high potential in the development of a bio-economy policy, thanks to its specific advantages with respect to existing biodiversity, the hectares available for agriculture, the generation of residual biomass and the experience of export sectors. Therefore, initiatives such as Colombia BIO, the National Biotechnology Program, CONPES in the areas of biotechnology, conservation and climate change and plans such as the National Green Business Plan have been launched. However, there is a lack of coordination in efforts and an absence of a systemic

---

<sup>1</sup> OECD, The Bio-economy to 2030: Designing a Policy Agenda (2009).

<sup>2</sup> Definition developed in phase 1 of the study “Study of Bio-economy as a source of new industries. DNP-BM. Performed by Biointropic-Silo-Eafit. 2018

and strategic view of the bio-economy approach that allows integrating actions of various productive sectors based on sustainability, which has hindered positioning the issue as a national priority.

The main findings and gaps identified in the analysis are summarized below by dimensions:

### 1.1 Analysis by dimension

Within the analysis of dimensions we can highlight:

**Table 1.** Analysis summary by dimension

Dimension	Findings	Gaps
Technological	<ul style="list-style-type: none"> <li>-More than 1,500 research groups related to Bio-economy, where more than 600 are related to areas of biodiversity and biotechnology.</li> <li>-The first scientific community of Biotechnology is in Bogotá, the second in Medellín and the third in Cali.</li> <li>- Programs such as Colombia BIO have promoted the development of 15 bio-expeditions identifying 131 endemic species and more than one and a half million new records for the Biodiversity Information System-SIB.</li> </ul>	<ul style="list-style-type: none"> <li>-Difficulty in converting the R&amp;D results into innovation products, processes or services for the market. "Valley of death".</li> </ul>
Regulatory	<ul style="list-style-type: none"> <li>- There is progress with the creation in 2012 of the Genetic Resources Group of Minambiente with the approval of 149 contracts, mostly for research purposes.</li> <li>- Invima and ICA have made progress in health surveillance and quality control of medicines, food, biological products, biotechnology and agricultural inputs.</li> </ul>	<ul style="list-style-type: none"> <li>-Only 8 contracts for access to genetic resources for commercial purposes. Lack of clarity in management and application.</li> <li>- Both the regulations and the capacities created serve traditional businesses and not the innovative and future activities of the bio-economy.</li> <li>It is important to ratify the postulates in the Nagoya protocol.</li> </ul>
Market	<ul style="list-style-type: none"> <li>-The international consumption of bio-products, bio-solutions and bio-processes is increasing.</li> <li>- Biotechnology is seeing global sales at the end of 2017 of USD 441.5 billion, with annual growth of more than 10%.</li> <li>- Tractor agricultural sectors such as Palm and Sugar Cane with experience in bio-fuels could change to new models of the circular economy and bio-refineries.</li> <li>- Miambiente has supported more than 900 green businesses through regional autonomous Corporations.</li> <li>- Innpulsa has supported more than 50 companies with bio-based products.</li> <li>-Colciencias has supported the development of 85 bio-products.</li> </ul>	<ul style="list-style-type: none"> <li>-Emergent demand in the national market for bio-based innovations.</li> <li>-Absence of campaigns and specialized information to raise awareness about the consumption of bio-based products.</li> <li>-International trade of bio-based products from Colombia is emergent and sectoral exports are not measured with adequate level of detail.</li> </ul>

<p style="text-align: center;"><b>Financing &amp; investment</b></p>	<p>-The country has experience in development, cooperation, financing and more recently in investment instruments in various sectors.</p> <p>-In relation to calls for the promotion of R&amp;D related to bio-based products, some of the projects by Colciencias, Innpulsa, Sena, SGR and Colombia Científica can be highlighted. Nevertheless, these calls are not permanent.</p> <p>- Of 31 investment funds identified only 4 of have made investments in companies related to biotechnology.</p> <p>-In credit, entities such as Bancoldex and Finagro have been developing agreements with territorial entities for special lines. However, there is not yet a line established in biotechnology or bio-economy.</p>	<p>- There is a deficit of specialized financing and investment instruments for each of the stages of the life cycle of biotechnology.</p> <p>- There is a lack of a clear country portfolio of sophisticated businesses in the bio-economy and biotechnology to attract investment, as well as for the design of customized instruments.</p>
<p style="text-align: center;"><b>Human talent</b></p>	<p>-Undergraduate and graduate study programs in biotechnology were found: 3 undergraduate and 23 postgraduate programs exist in the country, with 19 currently active programs.</p> <p>-At the level of Bio-economy, some universities begin to offer continuing education programs (such as diploma studies) or incorporate courses on bio-economy into their curricula.</p> <p>-The master's and doctorate students are majoring on agricultural disciplines mostly, followed by energy, chemicals, and food.</p> <p>-The sectors with more doctors and master's hired by companies are health, food and energy.</p>	<p>-There is a lack of knowledge, personnel and business management methodologies based on biotechnology, technology transfer, market management, and international regulatory issues in bio-economy.</p> <p>- There is a shortage of personnel for value-added businesses in the bio-economy.</p>
<p style="text-align: center;"><b>Infrastructure</b></p>	<p>-At the national level, there are robust infrastructures related to bio-economy such as: germplasm banks (CIAT, AGROSAVIA) , genomic sequencing platforms (UDEA,CORPOGEN) tissue banks (IDCBIS, TISSUE BANK), bio-informatics (BIOS), phytochemical analysis (CENIVAM, UNAL, UDEA), bio-fuels production facilities (BIOD, Manuelita, Bioenergy), technology parks (GUATIVARA, BIOPACIFICO,UNAL).</p> <p>-There are leading biotechnology actors in several of the Colombian departments, that can be the main proponents of the bio-economy.</p>	<p>- Lack of coordination and institutional framework that would ensure leadership and development of the bio-economy, generating national guidelines and coordinating with the Colombian departments.</p> <p>- Lack of institutional platforms for the measurement and monitoring of the bio-economy.</p> <p>- Deficit in infrastructures capable to bring the services required for bio-processes scale-up.</p>
<p style="text-align: center;"><b>Environment</b></p>	<p>- In Colombia, 62,829 species have been identified in 2017 (SIB, 2017), which makes it a mega-diverse country.</p> <p>- According to the Agricultural Census (DANE, 2014) there are 111.5 million hectares (ha) in the continental area of Colombia. 56.7% corresponding to forest (63.2 million ha), 38.6% dedicated to agricultural use (43.1 million ha) and 2.2% (2.5 million ha) destined to a different use.</p> <p>- Only 7.1 million of the 43.1 million hectares suitable for agriculture are dedicated to planting crops and the remaining equivalent to 34.4 million hectares, are used for animal feed.</p> <p>-The production of residual agricultural and livestock biomass is 279,333,596 tn/year (Ministry of Mines and Energy, 2010) from crops such as palm, cane, coffee, rice, banana, banana and cattle, pig and poultry.</p> <p>- There is actual experience of companies focused on the sustainable use of biodiversity and ecosystem services</p>	<p>-The availability of biodiversity and access to species can be affected by extractive pressures and deterioration of environmental conditions.</p> <p>- Value chains interested in working with communities to value biodiversity face the difficulties of access permits, dispersion of biological resources, logistical difficulties and security problems in the rural zones.</p>

**Source:** Own elaboration

## 1.2. Analysis of the sectors of the bio-economy

The potential sectors to boost the bio-economy in Colombia in the first stage of the study are Agriculture and Livestock, Food and Beverages, Chemicals, Pharmaceuticals, Cosmetics and Healthcare, which face various challenges related to sustainable agricultural and livestock production, production of healthier foods, development of bio-energies, generation of new bio-products (agricultural bio-inputs, bio-plastics, bio-drugs, bio-cosmetics, bio-ingredients), development of personalized medicine, generation of new bio-industries and bio-refineries, use of residual biomass, as well as the sustainable use of biodiversity.

Each of these sectors was analyzed taking into account the description of the current state, its innovation opportunities to dynamize bio-economy and the critical factors for its development.

The analysis included information of the annual production, contribution to GDP, imports and exports by sector with DANE 2016 data, as well as the description of the value chain, key stakeholders and previous support initiatives to the sector.

For innovation opportunities, technological trends and applications of biotechnology for the development of products and services with high added value were identified by sector.

Finally, challenges by sector were analyzed including 7 dimensions, which were used as an input to define the critical factors of bio-economy described in the next chapter.

### Chapter 2: Critical factors to boost the bio-economy

The detailed review of the dimensions described in the previous chapter, contextualized in the six prioritized sectors, led to the identification of a set of factors with the potential to promote the bio-economy in Colombia. The factors were analyzed systematically in order to validate and prioritize them, obtaining a selection of critical factors, to be taken into account in the subsequent formulation of strategic guidelines to boost the bio-economy.

The analysis started with 34 candidate factors, which corresponded to gaps or barriers to boost the bio-economy, grouped in 7 dimensions that were based on 33 interviews with national experts in bio-economy. 13 critical factors were selected and are summarized below:

**Table 2.** Summary of critical factors

Dimension	Factor	What is considered in the factor
Regulatory	1. Clear regulations with international approval for bio-economy businesses.	An adequate regulatory framework and agile instruments to demonstrate compliance and obtain permits to launch new bio-economy products in national and international markets.
	2. Regulations that enable access to resources of Colombian biodiversity, for commercial purposes	Have the normative elements (framework and instruments) that allow and expedite the fulfillment of conditions to access biological resources and enter new markets.
	3. Intellectual property (IP) strategies	Improve strategic management capabilities of intellectual property: Legal management accompanied by strategic, business and technological vision. Development of IP-based business strategies
Technological	4. Sources of advanced biotechnological knowledge and access to its channels	Intensify and update the knowledge base in the country and improve the transfer and application of advanced knowledge. This task requires strengthening international knowledge flows towards Colombia, from generators to users, and between Colombian regions.
	5. R&D timing for new solutions in the bio-economy	Improve the timescales between the start of a development in bio-economy, until its materialization as a solution, product or business, to take advantage of windows of opportunity in the market.
	6. Level of preparation of technologies facing the bio-economy market	Increase percentage of developments that have passed the laboratory phases and progress has been made in scaling and developing solutions for market launch.

Financing and investment	7. Financing mechanisms for long-term and high-risk projects in the bio-economy	Finance the entire development cycle for bio-economy solutions, with mechanisms that do not depend on periods of public administration, and take advantage of other sources.
	8. Financing and investment incentives for bio-economy projects and businesses	Develop positive incentives for investment in value-added bio-economy projects to compensate for market failures.
	9. Clear business portfolio in bio-economy for investment attraction	Portfolios of projects that serve as mechanisms to promote investment opportunities and attract capital, diversify investment risks in the bio-economy and channel incentives.
Infrastructure	10. Institutional capacity to lead the bio-economy in the country	Have a high-level national entity that leads the vision, strategy and operation of policies and development programs in the bio-economy, articulates and coordinates actors, and manages resources.
	11. Infrastructure to materialize strategic projects of the Country ("tractor" projects) in sectors of the bio-economy	Have R&D platforms to develop strategic projects in the bio-economy for the Country. E.g. Bio-incubators, accelerators, tissue banks, blood products plant, bio-refineries, big data bio platforms, bio-scale centers).
Market	12. Maturity of the national market for bio-economy products	Position bio-economy concepts in the national market, to stimulate demand for bio-based solutions, and improve the assimilation capabilities of bio-economy technologies.
Human talent	13. Staff training for value-added businesses in the bio-economy	Increase staff trained in business, markets and innovation management for the bio-economy.

**Source:** Own elaboration

These factors were discussed in a validation and prioritization workshop with experts, which allowed the identification of the ability to solve the factor and the speed to obtain results, as inputs to define strategies.

### **Chapter 3: Policy recommendations for promoting the bio-economy**

After prioritizing the mobilizing factors of the Colombian bio-economy, a subsequent process was conducted to propose a set of objectives and strategies that constitute an integral proposal of guidelines for the bio-economy. To explore the strategies and adjust them to the Colombian context, the first two chapters of the study were taken as inputs, along with the results in the first stage of the study <sup>3</sup>, to identify intervention needs. After that, international benchmarks of related policies were explored, international experts were consulted, and an alternative approach workshop was carried out, which led to a group of objectives that are disaggregated into more specific strategies.

Furthermore, priorities and rationale were identified motivating policy recommendations.

- **Priorities and Rationale**
  - Coordination: Strengthen policy coordination and commitment to stakeholders.
  - System capabilities: Investment in research, innovation and transfer.
  - Market: financing, demand development, synchronization mechanism and framework conditions.
  - Demonstrative and multiplier effect: emblematic initiatives.
- **Policy recommendations.**

Table 3 summarizes the objectives, strategies and actions proposed.

<sup>3</sup> Developed in 2017 and delivered to the DNP and BM in December of that year.

**Table 3.** Summary of bio-economy objectives and strategies.

<p><b>GENERAL OBJECTIVE:</b> Develop a bio-economy model in Colombia based on R&amp;D and the natural capital of the country that contributes to the diversification of the productive apparatus, to the increase of the added value of the national products and to achieve sustainable and inclusive growth.</p>	
<p><b>SPECIFIC OBJECTIVES</b></p>	<p><b>STRATEGIES</b></p>
<p><b>SPECIFIC OBJECTIVE 1:</b> Define an institutional scheme to lead and coordinate the guidelines and strategies, follow up progress in the policy objectives and mobilize commitment of the different actors of the bio-economy.</p>	<p>1.1 Consolidation of an institutional framework in the national and local government to lead the bio-economy. <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Bio-economy committee</li> <li>• Stable resource fund</li> <li>• Regional manager network</li> </ul> <p>1.2 Establishment of a comprehensive system of monitoring, evaluation and communication of progress in bio-economy policy <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Centralization of information and inclusion of Bio-activities</li> <li>• Establishing indicators</li> <li>• Communication plan</li> </ul> <p>1.3 Implementation of a coordination system with stakeholders in the productive sector and citizens through orientation on Country goals <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Support for the creation of coordination platforms</li> <li>• Development of local plans within the framework of smart specialization</li> <li>• Platform for citizen interaction</li> </ul>
<p><b>SPECIFIC OBJECTIVE 2:</b> Design and implement programs and mechanisms to strengthen the capabilities of R&amp;D entities in the bio-economy and facilitate collaboration and the transfer of knowledge and technologies among them.</p>	<p>2.1 Increase the financial viability of new companies with a focus on the bio-economy and encourage the growth of existing ones <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Tax benefits for start-ups</li> <li>• Fund of funds for specialized risk capital</li> <li>• Promotion of Bio-economy SMEs</li> </ul> <p>2.2 Positioning Colombia as a key player in the international R&amp;D system in the bio-economy <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Support for the participation of entities in international projects</li> <li>• World-class genetic repository</li> </ul> <p>2.3 Promote technology transfer. <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Dissemination through leasing and soft financing for technological assets</li> <li>• Fund for proof of concept</li> <li>• Diagnosis and consolidation of acceleration capabilities, validation and scaling tests</li> <li>• Training of technological valorization managers</li> </ul>

<p><b>SPECIFIC OBJECTIVE 3:</b> Developing the market for bio-based products and improving competitiveness in sectors related to the bio-economy.</p>	<p>3.1 Consolidation of public demand for products with high bio-content and sustainable goods and services <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Public procurement program of innovative green technologies</li> <li>• Program of bio-economy challenges at the regional level</li> </ul> <p>3.2 Strengthening private demand for products with high bio-content and sustainable goods and services <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Development of a BIO country brand</li> <li>• Open innovation program with large companies</li> <li>• National portfolio of BIO products</li> <li>• Bio-economy fair</li> </ul> <p>3.3 Development of regulations and international standards to favor innovations in bio-economy. <u>Actions:</u></p> <ul style="list-style-type: none"> <li>• Technical councils specialized in legislation for innovation in the bio-economy</li> <li>• Quality monitoring program in regulatory procedures</li> <li>• Creation of a sandbox to promote R&amp;D in the bio-economy</li> <li>• Dissemination of access procedures to the biological resources and access to the market</li> </ul>
<p><b>SPECIFIC OBJECTIVE 4:</b> Start-up of emblematics projects in priority sectors that demonstrate transformative potential, a multiplying effect and persistence in the long term.</p>	<p>Creation and management of a permanent portfolio of local and national bio-economy emblematics projects.</p> <ul style="list-style-type: none"> <li>4.1 Large infrastructure projects (Bio-incubators, validation and scaling center, bio-refinery, others)</li> <li>4.2 Projects to promote demand (Public procurement of solutions for tropical diseases, nutrition, big data for agriculture, others)</li> <li>4.3 Projects of transformation of the productive model (circular economy with residual biomass, others)</li> <li>4.4 R&amp;D projects for challenges of the bio-economy (Human Genome Colombia, bio-prospecting associated with bio-expeditions, personalized medicine, climate change, others)</li> </ul>

**Source:** Own elaboration

**Table 4.** Summary of indicator and goals

SPECIFIC OBJECTIVES	STRATEGIES	INDICATOR	BASE LINE	2022	2026	2030
SPECIFIC OBJECTIVE 1	E 1.1	Public resources for the support of bio-economy (millions of pesos)	N/A	300.000	600.000	1'200.000
	E 1.2	Percentage of monitoring indicators from the policy collected within the bio-economy chapter of the OCYT	N/A	35%	100%	100%
	E 1.3	Implemented coordination platforms	N/A	6	12	18
Plans and agreements signed, endorsed and accompanied in regions		N/A	16	24	32	
SPECIFIC OBJECTIVE 2	E 2.1	Number of bio-innovating companies	343	394	473	639
	E 2.2	Colombian scientific publications in Bio-economy in the first quartile	N/A	base*1,05	(base*1,05)*1,1	((base*1,05)*1,1)*15
	E 2.3	Patents requested by Colombian residents in national office and PCT in Bio-economy	N/A	base*1,3	(base*1,3)*1,45	((base*1,3)*1,45)1,6
		Utility Models in Bio-economy	N/A	base*1,3	(base*1,3)*1,45	((base*1,3)*1,45)1,6
		Number of spin-offs and start-ups in bio-economy	N/A	base*1,15	(base*1,3)*1,2	((base*1,15)*1,2)1,35
Number of licenses or knowledge technologies sales within the innovation centers and OTRIs		N/A	base*1,15	(base*1,3)*1,2	((base*1,15)*1,2)1,35	
SPECIFIC OBJECTIVE 3	E 3.1	Percentage of public procurement incorporating green criteria	N/A	5%	10%	15%
	E 3.2	Total value of the production of bio-companies goods and services	N/A	7%	15%	19%
	E 3.3	New laws or regulations that contributes to the development of bio-economy	N/A	6	9	12
SPECIFIC OBJECTIVE 4	E 4.1	Total resources invested (millions of pesos)	N/A	30.000	90.000	120.000
		Number of implemented infrastructures within the policy framework	0	2	3	4
	E 4.2	Total value of public procurement on innovative bio-economy technologies	N/A	15.000	30.000	45.000
	E 4.3	Number of projects	N/A	6	12	18
	E 4.4	Number of projects	N/A	6	12	18

**Source:** Own elaboration

## Chapter 4: Economic growth impact analysis

After proposing strategic guidelines for the growth of the bio-economy, an impact analysis was carried out, which evaluates the strictly economic consequences of the proposed policies. This analysis seeks to quantify the changes in the allocation of resources induced by policies and their effects on the fundamental macroeconomic variables, including investment, GDP, employment and exports.

The resources that should be allocated for the implementation of the policies that drive the bio-economy in Colombia should rise progressively to 300 billion pesos in 2022, 600 billion in 2026 and 1,200 billion in 2030, generating growth in the chosen indicators that oscillate between 86% and 166%, starting from the baseline.

For the evaluation, a computable, dynamic, recursive general equilibrium model was used to simulate the evolution of the economy for 15 years. The model incorporates 28 sectors: the 6 sectors prioritized in the study, 21 that detail the productive structure of the Country, and one more that reflects informal activities. Three productive factors are considered (skilled, non-skilled labor and capital) and six institutions (households, companies, central and local government, and social security, and the rest of the world). The model is calibrated with information from the national accounts for 2015 and replicates the functioning of markets by modeling decisions of companies that minimize their costs and households that maximize their utility, incorporating the effect of consumption of present and future goods, and decisions related to leisure and job offers.

The baseline scenario in which the evaluation is made is a scenario of inertial growth, in which the productive structure of the country is not substantially modified and in which the economy adjusts to maintain a controlled fiscal deficit and a deficit in the current account of a declining Balance of Payments, reaching the level of 1% of GDP at the end of the projection horizon. The scenario is characterized by low growth in productivity, associated with the scarcity of entrepreneurship that characterizes economies with low technological externalities (associated with learning that does not occur within companies), information externalities (which hinder the discovery of opportunities) and coordination externalities (related to incomplete markets and infrastructure deficiencies).

The simulation that is compared with this baseline scenario assumes that the policies implemented to promote the bio-economy address the aforementioned market failures, encouraging the development of innovation and productive entrepreneurship, with the bio-economy contribution to GDP rising from 0.9% in the initial year of the projection to 2.1% in 2030.

This is achieved through a reallocation of resources in the economy, which occurs through the redirection of investments from conventional sectors to sectors associated with the bio-economy. This reallocation allows us to participate in global markets for biotechnological products, whose growth is greater than the growth experienced by conventional commodity markets and products of low technological complexity, which dominate our export offer.

This impacts the productivity of the country: on the one hand, there is an improvement in the internal efficiency of the firms, since in the innovative sectors, greater added value is generated with the same productive resources; but also, there is to some extent a recomposition of the productive structure that is at the base of every episode of economic growth studied in emerging countries.

The simulation results are summarized in the following table, which shows the increase in exports, GDP, employment, expenses to apply the policy and the compensations that are achieved by higher tax revenue.

**Table 5.** Impact of the proposed policies.

Item	2030	% Var Baseline 2030	TOTAL PROJECTION PERIOD
ADDITIONAL EXPORTS (US\$M 2015)	1,789	2.8%	7,429
ADDITIONAL GDP (\$B 2015)	2,129	0.2%	9,808
BIO GDP (\$B 2015)	13,896	104.5%	
BIO AGRICULTURE	9,103	106.8%	
BIO FOOD	875	101.9%	
BIOCHEMICALS	1,601	100.3%	
BIO PHARMACEUTICALS	257	99.7%	
BIO COSMETICS	261	101.3%	
BIO HEALTH	1,799	100.4%	
EMPLOYMENT (ADDITIONAL PERSONS)	60,373	0.31%	
BIO INVESTMENT (\$B 2015)	3,606		23,232
BIO PROGRAMS COST (AMOUNT \$B 2015)	1,200		7,050
FISCAL COMPENSATION (ONLY GNC)	388		1,560

**Source:** Own elaboration

These are favorable results: a modest investment of public resources (7.1 trillion pesos in fifteen years) achieves an important effect on exports, employment and generation of added value. This exercise illustrates the role of a good development policy, which stimulates innovation and entrepreneurship, and produces the effects of “creative destruction” that is the basis of every development process.