

Policy dialogue on a bioeconomy for sustainable development in Colombia

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1. Introduction

A bioeconomy is an economy based on renewable biological resources, which is a key element of long-term sustainability. However, the use of renewable resources by itself does not necessarily ensure sustainability (Pfau et al. 2014). Doubts remain about whether sustainability aspects have been fully addressed in some of the policy instruments aimed at supporting the transition to a bioeconomy (Gawel et al. 2019). A sustainable bioeconomy requires the resource base, products and processes of production and consumption to be sustainable, as well as circular processes of material flows (Gawel et al. 2019). Heimann (2019) suggests that in order to be considered sustainable, bioeconomy policy instruments must also support the Sustainable Development Goals (SDGs) through regulation, policy and investment decisions.

A bioeconomy vision is a shared understanding of the concept of the bioeconomy by a group of specific actors. Clarity about such a vision is important for planning public policy, since it determines the objective and thereby affects the actions and measures to be taken to achieve that objective. Bugge et al. (2016) identify three main understandings or visions of the bioeconomy, each of which has a different perspective on sustainability: the *bio-technology vision*, which prioritizes economic growth and employment creation over sustainability; the *bio-resources vision*, which aims to achieve environmental sustainability while generating economic growth; and the *bio-ecology vision*, in which economic growth and employment creation are both secondary to sustainability (Bugge et al. 2016). There are other visions, but Bugge’s concept underpinned the design of the workshop implemented in Colombia, and the interpretation of the results of the event (see Table 1).

Table 1. Key characteristics of bioeconomy visions

	Bio-technology vision	Bio-resources vision	Bio-ecology vision
Aims and objectives	Economic growth & job creation	Economic growth & sustainability	Sustainability, biodiversity, conservation of ecosystems, avoiding soil degradation
Value creation	Application of biotechnology, commercialization of research and technology	Conversion and upgrading of bio-resources (process- oriented)	Development of production systems and high-quality products integrated with territorial identity
Drivers & mediators of innovation	Research and Development, patents, research councils and funders (science push, linear model of innovation)	Interdisciplinarity, optimization of land use, includes degraded land in the production of biofuels, uses and availability of bio-resources, waste management (interactive and networked production mode)	Identification of favourable organic agro-ecological practices, ethics, risk, transdisciplinary sustainability, ecological interactions, reuse and recycling of waste, land use (circular and safe sustained production mode)
Spatial focus	Global clusters/central regions	Rural /peripheral regions	Rural /peripheral regions

(Source: Bugge et al. 2016 p.10)

In 2018, 41 states had strategies or policies in place on developing or expanding their bioeconomies (Dietz et al. 2018). Different sectors are included in these strategies, depending on the priorities of each country or region, their endowment of biomass, economic specialization, labour productivity and historical research and development investments (Bracco et al. 2018). The importance of a holistic or cross-sectoral bioeconomy strategy has been highlighted, in order to avoid policy fragmentation according to the different uses of biomass, and boom and bust policies (Johnson 2017; Bracco et al. 2018).

This report used a workshop for experts in Colombia to explore which vision of the bioeconomy currently prevails in that country, and its relationship with the environmental and social sustainability elements suggested by Gawel (2019) and Heimann (2019). Understanding these elements is key to ensuring that Colombia’s national strategy can provide a roadmap towards a sustainable and inclusive bioeconomy. Colombia is currently in the process of developing its

national bioeconomy strategy. As one of the most mega-biodiverse states in the world, Colombia has identified the development of a bioeconomy as a strategy for achieving green growth by leveraging its high level of biodiversity. The workshop, which was held in Bogotá in November 2019, was organized by SEI and designed in collaboration with members of the National Planning Department (DNP). This was the fourth global workshop carried out as part of the Policy dialogues on Bioeconomy for Sustainable Development: Value Creation, Pathways and Governance project, which was co-funded by Sida and Vinnova. The other three workshops were held in Estonia (see Canales et al. 2020), Thailand (see Gladkykh et al. 2020) and Sweden (see Ollson et al. 2020).

The workshop participants were government officials from the DNP, the Ministry of Environment and Sustainable Development; the Ministry of Science, Technology and Innovation (formerly Colciencias); the Ministry of Commerce, Industry and Tourism; and the National Statistics Department, as well as representatives of universities, and experts and consultants involved in the development of the bioeconomy in Colombia. For more details on the workshop methodology, see Annex I.

Section 2 provides some background on the bioeconomy in Colombia. Section 3 presents the bioeconomy visions developed by each of four working groups during the workshop, identifying which elements of the bio-technology, bio-resources or bio-ecology visions were highlighted by each group (See Bugge et al. 2016). Section 4 summarizes the common points of the paths identified by each group. Section 5 presents some reflections on environmental and social elements and section 6 presents some conclusions.

The use of renewable resources by itself does not necessarily ensure sustainability. A sustainable bioeconomy requires the resource base, products and processes of production and consumption to be sustainable.



Bioeconomy workshop, Bogotá, November 2019 © NELLA CANALES / SEI

2. Background to the bioeconomy in Colombia

The policy background on the bioeconomy in Colombia comprises several policy instruments, mainly linked to biotechnology and the sustainable use of biodiversity. Colombia established its first National Biotechnology Programme in 1991, with the aims of developing the biotechnology industry, developing and producing biofuels and promoting the sustainable use of Colombia's biodiversity. Colombia ratified the Convention on Biological Diversity in 1994. The convention's Nagoya Protocol on ensuring access to genetic resources, and fair and equitable benefits from biodiversity has not yet been ratified by the Colombian Congress. In 1996, the National Policy on Biodiversity made developing the economic potential of biodiversity one of its six thematic priorities, alongside the conservation of biodiversity and ecosystem services. Biotechnology was considered one of the seven long-term strategic sectors for science, innovation and technology (Consejo Nacional de Política Económica y Social 2009), and in 2011 a specific policy was approved to promote the development of biotechnology and its applications to the sustainable use of biodiversity (Consejo Nacional de Política Económica y Social 2011; López Hernández and Schanz 2019).

In addition, between 2011 and 2017, Colombia was part of a regional project with the European Commission: Towards a Latin America and Caribbean Knowledge Based Bio-economy in Partnership with Europe (ALCUE KBBE). The project explored the strengths and weaknesses of Colombia's bioeconomy in the bioenergy, biotechnology and biodiversity sectors, based on case studies of selected companies (Aramendis and Adriana 2019). It identified that Colombia's bioeconomy was mainly export-orientated; and that there was a need for environmental and social sustainability schemes to be implemented in relation to the bioeconomy (Aramendis and Adriana 2019).

Explicit references to the term bioeconomy were made in national policy in 2018. The bioeconomy is central to the development of new economic opportunities in the green growth policy (Consejo Nacional de Política Económica y Social 2018). This policy set three bioeconomy objectives for 2030: (a) to increase the number of bio-innovative companies by 86%; (b) to increase the number of spin-offs and start-ups by 180%; and (c) to increase by 19% the production of goods and services by bio-companies. In addition, cosmetics and cleaning products, chemicals, pharmaceuticals, health care, agriculture and livestock, and food and beverages were identified as priority sectors for development as part of the bioeconomy (Biointropic 2018). A specific national strategy on the bioeconomy is currently in development, and is expected to be launched in December 2020 (Sistema Nacional de Competitividad e Innovación 2019).

In Colombia, there are various policy and institutional linkages between the 2030 Agenda for Sustainable Development and the forthcoming bioeconomy strategy. All policy instruments in Colombia are linked to the national development plan, which is also aligned to Colombia's commitments under the 2030 Agenda. The DNP is the lead public institution on the development of the bioeconomy strategy. It also chairs the Sustainability Technical Committee on bioeconomy. In addition, the DNP is leading the implementation of the 2030 Agenda through the SDGs commission. These linkages are relevant to sustainability, as the fulfilment of each objective within the 2030 Agenda framework is equally important. Thus, the aim should be to achieve all dimensions of sustainability – environmental, social and economic – in the development of the bioeconomy strategy.

Finally, the bioeconomy was also one of the thematic focuses of the International Mission of Experts 2019, a working group appointed by the Presidency of the Republic to develop public policy recommendations on education, science, technology and innovation. The mission recommended that the bioeconomy should represent 10% of gross domestic product (GDP) and generate 100,000 new jobs by 2030, and that coherence with the 2030 Agenda framework should be maintained (Misión Internacional de Sabios 2019).

3. Visions of the bioeconomy in Colombia

To structure reporting on the discussion in the workshop, this report uses the categories “identified goals and objectives”, “value creation”, “drivers and mediators of innovation” and “spatial focus” (see Bugge et al. 2016) to categorize the visions developed during the event.

3.1 A national vision

The bioeconomy in Colombia is defined as an “economy that efficiently and sustainably manages biodiversity and biomass to generate new value-added products, processes and services based on knowledge and innovation” (Consejo Nacional de Política y Economía Social 2018, p.26). This official definition as part of the green growth policy considers the issues of sustainability and the conservation of biodiversity to be an integral part of the aims and objectives of the bioeconomy in Colombia. The policy also highlights the need to measure the contribution of the bioeconomy to GDP and job creation (DNP 2019b).

In terms of value creation, the official definition also highlights the processing and conversion of bio-resources into new products. While circularity is not part of the official definition, the development of a circular economy is part of the green growth policy. During the workshop, participants proposed that circularity should become an important characteristic of the Colombian bioeconomy.

Research was considered a primary driver of innovation, in particular to identify and increase knowledge on the uses of Colombian biodiversity. Research on this topic has been led by the Ministry of Science (formerly Colciencias), in a national project “Colombia bio” (2015-2018), which ran bioprospecting expeditions in different regions. The results of these expeditions are considered the basis for the bioeconomy.

The bioeconomy is also seen as an economic opportunity to address rural development within the sub-national regions of the country (Henry et al. 2017; López Hernández and Schanz 2019). Strengthening the bioeconomy at the sub-national level is considered one of the main strategies of the green growth policy (National Council for Economic and Social Policy 2018). Contributing to the development of the different territories within Colombia was seen by workshop participants as a crucial element of a sustainable bioeconomy.

These characteristics resemble those of the bio-resources vision, in which both economic growth and environmental sustainability are among the objectives of the bioeconomy, and in which the rural and peripheral regions are the spatial focus. In a bio-resources vision, however, it is common to assume that the effects of the development of a bioeconomy on sustainability will be inherently positive. Within this vision, there is not enough focus on environmental protections, and the effects on climate change are rarely assessed (Bugge et al. 2016).

3.2 Sectoral visions for priority sectors

Beyond the national vision, the workshop also sought to identify the different visions of four of the priority sectors for the bioeconomy in Colombia. During the workshop, participants were divided into sectoral groups for agriculture, biochemistry, bio-pharmaceuticals and bioenergy. The first three sectors were identified as priorities during the formulation of the green growth policy. A decision was made to include bioenergy in this workshop because Colombia already produces biofuels and it is a sector previously prioritized by the ALCUE KBBE project. The groups were asked to discuss which products and services, suppliers, processors and markets should be expected in their bioeconomy vision for 2050.

The bioeconomy in Colombia is defined as an “economy that efficiently and sustainably manages biodiversity and biomass to generate new value-added products, processes and services based on knowledge and innovation” (Consejo Nacional de Política Económica y Social 2018, p.26).

3.2.1 The bioeconomy vision of the agriculture group

The aims and objectives identified by the members of the agriculture group were to ensure sustainable production in the sector, with added foresight in relation to climate change, land use change and deforestation. In addition, the need to develop sustainability standards (through regulation) was mentioned, in order to identify that a product is sustainable. Participants also highlighted the need to review the ethics of the various business models to ensure inclusivity.

On value creation, the competitiveness of the sector is expected to be enhanced by an emphasis on biodiversity. The transition to a bioeconomy is expected to result from the application of biotechnology to agriculture, the development of precision agriculture and promotion of the use of bio-inputs, including bio-controllers and bioremediation. In addition, the importance of the use of agricultural waste, particularly at the community level, was highlighted.

As drivers and mediators of innovation, the need for collaboration between different actors, including public and private sector actors, was mentioned. In addition, because the agricultural sector is expected to be a provider of primary resources for other sectors, such as bioenergy, biocosmetics and bio-pharmaceuticals, the need to develop intersectoral collaboration and coordination in public policies was emphasized. The need to develop transdisciplinary research that includes traditional knowledge to generate value was also highlighted.

The spatial focus was on three levels: the community, local and international. At the community level, participants highlighted the importance of integrating territorial identity into development of the bioeconomy. Participants argued that the bioeconomy business models should start at the community level and move towards the subnational and then the national level. The importance of developing processing plants near areas of agricultural production was highlighted. However, it was also noted that products should be commercialized in international markets.

The vision elements proposed by the agriculture group correspond with elements of all three visions, but most of the elements corresponded with the bio-resources and the bio-ecology visions, and only a few characteristics contained a bio-technology vision. Most of the aims and objectives are related to the bio-ecology vision, as sustainability concerns are central to agriculture, and the issue of ethics around business models within the bioeconomy was highlighted. On value creation, different elements corresponded with different visions. The prominent role of waste management in agriculture producing areas corresponds with the bioresources vision, while the push for precision agriculture is related to a bio-technology vision and the importance of biodiversity is linked to the bio-ecology vision. In terms of drivers of innovation, most of the elements for this group corresponded with the bio-resources vision, including the need for cross-sectoral collaboration and the need to interact with customers.

3.2.2 The bioeconomy vision of the biochemistry group

The objective of the biochemistry group's vision was to develop a portfolio of products based on the biodiversity of Colombian native species. The location of resources makes it essential to involve communities in the distribution of the benefits of the development of the bioeconomy. Production must be sustainable, and the development of a "bio" label was proposed through which environmental benefits can be demonstrated. For this sector, value is mainly generated by transforming bio-resources into new products, including those from the use of residual biomass. For this reason, the importance of promoting waste management, particularly in agricultural production areas, was highlighted.

On innovation, this sector identified collaboration between various institutions such as research institutes, universities and private sector companies as important, but also with farmers, rural and indigenous people's communities, and their associations. In addition, research would be needed to understand consumer preferences, since it will be necessary to build trust in bioeconomy products to ensure demand for such products.

This group proposed that local competencies should be recognized, according to each territory's resources and capacities. This approach is justified because the departments (sub-national political divisions) with the greatest biodiversity in Colombia are also the least developed, with little or no infrastructure for processing or even for transporting biomass. The group's proposal is to make a transition from the extractive model of raw materials to the production of high value-added products. Finally, Colombian biochemistry products are expected to compete in international markets, through a country brand that will demonstrate compliance with specific requirements on traceability and sustainability.

Most of the elements of the discussion in the biochemistry group belonged in the bio-resource vision, especially those related to value creation and spatial focus. That said, there were also some elements of environmental and social sustainability from the bioecology vision in the aims and objectives and as part of the drivers of innovation.

3.2.3 The bioeconomy vision of the bio-pharmaceuticals group

The bio-pharmaceuticals group suggested that the objectives of the sector should be to focus on the development of phytopharmaceuticals, which are medicines obtained exclusively from the active ingredients of plants, and to seek to replace imported bio-inputs with domestic ones. This group highlighted the need to ensure sustainable primary production, for example in agriculture and forestry. In addition, compliance with international sustainability standards on obtaining raw materials and identifying the chemical agent would be crucial for this sector.

Value creation was directly related to the implementation of biotechnologies to generate new products, based on biodiversity. To achieve this, it will be necessary to know the uses and applications of bio-resources for the phytopharmaceutical sector. Participants also considered the scale of Colombian biodiversity to be a potential challenge, since it will not be possible to develop value webs – an approach that captures the diversity of products derived from a single biomass source (see Virchow et al. 2016) – for all the resources available in the country, and it will therefore be necessary to prioritize specific species for development in the bioeconomy.

For this sector, innovation follows the linear model typical of a biotechnology vision, in which the starting point is scientific research – in this case, bioprospecting, which is the search for products derived from bioresources such as plants, micro-organisms and animals – and continues with product development, industrialized production and marketing. This group considered good interaction between universities and industry to be essential for innovation. In addition, intersectoral collaboration will be needed, particularly among the ministries of agriculture and health, for the development of high-value-added products.

The spatial focus has different levels. Biological raw materials should be produced sustainably at the local level, where the processing should also take place – without neglecting sustainability standards. Once the products are ready, it is expected that they will be commercialized in niche global markets.

This group's vision has an equal number of elements that correspond with either the biotechnology or the bioresources vision. The aims and objectives mainly accord with the bioresources vision, while – given the nature of this sector – the drivers of innovation are linked more to the biotechnology vision.

3.2.4 The bioeconomy vision of the bioenergy group

The objective defined by the bioenergy group was to have an energy matrix made up of a contribution of at least 30% from biomass. The main proposal for achieving this objective was to use residual biomass. For this group, it is therefore essential that – in order to maintain supply – the main residue-generating businesses are financially sustainable. In addition, biomass energy generation is expected to meet international standards. Traditionally, the bioenergy sector in Colombia has included the production of biofuels, such as sugarcane ethanol and palm oil

biodiesel. However, these sectors may have to be reinvented due to consumer preferences. The group mentioned two critical points for sustainability. First, that there is the need to understand the impact of bioenergy on ecosystems, including the effects on soil, water and air quality, and to ensure the environmental sustainability of large-scale activities in particular. Second, it will be critical to ensure the availability of raw materials and bio-inputs for bioenergy.

On value creation, waste management plays a leading role. Residual biomass is expected to be used to produce electricity, heat and fertilizers. Solid waste and wastewater could be used in urban areas; while agricultural and livestock residues (e.g. poultry and pig waste) could be used in rural areas. Exploring the use of native species was also mentioned.

The spatial focus for bioenergy is on two levels. The primary aim of bioenergy production is self-sufficiency at the national level, as international markets are only for selling surpluses. In addition, it is expected that micro-solutions will be developed at the local level with state support, through which bioenergy would contribute to the well-being of small producers.

This group's vision mostly incorporates elements of the bio-resources vision. All the characteristics related to drivers of innovation and spatial focus correspond with the bio-resources vision. The aims and objectives suggested elements of the bio-ecology vision, particularly regarding ensuring the sustainable impact of bioenergy on ecosystems and genetic material.

4. Key action points for bioeconomy pathways in Colombia

Workshop participants designed roadmaps for each of the sectors to achieve the visions suggested in each group. Participants were asked to propose actions to ensure sustainable production (primary and processing), to encourage the reuse of residual biomass and waste, to achieve inclusive business models and to encourage demand for products.

A summary of the key actions is shown in Table 2. During the roadmap discussions, the actions required to facilitate multilevel governance were identified, given the expected potential of the bioeconomy to boost rural development in Colombian territories. It was emphasized that while biodiversity could provide a competitive advantage, it will be necessary to prioritize a group of strategic resources for development of the various value webs. The need to develop a bioeconomy at the “territorial” level was a recurrent theme of the discussions. All the groups suggested that processing plants should be built near primary production or raw material collection areas. However, it was also highlighted that to achieve this, roads and industrial infrastructure would need to be developed, and issues around land property rights resolved. Financial incentives to reduce capital costs were also mentioned, including those that would encourage a transition to a bioeconomy, such as subsidies to enable bioenergy to compete with fossil fuels. Finally, all the groups agreed that it will be necessary to set sustainability standards. These elements are all related first and foremost to a bio-resources vision.

Table 2. Key issues and action points for the bioeconomy in Colombia

	Agriculture Group	Biochemistry Group	Bio-pharmaceuticals Group	Bioenergy Group
Governance	<ul style="list-style-type: none"> * Integrate the bioeconomy into strategic science and technology planning * Include the bioeconomy in strategic sectoral planning * Policy coordination at territorial level * Understand socio-ecological conflicts within territories 	<ul style="list-style-type: none"> * Formalization of circular economy businesses * Align bioeconomy priorities to regional competitiveness agendas 	<ul style="list-style-type: none"> * Prioritize phytopharmaceuticals * Prioritization of bio- resources for the bioeconomy * Ministry of health working together with ministry of agriculture to ensure integration of agriculture into high-value-added production 	<ul style="list-style-type: none"> * Prioritization of biomass supplier sectors * The state should treat biomass as a public good * State leadership on promoting bioenergy generation on large and small scale
Strengthen capacities & facilitate technology transfer	<ul style="list-style-type: none"> * Information on agricultural potential of bioeconomy * Establish good agricultural practices (e.g. precision agriculture, bio-inputs) * Locate processing in primary production areas * Wide use of residual biomass in primary production areas 	<ul style="list-style-type: none"> * Information on value chains for biochemistry uses and applications * Information system on residual biomass and by-products * Technical assistance for residual biomass management * Regional technology clusters 	<ul style="list-style-type: none"> * Information system on uses and applications of bio-resources in phytopharmaceuticals * Establish good manufacturing practices * Collection and processing plants in territories (infrastructure) 	<ul style="list-style-type: none"> * Technology transfer and technical assistance in circular economy * Establish good practices for the sector * Waste biomass collection and processing plants (infrastructure)
Leverage economic resources		<ul style="list-style-type: none"> * Reduction of capital costs for start-ups * Credits for R&D+I in processing * Benefits to companies including local actors 	<ul style="list-style-type: none"> * Subsidies to develop priority value webs (similar to those for flowers and banana growing) * Royalties for public sector investment in phytopharmaceutical research 	<ul style="list-style-type: none"> * Reduction of capital costs (e.g. machinery import taxes) * Bioenergy bonus as an incentive for bioenergy production * Fintech for the establishment of a fund capitalized by stakeholders
Environmental and social sustainability	<ul style="list-style-type: none"> * Road infrastructure to mobilize biomass * Resolve land ownership issues * Assess impact of bioeconomy on climate change and land use change. * Include indigenous knowledge and cultural identity 	<ul style="list-style-type: none"> * Road infrastructure to mobilize biomass * Environmental labelling for bio products * Infrastructure for technology, information and communication (for information flows) 	<ul style="list-style-type: none"> * Road infrastructure to mobilize biomass * International sustainability standards 	<ul style="list-style-type: none"> * Sustainability criteria, including impact on ecosystems and other resources * Road infrastructure to mobilize biomass * Ensure regeneration of biomass and genetic material

5. Discussion: the challenges facing a sustainable bioeconomy in Colombia

A bioeconomy is sustainable only if the three pillars of sustainability (environmental, social and economic) are balanced. This involves ensuring the sustainability of the resource base, and of products, processes and consumption; and circular processes for material flows (Gawel et al. 2019), as well as supporting the SDGs through regulation, policy and investment for sustainability (Heimann 2019). The discussions during the policy dialogue on visions and pathways were analysed to identify the challenges to ensuring a sustainable bioeconomy, based on the social and environmental sustainability shortcomings of the three visions mentioned in Bugge et al. (2016).

Challenge 1: Use and conservation of biodiversity

The resource base for Colombia's bioeconomy is biodiversity. While the different groups addressed the need to base competitiveness on biodiversity, only the bioenergy group mentioned the need to ensure the sustainability of genetic material. Relying on biodiversity is not synonymous with biodiversity conservation. If biodiversity is only seen as a competitive commercial advantage, there is a risk that biodiversity losses of less-commercial varieties will be generated in the medium or long term, or of overexploitation of the species of greatest commercial interest. In Bolivia, for example, quinoa biodiversity is being lost due to the preference of the international market for quinoa "real" over other endemic varieties (Canales et al. 2020).

Challenge 2: Sustainability standards and results

All the groups highlighted the need for sustainable primary production (agricultural, livestock and forestry). Emphasis was placed on the establishment of sustainability standards. While this is an important step in the transition to a bioeconomy, care must be taken that the establishment of standards does not divert interest away from monitoring sustainability results or outcomes. In addition, the impacts of the bioeconomy on land use change, deforestation and climate change are not just the responsibility of the primary production sectors. A sustainable bioeconomy strategy must also consider how the demand for greater resources from other sectors of the bioeconomy will affect the sustainability of ecosystems and their services. In addition, while elements of ensuring demand were discussed, there was no emphasis on promoting responsible and sustainable consumption.

Challenge 3: Employment

It is important that social elements are considered not only in primary production, but also in processing and in commerce, which is where more new jobs would be expected to be created. Some potential conflicts regarding employment were not considered in the discussions. For example, the expansion of precision agriculture would reduce the number of jobs in the agricultural sector. To achieve the SDGs, decent jobs would not only be needed from the primary sectors, but also from sectors that require specialist labour.

Challenge 4: Rural development

To ensure equal access to resources for the bioeconomy, one of Colombia's most important challenges will be to resolve land ownership issues, especially in rural areas. In Colombia, 60% of rural properties lack formal property rights (Semana Rural 2019). This can be partially explained by deficiencies in the land allocation process. For example, approximately 36% of land title records began with a false claim, that is, the right to the property was transferred by a person who was not the registered owner (Superintendencia de Notariado y Registro 2018). The lack of property titles makes it difficult to invest in agriculture, to get access to credit or to gain access to subsidies and rural development programmes. The National Development Plan, 2018–2022 sets goals to increase formal land titles from 1000 to 24000, and to update the cadastral survey from 20% to 60% coverage of land titles.

Road infrastructure is also of the utmost importance for the development process in the bioeconomy. The situation for road infrastructure in Colombia, especially in rural areas, must be significantly improved to guarantee flows of biomass and related products. Currently, 75% of tertiary roads are in poor condition (DNP 2019a). The National Development Plan sets goals to adapt tertiary roads to regional integration (DNP 2019a). However, road construction could generate large-scale deforestation, especially if roads are connecting areas with primary forests.

The proposal to prioritize regions that already have relatively developed capabilities must be complemented by a long-term strategy to avoid excluding less developed regions, which are paradoxically the most biodiverse in the country. Such a strategy should include the development of innovative capacities in these less developed regions, such as for processing and adding value to bioresources. Without this, there is a risk of perpetuating the role of less developed regions as merely raw materials producers supplying resources to more developed regions where value will be added, and most of the benefits will be generated. The bioeconomy should have a regional development focus to avoid increasing the gap between departments.

6. Conclusions

There is no single, universal bioeconomy vision in Colombia. Instead, different visions of the bioeconomy coexist, each posing different challenges for ensuring its environmental and social sustainability. Historically, biotechnology has been a major topic in the bioeconomy policy background of Colombia. However, analysis of the workshop and the green growth policy shows that the bio-resources vision is currently predominant, although different sectors combine elements of the different visions according to their sectoral development and context.

In spite of the variation among sectors with regard to vision, there is a need to define concrete actions to overcome common or cross-sectoral sustainability challenges and include these in the forthcoming national bioeconomy strategy. These challenges include devising actions to conserve biodiversity, monitoring the environmental outcomes that result from the implementation of a bioeconomy, and ensuring the achievement of job creation targets. These elements should be considered part of a holistic approach to the bioeconomy, to ensure that policies or measures promoted in the name of bioeconomy are consistent and avoid policy silos among prioritized sectors. In addition, the development of the bioeconomy will require resolution of long-term challenges linked to land ownership and infrastructure at the territorial level. The bioeconomy could therefore be a push factor for these processes. Including such actions might also help to ensure coherence with the commitments made on the 2030 Agenda.

Finally, a territorial approach is an important element of the current bioeconomy vision. This might also require decentralized but coordinated governance. The identification of different visions and pathways by local stakeholders could be a useful way to identify specific actions to be taken to ensure sustainability at a multi-scalar level.

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Bioeconomy workshop, Bogotá, November 2019 © NELLA CANALES / SEI

Annex I: Reflections on and discussion of the methodology used in the Colombia workshop

The dialogue in Colombia was the first full-day workshop of the bioeconomy policy dialogue series. Several aspects were different from the dialogues in Tallinn and Thailand, which were only half-day events. The innovations in the methodology of the workshop and the analysis are described below.

Co-design with local stakeholders. The design of the workshop was led by SEI Latin America with support from the DNP, the lead institution on development of the national bioeconomy strategy, and two experts on bioeconomy in Colombia – one from the private sector and one from academia. The co-design process involved defining the structure of the workshop, its sectoral division and participants, the guiding questions for the panel, the group work and the plenary. Allocation to each of the sectoral groups was self-determined at registration, when each participant indicated a preferred group according to their expertise.

Understanding the context of bioeconomy in Colombia from the local experts' perspective. Colombia's bioeconomy has been included in national policy since the 1990s. Five experts were invited to participate in a panel discussion on the context of the bioeconomy in Colombia. The experts comprised a Latin American bioeconomy expert, an academic member of the 2019 International Mission of Experts, a representative of the DNP, a representative of the private sector and an expert on the SDGs. The discussions ranged from how other states were approaching their national bioeconomy strategies to the national policy context for the bioeconomy in Colombia, the needs of the private sector to encourage their involvement and the relationships between the bioeconomy and the 2030 Agenda. The panel discussion was the first content-related session of the workshop, and followed the welcome session.

Exploring visions of the bioeconomy at the sectoral level. Because the different stakeholders' understanding of a bioeconomy varied, an exercise was included to explore participants' visions of what they expected from the bioeconomy by 2050. Specific questions guided this process, asking about expected products and services, the providers of biomass and raw materials, processing and markets.

Exploration of actions to achieve the visions at the sectoral level, using specific questions. While recommendations were sought in previous dialogues on what needs to happen to achieve a sustainable bioeconomy this was the first time that specific questions were used to guide the discussion (instead of a single general question) to understand more specifically how the vision was expected to be achieved. Questions were also asked on how to include environmental sustainability elements in primary production and processing, and how to devise inclusive business models.

Closing reflection on the national-level vision. A set of questions reflecting on the national vision was asked at the end of the workshop. This included questions on how to guarantee equitable access to bio-resources, how to minimize the potentially negative environmental impacts of the bioeconomy and defining the national bioeconomy identity.

Definitions on visions and sustainability were clarified. The analysis of visions followed the structure in Bugge et al. (2016) with regard to aims and objectives, value creation, drivers and mediators of innovation, and spatial focus. The three visions identified by Bugge et al. involved specific considerations on aspects of sustainability that were also used to assess the sustainability of the bioeconomy visions. In addition, elements from Gawel et al. (2019) on environmental sustainability, and from Heinmann (2019) on the linkages between bioeconomy and the SDGs were also used.

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