Bioeconomy, strategies and impact

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Abstract:

Bioeconomy has been in existence for fifteen years and in those years, it has spread to more than fifty countries and regions around the world. It emerged as a means of seeking an alternative to an economy based exclusively on the exploitation of oil and other fossil resources. Each specific bioeconomy is adapted by its nature to the climate, agricultural, industrial and socioeconomic development of a country or region and to its political environment. At present, there is a great consensus at a global level that the bioeconomy must be circular, sustainable, use renewable raw materials and accept the ecological limits of the planet. The experience of these years allows us to reflect on how to increase the impact of the bioeconomy by learning from those successful experiences. In this article the following themes are proposed: need for coherence between the bioeconomy and other policies; generate a broad social and political consensus; strategies and action plans must be inclusive and combine strategies with concrete actions. It also advances some considerations between the concepts of bioeconomy, sustainability and biodiplomacy.

Key Words: Bioeconomy, sustainability, biodiplomacy, natural resources, circular economy

Bioeconomía, estrategias e impacto

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Resumen:

La bioeconomía tiene quince años de existencia y en esos años se ha extendido por más de cincuenta países y regiones de todo el mundo. Surgió como medio de buscar una alternativa a la economía basada exclusivamente en la explotación del petróleo y de otros recursos fósiles. La bioeconomía se adapta por su naturaleza al clima, desarrollo agrícola, industrial y socioeconómico de un país o región y a su entorno político. En la actualidad, hay un gran consenso a nivel global sobre el hecho de que la bioeconomía ha de ser circular, sostenible, usar materias primas renovables y aceptar los límites ecológicos del planeta. La experiencia de estos años permite reflexionar sobre la forma de incrementar el impacto de la bioeconomía aprendiendo de aquellas experiencias exitosas. En el presente artículo se postulan los siguientes temas: necesidad de una coherencia entre la bioeconomía y las otras políticas; generar un amplio consenso social y político; las estrategias y los planes de acción deben de ser inclusivos y combinar

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estrategias con acciones concretas. Se avanza asimismo unas consideraciones entre los conceptos de bioeconomía, sostenibilidad y biodiplomacia.

Palabras clave: bioeconomy, sostenibilidad, biodiplomacia, recursos naturales, economía circular

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1. REASONS FOR A BIOECONOMY

The reasons prompting the two great regions on the planet, the European Union (EU) and the USA, in the first decade of the 21st century, to develop initiatives in favour of a Bioeconomy were different. Consequently, their objectives, strategies and initiatives also diverged. The EU furnished the concept of the Bioeconomy with a solid scientific and technical foundation in order to develop the scientific knowledge to make the planet "greener" and less dependent on oil. Thus, the concept of the Knowledge-Based Bioeconomy (KBBE), was advanced in 2005 by the European Commission and, two years later, by Germany, which at that time occupied the presidency of the EU. This was the first decisive step to defining a framework for action and ensuring that policies in other areas - like agriculture, industry and the environment, among others - would concur with the new concept of the Bioeconomy. A few years later, in 2012, the EU adopted the Bioeconomy Strategy (European Commission, 2012). It is important to note that none of these documents just fell out of the sky, or were the result of mere improvisation. 10 years had passed between the adoption of a European strategy on Biotechnology (European Commission, 2002) and the strategy on the Bioeconomy; and 30 years since the first European biotechnology programme, and the adoption of the Bioeconomy Strategy (Patermann & Aguilar, 2018) (Aguilar et al, 2013). It is important to highlight this aspect since initiatives of this magnitude not only require decision and clear political initiatives, but also a variety of management instruments, maturity in sectoral policies, and broad socio-economic and political consensus. Without these essential elements, it is very likely that an initiative, no

matter how laudable, will fail due to the difficulty of its implementation, or a lack of follow-up.

The USA, meanwhile, based its strategy on ensuring its energy supply as far as possible at a time when its political relationships with several oil-exporting countries were strained (National Bioeconomy Blueprint, 2012). Its main objectives were to stimulate economic development based on innovation and to bring these innovations to the market in a way that allowed the US to maintain its leadership in innovation-related areas.

In the years after 2012, more than 50 countries around the world developed initiatives or strategies in relation to the Bioeconomy. The constraints of this article do not allow us to carry out an analysis - even a superficial one - of each and every one of these initiatives and strategies. Interested readers may consult the references published by the Office of the German Bioeconomy Council, where the different initiatives that exist today are described (Bioeconomy Policies Part I, Part II & Part III). Many of these initiatives were inspired by the strategies of Germany, a pioneering country in Bioeconomy, the EU, and the United States. Perhaps as surprising as the number of national strategies, and many more regional ones, is their diversity. Contrary to what some have articulated in an excessively reductionist way, a single Bioeconomy does not exist, but rather a great diversity of bioeconomies, each adapted to specific climates, agricultures, socio-economic and scientific-technical development, etc. However, it is necessary to insist on the fundamental characteristic that all bioeconomies must feature: the development of a socioeconomic system based on the sustainable use of biological resources, while respecting the ecological limits of the planet.

While a knowledge base was the starting point for the EU Bioeconomy, this approach has been complemented over the years by a more holistic vision based on making the Bioeconomy compatible and synergistic with other Community policies, while at the same time seeking clear and

resounding support from society. To be successful the Bioeconomy needs to strike and maintain a delicate balance between the impetus of science and technology, mainly supported by the public sector, and of the market and society, stimulated, in turn by, the agricultural, industrial and financial sectors, all within a coherent policy framework. In each of these stages widespread social consultation, participation and support in preparation and decision-making is absolutely essential. In this regard, in 2018 the EU adapted its Bioeconomy Strategy of 2012, in which aspects such as sustainability and the Circular Economy, as well as the need to know the ecological limits of the Bioeconomy, became inseparable parts of the concept (European Commission, 2018).

In recent years a broad social movement has emerged around the world, mainly comprised of young people, demanding from those in power a more rational use of biological resources, and changes to an outdated productive system that functions at the expense of young people's futures. There are incipient initiatives in this direction, undertaken by both institutions and individuals, to ensure that the fight against global warming and population growth, for food security, and for the preservation of the environment, including that of the oceans, is approached from a global perspective. In this way the interests of humanity as a whole may prevail over legitimate, but more limited, national or regional priorities (Marvik & Philp, 2020) (Aguilar & Patermann, 2020). In this regard "biodiplomacy" has been proposed as a new instrument, in addition to the existing ones, for the global, efficient management of biological resources and to deal with the major challenges that the planet faces, such as climate change, food security, and the increase in the population, among others (Aguilar & Patermann, 2020).

At the Global Bioeconomy Summit 2020, (GBS2020) the IACGB (International Advisory Council on Global Bioeconomy) published its fourth report, featuring a very interesting, critical analysis of the evolution of policies

and initiatives in different countries around the world in relation to the Bioeconomy, as well as its evolution in recent years. Of particular interest in this context was the communiqué, or final statement, of the GBS2020, which provides guidance on the different sensibilities and global challenges facing the world in relation to the Bioeconomy (IACGB, 2020).

It is clear that the Bioeconomy is destined to play a key role on the political and social agendas of tomorrow in the short and medium term. However, degrees of involvement and political and social commitment will largely depend on the way in which the Bioeconomy, or bioeconomies, respond to the social demands to address and solve, or at least mitigate and adapt to, the global challenges that humanity has been facing. It is important to remember, once again, that the Bioeconomy is not a scientific discipline, nor is it a technology, or even an industrial sector. The concept of the Bioeconomy is generated by the amalgamation of all these disciplines, technologies and agricultural and industrial sectors, integrated into a socioeconomic context and with the political objective of managing the use of natural resources in a sustainable and economically viable way (Aguilar et al., 2019).

2. THE BIOECONOMY AND OTHER POLICIES

One of the most important aspects in the development of a Bioeconomy strategy is ensuring coherence with other policies and initiatives, both national and regional, as well as the support of the different socio-economic sectors. The need to engage society as a whole in each and every one of the stages, both of preparation and implementation, cannot be stressed enough. As the Bioeconomy is an activity that aspires to have a positive socioeconomic impact, its implementation must be harmonious, coherent and synergistic with other existing policies.

It is particularly important to guarantee maximum connection and interaction with what might be called "traditional" agricultural, industrial, and environmental policies. Quite a few of the benefits of the Bioeconomy, such as new jobs and technologies, and a positive impact on the environment, among others, will be generated where these policies interface with the Bioeconomy. It is critical, therefore, to nurture these interactions and promote dialogue, assistance and attention, with a view to allowing both traditional policies and the Bioeconomy to emerge strengthened from them. Some of the initiatives of the European Union in which there have been positive mutual interactions between the Bioeconomy and other policies are described very briefly below. Given the complexity of these multiple interactions, only those EU initiatives closely related to research and innovation will be mentioned:

- Food 2030. In this 2015 initiative the EU prioritizes food security in Food and Nutrition through the production of sustainable and healthy food that is accessible to the entire population (European Commission, 2015).
- Blue Growth. This initiative seeks to serve as an EU response to the United Nations Sustainable Development Agenda, in particular to its Objective 14: "Conserve and sustainably use the oceans, seas and marine resources" (European Commission, 2019).
- Bio-Based Products and Processing. This joint initiative of the European Union and European bioindustries aims to promote and develop new technologies favouring the sustainable transformation of renewable biological resources (EU Regulation No. 560/2014) (Mengal et al, 2018) (Ruíz Sierra et al, 2020).
- International Bioeconomy Forum. The aim of this initiative is to ensure that the Bioeconomy is assigned the importance it deserves at the international level, in concert with ongoing global initiatives, such as COP21, the SDGs (Sustainable Development Goals), the Circular Economy, and food security, while promoting research and innovation

internationally to help achieve the political objectives of the Bioeconomy (European Commission, 2020).

EU authorities recently adopted the European Green Deal initiative. This ambitious undertaking, of great political significance, aims for Europe to become the first climate-neutral continent by 2050. The Green Deal features a roadmap to provide the EU with a sustainable and prosperous economy. The attainment of this objective will require the transformation of climate and environmental challenges into opportunities in all areas so that a just and inclusive transition is achieved for all (The European Green Deal, 2019). The European Green Deal establishes an action plan to promote the efficient use of resources by moving towards a clean and circular economy, as well as restoring biodiversity and reducing environmental pollution. The Green Deal also describes the necessary investments and the financing tools available, and explains how to ensure a just and inclusive transition. To achieve this ambitious goal, it will be necessary to act in every sector of our economy, across each and every country and region in the EU. In particular, this will be done by investing in environmentally friendly technologies, supporting innovative industry, and developing and deploying cleaner, cheaper and healthier public and private transport systems for users, living beings and the environment; and by helping to decarbonize energy and ensure that buildings are more energy efficient. Finally, the EU aims to take the lead at the international level, collaborating with other regional and international partners to improve global environmental standards.

The EU will also provide financial support and technical assistance to help those individuals, businesses and regions most affected by the transition to the green economy. This is called the Just Transition Mechanism. It will help marshal at least €100 billion over the period from 2021 to 2027 in the most affected regions.

The European Green Deal features many elements that converge with the

European Bioeconomy Strategy, although these synergies have not been outlined in the former's initial documents. The subsequent execution of the Green Deal's actions and programmes, as well as the European Bioeconomy Strategy, should illustrate in a more visible way these actions' greater synergy and convergence.

Beyond the EU, representatives of the Organization for Economic Cooperation and Development (OECD) and Norway, have pointed to the vital need to integrate the concept of the Bioeconomy into a broader perspective related to a renewable carbon cycle strategy integrating biomass production into the industrial carbon cycle (11). This line of thought coincides with that previously advanced by Aguilar and Patermann (2020), who indicated the pressing need to address in a global way the great challenges that humanity faces at this time, as, if nothing is done, they will worsen, irreversibly. These authors argue that it is not possible to address the great challenges of the planet in a sectoral or piecemeal way, which, as mentioned above, are well known: climate change, food security, and the increase in the population, among others. Each of these challenges has innumerable consequences in different areas and sectors of our lives.

Furthermore, the challenges we face are inextricably linked. It is naïve to think that the only effect of climate change is global warming, and that by fighting global warming from a reductionist perspective, the problem will be solved. Climate change will have (in fact, it is already having) devastating effects on agriculture in certain countries, and the transmission of zoonoses, and other diseases, with this triggering migrations and the displacement of human populations of unthinkable dimensions and consequences, including in terms of security and armed conflicts. Therefore, a holistic approach is required, guided by the United Nations and supported by the regions and countries committed to these sustainable policies, serving as a stimulus and catalyst encouraging other countries to join this collective effort. For this

process to be successful, it is necessary to replace - at least as regards the management of the planet's biological resources - the classic diplomacy of countries, in which national interests prevail over collective ones, with biodiplomacy, in which the global interests of humanity come first. Our survival as a species, at least in the way we know it today, will depend on the way in which political leaders become aware of the dimension of the problems that humanity as a species faces, and broaden their horizons and fields of political vision. Interested readers can consult reference No. 12, featuring a more extensive discussion of the interactions between the Bioeconomy, biodiplomacy and the planet's global challenges related to the biosphere.

The Club of Rome recently published a study, complementing the previous one, indicating the catastrophic consequences entailed by the continuation of current economic models, which are unsustainable, as they prey on the environment and surpass the planet's ecological limitations (ULRICH VON WEIZSÄKER & WIJKMAN, 2018). This work also analyses some of the new economic theories that have been developed in recent decades calling for sustainable economic development and biological resource exploitation, thereby guaranteeing resources for future generations.

The concept of the Bioeconomy has evolved greatly since its advent 15 years ago. In 2009 the OECD defined the Bioeconomy in a rather restrictive way: "The Bioeconomy involves economic activities related to the invention, development, production and use of biological products and processes" (The Bioeconomy to 2030, 2009). In other words, the Bioeconomy was considered one like others, but one based on products of biological origin. The EU, in its 2012 European Bioeconomy Strategy, stated that, "The Bioeconomy deals with those parts of the economy that use renewable biological resources from land and sea, - such as crops, forests, fish, animals and microorganisms - to produce food, materials and energy." European Commission (2012). In this case, the concept of renewable resources was introduced. Later, the 2015

Global Bioeconomy Summit (GBS) integrated the concept of sustainability into the definition of Bioeconomy: "The Bioeconomy consists of the production and use of biological resources based on innovation and biological knowledge, processes and principles to provide goods and services in a sustainable way in every economic sector" (Bioeconomy Summit Global Communiqué, 2015). It was not until 2018, however, that the EU's review of the Bioeconomy Strategy included the concepts of sustainability, the Circular Economy, and, above all, the need to know and understand the ecological limits of the Bioeconomy, which then became integral parts of the concept (European Commission, 2018).

3. THE IMPACT OF THE BIOECONOMY: LESSONS FOR THE FUTURE

Until very recently, the Bioeconomy, or rather, the different strategies of bioeconomies, have been developed in a "top down" manner. Generally, they had come from political circles, and been based on technical and scientific sectors and scientific and technological knowledge of living beings. For more than a decade these approaches have served to build the scaffolding needed to take the requisite actions to implement the Bioeconomy. Given the high level of specialization of some contents of the Bioeconomy, these approaches may have been, despite some criticisms, the only ones possible under the circumstances in which they were adopted. It is necessary to recognize that a good number of these strategies were very successful, and continue to yield concrete actions and projects having a visible impact on society and the socioeconomic fabric. However, the strategies of a good number of countries and regions developed without this consensus often had a limited impact on their respective societies.

An exhaustive analysis of the reasons why a certain number of Bioeconomy strategies and initiatives have not had an impact on the social and economic

fabric would require a much more in-depth discussion than this article can provide. However, some of the factors that may have impeded the implementation of otherwise sound Bioeconomy strategies are briefly outlined below.

The need for a broad social and political consensus. The first has been some leaders and institutions thinking that the development of a strategy was an end in itself, rather than the beginning of a long process to culminate in the incorporation of sound Bioeconomy practices into society. Some of these strategies have been limited to political declarations of intent, lacking real work and follow-up plans. Also, the Bioeconomy has often been seen by many leaders as party initiatives. Thus, changes in the parties in power have led to the abandonment of the Bioeconomy initiatives undertaken by previous ones. Those strategies that have been successful in terms of their implementation and social acceptance have featured widespread dialogue with scientific, technical, and industrial actors in each and every one of the stages of strategy preparation, and in the execution of action plans. Moreover, efforts to establish a broad consensus with other political forces were made. This process undoubtedly retards the development of the strategy, but it allows for the gauging of sensibilities and specific aspects that are important to certain sectors. It also allows the majority of society and its representatives to take on joint responsibility for planning and managing strategies, and their action mechanisms.

Strategies and their action plans must be inclusive. A factor critical to broad social acceptance is paying particular attention to not excluding any social sectors from the positive, beneficial aspects of the Bioeconomy. A strategy that supports and benefits a certain sector at the expense of another, or whose possible benefits do not encompass all social actors, will probably be short-lived. A quintessential example of this is the initial development of GMOs (Genetically Modified Organisms) back in the 1980s, whose benefits were

approached almost exclusively with reference to seed producers and farmers, while the public was all but ignored. The result is well known, and should serve as a lesson that is learned once and for all: in areas in which scientific-technical aspects converge, having a broad social impact on very sensitive sectors, such as food, environment, health, etc., it is absolutely essential to reach a broad social consensus. This social consensus is based on several factors: reliable and accurate information, dialogue in which everything is on the table, and in which all actors and sectors with legitimate interests in the issue are welcome; and, finally, a process of co-decision and co-governance that favours joint responsibility in decision-making. Scientific evidence and technological reliability are absolutely essential elements, but it is critical for a successful implementation of a Bioeconomy strategy to generate a climate of trust between the different actors sharing a common objective.

Combining strategies with concrete actions**.** The Bioeconomy is not developed through the devising of ambitious strategies alone, nor through the execution of projects that are dissociated from one another, lacking a shared strategy. Unfortunately, there are many examples illustrating that strategies conceived and developed without sufficient dialogue and social consensus, and without a corresponding action plan, have little impact. Meanwhile, projects and actions without any strategic planning or follow-up on results and impact generally have only fleeting mobilisation effects, lasting only as long as the actions and projects last. It is necessary, therefore, to inextricably combine strategies with concrete actions that yield visible results. In this regard, it is critical to integrate high-level concepts such as:

- the preservation of our planet's natural capital, both biological and non-biological;
- connecting economy and ecology;
- maintaining the biosphere's conditions of sustainability and habitability.

Concrete and verifiable actions should include:

- very specific actions, with a concrete and measurable impact on the area in question;
- programmes and action plans leading to the creation of jobs, programmes and plans favouring the development of sustainable economic growth. All these specific actions should be evaluated by independent committees. This area has recently been covered in depth by Wohlgemuth et al (2021).

4. BIOECONOMY, SUSTAINABILITY AND BIODIPLOMACY

Perhaps the most important shift in the development of the Bioeconomy in recent years has been the incorporation of the concept of sustainability into local ecosystems and the framing of the Bioeconomy taking into account the ecological limits of the planet at a more global level. In the face of the predatory attitude adopted in the last two centuries with respect to the extraction and consumption of fossil fuels, the Bioeconomy embraces these two key concepts as keystones of its action. It is not possible, though some have tried, to simply transfer, in a mechanical way, the economic model of an economy based on fossil resources over to the Bioeconomy. In a recent monograph on which numerous Spanish-speaking authors collaborated, the concepts of the Bioeconomy are discussed against the backdrop of sustainability, the development of a circular Bioeconomy, and its relationship to society as a whole (Aguilar et al, 2018).

The Bioeconomy is an activity that, by its very nature, encompasses numerous industrial, agricultural, scientific-technical and, of course, social sectors, of which it is not possible to have a reductionist vision. In this regard the Bioeconomy aims to contribute, with all its potential, but also aware of its limitations, to the discussions that are currently taking place on a global scale about the great challenges facing the planet. The development of

biodiplomacy has recently been proposed, which, adopting a sustainable circular Bioeconomy as a conceptual basis, articulates and manages the planet's biological resources. This management should be radically different from what has been done with fossil resources so that biological resources can be guaranteed for future generations, while ensuring the sustainability of our planet (Aguilar & Patermann, 2020). Thus, the authors also propose that the planet's great challenges, such as food security, population increase, climate change, and environmental preservation, among others, be tackled in an integrated way and managed by the United Nations on the basis of biodiplomacy, accepted by a significant number of countries.

In short, the Bioeconomy is destined to play a very important role in our societies. For this, a change in our productive and resource consumption paradigm is necessary to ensure the sustainability of biological resources, today and tomorrow. This attitude concerns all of society: scientists, technologists, farmers, businessmen, financial institutions, etc. The fate of future generations depends on our responsible and determined attitude.

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