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Unlocking Romania's Forest-Based Bioeconomy Potential: Knowledge-Action-Gaps and the Way Forward

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Abstract: As national governments continue developing bioeconomy strategies, the forest-based sector becomes increasingly important. Romania's forest sector can be at the heart of a sustainable circular-bioeconomy transition. However, despite recently launching its national forest strategy, the country has yet to produce a comprehensive bioeconomy strategy where the forest sector is properly acknowledged and integrated. Here, we discuss the potential opportunities and challenges for developing a national circular–bioeconomy strategy that builds around the forest-based sector. Methodologically, we build on qualitative insights from two foresight workshops conducted with 16 international experts. Conceptually, we draw on recent forest-based circular-bioeconomy literature, which we synthesize and use to complement the insights provided by workshop participants. Three main key findings emerged from this analysis: (i) Several knowledge gaps related to biomass availability, carbon storage, biodiversity status, ecosystem services, or governance arrangements persist. (ii) A circular forest bioeconomy must focus on regional and rural development, including both traditional wood use, as well as new wood-based products. Finally, (iii) the transition to a forest-based bioeconomy requires substantial investments in areas such as forest infrastructure, education, and labor force. Forward-looking policies can address these challenges by fostering new ways of thinking, collaborating and researching the bioeconomy. We anticipate our article to be a starting point for more informed discussions around the role of forests and the forest-based sector in Romania's future bioeconomy strategy. Furthermore, as work around the implementation of the national forest strategy has recently commenced, the ideas discussed here could help decision-makers better integrate and coordinate national and European forest policies with bioeconomy ambitions.

Keywords: bioeconomy strategy; forest-based sector; national forest strategy; foresight workshops; qualitative data analysis; Romania

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1. Introduction

As the European bioeconomy continues to gain traction, governments are designing national strategies to advance and strengthen regional bioeconomy approaches. Such national bioeconomy strategies are often based on the prerequisites of the country in focus [1]. For example, advanced agricultural nations such as the Netherlands tend to leverage their agricultural, transport, and chemical sectors for the implementation of a bio-based economy [2]. Mediterranean countries such as Spain and Italy emphasize their strong agroforestry sectors, timber production, non-timber forest products, as well as other ecosystem services provided by different land use systems [3]. Countries such as Finland and Sweden, where the forest industry plays a central role, concentrate on developing higher added-value and expanding product portfolios from their strong forest industries [3,4]. The forest sector is thus weighted differently in national bioeconomy strategies [5]. Romania

does not have a national bioeconomy strategy. The recently approved National Forest Strategy 2030 [6] addresses the goal to promote the sustainable circular forest bioeconomy through long-life wood products and through strengthening the role of the forest-based sector in supporting the economic development of local communities. However, a more holistic debate about the forest bioeconomy needs to take place.

The bioeconomy is an interdisciplinary concept encompassing innovation networks, coherent policies, and a strong governance framework [7]. It builds on concepts such as industrial ecology [8,9], wherein ecological design and waste management play an important role. Furthermore, a so-called "knowledge-based" bioeconomy draws on the existing social capital and takes into consideration the know-how of a country, i.e., where the academic and research expertise lies and how these strengths can be harnessed to advance national bioeconomy agendas [10]. A forest-based bioeconomy includes a broad definition encompassing everything from the usage of forest resources for basic needs to value chains and forest services. This involves cultivating, gathering, and processing both wood and non-wood products (such as medicinal herbs and bushmeat), as well as other products such as industrial roundwood, fuelwood, pulp and paper, and furniture. In fact, all goods produced by primary, secondary, or tertiary processing of both wood and non-wood products, such as roundwood, pulp, bioenergy, and new bio-based products may be included in the concept [5]. Hence, taking these two aspects into consideration, i.e., that a sustainable bioeconomy strategy must build on both natural land-based resources and knowledge prerequisites, this article puts forth the argument to develop and strengthen a national bioeconomy approach based around the Romanian forest-based sector.

The reasons for focusing on the Romanian forest sector are manifold. Romania harbors some of the largest areas of primary forests [11] in Europe inside well-connected forested landscapes [12]. Historically, implementing rigorous and consistent forest management planning has been a model for applying multi-functionality principles [13]. Such principles continue to secure the provision of forest ecosystem services from the perspective of sustained yield, regulatory functions, recreational values, and biological diversity [14]. Despite these advantages, one must acknowledge that the Romanian forest sector is still inadequately prepared to transition to a bioeconomy. Outdated governance approaches and institutions that no longer reflect the diversity of forest stakeholders, their needs, and expectations from forests [15], a dormant innovation culture, and a lack of adequate political support slow the transition in its pace. Important challenges related to the restitution of forestlands, privatization of forest industry and of the forest administration still divide stakeholders and challenge policymakers [16]. The Romanian forest sector thus faces immense challenges that need to be overcome in order to jumpstart a successful transition towards a bioeconomy.

Several position papers and international reports have brought the importance of the European forest-based bioeconomy to the forefront [17–19]. Only a few studies in Central and Eastern Europe, however, have so far focused on regional bioeconomy developments. This is potentially due to the unequal bioeconomy funding distribution between Eastern and North-Western Europe [20]. Some interesting insights have nevertheless emerged from the region. Navrátilová et al. [21] offer an overview of forest stakeholder perceptions of bioeconomy in Slovakia, showing that they generally tend to lean towards the opportunities of a forest-based bioeconomy. Other studies have compared national forest bioeconomy strategies with those of Western and Northern European countries such as Germany or Sweden, two countries with strong forest-based sectors, experienced in developing and implementing national bioeconomy strategies. For example, Purwestri et al. [22] compare Czechia's forest-bioeconomy strategy with that of Germany concluding that the main challenges faced by the forest-based sector in the country is to fulfil the demand for sustainable forest biomass and high value-added products. Similarly, Purwestri et al. [23] later compare the role of a bioeconomy in the Czech national forest strategy with that of Sweden, again pointing to several challenges related to fulfilling the provision of sustainable forest biomass and high added-value products while harmonizing forest policies and regulations.

To date, no studies have qualitatively assessed Romania's readiness for unlocking its forest-bioeconomy. Some studies have quantitatively investigated the production and use of biomass from the perspective of an agriculture-based and food-based bioeconomy [24]. Despite the existence of several decades of forestry-related research from a plethora of disciplinary perspectives (i.e., forest management, biodiversity conservation, policy and governance, etc. [13,25]), few studies have synthetized the lessons learned under the conceptual umbrella of a circular-forest-bioeconomy. The most comprehensive study so far addressing the role of the forest sector in Romania's bioeconomy is the recently published volume "The Plan B for Romania's Forests and Society" [26]. The volume presents a general overview of the status quo of forest-bioeconomy developments. In the present article, we draw upon empirical data collected during the ideation process for writing Plan B volume with the aim of laying the conceptual groundwork for developing a forest-based bioeconomy strategy for Romania.

The main objective of the present study is, thus, to jumpstart a discussion about the challenges and opportunities faced by the Romanian forest-based sector, should the government decide to pursue a national bioeconomy strategy. By diagnosing the past and current situation, exploring possible alternative futures, and describing a desirable future scenario, it identifies a series of concrete actions to unlock Romania's forest bioeconomy potential. The time is ripe for such an analysis, given that the Romanian Government has recently approved its new forest strategy. The sector is also currently witnessing mounting political and public pressure challenging the sustainability and closeness to nature of current forest management practices. In this context, this article addresses following questions:

- What are the challenges that Romanian forests/forestry face when it comes to transitioning to a sustainable bioeconomy?
- What would a sustainable circular-bioeconomy entail for Romanian forests and forestry?
- How do we get there by the year 2030?

This article proceeds as follows: in the next section, we lay out the conceptual underpinnings of this study by briefly revisiting the main different scholarly conceptualizations of the (forest-based) bioeconomy. We then describe the study design and the foresight methodology applied in Section 3. In Section 4, we present the main findings according to each of the three questions outlined above. In the end, with Section 5, we summarize the main insights gained from this study.

2. Conceptual Underpinnings

Over the years, different bioeconomy conceptual approaches have appeared in the scientific literature. Bugge et al.'s [27] well-known classification of bio-technology, bio-ecology, and bio-resource research visions was recently complemented by Piplani and Smith-Hall's [5] framework for analyzing the forest-based bioeconomy, which distinguishes between five schools of thought: the biotechnology, techno-bioresource, socio-bioresource, eco-efficiency, and eco-society. Jankovský et al. [28] review the scientific literature on the topic of innovations in the forest bioeconomy, finding that most studies dealt with the necessary adaptation of policies, while innovations were mainly focused on biorefining, biotechnology, and production of various biomaterials, as well as innovations of business models and stakeholder interactions.

Despite growing diversity, the dominant way of framing bioeconomy is through the lens of existing policies, particularly the Organization for Economic Co-operation and Development's (OECD) bioeconomy policy agenda [29] and the European Union's (EU) bioeconomy strategy [30]. Whereas it is beyond the scope of this study to deconstruct the normativity of these approaches, we do acknowledge their political character [31]. Indeed, such conceptualizations are often underpinned by different values, and socio-political and technical beliefs about socio-ecological systems and economic development [30,32,33].

As Allain et al. [32] helpfully point out, it is often useful to distinguish between the "bioeconomics" and the "bioeconomy" schools of thought wherein different values, models and goals come into conflict. The first school emphasizes economic growth enabled by

the use of biotechnology in large amounts of biomass (wood, crops, agricultural residues, etc.). The latter school subscribes to the "bioeconomics programme" [34] and argues for de-growth, new social organization, and low-tech innovations (e.g., inclusive innovations, agroecological practices etc.) [32]. Regardless of the school of thought, there is clearly no one-size-fits-all approach to bioeconomy. Given the geopolitical preconditions and local prerequisites, governments will likely adopt bioeconomy strategies that build on preexisting strengths, and that can secure economic competitiveness and some form of resource sovereignty [1,3]. This is especially likely to be the case for countries still transitioning to a market economy, many of which have yet to produce comprehensive bioeconomy strategies [3]. This, however, should not justify unabated green-growth narratives and neoliberal opportunism when it comes to bioeconomy [35,36]. Simply copying the European Commission's or the OECD's bioeconomy blueprint without adapting it to local realities may lead to undirected public funding, policies astray, and ultimately failure. A bioeconomy rooted within the limits of planetary boundaries [37], one that builds on strong sustainability principles [38], local prerequisites and socio-economic realties [39] should therefore be strived for. To enable this, a set of commonly accepted principles can aid the design of a functional bioeconomy conceptualization. One must not reinvent the wheel, as such principles have long been acknowledged in the sustainability literature with its focus on the equal balance between economy, ecology and society. Unconditionally, sustainability has to be an inherent part of any bioeconomy conceptualization [40].

A more holistic approach that takes many of the abovementioned aspects into consideration was recently termed "The Circular Bioeconomy of Wellbeing" [41]. In this conceptualization, contrary to our extractive and linear fossil-based economy, the circular bioeconomy relies on healthy, biodiverse, and resilient ecosystems. Most importantly, it acknowledges the role of society beyond mere consumers of bio-based products, but instead puts societal wellbeing at its core. The circular bioeconomy is powered by renewable energy and includes, and holistically interlinks, multiple systems and sectors, i.e., primary production sectors (agriculture, forestry, fisheries, aquaculture); economic and industrial sectors relying on biological resources (food, wood industry, the chemical industry, the construction sector, the packaging industry, textiles, pharmaceuticals, bioenergy etc.), as well as green infrastructures such as urban forests and trees and the services they provide to cities and rural communities. This is achieved through the provision of ecosystem services and the sustainable management of biological resources and its circular transformation into food, feed, energy, and biomaterials within the ecological boundaries of the ecosystems that the system relies upon [41] (p.15).

3. Study Design

3.1. Foresight Exercises

The research design takes an exploratory approach based on qualitative data analysis. Foresight tools are a common approach to stakeholder engagement, both at the level of individual strategy formulation of firms and as tools to coordinate different actors in politics or industry [42]. Outlook studies have been employed in the forest sector for over 60 years [43]. These approaches can roughly be divided into model-based (e.g., forecasts and scenarios, or policy impact studies, i.e., [44,45]) or qualitative approaches (e.g., roadmaps, scenarios, visions, etc., e.g., [46,47]) [43]. This analysis falls into the latter category.

There is no single agreed-upon definition of foresight or futures studies [43]. Here, we use Bell's approach, who ascertains that "the purpose of futures studies is to discover or invent, examine and evaluate, and propose possible, probable and preferable futures" [48] (p. 73). Typically, a future studies process comprises some of the following stages [43]:

i. Diagnosing the past and current situation in order to gain an understanding of the present state of affairs;
ii. Exploring possible alternative futures;

iii. Choosing a preferable or desirable future scenario where the experts would prefer the future to be directed;
iv. Identifying concrete actions to achieve the preferred future.

3.2. Expert Selection

A total of 16 Romanian and international experts participated in two foresight workshops (first workshop-seven participants; second workshop-nine participants). The participants were selected based on their expertise in the forest bioeconomy. Similar studies analyzing bioeconomy outlooks relied on different rationales for actor selection. For example, Hagemann et al. [49] surveyed experts from a preexisting multidisciplinary bioeconomy cluster. Hurmekoski et al. [50] developed an expertise matrix to create a diverse and complementary panel of experts. Inspired by these approaches, the criteria for expert selection for this study included:

1. activity within the forest-based sector, or other related sectors working closely with the forest-based sector and/or using wood-based raw materials or products;
2. relevant job title or job description both in national and international context;
3. relevant publications or academic contributions on the topic;
4. membership in bioeconomy-relevant boards, committees, working groups, or technology clusters.

We aimed to include stakeholders from different backgrounds, i.e., academia, the private sector, NGOs, stakeholder associations etc. but academics were nevertheless unintentionally overrepresented in the sample (Table 1). Nonetheless, a mix of national, and international experts with different professional backgrounds participated (Appendix A). The limitations of our selection and the inherent biases are further discussed in section.

Table 1. Profile of workshop participants.

Gender	Types of Expertise	Country
12 male 4 female	11 Academia 2 International research 1 Policy making 1 Industrial Company 1 NGO	8 Romania 2 Romania/international 3 Austria 1 Finland 1 Italy 1 Belgium

3.3. Workshop Facilitation and Qualitative Content Analysis

Two online expert workshops were organized on 17 February and 25 February 2021 and facilitated by two of the authors of this study. The workshop participants were introduced beforehand with the foresight design and were asked to structure their statements according to the steps outlined above. The workshops lasted about two hours, allowing each participant the time to introduce their perspective on the discussed topics. The two-hour workshops kicked-off with a short listing of the objectives, as well a short overview of the European bioeconomy strategy. Afterwards, participants were presented with the rules of the foresight exercise. Participants were prompted to discuss the current state of Romanian forests and forestry, its current challenges, and the historical, political, institutional, and cultural circumstances that have led to its present configuration.

Participants were then separated into two groups based on their expertise, i.e., one focused on management and conservation, and one on governance and innovation. Participants were asked to envision the year 2030 and from that vantage point explore the different ways the forest-bioeconomy had unfolded, what challenges it faced and the opportunities it generated. After discussing these different possibilities, the participants were asked to agree on a preferable future scenario. After some brief moments of reflection, each participant was allowed to add one or several concrete action points to a digital pin board. At the end of the session, the two groups were brought together in the same room.

The results from each group discussion were shared and discussed with all workshops participants. Finally, the workshop facilitators collected all points discussed during each session, summarized and shared them with all workshop participants. The participants could add, remove or clarify the summarized points (Appendix B).

Using qualitative content analysis [51], the summarized points were grouped in terms of predetermined categories that were systematically identified by the authors. We used a deductive approach by triangulating emerging frames with theoretically derived frames from the existing bioeconomy literature. Easily and unambiguously detectable frames from the content analysis were identified [52] and summarized in Section 4 below. Based on these frames, we summarized eight major themes which were complemented by concrete initiatives suggested by workshop participants.

The volume "The Plan B for Romania's Forests and Society" [26], involving a large group of national and international authors from various fields of expertise, provides a larger collection of secondary literature on the topics impacting on the Romanian forest-based bioeconomy. Thus, in the presentation of the research results, the identified frames are backed-up with references from the relevant scientific literature.

4. Main Insights

4.1. Romania's Forests and Forestry: Past and Present Diagnosis

4.1.1. Forestland and Forest Management

Despite a relatively low county-wide forest cover (approx. 30% [53]) historically, Romanian forests have been a major source of rural employment through wood harvesting, wood processing, as well as non-timber forest products [54]. The forestland of roughly 7 million ha is mainly distributed in the mountainous and hill areas (60% and, respectively, 34%) [53]. The forests are composed in most cases by native species (97% [53]) and range from open oak woodlands in dry lowlands and riparian forests in the flood plains to mixed deciduous forests on the hills and to pure European beech and Norway spruce stands in the Carpathian Mountains.

As indicated by workshop participants, forestry is still tightly regulated by the state through an intricate system of management planning and implementation following a single set of technical norms, generally maintaining the same forest management approach used during communism [54]. The sustainable forest management principles integrated in the design of forest management plans are the sustainable yield principle, the functional effectiveness principle, and biodiversity conservation and improvement [55]. Forest management plans based on these principles are developed (for forests larger than 10 ha) by specialized entities (registered by the ministry) and their implementation in practice is carried out exclusively through forest districts (authorized and registered with the ministry as well). Regardless of ownership, high-forest systems with long rotations (over 100 years), natural stand composition, and balanced age class proportion for sustained yield are some of the keystone principles of Romanian forestry. Over time, these principles resulted in a countrywide forest mosaic of various stand types encompassing all development stages, including the old and very old (old-growth) stages which offer important habitats for some specialized species. As a result, despite being under continuous regulated management for more than a century, Romania's forests harbor a high diversity of fauna and flora [14]. This is probably why most of the natural protected areas (which altogether cover roughly 24% of the country [14]) were designated in managed forested landscapes. As stated by the recent European Biodiversity Strategy, the protected area should increase in the near future by up to 30% (out of which a third should be strictly protected [56]) with a special focus on the primary and old-growth forests. Experts pointed out that in order to fulfill both conservation and bioeconomy needs, the management of Romania's forests will most likely face increased challenges in the coming years.

With the technical norms from 1985, Romanian forestry has strengthened the close-to-nature management approach. However, this management approach is hampered by the insufficient network of forest roads. In consequence, timber was sold on the stump, since

the National Forest Administration (NFA) was not allowed to invest in new roads meant to shorten the logging distances into the forests which were supposed to be restituted to private owners [57]. Another issue identified by participants was that between 1991 to 2012, neither NFA, nor the private owners, had properly invested in logging equipment, cable cranes or trucks. In 2007, within the World Bank Forestry Development Project, the NFA benefited from international expertise in developing a better strategy after ceasing the restitution process [58]. Those directions have never been consistently pursued by forest policy makers. Experts consider that moving the marketplace from the forest to the forest road or log yards takes considerable time. Hence, bottle-necks are inevitable as long as the average forest road density still lays below 6 m/hectares [59]. In addition to this, experts point to a great deal of information asymmetry which is inevitable when it comes to stumpage sales. This is also an important downside to diversifying the utilization of wood in different sectors [60]. The limited forest road density and the lack of investments in harvesting capacities also result in high costs of harvesting. Consequently, Romania has the lowest harvesting productivity across EU countries. Experts point out that this is also reflected in important negative impacts on the environment and in the harvesting sector's low awareness of health and safety measures (i.e., problems mainly identified during forest certification audits [61]).

4.1.2. Policy and Governance

Over the past 30 years, Romania has faced important institutional and structural changes such as, for example, the restitution of forests, the institutional separation of the regulatory, control and forest management function, the privatization of the wood harvesting and processing sector, and forest administration reform. As a result, private property currently represents 35% of the forests, the wood harvesting and processing sector is fully privatized while 22% of the forests are under private forest administration [15]. Due to these changes, Romanian forestry has moved from a heavily centralized sector to a multilayer type of governance, with more actors playing different and even overlapping roles [57]. This, some workshop participants believe, has considerably increased the complexity and difficulty of Romanian forest governance.

Despite these significant institutional changes, experts pointed out that policy instruments have largely remained focused on "command-and-control" tools which failed to address small-scale forest properties and ownership diversity. As a consequence, the property rights of Romanian forest owners are among the most restricted in Europe [16]. The regulatory system involves high bureaucratic and administrative costs which hinder the economic viability of forest management, and which often causes forest owners to use the forest resource beyond the legal requirements. The need for economic instruments to partially cover the high administrative costs or to compensate owners for the restriction imposed for the provision of regulatory or cultural ecosystem services are slowly entering the political agenda and are far from reaching significant results in practice. Experts pointed out that the highly regulatory system also restricts innovation and efficient forest management for responsible forest owners. Innovation and efficient management were considered essential elements for entering the bioeconomy market. The fragmentation of property was also identified as hindering the application of a unitary management regime. So far, no alternative forest management systems have been put in place. Moreover, experts pointed out that the efficiency of the regulatory system is poorly monitored, and the high costs of controlling are not appropriately addressed.

The Romanian forest strategy 2030, approved in October 2022, integrates the objectives set by the EU Forest Strategy 2030 on five thematic areas defining strategic directions for actions for the forest-based bioeconomy, the biodiversity conservation and adaptation to climate change, the strategic monitoring and reporting of data, the communication, education and research and for an efficient and transparent forest governance system. The strategy also aims for a structural reform at the legislative, institutional and operational

level meant to diversify the role of the policy instruments used to achieve its overall policy objectives.

4.1.3. Data and Metrics

In terms of forest production, the National Forest Inventory (NFI) (currently completing its 3rd cycle) reports a standing volume of 2.355 million m^3 with a current annual increment of 58.6 mil. m^3 (i.e., 8.46 m^3 ha^{-1} yr^{-1}) [53]. According to the official numbers offered by the National Statistics Institute, the annual timber removal in recent decades ranged from 13 to 19 million m^3, and has constantly been below the annual allowable cut [54]. The recent figures for 2019 report 19.7 million m^3 removed [47] out of the 21.4 million m^3 allowed [48]. However, figures from the two national reporting systems (National Forest Inventory and National Statistics Institute) differ greatly inferring that larger amounts of wood might have been removed from forests.

Therefore, experts agreed that there is a lack of reliable data on timber harvests [62]. Hence, only when scientifically robust data on timber harvesting becomes available, can the accounting of GHG also become reliable. Since unreliable data on harvesting, the gap between solid and bioenergy use, the historical deforestation rate, and the low harvesting efficiency seriously hamper the realistic assessment of the carbon sink of the wood products pool [62] and of the national timber balance.

The second cycle of the national forest inventory triggered a long and hot dispute over the timber volume annually removed from Romania's forests. An intense debate over methodological weaknesses of the forest inventory, on the one hand, and the high level of illegal harvests, on the other hand, started. Experts indicate that this is due to the difference between the official yield, summed up and reported by the National Institute of Statistics, and the total removals which could be derived from the data reported by the national forest inventory. All disagreements are focused on the removals estimated from the NFI results [53], but not on the official yield, governmentally assumed to be realistic and reliable. However, since such differences had been reported all over Europe after the second cycle of the national inventory, one possible explanation offered by workshop participants is the systematic underestimation of the yield itself, be it the harvest at stand level or the national aggregated harvest. The more links along the value-chain, the larger the differences were between removals and official harvest. The recorded differences are even more controversial considering that since 2008 onward, a legal digital timber flow system was implemented to control and track the wood provenience and use (SUMAL) which has a new version released in the beginning of 2021. All timber suppliers and timber buyers are requested to record in the system the transactions made along the production chain, the timber not recorded being considered, by definition, illegal timber.

Wood fuel consumption and supply also opens important debates on the accuracy of the data. The Romanian Energy Strategy 2016–2030 [63] indicates a need for household heating of about 16 million m^3 at the level of 2016 while the study on energy consumption in households [64] indicates a wood consumption of 19 million m^3 at the level of 2009. Regarding the wood fuel supply, it is estimated, based on official data at national scale on harvested timber, imports and exports, that about 10–13 million m^3 have been annually supplied directly as firewood or indirectly from harvesting and timber processing residues [65]. Experts consider wood fuel consumption/availability an important aspect of local bioeconomies and rural development. They point out that this too has so far been ignored in policy discussions. They warn that the requirements to strengthened sustainability criteria for bioenergy and to minimize the use of wood for energy production may have an important negative impact on assuring the energy security of local communities with no energy alternatives. On the other hand, the dependency of many households on bioenergy may be turned into an advantage by increasing the share of renewable energy use. However, experts point out that pragmatic rules are needed in order to assure that the wood fuel is supplied from sustainable managed forests.

4.1.4. Innovation and Trade

Together with the high and constant demand for wood for energy, experts indicated another defining element of the Romanian forest-wood sector: the disappearance of the chemical processing of wood after 1990 [66]. Gradually, the pre-1989 pulp and paper mills that were producing an entire range of byproducts with applications in other industrial sectors have been decommissioned. Currently, Romania has a sole industrial producer of hemicellulose, which is further integrated into packaging materials production, but fails to contribute with any novel wood-based bioproducts. The gap left by the pulp and paper industry was partly filled by increased production of sawnwood and wood panels, but at the same time, due to insufficient demand, the entire wood procurements chain was reorganized, and important forest tending and thinning operations in young forest stands were postponed. This led to negative consequences on the wood market which was left without 5–7 million m^3 of wood compared to pre-1989. Experts pointed out that most of the research and development in the area of chemical processing of wood was lost. This was aggravated by a generalized lack of funding that characterized the wood sector in the past 30 years. The participants agreed that research, development, and innovation have not been prioritized on the policy agenda, nor in the state budget for the past three decades. Individual efforts were initiated sporadically, but without any significant scale in terms of new products originating from Romania or neighboring regions.

Some experts believe that this weakness can also represent an important window of opportunity for further investments and business development. Examples of bio-based solutions included the replacement of plastics with bio-based packaging materials, the increased utilization of wood in construction (mass timber concept), and the shift from fossil fuels to renewable ones in order to strengthen the EU's energy sovereignty. According to some participants, the variety of tree species present in Romania allows for multiple uses of the woody biomass, which could be further integrated in the industrial production of other well-represented economic sectors, such as food and feed, pharmaceuticals and cosmetics, textiles, automotive and aviation, energy and construction (i.e., for the establishment of future biocities) [67].

Social innovation was also mentioned as an important driver for local bioeconomies. Studies show that the forest bioeconomy plays a unique role in addressing unmet needs with the development of new types of services [68]. Examples of service innovations from other European countries include activities that range from social biomass plants to collectively organized charcoal (biochar) production in remote rural areas [68]. In the case of Romania, experts raised the need for providing opportunity structures and thus by strengthening local social capital in combination with the provision of sufficient education and training. This may include the development of social entrepreneurship both in relation to forest management and small-scale farming [69].

4.1.5. Cooperation

Workshop participants indicated that the forest-based sector cannot contribute to the national bioeconomy by itself, but that cooperation with other sectors and industries is needed (e.g., sustainable agriculture, energy, pharmaceutical industry, textile industry etc.). Some experts thus called for an integrative approach that links the different economic sectors of Romania with research and academia. This would allow for properly assessing and mobilizing the natural resources available domestically, and to strive for adding value, through innovation, along the entire chain: from stump to high-end products. However, participants pointed out that the forest-based sector currently has little to no cooperation with other sectors even though this is paramount considering the government's efforts to develop different national strategies (e.g., forest strategy, biodiversity strategy, energy strategy, etc.). This was attributed to a lack of collaborative mindset at individual, institutional, and decision-making levels. Some experts suggested establishing a think-tank of local and foreign experts who can define a bioeconomy strategy for Romania, and to support decision makers in approving and implementing bioeconomy-related policies in

synchronicity with the EU. This was also believed to attract important funding for research, development and innovation.

The issues with cooperation seem to go beyond the business sector. The workshop participants also pointed out that local communities' role in bioeconomy is so far absent from policy discussions. The main critique was that rural areas were not adequately addressed with specific policy instruments in order to adapt the forest bieconomy to local needs. The ability to address such issues is likely to be enhanced by an active partnership where practitioners, researchers, and decision-makers share authority and responsibility [70].

4.1.6. Education

Education and life-long learning were often mentioned by participants as one of key areas for unlocking Romania's forest bioeconomy potential. Experts believe that bioeconomy education should successfully address societal and technological developments including, among others, climate-smart forestry, habitat, and stand-specific silvicultural measures. Hard skills for addressing the increasing digitalization of forest measurement, inventory, and timber traceability were also mentioned [71]. In addition to such techno-scientific and management-oriented skills taught at forestry universities, fundamental knowledge of the industrial value chains, harvesting, and supply chains, manufacturing, logistics, and trade of bio-based products and bioeconomy-related services were also deemed important [72].

Experts pointed out that there are good prerequisites for a forestry educational system at Romanian universities. However, given the current capacities, research and education could mainly support process-based innovation (i.e., improved management) and innovation in forest-based bioeconomy services (i.e., social innovation, non-timber forest products, tourism or innovation in forest-related cultural services) [71]. Other skills such as communication, networking, and decision-making skills remain to be fostered [73]. Moreover, participants pointed out that there is also a weak development of vocational education that trains workers and operators of modern forestry machinery with low environmental impact. Despite existing agreements for collaboration between sector stakeholders and educational institutions, there is still a dire lack of directly transferable research contributions that meet the forest industry's needs for product innovations, business models and expertise [71].

4.1.7. Communication

Finally, all the identified challenges faced by the Romanian forest sector have a substantial impact on the messages that are communicated to the general public. Communication challenges identified by experts are related to law enforcement and illegal logging. As a result, public perceptions of forest management in Romania is highly negative as confirmed by a recent national survey [74] pointing out that 53% of Romanians consider that all types of forest logging should be banned. Thus, the gap between the perceptions of the general public on the outcomes of forest management and the desired policy goals is currently larger than ever. Workshop participants mentioned that there are no efforts to identify the perceptions of consumers when it comes to wood-based products, e.g., wood construction and other bio-based products and to build a communication strategy meant to promote the role of forest products in the bioeconomy.

Hence, participants called for designing and implementing an efficient communication strategy that promotes the sustainable use of forest-based resources. According to workshop participants, such a strategy ought to build on specific indicators that transparently monitor the efficiency of implementing policy instruments covering the multiple ecological, social and economic impacts of the forest-based bioeconomy [71].

4.2. Top-Down and Bottom-Up Initiatives to Support the Forest Bioeconomy

Participants were asked to provide concrete suggestions for policy tools and incentives for unlocking Romania's forest bioeconomy potential. As described above, the suggestions ranged from overall initiatives such as enhancing cooperation, improving communication,

increasing funding and financial incentives, to different focus areas such as rural development or education. Table 2 lists the 8 major themes as summarized by the authors. Each theme is complemented by a brief explanation of its focus, the main arguments for its implementation as well as individual specific initiatives as indicated by workshop participants. For clarity, some of these initiatives were slightly reformulated by the authors; some were merged or eliminated in order to avoid duplicates. The original list of suggested initiatives can be found in Appendix B.

Table 2. Different initiatives suggested by workshop participants.

Theme	Main Arguments	Specific Initiatives
Forward-looking policy-making Different initiatives related to policies, politics and policymaking at a national and EU- level are grouped under this theme.	Romania does not have a clear vision, objectives and targets when it comes to the bioeconomy. The political environment is highly unstable and decision-making is often short-termed. The EU bioeconomy policies are rather broad and bottom-up approaches are needed to adapt them to the national context.	- Set long-term policy goals based on a vision that goes beyond wood use, and the biorefinery concept; one that includes the source (forests and forestry), and consumers along the entire value chain; - The new strategies, legislation, and forest law need to implement the concept of bioeconomy using a clear overview of the forest sector and its future development.
Enhance Cooperation This theme mainly refers to cooperation between different stakeholders of the forest-based sector but also to cooperation between the forest industry and other sectors and industries relevant to the bioeconomy.	The forest-based sector is not independent and must cooperate with other sectors (e.g., agriculture, energy, biodiversity, pharmaceutical industry, textile industry etc.). The sector also lacks cooperation with other sectors. There is a lack of collaborative mindset at both individual and policy level.	- Cooperation between the Ministry of Environment, Waters and Forests and Ministry of Agriculture (which coordinates the distribution of EU financial support), Ministry of Energy (e.g., regarding the energy security of local communities and the role of biomass in the energy balance), Ministry of Industry (e.g., for the development of common programs supporting the use of wood) and the Ministry of Tourism (e.g., to develop a common strategy promoting nature-based tourism); - Provide policy support and incentivize cooperation between different stakeholders, especially between the forest-based sector and other industries.
Provide better data, indicators, and monitoring This theme groups various data- and monitoring- related initiatives to support fact-based decision-making.	Important discrepancies exist between the data collected by different institutions in Romania describing the forest status, wood production, timber processing and consumption (see Section 4.1); moreover, for non-timber forest products (NTFP) there is a lack of accurate data regarding their share on the market.	- Improve data collection and data on indicators and monitoring of the forest sector considering the set of indicators agreed upon at the European level (e.g., Forest Europe); - Use accurate data and scientific knowledge for decision-making in forest management and nature conservation (rooted in social and economic realities);Acquire better data on usage of wood, NTFP and other ecosystem services in rural areas in order to create policy tools increasing their role in local bioeconomies and to balance the demand of industry and forest-dependent communities.

Table 2. *Cont.*

Theme	Main Arguments	Specific Initiatives
Increase funding/financial incentives This theme mainly includes financial incentives for supporting the development of the forest-based sector.	Romanian forest policy remained focused on the command-and-control paradigm for implementing sustainable forest management. This top-down approach is inefficient. Financial incentives are necessary for the forest sector to unlock its innovative potential.	- Proper funding for sustainable forest management at all ownership scales (especially for private ownership and community forests) not only for the costs imposed for biodiversity conservation but also to assure the transition towards diverse, stable and resilient forest ecosystems; - Support innovative approaches and reduce bureaucracy so that local small business can access EU funding more easily; provide follow-up measures and monitor their successful implementation.; - Offer incentives/financial support for local communities and local businesses in order to increase their contribution to the forest-based bioeconomy; - Increase initiatives supported by professional associations, NGOs, EU institutions to develop bottom-up approaches (e.g., social innovation).
Focus on rural development This theme bundles together different initiatives targeted at supporting and incentivizing local bioeconomy initiatives that can support rural development.	Local communities are an important pillar in the Romanian economy and particularly in the forest sector. They are crucial for providing forest-related jobs, for developing local businesses, and producing and marketing different forest products. The needs, capabilities and values of local communities are diverse providing for contrasting approaches at local levels in the management of forest resource. Navigating these challenges constitutes a delicate act for implementing the bioeconomy principles.	- Reconsider the scaling issue with regards to how to bring the global to the regional benefits; use local and regional approaches depending on local particularities; - Avoid embracing pathways that would be detrimental to what is already on the ground; embrace and encourage local-level production and innovation, local use, etc.; - Support people in rural areas: acknowledge the issues of migration, land abandonment, corruption; support the traditional practices which are sometimes more sustainable; - Adapt the forest bioeconomy to social needs; move beyond production and growth narrative, focus on sufficiency and circularity.
Diversify products and supply chains This theme includes initiative targeted at diversifying supply chains and product portfolios, beyond the classical forest-based products and services.	Despite the positive foreign trade balance of the forest sector, which relies on value added products (e.g., furniture, particle boards, timber frames), the high value timber products provided by Romanian forests are not efficiently used along the supply chain. The approach used for timber selling, firewood consumption, and the high bureaucratic costs hinders innovation capacities.	- Diversify products and embrace innovation: promote innovative technologies that produce "more from less"-adding value to that category of wood products/waste that, at present, is not capitalized properly (i.e., exploitation and processing residues), through their chemical processing in raw materials needed for other sectors of activity: energy (biofuels), textiles (nano-cellulose fibers), pharmaceuticals (crystalline nano-cellulose), food, vehicles, etc.; - Build upon the entire spectrum of ecosystem service (e.g., promote businesses based on the traditional use of non-wood-forest-products, develop nature-based tourism valuing the high level of biodiversity of the Romanian forests etc.);

Table 2. *Cont.*

Theme	Main Arguments	Specific Initiatives
Strengthen education and training This theme refers both to academic education (i.e., establishing bioeconomy curricula) but also to training targeted at professionals.	Generally, the current forestry educational system integrates economy, society and natural sciences in its curricula thus offering good preconditions for a bioeconomy educational program. However, the rapidly changing societal and technological development requires research and education to support an adaptive forest management, innovation in forest-based bioeconomy and to provide skilled workers for the forest sector of tomorrow.	- Curricula reform for the development of a wider set of interdisciplinary skills regarding the use of forest products and services especially at the master's level; - Develop vocational training specifically to train wood harvesting workers and operators of modern forestry machinery with low environmental impact; - Stimulate the professional skills in the field of forest management, forest harvesting and forest industry; - Foster transferable, transdisciplinary, soft skills such as participation, communication, leadership and decision-making.
Improve Communication This theme mainly refers to improving communication within and between the institutions responsible for the forest sector and decision-making, as well as between forest managers and the general public.	The lack of proper communication strategies from national authorities and professional associations have resulted in a negative image of the forest sector at the national and international level. The current messages presented to the general public are focused on illegal logging, deforestation and improper natural protected areas management which are more often not backed-up by accurate data. Promoting the role of sustainable management for ensuring stable and resilient forests and the role of wood products resulting from sustainably managed forests is an important challenge for the implementation of bioeconomy principles.	- Create a communication and social outreach strategy to inform the public. Foster cooperation with media outlets, discuss and clarify biases, provide accurate information and manage the negative image and the bias media reporting; - Establish citizen information platforms and enhance transparency (in data reporting and policy making); - Create and share knowledge, with a focus on forest owners, rural communities and other forest dependent stakeholders; - Open forest-related social services (e.g., thematic forest educational paths, cultural ecosystem services, etc.); - Improve the "image" of wood coming from Romania; focus on different positive aspects (sustainability principles, biodiversity, national parks etc.) and international forest certification systems; - Make EU strategies and regulatory frameworks known to stakeholders and to general public and preset their transposition in the national legislation;

4.3. The Way Forward

After describing the main challenges and opportunities that the Romanian forest sector faces in its transition to bioeconomy, as well as presenting the main top-down and bottom-up initiatives suggested, we can now summarize the main insights provided by workshop participants for a 2030 bioeconomy vision. We relate these to the insights from the different sustainable circular-bioeconomy conceptualizations described in Section 2. Based on these insights, we define three key messages that may serve as a "way forward" for the Romanian forest bioeconomy:

i. Romania potentially has the forest biomass and know-how prerequisites needed to enable a bioeconomy strategy built around the forest sector. However, important knowledge and policy gaps, as well as conflicting information related to the availability of forest biomass, carbon storage, biodiversity status, ecosystem services, or governance arrangements still persist. There is an urgent need for addressing these action-knowledge gaps before making projections about the future possibilities of a circular forest bioeconomy.

ii. A circular (forest) bioeconomy of wellbeing must focus on regional and rural development. A national bioeconomy strategy must also acknowledge the country's distinct socio-ecological configuration. The national forest-bioeconomy must both include traditional wood use, as well as new wood-based products. Close cooperation with communities and concerned stakeholders must continue being at the center of these developments, both for fostering nature conservation and for continuing to provide much-needed services (e.g., bioenergy provision for rural households). In consequence, innovations must not necessarily come from high-tech technologies and bio-refining facilities, but build on local know-how and inclusive social innovation.

iii. The transition to a forest-based bioeconomy needs investments in forests, forest infrastructure, and labor force. The potential of Romanian forests for providing timber for long-lived products, for example in buildings and furniture, is limited by the poor forest road infrastructure, the outdated forest harvesting equipment, the lack of wood warehouses for timber valuation. The implementation of cascading principles also needs a strategic development of the infrastructure required for the recycling of timber-based products. At the same time, a stronger emphasis on economic instruments is needed as an alternative to the command-and-control instruments. This involves setting clear compensation schemes for biodiversity conservation, setting payments for ecosystem services, and creating financial programs to support forest owners for the implementation of responsible forest management.

Based on these key insights, the Romanian forest-based circular bioeconomy of 2030 may be envisioned as follows (Figure 1):

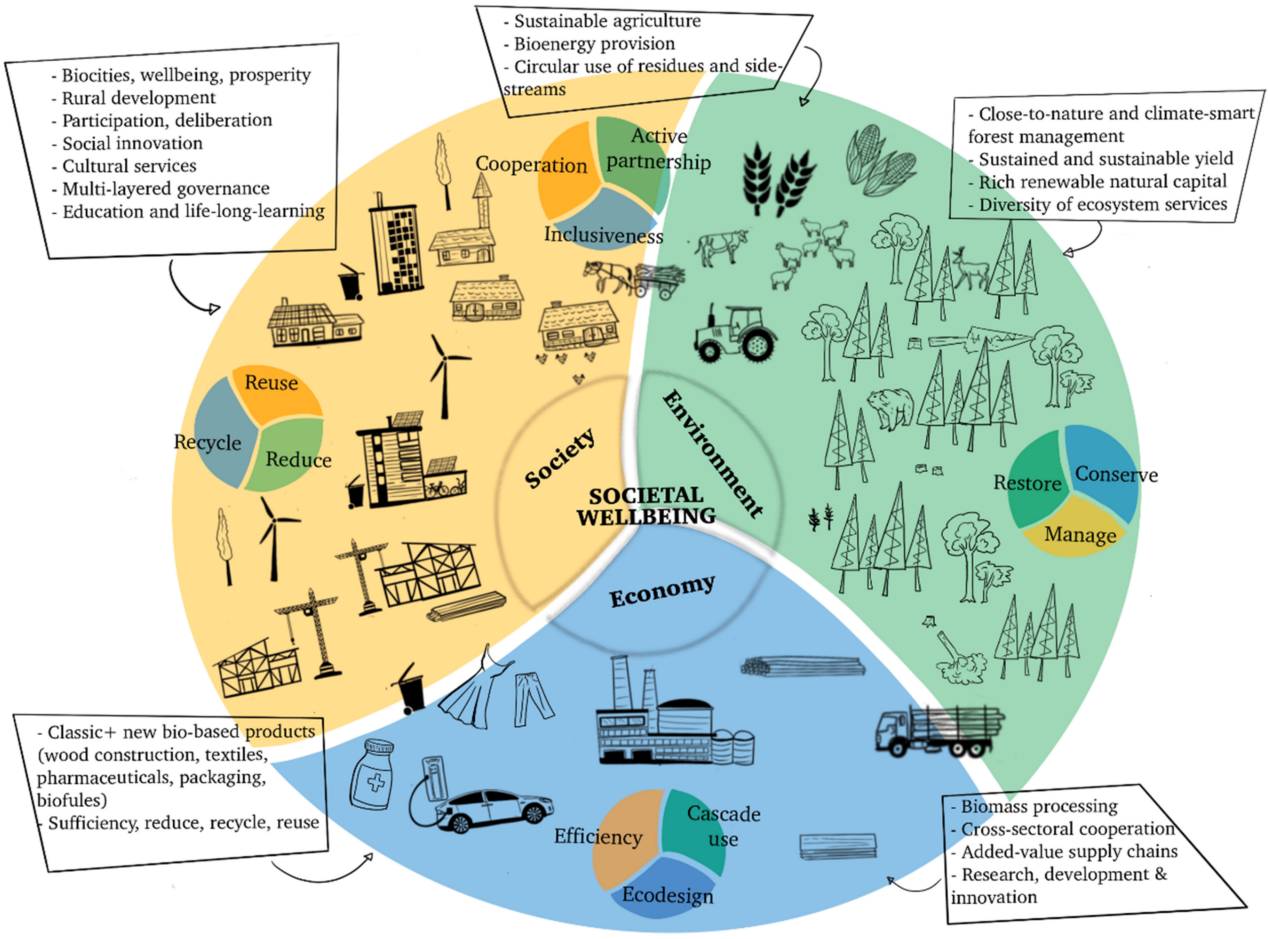

Figure 1. Romania's Circular Forest-Bioeconomy of Wellbeing. Adapted after [41].

An economy in which the basic building blocks for materials, chemicals and energy are partly derived from sustainably managed forests. The management approaches adhere to the close-to-nature principles and climate smart forestry. These approaches are ensured by adequate financial incentives. Accurate data and indicators support managers in their decision-making regarding timber harvest and carbon storage. Infrastructural and technological developments ensure efficient access to sustained yields, which in turn continue to provide and strengthen existing supply chains and traditional timber and non-timber products, as well as other ecosystem and cultural services. Product portfolios are diversified, and new bio-based markets are accessed. This is carried out through close cooperation between the forest-based sector and other sectors and industries (e.g., agriculture, construction, pharmaceutical, textiles etc.). Local communities and other societal stakeholders are involved in the decision-making process. A multi-layered governance model is adopted, where an active partnership between practitioners, researchers, and decision-makers equally sharing authority and responsibility is enhanced. Forward-looking policymaking, financial incentives and funding for research, development and innovation continue to support and enhance these synergies. Bioeconomy- and forest- policy engage with the demands of a broader society to gain societal legitimacy that goes beyond consumer acceptance and focuses on sustainable production and consumption patterns, sustainable and social innovations, and ultimately societal wellbeing.

The policy developments in Romania in the last year show a promising implementation of the bioeconomy principles for the forest-based sector. The National Resilience and Recovery Plan integrates specific measures for the forest sector, mainly related to the development of a new forest strategy and forest legislation. It also has ambitious targets for afforestation, nature protection management, and digitalization. Nevertheless, out of the initial proposed measures, those specifically addressing the development of a sustainable wood harvesting and primary processing sector (i.e., forest road infrastructure, wood warehouses, modern harvesting equipment) have not been considered eligible by the European Commission.

Many of the specific initiatives underlined in Section 4.2. are now covered by the Romanian forest strategy 2030 and (at least some) knowledge gaps described above appear to be acknowledged. The first strategic objective aims to support a competitive, transparent and socio-economically viable forest sector oriented towards the circular bioeconomy. Four strategic actions are set to: (i) promote the sustainable circular forest bioeconomy through long-life wood products, (ii) ensure transparency and competitiveness on the timber market, (iii) increase the contribution of the forestry sector to the economic development of rural communities, and (iv) increase the socio-cultural role of forests [6].

Nevertheless, the new forest strategy still lacks an inter-sectorial approach. Moreover, despite the strategy also addressing forest biodiversity conservation (including the protection targets set at EU level), the conflicting views and opinions of various stakeholders on how nature protection could be integrated with forest management may still hinder a smooth transition to the circular bioeconomy envisaged above. Therefore, a constant dialogue between professionals, policymakers and societal organizations is an essential prerequisite for the implementation of these strategic objectives.

4.4. Limitations and Outlook

As with other foresight studies, this analysis presents several challenges [45,46,50,51]. First, although we strived for transparency in the selection process, the selected group of experts is not exhaustive, nor is it representative of the plethora of experts that could have had an informed opinion on the matter. A certain bias in expert selection is acknowledged, as some came from the authors' own academic networks or were recommended by experts already selected for the workshop. Despite aiming to include more experts from different backgrounds, i.e., the private sector, NGOs, stakeholder associations etc. the academic group of experts was nevertheless unintentionally overrepresented in the sample. This is

however to be expected given the relative novelty of the topic for the Romanian forest-based sector. To date, the topic has mainly been discussed in academic circles.

This study does not pertain to full expert representation nor inclusiveness. It is but a qualitative sample from which we extract informed opinions from (some) national and international experts which we believe could kick-start an interesting debate about the role of forests and forestry in Romania's bioeconomy. A second obvious limitation of conducting the forecasting exercises with this select group of experts is, thus, the inherent bias of the presented results and calls for action. In order to include different opinions and perhaps more nuanced bioeconomy imaginaries, a broader group of experts, i.e., forest owners, civil society representatives and other societal organizations could have been included in the study [30]. A more inclusive bioeconomy concept, co-created by different stakeholders could counteract future conceptual hijacking by more powerful stakeholder groups [75,76]. Once a general circular forest bioeconomy strategy has been drafted, it could be subjected to stakeholder consultations which can be simultaneously followed by researchers.

Thirdly, a methodological limitation is also acknowledged. The two expert workshops were conducted online and were relatively short in length. Despite the many benefits that online interactions offer, they cannot fully replace in-person debates. Qualitative foresight approaches have also evolved over the years, offering a diversified toolbox of approaches that could aid more nuanced processes for developing reliable roadmaps, scenarios, or visions [42,45,46]. In addition to including a broader array of stakeholders, future foresight studies on Romania's forest bioeconomy may include qualitative methods such as Delphi studies or genius pooling, both during workshops and in combination with questionnaires and in-depth literature reviews [43]. Once the targets of the strategy are defined, and more accurate data becomes available, modelling-based approaches could also yield interesting decision options [42–44].

5. Conclusions

The study has laid the groundwork for a Romanian bioeconomy strategy based on two of its most important prerequisites, those being its forest resources, and the social capital and knowhow stemming from the forest-based sector. In this sense, it brings an original contribution by drawing on different interdisciplinary and international expertise to propose a potential way forward for Romania's forest bioeconomy. As the Romanian government is expected to commence work on implementing its newly published National Forest Strategy [6] the insights discussed herein can help decision-makers take more informed decisions about the role of forests, and the forest-based sector in a future circular forest-based bioeconomy strategy. It may also encourage discussions about how to better coordinate national and international forest policies, and better integrate the forest-based sector in national bioeconomy endeavors.

To enable a successful circular-bioeconomy transition, several top-down and bottom-up initiatives are needed. Nevertheless, some of the most important actions needed for supporting the forest-based bioeconomy in its initial phase are financial. These include:

- Adequate funding for sustainable forest management at all ownership levels (and especially for private ownership and community forests);
- Offering incentives/financial support for local communities and local businesses;
- Minimizing bureaucracy so that local small business can access EU funding more easily;
- Incentivizing cooperation between different stakeholders, especially between the forest-based sector and other industries;
- Continuous investment in research, development, education and training.

Many of the challenges discussed here are by no means specific to the bioeconomy discussion, and are relevant for the Romanian forest-based sector as a whole. One key message is that before Romania can have a comprehensive (forest) circular-bioeconomy strategy, several knowledge-action gaps that are specific to the forest-based sector must be addressed first. Such gaps are mainly related to the conflicting information related to the availability of forest biomass, carbon storage, biodiversity status, ecosystem services,

or governance arrangements. The newly published National Forest strategy certainly addresses some of these issues, but its success can only be judged several years after its implementation period.

Once such fundamental action-knowledge gaps are properly addressed, the work on devising an interdisciplinary bioeconomy strategy can truly commence. Experts suggested several key areas where attention is needed in the preparatory phase, e.g., enhancing inter-sectoral cooperation, improving communication within the forest-based sector and between the sector and the general public, increasing funding and financial incentives, and a stronger emphasis on rural development, education and life-long learning. These and other areas of interest would have to be identified and negotiated with a broader group of stakeholders. The way forward proposed here may hopefully serve as a guide in this direction.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A Workshop Participants

	Gender	Group	Affiliation	Expertise	Country
Workshop 1	F	Academia	Forestry Faculty in Romania (a)	Forest governance, forest education, women in forestry	Romania
	M	Academia	Forestry Faculty in Romania (b)	Sustainable forest management certification, chain of custody certification	Romania
	M	Academia	Forestry Faculty in Romania (b)	Ecosystem services, forest management	Romania
	F	NGO	International NGO	Biomass certification, biodiversity conservation	Romania/ International
	M	Academia	Forestry Faculty in Romania (b)	Biodiversity conservation, close to nature forest management	Romania
	M	Policy	Policymaking Body	Research and development	Belgium
	M	Academia	Forestry Faculty in Romania (a)	Forest governance, restitution rights	Romania

Workshop 2	M	Academia	Forestry Faculty in Romania (b)	Silviculture	Romania
	F	Academia	Forestry Faculty in Austria	Local governance, social innovation	Austria
	M	Research	International Research Institute (a)	International trade networks, Bio-based products trade	Finland
	M	Research	International Research Institute (b)	Carbon storage, material substitution, LULUCF	Italy
	F	Academia	Romanian University	Social-ecological systems, knowledge co-creation, rural development	Romania
	M	Academia	Forestry Faculty in Austria	International forest governance, forest policy	Austria
	M	Academia	Austrian University	Wood-based innovations, technology innovation systems	Austria
	M	Academia	Forestry Faculty in Romania (b)	Remote sensing	Romania
	M	Private sector	International Company	Forest management, forestland investment	Romania/ International

Appendix B Discussion Results of the Two Expert Workshops

What are the challenges?

Sustainability

- Missing discussion about the meaning of "weak" and "strong" Sustainability concepts;
- Lack of appropriate assessment of social and economic costs of Sustainable Forest Management (SFM) (especially environmental costs);
- Lack of understanding of what sustainable forest management entails;
- Lack of integrated approaches to management;
- Tension between production forestry and conservation management;
- Certification as an indicator for sustainable bioeconomy needs to be strengthened;

Property rights and governance

- Top-down property rights. No policy, instruments, governance for property rights;
- Unclear (financial) contribution of property rights to the economic sector;
- Forest owners are not aware and not involved in the bioeconomy discussion;

Lack of funding

- Lack of appropriate funding (incentives) for SFM;
- Funding goes to already established actors, not to small businesses and entrepreneurs;
- Lack of appropriate funding for research and Development (R&D);

Policy and politics

- At European Union (EU) level, the bioeconomy is still a very broad, interdisciplinary concept: hard to grasp, implement, apply in practice;
- EU strategies are shallow and broad. No bottom-up approach;
- Romania has yet to produce a national bioeconomy strategy;
- Romania does not have clear objectives, targets, visions, definitions etc. when it comes to bioeconomy and the forest-sector in particular;
- The forest-based sector is not independent; there is pressure from different interest groups;
- The forest-based sector lacks cross-connections with other sectors; Collaborative, cross-institutional collaboration is needed BUT lack of collaborative mindset in Romania, at individual level;
- The political environment is highly unstable with short-term approach;
- Politicians "hunt" academics and high profile specialists in order to gain personal benefits and political clout;
- Decision-making highly influenced by emotional reasons rather than rational thinking;

- Lack of discussion about the role of foreign investors and companies. What role do they play in the "national" bioeconomy;
- Decision and lawmaking are not science-based;
- Limited dialogue between professionals and policy makers;
- Lack of adequate regulatory and policy support;
- No agreement within political parties, who is responsible for what;

Harvesting and (lack of) reliable metrics and data

- Sorting wood problem- high quality wood ends up as wood fuel;
- Inaccurate and unreliable data;
- Biometrics in Romania are based on forest that no longer exist;
- There is no reliable data on the "true" annual removal;
- Government is not yet fully acknowledging the National Forest Inventory (NFI) results-what is the base of "calculation"?
- It is not known if there is enough biomass to feed a national forest-bioeconomy, not to mention an export-oriented one;
- High competition for existing resources;
- Unbalanced/unequal distribution of wood removals;
- Lack of proper forest accessibility;

Carbon

- CO_2 schemes not yet implemented at property level;
- Romania is not aware of the effort ahead in terms of reductions of CO_2 emissions;
- Lack of knowledge regarding market tools/carbon farming;

Bioenergy, Wood fuel and local needs

- It is unclear if Romania has enough forest resources for phasing out fossil fuels and nuclear energy;
- Half of forest harvest is fuelwood-Romania must acknowledge this dire need for fuel wood;
- fuel wood consumption/availability is an important aspect of local bioeconomies and rural development which has so far been ignored in policy discussions;
- Unclear if fuelwood should even be part of bioeconomy discussion. Unknown if it is contributing to climate change mitigation;

Local communities and bioeconomy

- Rural areas are not included in the bioeconomy discussion;
- Regional vs. Global, lack of discussion on how to bring the global to the regional benefits;
- Local communities' role in bioeconomy is so far absent from discussions. There is no discussion about "local bioeconomy";
- Lack of discussion about RURAL DEVELOPMENT in bioeconomy strategies;
- At a local level, we don't have an adaptation of forest bioeconomy to social needs;
- Stakeholder processes rather weak-trying to consider everyone and everything;

Innovation, (new) value-added products and cooperation

- Lack of new, innovative products that can add value to existing supply chains;
- There is no diversification of products;
- Primitive approach in terms of selling the (raw) resources- increase harvesting in order to feed the bioeconomy and add value to the supply chains;
- General lack of innovative products and services; It's success is dependent on many actors' capacity to collaborate;
- A serious discussion about the role of social innovation, collaborative, bottom-up approaches is lacking;

Education and training

- Brain-drain, lack of skilled workers, low quality (funding, working conditions);

- Lack of qualified people and personnel;
- Education is highly centralized and outdated;

Perceptions, communication, consumers

- No adequate communication between the forest sector, NGOs and the general public;
- Unknown consumer perception when it comes to wood-based products, e.g., wood construction and other bio-based products;
- Consumer market is not there, lack of instruments. Fuelwood Ex. of Upscaling Romania's needs to be transformed from a "handicap" to "advantage"

What would a sustainable bioeconomy entail for Romania?
A common (inclusive) vision

- A common understanding of the concept- shared by professionals, policy makers and the general public;
- A vision that goes beyond wood use, and the bioreffinery concept. One that includes the source (forests and forestry), consumers, along the entire value chain;
- A holistic concept, that starts from source, goes along the value chain and ends with the consumer;
- A service-based bioeconomy with the help of adequate tools (top-down, bottom up) to satisfy local (customer) needs;
- One that starts from EU perspective but is adapted to Romanian reality (local, finance etc.) Upscaling of Romanian needs;

System change

- A system change, e.g., fuel demand with biofuels. Reduce our fuel consumption;

Go beyond wood, technology and innovation

- Go beyond market and production! Business as usual this time with natural resources;
- Go beyond just being innovative with biomass; additionally including a system change;

Better, smarter, faster

- Do things better, so that we manage to capture and store more Carbon;
- A bioeconomy that balances resources with demand from industry and population;
- Value added on chemically processed products-pulp paper, textile, food feed, energy;

Knowledge-based bioeconomy

- Clear overview of the sector and its future development;
- Qualified people in the forest-especially in the harvesting sector (the strongest visual impact on society);

A regional bioeconomy

- A pathway to regionalizing value-chains, e.g., car or textile industry- shifting value chains back to Europe;
- Link top-down to bottom-down strategies; tackle the problem from both sides;
- Proper funding/incentives for economically viable and socially/environmentally responsible forest management;
- High value-added forest economy with emphasis on local communities (which should be viable and prosperous) and local businesses;
- Rational nature conservation in partnership with communities and in agreement with bioeconomy.

How do we get there by 2030?
Forward-looking policymaking

- Set long-term goal and approaches;
- Legislation, strategies, forest law- implement the concept of bioeconomy;

Enhance cooperation

- Cooperation between Ministry of Environment and Ministry of Agriculture;
- Incentivize cooperation between different stakeholders, especially between the forest-based sector and other industries;

Provide better data, indicators and monitoring

- Improve data collection and data on indicators and monitoring;
- Acquire better data on usage of wood in rural areas;
- Use facts and scientific knowledge for decision-making in forest management and nature conservation (rooted in social and economic realities);

Increase funding/financial incentives

- Proper funding for SFM at all ownership scales (and especially for private ownership);
- Increase initiatives supported by NGOs and EU institutions;
- Support innovative approaches and integrate them into practice;
- Offer incentives/financial support for local communities and local businesses;
- Reduce bureaucracy so that local small business can access EU funding more easily;

Focus on rural development

- Reconsider the scaling issue;
- Acknowledge the issues of migration, land abandonment, corruption. Keep the people in rural areas;
- High-tech is good but acknowledge and support the traditional practices which are sometimes even more sustainable;
- Move beyond production and growth narrative, focus on sufficiency and circularity;
- Avoid embracing pathways that would destroy what's already on the ground. Embrace and encourage local-level production and innovation, local consumption, local use etc.
- Local and regional approaches depending on the particularities;

Diversify products and supply chains

- Diversify products from, e.g., lignin, pulp mills, etc.
- Build upon the entire spectrum of ecosystem services;
- Implement biodiversity-smart approaches;
- Embrace innovation;

Focus on education and training

- Develop vocational training;
- Professionals at the top of decisions;
- Forestry Curricula reform!

Improve Communication

- Create and share knowledge, with a focus on forest owners and other stakeholders;
- Establish citizen information platforms;
- Open social services;
- Communication and social outreach;
- Improve "image" of wood coming from Romania. Focus on different positive aspects (biodiversity, parks etc.);
- Manage public opinions, negative image, bias media reporting etc.
- Better public communication!
- Enhance transparency (in reporting and policy making);
- Make EU regulatory framework known to stakeholders;

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