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The Emerging Forest Resources-based Bio-economy in Indonesia

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In this essay, we would like to introduce the international discussions around bio-economy and make the point why this is a very relevant discussion for Indonesia in its emerging role as a G20 country but specifically for its national development path and future economic potential. We would like to start with a broad introduction of what bioeconomy is and highlight the relevance for Indonesia's status through a Strength Weakness Opportunity Threat (SWOT) analysis while pointing out the potential along with recommendations and suggestions for the way forward. We should point out that our perspective is primarily coming from the forestry point of view thereby focusing mostly on



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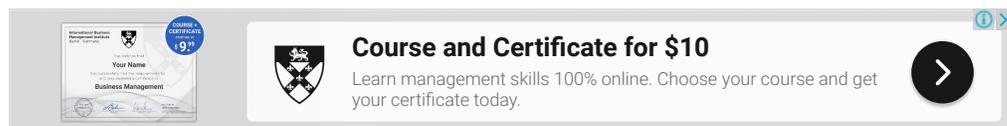
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biomass, genetic resources, and medicinal values from forest ecosystems or activities and using the term "forest-resources based bioeconomy".

We also would like to emphasize the importance of 'sustainability' in this context and that governance structures and regulated production are key for a sustainable bioeconomy indifference to short term "boom and bust" activities through unsustainable resource extraction in competition with food security or ecological values. Beside the forest-based bioeconomy, we wanted to state that there is also potential when looking at the so-called "blue bioeconomy", where algae, seaweed, fish and seafood production is being considered. This topic is outside of the scope of this essay is however a discussion worthwhile exploring in a country, consisting of over 17,000 islands and the ocean being mentioned in the government policy papers as crucial for its future.

In 1949, Egon Glesiger, founder of the *Comité International du Bois* and later FAO Director of the Forestry and Forest Products Division wrote a visionary book, called the "Coming age of Wood" in which he outlined the potentials of forest products and the sustainable use for the future of mankind. This vision was developed 70 years ago in a world that was shattered by the second world war, in ruins but with the need and energy to rebuild and innovate. For the forestry sector, he prophesized that: *"the main trouble is knowledge. The average person believes that wood is only good for lumber and fuel. He sees the forest not as a source of wealth but primarily as an encumbrance that must be cleared away. Yet wood has more uses than any other material. if wood would be put at service of man it could eliminate want. Utilization of the full resources of forests would constitute a major bloodless beneficent world revolution"*.



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This vision has echoed in the halls of international forestry discussion over decades but is picking up much more tracking with the new concept of bioeconomy. Maybe this is due to the fact that again we are standing at the crossroads. Not after the devastations of a world war but with the realization that our world has limited resources and the consensus that if we continue to use the fossil fuels and the resources as we did in the past we are heading towards a new global crisis, just as Egon Glesiger has witnessed at World War 2. The new special report from the Intergovernmental Panel on Climate Change (IPCC) on Climate Change and Land describes drastically the scenario we are heading towards and that the way we are currently misusing our land is worsening climate change. At the same time land is acting as a tremendous carbon sink and offers potential to reduce emissions and/or remove carbon from the atmosphere. The report states that it will be not possible to limit temperature rise to safe levels without fundamentally altering the way the world produces food and manages land. Within this doomsday scenario forest-based bioeconomy emerges as a possibility for a low-carbon development and a viable approach to reduce our carbon footprint in the future.

So, what is bioeconomy? The FAO defines bioeconomy as: 'the knowledge-based production and utilization of biological resources, biological processes and principles to sustainably provide goods and services across all economic sectors. It involves three elements:

1. The use of renewable biomass and efficient bioprocesses to achieve a sustainable production;
2. The use of enabling and converging technologies, including biotechnology;
3. Integration across applications such as agriculture, health and industry."

The keywords are biomass and knowledge, meaning an emphasis is on the creation of innovations through applied research and development. This definition is highly relevant to the forest/land use economics since compared to the fossil-based economy, being depending on oil, gas and coal, the main raw material of the forest resources-based bioeconomy is biomass from woody and grassy material or other biological products. This definition is closely linked to the term 'circular economy', which has a special significance for the forest-based bio-economy, due to the potential of waste wood and biomass from primary production processes within this context. As of now, around 37 countries including Asian countries such as Thailand and Malaysia have bioeconomy strategies in place. The BioSTEP project funded by the European Union performed an excellent summary and analysis of these recent developments.



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The topic has become mainstream. Stories like the production of rubber tires by the tire giant Continental from the latex of the roots of the Dandelion flower or implants made out of spider fibers are catching the attention and imagination of mainstream media. Nowadays, nobody is really questioning the issue of climate change anymore and the detrimental effects it could have on humankind in the next decades. Indonesia is feeling the brunt of these changes already: the weather patterns are changing, droughts, storms and heavy rains are increasing and as a country of over 17,000 islands rising sea levels are felt here in Indonesia much more intense than in other parts of the world. The torrential rains are much more intense during the rainy season but especially the longer droughts and associated landscape fires are just some of the signs we see around us. Beside these environmental effects, the underlying economic realization is as well that fossil fuels are not unlimited and will over long or short be depleted. So new development paths must be discovered to ensure the survival of civilization as we know it. Bioeconomy as defined above emerges as a viable new and different opportunity since it used the one energy source that is for free, the energy from the sun and what plants through the process of photosynthesis are generating from it: biomass and bioproducts.

Learning from nature and mimicking its processes using and harnessing bio-resources in a sustainable manner seems a viable alternative to the fossil fuel-based "carbon economy" that is our current paradigm. Seventy years ago, Mr. Glesiger gave three reasons why he thought wood would be the ideal raw material for a new civilization: He mentioned: 1. *Wood is universal*: The material wood can be used universally as building material meeting any engineering specification, food, textile fiber, motor fuels and lubricants 2. *Wood is abundant*, roughly 30 percent of land's earth mass is covered by forests. A hectare of forest is producing several times more fibre as an acre of cotton and as much sugar as the soil of the same area of sugar beets. 3. *Wood is inexhaustible*. If managed sustainably wood will forever yield all the material that the human race can conceivably require.

This statement has to be re-interpreted in the context of climate change adaptation. Changing climate patterns, recurring droughts and fires require climate change resilient forests. A lot of focus of forest management in the future will be to support the climate resilience of forests. More research is needed for tropical forests; however, the current scenarios see without control of fires a long-term gradual shift from some tropical forests to more savanna type ecosystems.

While bio-economy through its replacement of fossil fuels could work on the big questions looming above us, it should also be mentioned that it is relevant for the issues of national resource sovereignty as well. Using wood-based products, ideally waste wood or other waste material, especially in the context of biofuel makes a country less depending on importing oil and gas and addresses issues of energy self-reliance especially in the geographic setting of Indonesia with over 17,000 islands and no central energy infrastructure on the outer islands thus offering an economic potential for a different development path. This could be especially relevant for rural areas through the decentralized production of these primary bio-resources and processing facilities. Besides the more obvious biomass related issues such as bio-energy and chemical properties, we would however especially highlight the potential of non-timber forest products, like substances from organisms of the biodiverse tropical forests and its potential for the chemical industry, pharmaceutical and cosmetic industry. This is an untapped field of immense potential, which in Indonesia is hardly explored so far.

So, what is so special about Indonesia within the international bioeconomy discussion? It is interesting to note that the most advanced countries in bioeconomy discussions are the Nordic countries such Sweden, Finland and Canada. Although these countries have vast forest areas, they are missing one important factor: Sunshine all over the year!

Based on the availability of sun over the whole year and no dark autumn and winter the tropical forests produce 40% more the amount of biomass per ha than temperate and boreal forests. The carbon sequestration potential of afforestation/reforestation is specific to the species, site and management involved, and it is therefore very variable. Typical sequestration rates for afforestation/reforestation, in tonnes of carbon per hectare per year, are 0.8 to 2.4 tonnes in boreal forests, 0.7 to 7.5 tonnes in temperate regions and 3.2 to 10 tonnes in the tropics. Another aspect of relevance is the landmass and scale.

Indonesia is one of the biggest countries in the world, the distance between Sabang and Merauke equals twice the distance of London to Moscow or in other words accounts for 1/8 of the earth's circumferences. Thirdly the immense biodiversity and the unexplored genetic richness of tropical ecosystems are incomparable to the competing countries in the temperate and boreal biomes. As Safendri Komara Ragamustari director of the School of Governance and Public Policy with

Professor Endang Sukara point out in a previous Strategic Review essay: “Indonesia: Genetic diversity 101 “Indonesia harbors 10% of all flowering plants and harbors one of the largest collections of indigenous medicinal plants in the world only second to the Amazonia. In their essay, they emphasize the potential this genetic diversity has for scientific excellence and economic growth.



Looking at these strengths of Indonesia, we should also look at the current weaknesses within the Indonesian framework for bioeconomy. First and foremost, advances in bioeconomy require investments, investments from private but also from the public sector. These are no short-term investments, since Research and Development are needed in all fields. Indonesia has a very fragmented research landscape in applied research and little has been done to systematically analyse and use research done on the topic. There is room for improvement of cooperation between private sector and government on Research and Development. Although international research programmes with universities and research agencies exist, the recent past showed signs of suspicion within the Indonesian government on scientific cooperation with an increased difficulty in receiving research permits. This is coupled with a low investment influx of Foreign Direct Investment (FDI) at the moment.

There is a need for more research and applied science and materialize in concrete and a wholistic approach for a bio-economy research strategy and actions. In this context it must be noted that the current strategic bio-economy related focus is primarily focusing on biofuel within the National Energy Policy and on the agro-industry within the “Grand Strategy of Agricultural Development 2015–2045”. BAPPENAS and the Ministry of Environment and Forestry are in the progress of in formulating a strategic framework for a forest-based bioeconomy and at the 10th of May within the Ministry of Environment and Forestry conference on Non-Timber Forest Products showed promising signs indicating that the forestry sector will embrace the Indonesian discussions around “revolusi industri 4.0” through a forest resources-based bioeconomy approach looking at the ‘forest resources beyond timber’.

Opportunities exist manifold, while long-term research within the plantation sector exist, more research on wood properties and other uses of timber and other forest products should be investigated. The pulp and paper sector has been active for years but it is felt that most of this research remains strongly guarded in the hands of the private sector and more incentives from the public sector and cooperation are needed.

One aspect however that receives little attention is the research and development of new products of non-timber forest products. A study commissioned by the European Union’s Horizon 2020 research and innovation program BIOPEN project estimates that the global market for bioproducts should reach \$714.6 billion by 2021. However, little is known on the current status of bioproducts in Indonesia. That there is potential is undoubtful as the use of Nyamplung – (*Calophylluminophyllum*) as biofuel during the Japanese occupation or the current hype around the ‘money tree’ Kratom (*Mitragyna speciosa*) in Kalimantan shows.

Other potential of microbial from forest resources include (i) endophytic fungi isolated from agarwood tree, have the potential for bio-health, (ii) *Cerrenasp* for bioprocess and biotechnology, and (iii) *Morchellacrassipes* as the bio-food potential with high economic value.

The further development of these products is linked to the bioprospecting, which just recently received attention through a ministerial decree which restricts foreign research in remote areas and puts criminal charges for foreign individuals being caught in the forest without proper support documents. However, it should be mentioned that these difficult and sensitive issues are formally regulated on the international level in the Convention on Biodiversity within the so-called Nagoya protocol. Indonesia has signed this protocol which foresees that an *Access and Benefit Sharing* (ABS) mechanism shall be established in each member country. Indonesia has established such a mechanism hosted under the Directorate General of Natural Resources and Ecosystem Conservation DNA in the Ministry of Environment and Forestry, where a procedure and database for research and products derived from natural resources has been established. The system needs to be fully functional and improve in administrative and scientific hurdles to operationalize ABS mechanism in Indonesia.

The innovation of this benefit-sharing mechanism is that the rights to the products shall be documented and given to the owner of the resource, which in practice means in many cases recognizing the role to the customary *Adat*, *local* community that has been using these materials over centuries, and the role of innovations. And this is where these bioeconomy discussions link with the underlying forest governance reform in Indonesia. Indonesia has embarked on the journey to include local *Adat* and local communities for forest management, as well as advancement in the recognition of science and innovation to advance this local knowledge for realizing a more equitable sharing of benefits from the manifold treasures found and to be discovered in the tropical forest of Indonesia.

To balance the overall bioeconomy strategic development in Indonesia it is important to realize that there are 3 competing dimensions within the overall conceptional bioeconomy framework. In principle the goals of food security are competing with the production of biomass for fuel or other biomaterials and both these goals must be balanced with ecological and nature conservation goals. These three considerations have to be well-adjusted and regulated within a clear policy and sustainability framework. Indonesia as a country should answer these questions within an overall bioeconomy strategy along with clear mandates and budget lines to bring this issue forward.

Conflicting dimensions of the bioeconomy concept, Ultimately Indonesia has to decide for herself if it wants to be a mere producer of raw materials or as working along the value chain. The fundamental question within the bioeconomy strategic discussions to ask is: Do you want to export raw materials, products or ideas? Very relevant questions around the concept of *industri 4.0* being currently discussed in political circles. We believe that the time is now to guide this economic development path for future generations.

Based on the discussions above, we would recommend the following steps for consideration:

1. Establishment of a bio-economy advisory center through a presidential instruction or inter-ministerial declarations. To initiate the policy process based on scientific and knowledge systems support, which is in charge of development of an intersectoral bioeconomy strategy for Indonesia. This institutional set up is time-based with the mandate of coordinating between ministries. This center would not have the difficulties of 'competing interests' but would have the sole function of coordinating and enabling the different ministries for a coordinated effort in addressing bioeconomy development within Indonesia. As a "Center", it could encourage the establishment of working unit (unit kerja) which implementing bioeconomy program in related ministries, such as Forestry, Agriculture, Fisheries and Marine Affairs, which could promote pharmaceutical, bioenergy, genetic engineering, and other relevant industries.
2. As a result of the above-mentioned policy coordination process and to ensure long term funding the topic bioeconomy should be attached to the relevant line ministries and the Ministry of Research, and Technology or BRIN.
3. As an additional prerequisite the term bioeconomy should be included in the next National Medium Term Development Plan (RPJMN 2025-2030). BAPPENAS has a leading role in this process. This would ensure budget lines in the line ministries could be included. It is further suggested to include measurable Key Performance Indicators (KPI) for bioeconomy in these sector plans to evaluate performance over the years.
4. Form networking partnerships: There are several examples of formal bilateral agreements between countries for technology transfer and joint bio economy partnerships. As an example, Germany has formal bio economy development partnerships with several countries such as Uruguay and Brazil in furthering bioeconomy development and partnerships in research and development for joint benefits.

5. Further invest in public research, education and development and engaging in research cooperation with international universities and research centers and encouraging FDI in the development of bio-technology within a clear framework.

6. Continue the recognition for communities and customary (Adat) knowledge as well as acknowledging the use and advancement of traditional knowledge to be able to engage in workable Access and Benefit-sharing mechanism for further development of medicinal, pharmaceutical and cosmetic substances in the future.

Finally, we would like to quote parts of the global declaration of the second World Bioeconomy Forum held in Finland this September 2019: “.. *bioeconomy is right at the heart of solutions to climate change. Through its strategy and actions, stakeholders must be committed to the bioeconomy with the knowledge that it is a crucial tool to mitigate climate change and to operate as such*” and hope that this essay contributes to Indonesian discussions on bioeconomy and inspires for action to support SDGs.

*)

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