Implementation of Nagoya Protocol – the Case Study of Indonesia

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DOI: https://doi.org/10.3329/bioethics.v11i2.49262

Abstract: Indonesia consists of more than 17,000 islands separated for hundreds of thousands of years, which consequently results in biodiversity and cultural diversity richness. Strong connection between people and biodiversity form a vast array of traditional knowledges which are related to the conservation and the use of biological diversity. During the last 3 decades, tremendous advancement in science and technology has been able to uncover the intrinsic value of biodiversity. Many lead chemical compounds have been isolated and identified from, and have opened up huge opportunities in developing new businesses based on biodiversity. The consciousness of the intrinsic value of biodiversity is, however, only being understood by countries with high science and technology capacity. The intrinsic value of biodiversity remains abstract to most of the people in the developing and less developed nations. The Convention on Biological Diversity (UN-CBD), Cartagena and Nagoya Protocol are legal documents to ensure conservation, sustainable use and sharing of the benefits from the utilization of biodiversity and its components. Nagoya Protocol dealing with access and benefit sharing from the utilization of biological materials has open new and better opportunities for the developed nations to study the potential use of biological resources exist in developing and less develop nations. The implementation Nagoya Protocol on access, fair and equitable sharing of the benefit from the utilization of biodiversity very complex and full with ethical dilemmas. Basic principles stipulated in the Universal Declaration on Human Rights and Bioethics UNESCO 2005 e.g. consent, persons without the capacity to consent, equality, justice and equity, respect for cultural diversity and pluralism, solidarity and cooperation, sharing of benefits, protecting future generations, protection of the environment, the biosphere and biodiversity may be applied in addressing ethical issues.

(Some part of this article was presented at 20th Asian Bioethics Conference, Dhaka, Bangladesh).

Introduction: Biodiversity is the variety of life on Earth. It is the most complex feature of our planet and it is the most vital. Without biodiversity, there is no future for humanity. Biodiversity is important to support life systems and to keep our planet green and healthy. There is no record of the number of species on Earth, but it is estimated to be around 10 million. The total number of species used by human civilization for food, health and energy is very limited. The majority of species are remained untapped [1,2].

It is believed that biodiversity has an enormous value as genetic resources. Biodiversity plays an important role in nutrient cycle, soil formation. Plant resources and photosynthetic organisms have a tremendous vehicle as an active carbon sink and controlling the climate. The presence of biodiversity is also an important

element in controlling diseases, natural disaster protection, and erosion control. Biodiversity has a spiritual value, source of education and knowledge, recreation and esthetical values[3]. During the last 2 decades, the advancement of science and technology, biotechnology growing rapidly and influence mankind understanding on the important of biodiversity related to food, health, and energy. Biodiversity is now becoming an important asset for bioeconomy.

Indonesia is a maritime country with more than 17,000 islands across the equator, laying between Asia and Australia. The Islands are separated from each other for hundreds of thousands of years. It is no doubt that species exist in the islands undergone a long period of isolation and adaptation creating species endemicity of both flora and fauna. Komodo for example is only found in Komodo Island while a single horn Rhino is only found in West Coast of Java and Maleo bird is endemic to Sulawesi Island. Indonesia is also blessed with over 42 terrestrial ecosystem types and more than 5 ocean ecosystems from ice landscapes and alpine mountains, to *spectacular coral reefs, sea grass beds* and deep weber seas[4]. It is obvious that Indonesia is known as a mega bio-diversity country source? There are about 1.500 species of algae, 80.000 species of cryptogrames, 595 species of lichenes, 2.197 species of fern, 30.000 to 40.000 species of plants, 8.157 species of animal (mammal, birds, herpetofauna, and fish) and 1.900 butterfly species [5]. Among them, 270 species of mammals, 386 species of birds, 328 species of reptiles, 204 species of amphibian, and 280 species of fishes are endemic[5]. In Indonesian context, the connection between people, cultures, traditions and biodiversity is strong. The vast array of traditional knowledge accumulated and being embodied in daily life for hundreds of thousands of years. Traditionally, biodiversity used as food, source for medicine, fiber for clothing, coloring agent, source of energy. The way of using biodiversity is quite diverse depending on the tribes in the country.

In relation to food, Indonesians consume around 100 plant species as carbohydrate sources, 100 legume plants, 450 species of fruits and 250 species of vegetables, diverse species of animals, both terrestrial and aquatic, mushroom, fungi and microbes [6].

Study in an area of 1 ha of the low land forest in Sumatera, there are more than 300 species of plant observed. Evaluation using ethnobotanical analysis, the total number of 51 plants species are used as source of fruit, 21 species as source of vegetable, 6 species for spices, 77 species as source for traditional medicine, 2 plants species containing poison, and 45 species as a source of energy (firewood), 65 species as raw material for craft and art, 157 species for construction and 27 species are suitable for future pulp, paper and plywood industry [7].

Related to health, the use of diverse plant species is already embedded to the culture of Javanese tribes. The mixer of plant species is blend and sell to the market as traditional medicine, jamu. Around 75 percent of Indonesians consume jamu on a regular basis, either to prevent or treat diseases Jamu has been an integral part of Indonesia's socio-cultural identity [8]. The use of diverse plants species as medicine is already exist since ancient time in Indonesia.

Advancement of Science and Technology in Utilizing Biodiversity: The advancement of science and technology has opened our understanding on the value of biodiversity unexpectedly. Deep study on around 200 plant species extracts native to Indonesia by the Indonesian Institute of Sciences (LIPI) cooperated with cosmetic industry, Shiseido in 2007, the total of 30 lead molecules found and may be patented. Advancement of science and technology may unlock the intrinsic value of the Indonesian plant biodiversity and open opportunities to bring this research output to commercial. Another example is *Scorodocarpus borneensis* (Baill) Becc, a family of Oleaceae traditionally, the seed and bark are used as vegetable, root and fruit as medicine and ritual ceremony [9]. This species is one among 200 rare plant species to Indonesia [10]. Using sophisticated equipment, LC-MS and NMR, supported by DEPT techniques, this species containing Scorocarpine B which is leukemia cell inhibitor[11]. In addition, during the last 3 decades, tremendous advancement of science and technology has been able to continuously uncover the intrinsic value of biodiversity. In the near future, many lead chemical compounds may also be isolated and identified from microbial genetic resources. *Pseudobotyris terrestris* from Wallacea region is a fungal species reported by Uchida [12] and Fraga [13] has an ability to produce enzymes for lipid digestion which may important for treating obesity and atherosclerosis in the future. Diverse actinomycetes and actinomycetes non streptomycetes are successfully being isolated from the regions. The potential value of non-actinomycetes non streptomycetes are tremendous for degrading polylactate resin and plastics, as a raw material for developing anti-cholesterol, antibiotics, anti-viral. anti-tumor, anti-neoplastic, stabilizer for medicine, food, cosmetics, for the production of industrial enzymes, diagnostics, food colorant, and novel paints coatings [14].

The expedition to Foya Membramo, Papua – Indonesia, discovered many new species of reptiles, fishes, birds, and mammals. It is not only important for taxonomists, but also as materials in drugs discovery project. Frog from genera of Xenopus, Silurana, Hymenochirus, and Pseudhymenochirus in the family Pipidae containing gene responsible for the synthesis of small aphifilic peptide collapsing ion-gradients and lethal to many microbial pathogens. Frogs skin are a rich source of genes important in producing peptides with varying degrees of antimicrobial activities and cytotoxicities to mammalian cells. Magainin, peptide glycine-leucine-amide (PGLa), caerulein-precursor fragment (CPF), and xenopsin-precursor fragment (XPF) peptides have been isolated from norepinephrine-stimulated skin secretions from several species of Xenopus and Silurana. Analogs of the magainins, CPF peptides and hymenochirin-1B with increased antimicrobial potencies and low cytotoxicities have been developed that are active (MIC < 5 μM) against multidrug-resistant clinical isolates of *Staphylococcus aureus*, *Escherichia coli*, *Acinetobacter baumannii*, *Stenotrophomonas maltophilia* and *Klebsiella pneumoniae*. Despite this, genes having therapeutic potential in frog skin as an anti-infective agents for anti-cancer, anti-viral, anti-diabetic, or immunomodulatory drugs [15].

Another great achievement is in pain therapy. A chemical compound called Ziconotide, which is also known as SNX-

111, is a novel non-opioid analgesic drug. Ziconotide is actually a synthetic version of ω-conotoxin MVIIA (ω-MVIIA), which is a peptide that is found in the venom of the fish-eating marine snail, *Conus magus* [16]. There are more than 600 different species of cone snails exist. It belongs to the phylum of Mollusca and the genus Conus. Most of the species inhabit the warm water of tropical reefs. The venom of each species of cone snail contains its own unique mixture of chemicals. This increases the likelihood that some of the chemicals may be useful to humans in the future. Ziconotide itself could be up to 1,000 times more effective than morphine at relieving pain and has the added advantage of not being addictive. In addition, it doesn't cause the development of tolerance in the patient. Tolerance is a state in which a medication that was once effective no longer works. Ziconotide is used after other analgesics have been tried and have failed to work. It is prescribed only for people who are suffering from intense and prolonged pain, such as the pain that may be experienced by people with certain types of cancer or for people experiencing neuropathic pain. Ziconotide is sold under the brand name of Prialt. Santa Cruz Biotech News mentioned that ziconotide is sold as a selective antagonist of N-Type Voltage Sensitive Calcium Channels (VSCC) with a current price of US$ 6.500.000 per gram [17].

Currently, data of entire genome sequences of organisms can be extracted and saved as electronic files. The genomic data has the potential to be used to develop production systems for fine chemicals without the need to grow or cultivate the source organism, known as synthetic biology. Thus, through synthetic biology, genetic resources, genes can be utilized readily for economic benefit. An example of the production of chemical compounds using synthetic biology is done by Evolva, a Switzerland-based company. The company produces vanillin through synthetic biology. Genes in the vanillin biosynthetic pathway were inserted in yeast, and are being used to convert sugar into vanillin. The fluctuating production and price of natural vanillin due to climate change and other factors will most likely make synthetic biology-vanillin a viable option in the future.

With those examples, biodiversity could be used as a good starting point for establishing bio-based industry including synthetic biology. Biodiversity is an important asset in developing a blue-print to establish production pathways of high-value chemical compounds using genetic data from biodiversity which could boost economic development while increasing science capacity. Access to biodiversity is mandatory. Legally binding protocol, Nagoya Protocol, is in place. The implementation of this protocol will not be always easy and need to concider bioethics principles.

How to proceed: The implementation Nagoya Protocol on access, fair and equitable sharing of the benefit from the utilization of biodiversity is very complex and full with ethical dilemmas. Basic principles stipulated in the Universal Declaration on Human Rights and Bioethics UNESCO 2005 such as consent (persons without the capacity to consent), equality, justice and equity, respect for cultural diversity and pluralism, solidarity and cooperation, sharing of benefits, protecting future generations, protection of the environment, the biosphere and biodiversity may be applied in addressing ethical issues may help to smoothen its implementation.

The consent of most people in developing countries and less developed nations on the intrinsic value of biodiversity is lacking. For this reason, before access to biological resources, the capacity to consent the people in the developing country and less developed nation own biodiversity should first be improved.

With an appropriate knowledge on the intrinsic value of biodiversity, the equality, justice and equity may be developed through continues dialog. Respect on cultural and traditional knowledge should become an instrument for access to biodiversity. In the implementation of Nagoya Protocol, solidarity and cooperation, sharing of benefits are an important part which should be understood by all parties involved.

The developed country who owns the technology need an access to biodiversity, basic principles of bioethics should be incorporated in the mechanism of access to ensure fair and equitable sharing of the benefit from the utilization of biodiversity and its components.

When access granted, another basic principle of bioethics, protecting future generations, protection of the environment, the biosphere and biodiversity is mandatory. Over exploitation should be prevented to ensure that biodiversity is conserved, used sustainably while creating the prosperity for all.

Trust between countries rich in biodiversity and countries having high science and technology capacity at all levels is becoming a crucial factor. Greater transparency and recognition on comprehensive rights of people providing biodiversity is a key element in maintaining trust.

Global community has signed three legally binding protocol namely the Convention on Biological Diversity (UN-CBD) signed at the Earth Summit in Rio de Janeiro, Brazil, in 1992 and entered into force on 29 December 1993, Cartagena Protocol on biosafety adopted on 29 January 2000 and entered into force on 11 September 2003 and Nagoya Protocol on Access to genetic resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity which entered into force on 12 October 2014. Those three legal documents should be used to properly manage biodiversity to ensure conservation, sustainable use and sharing of the benefit from the utilization of biodiversity and its components. Those three legally binding protocols are now ratified by Indonesian by releasing national legislation namely Act No. 5 Th 1994, Act No. 21 Th 2004 and Act No. 11 Th 2013. The CBD, Cartagena and Nagoya Protocol are in line with the Indonesian Constitution, which clearly states that all-natural resources belong to the state and are to be used for the utmost welfare/benefit of the people of Indonesia.

In the Preamble of the Convention on Biological Diversity, it is mandatory for each contracting party conscious the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components and on the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere. Conservation of biological diversity must be a common concern of humankind, and each contracting party is responsible for conserving their biological diversity and for using their biological

resources in a sustainable manner. Each contracting party is also fully aware that the conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of the growing world population, for which purpose access to and sharing of both genetic resources and technologies are essential. The implementation of such protocol can not solely depend of rule and regulation but need ethics/bioethics considerations.

Trust between countries rich in biodiversity and countries having high science and technology is the most crucial factor in implementing Convention on Biological Diversity including Cartagena and Nagoya Protocol. There is also a need for greater transparency on the possible future value of biodiversity through research and development. Access to biodiversity is subject to negotiation while respecting a comprehensive right of the local peoples, their needs and aspirations for sustainable development and poverty alleviation.

A rights-based approach would be important to promote people's knowledge about the existence of their rights and to develop political strategies to make people's rights become reality. Statement from Australian National Health and Medical Research Council is fundamental: The responsibility for maintaining trust and ethical standards cannot depend solely on rules or guidelines. Ethical consideration should be an integral part in the implementation of such rules and guidelines. In developing products of both research and researchers should involve people transparently and honestly especially when dealing with values and principles. The elimination of 'difference blindness' and a subtlety of judgement is required to eliminate prejudice and maintain respect.

Model Legislation should be developed to provide a comprehensive scheme for ensuring conservation and sustainable use of biological resources and to support for the 'inalienable rights of local communities over their biological resources, knowledge and technologies'. Access to biological resources subject to prior informed consent of local communities, fair and equitable sharing of benefits, effective participation of local communities and appropriate institutional mechanisms to ensure effective implementation of Nagoya Protocol on Access and Benefit Sharing.

Conclusion and recommendation: Nagoya Protocol on Access and Benefit Sharing from the utilization of biological resources is an important step to get most benefit from biological resources. The protocol could be a vehicle for strategic partnership between country rich in biodiversity and country with greater capacity in science and technology. Due to the nature of biodiversity where the intrinsic value of the resources is uncertain and can only be elucidated by advance science and technology, the implementation of Nagoya Protocol full of ethical dilemmas. Rule and regulations is not sufficient in implementing access and benefit sharing properly. Ethics/Bioethical consideration is of importance. Basic principle stipulated in the Universal Declaration on Human Right and Bioethics UNESCO may incorporated to ensure smooth implementation of the protocol.

Acknowledgements: Greatly acknowledge the Universitas Nasional and the Indonesian Academy

of Sciences for giving me an opportunity to participate in the 20th Asian Bioethics in Dhaka, Bangladesh. Acknowledgement also directed to the Organizing Committee for inviting me to join this Symposium.

References:

1. Sukara, E. The 4th International Conference on Sustainable Future for Human Security (SUSTAIN) 2013, Clock Tower Centennial Hall, Kyoto University, Japan, Kyoto, October 2013; 18-21, 2013
2. Sukara, E. Biodiversity a Common Wealth for a Crowded Planet. *The 2nd GSS Leading Expert Seminar – Graduate School Programme for Sustainable Development and Survivable Societies, Kyoto University – Japan December 19, 2013*.
3. Sukara, E. Tropical Forest Biodiversity to provide food, health, and energy solution of the rapid growth of modern society. Procedia Environment Sciences 2014; 20: 803 – 808.
4. Sukara, E. 2019. Capacity Building as Mutual Benefit in Life Sciences Research Collaborations. National Workshop: Evaluation of Capacity Building Measure as Impacts of Research Permits. Indonesian Ministry for Research and Higher Education, Jakarta.
5. Widjaja, E. A., Y. Rahayuningsih, J. S. Rahajoe, R. Ubaidillah, I. Maryanto, E. B. Walujo dan G. Semiadi. Kekinian Keanekaragaman Hayati. 2014, LIPI Press, Jakarta: Indonesia.
6. Walujo, E. B. Keanekaragaman hayati untuk pangan. Konggres Ilmu Pengetahuan Nasional X Jakarta, 8 – 10 Nopember 2011.
7. Rahayu, M., S. Susianrti and Y. Purwanto. Kajian pemanfaatan tumbuhan hutan non kayu oleh masyarakat local di kawasan konservasi PT Wira Karya Sakti Sungai Tapa – Jambi. Jurnal Biodiversitas 2007; 8(1): 73 –78.
8. Ragamustari, K. RLeveraging jamu heritage using science and technology. The Jakarta Post, Jakarta / Mon, April 8, 2019 / 03:04 pm.
9. Siagian, M.H., M. Rahayu dan U. Hapid. Telaah pemanfaatan tumbuhan "bawa hutan" (*Scorodocarpus borneensis*) di Daerah Kenohan – Kalimantan Timur. *Prosiding Seminar Nasional Etnobotani III.* Dsnpasar – Bali, Hal" 2000, 270-273.
10. Mogea, J.P.M., D. Gandawidjaja, H. Wiriadinata, R.E. Nasution dan Irawati. *Tumbuhan Langka Indonesia*. Buku Seri Panduan Lapangan. Pusat Penelitian dan Pengembangan Biologi – LIPI. Balai Penelitian Botani, Herbarium Bogoriense. Bogor, Indonesia, 2001.
11. Kartika, R., T. Barus, R. Surbakti, and P. Simanjuntak. Structure Characterization of Alkaloid Scorodocarpines derivative from Fruits of *Scorodocarpus borneensis* Becc (Olacaceae). Asian Journal of Chemistry. 2014; 26 (18): 6047-6049. http://dx.doi.org/10.14233/ajchem.2014.16562. (Updated on September 23, 2019).
12. Uchida, R., Y. Pil Kim, I Namatame, H. Tomoda and S Omura. Sespendole, New inhibitor of lipid droplet synthesis in macrophages, procuced by Pseudobotrytis terrestis FKA 25. The Journal of Antibiotics 2006; 59 (2): 93–97.
13. Fraga, B. M. Natural sesquiterpenoids. Natural Product Report, Stanford University, Stanford, USA,2007.
14. Sukara E, P. Lisdiyanti, H. Yamamura, J-Y. Park, Y. Kurihara, N. Sukarno, W. Sjamsuridzal, K. Ando, and Y. Widyastuti. Potentials of the Wallacea Biodiversity in Bioprospecting. *Berita Iptek* 2009; 47 (1): 9- 18.
15. Conlon, J. M. and M. Mechkarska. Host-Defense Peptides with Therapeutic Potential from Skin Secretions of Frogs from the Family Pipidae. Pharmaceuticals 2014, 7, 58-77; doi:10.3390/ph7010058.
16. McGivern, J. G. Ziconotide: a review of its pharmacology and use in the treatment of pain. Neuropsychiatric Disease and Treatment 2007; **3**(1): 69–85.
17. Crampton, L. Cone snail venom facts and potential medical benefits. 2019. https://owlcation.com/stem/Cone-Snails-Dangerous-Venom-With-Medicinal-Uses (Updated on September 23, 2019).

Author contribution: 1st author Endang Sukara conceived the idea, designed of the manuscript, performed the literature search, wrote the initial draft, checked the manuscript meticulously and gave final approval of the manuscript for submission. 2nd author Safendrri Komara Ragamustari did the critical revision of the article, performed the literature search and gave the final approval of the manuscript for submission. 3rd author Ernawati Sinaga performed the literature search, revised the article critically and checked the manuscript meticulously and gave final approval of the manuscript for submission.

Conflict of interests: No conflict of interest in this study to declare.