Indonesian Young Academy of Sciences (ALMI):

Science for Indonesian Biodiversity

Tatas Hardo Panintingjati Brotosudarmo

- Vice President for Science & Policy, Indonesian Young Academy of Sciences (ALMI)
- Senior President, Indonesian Chemical Society
- Director, National CoE Ma Chung Research Center for Photosynthetic Pigments, Malang

Capacity Building Workshop on Biodiversity and Its Research Management, September 23-24, 2019, National Library of the Republic of Indonesia Building, Jakarta
Republic of Indonesia

Official Language (Lingua Franca)
Indonesian

Area
5,455,675.22 km²
35.03% Land
64.97% Water

Number of Island
17,508

Ethnic Groups
> 300

Spoken Languages
> 700

State Recognized Religion
Islam, Christianity, Hinduism, Buddhism, and Confucianism

GDP (PPP) 2019 estimate
$14,020

Gini (2017)
39.5

Population 2017
World Bank
263,991,379

https://www.drivingdirectionsandmaps.com/indonesia-google-map/
ALMI MISSIONS

➢ Encourage the creation of the advancement of frontier of science through cross-disciplinary collaboration among young scientists.

➢ Encourage the creation of scientific temper and the development of scientific culture of excellence in the younger generation.

➢ Encourage the use of science in the formulation of public policy.

➢ Become a part of the global young academy movement in responding to global challenges.
ALMI WORKING GROUP

Indonesia as a united, sovereign, fair, prosperous, superior, competitive and respected nation in the world.

Advancement of **science** and scientific **culture of excellence** in Indonesia, with the aim to increase the nation's **competitiveness**

**ALMI WORKING GROUPS**

- Frontier of Science
- Science & Society
- Science & Policy
- Science & Education
AGENDA 2030 SUSTAINABLE DEVELOPMENT GOALS
FROM AN INDONESIAN PERSPECTIVE UNDER JOKOWI’S ADMINISTRATION

"Indonesia is committed to become a world leader and inspire others in development, as NAWACITA is aligned with the sustainable development goals 2015-2030" (Jokowi, 2015)

STRENGTHEN INDONESIA’S POSITION IN THE GLOBAL DEVELOPMENT

REFORMING MULTILATERAL ORGANIZATIONS

ACTIVE PARTICIPATION

DIRECT ROLE IN GLOBAL DEVELOPMENT

THE BENEFITS OF NETWORKING AND FINANCING TO FOSTER NATIONAL DEVELOPMENT

POST-2015 DEVELOPMENT AGENDA/SUSTAINABLE DEVELOPMENT GOALS (SDGs)/AGENDA2030: 2015-2030

UNITED NATIONS

IMPROVED GLOBAL DEVELOPMENT

THE 70TH GENERAL ASSEMBLY (SEPTEMBER 2015)

HISTORICAL DATES:
- 19 July 2014: FORMULATION OF GOALS & TARGETS
- 2 August 2015: FINALISATION OF SDGS WITH MOIS
- 25 September 2015: ADOPTION OF SDGs BY MEMBER STATES

 Courtesy of Dr. Yanuar Nugroho, ALMI Fellow, Deputy Chief of Staff, Executive Office of the President, Republic of Indonesia
NAWA CITA AND SUSTAINABLE DEVELOPMENT GOALS: ALIGNMENT AND REINFORCEMENT

1. To renew the state’s obligation to protect all people and provide security to all citizens
   - Goal 17, 16, 10, 3

2. The presence of the government through a clean, effective, democratic, and reliable governance,
   - All Goals

3. To build Indonesia from its periphery; to strengthening the rural areas within the framework of a unitary state of Indonesia.
   - Goal 1-11

4. To reject a weak state by reforming the system through corruption-free, dignified, and reliable law enforcement.
   - All Goals

5. To improve the living quality of all citizens
   - Goal 4, 2, 3, 6

6. To improve people’s productivity and competitiveness in the international market
   - Goal 1-10

7. To achieve economic independence by moving the strategic sectors to domestic economy.
   - Goal 1, 2, 3, 4, 5, 8, 9, 12

8. To revolutionise the nation’s character
   - Goal 3, 4, 11

9. To strengthen diversity and social restoration of Indonesia
   - Goal 17, 16, 10, 5

Courtesy of Dr. Yanuar Nugroho, ALMI Fellow, Deputy Chief of Staff, Executive Office of the President, Republic of Indonesia
How do we contribute actively to achieve these goals?
Strategy in the Science & Policy Working Group

Enabling Community

Research Funding System

Community of Researchers

Indonesia Science Agenda

National Science & Technology System Bill

Science for Indonesian Biodiversity
Enabling Community: Directing Science Agenda

From the preparation of SAINS45, born:

Supported by

Kementerian PPN/ Bappenas

Knowledge Sector Initiative

USAID From the American People

Australian Aid

TEMPO INSTITUTE Center for Excellent Journalism

KOMPAS
Enabling Community: Directing Science Agenda

SAINS45:
Dreams and Ideals of Indonesian Young Scientists in 2045
Enabling Community: Directing Science Agenda

SAINS45:
45 Fundamental scientific questions for the future of Indonesia

- Fundamental scientific questions that have strategic value to tackle the main problems faced by the Indonesian people.

- The solutions offered have a great impact in answering these problems while advancing science in Indonesia.

- Time frame - leading to the celebration of One Century of Indonesian Independence.

- Utilizing young Indonesian scientists connected through the AIPI Frontiers of Science annual meeting since 2010.
Enabling Community: Directing Science Agenda

United, sovereign, just, prosperous and respected INDONESIA

8 Clusters of Questions

I. IDENTITY, DIVERSITY, AND CULTURE
II. ARCHIPELAGO, MARINE, AND BIORESOURCES
III. LIFE, HEALTH, AND NUTRITION
IV. WATER, FOOD, AND ENERGY
V. EARTH, CLIMATE, AND THE UNIVERSE
VI. DISASTERS AND COMMUNITY RESILIENCE
VII. MATERIALS AND COMPUTATIONAL SCIENCE
VIII. ECONOMY, SOCIETY AND GOVERNANCE

Clusters of Questions
The establishment of research funding system...

The Indonesian Science Fund (Dana Ilmu Pengetahuan Indonesia, DIPI) provides independent scientific research funding for investigators who show evidence of strong and exemplary scientific merit and potential.

We aim to elevate the overall quality of Indonesian research to produce cutting edge science to build Indonesia’s global competitiveness through sustainable financial infrastructure. DIPI grants are autonomous from the state budgeting cycle and state financial administration system. Applications for research funding are reviewed by panels of independent experts.

SAINS45 has been adopted by DIPI as reference for research focus areas
Available online at www.aipi.or.id

I. IDENTITY, DIVERSITY, AND CULTURE
1. What makes Indonesia "Indonesia"?
2. Torang Samua Basudara: one nation in the midst of diversity
3. Nationalism in the era of transnationalism
4. How technology reshape humanity?
5. Footprints of human evolution in Indonesian archipelago
6. Changing architecture of science: how to respond?
7. Mega-biodiversity: how will this Noah's Ark survive?
8. Caring for marine biodiversity is caring for the future
9. In the sea, will we triumph?
10. How can we feed the world from our seas?
11. Poverty in coastal communities: irony in abundance
12. Potentials of the extreme deep seas

IV. WATER, FOOD, AND ENERGY
20. Water for all: how to secure it?
21. Smart agriculture for the best yield
22. Agriculture beyond food: vaccines and medicines
23. Geothermal energy, the hidden treasure

III. LIFE, HEALTH, AND NUTRITION
13. Are we what we eat?
14. The journey of germs: between animal, human, and environment
15. How to outsmart pathogens?
16. Exploring the archipelago for medicine
17. How to remain healthy in old age?
18. How to prepare for an aging population?
19. Beyond stem cells, what is next?

V. EARTH, CLIMATE, AND THE UNIVERSE
24. Understanding the dynamic nature of the mother earth
25. Tropical forests: to conserve or to convert?
26. How does waste become a blessing?
27. Deciphering the might of Indonesian maritime continent
28. Carbon and climate change: the cycle that shapes human destiny
29. Exploring the universe from the equator

VI. DISASTERS AND COMMUNITY RESILIENCE
30. Living on this restless earth
31. Measuring latent coastal and oceanic disasters
32. Living with disaster

VII. MATERIAL AND COMPUTATIONAL SCIENCE
33. Scanning the earth, counting nature's gifts
34. In search of green mining
35. Harvesting solar energy: inventing novel materials
36. Material designs for strategic industries
37. Computational science and complex systems for Indonesia

VIII. ECONOMY, SOCIETY AND GOVERNANCE
38. One country, one nation, one economy
39. Wanted! Institutions that guarantee and drive prosperity
40. Will the youth continue to write Indonesia's history?
41. What new forms will inequality and poverty take in the future?
42. How to filter the flood of information?
43. How to formulate public policy that is both effective and democratic?
44. Education for human development
45. How can we make humane people-oriented laws?
What next?

• Translating SAINS45 Agenda into an actionable science policy:
• Pilot Study: Science for Indonesian Biodiversity
WHY BIODIVERSITY?
Home to 11% of the Earth’s species (terrestrial biodiversity)
The world’s richest marine biodiversity
Policy Advices: Science for Indonesian Biodiversity

Numbers of endemicty and species richness in Southeast Asia (Modified from Sodhi dkk, 2004)
Global distribution and biodiversity levels of three key ecosystems in coastal and marine areas, namely coral reef ecosystems, mangrove forests, and seagrass beds.

Indonesian waters have the highest biodiversity in the world for these three ecosystems.
Function of Coral Symbiont:

1. **Detoxification:** Hydrogen sulfide is toxic to a wide range of eukaryotic organisms, such as coral and sponges. Previous studies have suggested that the co-existence of sulfur-oxidizing bacteria might convert hydrogen sulfide to sulfate, thereby contributing to coral health.

2. **UV-Blue Light Protection:** Ability of carotenoid to absorb UV-Blue light radiation contributes to the protection of coral from bleaching.

The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps.

Georg Eberhard Rumphius  
1627-1702  
Pioneer of tropical taxonomy and botany

Franz W. Junghuhn  
1809-1864  
Plant acclimatization efforts

Alfred Russel Wallace  
1823-1913  
Theory of evolution & modern biogeography (with Charles Darwin)

Christiaan Eijkman  
1858-1930  
Nobel Prize 1929 in medicine for the discovery of vitamins

Eugene Dubois  
1858-1940  
Inventor of fossils Homo erectus in Sangiran
The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps.
The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps.

**Alexander von Humboldt Anniversary**

September 14th, 2019 marks 250 years since the birth of explorer-naturalist Alexander von Humboldt. This collection celebrates his life and legacy by bringing together articles on ecology, global change, and geoscience from across six Nature journals.

"He who, with a keen appreciation of the beauties of nature manifested in mountains, rivers, and forest glades, has himself traveled over the torrid zone, and seen the luxuriance and diversity of vegetation, not only on the cultivated sea-coasts, but on the declivities of the snow-crowned Andes, the Himalaya, or the Nilgherry Mountains of Mysore, or in the primitive forests, amid the net-work of rivers lying between the Orinoco and the Amazon, can alone feel what an inexhaustible treasure remains still unopened by the landscape painter between the tropics in both continents, or in the island-world of Sumatra, Borneo, and the Philippines" [Humboldt, 1877 (1845), vol 2, p93]
The wealth of Indonesia's mega-diversity has inspired the birth of a large number of global scientific leaps

”Over the next decade Haeckel travelled a great deal – mainly within Europe but also to Egypt, India, Sri Langka, Java and Sumatera. He still taught students at Jena, but his was happiest when travelling. His passion for adventure never disappeared. In 1900, aged sixty-six, he went on expedition to Java, the mere prospect of which, his friends commented, ’rejuvenated’ him. During these explorations, he collected specimens but also sketched. Like, Humboldt, Haeckel thought that the tropics were the best place to understand the fundamental of ecology.” –page 309

Ernst Heinrich Philipp August Haeckel (1834 –1919) was a German zoologist, naturalist, philosopher, physician, professor, marine biologist, and artist who discovered, described and named thousands of new species, mapped a genealogical tree relating all life forms, and coined many terms in biology, including ecology, phylum, phylogeny, and Protista.
Policy Advices: Science for Indonesian Biodiversity

Biodiversity drives economic development

Figure 5. Indonesia Green Beans Export Markets 2017 vs 2018 (ton)

THE CHALLENGES FACED BY BIODIVERSITY

United Nations’ 3rd Global Diversity Outlook raises 5 main reasons for the loss of biodiversity:

1. Loss and degradation of habitat:
2. Climate change;
3. Pollutions
4. High exploitation and unsustainable use resources
5. Massive invasion of alien species;

*Human ecological footprints increasingly exceed earth’s biocapacity.*
Policy Advices: Science for Indonesian Biodiversity

Topics

1. the need for adequate knowledge regarding the wealth of Indonesia's biodiversity
2. damage to important ecosystems and the threat of extinction of various species
3. the potential for optimal biodiversity benefits
4. strengthening of science and technology related to potential utilization and biodiversity conservation
5. roles in formulating various related policies
Policy Advices: Science for Indonesian Biodiversity

Recommendations:

A. National Investment Priorities in Biodiversity Utilization and Management
1. Development of Science-Based Ecotourism
2. Bioprospection for Drug Discovery and Energy
3. Deep Sea Exploration

B. Developing Science and Technology for Indonesian Biodiversity
Developing Science and Technology for Understanding the Basic Characteristics of Indonesian Megabiodiversity
2. Increasing Understanding of Ecosystem Balance for the Continuity of Protection of Endemic and / or Endangered Species.
3. Understanding the Pattern of Biodiversity Adaptation to Global Development and Climate Change.
4. Strengthening Indonesian Biodiversity Specimen Banks
Recommendations:

B. Developing Science and Technology for Indonesian Biodiversity

Increasing Community Participation in Efforts to Manage Productive and Sustainable Biodiversity
1. Increasing Public Awareness of the Importance of Biodiversity
2. Developing Local Wisdom
3. Develop Citizen Science and Computational Data

Improving the Utilization and Economic Value of Excellence in Indonesian Biodiversity

Utilization and Exploitation of Ecosystem Services
Technology Inspiration from Nature: Developing Biomimicry Science
Sustainable Use of Deep Sea Resources
Recommendations:

B. Developing Science and Technology for Indonesian Biodiversity

*Develop and Improve the Effectiveness of Conservation and Governance of Biodiversity*

1. Restoration and conservation of key ecosystems: forests, mangroves, seagrass beds, and coral reefs
2. Interaction and impact of alien species on local species

C. Human Resource Development

D. Institution and Funding

1. Competitive Funding System, Autonomy, and Sustainability
2. Reviving Indonesian Biodiversity Clearing Houses
3. International Collaboration
4. Research University
New paradigms and new ways based on science and technology are needed in managing Indonesia's natural resources and people as the main capital of development.

To make biodiversity a foothold in bringing Indonesia into a developed country, it takes a **big commitment** and **strong political support** to make science and technology the main key to innovative economic development.
Prioritizing Biodiversity in Public Policy

- Development an integrated biodiversity database is required as a breakthrough in biodiversity management, including in making evidence based-policies for economic use of biodiversity.

- To make Indonesian economy aware of biodiversity science, a major breakthrough and political support for investment in financial infrastructure are needed in the form of an autonomous, sustainable and flexible research funding system from the annual stage budget cycle to drive strategic frontier science (Development of Sovereign Wealth Fund system for research in biodiversity).
Indonesian is the center of marine biodiversity:
Center of overlapping, the most of important refuge for marine life

Jakarta (12 November 2018) - Introducing “Science for Indonesia Biodiversity”
Jakarta (29 August 2019) - Indonesian Young Academy of Sciences (ALMI) in cooperation with AIPI launches "Science for Indonesian Biodiversity"
Acknowledgement

Forum Discussion Series
Emil Salim
Endang Sukara
Djoko Iskandar
Daniel Murdiyarso
Mubariq Ahmad
Eniya L. Dewi
Endah Murniningtyas
Diah S. Saminarsih
Hawis Madduppa
Brigitta Isworo Laksmi
Ilyas Asaad
Herry Subagiadi

Editing Team (Tempo Institute)
Yosep Suprayogi
Purwanto Setiadi
Idrus Fahmi Shahab
Mardiyah Chamim
Mahardhika

267 Young Scientists Network
Alumni Pertemuan Frontiers of Sciences AIPI
Acknowledgement

50 Fellows of the Indonesian Young Academy of Sciences
ACKNOWLEDGEMENT