

# Higher Education is the Key to Economic Growth

**Stella Christie**

Vice Minister of Higher Education, Science, and Technology  
Republic of Indonesia



Ministry of Higher Education,  
Science, and Technology  
Republic of Indonesia



# Asta Cita: President Prabowo's Eight-Point Vision



KEMENTERIAN SEKRETARIAT NEGARA  
REPUBLIK INDONESIA

## Asta Cita

Presiden Prabowo & Wapres Gibran



- 1 Memperkokoh ideologi Pancasila, demokrasi, dan hak asasi manusia (HAM)
- 2 Memantapkan sistem pertahanan keamanan negara dan mendorong kemandirian bangsa melalui swasembada pangan, energi, air, ekonomi kreatif, ekonomi hijau, dan ekonomi biru
- 3 Meningkatkan lapangan kerja yang berkualitas, mendorong kewirausahaan, mengembangkan industri kreatif, dan melanjutkan pengembangan infrastruktur.
- 4 Memperkuat pembangunan sumber daya manusia (SDM), sains, teknologi, pendidikan, kesehatan, prestasi olahraga, kesetaraan gender, serta penguatan peran perempuan, pemuda, dan penyandang disabilitas
- 5 Melanjutkan hilirisasi dan industrialisasi untuk meningkatkan nilai tambah di dalam negeri
- 6 Membangun dari desa dan dari bawah untuk pemerataan ekonomi dan pemberantasan kemiskinan
- 7 Memperkuat reformasi politik, hukum, dan birokrasi, serta memperkuat pencegahan dan pemberantasan korupsi dan narkoba
- 8 Memperkuat penyalarsan kehidupan yang harmonis dengan lingkungan, alam, dan budaya, serta peningkatan toleransi antarumat beragama untuk mencapai masyarakat yang adil dan makmur.

4. Strengthening the development of **human resource, science, technology, education, health, sports achievements, gender equality, and empower the roles of women, youth, and persons with disabilities.**



Since the 1930's **Stanford University** alumni and faculty had started nearly **40,000 companies** that employed **5.4 million people** and generated **\$2.7 trillion in annual revenues**, putting Stanford among the world's ten largest economies

As of 2014, **MIT**'s living alumni had founded over **30,000 companies** that employed **4.6 million people** and generated nearly **\$2 trillion in annual revenues**

**University of Kansas** drives **\$7.8 billion annual economic impact** in Kansas; supports nearly **88,000 jobs**

Since the 1930's **Stanford University** alumni and faculty had started nearly **40,000 companies** that employed **5.4 million people** and generated **\$2.7 trillion in annual revenues**, putting Stanford among the world's ten largest economies

As of 2014, **MIT's** living alumni had founded over **30,000 companies** that employed 4.6 million people and generated nearly **\$2 trillion in annual revenues**

## nature index

2016: **5** of the world's top ten academic institutions generating high-quality research were American and **1** was Chinese.

Position	Institution
1	<a href="#">Chinese Academy of Sciences (CAS), China</a>
2	<a href="#">Harvard University, United States of America (USA)</a>
3	<a href="#">French National Centre for Scientific Research (CNRS), France</a>
4	<a href="#">Max Planck Society, Germany</a>
5	<a href="#">Stanford University, United States of America (USA)</a>
6	<a href="#">Massachusetts Institute of Technology (MIT), United States of America (USA)</a>
7	<a href="#">Helmholtz Association of German Research Centres, Germany</a>
8	<a href="#">The University of Tokyo (UTokyo), Japan</a>
9	<a href="#">University of Oxford, United Kingdom (UK)</a>
10	<a href="#">University of Cambridge, United Kingdom (UK)</a>

2025: 8 are Chinese, only 2 others (American & German)

Position	Institution
1	<a href="#">Chinese Academy of Sciences (CAS)</a>
2	<a href="#">Harvard University</a>
3	<a href="#">University of Science and Technology of China (USTC)</a>
4	<a href="#">Zhejiang University (ZJU)</a>
5	<a href="#">Peking University (PKU)</a>
6	<a href="#">University of Chinese Academy of Sciences (UCAS)</a>
7	<a href="#">Tsinghua University</a>
8	<a href="#">Shanghai Jiao Tong University (SJTU)</a>
9	<a href="#">Nanjing University (NJU)</a>
10	<a href="#">Max Planck Society</a>

**Rafel Reif.** America's Coming Brain Drain. Trump's War on Universities Could Kill U.S. Innovation. *Foreign Affairs*. May 6, 2025  
Reif is MIT's President Emeritus and the Ray and Maria Stata Professor of Electrical Engineering and Computer Science.





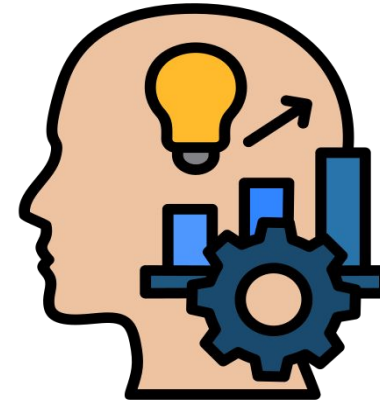
## Two mechanisms through which **higher education drives economic growth**

1



***skilled workforce***

2



***research innovation***

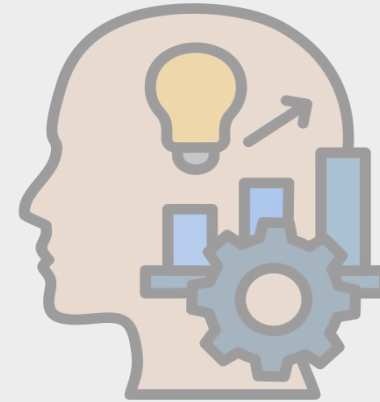
## Two mechanisms through which **higher education drives economic growth**

1



***skilled workforce***

2



***research innovation***



# Indonesia is strategic for investment: 28 key natural resources

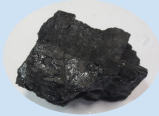
## Mineral

## Coal

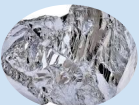


**USD 498.4 Billion**

Coal



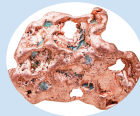
Nickel



Tin



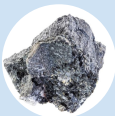
Copper



Bauxite



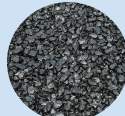
Stainless Steel



Gold Silver



Asphalt



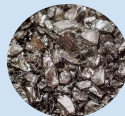
Silica Sand



Manganese Cobalt



Rare Earth materials



## Crude Oil



## Natural Gas



**USD 68.3 Billion**

Crude Oil



Natural Gas



## Agriculture



## Maritim



## Fisheries



## Forestry



**USD 51.4 Billion**

Palm Oil



Coconut



Rubber



Biofuel



Round Log



Pine Resin



Shrimp



Fish TCT



Crab



Seaweed



Salt



Nutmeg



Cocoa



Tilapia



## Economic impact until 2040



**Investment**  
618.1 Billion USD



**Export**  
857.9 Billion USD



**GDP**  
235.9 Billion USD



**Employment**  
3,016,179 workers



# Economic growth through downstream industrialization requires a skilled workforce

*Industry-Matched  
Curriculums*

*Industry-Matched  
Instructors*

*Industry-Matched  
Infrastructures*

## **National Downstreaming Blueprint 2025–2030:**

21 priority downstream projects in the first phase (2025)

30,000 technicians needed for oil refineries with a capacity of 500,000 barrels/day

15,000 plant operators for DME (Dimethyl Ether) production facilities as LPG substitutes

5,000 big data specialists to support the national employment outlook system

10,000 smelter experts for copper and aluminum processing plants





Ministry of Higher Education,  
Science, and Technology  
Republic of Indonesia

# Vocational Ed + Industry Policy of MoHEST RI

*Industry-Matched  
Curriculums*

*Industry-Matched  
Instructors*

*Industry-Matched  
Infrastructures*

## 中国-东盟教育部长对话会 China-ASEAN Education Ministers Dialogue







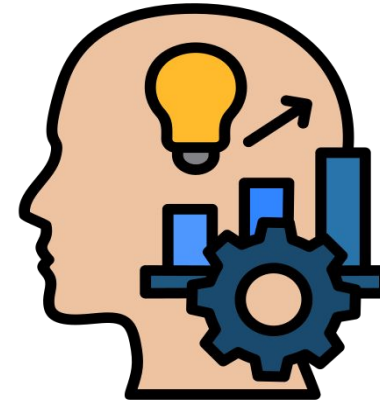
## Two mechanisms through which **higher education drives economic growth**

1



*skilled workforce*

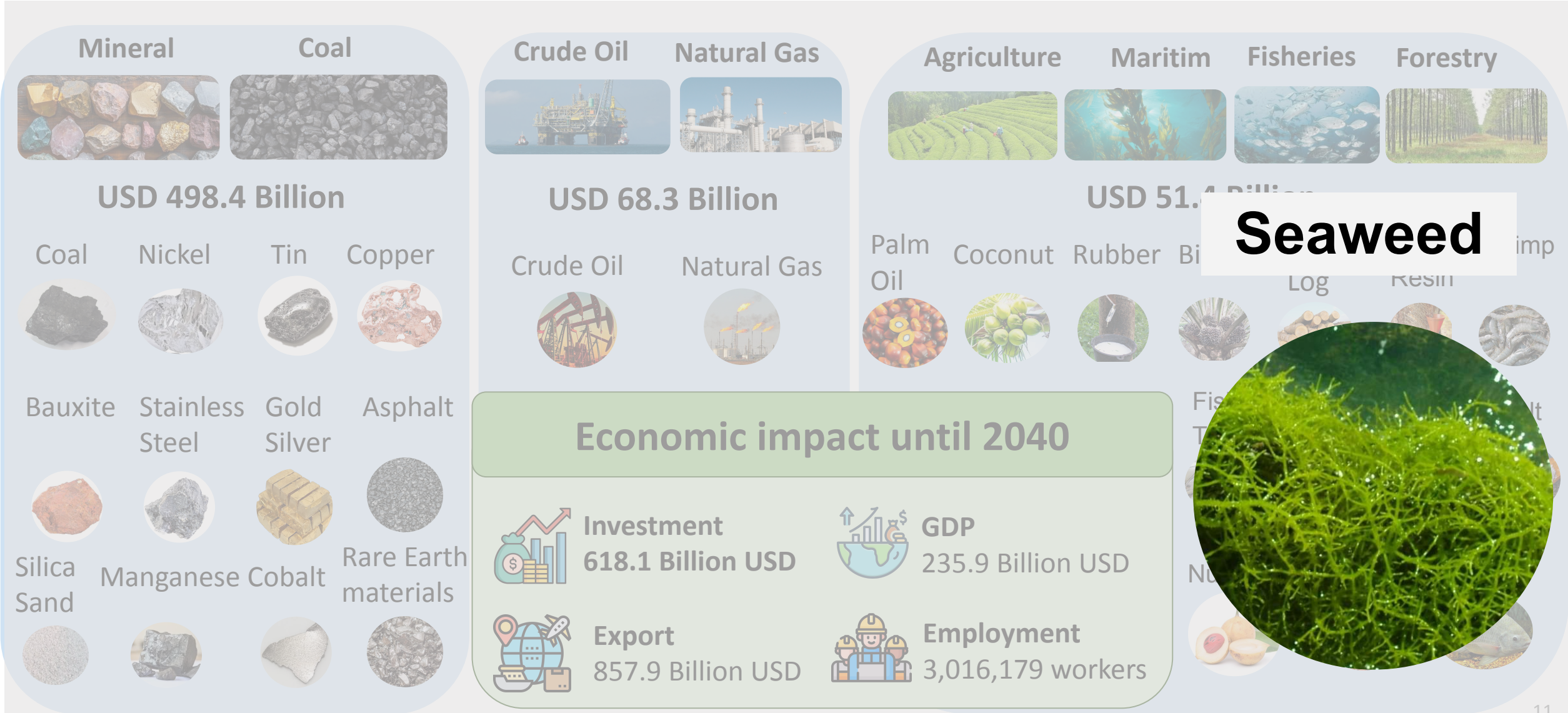
2



*research innovation*

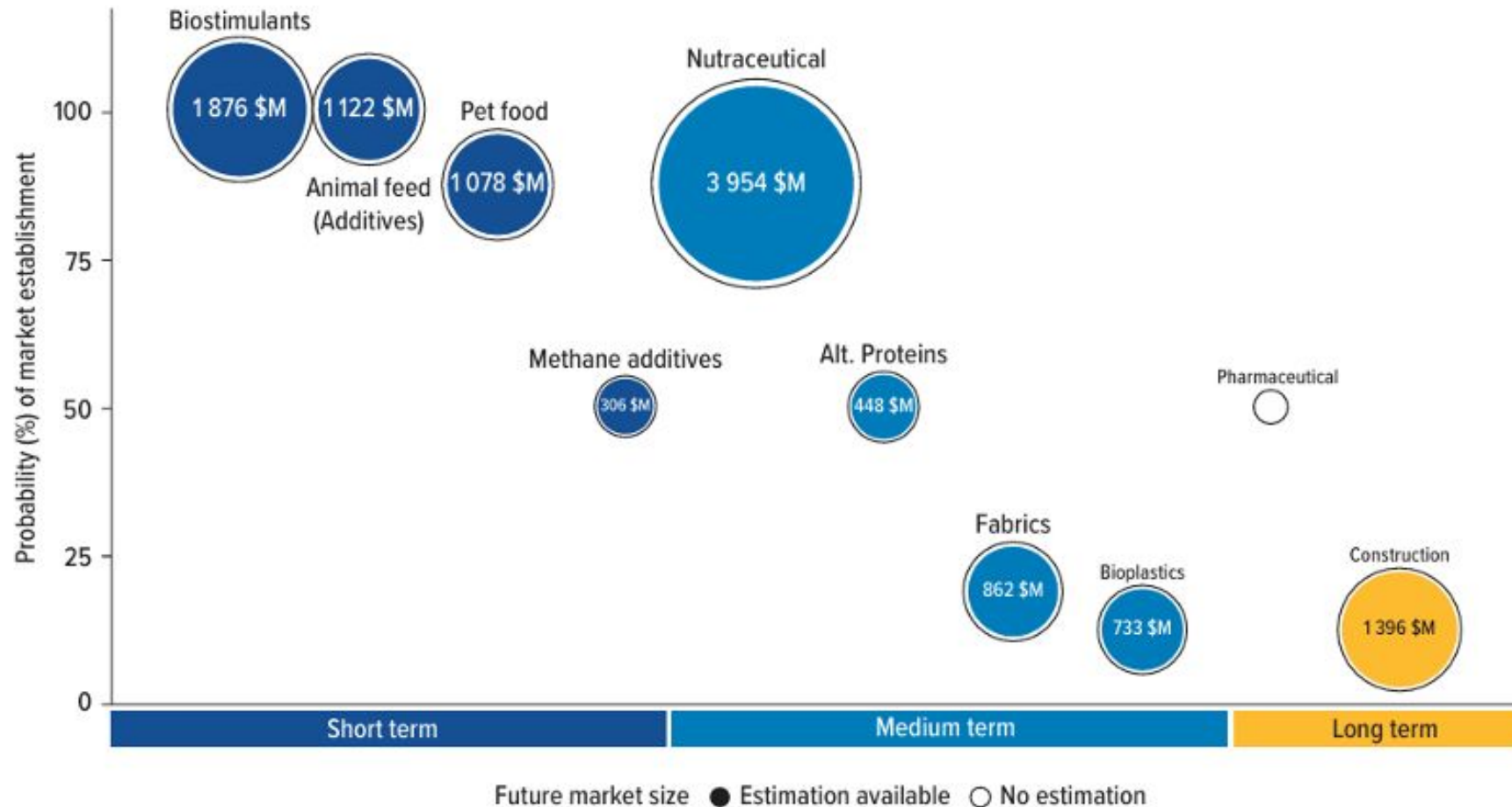


# Indonesia is strategic for investment: 28 key natural resources



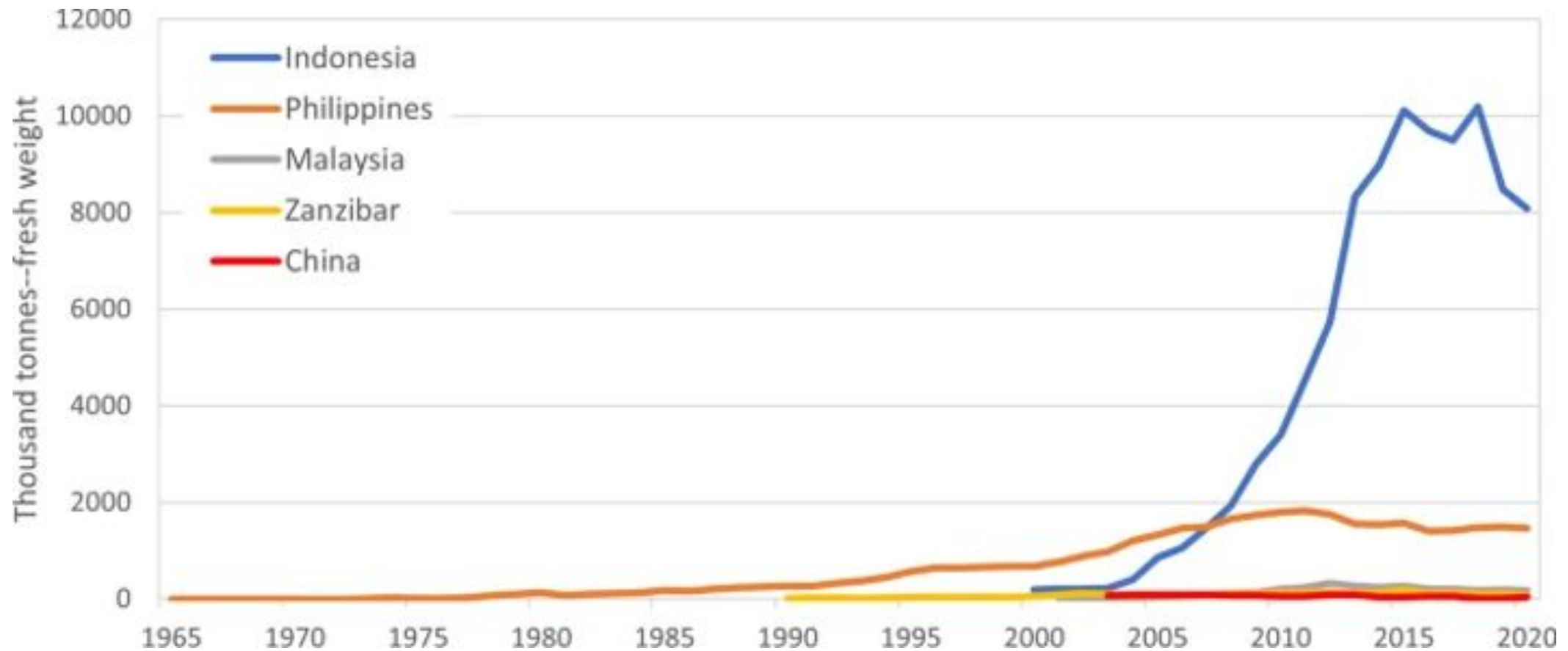


## Seaweed has high economic potential, valued at **USD 12 billion**





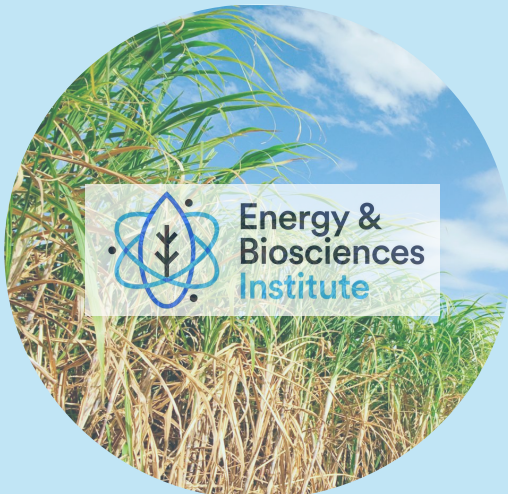
# Indonesia is the world's largest producer of tropical seaweed





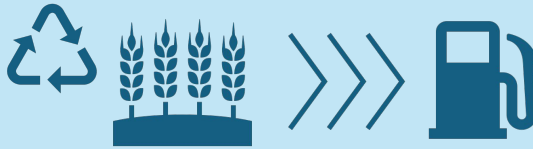
# Seaweed: the emerging biomass feedstock

## 1<sup>st</sup> Generation feedstock for biofuels: Food Crops



*EBI was created to solve the food vs. energy dilemma*

## 2<sup>nd</sup> Generation feedstock for biofuels: use of agricultural residues



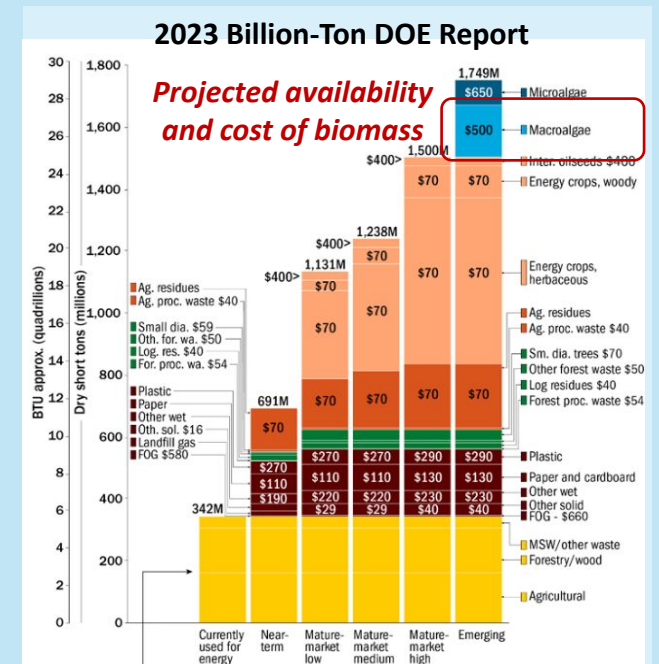
...but breaking down lignin turned out very energy and resource intensive



*A different feedstock is needed!*

## 3<sup>rd</sup> Generation feedstock that does not:

- ✓ Compete with food
- ✓ Require fertilizers and freshwater
- ✓ Contain lignin



*IBMC was created to upscale seaweed as a feedstock for the bioeconomy*



# What would take for Indonesia to produce 10% of jet fuel global demand based on SAF?

## ASSUMPTION

### Existing conversion technology

**1 g of seaweed produces 0.281g of ethanol**



Wargacki et al. 2012  
(Science)

#### An Engineered Microbial Platform for Direct Biofuel Production from Brown Macroalgae

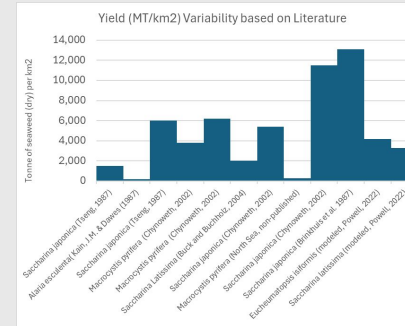
Adam J. Wargacki,<sup>1,2</sup> Effendi Leonard,<sup>1,2</sup> Maung Nyan Win,<sup>1,2</sup> Drew D. Regitsky,<sup>1</sup> Christine Nicole S. Santos,<sup>2</sup> Peter B. Kim,<sup>1</sup> Susan R. Cooper,<sup>2</sup> Ryan K. Ralston,<sup>2</sup> Asael Herman,<sup>1,2</sup> Alicia B. Slivitz,<sup>1,2</sup> Arun Lakshmanaswamy,<sup>1</sup> Yuki Kashiyama,<sup>1,2,3</sup> David Baker,<sup>1</sup> Yasuo Yoshikuni<sup>1,2</sup>

*Based on brown algae with high sugar content.  
Only the sugar compounds are converted into fuel!*

### Metric tonne of seaweed (dry) per Km2



**10-fold  
variation in yield  
based on literature**

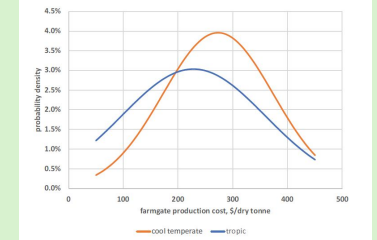


### Modeled cost of production



**\$200 - \$300  
with a target of  
\$100**

Lite-Powell et al. 2022  
(Applied Phycology)



*Model production costs of large-scale offshore farming (USD per dry metric tone/km2)*

## PROBABILISTIC ANALYSIS

P10: conservative  
P50: median  
P90: optimistic

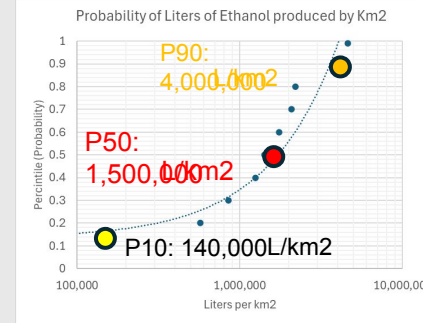
### Ethanol volume per metric tonne

1. Calculate the mass of ethanol produced: 1,000,000 g seaweed  $\times$  0.281  $\frac{\text{g ethanol}}{\text{g seaweed}}$  = 281,000 g ethanol
2. Convert the mass of ethanol to volume: Ethanol has a density of approximately 0.789 g/mL (or 789 g/L).  
 $\frac{281,000 \text{ g ethanol}}{789 \text{ g/L}} \approx 356 \text{ L ethanol}$

**356L of Ethanol per metric tonne  
(dry) of brown seaweed**

### Liters of ethanol per farmed area

*Using the variable  
distribution, we  
calculate the P50  
of Liters of  
Ethanol per km2  
of seaweed farm*

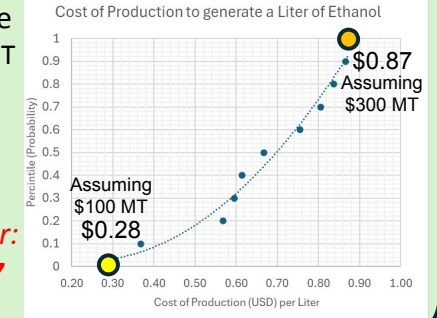


### Cost of production per Liter

Applied range  
\$100 - \$300 MT



*Cost of  
Production  
(USD) per liter:  
\$0.28 - 0.87*

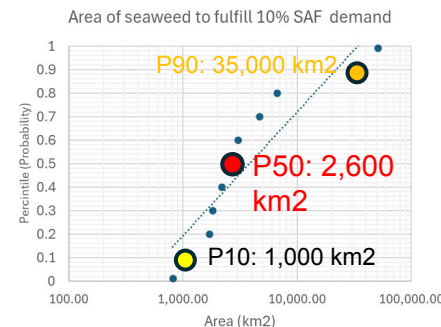


### SAF Production target:



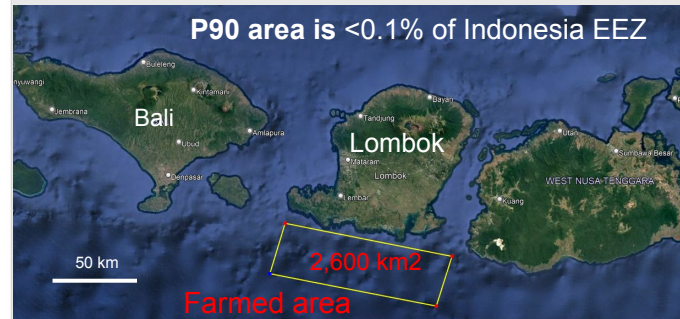
**4 Billion Liters\***

*\*10% of Jet fuel  
demand (SAF) annually*



### Seaweed farm area for 10% of SAF

P90 area is <0.1% of Indonesia EEZ



### Benchmarking biofuel cost:



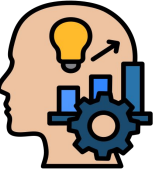
**\$1 L** cost of biofuel at the pump in Indonesia

*This means that seaweed biofuel can be competitive in a local and global market*



Ministry of Higher Education,  
Science, and Technology  
Republic of Indonesia

# Unlocking Seaweed's Economic Potential Requires Research



*Consistent  
supply & yield  
improvement*

**Production cost  
efficiency**

**Product  
development**



Basic Seaweed  
Research



Cultivation &  
Harvesting



Processing &  
Conversion



Biorefinery &  
Circularity



Supply chain, policy &  
socioeconomics





Ministry of Higher Education,  
Science, and Technology  
Republic of Indonesia

# Seaweed Research and Downstreaming Policy

**MoHEST RI**

**X**

**University of Mataram**

**X**

**UC Berkeley**

**X**

**Beijing Genomics  
Institute**

**X**

**Indonesian Employers'  
Association (APINDO)**



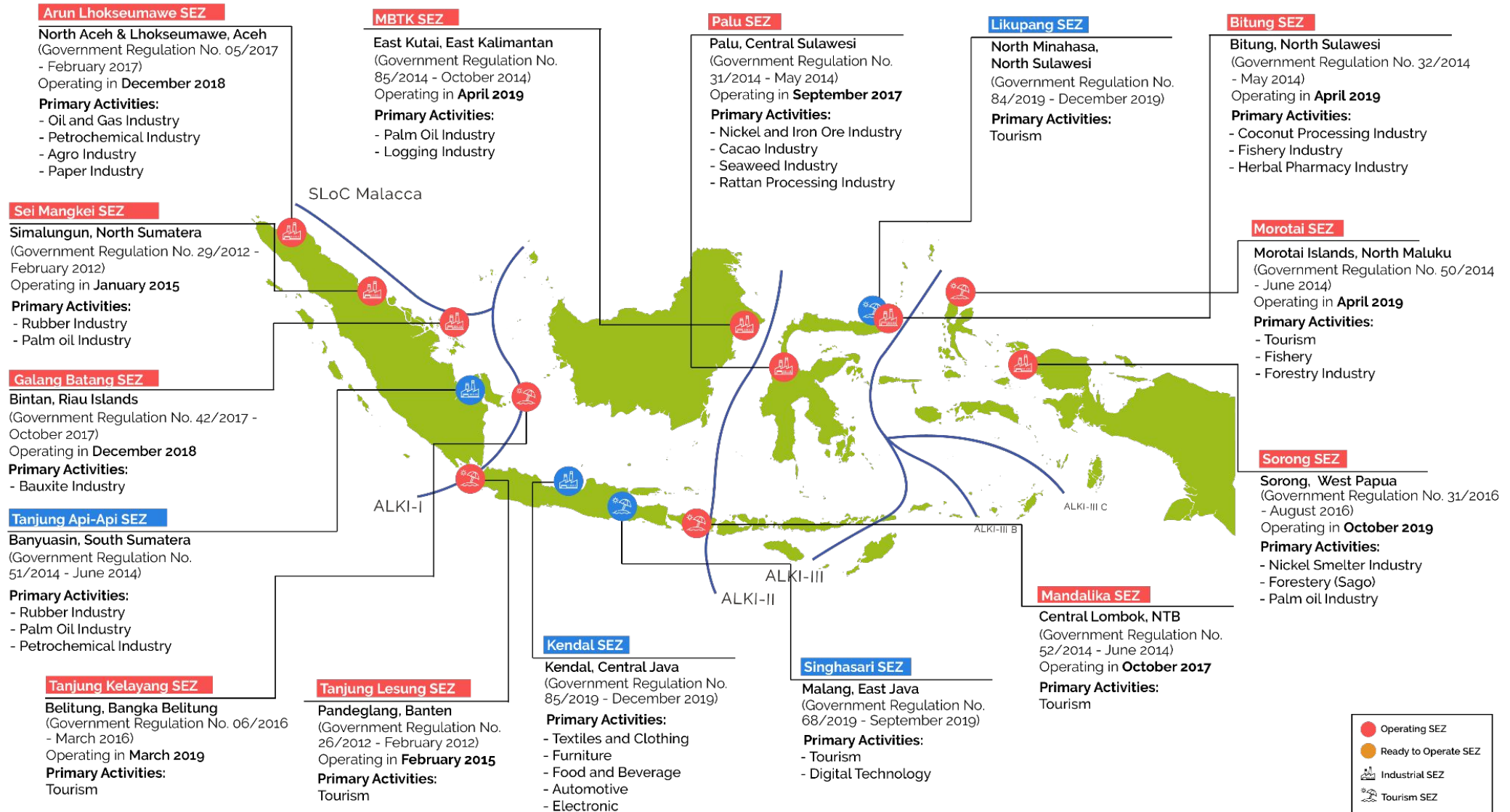


## Partnership between academia and private sectors

- In the **EU**, companies fund **59%** of total R&D;
- In the **US**, **63%**;
- In **China, South Korea, and Japan**, **over 75%** of R&D investment comes from the private sector.



# Indonesia's Special Economic Zones







# Indonesia's Special Economic Zones

