ด่วนที่สุด

บันทึกข้อความ

ส่วนงาน สำนักงานพัฒนาทรัพยากรบุคคล สำนักงานอธิการบดี **โทร** 8375
ที่ อว 7601.23/สพบ1/58/2569 **วันที่** 24 กุมภาพันธ์ 2569
เรื่อง การกรอกข้อมูลแบบสำรวจความต้องการขอรับการจัดสรรทุน เพื่อรับทุนรัฐบาลด้านวิทยาศาสตร์และเทคโนโลยี ประจำปี 2570

เรียน คณบดี/ผู้อำนวยการสำนัก/สถาบัน/ผู้อำนวยการสำนักงานและหัวหน้าส่วนงานที่ขึ้นตรงต่อรองอธิการบดี
อ้างถึง หนังสือสำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ ที่ อว 6001/ว 1094 ลงวันที่ 9 กุมภาพันธ์ 2569
สิ่งที่ส่งมาด้วย เอกสารประกอบความต้องการพัฒนากำลังของประเทศ_ Government Science and Technology Scholarship Allocation Across Strategic Industries in B.E. 2570 (GSTScholarship Strategy 2570)

ตามหนังสือที่อ้างถึงสำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ (สวทช.) ให้สำรวจความต้องการขอรับการจัดสรรทุน เพื่อรับทุนรัฐบาลด้านวิทยาศาสตร์และเทคโนโลยี ประจำปี 2570 โดยงานทุนรัฐบาล กระทรวงการอุดมศึกษา วิทยาศาสตร์ วิจัยและนวัตกรรม (อว.) ได้จัดทำแบบสำรวจความต้องการขอรับการจัดสรรทุนให้หน่วยงานที่ประสงค์ได้รับทุนดังกล่าว โดยมีวัตถุประสงค์เพื่อให้หน่วยงานที่ได้รับทุน รับบุคลากรที่สำเร็จการศึกษาและมีความรู้ ความสามารถสูง ตอบสนองความต้องการกำลังคนที่มีทักษะสูงในแต่ละอุตสาหกรรมเพื่อการพัฒนาประเทศ นั้น

สำนักงานพัฒนาทรัพยากรบุคคล (สพบ.) จึงขอให้**หน่วยงานที่มีความประสงค์ขอรับการจัดสรรทุน ประจำปี 2570** ดำเนินการกรอกข้อมูลแบบสำรวจความต้องการขอรับการจัดสรรทุน **ผ่านลิงก์ Google Form ของมหาวิทยาลัย** เพื่อรับทุนรัฐบาลด้านวิทยาศาสตร์และเทคโนโลยี ประจำปี 2570 โดยมหาวิทยาลัยจะพิจารณาการเสนอขอรับการจัดสรรทุนจากข้อมูล ดังนี้

1. ความสอดคล้องกับอุตสาหกรรมยุทธศาสตร์เป้าหมายของประเทศ
   - สาขาวิชา/ความเชี่ยวชาญที่เสนอ เพื่อตอบโจทย์ยุทธศาสตร์ชาติ แผนพัฒนาเศรษฐกิจและสังคมแห่งชาติ หรือทิศทางการพัฒนากำลังคนในสาขาที่ประเทศมีความต้องการ
   - ชี้ให้เห็นถึงผลกระทบเชิงระบบหรือคุณค่าที่จะเกิดขึ้นต่อประเทศในระยะยาว
2. ความสอดคล้องกับเป้าหมายยุทธศาสตร์ของมหาวิทยาลัย
   - สนับสนุนแผนยุทธศาสตร์มหาวิทยาลัย
   - รองรับการพัฒนาหลักสูตร งานวิจัย บริการวิชาการ หรือพันธกิจหลักของหน่วยงาน
   - มีแผนรองรับตำแหน่งและบทบาทเมื่อผู้รับทุนสำเร็จการศึกษาและกลับมาปฏิบัติงาน
3. การกระจายโอกาสอย่างเหมาะสม
   - ให้โอกาสหน่วยงานที่ยังไม่มีนักเรียนทุนรัฐบาล หรือนักเรียนทุนอยู่ระหว่างการศึกษายังไม่กลับมาปฏิบัติงานในช่วงระยะเวลา 3-5 ปีข้างหน้า ทั้งนี้ เพื่อให้เกิดความสมดุลในการพัฒนาบุคลากรของหน่วยงาน
4. สถานะทางการเงินของหน่วยงาน
   - ประเมินความพร้อมด้านงบประมาณและความสามารถในการรองรับภาระผูกพันที่เกี่ยวข้อง
   - พิจารณาความคุ้มค่าและผลตอบแทนเชิงยุทธศาสตร์ที่หน่วยงานจะได้รับ

   *__ข้อควรพิจารณา__ : ปัจจุบันมหาวิทยาลัยไม่ได้รับจัดสรรกรอบอัตรากำลังใหม่ (นักเรียนทุน) จากงบประมาณแผ่นดิน

<u>หน่วยงานดำเนินการ</u>

1. **ศึกษาข้อมูล :** ความต้องการพัฒนากำลังคนของประเทศ
   - เอกสารการสำรวจความต้องการบุคลากรทักษะสูงในอุตสาหกรรมเป้าหมาย พ.ศ.2568-2572 โดยสำนักงานสภานโยบายการอุดมศึกษา วิทยาศาสตร์ วิจัยและนวัตกรรมแห่งชาติ กระทรวงการอุดมศึกษา วิทยาศาสตร์ วิจัยและนวัตกรรม (สอวช.)_ (download ได้ที่ การสำรวจความต้องการบุคลากรทักษะสูง ในอุตสาหกรรมเป้าหมาย พ.ศ.2568-2572 (THAILAND TALENT LANDSCAPE 2025-2029) หาดูได้ที่ https://www.nxpo.or.th/th/report/
2. **กรอกข้อมูลตาม QR Code (Link : Google form)** ของมหาวิทยาลัย ได้แก่
   - แบบสำรวจความต้องการขอรับการจัดสรรทุนรัฐบาลทางด้านวิทยาศาสตร์และเทคโนโลยีประจำปี 2570 ตามประเภททุนที่จะขอรับการจัดสรร ประกอบด้วย ทุนระดับมัธยมศึกษาตอนปลาย ทุนบุคคลทั่วไประดับปริญญา ตรี-โท-เอก (ต่างประเทศ) /ทุนบุคคลทั่วไประดับปริญญา (ต่างประเทศ) / ทุนพัฒนาบุคลากรภาครัฐ (ต่างประเทศ) และทุนพัฒนาบุคลากรภาครัฐ (ในประเทศ)
3. **กรอกข้อมูลเสนอขอรับทุน** : หน่วยงานเสนอขอรับการจัดสรรทุนได้**มากกว่า 1 ทุน** โดยคำนึงถึงความต้องการของหน่วยงานในอนาคต 5 - 7 ปีข้างหน้า รวมถึงสอดคล้องกับเป้าหมายของประเทศและมหาวิทยาลัยตามข้อ 1 และข้อ 2 ข้างต้น ทั้งนี้ ขอให้เสนอทุนเรียงลำดับความสำคัญของความต้องการรับทุนแต่ละประเภท พร้อมระบุเหตุผลแยกแต่ละประเภททุนเพื่อประกอบการพิจารณาของมหาวิทยาลัย

โดย มหาวิทยาลัยมีกำหนดระยะเวลาในการดำเนินการข้อมูลแบบสำรวจทุน ดังนี้

1. หน่วยงานกรอกข้อมูลตามลิงก์ของมหาวิทยาลัย (Google Form)	**ภายใน 6 มีนาคม 2569**
2. มหาวิทยาลัยพิจารณากลั่นกรองและส่งแจ้งผลกลับหน่วยงาน	**ภายใน 16 มีนาคม 2569**
3. สำนักงานพัฒนาทรัพยากรบุคคลจะมีการแนะนำวิธีการและขั้นตอนการกรอกข้อมูล และแนบเอกสารที่เกี่ยวข้อง ให้หน่วยงานดำเนินการกรอกข้อมูลจัดสรรทุนในระบบของ อว.	**วันที่ 19 มีนาคม 2569**

ทั้งนี้ สำนักงานพัฒนาทรัพยากรบุคคลต้องยืนยันจำนวนทุนของมหาวิทยาลัยและนำข้อมูลเข้าสู่ระบบงานทุนรัฐบาล กระทรวงการอุดมศึกษา วิทยาศาสตร์ วิจัยและนวัตกรรม (อว.) และส่งเอกสารตัวจริงให้ สวทช. **ภายในวันที่ 31 มีนาคม 2569** เพื่อพิจารณาต่อไป

จึงเรียนมาเพื่อโปรดดำเนินการให้แล้วเสร็จตามระยะเวลาที่กำหนด หากมีข้อสงสัยโปรดติดต่อ สุกานดา บุณยาทร โทร 02-470-8375

(แบบสำรวจทุน อว.2570)

https://forms.gle/E5Yo85i3qTnX9kCHA

Jeeragarn Sriwiset
2026.02.24 17:29:46 +07'00'

(นางสาวจีรกาญจน์ ศรีวิเศษ)
ผู้อำนวยการสำนักงานพัฒนาทรัพยากรบุคคล

<u>หมายเหตุ</u> สพบ. อยู่ระหว่างตรวจสอบข้อมูลเพื่อจัดส่งรายละเอียดนักเรียนทุนในสังกัดถึงหัวหน้าของหน่วยงานในมหาวิทยาลัยเพื่อใช้ประกอบการพิจารณาต่อไป

Government Science and Technology Scholarship Allocation

Across Strategic Industries in B.E. 2570

- adapted from the results of การสำรวจความต้องการบุคลากรทักษะสูง ในอุตสาหกรรมเป้าหมาย พ.ศ. 2568-2572 (THAILAND TALENT LANDSCAPE 2025-2029)
- หาดูได้ที่ https://www.nxpo.or.th/th/report/

A. **9 กลุ่มวิชาที่สอดคล้องกับนโยบายการพัฒนาประเทศในอุตสาหกรรมที่มีอยู่ของประเทศ (Existing Industries)**
    1) อุตสาหกรรมยานยนต์สมัยใหม่ (Modern Automotive Industry)
    2) อุตสาหกรรมหุ่นยนต์เพื่ออุตสาหกรรม (Industrial Robotics Industry)
    3) อุตสาหกรรมการท่องเที่ยวกลุ่มรายได้ดี และการท่องเที่ยวเชิงสุขภาพ (High-Income and Health Tourism Industry)
    4) อุตสาหกรรมการเกษตรและเทคโนโลยีชีวภาพ (Agriculture and Biotechnology Industry)
    5) อุตสาหกรรมแปรรูปอาหารและอาหารแห่งอนาคต (Food Processing and Future for the Future Industry)
    6) อุตสาหกรรมการบินและโลจิสติกส์ (Aviation and Logistics Industry)
    7) อุตสาหกรรมสร้างสรรค์ (Creative Industry)
    8) อุตสาหกรรมดิจิทัล (Digital Industry)
    9) อุตสาหกรรมการแพทย์ครบวงจร (Integrated Medical Industry)
B. **6 กลุ่มวิชาที่สอดคล้องกับนโยบายการพัฒนาประเทศในอุตสาหกรรมเที่เกิดไหม่ของประเทศ (Emerging Industries)**
    1) อุตสาหกรรมยานยนต์ไฟฟ้า (Electric Vehicle Industry)
    2) อุตสาหกรรมปัญญาประดิษฐ์และความปลอดภัยทางไซเบอร์ (Artificial Intelligence and Cybersecurity Industry)
    3) อุตสาหกรรมเซมิคอนดักเตอร์ขั้นสูงและอิเล็กทรอนิกส์อัจฉริยะ (Advanced Semiconductors and Smart Electronics Industry)
    4) อุตสาหกรรมการแพทย์ขั้นสูง (Advanced Medical Industry)
    5) อุตสาหกรรมการเปลี่ยนผ่านด้านพลังงาน ชีวพลังงาน ชีวเคมี และเทคโนโลยีชีวภาพ (Energy Transition, Bioenergy, Biochemicals, and Biotechnology Industry)
    6) อุตสาหกรรมทรัพยากรธรรมชาติและสิ่งแวดล้อมที่ยั่งยืน เศรษฐกิจหมุนเวียน และเศรษฐกิจสีเขียว (Sustainable Natural Resources and Environment, Circular Economy, and Green Economy Industry)

Demanded Fields of Study for Each Industry

A. Existing Industries

A1. **Modern Automotive Industry:** Mechanical Engineering & Material Science, Electrical & Electronics Engineering, Industrial Engineering & Systems Engineering, Computer Science & Software Engineering, Business & Marketing, Data Science & Analytics, Data Engineering, Software Engineering, Marketing and Business Development, etc.

A2. **Industrial Robotics Industry**: Mechatronics Engineering & Mechanical Engineering, Electrical Engineering & Robotics Engineering, Computer Science, Computer Vision & AI, Control & Automation Engineering, Manufacturing Systems Engineering, etc.

A3. **High-Income and Health Tourism Industry**: Hospitality & Tourism Management, Digital Marketing & Business Management, Food Science & Nutrition, Wellness & Spa Management, Public Health & Health Services Management, Languages & Intercultural Communication, etc.

A4. **Agriculture and Biotechnology Industry**: Agricultural Science, Agronomy, Veterinary Technology & Animal Science, Chemical Engineering & Industrial Engineering, Molecular Biology, Genetic Engineering & Applied Biotechnology, Food Science & Technology, Environmental Science & Natural Resources, Bioinformatics & Data Science for Agriculture, etc.

A5. **Food Processing and Future for the Future Industry**: Food Science, Technology & Engineering, Nutrition & Dietetics, Molecular Biology, Agricultural & Food Biotechnology, Business & Marketing for Food Industry, Food Safety & Regulation Management, Innovation & Operations Management, etc.

A6. **Aviation and Logistics Industry**: Aviation Management & Operations, Logistics & Supply Chain Management, Aviation Engineering, Information Technology for Logistics, Operations & Business Management, etc.

A7. **Creative Industry**: Digital Marketing & Communication, Design, Creative Arts, Digital Media & Creative Technology, Business & Creative Entrepreneurship, Information Technology, Creative Economy & Innovation Management, Cultural & Heritage Management, etc.

A8 **Digital Industry**: Computer Science & Software Engineering, Information Technology & Systems, Data Science & Engineering, Digital Business, Marketing, Strategy & Innovation, Digital Product & User Experience/Interface Design, Cloud & Platform Engineering, etc.

A9. **Integrated Medical Industry**: Nursing & Physical Therapy, Pharmacy & Pharmaceutical Sciences, Medical Technology & Biomedical Sciences, Public Health & Health Information Technology, Traditional Medicine, Cosmetic Science, etc.

B. Emerging Industries

B1. **Electric Vehicle Industry**: Electrical Engineering, Mechatronics Engineering, Materials Engineering, Computer Engineering, Data Science, Electric Vehicle Technology, Energy Storage & Battery Engineering, etc.

B2. **Artificial Intelligence and Cybersecurity Industry**: Computer Engineering, Artificial Intelligence & Machine Learning, Cybersecurity & Information Assurance Science & Engineering, Applied Statistics, Data Science & Engineering, AI Ethics & Governance, etc.

B3. **Advanced Semiconductors and Smart Electronics Industry**: Electrical & Electronics Engineering, Semiconductor Engineering, Computer Engineering, Software Engineering, Materials Science, Data Science & Artificial Intelligence, Device & Hardware Development, etc.

B4. **Advanced Medical Industry**: Medicinal Chemistry & Pharmaceutical Sciences, Biomedical Engineering, Clinical Data Science & Health Informatics, Pharmaceutical Process Engineering, Regenerative & Precision Medicine, Neuroscience & Psychiatry, etc.

B5. **Energy Transition, Bioenergy, Biochemicals, and Biotechnology Industry**: Chemical & Biochemical Engineering, Biotechnology, Bioenergy & Renewable Energy, Materials Science & Engineering, Environmental Engineering, Quality Control & Industrial Technology, Energy Systems & Technology, etc.

B6 **Sustainable Natural Resources and Environment, Circular Economy, and Green Economy Industry**: Environmental Engineering & Management, Sustainability Studies, Circular Economy & Resource Efficiency, Materials & Recycling Technology, Sustainable Business Management, Policy & Governance for Sustainability, Data Science for Sustainability

Human Capacity Development Strategy for Each Industry

A. Existing Industries

A.1) Future Mobility Industry

Focus: General automotive transformation, advanced manufacturing, and smart mobility systems.
Scholarship Level: Primarily **Bachelor's and Master's**, with targeted **PhD** for R&D and systems integration.

Critical Positions (High Demand)

- Systems Design Engineers
- Electronics Engineers
- Industrial Engineers
- Automotive Engineers
- Mechanical Engineers
- Data Analysts & Data Engineers
- Software Engineers
- Marketing & Business Development Specialists

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Bachelor's	Mechanical Engineering	Automotive Systems, Robotics in Manufacturing, Lightweight Materials
	Electrical & Electronics Engineering	Embedded Systems, Power Electronics, Sensor Technology
	Industrial Engineering	Lean Manufacturing, Automation, Supply Chain Optimization
	Computer Science / Software Engineering	Automotive Software, IoT Applications, Cybersecurity for Mobility
	Business & Marketing	Automotive Marketing, Mobility Services, Green Business Models
Master's	Systems Engineering	System Integration, Mechatronics, Control Systems
	Data Science & Analytics	Predictive Maintenance, Mobility Data Platforms
	Materials Science	Polymer Engineering, Advanced Composites
	Sustainable Energy Systems	Hybrid Systems, Alternative Fuels
PhD (selective)	Intelligent Transportation Systems	Autonomous Driving, Connected Vehicle Systems
	Advanced Manufacturing	Robotics, Industry 4.0 Applications
	Policy & Mobility Innovation	Smart Cities, Mobility-as-a-Service (MaaS)

🔑 Key Takeaways for Scholarship Allocation

- **Future Mobility Cluster:**
  Focus **Bachelor's and Master's scholarships** to build a **large skilled workforce** in mechanical, electrical, industrial, and software engineering, plus data and business roles.

A.2) Industrial Robotics Industry

Focus: Robotics engineering, mechatronics, automation, and control systems.

Scholarship Level: Primarily **Bachelor's and Master's**, with **PhD** for robotics R&D and AI-driven automation.

Critical Positions

- Mechatronics Engineers
- Control Systems Engineers
- Mechanical Engineers (robotics applications)
- Robotics Software Developers
- Industrial Automation Specialists
- Product & Hardware Designers (robotics components)
- Failure Analysis Engineers (robotics systems)

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Bachelor's	Mechatronics Engineering	Robotics Design, Sensors & Actuators, Automation Systems
	Mechanical Engineering	Industrial Machinery, Robotics Integration
	Electrical Engineering	Control Systems, Power Systems for Robotics
	Computer Science	Robotics Programming, Simulation, AI for Robotics
Master's	Robotics Engineering	Autonomous Systems, Human-Robot Interaction, Mobile Robotics
	Control & Automation Engineering	Programmable Logic Controllers, Industrial Control, Smart Manufacturing
	Computer Vision & AI	Object Recognition, Navigation Systems
	Manufacturing Systems Engineering	Robotics in Production, Digital Twins
PhD	Advanced Robotics	Swarm Robotics, Cognitive Robotics, AI-Driven Automation
	Human-Machine Collaboration	Safety Systems, Ergonomics, Exoskeletons
	Smart Manufacturing & Industry 4.0	Robotics-Data Integration, Predictive Maintenance

🔑 **Key Takeaways for Scholarship Allocation**

- **Industrial Robotics Cluster:**
    - **Bachelor's/Master's:** Focus on **mechatronics, robotics engineering, and automation** to meet immediate workforce demand.
    - **PhD:** Invest in **advanced robotics, AI-driven automation, and Industry 4.0 research** to position Thailand as a leader in robotics manufacturing.

📄 **A.3) High-Income and Health Tourism Industry**

🎓 **Recommended Scholarship Fields by Level**

1. Bachelor's Level (Workforce Readiness & Service Excellence)

Focus: Building a large pool of skilled professionals in hospitality, tourism, and wellness services.

- **Hospitality & Tourism Management**
    - Hotel & resort management
    - Tourism destination management
    - MICE (Meetings, Incentives, Conferences, Exhibitions) management
- **Digital Marketing & Business**
    - Digital marketing for tourism
    - Search Engine Optimization/Search Engine Marketing and social media marketing
    - Reservation and digital platform management
- **Food Science & Nutrition**
    - Food safety & hygiene
    - Culinary tourism
    - Nutrition for wellness tourism

- **Wellness & Spa Management**
    - Spa and wellness operations
    - Holistic health tourism services
- **Thai Traditional Medicine & Integrative Health**
    - Thai traditional medicine
    - Herbal medicine and wellness practices
- **Languages & Intercultural Communication**
    - Multilingual communication for tourism
    - Cross-cultural service delivery

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2. Master's Level (Specialization & Applied Innovation)

Focus: Developing specialists who can integrate health, business, and technology into tourism.

- **Tourism & Hospitality Innovation**
    - Sustainable tourism management
    - Luxury and experiential tourism design
- **Health & Wellness Tourism**
    - Integrative medicine for tourism
    - Wellness program design and management
- **Digital Transformation in Tourism**
    - Smart tourism platforms
    - Data analytics for customer experience
- **Marketing & Business Development**
    - International marketing for health tourism
    - Business development for wellness clusters

- **Food & Nutrition Science**
    - Advanced food safety systems
    - Functional foods for health tourism
- **Public Health & Health Services Management**
    - Health systems for medical tourism
    - Clinical research coordination in tourism context

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3. PhD Level (Frontier Research & Global Leadership)

Focus: Creating thought leaders and innovators who can position Thailand as a global hub.

- **Medical & Health Tourism Policy and Strategy**
    - Comparative studies of global health tourism hubs
    - Policy frameworks for sustainable growth
- **Digital Health & AI in Tourism**
    - Telemedicine integration in tourism
    - AI-driven customer experience personalization
- **Wellness Science & Integrative Medicine**
    - Evidence-based Thai traditional medicine
    - Preventive health and longevity research
- **Sustainable Tourism & Experience Design**
    - Eco-wellness tourism
    - Cultural heritage and health tourism integration
- **Food, Nutrition & Health Innovation**
    - Nutraceuticals and functional foods for wellness
    - Food safety systems for international tourism

- **Global Hospitality & Service Excellence**
    - Service innovation models
    - Cross-cultural customer experience research

🔑 **Strategic Alignment with Report Findings**

- **Top Competencies**: Customer service, digital marketing, tourism management ⟶ scholarships in **hospitality, tourism, and digital marketing**.
- **Emerging Needs**: Thai traditional medicine, nutrition, spa/wellness ⟶ scholarships in **health sciences, integrative medicine, and wellness management**.
- **National Gaps**: Digital platforms, AI, telemedicine ⟶ scholarships in **digital health, smart tourism, and data-driven service innovation**.
- **Global Competitiveness**: To differentiate Thailand, PhD scholarships should emphasize **policy, sustainability, and integrative health research**.

✅ **Summary Recommendation**:

- **Bachelor's** ⟶ Hospitality, Tourism, Digital Marketing, Food Safety, Wellness, Thai Traditional Medicine.
- **Master's** ⟶ Sustainable Tourism, Health & Wellness Management, Digital Platforms, Business Development, Nutrition Science.
- **PhD** ⟶ Policy & Strategy, Digital Health/AI, Integrative Medicine, Sustainable Tourism Research, Food & Health Innovation.

A.4) Agriculture & Biotechnology Industry

Recommended Scholarship Fields by Level

1. Bachelor's Level (Applied Workforce & Technical Specialists)

Focus: Building a strong base of skilled graduates who can support modern agriculture, food systems, and biotech industries.

- **Agricultural Science & Agronomy**
  - Precision agriculture
  - Crop science and soil management
- **Biotechnology (Applied)**
  - Plant biotechnology
  - Animal biotechnology
- **Food Science & Technology**
  - Food safety and hygiene
  - Post-harvest technology
- **Environmental Science & Natural Resources**
  - Sustainable farming systems
  - Agro-ecology
- **Agricultural Engineering**
  - Smart farming machinery
  - Irrigation and automation systems
- **Veterinary Technology & Animal Science**
  - Animal husbandry
  - Livestock health management

2. Master's Level (Specialization & Applied R&D)

Focus: Developing specialists who can integrate biotech, digital, and sustainability into agriculture.

- **Molecular Biology & Genetic Engineering**
    - Crop genetic improvement
    - Livestock genetics
- **Bioinformatics & Data Science for Agriculture**
    - Genomic data analysis
    - AI for crop and livestock monitoring
- **Food Biotechnology & Nutrition**
    - Functional foods
    - Nutraceuticals
- **Agro-Industrial Technology**
    - Bioprocessing
    - Agricultural value chain innovation
- **Sustainable Agriculture & Climate Adaptation**
    - Climate-smart agriculture
    - Soil and water resource management
- **Plant Pathology & Pest Management**
    - Integrated pest management
    - Biocontrol technologies

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3. PhD Level (Frontier Research & Innovation Leadership)

Focus: Building deep expertise in frontier areas where Thailand must compete globally.

- **Advanced Agricultural Biotechnology**
    - CRISPR and gene-editing for crops and livestock
    - Synthetic biology for agriculture
- **Biopharmaceuticals & Bio-based Products**
    - Plant-based vaccines
    - Industrial enzymes and bio-materials
- **Agri-genomics & Systems Biology**
    - Multi-omics for crop and livestock improvement
    - Precision breeding
- **Sustainable Food Systems & Policy**
    - Food security and nutrition policy
    - Circular bioeconomy in agriculture
- **Climate & Environmental Biotechnology**
    - Carbon-neutral farming
    - Bio-remediation and soil microbiome research
- **Smart Agriculture & Robotics**
    - AI-driven farm management
    - Robotics in precision farming

🔑 **Strategic Alignment with Workforce Needs**

- **Critical Positions (likely in the report)**: Agronomists, Biotechnologists, Food Safety Specialists, Agricultural Engineers, Bioinformatics Specialists, Animal Scientists, and Sustainable Farming Experts.
- **Top Functional Competencies**: Food safety, genetic engineering, digital agriculture, bioinformatics, sustainable resource management.
- **National Gaps**: Shortage of advanced R&D in biotech, limited expertise in agri-digital transformation, and need for climate-smart agriculture specialists.
- **Global Competitiveness**: Scholarships should emphasize **biotech innovation, sustainable food systems, and digital agriculture** to position Thailand as a regional leader.

✅ **Summary Recommendation**:

- **Bachelor's** ⟶ Core applied fields (Agronomy, Biotechnology, Food Science, Agricultural Engineering, Animal Science).
- **Master's** ⟶ Specialized applied research (Genetics, Bioinformatics, Food Biotech, Sustainable Agriculture).
- **PhD** ⟶ Frontier innovation (CRISPR, Biopharma, Agri-genomics, Climate-smart biotech, Smart farming robotics).

A.5) Food Processing and Food for the Future Industry

Recommended Scholarship Fields by Level

1. Bachelor's Level (Applied Workforce & Industry Readiness)

Focus: Producing a large pool of graduates with strong technical and applied skills for food production, safety, and innovation.

- **Food Science & Technology**
    - Food chemistry & microbiology
    - Food processing technology
    - Food safety & hygiene (HACCP, GMP)
- **Nutrition & Dietetics**
    - Nutrition science
    - Functional foods & nutraceuticals
- **Food Engineering**
    - Process engineering
    - Packaging technology
- **Agricultural & Food Biotechnology**
    - Plant-based protein development
    - Fermentation technology
- **Business & Marketing for Food Industry**
    - Food marketing & branding
    - Market insight & consumer behavior

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2. Master's Level (Specialization & Applied R&D)

Focus: Developing specialists who can integrate science, technology, and business to drive innovation.

- **Food Innovation & Product Design**
    - Sensory science & consumer testing
    - Sustainable product development (plant-based, lab-grown foods)
- **Food Biotechnology & Molecular Biology**
    - Genetic engineering for food crops
    - Microbial biotechnology for fermentation & preservation
- **Nutrition & Functional Foods**
    - Nutraceuticals & health-promoting foods
    - Personalized nutrition
- **Food Safety & Regulatory Science**
    - International food law & standards
    - Risk assessment & compliance
- **Innovation & Operations Management**
    - Innovation management in food industry
    - Supply chain & operations for food systems

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3. PhD Level (Frontier Research & Global Leadership)

Focus: Building deep expertise in frontier areas where Thailand can lead globally in food innovation.

- **Advanced Food Biotechnology**
    - Synthetic biology for food
    - CRISPR applications in food crops & microbes
- **Future Foods & Sustainable Systems**
    - Lab-grown meat & cellular agriculture
    - Circular economy in food systems
- **Food & Health Research**
    - Gut microbiome & nutrition
    - Food as medicine research
- **Smart Food Manufacturing**
    - AI & IoT in food production
    - Robotics & automation in food processing
- **Packaging & Preservation Innovation**
    - Biodegradable & smart packaging
    - Nanotechnology for food safety & shelf-life extension

🔑 **Strategic Alignment with Report Findings**

- **Top Functional Competencies**: Food science, food technology, innovation & design ⟶ scholarships in **Food Science, Food Technology, and Food Innovation**.
- **Emerging Needs**: Nutraceuticals, food biotechnology, molecular biology ⟶ scholarships in **Nutrition Science, Biotech, and Molecular Food Research**.

- **National Gaps**: R&D in future foods (plant-based, lab-grown), packaging innovation, and digital transformation ⟶ scholarships in **PhD-level frontier research**.
- **Industry-Academia Collaboration**: The report emphasizes joint R&D with universities and global implementors ⟶ scholarships should encourage **research-industry partnerships and international collaboration**.

✅ **Summary Recommendation**:

- **Bachelor's** ⟶ Food Science & Technology, Nutrition, Food Engineering, Food Marketing.
- **Master's** ⟶ Food Innovation, Food Biotechnology, Functional Foods, Food Safety & Regulation, Innovation Management.
- **PhD** ⟶ Advanced Food Biotech, Future Foods (plant-based, lab-grown), Smart Food Manufacturing, Sustainable Packaging, Food & Health Research.

A.6) Aviation and Logistics Industry

Recommended Scholarship Fields by Level

1. Bachelor's Level (Operational & Technical Workforce)

Focus: Building a strong base of professionals for aviation operations, logistics, and compliance.

- **Aviation Management & Operations**
  - Airline operations
  - Airport management
  - Aviation safety & security
- **Logistics & Supply Chain Management**
  - Freight forwarding & multimodal transport
  - Warehouse & distribution management
  - E-commerce logistics
- **Engineering & Technical Fields**
  - Aeronautical engineering (maintenance, systems)
  - Aviation technology systems
  - Transport engineering
- **Business & Regulatory Studies**
  - International trade & customs management
  - Regulatory compliance in aviation/logistics
- **Information Technology for Logistics**
  - Logistics software systems
  - Data analytics for supply chain

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2. Master's Level (Specialization & Applied Leadership)

Focus: Developing specialists who can integrate technology, safety, and compliance into aviation and logistics.

- **Aviation Safety & Risk Management**
    - Safety management systems (SMS)
    - Emergency response planning
- **Regulatory & Policy Studies**
    - International aviation law & regulation
    - Trade compliance & customs policy
- **Aviation Technology & Innovation**
    - Smart airport systems
    - Aviation data analytics & AI applications
- **Advanced Logistics & Supply Chain**
    - Global supply chain strategy
    - Green logistics & sustainability
- **Operations & Business Analytics**
    - Predictive analytics for logistics
    - Aviation economics & route planning

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3. PhD Level (Frontier Research & Global Leadership)

Focus: Building deep expertise in frontier areas where Thailand must compete globally.

- **Advanced Aviation Systems & Technology**
    - Next-generation air traffic management
    - Unmanned aerial systems (UAS/drones) integration
- **Global Logistics & Supply Chain Innovation**
    - AI-driven logistics optimization
    - Blockchain for supply chain transparency
- **Safety Science & Human Factors**
    - Human-machine interaction in aviation
    - Safety culture and organizational resilience
- **Sustainable Aviation & Logistics**
    - Green aviation fuels & carbon-neutral logistics
    - Circular economy in transport systems
- **Policy & Strategic Studies**
    - Aviation and logistics policy for ASEAN/global hubs
    - Geopolitics of air transport and trade corridors

🔑 **Strategic Alignment with Report Findings**

- **Core Competencies Identified**: Safety management, regulatory compliance, aviation technology management ⟶ map directly to **scholarships in aviation safety, compliance, and technology management**.
- **Emerging Needs**: Digital logistics, AI, drones, green aviation ⟶ justify **Masters/PhD scholarships in smart logistics, sustainable aviation, and advanced aviation systems**.

- **National Gaps**: Limited expertise in compliance, safety culture, and advanced aviation R&D ⟶ prioritize **PhD scholarships in safety science, regulatory frameworks, and aviation innovation**.
- **Industry-Academia Collaboration**: The report stresses partnerships with global implementors ⟶ scholarships should encourage **international research collaboration and industry-linked projects**.

✅ **Summary Recommendation**:

- **Bachelor's** ⟶ Aviation Management, Logistics & Supply Chain, Aeronautical Engineering, IT for Logistics.
- **Master's** ⟶ Aviation Safety, Regulatory Compliance, Smart Aviation Systems, Global Supply Chain Strategy.
- **PhD** ⟶ Advanced Aviation Systems, AI & Blockchain in Logistics, Sustainable Aviation, Safety Science & Policy.

A.7) Creative Industry

Bachelor's Level (Applied Workforce & Creative Practitioners)

Focus: Building a large pool of creative professionals with strong technical and digital skills.

- **Digital Marketing & Communication**
    - Search Engine Optimization/Search Engine Marketing, social media marketing
    - Content creation and digital storytelling
- **Design & Creative Arts**
    - Graphic design, product design, User Experience (UX)/User Interface (UI) design
    - Visual communication and branding
- **Digital Media & Creative Technology**
    - Multimedia production (film, animation, Augmented Reality (AR)/Virtual Reality (VR))
    - Game design and interactive media
- **Business & Creative Entrepreneurship**
    - Creative business management
    - E-commerce for creative products
- **Digital Literacy & IT Foundations**
    - Applied digital tools for creative industries
    - Cybersecurity and digital rights awareness

🎓 Master's Level (Specialization & Applied Innovation)

Focus: Developing specialists who can integrate creativity, technology, and business strategy.

- **Creative Economy & Innovation Management**
    - Creative entrepreneurship and start-up incubation
    - Innovation management in cultural industries
- **Advanced Design & Experience Creation**
    - Human-centered design (User Experience (UX)/User Interface (UI), service design)
    - Design thinking for product and service innovation
- **Digital Media & Marketing Analytics**
    - Data-driven marketing strategies
    - Consumer behavior analytics in creative industries
- **Creative Technology & Immersive Media**
    - Augmented Reality (AR)/Virtual Reality (VR)/Extended Reality (XR) applications in entertainment and education
    - AI in creative content generation
- **Cultural & Heritage Management**
    - Sustainable cultural tourism
    - Heritage conservation with digital tools

🎓 PhD Level (Frontier Research & Global Leadership)

Focus: Building thought leaders and innovators who can position Thailand as a global creative hub.

- **Creative Economy Policy & Strategy**
    - Comparative studies of global creative hubs
    - Policy frameworks for creative industry growth
- **Digital Transformation in Creative Industries**
    - AI, blockchain, and Web3 for creative content
    - Smart platforms for creative distribution
- **Design Futures & Innovation Research**
    - Speculative design and future studies
    - Cross-disciplinary design research (art, tech, society)
- **Creative Media & Society**
    - Media innovation and cultural impact studies
    - Ethics and governance in digital creativity
- **Sustainable Creative Ecosystems**
    - Green design and sustainable creative production
    - Circular economy in creative industries

🔑 **Strategic Alignment with Report Findings**

- **Top Competencies**: Digital Marketing, Design Principles, Digital Literacy ⟶ scholarships in **Digital Marketing, Design, and Creative Technology**.
- **Emerging Needs**: AR/VR, AI-driven content, creative entrepreneurship ⟶ scholarships in **Creative Tech, Innovation Management, and Start-up Development**.
- **National Gaps**: Limited global competitiveness in content production and digital platforms ⟶ prioritize **PhD scholarships in Creative Economy Policy, Digital Transformation, and Sustainable Creative Ecosystems**.
- **Industry-Academia Collaboration**: The report stresses **global implementors and local start-up investment** ⟶ scholarships should encourage **international research collaboration and creative entrepreneurship incubation**.

✅ **Summary Recommendation**:

- **Bachelor's** ⟶ Digital Marketing, Design, Creative Media, Digital Literacy, Creative Business.
- **Master's** ⟶ Creative Economy & Innovation, Advanced Design, Marketing Analytics, Augmented Reality (AR)/Virtual Reality (VR) & Creative Tech, Cultural Management.
- **PhD** ⟶ Creative Economy Policy, Digital Transformation, Design Futures, Media & Society, Sustainable Creative Ecosystems.

A.8) Digital Industry

Bachelor's Level (Applied Workforce & Technical Specialists)

- **Computer Science & Software Engineering**
  - Software development processes
  - Web and mobile application development
- **Information Technology & Systems**
  - IT support and network administration
  - Cloud systems and platform management
- **Data Science Foundations**
  - Data analytics and statistics
  - Database management
- **Digital Business & Marketing**
  - Digital marketing strategies
  - E-commerce and digital business analysis
- **Digital Product & User Experience (UX)/User Interface (UI) Design**
  - User interface and user experience design
  - Digital product design

🎓 Master's Level (Specialization & Applied R&D)

- **Advanced Software Engineering**
    - Agile and DevOps practices
    - Secure software development
- **Data Science & Engineering**
    - Big data systems
    - Data pipeline and architecture design
- **Digital Business Strategy & Innovation**
    - Digital transformation management
    - FinTech and platform economy
- **Cloud & Platform Engineering**
    - Cloud-native applications
    - Platform integration and management
- **Digital Marketing Analytics**
    - Consumer behavior analytics
    - Marketing automation and personalization

🎓 **PhD Level (Frontier Research & Global Leadership)**

- **Next-Generation Software & Platforms**
  - Scalable distributed systems
  - Edge computing and IoT governance
- **Digital Economy & Policy**
  - Digital trade and platform regulation
  - Cyber law and digital governance frameworks
- **Human-Centered Digital Design**
  - Advanced User Experience (UX) research
  - Neurodesign and digital behavior studies
- **Cloud & Data Infrastructure Research**
  - Data center optimization
  - Cloud security and compliance frameworks

🔑 **Strategic Takeaways**

- **Digital Cluster** scholarships should focus on **software, platforms, data, digital business, and cloud systems** to build a broad digital workforce.
- **National Gaps**: Thailand needs more **PhD-level researchers** in **digital economy policy** to compete globally.

✅ **Summary Recommendation**:

- **Digital Cluster** ⟶ Bachelor's for software/IT/digital business, Master's for data/cloud/strategy, PhD for digital economy and advanced platforms.

A.9) Integrated Medical Industry

Focus: General workforce demand, frontline healthcare, and applied medical services.

Scholarship Level: Primarily **Bachelor's and Master's**, with some PhD for applied research.

Critical Positions (High Demand)

- Nurses
- Pharmacists
- Medical Technicians
- Physical Therapists
- Thai & Chinese Traditional Medicine Doctors
- Cosmetic Scientists
- Physicians (general practice)

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Bachelor's	Nursing	Geriatric Nursing, Critical Care, Community Health
	Pharmacy	Clinical Pharmacy, Hospital Pharmacy, Herbal & Natural Products
	Medical Technology	Clinical Laboratory Science, Diagnostic Imaging
	Physical Therapy	Rehabilitation, Sports Therapy, Elderly Care
	Traditional Medicine	Thai Traditional Medicine, Chinese Herbal Medicine
	Cosmetic Science	Dermatological Formulations, Cosmetic Product Development
Master's	Public Health	Health Policy, Epidemiology, Health Informatics
	Pharmaceutical Sciences	Drug Formulation, Pharmacokinetics
	Biomedical Sciences	Microbiology, Immunology
	Health Information Technology	Electronic Health Records (EHR), Telemedicine Systems
PhD (selective)	Applied Medical Sciences	Translational Medicine, Integrative Medicine

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🔑 Key Takeaways for Scholarship Allocation

- **Medical Hub Cluster (Report 1):**
  Focus scholarships at **Bachelor's and Master's** levels to meet **large-scale workforce demand** (nurses, pharmacists, technicians, therapists).

B. Emerging Industries

B.1) Electric Vehicle Industry

Focus: Electric vehicle (EV) technology, energy storage, and next-generation propulsion systems.
Scholarship Level: Master's and PhD heavy, with **Bachelor's** for technician and applied engineering roles.

EV-Specific Critical Positions

- Electric Engineers (EV propulsion, motors)
- EV Systems Integration Specialists
- Battery & Energy Storage Researchers
- High-Performance Materials Researchers
- Automated Driving Systems Researchers
- Intelligent Vehicle Systems Researchers
- Sustainable Energy Systems Researchers

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Bachelor's	Electrical Engineering	EV Powertrain, Charging Infrastructure
	Mechatronics Engineering	EV Control Systems, Sensor Integration
	Materials Engineering	Battery Materials, Lightweight Alloys
Master's	Electric Vehicle Technology	EV Design, Power Electronics, Thermal Management
	Energy Storage & Battery Engineering	Lithium-ion, Solid-State Batteries, Recycling & Lifecycle
	Computer Engineering	Autonomous Driving Software, Vehicle-to-Everything (V2X)
	Data Science	EV Data Acquisition, AI for Energy Optimization
PhD	Advanced Energy Systems	Grid Integration, Smart Charging, Hydrogen Fuel Cells
	High-Performance Materials	Nanomaterials, Polymer Composites for EVs
	Autonomous & Intelligent Systems	AI for Autonomous Driving, Human-Machine Interaction
	Sustainable Mobility Policy	EV Ecosystem Development, Green Mobility Strategy

🔑 **Key Takeaways for Scholarship Allocation**

- **Electric Vehicle Industrial Cluster:**
  Prioritize **Master's and PhD scholarships** for **EV propulsion, battery technology, autonomous driving, and sustainable energy systems**, ensuring Thailand can compete in the global EV race.

B.2) Artificial Intelligence & Cybersecurity Industry

Bachelor's Level (Applied Workforce & Technical Specialists)

- **Artificial Intelligence & Machine Learning**
    - Fundamentals of AI/ML
    - Applied AI in business and industry
- **Cybersecurity & Information Assurance**
    - Network security fundamentals
    - Digital security compliance basics
- **Data Science & Applied Statistics**
    - Data mining and predictive analytics
    - Statistical modeling for AI

🎓 Master's Level (Specialization & Applied R&D)

- **Artificial Intelligence Engineering**
    - Deep learning and neural networks
    - Natural language processing (NLP)
- **Machine Learning Systems**
    - Scalable ML pipelines
    - AI model deployment and monitoring
- **Cybersecurity Engineering**
    - Cyber defense and penetration testing
    - Cloud and platform security
- **AI Ethics & Governance**
    - Responsible AI frameworks
    - Data privacy and AI regulation

🎓 **PhD Level (Frontier Research & Global Leadership)**

- **Advanced AI Research**
  - Generative AI and foundation models
  - Reinforcement learning and autonomous systems
- **AI for Industry & Society**
  - AI in healthcare, finance, and logistics
  - Human-AI collaboration research
- **Cybersecurity Science**
  - Cryptography and quantum-safe security
  - AI-driven cybersecurity defense systems
- **AI Policy & Global Strategy**
  - International AI governance
  - Ethical and societal impacts of AI adoption

🔑 **Strategic Takeaways**

- **AI Cluster** scholarships should prioritize **AI engineering, machine learning, data science, and cybersecurity** to address the acute shortage of advanced specialists.
- **National Gaps**: Thailand needs more **PhD-level researchers** in **AI, and cybersecurity** to compete globally.

✅ **Summary Recommendation**:

- **AI Cluster** ⟶ Bachelor's for AI/cyber foundations, Master's for AI engineering and cybersecurity, PhD for frontier AI research, cybersecurity science, and AI governance.

B.3) Advanced Semiconductors & Smart Electronics Industry

Focus: Electronics, semiconductors, IoT, AI, and data-driven systems.

Scholarship Level: Balanced across **Bachelor's, Master's, and PhD**, with heavier emphasis on **Master's/PhD** for semiconductor R&D and AI.

Critical Positions

- Electronic Engineers
- Electrical Engineers
- Computer Engineers
- Software Engineers
- Data Engineers / Data Analysts
- Semiconductor Researchers
- Electronics Researchers
- Device & Hardware Developers
- AI Specialists

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Bachelor's	Electrical & Electronics Engineering	Circuit Design, Embedded Systems, Power Electronics
	Computer Engineering	Microprocessors, IoT Systems, Cybersecurity for Devices
	Software Engineering	Programming, Firmware Development, Robotics Software
	Materials Science	Semiconductor Materials, Nanomaterials
Master's	Semiconductor Engineering	Very Large Scale Integration (VLSI) Design, Chip Fabrication, Failure Analysis
	Data Science & AI	Machine Learning, Computer Vision, Edge AI for Devices
	IoT & Cyber-Physical Systems	IoT Governance, Sensor Networks, Smart Devices
	Advanced Electronics	Signal Processing, Electromagnetic Compatibility (EMC)
PhD	Advanced Semiconductor Research	Nanoelectronics, Quantum Devices, High-Performance Materials
	Artificial Intelligence	Deep Learning for Robotics & Electronics, AI Hardware Acceleration
	Smart Systems Integration	Human-Machine Interfaces, Intelligent Embedded Systems

🔑 **Key Takeaways for Scholarship Allocation**

- **Smart Electronics & Advanced Semiconductors Cluster:**
    - **Bachelor's:** Build a strong base of engineers in electronics, computers, and software.
    - **Master's/PhD:** Prioritize **semiconductors, AI, IoT, and data science** to strengthen Thailand's competitiveness in chip design and smart devices.

B.4) Advanced Medical Industry

Focus: R&D, innovation, and specialized expertise for Thailand's ambition to be a **regional medical hub**.

Scholarship Level: Primarily **Master's and PhD**.

🎯 Advanced / Strategic Positions

- Medical Researchers
- Pharmaceutical Researchers
- Biomedical Engineers
- Sports Medicine Physicians
- Psychiatrists
- Healthcare IT Specialists
- Development Project Managers (R&D)

📘 Recommended Fields of Study

Degree Level	Major Fields	Suggested Specializations
Master's	Medicinal Chemistry	Drug Discovery, Structure-Activity Relationship (SAR)
	Biomedical Engineering	Medical Devices, Prosthetics, Imaging Systems
	Clinical Data Science	AI in Healthcare, Big Data Analytics, Predictive Modeling
	Health Informatics	Health Information Exchange (HIE), Digital Health Platforms
	Pharmaceutical Process Engineering	Biopharmaceutical Manufacturing, GMP Compliance

PhD	Advanced Pharmaceutical Sciences	Novel Drug Delivery, Pharmacogenomics
	Regenerative Medicine	Stem Cell Therapy, Tissue Engineering
	Neuroscience & Psychiatry	Mental Health Innovation, Neuropharmacology
	Precision Medicine	Genomics, Personalized Therapeutics
	Global Health & Policy	Medical Tourism Strategy, International Health Systems
	Advanced Laboratory Science	Good Laboratory Practice (GLP) Systems, Biotech Innovation

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🔑 **Key Takeaways for Scholarship Allocation**

- **Advanced Medical Cluster:**
  Prioritize **Master's and PhD scholarships** for **R&D, biomedical engineering, pharmaceutical innovation, and digital health** to position Thailand as a **global medical hub**.

B.5) Energy Transition, Bioenergy, Biochemicals, and Biotechnology Industry

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Bachelor's Level (Applied Workforce & Technical Specialists)

- **Chemical Engineering (Biochemical & Biofuel focus)**
    - Bioprocess engineering
    - Refinery technology for biofuels
- **Biotechnology**
    - Industrial biotechnology applications
    - Microbial and enzyme technology
- **Materials Engineering**
    - Biobased materials development
    - Polymer and composites from renewable sources
- **Environmental Engineering (Energy focus)**
    - Waste-to-energy systems
    - Emission control technologies
- **Quality Control & Industrial Technology**
    - Bioproduct quality assurance
    - Laboratory techniques for bio-based industries

🎓 **Master's Level (Specialization & Applied R&D)**

- **Bioenergy & Renewable Fuels**
    - Advanced biofuel development (2nd/3rd generation biofuels)
    - Biomass conversion technologies
- **Biochemical Engineering**
    - Biocatalysis and fermentation technology
    - Biorefinery process design
- **Industrial Biotechnology**
    - Synthetic biology for industrial applications
    - Biopharmaceutical and bio-based product development
- **Materials Science & Engineering**
    - Advanced biomaterials and nanomaterials
    - Sustainable packaging from biopolymers
- **Energy Systems & Technology**
    - Energy technology integration
    - Smart grids for renewable energy

🎓 **PhD Level (Frontier Research & Innovation Leadership)**

- **Advanced Biotechnology & Synthetic Biology**
    - CRISPR and gene-editing for bio-based industries
    - Metabolic engineering for high-value biochemicals
- **Next-Generation Biofuels & Biochemicals**
    - Algae-based fuels
    - Hydrogen and bio-hybrid energy systems
- **Biobased Materials & Circular Biomanufacturing**
    - High-performance composites from renewable feedstocks
    - Industrial-scale biopolymer innovation
- **Sustainable Energy Policy & Economics**
    - Policy frameworks for bioenergy adoption
    - Techno-economic analysis of biorefineries
- **Climate & Environmental Biotechnology**
    - Carbon capture using bio-based systems
    - Soil and water remediation with biotechnology

🔑 **Strategic Takeaways**

- **Energy Transition Cluster** ⟶ Scholarships should prioritize **STEM-heavy fields** (biotech, chemical engineering, materials science, energy systems) to build R&D capacity.
- **National Gaps**: Thailand needs more **PhD-level researchers** in **bio-based innovation** to compete globally.

✅ **Summary**:

- **Bachelor's** ⟶ Build a broad technical workforce (engineering and biotech).
- **Master's** ⟶ Develop applied specialists (bioenergy and biochemicals).
- **PhD** ⟶ Invest in frontier innovation (synthetic biology and advanced biofuels).

B.6) Sustainable Natural Resources and Environment, Circular Economy, and Green Economy Industry

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Bachelor's Level (Applied Workforce & Technical Specialists)

- **Environmental Engineering & Management**
    - Waste management and recycling technology
    - Pollution control systems
- **Sustainability Studies**
    - Environmental science and resource management
    - Environmental, Social, Governance (ESG) fundamentals
- **Materials & Recycling Technology**
    - Recycling engineering
    - High-value waste management
- **Business & Sustainable Management**
    - Green supply chain management
    - Sustainable business practices

🎓 **Master's Level (Specialization & Applied R&D)**

- **Circular Economy & Resource Efficiency**
    - Lifecycle assessment (LCA)
    - Circular supply chain design
- **Environmental Technology & Green Innovation**
    - Smart monitoring systems for emissions and waste
    - Eco-industrial park design
- **Sustainable Business & ESG Management**
    - Corporate sustainability strategy
    - Environmental, Social, Governance (ESG) reporting and compliance
- **Policy & Governance for Sustainability**
    - Environmental law and policy
    - International frameworks for Green Economy
- **Data Science for Sustainability**
    - Environmental modeling and simulation
    - Market and consumer analytics for green products

🎓 **PhD Level (Frontier Research & Global Leadership)**

- **Advanced Circular Economy Systems**
    - Zero-waste industrial ecosystems
    - Circular design for manufacturing and cities
- **Green Technology & Climate Innovation**
    - Carbon-neutral technologies
    - Renewable resource substitution
- **Environmental Policy & Global Governance**
    - Comparative studies of green economy models
    - ASEAN and global sustainability frameworks
- **Sustainable Materials & Recycling Science**
    - Nanotechnology for recycling and waste valorization
    - High-value recovery from industrial/agricultural waste
- **Integrated Climate & Resource Management**
    - Climate adaptation strategies
    - Water-energy-food nexus research

🔑 **Strategic Takeaways**

- **Sustainable Natural Resources & Environment Cluster** ⟶ Scholarships should emphasize **interdisciplinary programs** (environmental engineering, sustainability management, ESG, policy, and data science) to create leaders in green transformation.
- **National Gaps**: Thailand needs more **PhD-level researchers** in **circular economy systems, and green policy frameworks** to compete globally.

✅ **Summary**:

- **Bachelor's** ⟶ Build a broad technical workforce (environmental science and sustainability).
- **Master's** ⟶ Develop applied specialists (Environmental Social and Governance, circular economy, and environmental technology).
- **PhD** ⟶ Invest in frontier innovation (zero-waste systems and climate policy).