Crafting Regional Innovation Ecosystems in Southeast Asia

Three Country Case Studies

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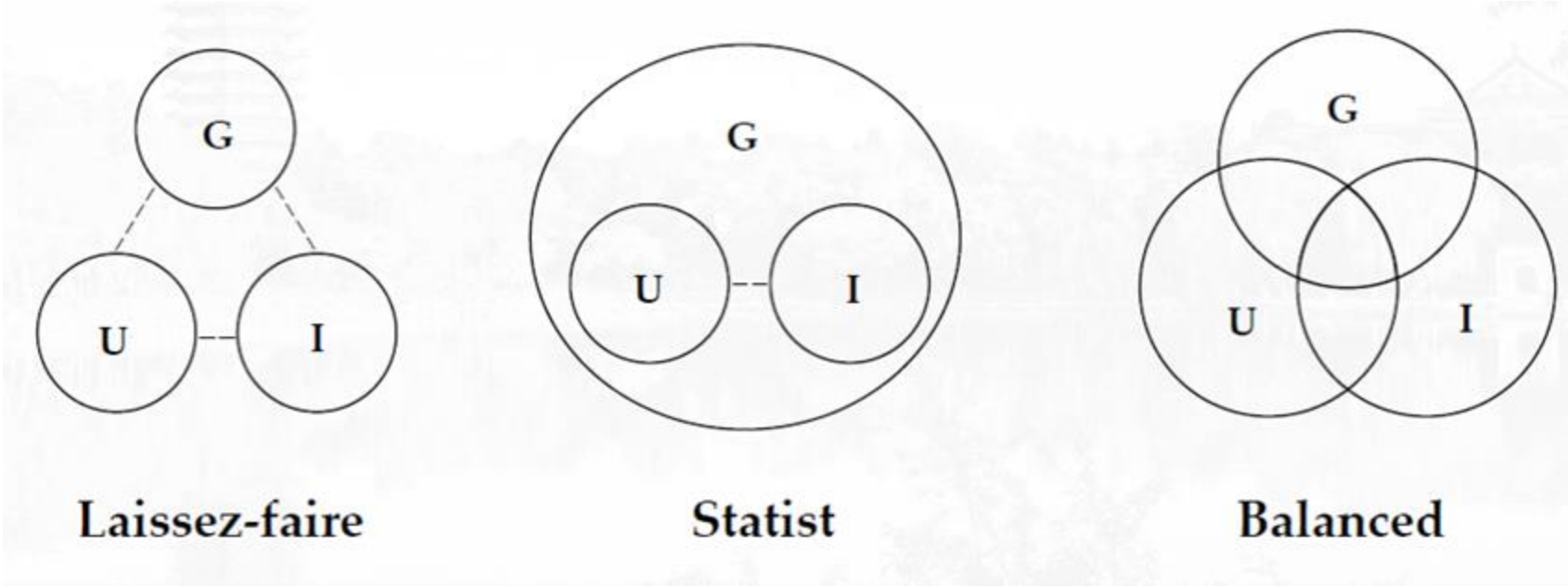
Part I: Introduction

Regional Innovation Systems around the World

It all started with a question during a study visit to ADB in 2016!

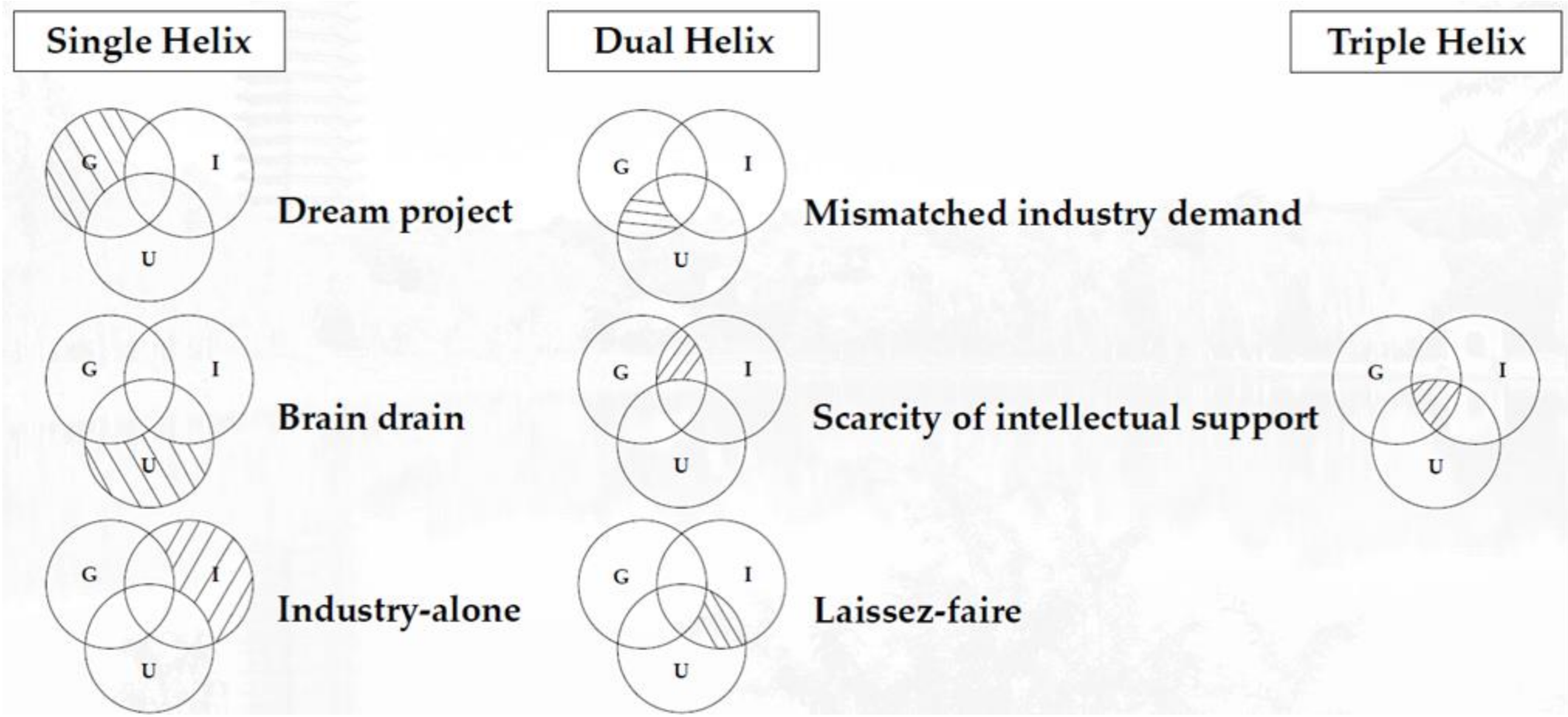
"You talk about the importance of strengthening university-industry linkage, but what can we do when there is no solid industry to begin with and our universities are rather weak in capacity?"

Triple Helix Theory (Etzkowitz & Leydesdorff, 2000)

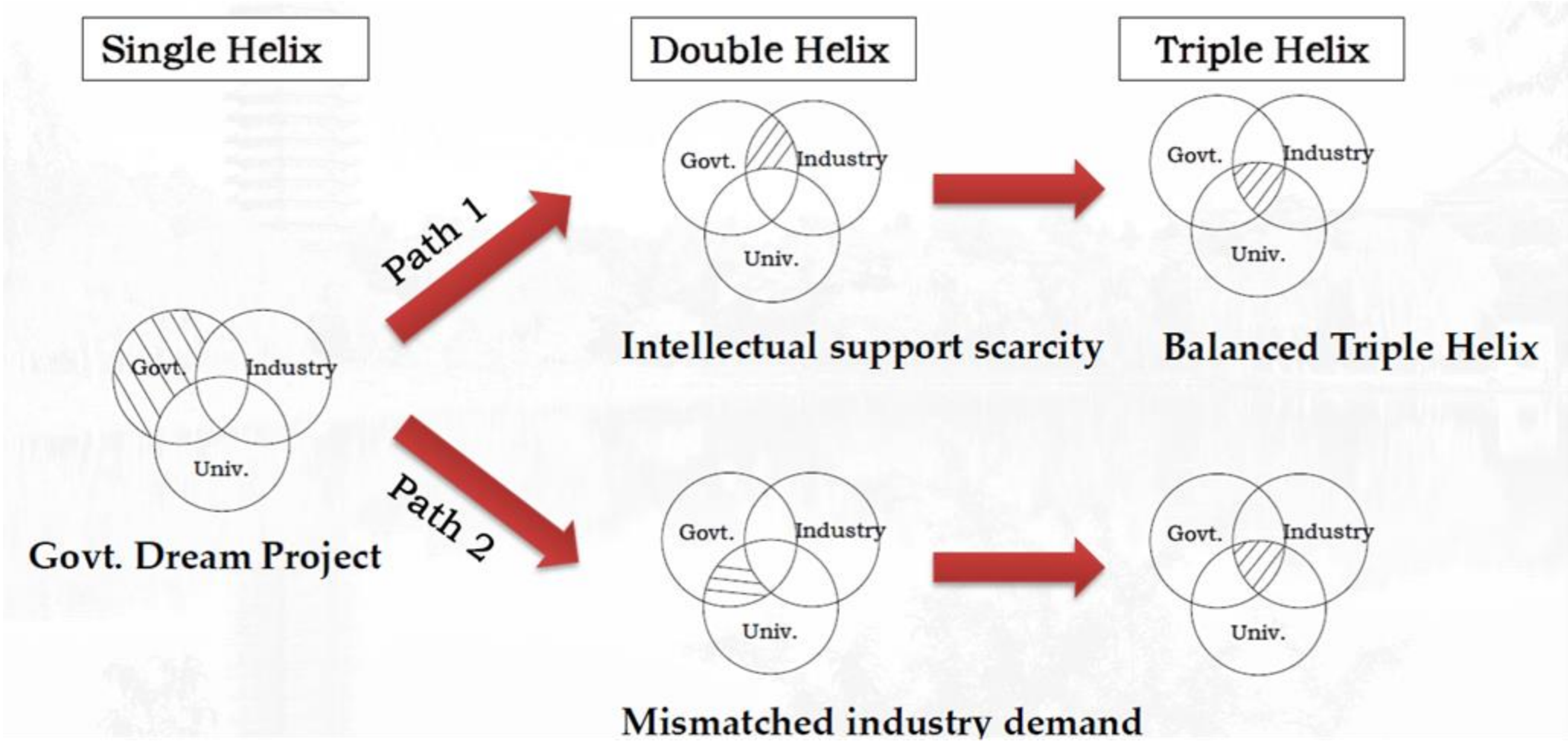


- Lacks applicability in other institutional contexts（Cai, 2014, 2015; Cooke, 2005）
- Lacks micro-theoretical foundation, being highly-abstract（Shinn, 2002）
- Underestimates the roles of governments

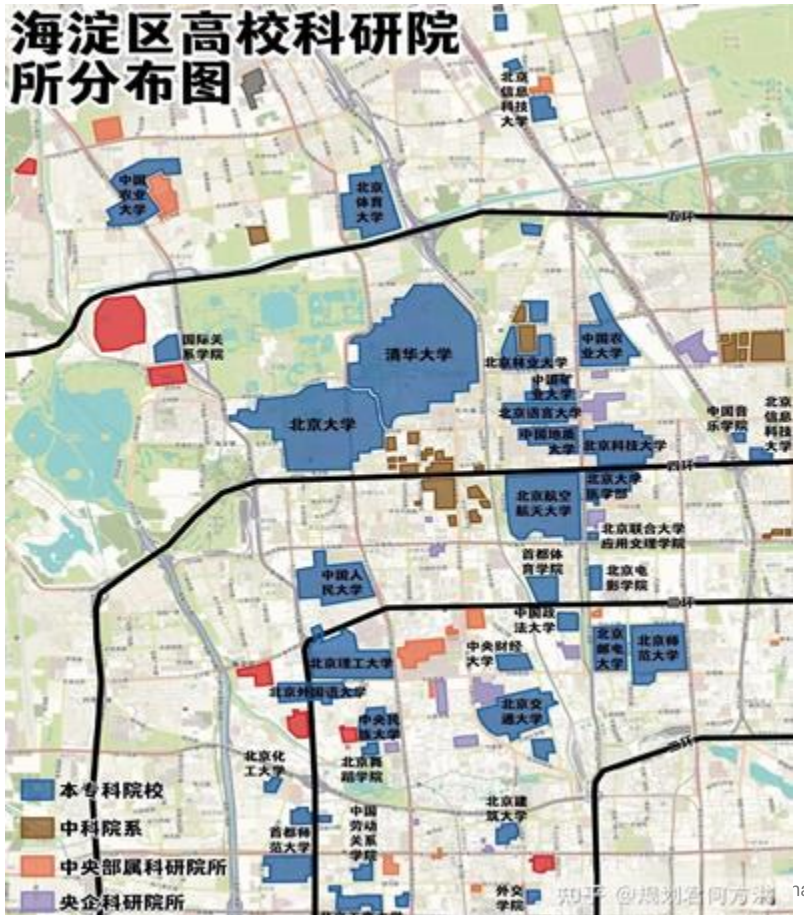
New Triple Helix model (Ha and Lin, 2023)



Evolutionary Pathways of Triple Helix



U→U+I→U+I+G：Zhongguancun Science Park



➢ **1950s-early 1970s**：

U： high density of research universities and research institutes of Chinese Academy of Sciences and others under Statist Triple Helix

➢ **1980s**：

U：Chen Chunxian, a researcher at the Institute of Physics Chinese Academy of Sciences, established the Advanced Technology Development Service Department of the Beijing Plasma Society in a region boasting itself as bread basket.

➢ **Early 1990s**：

I：Forming of the "Zhongguancun Electronics Street“ with nearly 100 IT firms such as Tsinghua Unisplendour, PKU Founder, Lenovo from CAS.

➢ **Late 1990s to date**：

G：In 1988, the State Council officially approved the Science Park. In 2009, it was recognized as National Innovation Demonstration Zone.

Shenzhen Science Park

G→G+I→G+I+U：Shenzhen IT Cluster

➢ **1980s and early 1990s**：

G: Shenzhen Special Economic Zone established 1980.

I: Labor-intensive industries & carrying-trade developed.

U: Shenzhen University (1983) & Shenzhen Vocational College (1993)

➢ **Late 1990s to date**：

I: Forming an IT cluster including Tencent, Huawei, BYD

U: Introducing satellite campuses from top universities, PKU Shenzhen (2001), Tsinghua Shenzhen (2001), Harbin Institute of Technology Shenzhen (2002), CUHK Shenzhen (2014), Zhongshan Univ Shenzhen (2015) ; Shenzhen Institute of Information Technology, SusTech (2012), Shenzhen Technology University (2018), Shenzhen University of Advanced Technology (2024),

Part II: Innovation Systems in Cambodia

Applying Triple-Helix to Nascent Innovation-fostering Cooperation

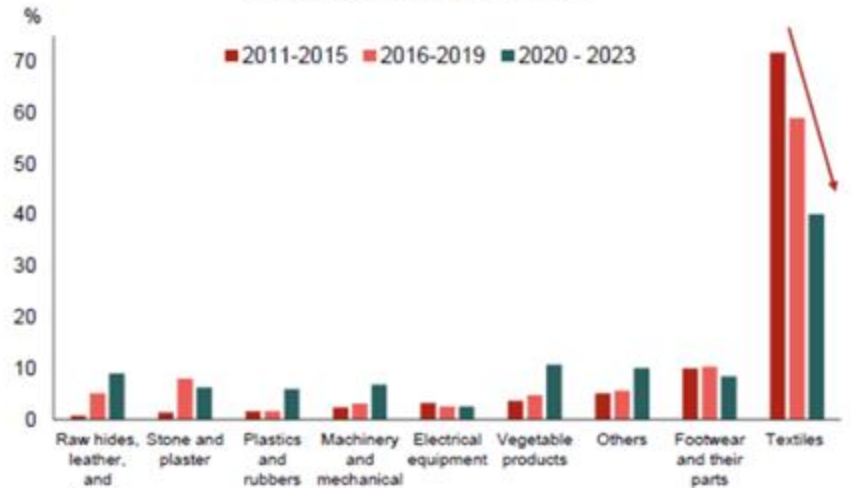
Isaac Castella McDonald

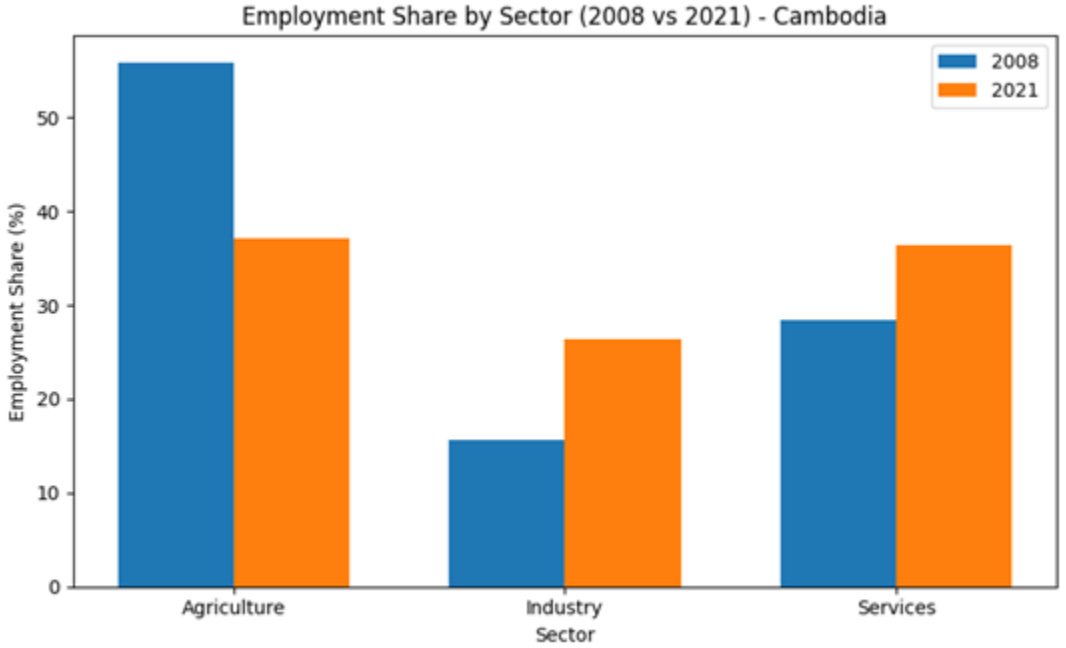
Cambodia's Development Profile

From garments to diversification

- Since reconstruction Cambodia has transformed from an agricultural to an industrial economy.
- **1990s:** Economy opened to international investment. FDI made Cambodia of the world's **fastest growing economies** from 1995-2019.
- **2000s:** Garments drove growth. Today 16% of GDP, 62% exports in 2023.
- **2010-20s:** Diversification into Electronics, Automotives, Tires, Bicycles.

Figure 1. Cambodia's Export Share by Manufacturing Sector

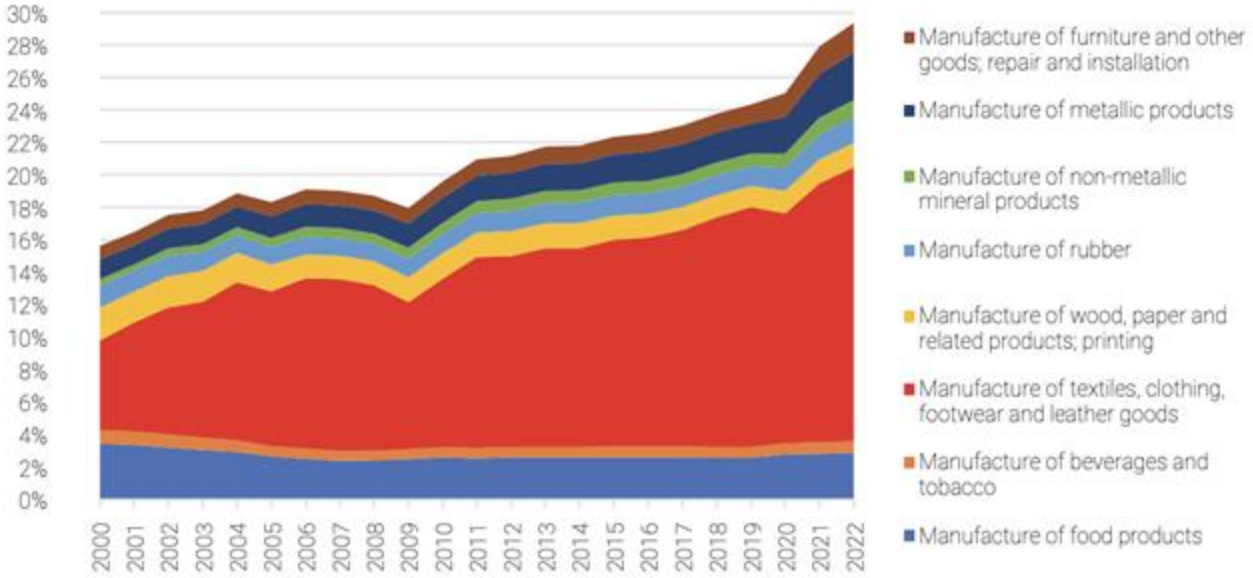




Helix 1: Private Sector

- Cambodia's private sector is dominated by large firms (0.6% of firms make 76% of turnover)
- 68% of large manufacturers are based in Phnom Penh and surrounding Kandal Province
- SEZs employ 226,000, but with 90% foreign-ownership risk weak value-transfer
- Major limiting factor is the lack of skilled staff (Elçi, 2023). Emergent VC funds have found a lack of scalable firms.
- High degree of informality (87.75% in 2023)

Figure 12: Share of value-added within the manufacturing sector (Percent)



Source: Author's calculation based on MEF rebased data 2023 (Constant price 2014)

Helix 2: Government

- **2015:** Industrial Development Policy (2015-25)
  - Diversify manufacturing exports
  - Enhance value-capture through agro-processing

- **2018:** Skills Development Fund founded to train diversified workforce
  - 2023: Enterprise 'Go Digital'

- **2021:** Formation of Ministry of Science, Technology, and Innovation (MISTI)
  - 3 STI Parks proposed in Phnom Penh, Battambang, Kampong Thom
  - Increase R&D to 1% of GDP
  - National Research Agenda 2025

- **2021:** Ministry of Posts and Telecommunications (MPAT)
  - Channels industry levies into research through CADT and IDRI
  - Equity-free cash grants for startups +67% from 2023-2024
  - National Digital Park, data centre

Post-pandemic there has been a notable emphasis on digital transformation in Cambodia's National Innovation Narrative

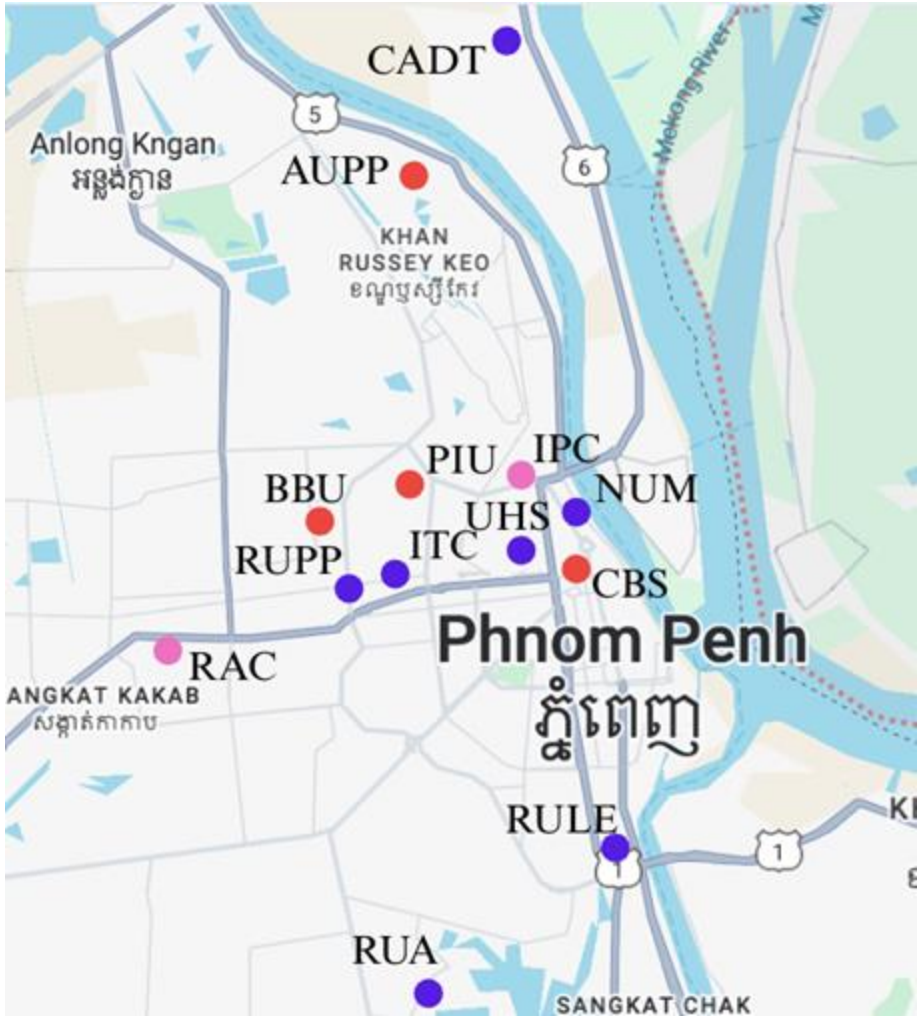
Helix 3: Higher Education

- **132 HEIs, 36% Public**
- **HEI enrolment increased 10x since 2000, reaching 18%**
- **STEM accounts for ⅕ of enrolment (2024)**
- **Key Institutions**

1960: Royal University of Phnom Penh (RUPP)
- Techo Startup Centre

1964: Institute of Technology of Cambodia (ITC)
- Research and Innovation Centre (RIC)
- Training partnerships with Huawei, Panasonic, Siemens

2013: Cambodian Academy of Digital Technology (CADT)
- Institute for Digital Research and Innovation (IDRI)



Case: Phnom Penh

1993 – early 2000s
Private sector leads
Liberalised investment sparks rapid FDI-driven growth in garments:

- Kong Hong Garment Co Ltd.
- High Fashion Group

Domestic conglomerates pioneer diversification:

- Royal Group → Wing Bank
- Smart Axiata → SmartStart (with Impact Hub)

2000-2020s
Gov-led Diversification
Shift to proactive industrial policy.

- Established Phnom Penh SEZ in 2006
- MEF's Skills Development Fund (2018) Deployed $13.28m USD in grants with a cost-sharing, demand-driven model.
- Khmer Enterprise (2019)

2019+ R&D, Incubators, TVET
Universities in the capital increasingly prioritise research and industry linkages.

- MPTC's Academy of Digital Technology (CADT) invests telecoms levies into digital innovation
- ITC's partnerships with Siemens, Huawei, Panasonic for upskilling
- RUPP's Techo Startup Centre

Present Status
Intellectual support scarcity status
Priorities are - Investing in undergraduate STEM education - Standard-raising reforms at HEIs - Deeper U-I linkages, - Nurturing domestic "superstar" firms

Evolutionary Path

Part III: Indonesia's National Innovation System

From Academia to Regional Innovation

Nicole Accalia Angriawan

Indonesia's Development Profile

PRE MATURITY INSTABILITY (1945–1970)

- Post Independence & Focus on Nation building
- Agricultural-based economy due to colonization legacy
- First foundation of Innovation Institution through Science Vision 1961–1969
  - Establishment of science institutions
  - Research as an important tool for national development

INDUSTRIALIZATION & INFRASTRUCTURE DEVELOPMENT (1970–2004)

- Boosting Economy & Human Capital through Five Year Plan (Pelita) Development
- Economic transition from agrarian to industrial society due to 1970–1980 oil boom
- Major economic shock due to Asia Financial Crisis 1997–1998, led to GDP contraction (National Statistics Agency, 1998; CNBC, 2025)
  - 49.5 million people (poverty)
  - 29.5 million people (lost employment)
- Government transition to Reformation (1998) & Economy Recovery plan
  - Social safety network (access to health and education), emphasizing on human capital investment

PATHWAY TO KNOWLEDGE-BASED ECONOMY (2004–Present)

- First National RPJP (Long-term Development Plan implementation (2005–2025) aiming to achieve middle income status and boost economy through human capital investment
- MP3EI (National Economic Advancement Masterplan) 2011–2025, establishing economic corridor and interregional connectivity
- Establishment of BRIN as an integrated government innovation agency (2021)
- 5.0% GDP Growth Annually (World Bank, 2024): Economy is dominated by service industry: 43% contribution to GDP & 49.2% contribution to employment rate
- National RPJP 2025–2045 to achieve Golden Indonesia 2045 as an umbrella vision of Indonesia pathway to be a developed nation

Triple Helix Lens: Higher Education Institutions

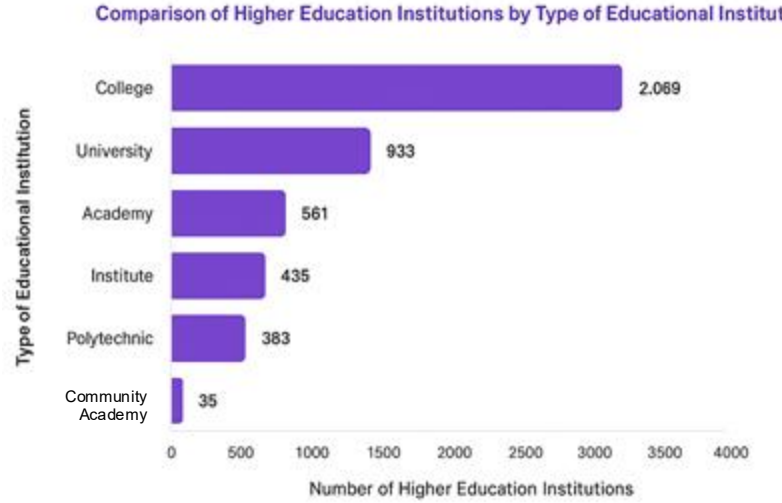
Main Executors in implementing Innovations: 4,416 higher education institutions, 8.4 million students, 249,375 educators (Indonesian Higher Education Database & National Statistics Center, 2024)

Roles:

- Biggest contributor in research expenditures (46.02%) and has the largest number of researchers (96.06%), compared to government and industry
- University-initiated Science and Technology Park as an innovation hub and connecting with industry partners

Challenges: Limited numbers of universities with high ranking and impactful contribution to the innovation ecosystem

Picture 1: Universities's Science and Technology Parks: Universitas Indonesia, Bandung Technological Institute, Gadjah Mada University, and Bogor Agricultural Institution



Picture 2: Top Universities' distribution in Indonesia

Sources: National Research and Innovation Agency, Ministry of Higher Education, Science, and Technology, Kompas.id

Triple Helix Lens: Government

Policymakers consist of multiple actors: **Ministry of Higher Education, Science, and Technology** (MoHEST), **Ministry of Development Planning** (Bappenas), and **National Research and Innovation Agency** (BRIN) where each institution has respective funding, mandate, and coordination channel.

Relevant Policies:

- Bappenas implemented the Long Term Development Planning (National RPJP 2025–2045) Golden Indonesia 2045
- Ministries follow the National RPJP: MoHEST on (1) Impactful Higher Education, (2) National Science and Technology Park establishment
- Establishment of National Research and Innovation Agency (BRIN), boosting the national innovation ecosystem, led to rapid growth in Global Innovation Index

Challenges: Centralized yet Fragmented government institutions led to complex bureaucracy

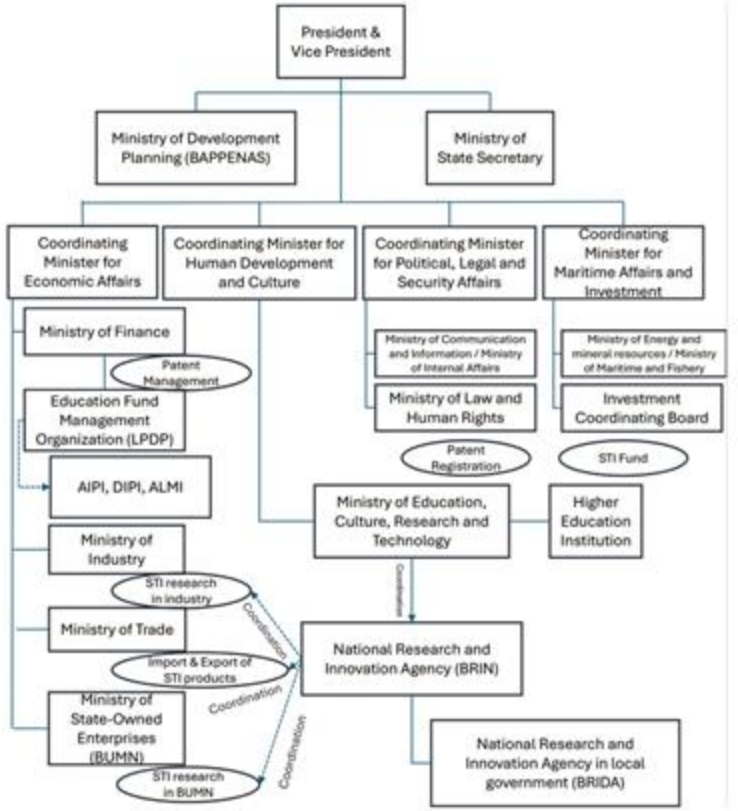
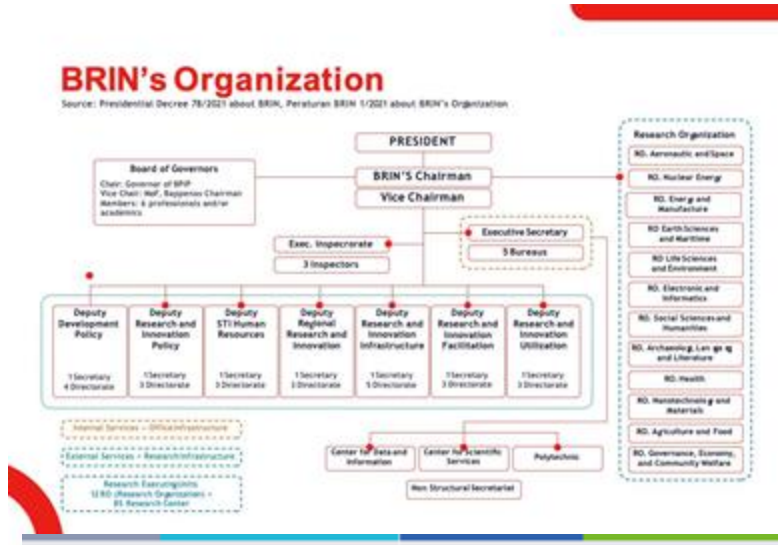


Figure 28 Institutions in implementing Science and Technology Policy in Indonesia
Source: adapted from JST (2015)



Year	GII Position	Innovation Inputs	Innovation Outputs
2020	85th	91st	76th
2021	87th	87th	84th
2022	75th	72nd	74th
2023	61st	64th	63rd
2024	54th	54th	67th
2025	55th	60th	59th

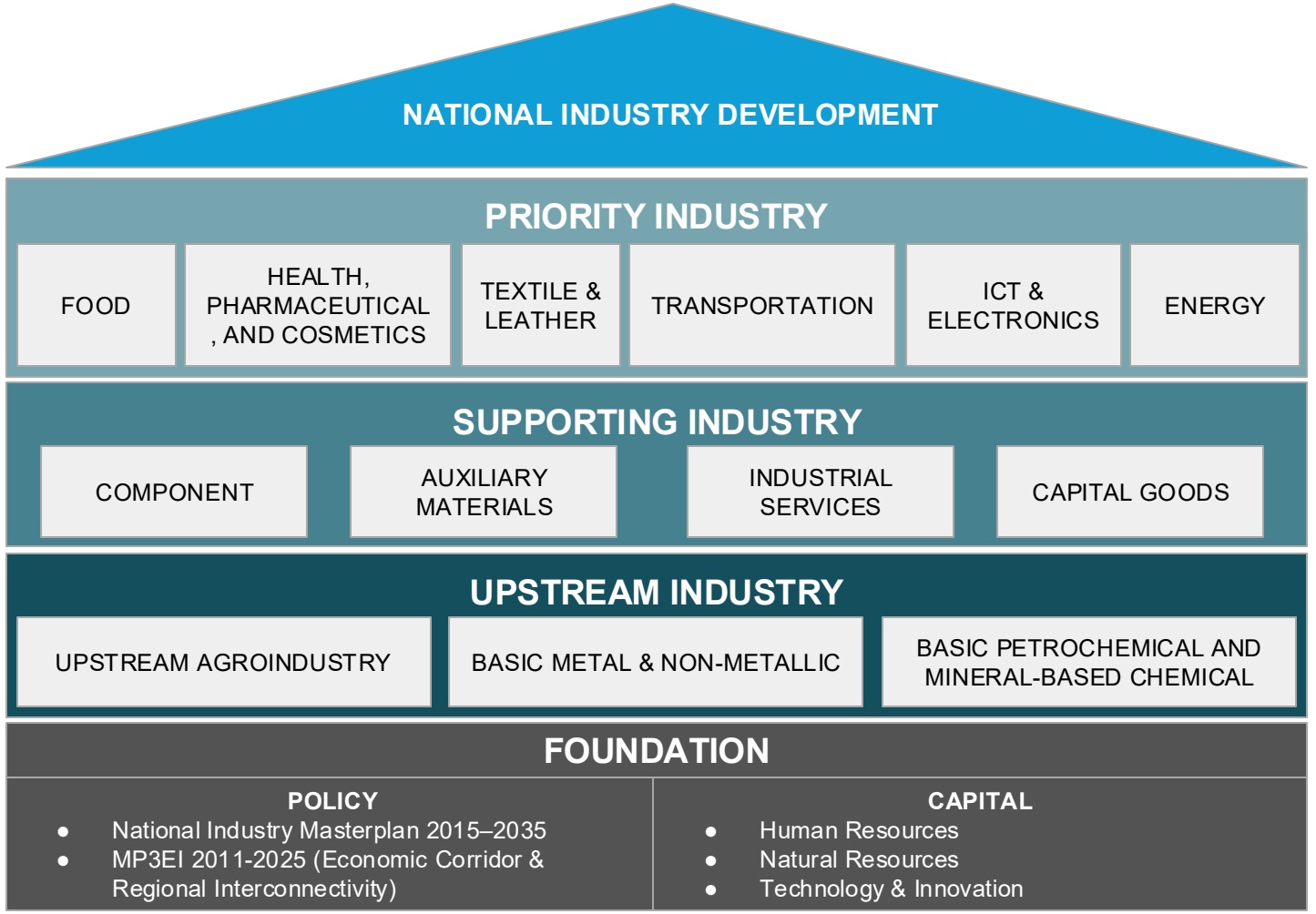
Sources: Ministry of Development Planning (Bappenas), National Research and Innovation Agency (BRIN), Japan Science, and Technology Agency (JST) and World Intellectual Property Office (WIPO)

Triple Helix Lens: Industry

Key player in driving the economic growth, prominent collaborator to advance Innovation in Indonesia:

- Economic sectors
  - Food processing
  - Health & Pharmaceuticals
  - Mineral & Energy
  - Construction & Infrastructure
- State Owned Enterprises influence in vital resources (Energy and Mineral & Banking)
- Private Companies
  - Growing startups in Southeast Asia (Kopi Kenangan - FnB, GoTo - Service, Halodoc - Health)
  - Corporations leading in industry
- Small & Medium Enterprises as the local economy backbone

Challenges: Weakest Linkage within NIS & economy is still dominated by low-skilled & low productivity labour as well as low technology output



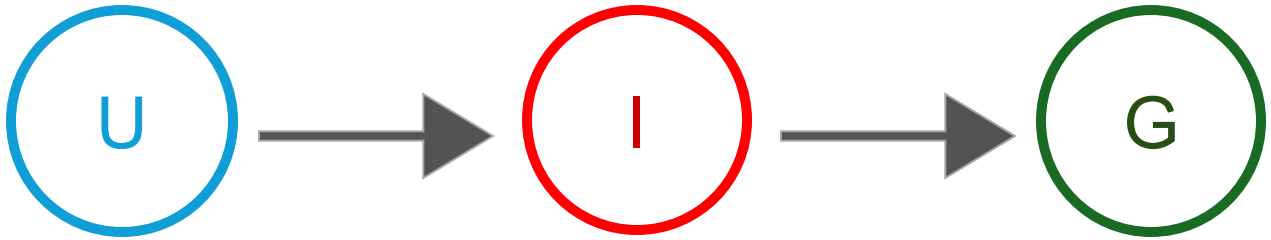
Sources: Masterplan on National Industry Development (RIPIN 2015–2035) by Ministry of Industry Indonesia, and Global Innovation Index by World Intellectual Property Office 2024 & 2025

Case: Universitas Indonesia's Science Technology Park

- Aims to be an research-industry innovation hub in 2007
- Established STP UI as a startup incubator and service providers for industries
- Series of institutional transformation until becoming the Directorate of High-Impact Research (2024)

- Initially has a strong startup incubators, producing inventions and establishing holding company: ATM Health, PT UI Medikal, Tele Health Indonesia
- Furthermore partnering with medical industrial partner for research downstreaming (COVENT 20 ventilator, CENTRI-FLOW, etc.)

- Aided funding through Impactful Higher Education Policy and PRIME STeP
- COVID-19 Taskforce on Vaccination, Connecting UI with industry partner: PT Biofarma Indonesia



Present Status
Laissez-faire Need to strengthen government role in bridging the gap between industry and academia

Priorities are
- Sustaining health startups and focusing on downstreaming research output
- Bridging the gap & Strengthening regional embeddedness:
  - Matchmake relevant health industry partners with STP UI
  - Assisting the bureaucracy barrier (clinical testing and license)
  - Exploring regional government possible effort in connecting UI with health industry partners

Lessons from Indonesia's Triple-Helix Experience

Major Findings	Indonesia is an emerging country in innovation that has performed above expectation (WIPO, 2025) and has went through a rapid development in socio-economic (GDP growth & Human Development Index) yet still need for room of improvements In regards to triple helix collaboration, the roles are: ● University as the key role in the national innovation ecosystem as they contribute in the human resource and expenditures in research and development ● Industry as the collaborators and need the most improvement in NIS ● Government provides funding and policies, yet need to be a more active key player in uniting universities and industries actor
Key Challenges	● Limited Budget & Fragmented Government Institutions ○ Indonesia's overall (government and non-government) R&D expenditure remains low: 0.28% to GDP (WIPO, 2025). ○ National government with ministries & BRIN; Regional government with their own institutions; yet most of the innovation collaboration is still centralized to national government ● Mismatch between Industry and University ○ Valley of Death to commercialize research output between Industry and Higher Education Institution ● Lack of Embeddedness Between Universities and Industries ○ Study case shows the location between industries partners and Universitas Indonesia STP are scattered: low proximity where partners need to travel 1 - 2 hours away to reach Depok ○ University-based science park and top universities (with research capabilities) are scattered

Part IV: Thailand's National Innovation System

From Industrial Upgrading to Regional Innovation Ecosystems

Aneka Rebecca Rajbhandari

Thailand's Development Profile

Agrarian Economy to Early Industrialization (1950–1985)

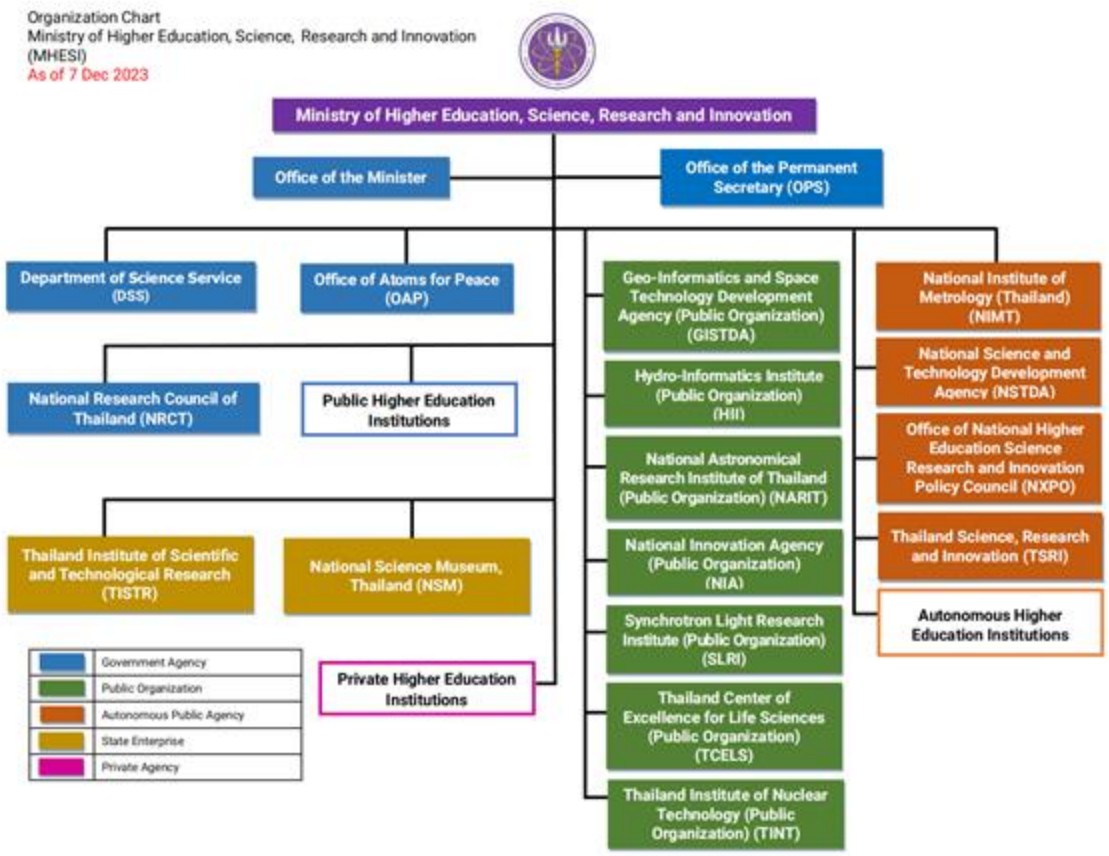
- Rapid growth (5–7% annually) driven by infrastructure and early industrial policy.
- BOI (1960) introduced incentives that attracted early manufacturing and FDI.
- Shift from import substitution to export orientation by late 1970s.

Export-Led Industrial Boom (1986–2000)

- 1984 baht realignment and market reforms triggered manufacturing expansion.
- FDI from Japan and East Asia anchored electronics, petrochemicals, and automotive.
- 1997 Asian Financial Crisis led to restructuring and renewed competitiveness.

Transition Toward Innovation-Driven Growth (2000s–)

- National strategies such as Thailand 4.0, the Bio-Circular-Green (BCG) Model, and the SRI Plan (2023–27) steer the shift to high-value, innovation-led development.
- GDP growth rate ~2.5%,(2024/25) recovering modestly from weaker years post-COVID
- Creation of MHESI (2019) unified higher education, science, research, and innovation institutions.
- R&D intensity has risen to ~1.2% of GDP, backed by emerging hubs such as the Eastern Economic Corridor (EEC/EECi) and Thailand Science Park.



Helix 1: Government

MHESI (post-2019) integrates higher education, science, research, innovation, and key national labs under one ministry.

- NXPO, chaired by the Prime Minister, coordinates national STI strategy, SRI Plan, and funding. NSTDA, NIA, TISTR, NIMT, and public universities form the core research infrastructure.

Strategic Direction: Long-term frameworks (Thailand 4.0, BCG Model, SRI Plan 2023–27).

Funding & Incentives

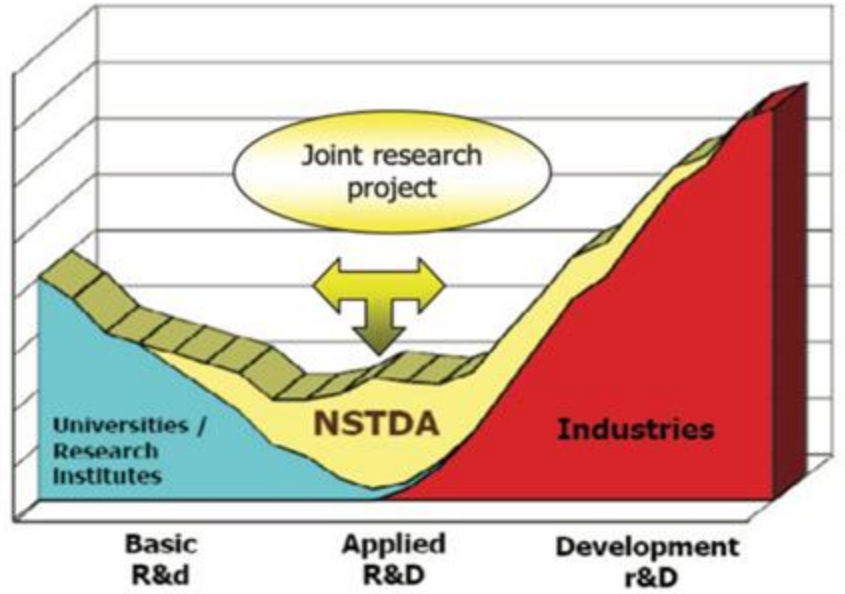
- SRI Fund (FY2025: THB 44.9B) finances mission-driven and competitive research
- PMU-A/B/C support area-based, talent-based, and industry-focused R&D.
- BOI incentives (e.g., EV tax breaks) mobilize private R&D investment.

Helix 2: Industry

Private sector as main R&D driver	• Industry funds ~70% of GERD, led by large conglomerates (PTT, SCG, CP Group, Thai Union). • Investment concentrated in automotive, electronics, petrochemicals, food processing, and emerging EV/digital sectors. • FDI from Japan, Korea, and China are key global value chain industries.
SME Innovation	• MSMEs make up over 99.5% of firms, but contribute less than 10% of total R&D. • Constraints include limited technical staff, weak digitalization, and low absorptive capacity. • Low awareness and uptake of government programs (BOI, NXPO/PMU funding, innovation vouchers).
Emerging Industrial Trends	• Rapid growth of EV and battery ecosystems in the EEC. • Expansion of functional foods, biotech, and halal innovation. • Increasing university–industry collaboration, but limited co-owned IP and deep joint R&D.

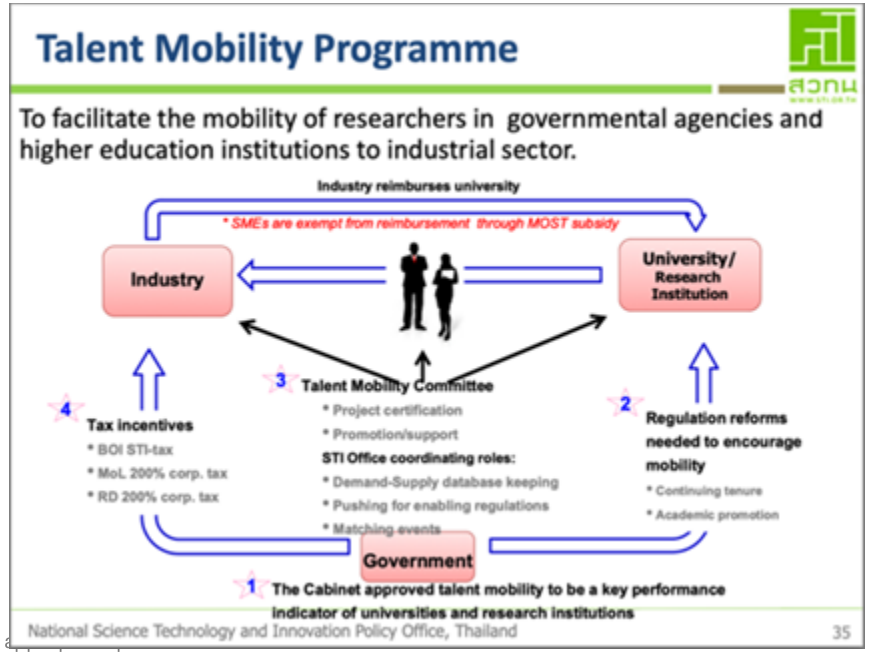
Helix 3: Higher Education Institutions

- 286 HEIs under MHESI, including 83 public universities and ~70 private HEIs.
- Chulalongkorn, Mahidol, and KMUTT serve as Thailand's leading research universities.
- Rajamangala and Rajabhat universities expand regional technical and applied-skills capacity.
- Tertiary enrollment ~45%, STEM graduates 30.07 % of total graduates(2024)
- NSTDA (BIOTEC, MTEC, NECTEC, NANOTEC, TMC) provides the national applied-research link between universities and industry.



University-Industry linkage

- Talent Mobility Programme places researchers and lecturers in firms to support industrial R&D.
- Co-supervised graduate programs, joint labs, and PMU-funded research connect universities with EV, biotech, digital, and food-tech sectors.
- Collaboration improving, but co-owned IP and commercialization remain limited.
- Rising start-up, spin-off, and incubation activity, but fragmented.



Food Innopolis under the Triple Helix Lens (Thailand Science Park)

Evolutionary Path

- Launched Food Innopolis in 2016 at Thailand Science Park under NSTDA, positioning food innovation as a national priority under Thailand 4.0 and the BCG Model.
- Provided funding tools: innovation vouchers, testing & certification support, and SME upgrading programs.
- Expanded reach through regional science parks in the North, Northeast, and South.

- NSTDA centers (BIOTEC, MTEC, NANOTEC, NECTEC, TMC) provide multidisciplinary food R&D, testing, and quality assurance.
- Universities (KU, CMU, KKU, PSU) collaborate on food science, packaging, fermentation, halal innovation, and sensory analysis.
- Regional nodes anchor local innovation ecosystems and support SME product development.
- Joint R&D projects, internships, and talent pipelines strengthen capabilities.

- Thai food companies (Thai Union, CP Foods, Betagro) adopt Food Innopolis services for product development and testing.
- SMEs increasingly use pilot plants, packaging labs, certification, and innovation vouchers.
- Growing demand for functional foods, quality assurance, and food-safety compliance.
- Emerging collaboration in value-added products and bio-packaging.

Present Status
Strong R&D platform, but weak SME engagement and uneven diffusion
Priorities: • Strengthening SME adoption • Scaling U–I collaboration • Expanding testing & certification • Developing food-tech talent

11th ADB International Education and Skills Forum

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Conclusions

Cambodia

1. Cambodia should prioritise sustained **investment in STEM education at key universities** in Phnom Penh and Battambang, while strengthening secondary education across provinces.

2. The government should leverage recent successes in digitising public services to further **reduce informality**, enhance transparency, and **increase public revenue**.

3. While maintaining its commendable emphasis on digital transformation, Cambodia must ensure that this focus does not divert resources from high-return, low-hanging opportunities in **agro-processing value addition**.

Indonesia

1. **HEIs are the main contributor** of the innovation system, while government and industry are also playing a part in leveraging university-based STP to further promote research downstreaming.

2. Key challenges consists of **budget limitations** and valley of death due to bureaucracy and difference between business and academia actors

3. Indonesia should focus on **strengthening HEIs-initiated innovation hubs** and expand platform that matchmake industry and HEIs

Thailand

1. Thailand has advanced innovation infrastructure, but **ensuring coordination** across MHESI, NSTDA, the EEC, and Thailand Science Park remains a key challenge.

2. Expanding regional innovation capacity through science parks, university networks, and **local supplier upgrading** is vital for **inclusive SME participation**.

3. Developing a future-ready workforce remains critical, especially in EV engineering, food-tech, automation, and digital skills. **Closer alignment between universities, industry, and vocational providers** will support Thailand's shift toward higher-value, innovation-led growth.

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