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PUSAT UNGGULAN IPTEK PERGURUAN TINGGI INDONESIA

INSTITUT TEKNOLOGI BANDUNG 1920

NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION TECHNOLOGY (NCSTT)

Research Innovation and Entrepreneurship Development To Support Sustaianable Transportation Technology in Indonesia

Sigit P. Santosa

26 September 2017

AGENDA

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- NCSTT Introduction

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- Indonesia Economic Growth & Potential

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- Challenges and Opportunity

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- Mass Transport Solution
- National Railway Master Plan - Indonesia

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- NCSTT Research and Collaboration
- Summary / Closing Remark

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Johari Chart

SIGIT P. SANTOSA

- **EDUCATION:**
  - Enginieur, Ir – ITB (1991),
  - Master of Science of Mechanical Engineering, MSME – MIT (1997),
  - Doctor of Science, Sc.D – MIT (1999)
- **GM – North America Product Development** (1999 – 2013)
- **Faculty Staff**, Faculty of Mechanical and Aerospace Engineering, ITB
- **Chairman NCSTT** – National Center for Sustainable Transportation Technology
- **Director** – CCR Electric Based Transportation Technology Development

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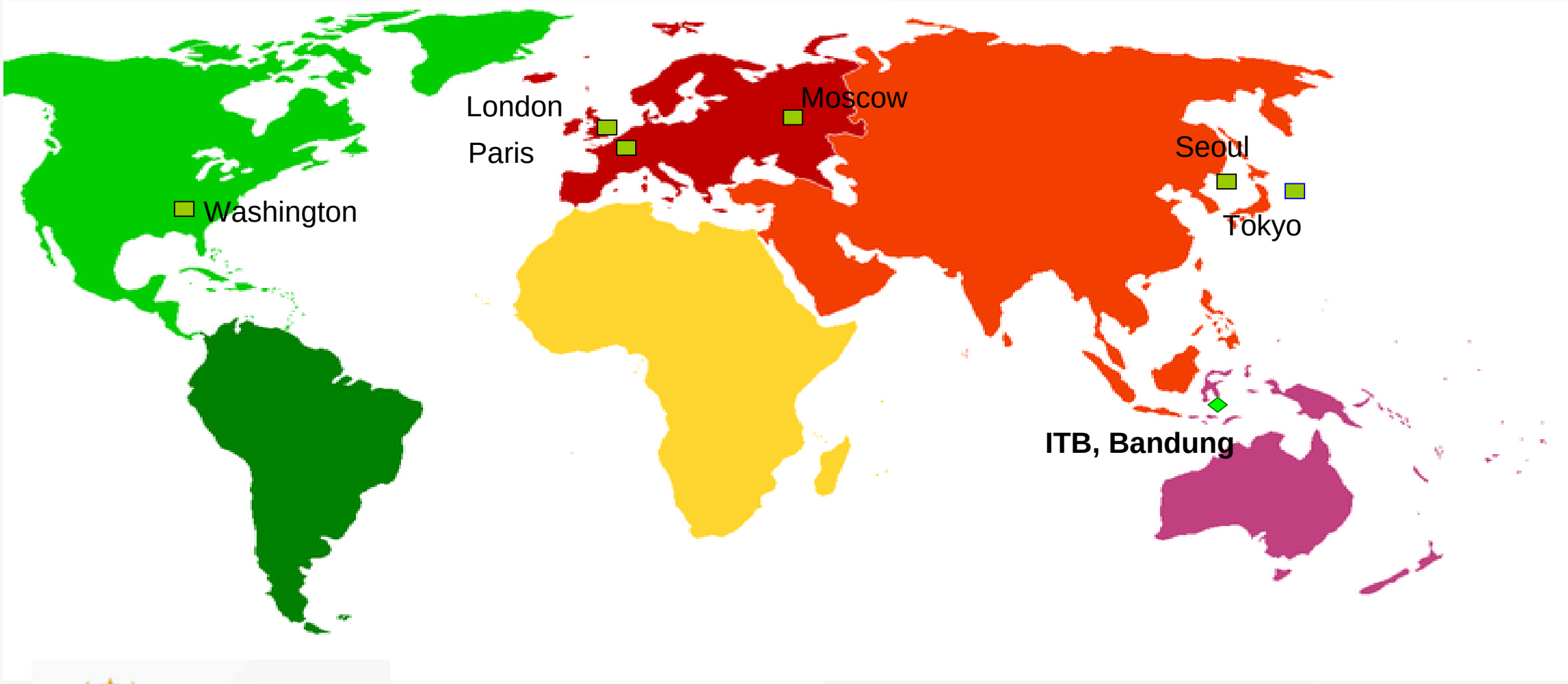
INDONESIA



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INSTITUT TEKNOLOGI BANDUNG

INDONESIA

INSTITUT TEKNOLOGI BANDUNG
INDONESIA

Location: **Bandung, capital of West Java province**

Facilities

CAMPUS Ganesha	29 Ha
CAMPUS Jatinangor	40 Ha
SPORT FACILITIES	4 Ha
BUILDING FLOOR PER STUDENT	18.5 m^2

STUDENTS

STUDENT BODY	Under-graduate	14501
	Master	5868
	Doctor	936
ENROLLMENT	Undergraduate	3544
	Master	2541
	Doctor	190
GRADUATES	Under-graduate	3343
	Master	2066
	Doctor	87

ACADEMIC AND NON ACADEMIC STAFF

ACADEMIC STAFF		1221
EDUCATION	Bachelor	18
	Master	273
	Ph.D.	804
ACADEMIC RANK	Professor	145
	Assoc. Professor	308
	Assistant Professor	432
	Lecturer	292
FACULTY : STUDENT RATIO		1:17
NO OF ADMINISTRATIVE STAFF		1513
ADM. STAFF : STUDENT RATIO		1:14

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Executive Summary

- Indonesian transportation industry is an important pillar for manufacturing sector
- Many transportation industries, i.e. automotive and railway industries have manufacturing plants and expanded production capacity in Indonesia
- Rising per capita GDP – major automotive production in ASEAN market: Indonesia (34%), Thailand (43.5 %)
- Strong projected demand for railway vehicles in Indonesia as part of the National Railway Masterplan 2030.

GDP Per Capita ASEAN (2016)

Country	GDP Per Capita ($)	GDP Growth Per Capita (%)
Singapore	52.888,7	0.8
Brunei Darussalam	36.607,9	-1,9
Malaysia	9.766,2	3,5
Thailand	5.816,4	2,5
Indonesia	3.346,5	3,5
The Philippines	2.899,4	4,2
Vietnam	2.111,1	5,5
Lao PDR	1.812,3	5,2
Myanmar	1.203,5	6,1
Cambodia	1.158,7	5,3

Source: World Bank Data

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Indonesian Transport System

PROBLEM: Un-sustainable Transportation in Indonesia

- High traffic congestion, polution, dependence on fossil fuel
- Transportation system in Indonesia cannot support national economic development. Rp. 65 T economic losses/ year

CHALLENGES: Electric Vehicle Revolution in 2025

- Fuel Economy Regulation of 56.5 MPG (Mile Per Gallon) started in 2025
- The electric based transportation will be the solution wrt cost & regulation
- Global electric vehicle proliferation strategy In Indonesia will need to be addressed

OPPORTUNITIES: Indonesian Transport Expansion Plan in 2030

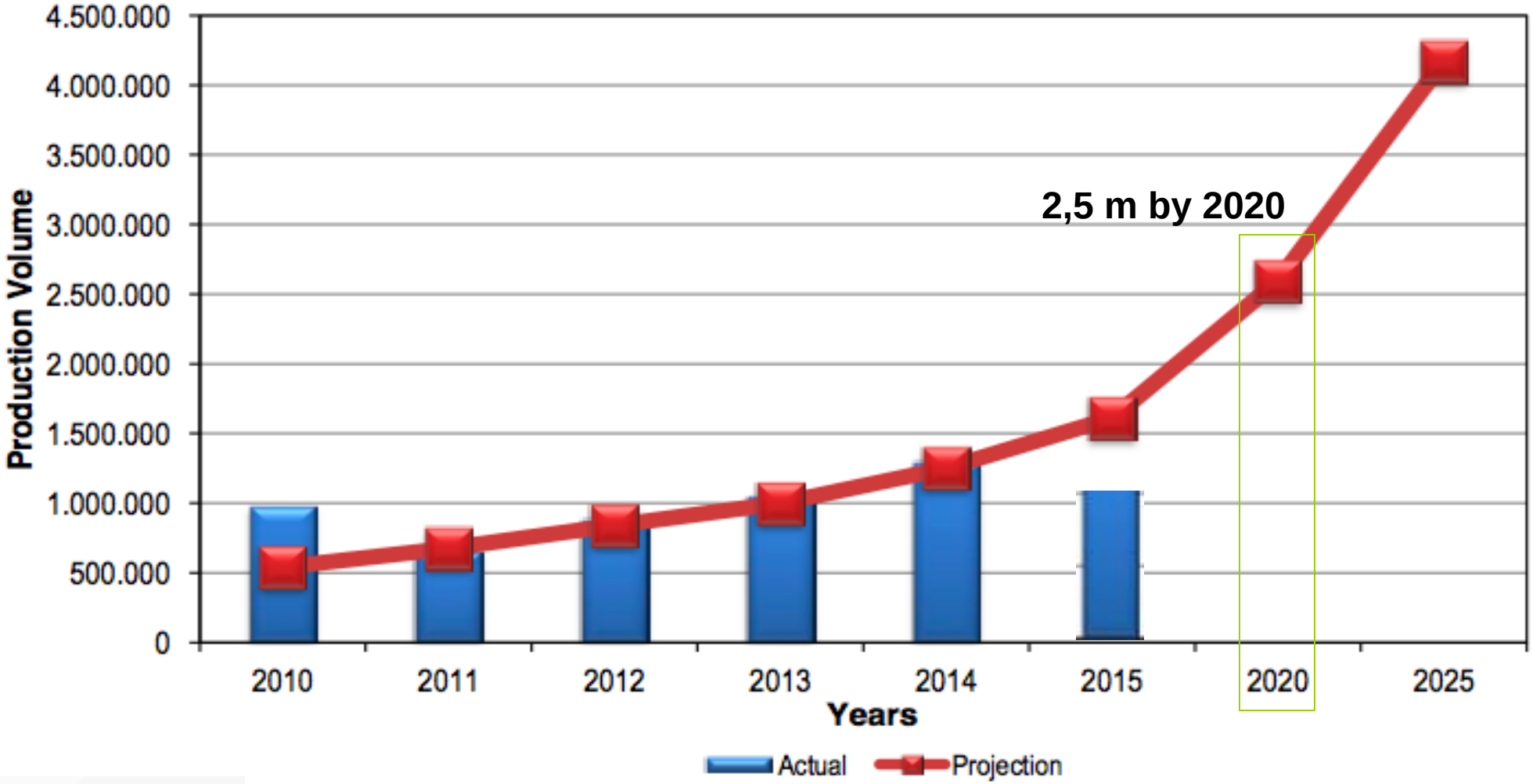
- Indonesian market for passenger vehicles will increase from 1.4 million to 4 million.
- New urban railways system of 3800 km will require 12,000 new passenger coaches will be needed (RIPNAS).

Jakarta

Bandung

Surabaya

Car Market Projection in Indonesia 2010-2025

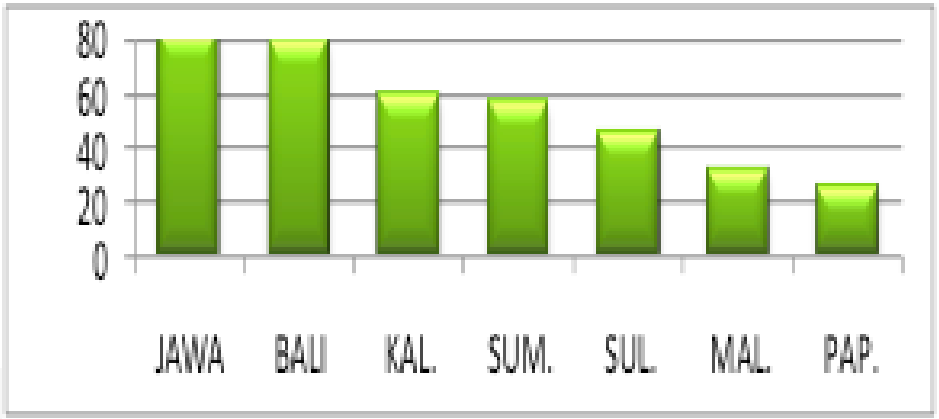


Source : Minsistry of Industry Doc. No 123/M-IND/PER/10/2009

Railway Passenger Projection 2015-2025

Passenger Projection - Train					
	2006	2010	2015	2020	2025
Java	127.519.723	155.158.347	184.299.294	214.417.082	244.673.991
Sumatera	2.566.924	4.366.143	6.401.799	8.653.562	11.103.851
Kalimantan	-	-	479.468	781.226	1.120.520
Sulawesi	-	-	2.483.369	3.902.371	5.406.375
TOTAL	130.086.647	159.524.490	193.663.930	227.754.241	262.304.737

SOURCE : RAILWAYS MASTER PLAN 2009



% URBAN POPULATION

- INDONESIAN POPULATION IN 2025: 273.6 MILLION.
- URBAN POPULATION IN JAVA: 82.2% (120 MILLION).
- GDP PER CAPITA: US$ 13,000-16,000,
- MOBILITY AND CONNECTIVITY IS CRITICAL.

Indonesian Railway Master Plan (RIPNAS) 2030

- Existing railway track : 4,500 km
- Expansion Plan in 2030 : 12,000 km

Source : RIPNAS 2010-2030

National Center for Sustainable Transportation Technology (NCSTT)

- Established by ITB for the development of integrated and sustainable transportation to support National Transportation Master Plan
- Appointed by the Ministry of Research, Technology, and Higher Education as the **National Center of Excellence**

Target Accomplishments:

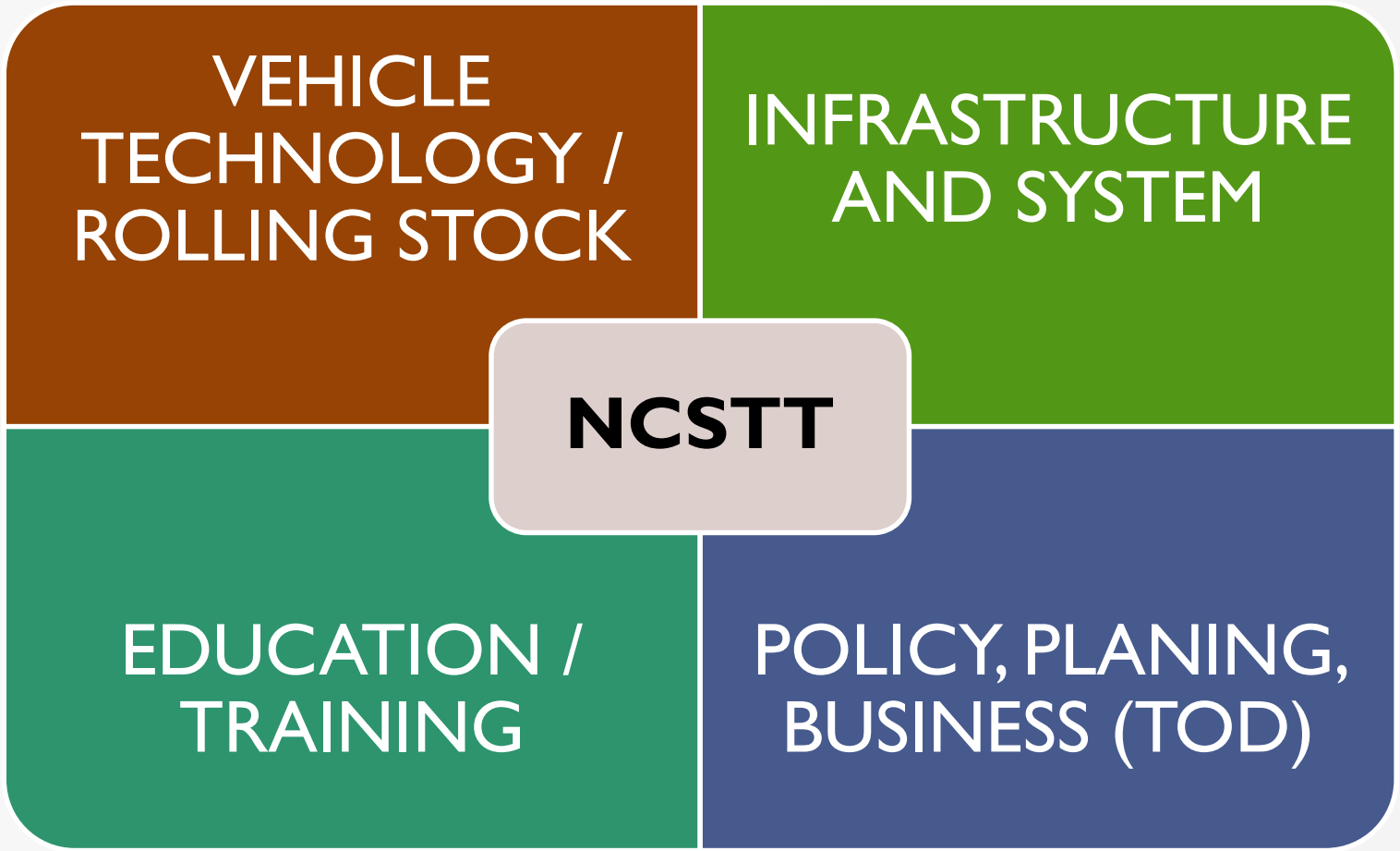
- Downstream research in collaboration with transport industries
- Stimulate new innovations and acquisition of transport technologies
- Capacity building of local manufacturers especially SME's that produce parts and components

Electric & Mass Transport Solution

Electric based and mass transportation system is selected due to the fact :

- Electric Vehicle – Renewable & Sustainable Energy Solution
- Mass Transport – Significant reduction of the roadway load and high capacity on cargo/passenger. Railway track only occupy 1/8 area of the roadway for passenger cars
- Technological Challenge for Electric Vehicle:
  1. Battery / RESS Technology Maturity
  2. Lightweight vehicle technology
  3. Using electric motor with high energy efficiency

NCSTT Research Ecosystem



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Product of Research - NCSTT

Vehicle Technology

- Mass Transport : LRT, MRT
- Electric Vehicles

Infrastructure

- Railway, Road, Signal, Control
- Electrification infrastructure and charging

Policy and Planning

- Integrated Transport policy
- Regulation, management, business plan

Resources

- Expert, researcher, operator
- Training and education curriculum

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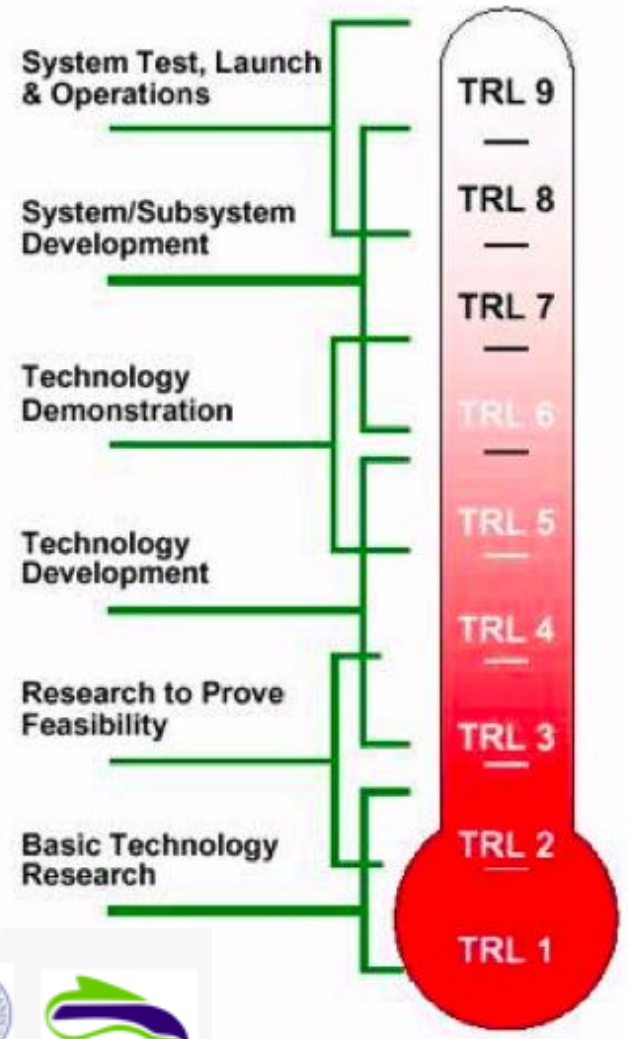
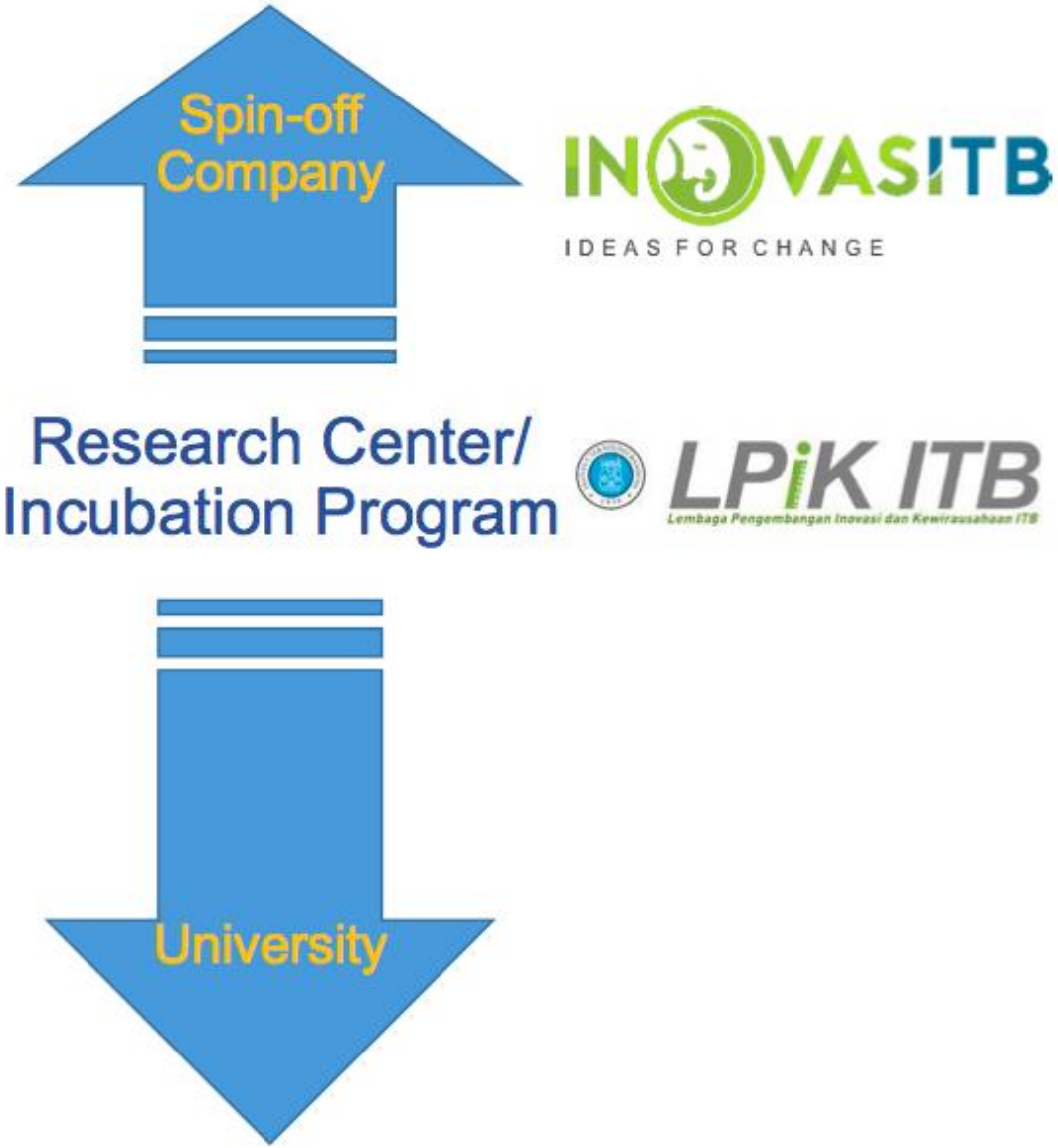
Innovation & Entrepreneurship Readiness





DEVELOPMENT MODEL FOR INNOVATION AND ENTREPRENEURSHIP

- Educating innovation process
- Coaching to commercialize the invention
- Achieving proof of concept in the applied research
- Pursuing Intellectual Property (IP) right

- LPiK
- Innovators

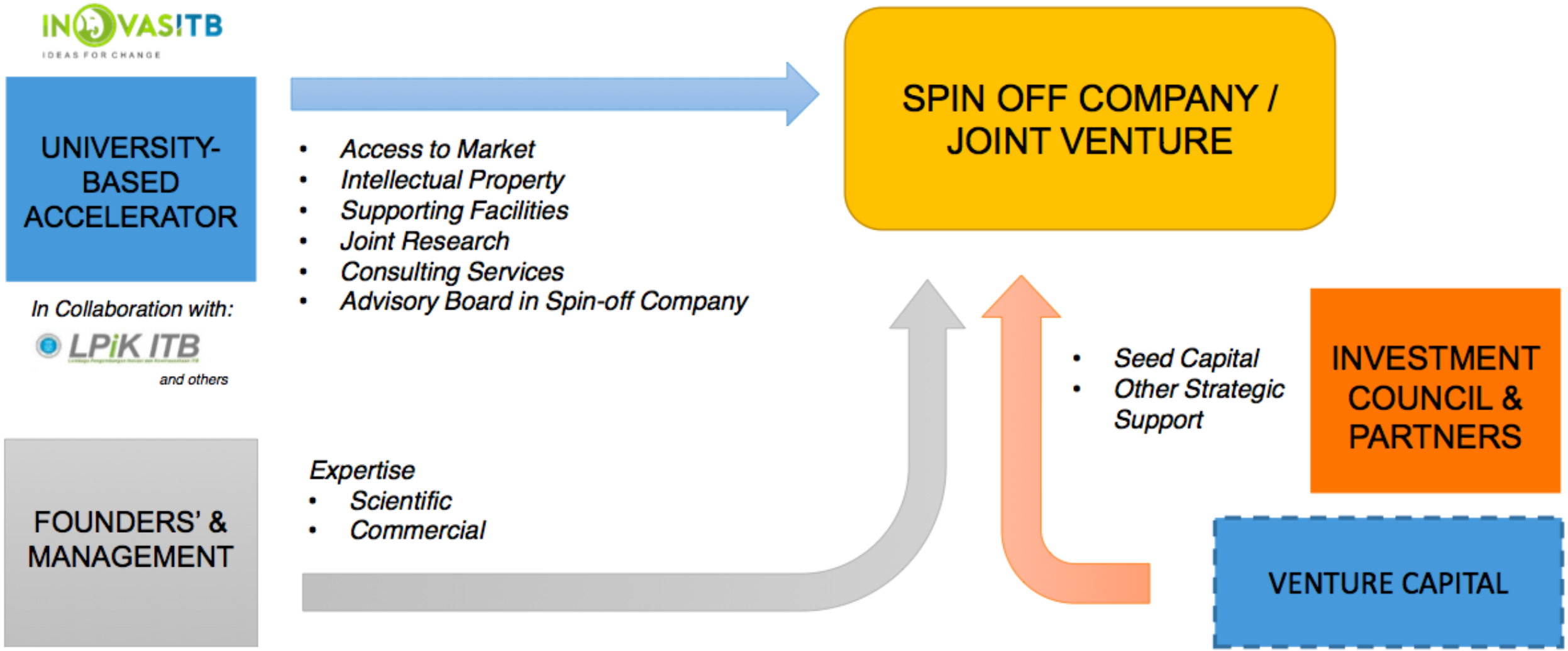
- LPiK /Tenants
- Venture Investors
- Start up specialists
- Entrepreneurs

- Open ITB inovation to public
- Linking to potential venture investors
- Coachig with start up specialist & entrepreneurs
- Forming incubators

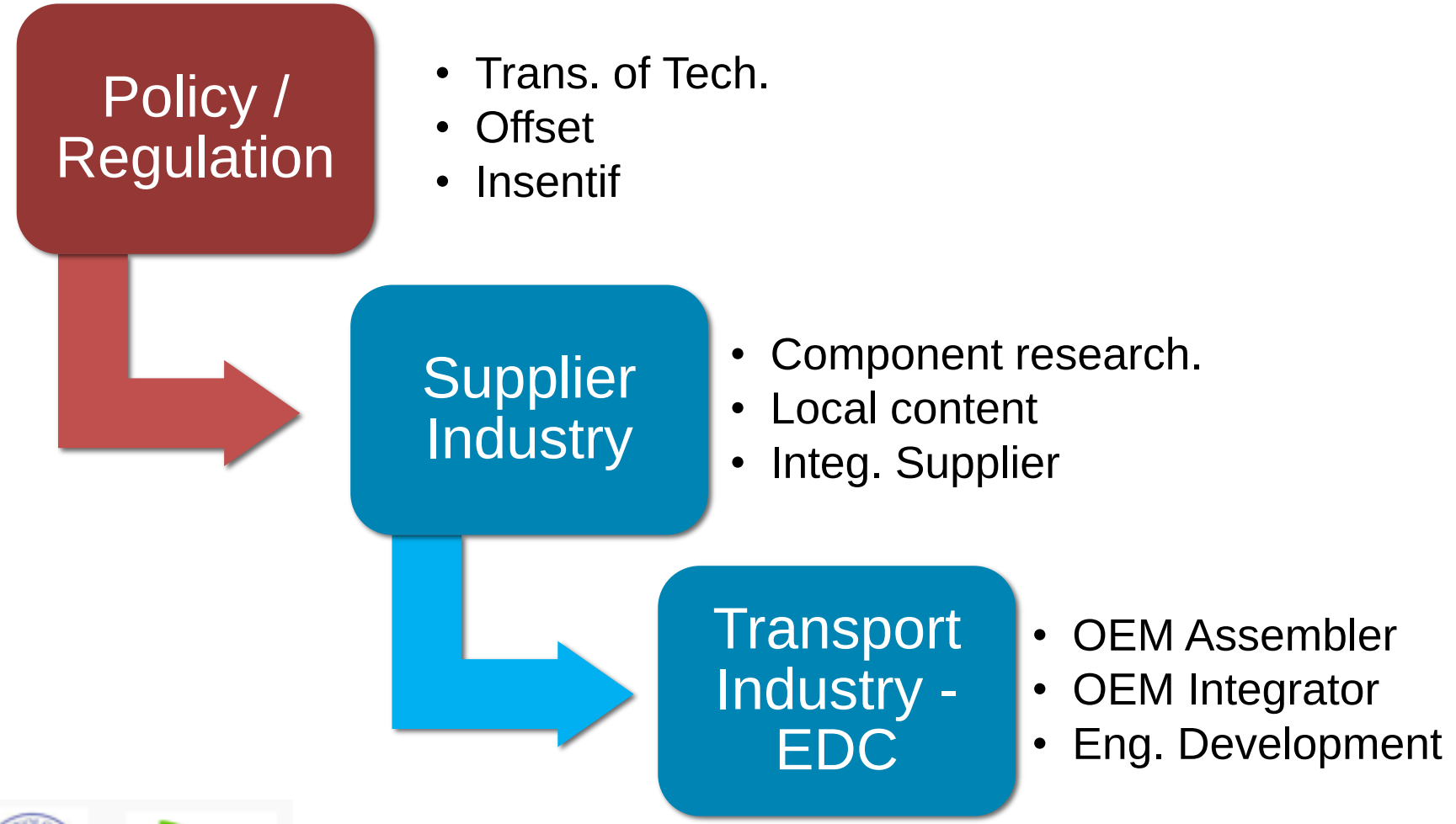
- Joint venture and start up establishment
- Product dissemination and marketing
- Nurturing ecosystem of inovation & entreprenurship

- Inventors
- Entrepreneurs
- Start up company
- ITB

Innovation Development Scheme



Transportation Technology Acquisition Phases



NCSTT Collaborative Research (Selected Project)

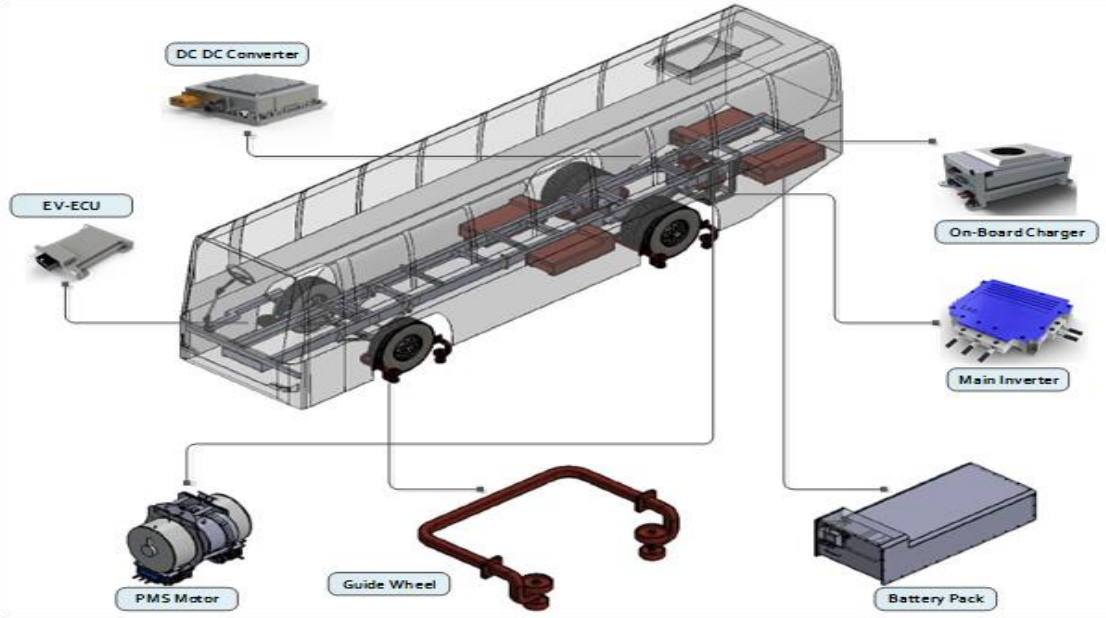
No	Research Title	Partners	Period	Status	Funding Source
1	CCR Electric Based Transportation Technology	MIT, Undip, UNS, Unsri, ITK, Unlam, Unsrat	2017 - 2021	Approved	USAID-SHERA
2	Material modeling and development of ultralight metal structures applicable for railway vehicles	Oxford Univ, INKA	2017 - 2019	Approved	RAEng / Newton Fund UK, Ristekdikti
3	Research and application of mobile communication network technology for high speed railway in Indonesia	Bejing Jiaotong Univ. of Technology	2017 - 2018	Approved	China Ministry of Research & Technology
4	Feasibility Study for Jakarta-Surabaya Medium Speed Train	ITB, Undip, ITS, BPPT	2017	Approved	Ministry of Transportation
5	Development of Raillink Vehicle to meet NVH Requirements.	INKA	2017	Approved	Ristekdikti
6	Feasibility study for Urban Rail Development - Technology Selection and Infrastructure Development	PT KAI	2017	Approved	PT KAI
7	Development of railway seat for low cost railway liner in Indonesia.	INKA	2017	Approved	Ristekdikti

Metro Capsul – TRL 7

- Feeder 3: urban mass transport 50 passengers
- Build and validated at Subang Test Track
- Pilot project: Bandung 6 km Loop
- Expansion project to Kereta Kapsul (LRT) for 120 passengers for CGK-Pluit LRT route

Railway control/automation Research with PT LEN

Automated Guided Transit (AGT)



- ITB – PT LEN for Airport People Mover
- For Jakarta Airport (CGK)

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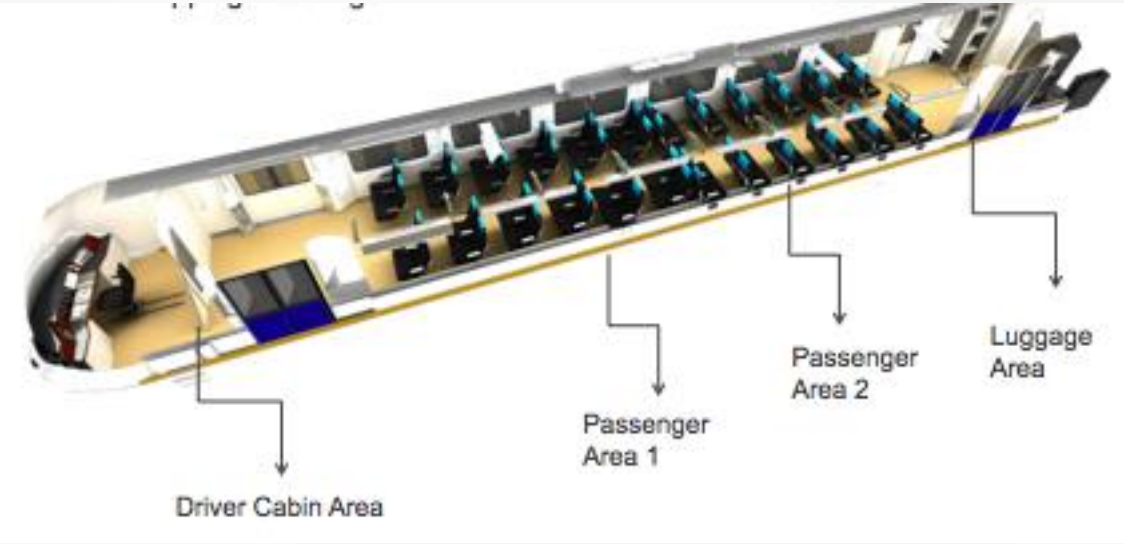
Railway Product Innovation with PT INKA

Railink Vehicle for Jakarta Airport - Tangerang

LRT Palembang
Aluminum construction

Interior design & prototyping



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NCSTT Technology Development

In order to create focus research innovation, acticities for product innovation priorities in the CCR are:

- **Battery integrity/safety system – with MIT**
- **Electric bus** for student/faculty shuttle transportation
- **e-Trike:** Electric vehicle for postal delivery
- **Light Rail Transit/LRT** (Kereta Kapsul) for urban transport in Jakarta and Bandung
- infrastructure development, **static/dynamic induction charging system**

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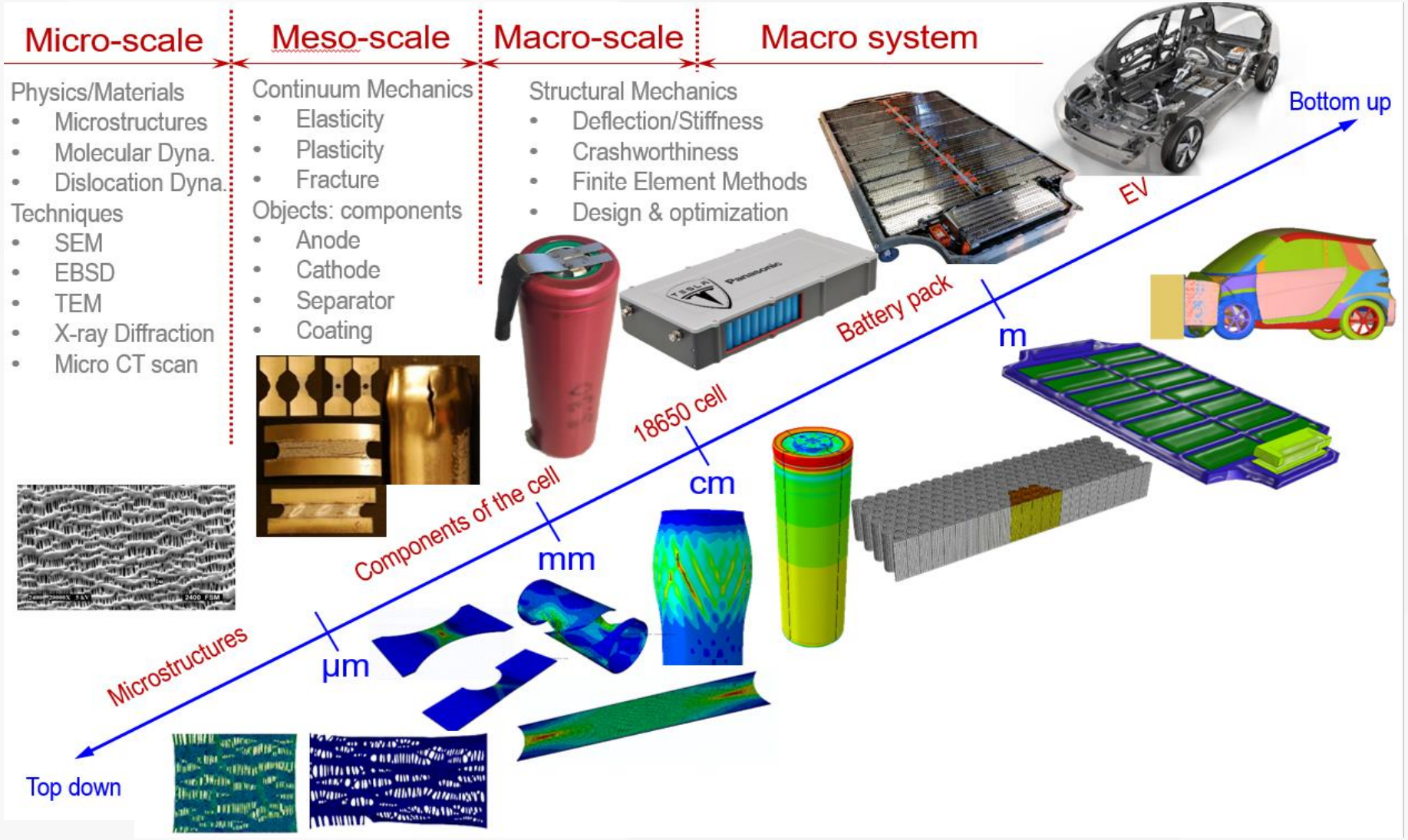
MIT Collaborative Research on Li-Ion Battery



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RISTEKDIKTI

NATIONAL CENTER FOR SUSTAINABLE TRANSPORTATION TECHNOLOGY (NCSTT)

Material Modeling and Development of Ultralight Metal Structures Applicable for Railway Vehicles

ITB – University of Oxford Collaboration
Funded by Royal Academy of Engineering/Newton Fund - UK

National Center for Sustainable Transportation Technology

INSTITUT TEKNOLOGI BANDUNG 1920

UNIVERSITY OF OXFORD DOMI NVS ILLV MINA TIO MEA

INKA
PT. INDUSTRI KERETA API (Persero)

Program Objectives

- To develop a material constitutive model for ultralight metal sructures to predict:
  - Dynamic/strain rate behavior of crashworty structures
  - Manufacturability process, and its influence to dynamic performance.
  - Damage behavior

- To strengthen research network between universities (ITB and Oxford) and industry (INKA).

- To improve expertise on **product development** and research capacity of each involving research institution & Industry

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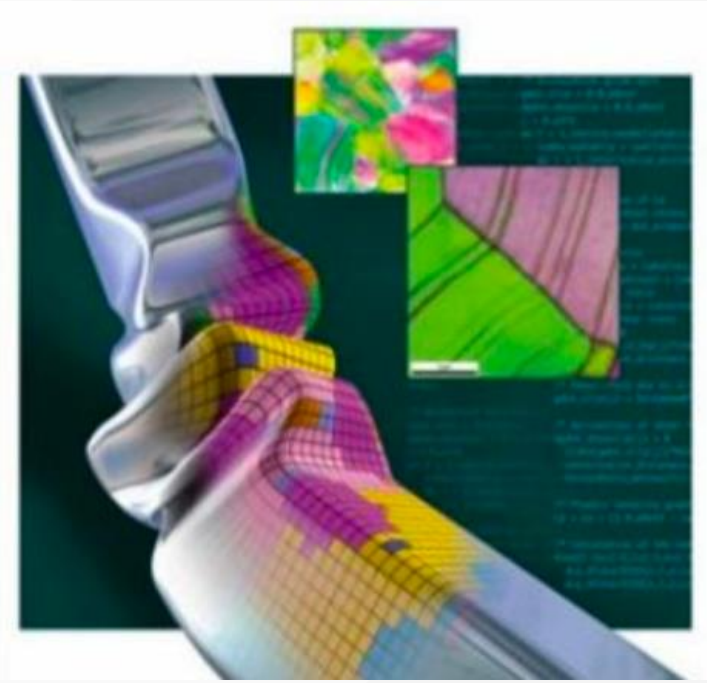
Research on High Strength Steel Materials

Multiscale testing and characterization for high strength steel Materials

Multiscale material modeling for damage mechanisms

Newly designed structure of railway vehicles expected to substantially improve and contribute to the reduction of energy consumption



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National Center for Sustainable Transportation Technology

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Summary/Conclusion

- Focus on research innovation ecosystem with empahsys on product development and industrial implementation
- Strengthening supplier/component industries as the first step development before embarking into OEM industries
- Establishment of national research center, such as NCSTT research collaboration to support engineering development activity
- Embracing global partnership with international research institution and industries

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THANK YOU

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