MINISTRY OF TRANSPORTATION
RESEARCH AND DEVELOPMENT AGENCY

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PERSPECTIVES ON FUTURE TRANSPORTATION RESEARCH IN INDONESIA

Prof. Dr. Ir. Agus Taufik Mulyono, ST., MT., IPU., ASEAN Eng.
Head of Center for Transportation and Logistic Studies (PUSTRAL) UGM
Head of Indonesia Transportastion Society (MTI)

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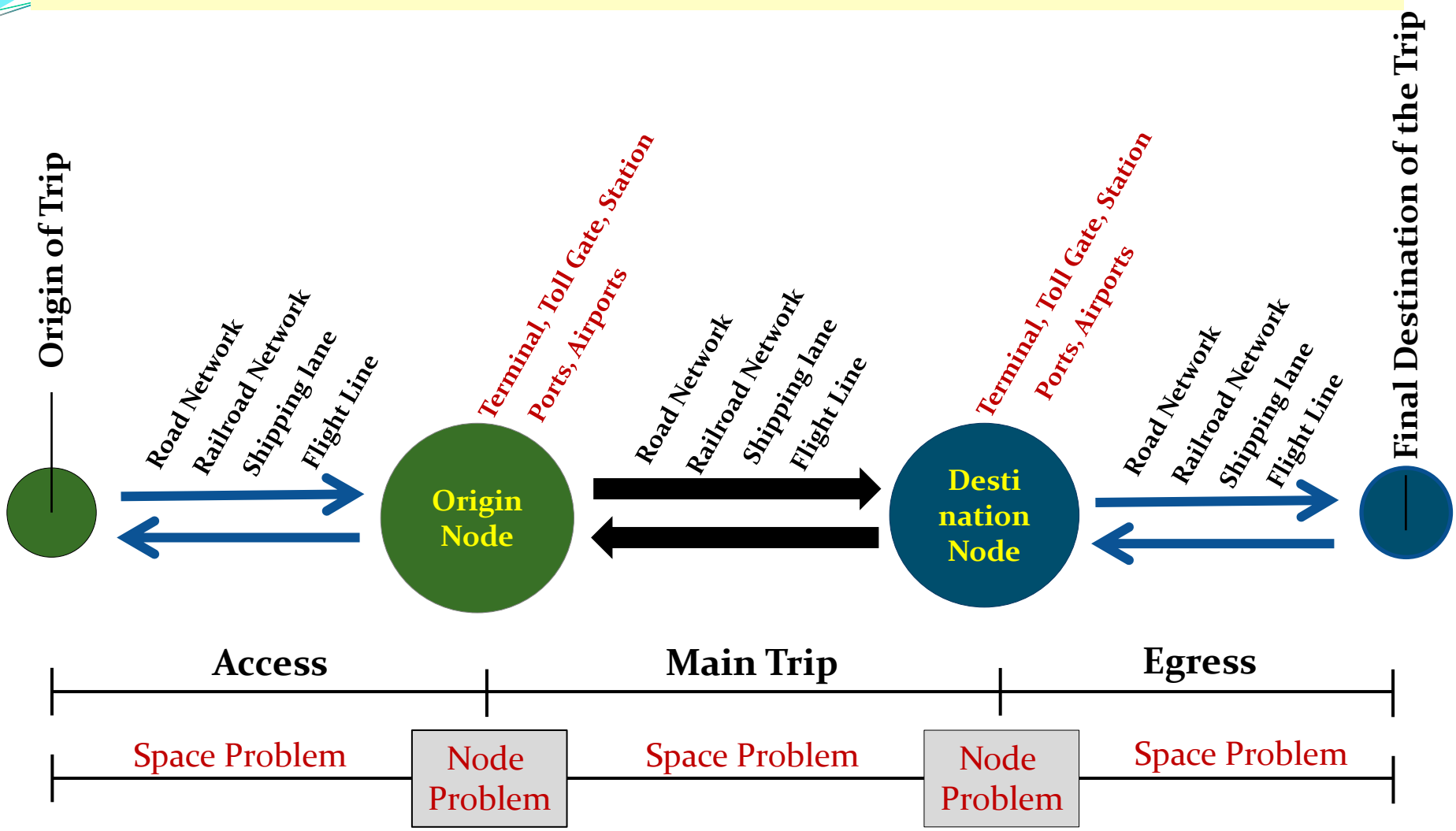
Presentation Outline :

- Understanding the Nature of Transportation
- The Node-Space-Node Problem
- Challenges of the Industrial Era 4.0: Sustainable Transportation
- Key Performance Indicators (KPI) for the Development of Sustainable Civilized Transportation (Industrial Era 4.0)
- Key Performance Indicators (KPI) for the Operation of Sustainable Civilized Transportation (Industrial Era 4.0)
- Sustainable-Civilized Transportation Research

MTI's Perspective:
Understanding the Nature of Transportation

Transportation : Access-Main Trip-Egress



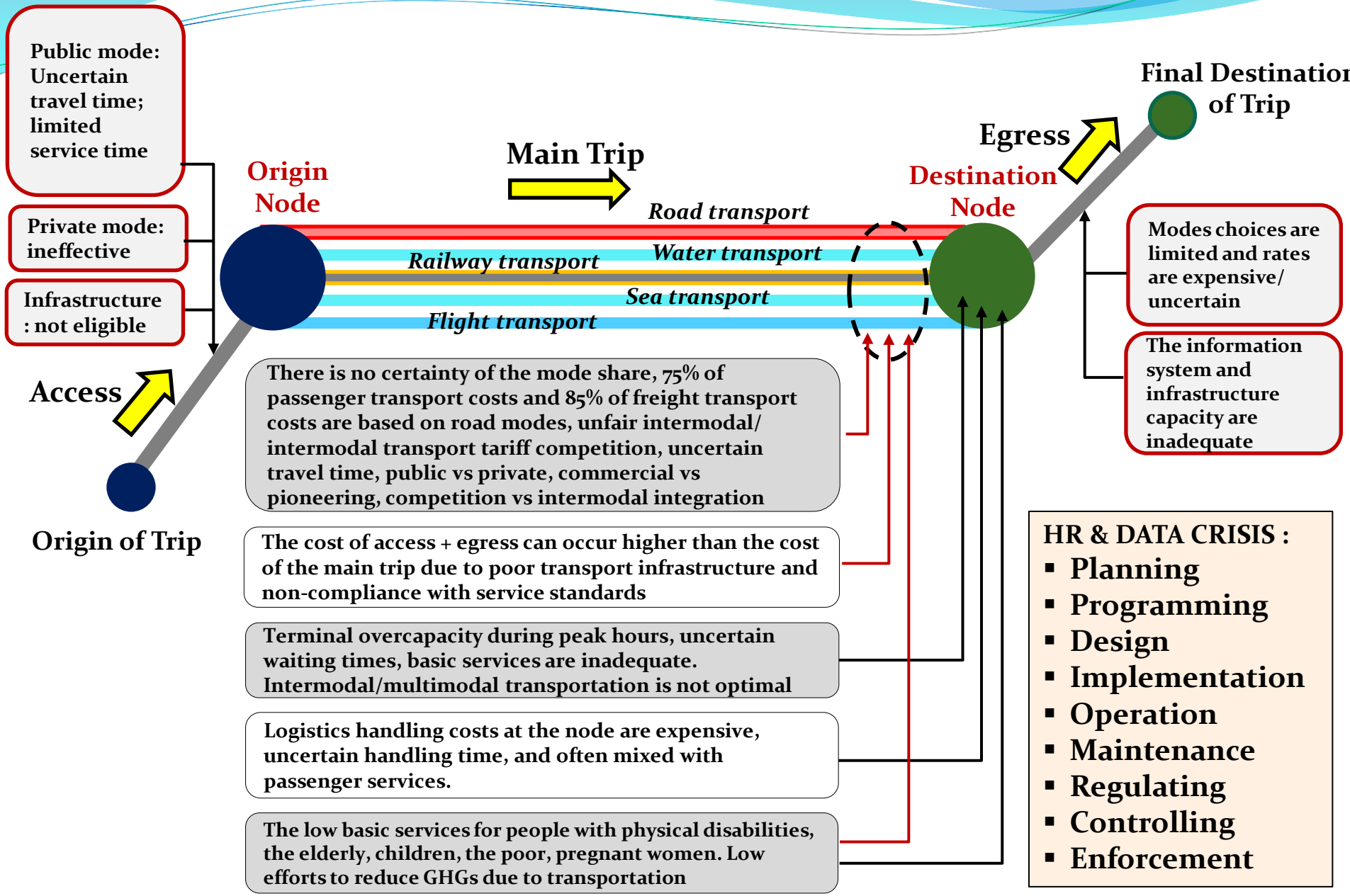
Source : Agus Taufik Mulyono (2019)

The Nature of Transportation

- Transportation: the process of moving people/goods/services from the Origin of Trip to the Final Destination of Trip safely, securely, comfortably, on time (effective), orderly and smoothly as well as with affordable (efficient) operational costs, through 3 (three) important components:
  - **NODE** (terminal, port, airport, station, toll gate, bus stop, agent)
  - **SPACE** (road & rail network, shipping lanes, flight lines)
  - **SERVICE** (travel time, waiting time, safety, security, cost affordability, smooth and order, comfort, equity, health, legal certainty)
- The trip of **NODE-SPACE-NODE** through 3 segments :
  - **ACCESS** (Origin of Trip - Origin Node)
  - **MAIN-TRIP** (Origin Node - Destination Node)
  - **EGRESS** (Destination Node – Final Destination of the Trip)

MTI's Perspective :
The Node-Space-Node Problem

PROBLEM OF NODE-SPACE-NODE TRANSPORTATION MANAGEMENT

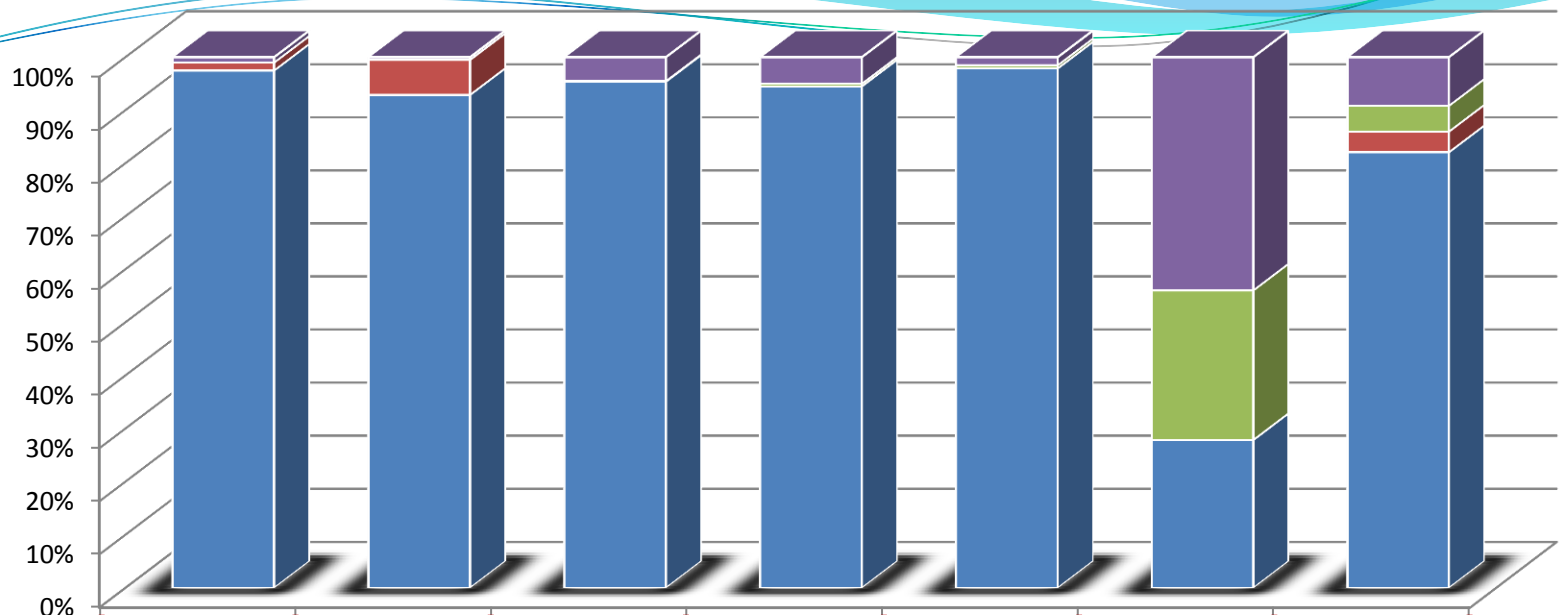


Source : Agus Taufik Mulyono (2019)

Problem of "Transportation Spaces"

- **MODE SHARE** : there is no courage to set targets for mode share, especially in the solid lane of transportation of goods (logistics). Conditions of production of freight transportation in Java :
  - Road Mode : **93,5%**
  - Railways Mode : 1,1%
  - Shipping Mode : 5,2%
  - Flight Mode : 0,2%
- **TRAVEL TIME** : still high, especially on national road and railroad transportation (> 2,0 hours/100 km).
- **FACILITIES-INFRASTRUCTURE CONDITIONS**: lack of attention on safety and security aspects, and inaccurate maintenance, as well as low services for people with disabilities, the elderly, children, the poor, and pregnant women.

Imbalance Number of Passenger Transport Trips in Each Mode

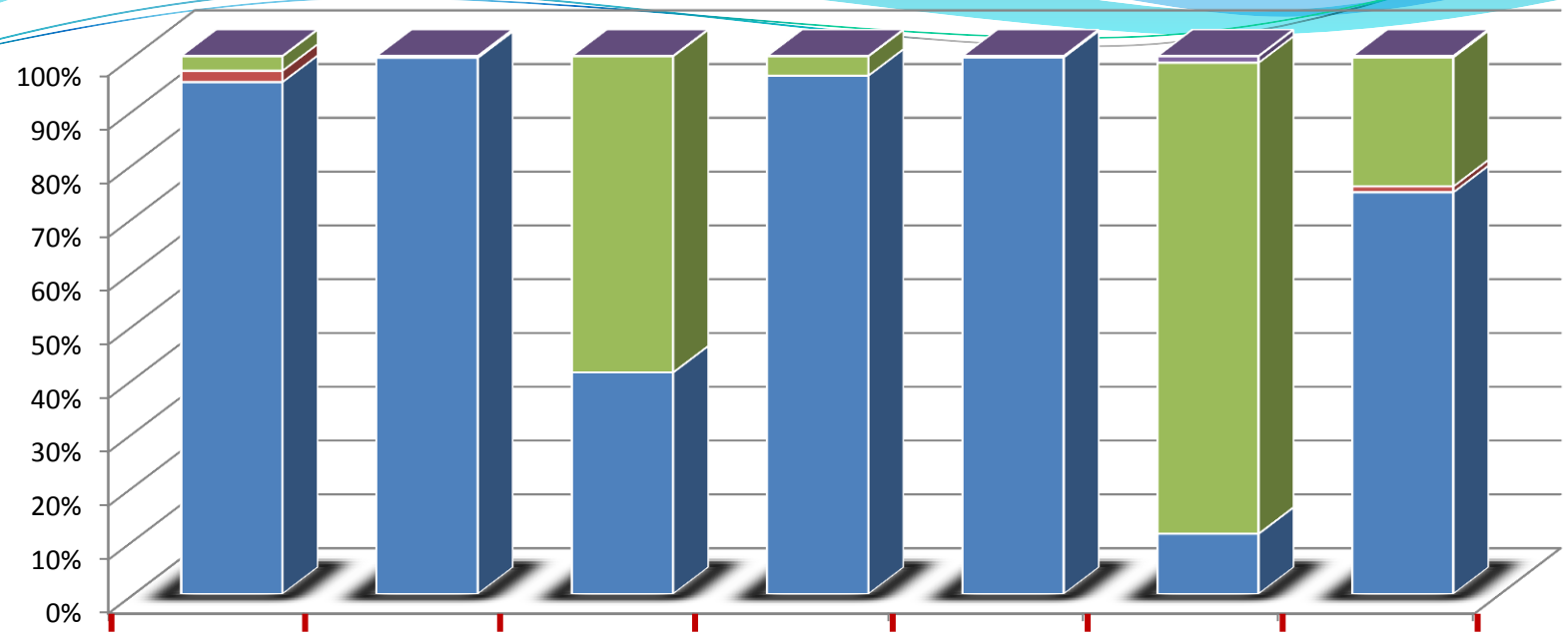


	Sumatera	Jawa	Kalimantan	Sulawesi	Bali NT	Maluku-Papua	Average
Flight	1,0%	0,5%	4,5%	5,0%	1,5%	43,7%	9,4%
Ship	0,0%	0,0%	0,1%	0,5%	0,6%	28,0%	5,0%
Railway	1,5%	6,6%					4,0%
Roadway	97,5%	93,0%	95,4%	94,6%	98,0%	27,7%	84,3%

Source : Agus Taufik Mulyono (2018); IndII (2015)

There is no policy on Mode Share of passenger transportation, especially railroad mode, sea-lines mode. Has the effect of increasing potential deficiencies in safety, security, timeliness, and optimizing intermodal terminal capacity.

Imbalance Number of Freight Trips in Each Mode



	Sumatera	Jawa	Kalimantan	Sulawesi	Bali NT	Maluku-Papua	Average
Flight	0,0%	0,0%	0,0%	0,0%	0,0%	1,1%	0,2%
Ship	2,7%	0,2%	58,8%	3,6%	0,2%	79,7%	24,2%
Railway	2,1%	0,1%					1,1%
Roadway	95,2%	99,7%	41,2%	96,4%	99,8%	10,2%	75,3%

Source : Agus Taufik Mulyono (2018); IndII (2015)

The double track railroad and port development have not yet had a significant impact on operators due to the poor integration of the infrastructure network system and the intermodal freight terminal services.

Imbalance of Transport Production for Each Passenger and Freight Transportation Modals in Java Island

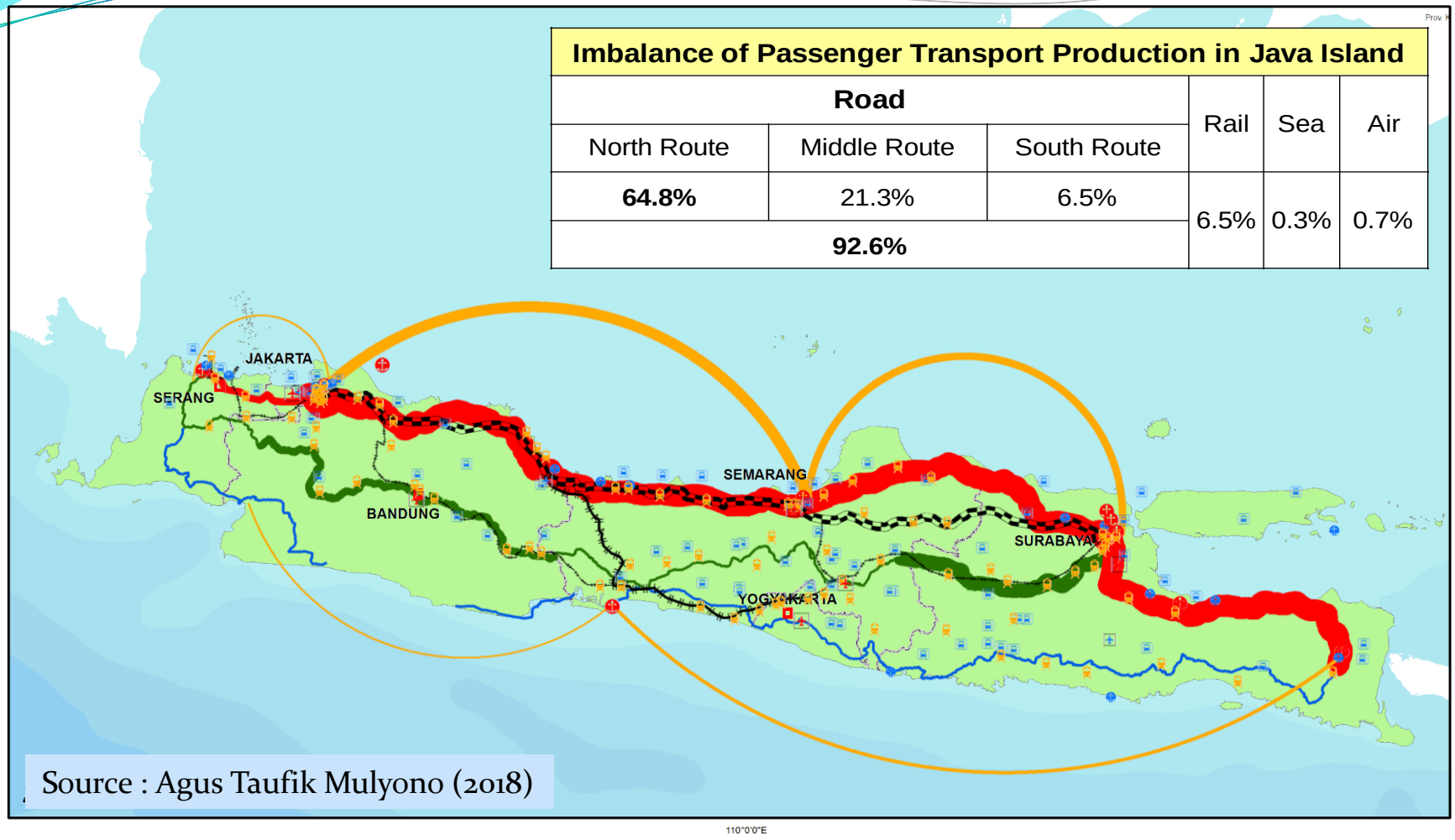
Transportation Modal	Freight Transportation Production (million ton.km/year)		Passenger Transportation Production (million seat.km/year)	
Road:				
• North Route (Pantura)	23,517.8	(74.7%)	6,285.6	(64.8%)
• Middle Route	4,439.1	(14.1%)	2,066.1	(21.3%)
• South Route	1,479.8	(4.7%)	632.4	(6.5%)
Railway	346.3	(1.1%)	628.6	(6.5%)
Sea	1,637.1	(5.2%)	29.1	(0.3%)
Air	62.9	(0.2%)	67.9	(0.7%)

Source: Mulyono and Kushari (2018)

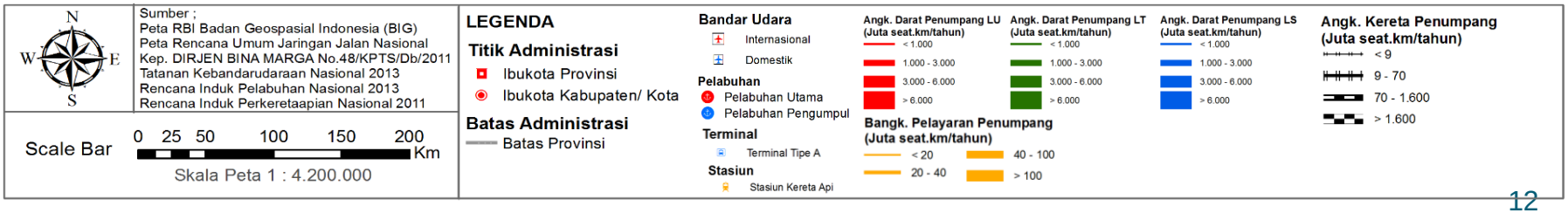
Imbalance of freight load shall not be neglected since it will speed up the structural damage rate of the north java national road during the design period due to high loading time of freight heavy vehicle. If it is not handled seriously and properly, the road service quality for road user will decrease; particularly due to increase on vehicle operating cost and the need of (everlasting) road reconstruction project as what currently happened.

Imbalance of Passenger Transport Production for Each Modal in Java Island

Imbalance of Passenger Transport Production in Java Island					
Road			Rail	Sea	Air
North Route	Middle Route	South Route			
64.8%	21.3%	6.5%	6.5%	0.3%	0.7%
92.6%					

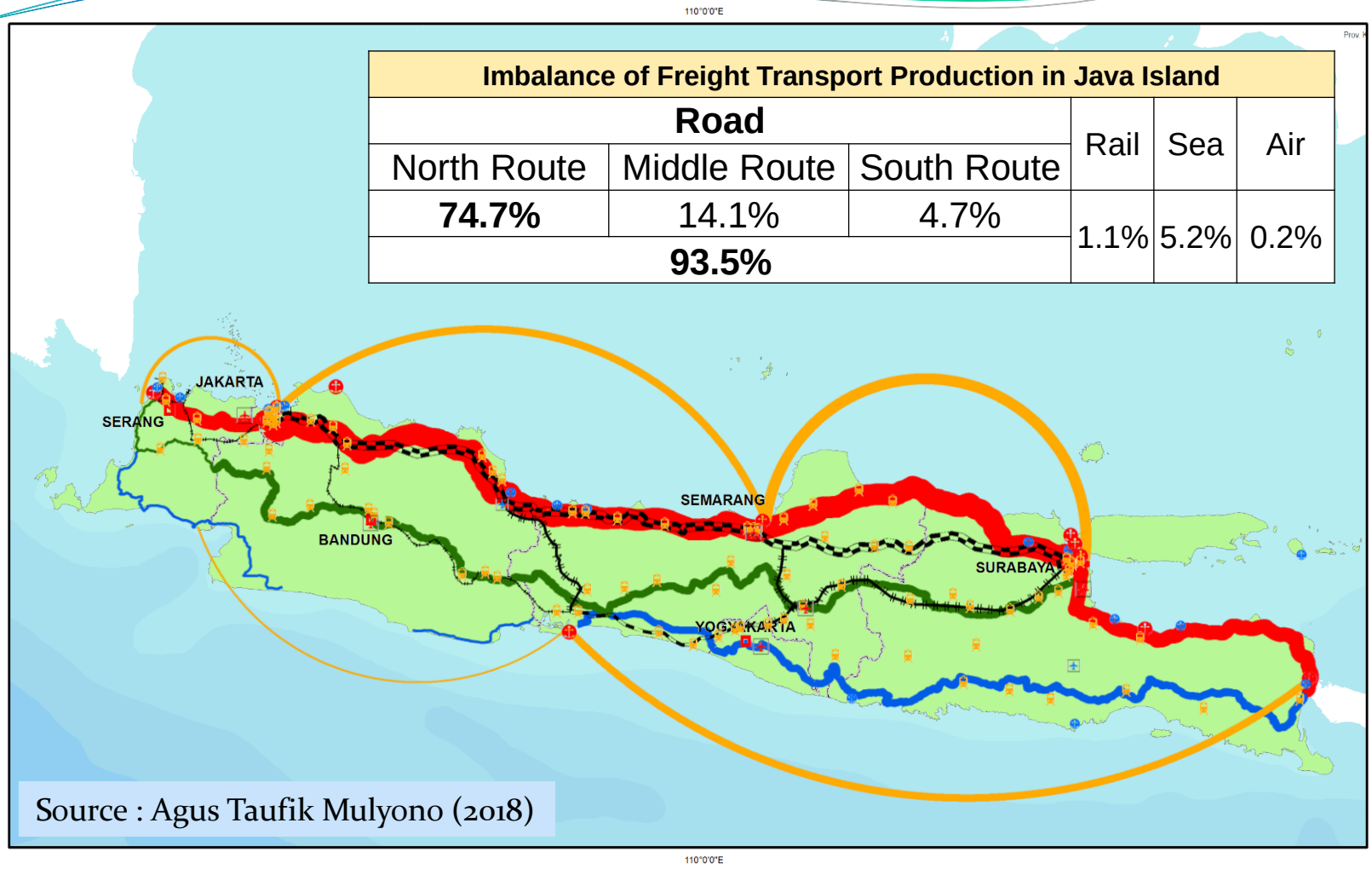


Source : Agus Taufik Mulyono (2018)



Imbalance of Freight Transport Production for Each Modal in Java Island

Imbalance of Freight Transport Production in Java Island					
Road			Rail	Sea	Air
North Route	Middle Route	South Route			
74.7%	14.1%	4.7%	1.1%	5.2%	0.2%
93.5%					



Source : Agus Taufik Mulyono (2018)

Sumber ;
Peta RBI Badan Geospasial Indonesia (BIG)
Peta Rencana Umum Jaringan Jalan Nasional
Kep. DIRJEN BINA MARGA No.48/KPTS/Db/2011
Tatanan Kebandarudaraan Nasional 2013
Rencana Induk Pelabuhan Nasional 2013
Rencana Induk Perkeretaapian Nasional 2011

Scale Bar 0 25 50 100 150 200 Km
Skala Peta 1 : 4.200.000

LEGENDA

Titik Administrasi
- Ibukota Provinsi
- Ibukota Kabupaten/ Kota

Batas Administrasi
- Batas Provinsi

Bandar Udara
- Internasional
- Domestik

Pelabuhan
- Pelabuhan Utama
- Pelabuhan Pengumpul

Stasiun
- Stasiun Kereta Api

Angk. Darat Barang LU (Juta ton.km/tahun)
- < 1.000
- 1.000 - 5.000
- 5.000 - 15.000
- > 15.000

Angk. Darat Barang LT (Juta ton.km/tahun)
- < 1.000
- 1.000 - 5.000
- 5.000 - 15.000
- > 15.000

Angk. Darat Barang LS (Juta ton.km/tahun)
- < 1.000
- 1.000 - 5.000
- 5.000 - 15.000
- > 15.000

Angk. Kereta Barang (Juta ton.km/tahun)
- < 60
- 60 - 200
- 200 - 800
- > 800

Bangk. Pelayaran Barang (Juta ton.km/tahun)
- < 250
- 250 - 2.000
- 2.000 - 9.000
- > 9.000

Problem of "Transportation Spaces"

- **COMPETITIVENESS :** The low competitiveness of infrastructure and transportation services is triggered by some conditions :
  - Commercial vs. Pioneer routes : difficult to control?
  - Mode competition vs. intermodal integration : lack of infrastructure and service networks integration?
  - Public vs private : congestion out of control?
  - Transport capacity : ODOL (Over Dimension Over Load) is difficult to solve?
  - Safety: high accident fatality?
  - Condition of facilities and infrastructure : improper function?
  - Social impact : seamless conflict of interest?
  - Environment: GHGs are increasing, lack of monitoring?
  - Health & psychological users : no complaints?
  - Affordability : the unfair subsidies?
  - ICT system: online motorcycle taxi (OJOL) behavior is difficult to control?

Problem of "Transportation Nodes"

- **WAITING TIME** : Delays often occur, resulting in large losses for users (public). OTP (on time performance) facts at node :
  - Bus Terminal : 67.0% (vehicles, roads, management)
  - Train Station : 90,0% (management, train facilities)
  - Seaport : 75,0% (weather, ships, management)
  - Airport Terminal : 80,0% (weather, airlines, management)
  - All Nodes : 72,0% (far enough from the target)
- **DWELLING TIME** : generally still quite high (> 3.0 days), the complexity of port services has not been resolved.
- **OVERCAPACITY** : some nodes experience greater density than the carrying capacity/planned capacity due to planning and field management errors.

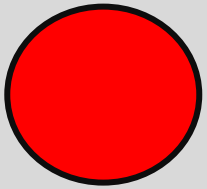
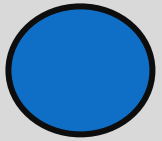
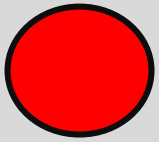
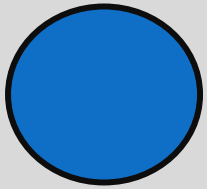
Problem of "Transportation Nodes"

- **INTEGRATION** : especially in intermodal and multimodal transportation, do not yet have an indicator of standardization of integration, and there is no assessment of the effectiveness and efficiency of its implementation in the field:
  - **Integration of networks** : order of infrastructure, facilities and services
  - **Integration of operations** : order of operational facilities, infrastructure, and services
  - **Integration of functions** : order of function, infrastructure, facilities, and services.
  - **Institutional Integration** : synchronization of action programs between institutions.
  - **Integrated Financing** : one document-one time pay

Problem of "Transportation Nodes"

- **LOGISTICS COSTS** : poor service conditions resulting in high logistics costs, can be detrimental to public spending. Field facts, logistics costs are greatly influenced by:
  - 10,0% (administrative costs for sending documents)
  - 60,0% (handling and inventory costs at the node)
  - 30,0% (inter node travel costs)
- **MITIGATION-ADAPTATION** of environmental impact: related to health, safety and security services for people with disabilities, children, elderly people, pregnant women and poor people.

The Most Expensive Logistics Component: Processing Cost in the Node

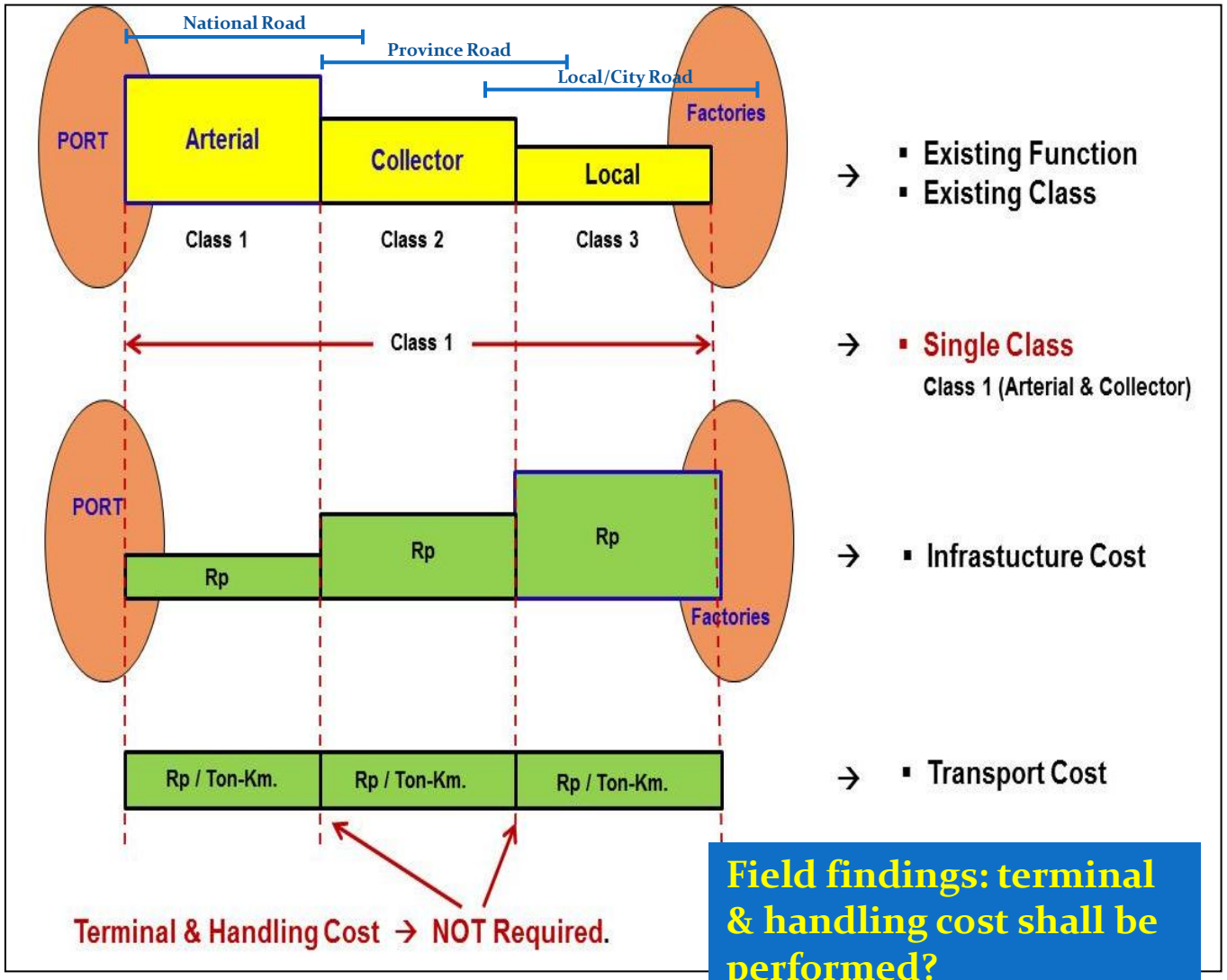
Logistics Cost Components	Cost Comparison	
	Field Findings	Operator
1. **Administration Cost of Delivery Documents:** • Customs • Tax • Packing list • Insurance • Security	 10.0%	 10.0%
2. **Handling and Inventory Cost:** • Vessel Cost in the Port (Docking, Berthing, Pilot and tugboat) • Wharfage • Handling (container movement) • Loading-unloading • Cargo pile up • Haulage • Demurrage • Container Rent • Repair Container • Equipment Rent (Fork lift, Container Crane, Rubber Tyred Gantry, etc.)	 60.0%	 30.0%
3. **Transportation Cost :** • Fuel (Producer → port – shipping – port → consumer) • Ship Crew and truck driver/train • Vessel and truck/train operation cost • Entrance and exist cost in the port (land and sea)	 30.0%	 60.0%

Source: Agus Taufik Mulyono (2018)

The challenge of "Transportation Management"

- **SUSTAINABLE TRANSPORTATION KPIs** : currently do not have a quantitative (measurable) sustainable development and operation KPI, at the node and between nodes.
- **TRANSPORTATION LAW** : National Transportation System (SISTRANAS) to regulate the legal certainty of integration and synchronization:
  - Efficiency : Integrating the order of facilities, operational, and functional to the infrastructure and services network.
  - Effectiveness : Integration of institutions and financing.
  - Action solutions : ODOL, OJOL, traffic jams, travel time, accident fatalities, Central-Regional connectivity, logistic lane.
  - Collaboration between government interests, research institutions, universities, industry, professional associations, and the community.
- **STANDARDIZATION OF INFRASTRUCTURE AND SERVICES NETWORKS** : not yet available comprehensively and integratively in the implementation of intermodal / multimodal transportation.

There no courage to standardize road class among road status to increase national connectivity of logistics transport



Field findings: terminal & handling cost shall be performed?

Consequence of Single Class :

- Conflict Between the Central and Local
- Unclear funding allocation
- More aligned to goods transporter with cheaper transport cost
- Short Travel time
- Expensive infrastructure cost that the government should bear
- Shall amend Law regarding Road and Law regarding Authority Distribution Between Central Government and Local Government

Single Class is suitable for continuous road network serving export goods transport from producer to port/outlet.

Source: Agus Taufik Mulyono (2018)

SISTRANAS
(Tatranas – Tatrawil – Tatralok - Tatrakota)

"Unimoda" Transportation Sector

UU No. 38/2004: Jalan
"...jalan sebagai bagian **sistem transportasi nasional** mempunyai peranan penting...."

UU No. 22/2009: LLAJ
"...LLAJ sebagai bagian dari **sistem transportasi nasional** ...."

UU No. 23/2007: Perkeretaapian
"...sebagai salah satu moda transportasi dalam **sistem transportasi nasional** ...."

UU No. 17/2008: Pelayaran
"...merupakan bagian dari **sistem transportasi nasional** yang harus dikembangkan...."

UU No. 1/2009: Penerbangan
"...merupakan bagian dari **sistem transportasi nasional** yang...."

NOT YET Intermodal / Multimodal Transport Integration

- Road Network Master Plan National/Province/Regency/City
- National General Safety Plan
- National Railroad Master Plan
- National Port Master Plan
- National Airport Master Plan

Problems of Synchronizing the Functional Order

Problems of Synchronizing the Operational Order

Spatial planning (UU 26/2007)

National Urban System:
- National City : (PKN/PKSN/ The Capital of Prov)
- Regional City : (PKW/PKSP/ The Capital of Regency)
- Local City : (PKL)

National Transportation Network System :
- Land Transportation (Highways & Terminals, Railway & Railway, SDP & Wharf)
- Sea Transportation (Seaports & Shipping Lines)
- Air Transportation (Airport & Airspace/ Aviation Lines

Problems of Synchronizing the Facilities Order

National Development Planning System (UU 25/2004)

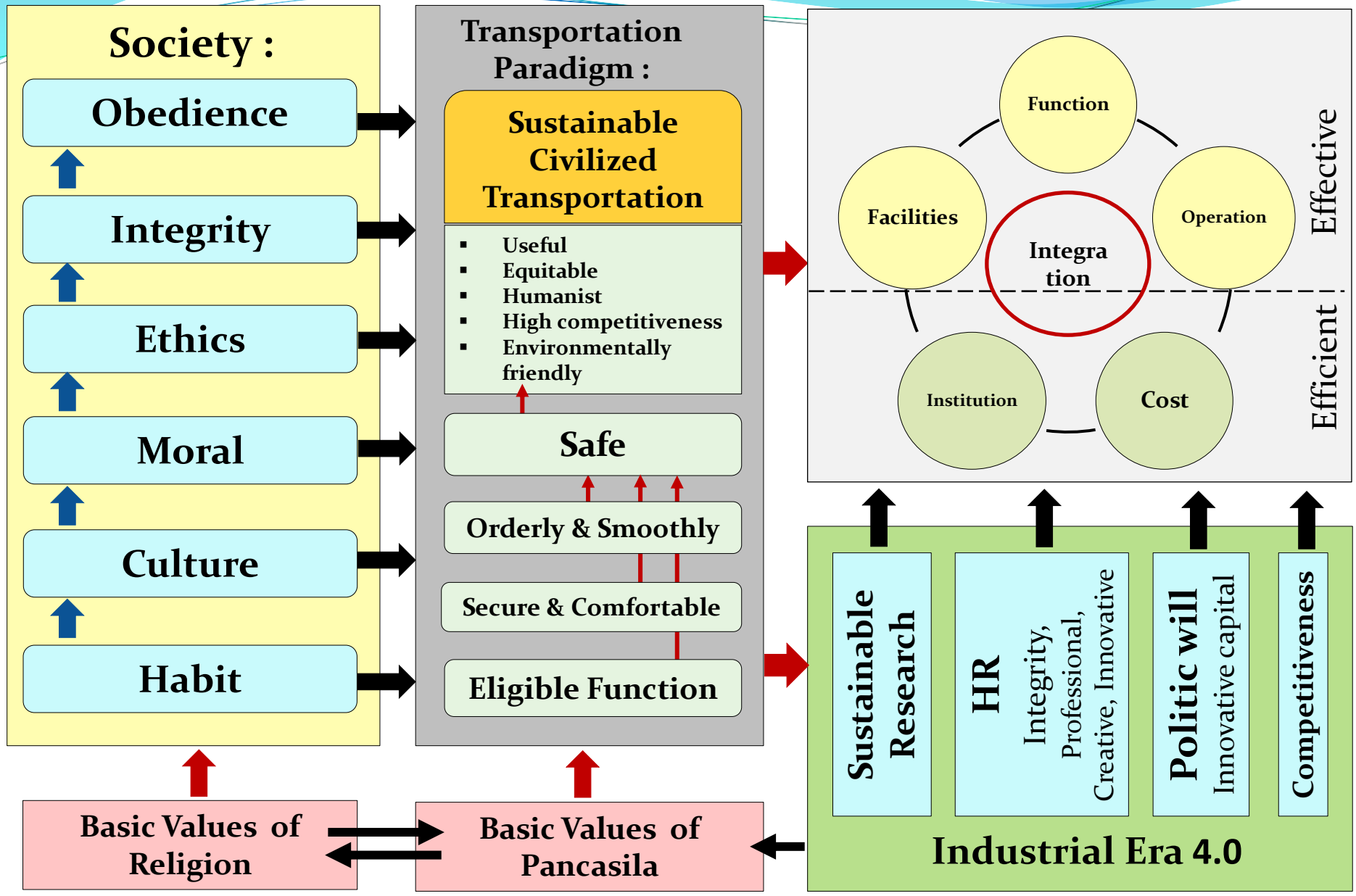
Local government (UU 32/2014)

RPJPN, RPJMN, RAK-K/L
RPJPD, RPJMD, RAK-SKPD

Source : Agus Taufik Mulyono (2018)

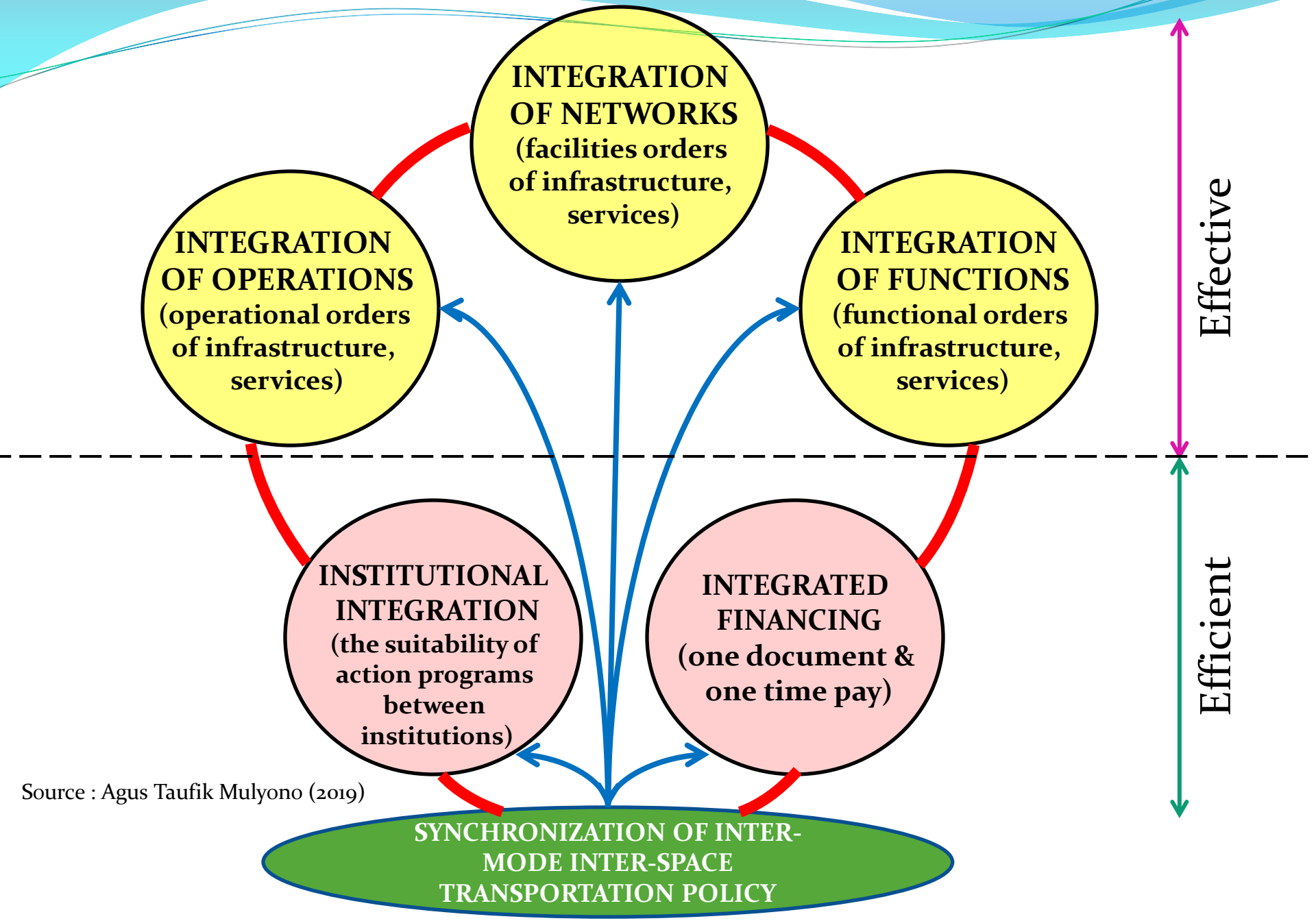
MTI's Perspective :
Challenges of the Industrial Era 4.0
Sustainable Civilized Transportation

Challenges of Industrial Era 4.0 → Civilization of Transportation



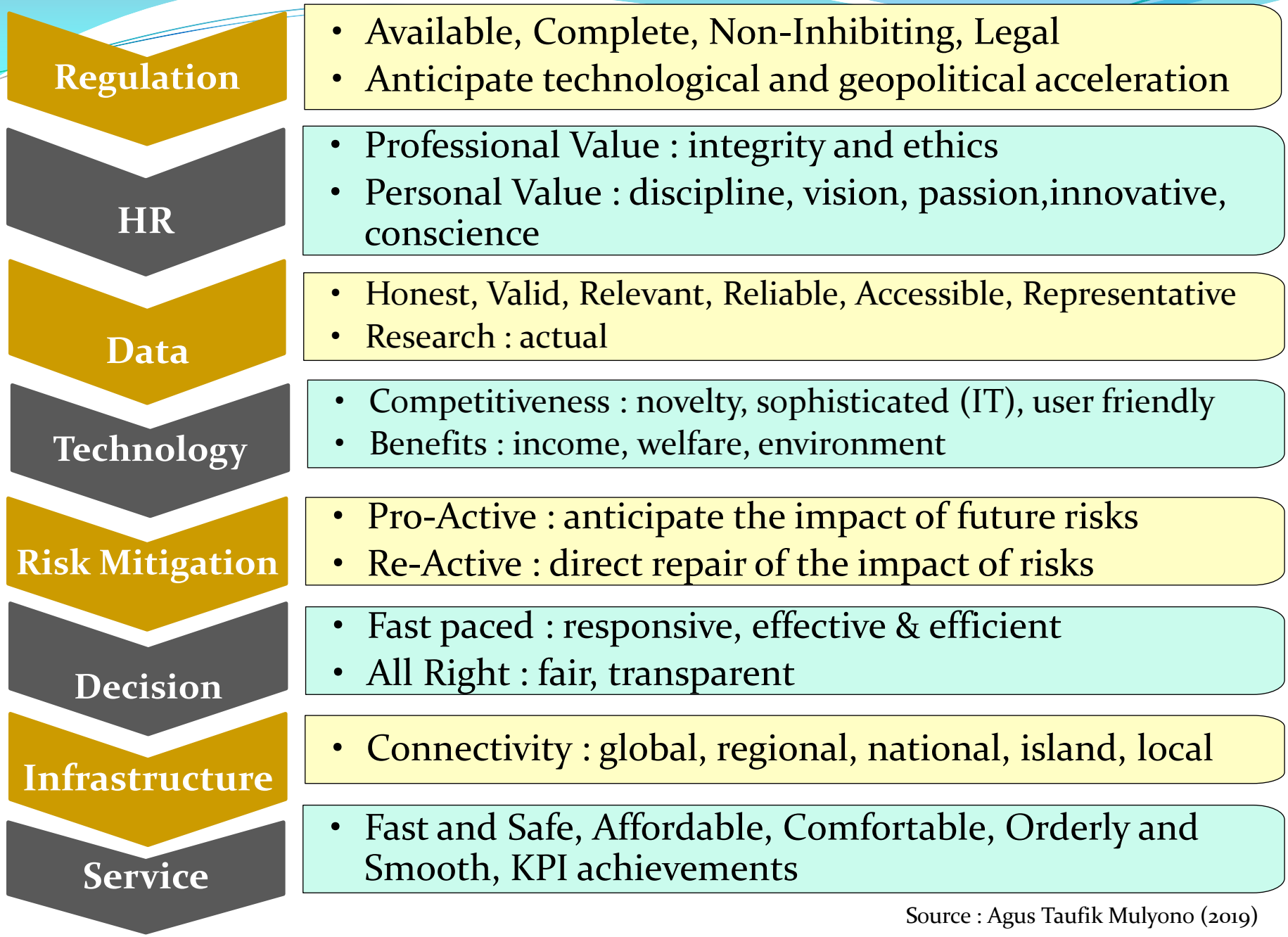
Source : Agus Taufik Mulyono (2019)

Industrial Era 4.0: Intermodal & Inter-space Harmonization



Source : Agus Taufik Mulyono (2019)

Industrial Era 4.0: Answering the Civilization of Sustainable Transportation

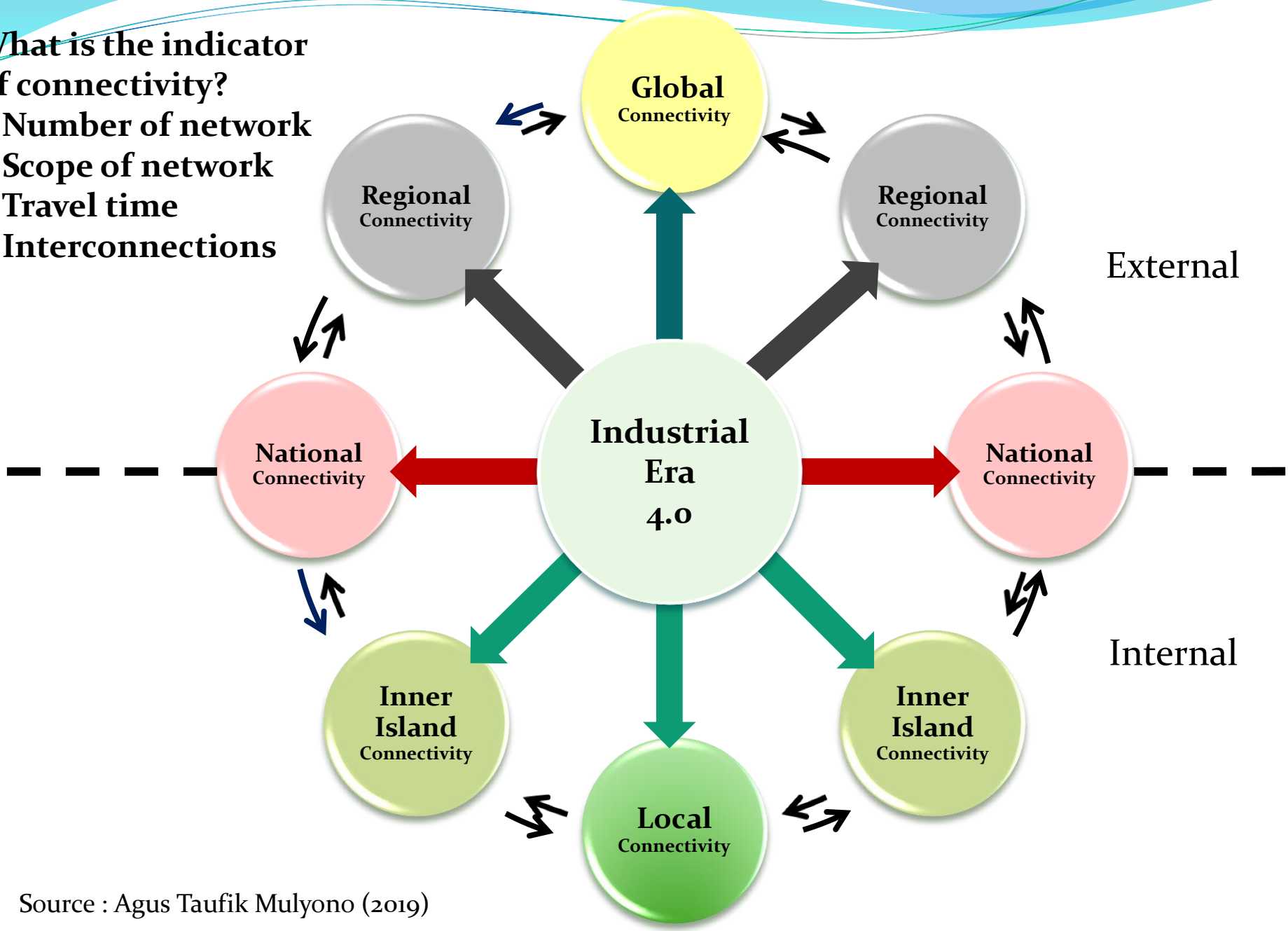


Source : Agus Taufik Mulyono (2019)

Industrial Era 4.0: Answering Acceleration Connectivity

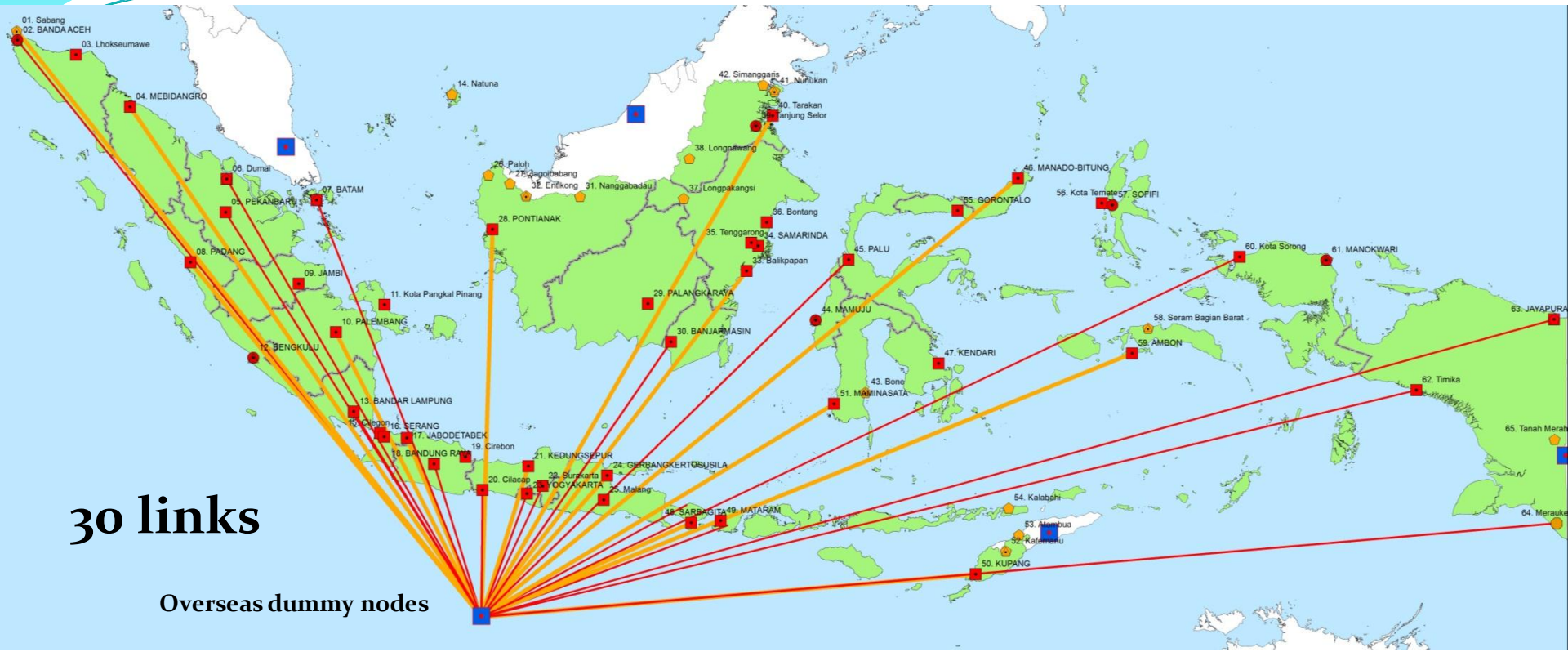
What is the indicator of connectivity?

- **Number of network**
- **Scope of network**
- **Travel time**
- **Interconnections**



Source : Agus Taufik Mulyono (2019)

Interconnections of Global Connectivity Nodes



30 links

Overseas dummy nodes

Challenges of IT Systems Develpoment in Industrial Era 4.0 :

- ✓ Monitoring and Evaluation of KPI achievement for each Node-Link-Node between Countries.
- ✓ Accuracy of connectivity Scores between countries, as input and technological solutions and national economy improvement.

Legenda

Sistem Perkotaan Nasional
- PKN
- PKN/KSN
- KSN
- KSN/PKW
- Pusat Pemerintahan
- Pusat Pemerintahan/P
- Pusat Ekonomi Nas./P

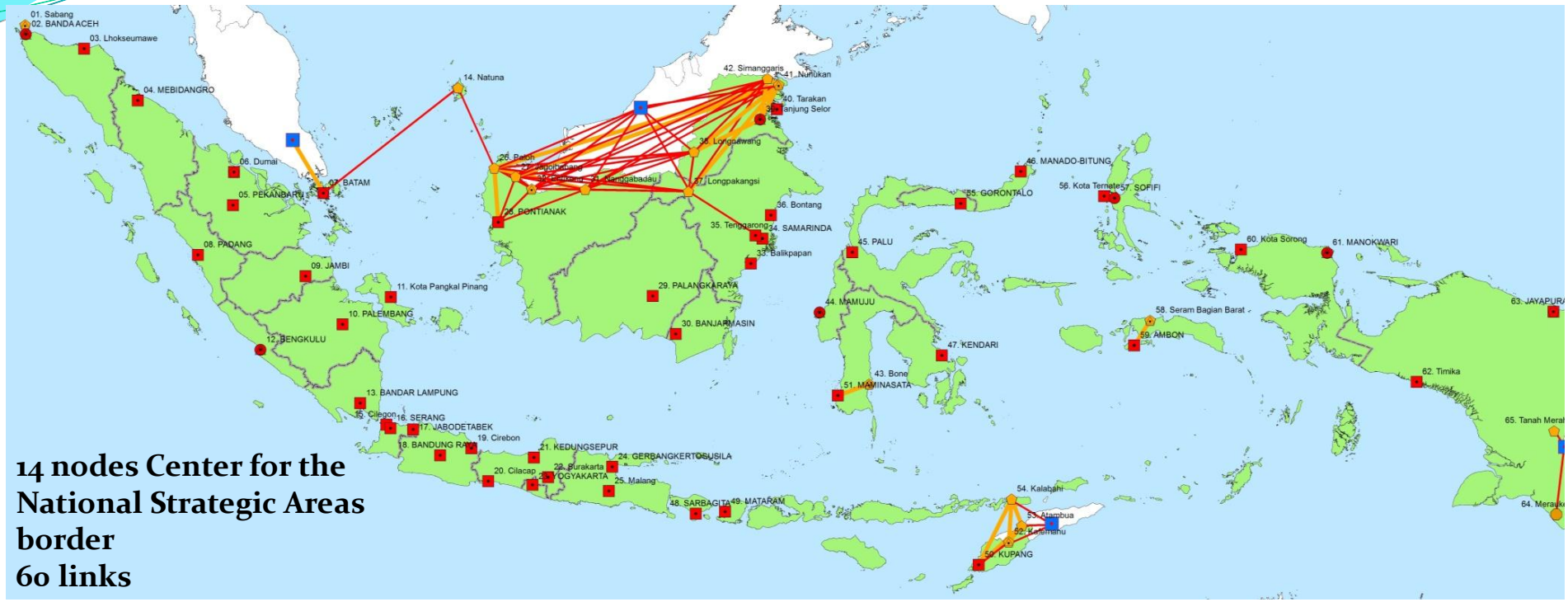
Batas Administrasi
- Batas Provinsi

Jaringan Transportasi Nasional Dalam Pulau

Skor Konektivitas
- 0 Konektivitas
- 1 Konektivitas
- 2 Konektivitas
- 3 Konektivitas

Source : Agus Taufik Mulyono (2018) ; Berlian Kushari (2015)

Interconnections of Regional Connectivity Nodes



14 nodes Center for the National Strategic Areas border
60 links

Challenges of IT Systems Develpoment in Industrial Era 4.0 :

- ✓ Monitoring and Evaluation of KPI achievements for each Node-Link-Node in the country's border areas.
- ✓ Accuracy of Regional Connectivity Scores in national border regions, as input and technological solutions and security improvement of national borders.

Legenda

Sistem Perkotaan Nasional
- PKN
- PKN/KSN
- KSN
- KSN/PKW
- Pusat Pemerintahan
- Pusat Pemerintahan/P
- Pusat Ekonomi Nas./P

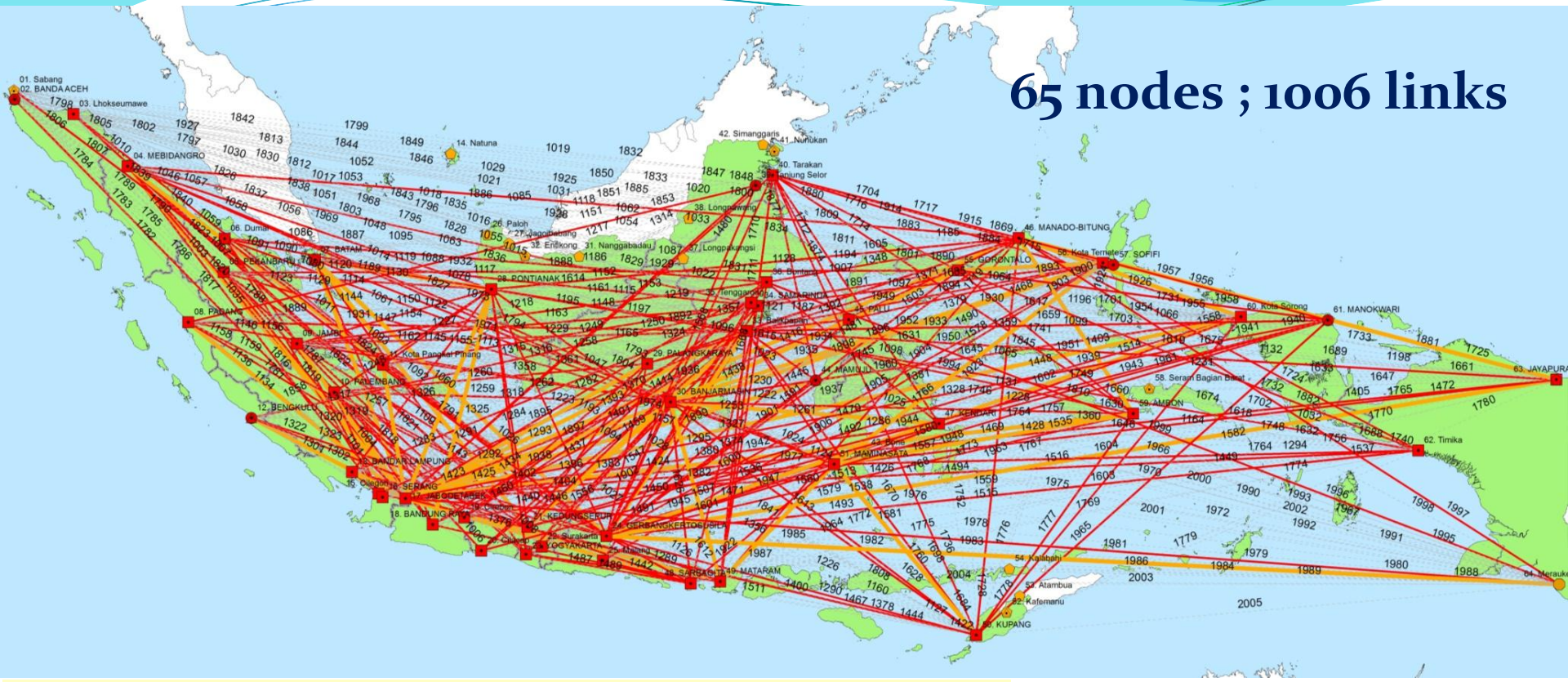
Batas Administrasi
- Batas Provinsi

Jaringan Transportasi Nasional Dalam Pulau

Skor Konektivitas
- 0 Konektivitas
- 1 Konektivitas
- 2 Konektivitas
- 3 Konektivitas

Source : Agus Taufik Mulyono (2018) ; Berlian Kushari (2015)

Interconnections of National Connectivity Nodes (between Islands)

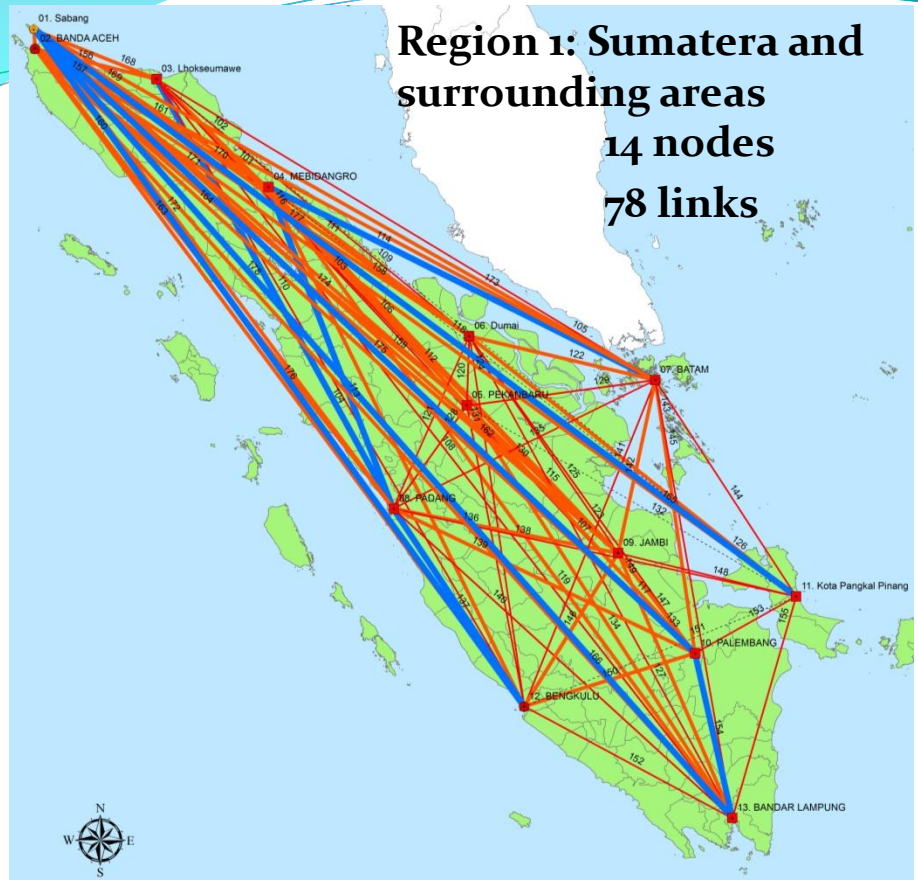


Challenges of IT Systems Develpoment in Industrial Era 4.0 :

- ✓ Monitoring and Evaluation of key performance indicators (KPI) for each Node-Link-Node, within Islands and between Islands.
- ✓ Quick and precise connectivity score so that it can be given technological solutions and improvements to civilization in an effective and efficient transportation.

Source : Agus Taufik Mulyono (2018) ; Berlian Kushari (2015)

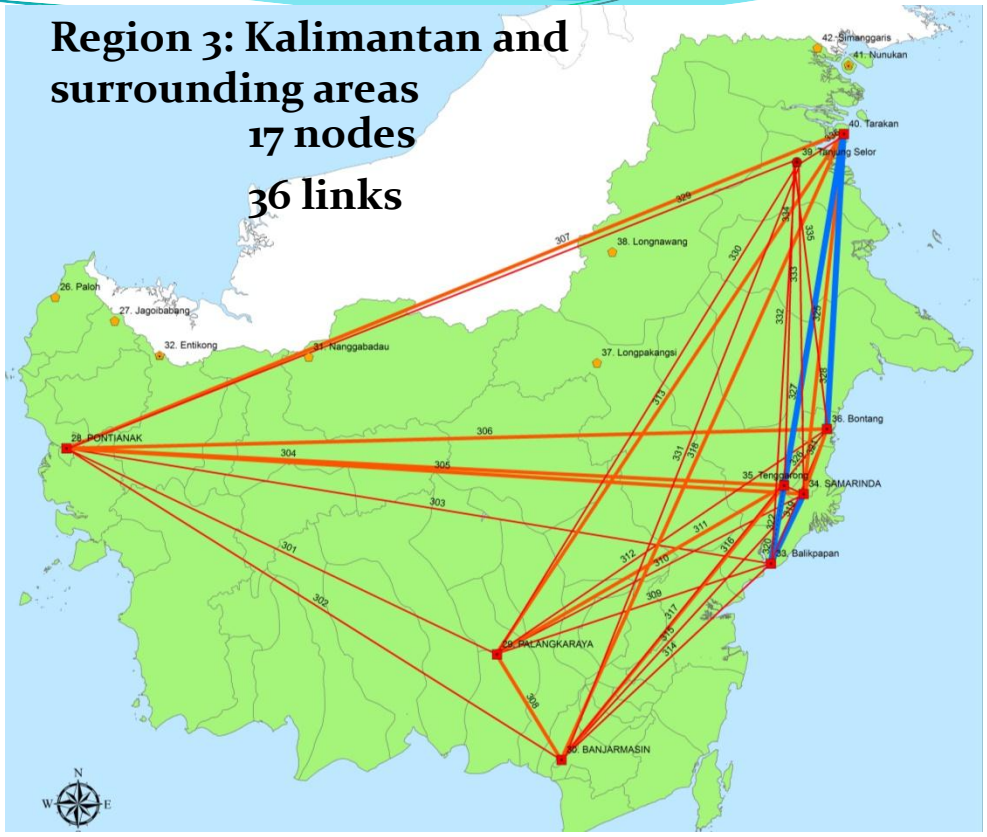
Inter-connectedness Node Connectivity in Island



Region 1: Sumatera and surrounding areas

14 nodes

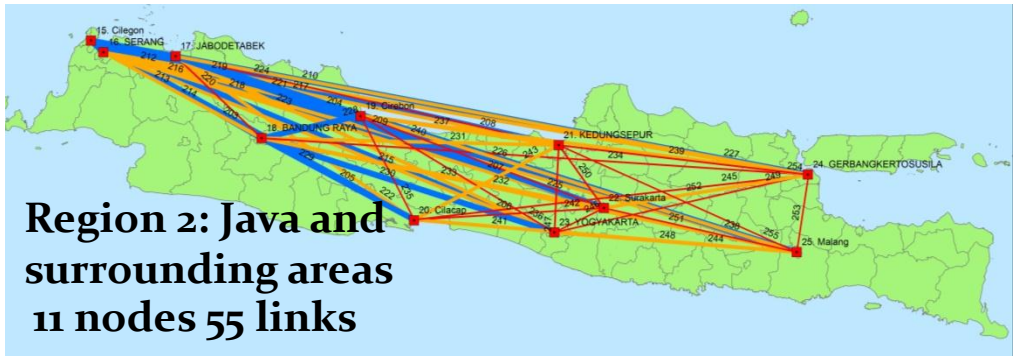
78 links



Region 3: Kalimantan and surrounding areas

17 nodes

36 links



Region 2: Java and surrounding areas

11 nodes 55 links

Legenda

Sistem Perkotaan Nasional

- PKN
- PKN/KSN
- KSN
- KSN/PKW
- Pusat Pemerintahan
- Pusat Pemerintahan/PKW
- Pusat Ekonomi Nas./PKW

Batas Administrasi

- Batas Provinsi

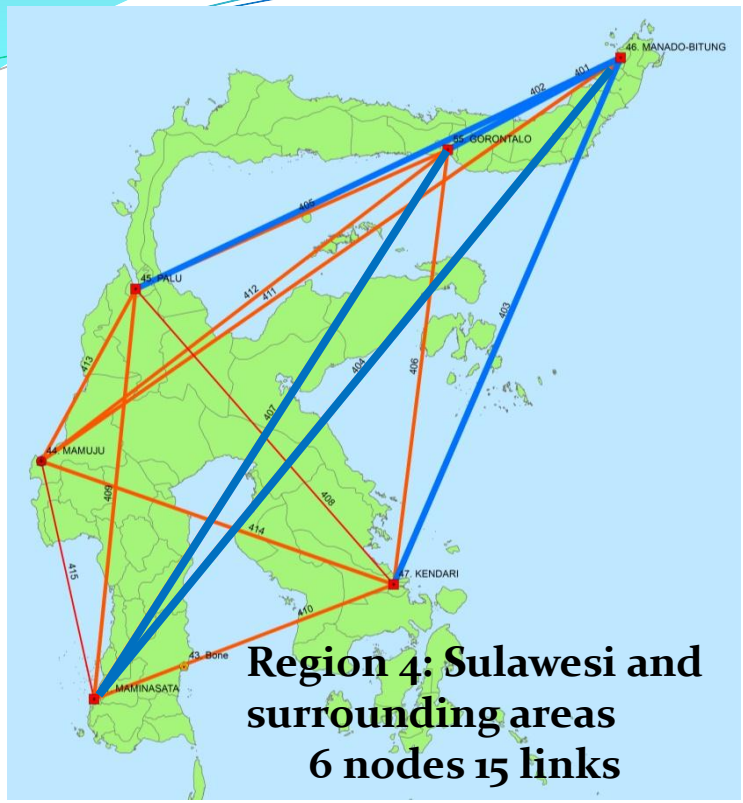
Jaringan Transportasi Nasional Dalam Pulau

Skor Konektivitas

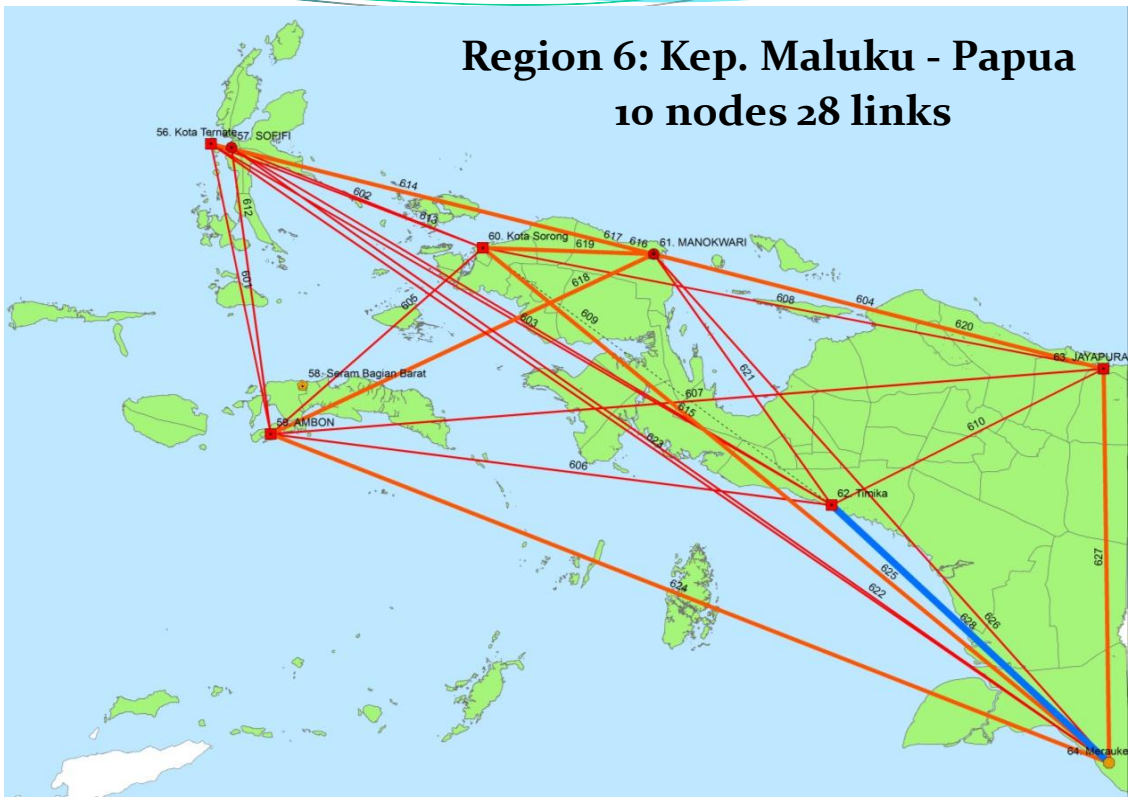
- 0 Konektivitas
- 1 Konektivitas
- 2 Konektivitas
- 3 Konektivitas

Source : Agus Taufik Mulyono (2018) ; Berlian Kushari (2015)

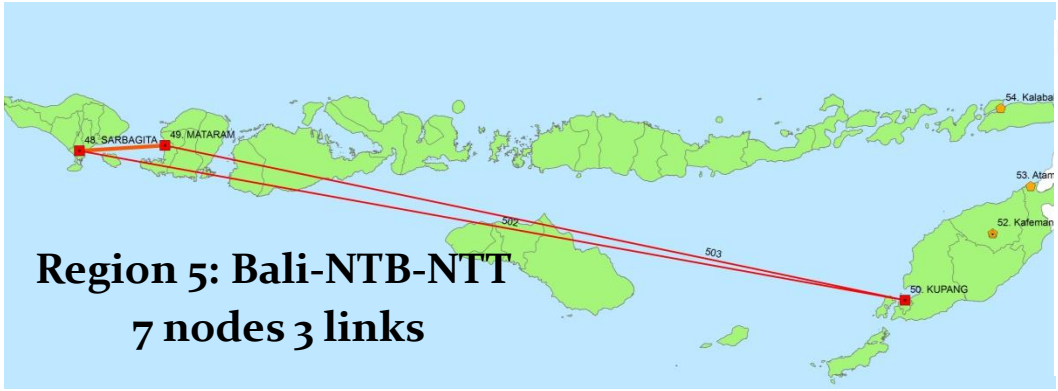
Inter-connectedness Node Connectivity in Island



Region 4: Sulawesi and surrounding areas
6 nodes 15 links



Region 6: Kep. Maluku - Papua
10 nodes 28 links



Region 5: Bali-NTB-NTT
7 nodes 3 links

Legenda

Sistem Perkotaan Nasional
- PKN
- PKN/KSN
- KSN
- KSN/PKW
- Pusat Pemerintahan
- Pusat Pemerintahan/PKW
- Pusat Ekonomi Nas./PKW

Batas Administrasi
- Batas Provinsi

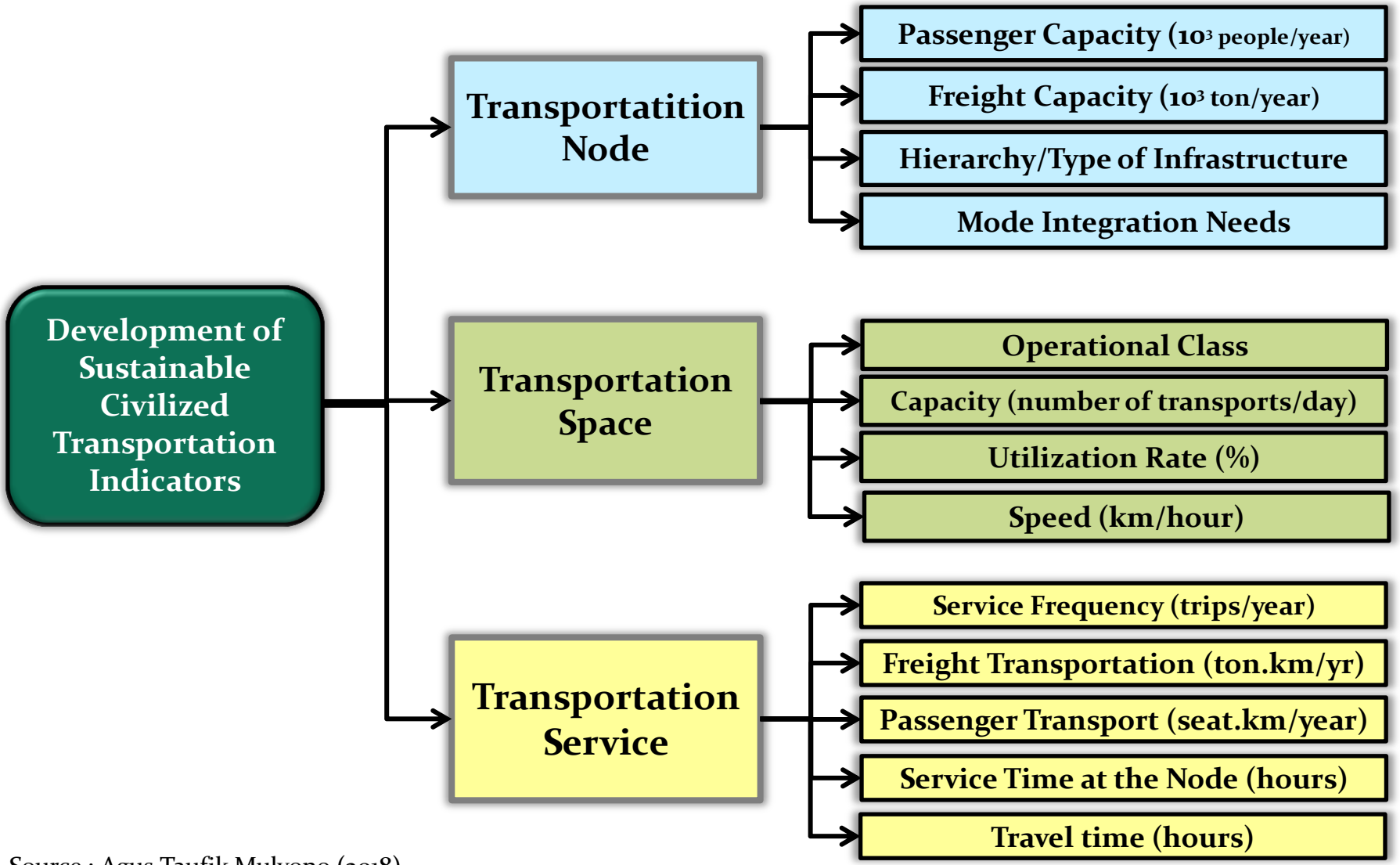
Jaringan Transportasi Nasional Dalam Pulau

Skor Konektivitas
- 0 Konektivitas
- 1 Konektivitas
- 2 Konektivitas
- 3 Konektivitas

Source : Agus Taufik Mulyono (2018) ; Berlian Kushari (2015)

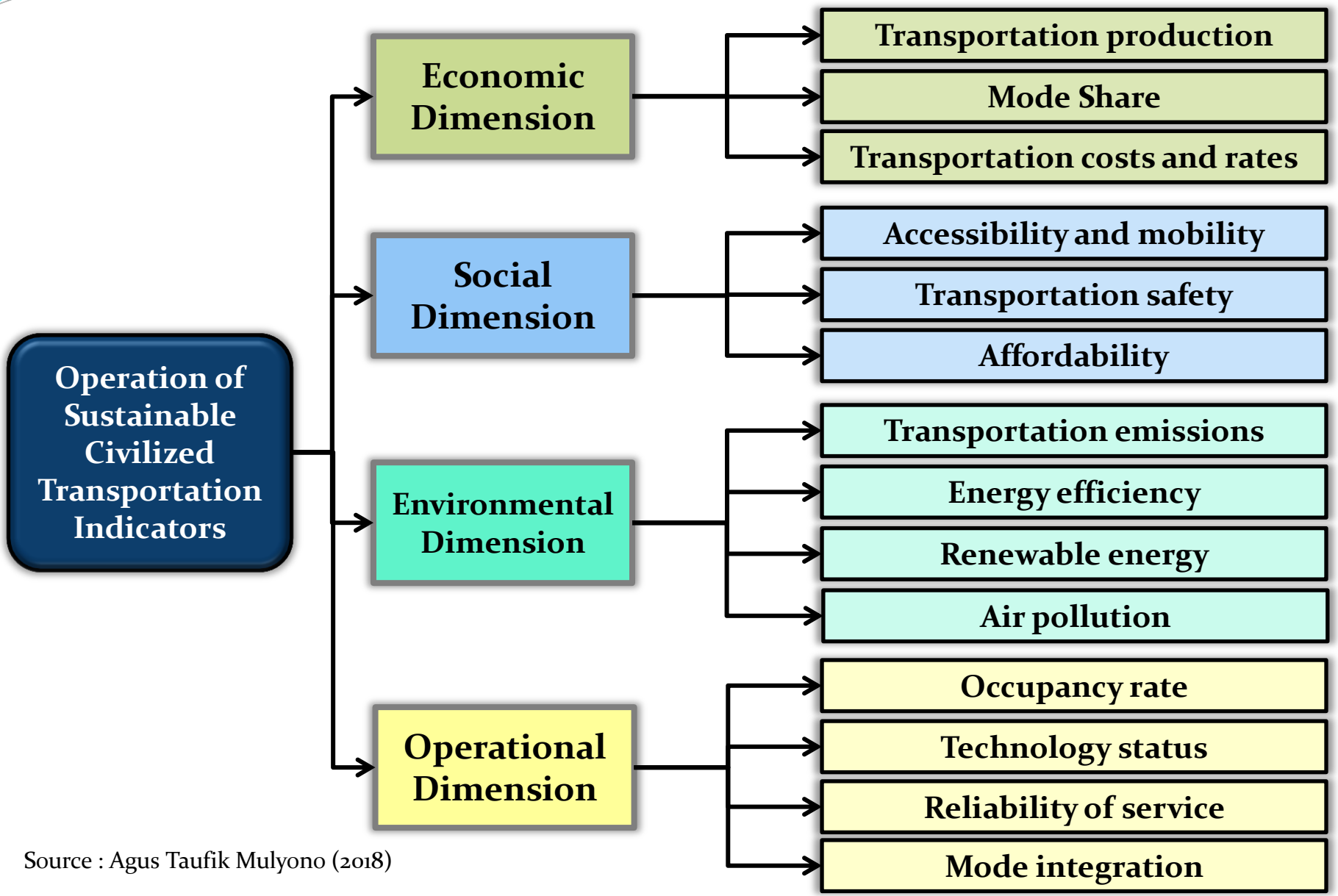
MTI's Perspective :
Key Performance Indicators (KPI)
Sustainable Civilized Transportation
in the Industrial Era 4.0

Development of Sustainable Civilized Transportation KPIs in the Industrial Era 4.0



Source : Agus Taufik Mulyono (2018)

Operation of Sustainable Civilized Transportation KPIs in the Industrial Era 4.0



Source : Agus Taufik Mulyono (2018)

OPERATION OF SUSTAINABLE CIVILIZED TRANSPORTATION KPIs
"ECONOMIC dimension"

ECONOMIC DIMENSION	Transportation Production	Passenger transport production (1,000,000 passenger-km/year)
		Freight transport production (1,000,000 ton-km/year)
	Mode Share	Passenger transport share mode (%)
		Freight transport share mode (%)
	Transportation Costs and Rates	Government subsidies on transportation rates (%)
		Direct costs borne by passenger transport users (1,000 Rp/passenger)
		Direct costs borne by freight transportation users (1,000 Rp/ton)
		Congestion costs against direct passenger transportation costs (%)
		Congestion costs against direct freight transportation costs (%)
		Emission costs (CO_2) to direct passenger transportation costs (%)
		Emission costs (CO_2) to direct freight transportation costs (%)
		External costs that can be internalized to passenger transportation rates (%)
		External costs that can be internalized to freight transportation rates (%)

Source : Agus Taufik Mulyono (2018)

OPERATION OF SUSTAINABLE CIVILIZED TRANSPORTATION KPIs
"SOCIAL dimension"

SOCIAL DIMENSION	Accessibility and Mobility	Average passenger travel distance (km)
		Average freight travel distance (km)
		Average travel time of road transport of passengers (hour/100km)
		Average travel time of road transport of freight (hours/100km)
		Average travel time of railway transport of passengers (hour)
		Average travel time of railway transport of freight (hour)
		Average travel time of water transport vehicles (hours)
		Average travel time of flight transport of passengers (hour)
		Average travel time of flight transport of freight (hour)
		Average travel time of sea transport of passengers (hour)
		Average travel time of sea transport of freight (hour)
	Transportation Safety	The rate of reduction in the number of transportation accidents against the base line (%)
		Rate of railway transport accident (%)
		AOC 121 and AOC 135 air transportation accident ratio (incidence/million flight cycle)
		Number of marine transportation accident (events/year)
		Number of ferry transportation accident (events/year)
		Number of river and lake transportation accidents (events/year)
		Number of victims fatalities in transportation accident (fatalities/yr)
	Affordability	Mid-income level family income spent on transportation costs (%)

Source : Agus Taufik Mulyono (2018)

OPERATION OF SUSTAINABLE CIVILIZED TRANSPORTATION KPIs
"ENVIRONMENTAL dimension"

ENVIRONMENTAL DIMENSIONS	Transportation Emissions	Max tolerance of NOx emission level to environmental quality standard (150 µg/Nm3),(%)
		Max tolerance of CO_2 emission levels to environmental quality standards (400 million.ton/year), (%)
		Max tolerance of CO emission levels to environmental quality standards (10,000 µg/Nm3), (%)
		Max tolerance of HC emission level to environmental quality standard (160 µg/Nm3), (%)
		Max tolerance of SOx emission levels to environmental quality standards (365 µg/Nm3),(%)
		Max tolerance of PM_{10} emission levels to environmental quality standards (150 µg/Nm3), (%)
	Sound Pollution	Noise level (dBA)
	Energy Efficiency	Fuel consumption of transportation facilities (liters/km vehicles)
		Fuel consumption of passenger transportation (liters/km vehicles)
		Fuel consumption of freight transportation (liters/km vehicles)
	Renewable energy	Use of renewable energy sources (percent alternative fuel fleet)

Source : Agus Taufik Mulyono (2018)

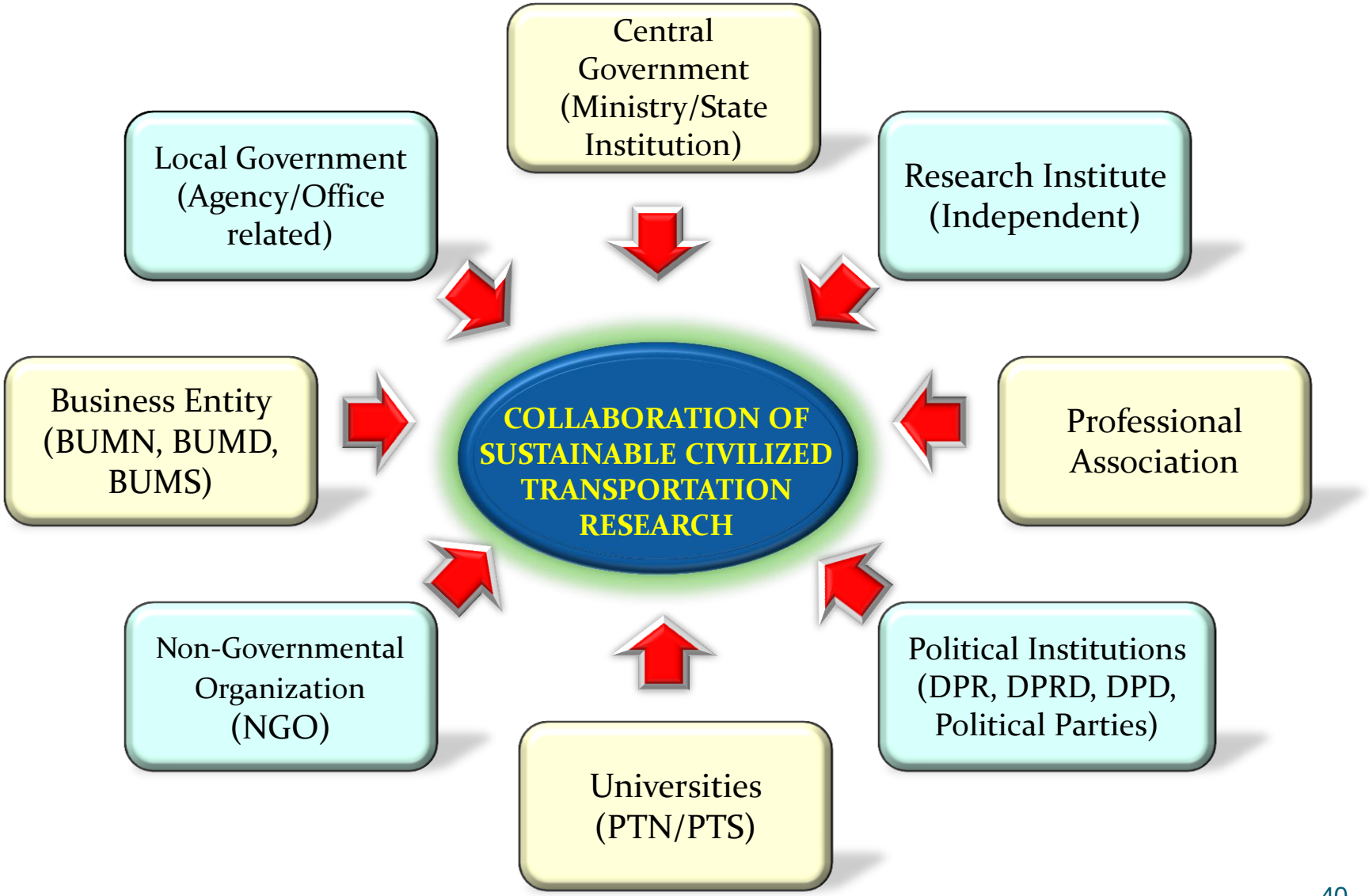
OPERATION OF SUSTAINABLE CIVILIZED TRANSPORTATION KPIs
"OPERATIONAL dimension"

OPERATIONAL DIMENSIONS	Occupancy Rate	Passenger transport occupancy rate (%)	
		Passenger transport Load Factor (%)	
	Technology Status	Average transportation age (year)	
		Proportion of fleets that meet emissions standards (%)	
	Reliability of Road Infrastructure	The maximum tolerance stability of national roads (IRI <8), (%)	
	Reliability of Port Services	On-time performance level of transportation service (%)	
		Dwelling time on the terminal (hour)	
		Ships Waiting Time (hour)	
		Boat Guide Service Time (Approach time) (hours)	
		Effectiveness level of Ship Services (%)	
		Fulfillment of frequency of transportation services (%)	
		Tolerance of service delay due to operational errors (hours)	
	Mode Integration	The transfer time on the modal transfer facility (min)	
		Fulfillment of need for modal integration (%)	
		Intermodal	Passenger transfer time between flight and train mode terminals (minutes)
			Passenger transfer time between sea and train mode terminals (minutes)
			Time of transfer of freight between flight and train modes terminals (minutes)
			Time of freight transfer between sea and train mode terminals (minutes)
		Number of Multimodal Transportation Business Entity services	

Source : Agus Taufik Mulyono (2018)

MTI's Perspective :
Sustainable Civilized Transportation Research

Transportation Research: Collaboration



Source : Agus Taufik Mulyono (2019)

Transportation Research: Macro-Meso-Micro

Macro Order Research

- Academic research on the Transportation Bill
- Academic research on establishment of Ministry of Transportation
- Academic research on ammandement of the Unimoda Law related to technological and civilization developments

Meso Order Research

- Transport Research Master Plan (RMP) for each relevant institution
- Big Data System of National and Local Transportation
- Grand Design of Human Reseource in Transportation (number, competency)
- Mapping of Impact of Transportation Infrastructure Development on Gross Domestic Product
- Grand Design of Energy Needs for Transportation Sector
- Business Model for Transportation Management Partnership
- KPI (Key Performance Indicator) for Developing Sustainable Civilized Transport Nodes-Space-Services
- KPI for the Operation of Sustainable Civilized Transportation (Economic, Socio-Culture, Environment, Operations)
- Standardization of Integrating Facility-Infrastructure-Service Network on Intermodal/ Multimodal Transportation.
- Mapping of function and role of related institution to anticipate development and application of autonomous vehicle

Source : Agus Taufik Mulyono (2019)

Transportation Research: Macro-Meso-Micro

Micro Order Research

- Production of Freight and Passenger Transportation for Each Link (Inner Island and Inter Island)
- Proportion of Mode Sharing of Transport Production : priority Java and Sumatera Island
- Standards and Operational Guidelines for Intermodal/Multimodal Transportation
- Big Data of travel time of Each Link in Transportation Space. Big Data of waiting time and dwelling time of Each Transportation Node
- Big Data of Origin-Destination (O-D) Based on Mobile GPS
- Punishment Scheme for ODOL Operator and ODOL Violation Negligence
- Model to Determine Optimum Quota of Online Taxi (Motorcycle and Car); Evaluation of Driving Behaviour of Online Taxi.
- Battery Technology for Electric Car : safe, affordable, enviromental friendly, and recycleable
- Development of green transport infrastructure design and utilization of recycled material to support green transportation infrastructure
- Mapping of alternative energy availability for transportation energy needs

Source : Agus Taufik Mulyono (2019)

Thank you

Future Transportation Research must be carried out in collaboration between relevant stakeholders: Central Government, Regional Governments, Independent Research Institutions, Universities, Business Entities, Professional Associations, NGOs, and Political Institutions, so a National Transportation Research Forum Institute must be formed. (Agus Taufik Mulyono, 2019)