Region-based On-device Artificial Intelligence Services in Indonesia

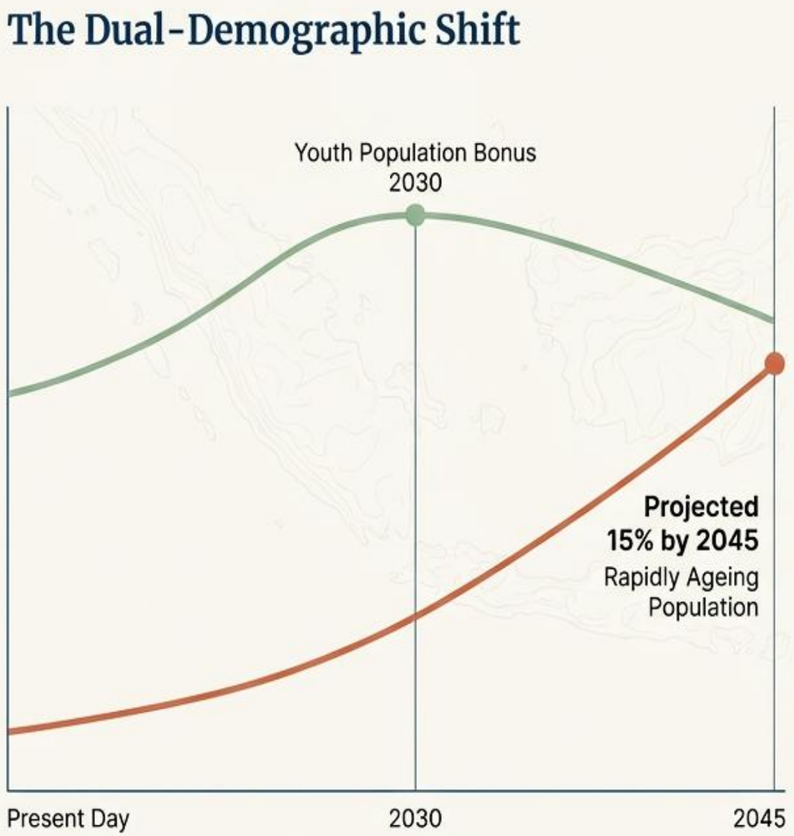
Advancing Inclusive Technologies for a Society for All Ages

Khairul Rizal S.T., M.P.P., Ph.D.
NATIONAL RESEARCH AND INNOVATION AGENCY

Why Indonesia Matters?

Indonesia presents a unique and complex environment for AI deployment:

1. Over 17,000 islands with dispersed populations
2. Significant regional disparities (urban vs. 3T regions)
3. Limited access to healthcare, education, and digital services in several remote areas



→ Indonesia represents an extreme and realistic testbed for inclusive AI deployment

The Architectural Pivot to Edge Processing

Evaluating structural viability for the Indonesian context

Region-based On-device AI

To be effective, AI systems in Indonesia must:

- Operate directly on local devices (on-device AI)
- Adapt to regional differences (region-based design)

This approach ensures:

- Accessibility in low-connectivity environments
- Relevance to local users

Dimension	Traditional Cloud AI	On-device AI (Edge)
Infrastructure Reliance	High broadband dependency; central server reliance	Local processing; connectivity independence
Data Privacy	Vulnerable to centralized breaches; data leaves source	Enhanced privacy; sensitive health data stays on device
Hardware Economics	Continuous high data transfer and server costs	Energy and cost-efficient; optimized for low-cost devices
Scalability	Constrained by geographic network reach	Instantly scalable via widely adopted smartphones & wearables

→ Centralized AI models may not fully accommodate the diverse needs of each region

Region-based AI

Region-based AI means designing solutions that are tailored to:

- Local languages and dialects
- Infrastructure availability
- Cultural practices and user behavior
- Specific local problems

Examples:

- Agricultural AI for rural farmers
- Health AI for remote clinics

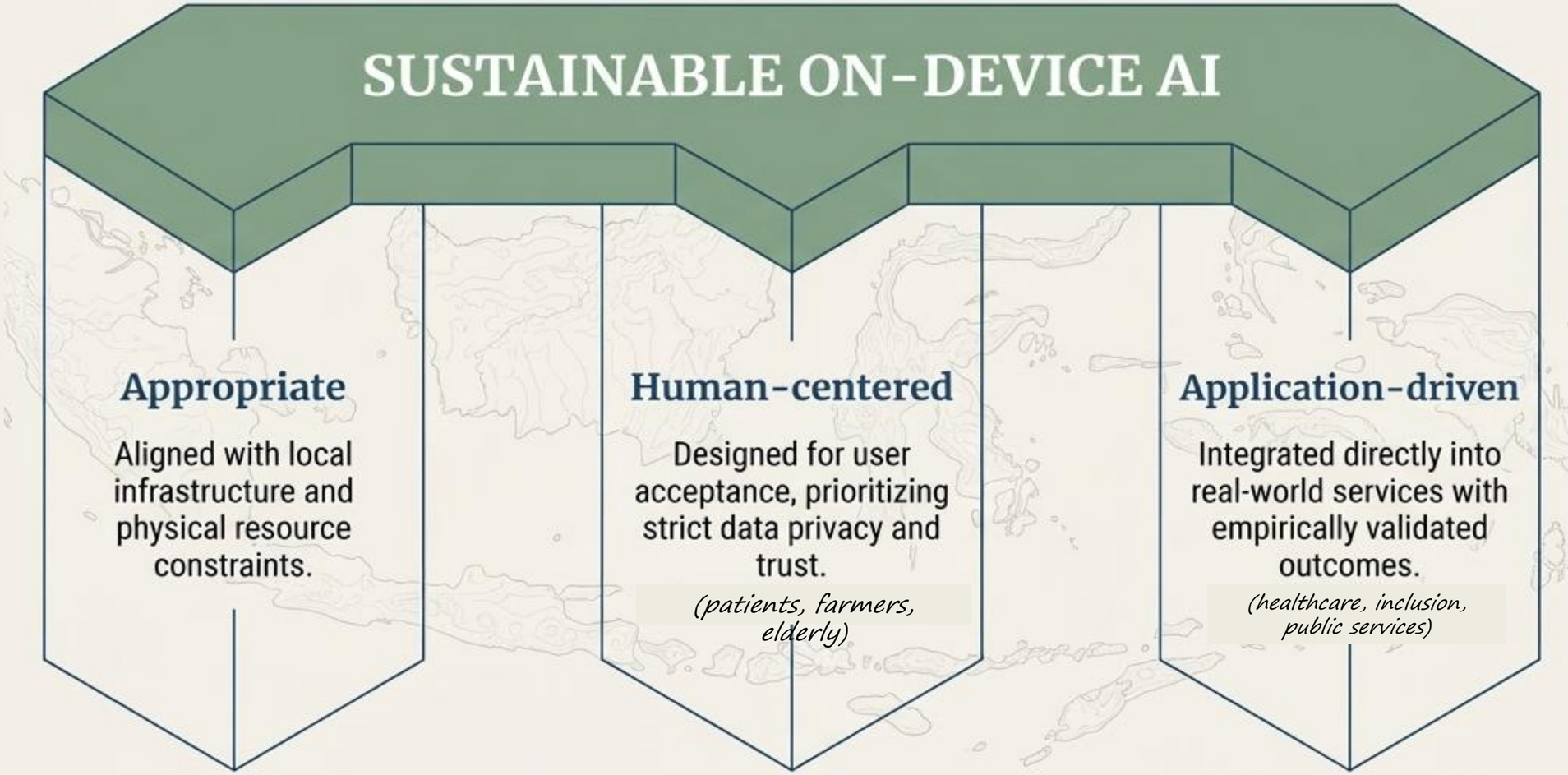
Impact: Society for All Ages

1. Older Persons
   → Remote health monitoring, assisted care
2. Working-age population
   → Productivity tools, agriculture support
3. Youth and students
   → Access to education and digital learning

➡ Context-aware design is key to successful deployment

The AHA Framework for Sustainable Integration

Applied in Indonesia



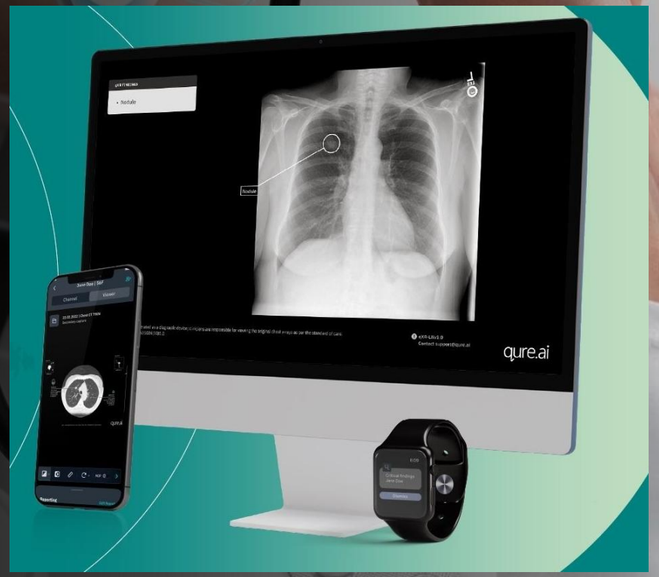
➞ Indonesia demonstrates how AHA can be operationalized in practice

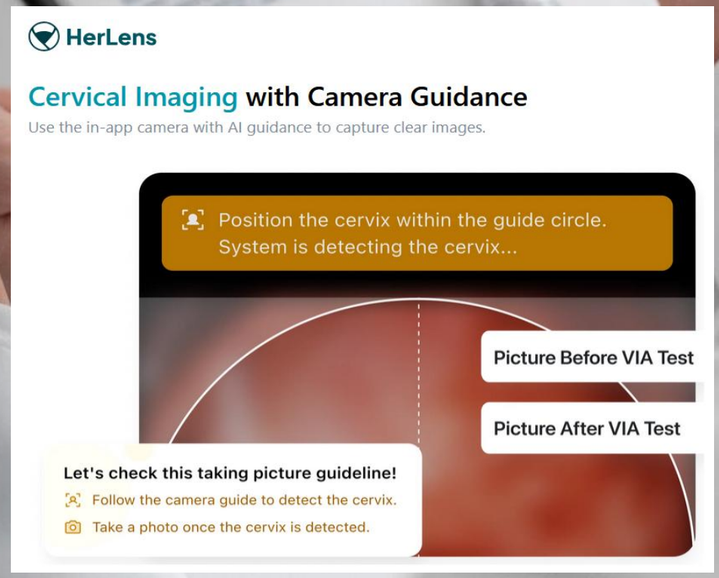
Healthcare & Care Systems

- Qure.ai
  AI-assisted diagnosis in low-resource environments
- Herlens
  Early detection of cervical cancer in remote regions

👉Contribution:

- Expands healthcare access
- Supports healthy ageing and care systems





Healthcare & Care Systems

"Indonesia is building the pathway from robotics and embedded systems toward scalable, region-based on-device AI services in healthcare."

- **Robotics for Post-Stroke Rehabilitation**

🎓**Universitas Gadjah Mada (UGM)**
- Multi-part rehabilitation robots (upper/lower limb)
- Locally adapted (cost, anthropometry)

→ Strong **region-based design (prototype)**

🎓**Universitas Diponegoro (Undip)**
- Lower-limb exoskeleton for post-stroke therapy
- Sensor-based motion control

→ Early **on-device intelligent system (prototype)**

🎓**Telkom University – Picobot**
- Robotic physiotherapy device (post-stroke rehab)
- Tested in clinical settings

→ Moving toward real use **(prototype)**

Social Inclusion

a. Demata 2.0

→ On-device AI assisting visually impaired users to read text and recognize surroundings

b. Runsight (University of Indonesia)

→ Navigation support for visually impaired

c. AI Tunanetra (Telkom University)

→ AI-based walking assistance

👉Contribution:

- Enhances independence
- Promotes accessibility and inclusion

➡ **On-device AI enables meaningful impact without constant connectivity**

Local Innovation Ecosystem

Indonesia’s AI ecosystem is evolving:

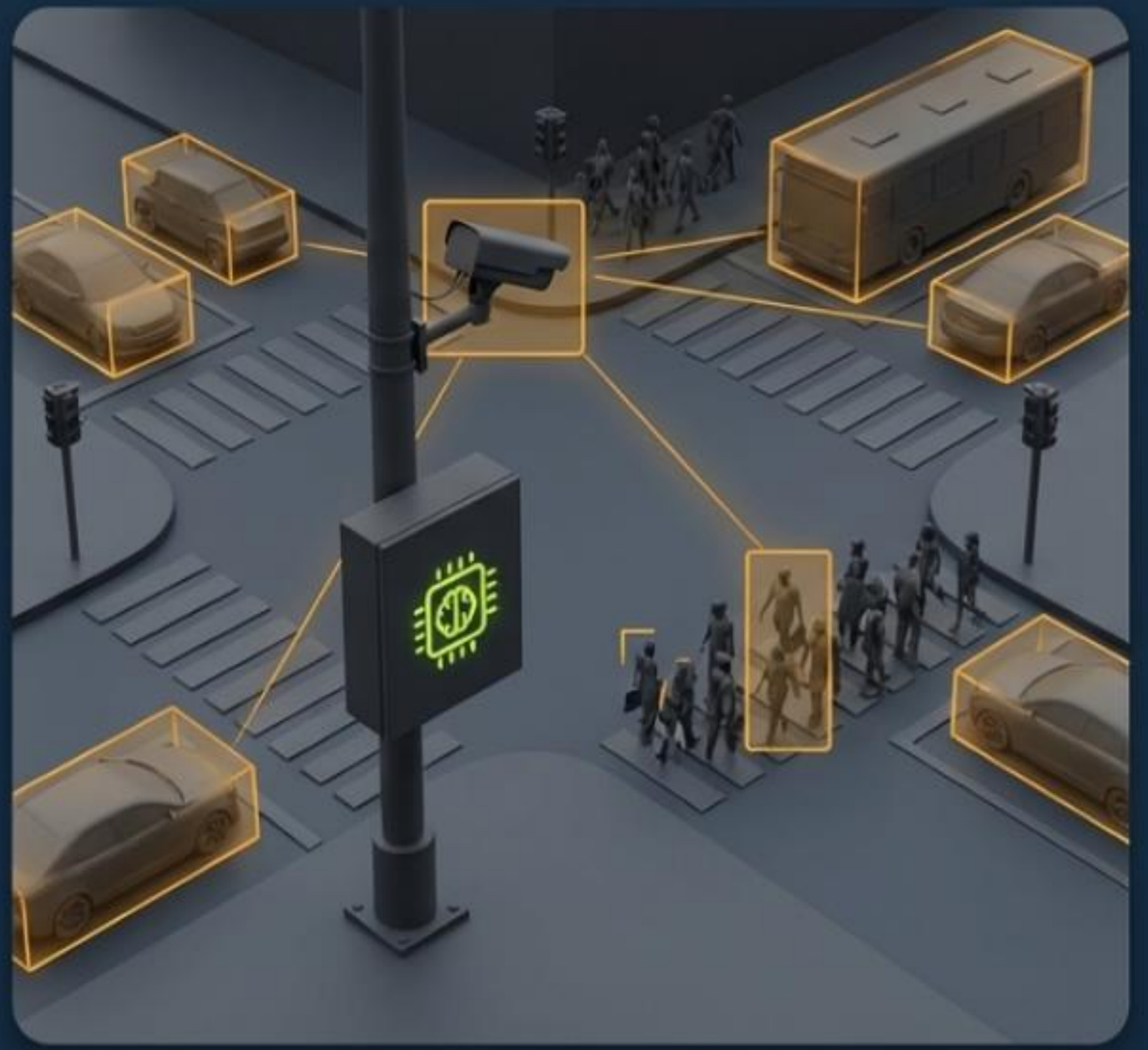
1. BRIN
   → Research in IoT and edge AI technologies

2. Company & Start Up (Nodeflux, Lenna AI, etc)
   → AI solutions for smart environments and public services

3. Universities
   → Driving context-specific innovation

→ Local challenges are driving locally relevant AI solutions

Nodeflux processes high-density urban analytics at the edge



Use Case 2: High-Density Urban Constraints

Context: Urban Public Service AI

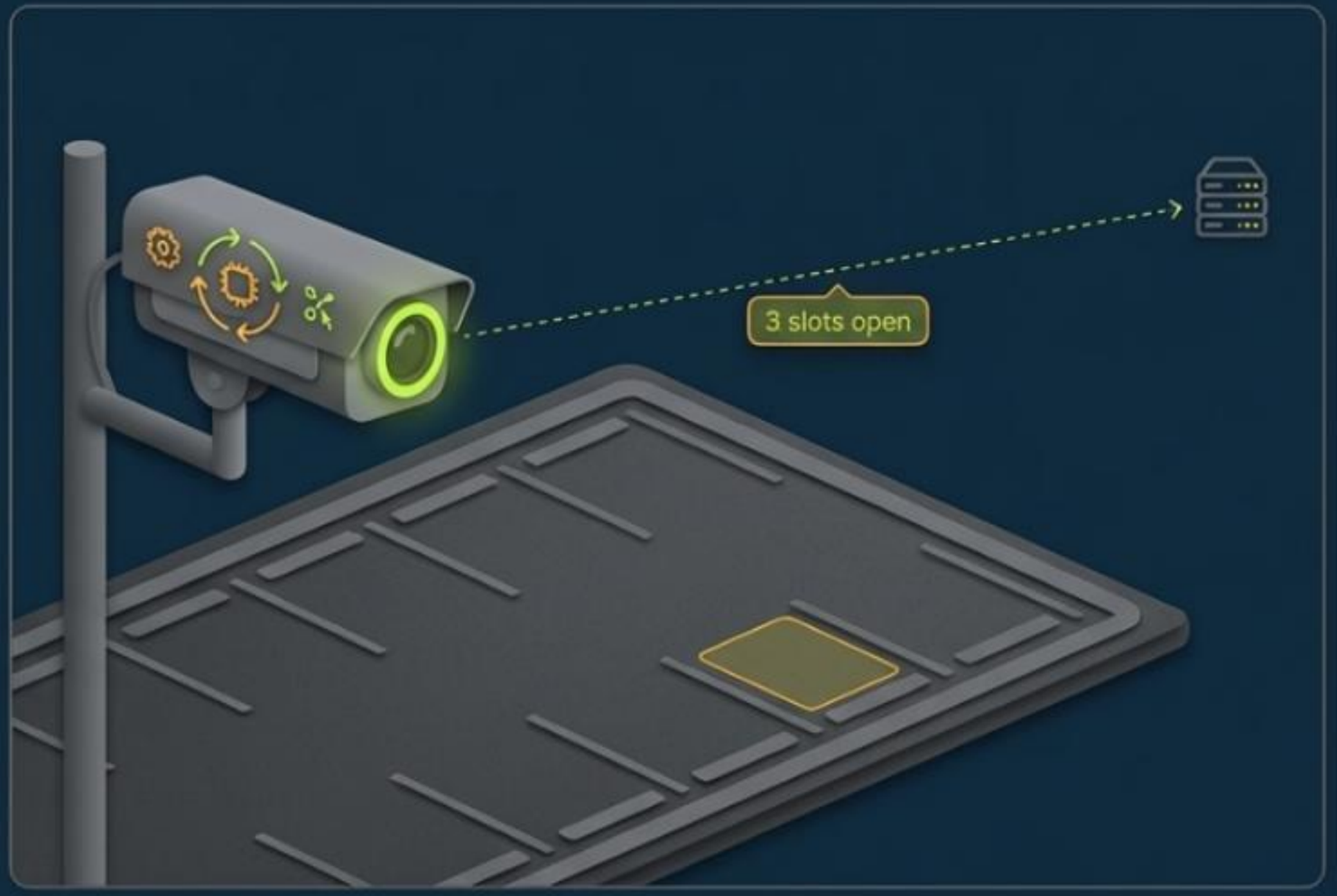
System Architecture: VisionAIre platform utilizing on-premise, GPU-enabled edge hardware

Processing Engine: Real-time Vision AI (<1 sec latency)

Real-World Application: Facial recognition, traffic monitoring, crowd analytics, and immediate flood detection

AHA Impact: Bypasses urban bandwidth bottlenecks to deliver immediate public safety and governance support.

Lenna.ai optimizes unstructured urban spaces with local vision



Use Case 3: Commercial Urban Service

Context: Urban Service Optimization

System Architecture: Camera-based local inference utilizing the Intel edge ecosystem

Processing Engine: Computer vision with edge processing

Real-World Application: Parking slot detection, vehicle monitoring, and real-time space analytics

AHA Impact: Solves unstructured parking challenges and scales efficiently across dense cities with minimal connectivity required.

From Lab to Real-World Deployment

How do we ensure AI works across diverse regions?

🌍 Living Labs

- Testing solutions in real environments (villages, clinics, farms)
- Co-creation with local communities

⚙ Verification

- Ensuring technical correctness
- Model accuracy and reliability

✓✓ Validation

- Ensuring usability and usefulness
- Real impact on end users

➞ Real-world testing is essential for context-aware AI deployment

Challenges

- **Uneven access to AI-ready infrastructure across regions**
  → Availability and quality of connectivity, devices, and edge computing capabilities remain uneven, particularly between urban and remote areas

- **Gaps in deployment and operational capacity**
  → Beyond AI expertise, there is a need to strengthen the pool of practitioners who can implement, adapt, and maintain solutions in diverse local contexts

➞ Without addressing these, AI may reinforce existing inequalities

Thank You