IOT TECHNOLOGY STRATEGY APPLICATION IN SMART SUSTAINABLE CITY

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Guru Besar STEI – ITB

Training Program on "Planning Internet of Things (IoTs) networks"

SCCIC (Smart City & Community Innovation Center) is Research Community in ITB that have strong motivation to find systematic solution for any city problem or city challenges (can expanded to village, province, nation, or others) and at the same time produce scientific publication as our contribution to scientific world.

GOALS

Propose smart solution for city, village, province, nation by creating: Model, Architecture, Method, Framework, Solution, Proposed Regulation, etc

ACTIVITY

Research, Innovation Development, Seminar, International Conference, Scientific Publication, Indonesia Smart City Rating (2015 & 2017), Training, Workshop, Consultations, etc

OUTLINE

SMART CITIES

INTERNET OF THINGS

EFFECT ON ECONOMY, SOCIETAL & ENVIRONMENT

ISSUE ON TECHNOLOGY, HUMAN RESOURCE & GOVERNANCE

IOT IMPLEMENTATION IN SMART CITIES: CASE STUDY
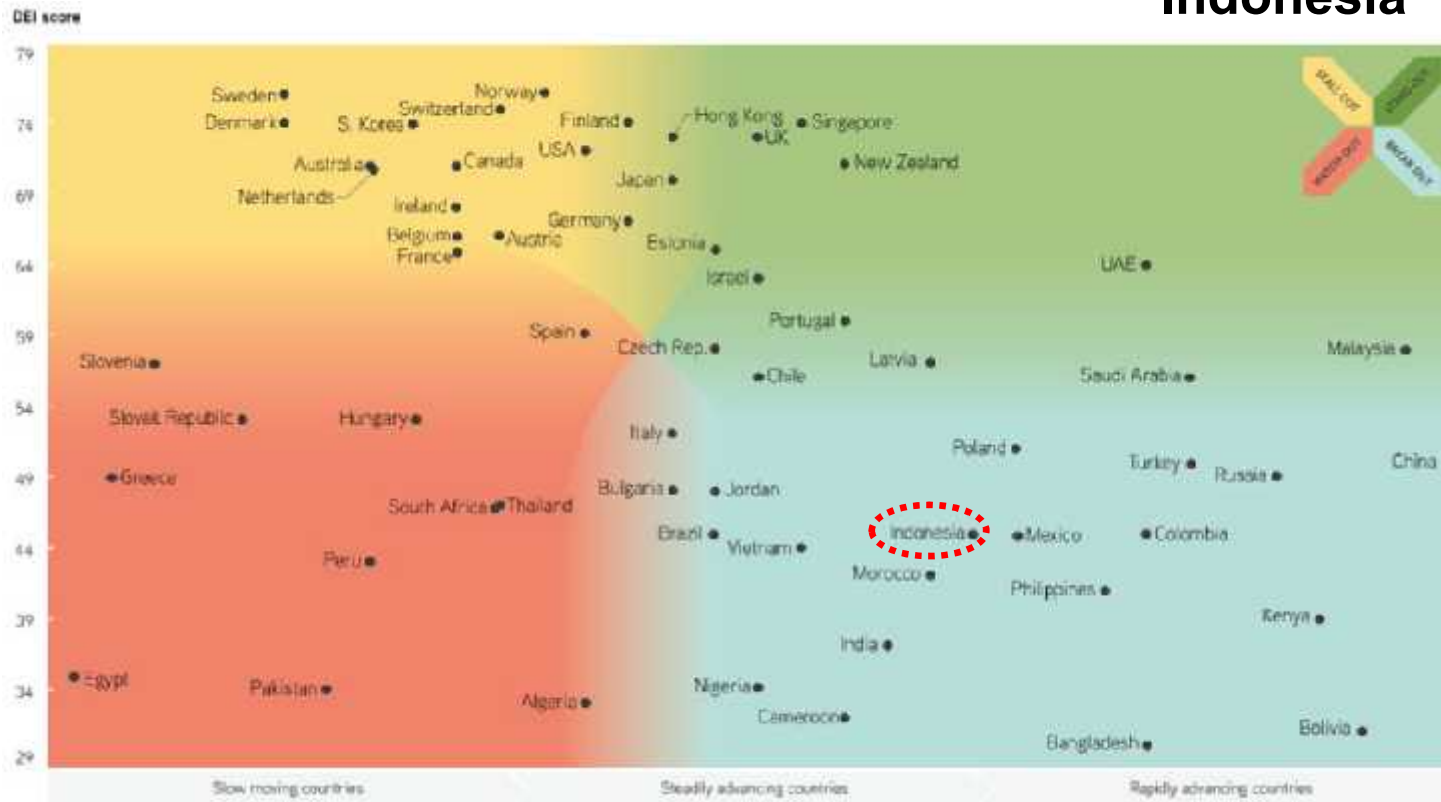
SMART CITIES

City Challenges

- **Complexity** of city problem is growing fast.
- In most cases, **capacity of conventional solution cannot fulfill** the capacity demand of city problem
- City **need innovative solution** that provide **higher capacity** of solution
- ICT (Information System and Technology) is potential enabler that enable innovative and effective solution and create high capacity of solution
- **But,** it should be noted that **ICT is not the only solution,** and Smart City is **not equal to ICT city or digital city.**

Sense

↓

Understand

↓

Act

Capacity of Problem or Solution

Innovative Solution

City Problem

Conventional Solution

Time
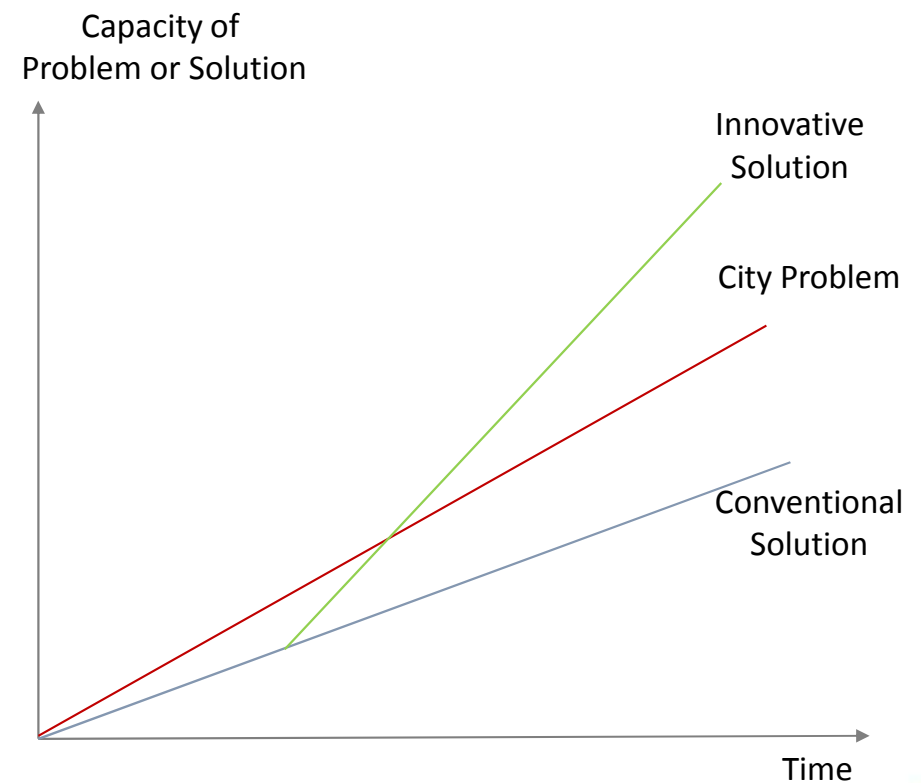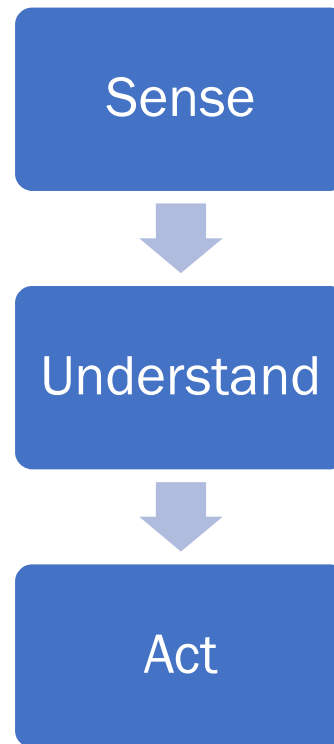
INDONESIA DIGITAL EVOLUTION INDEX

Indonesia → Break Out countries

Source: Digital Planet 2017: How Competitiveness and Trust in Digital Economies Vary Across the World

- **low-scoring in their current states of digitalization but are evolving rapidly.**
- The high momentum of Break Out countries and their significant headroom for growth would make them **highly attractive to investors.**
- **Held back often by relatively weak infrastructure and poor institutional quality,** Break Out countries **would do well to foster better institutions that can help nurture and sustain innovation.**
- Break Out countries **have the potential to become the Stand Out countries of the future** with China, Malaysia, Saudi Arabia, Kenya, and Russia leading the pack

ENABLER FOR DIGITAL EVOLUTION

Supply Condition
- Access Infrastructure
- Transaction Infrastructure
- Fulfillment Infrastructure

Demand Condition
- Consumer Capacity to Engage
- Digital Payment Uptake
- Digital Uptake

Institutional Environment
- Institution and the Business Environment
- Institution and the Digital Ecosystem
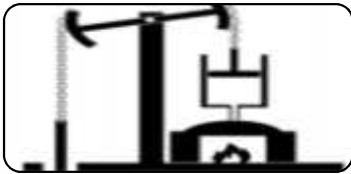- Institutional Effectiveness and Trust
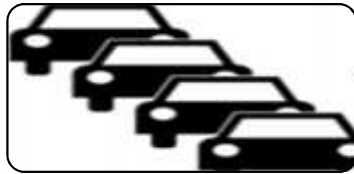
Innovation and Change
- Inputs
- Process
- Output

Sumber: Digital Planet 2017: How Competitiveness and Trust in Digital Economies Vary Across the World
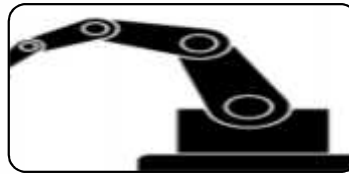
INDUSTRIAL REVOLUTION

- **First generation**
  - development of water-powered and steam-powered mechanization
  - during the early 19th century.

- **Second generation**
  - the development of electrical-powered, assembly-line mass production
  - at the dawn of the 20th century
  - marked by the introduction of the automobile.

- **Third generation**
  - the introduction of computerized automation
  - during the 1950s and '60s.

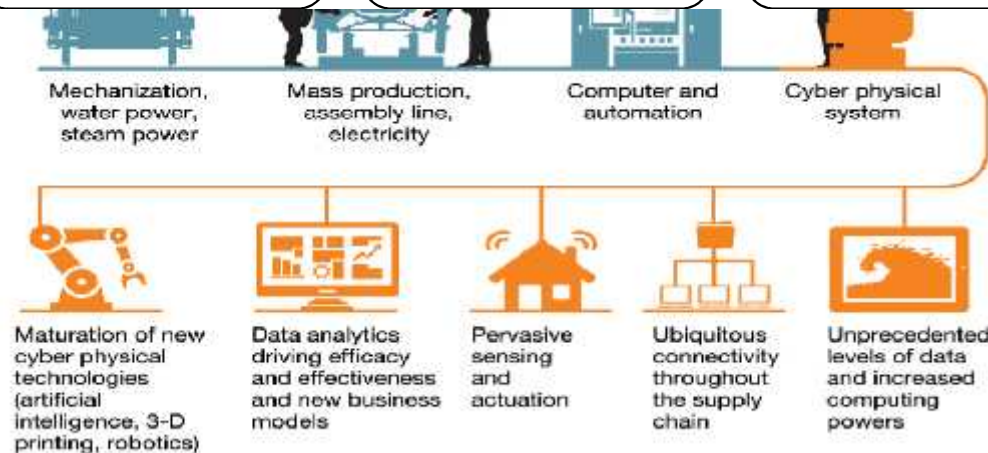- **Fourth generation**
  - the integration of high-tech cyber-systems into the means of production
  - Cyber-Physical System
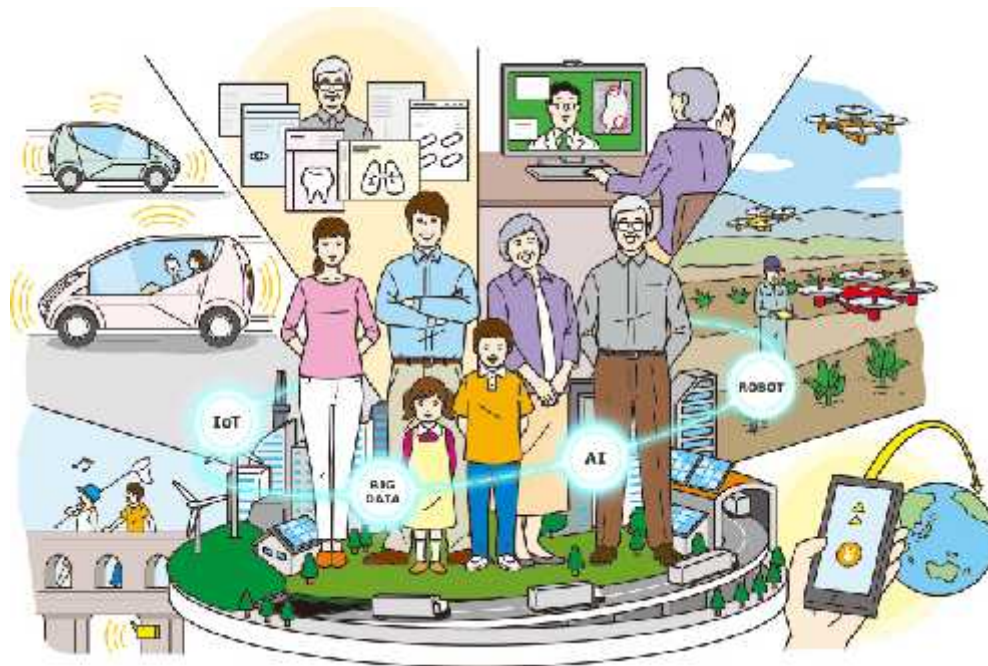 - during the 21st century.

- **Fifth Generation**
  - is the revolution in which man and machine reconcile and find ways to work together to improve the means and efficiency of production.
  - Co-Working

Mechanization, water power, steam power

Mass production, assembly line, electricity

Computer and automation

Cyber physical system

Maturation of new cyber physical technologies (artificial intelligence, 3-D printing, robotics)

Data analytics driving efficacy and effectiveness and new business models

Pervasive sensing and actuation

Ubiquitous connectivity throughout the supply chain

Unprecedented levels of data and increased computing powers

SOCIETY 5.0 & SMART CITY

SOCIETY 5.0

SMART CITY

https://www.japan.go.jp/abenomics/productivity/society5_0/index.html

SCCIC ITB

SMART CITY EVOLUTION
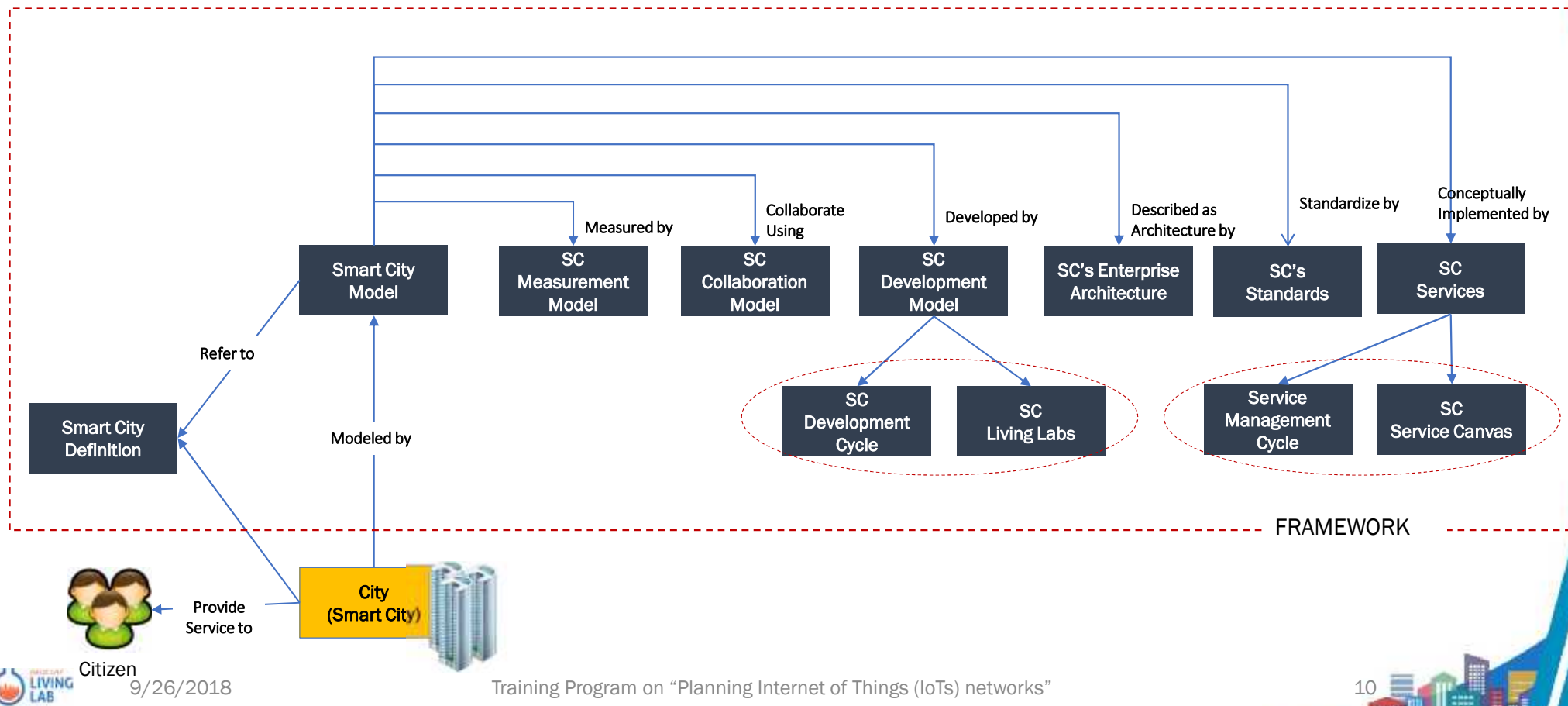
Smart Cities 1.0:
Technology Driven

Smart Cities 3.0:
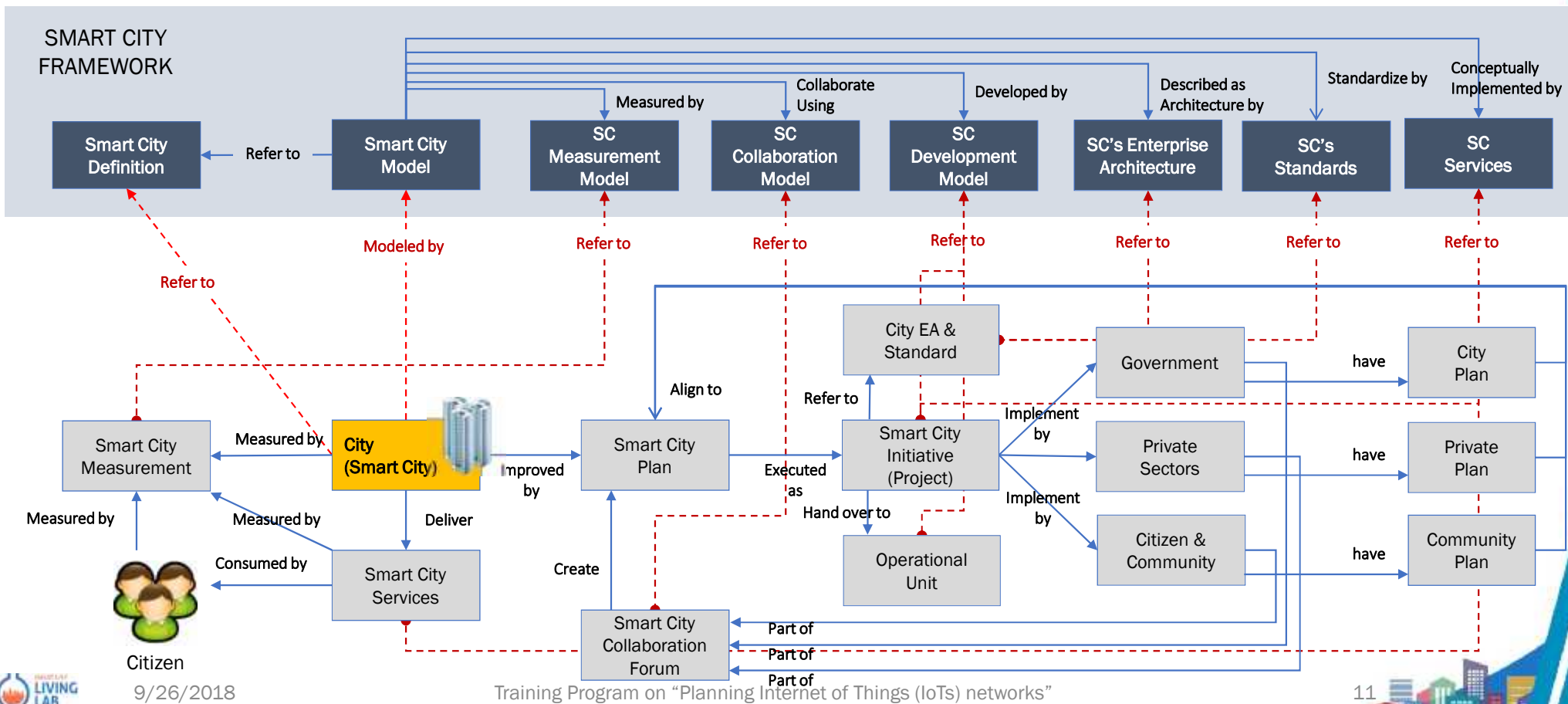Citizen co-creation

Smart Cities 2.0:
Technology Enabled, City-Led

ARCHITECTURE OF GSC FRAMEWORK 3.0

CONNECTION BETWEEN GSCF AND (REAL) SMART CITY

SMART CITY DEFINITION

Smart City is a city that can utilize its resources effectively and efficiently to solve any city challenges using *innovative*, *integrated*, and *sustainable* solution by providing infrastructures and deliver city services to improve Quality of Life.
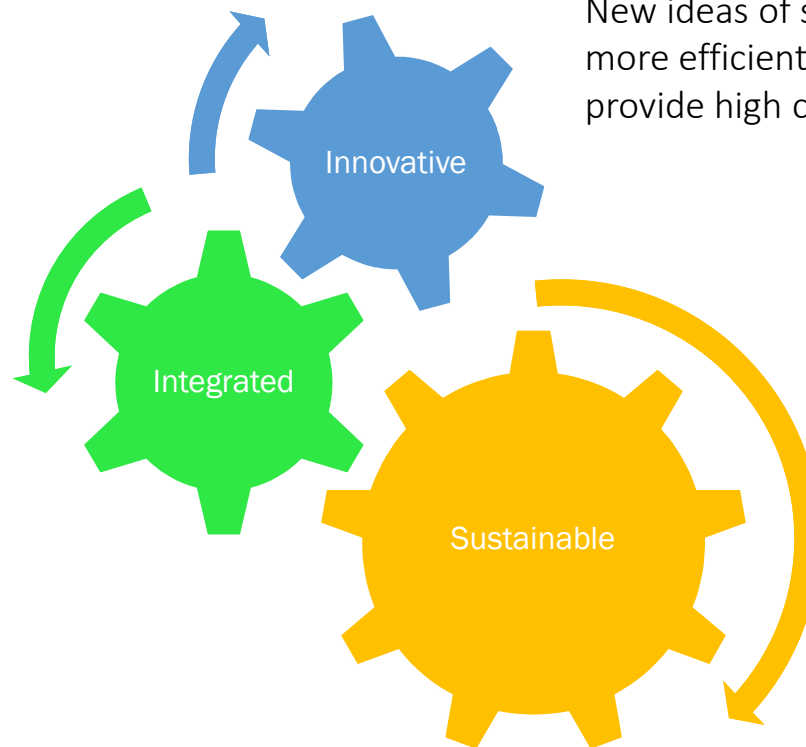
SMART SOLUTION CHARACTERISTICS

New ideas of solutions that utilize resources more efficient and more effective and provide high capacity of solutions.

Innovative

Solutions should be integrated between government institution as well as between government and non-government, vertical, also horizontal.

Integrated

Solution should be designed to be sustained for long time

Sustainable

Integration cover:
Business Process,
Data, Application,
IT Infrastructure,
and non-IT Infrastructure

SMART CITY MODEL

Service Domain

Service Cluster
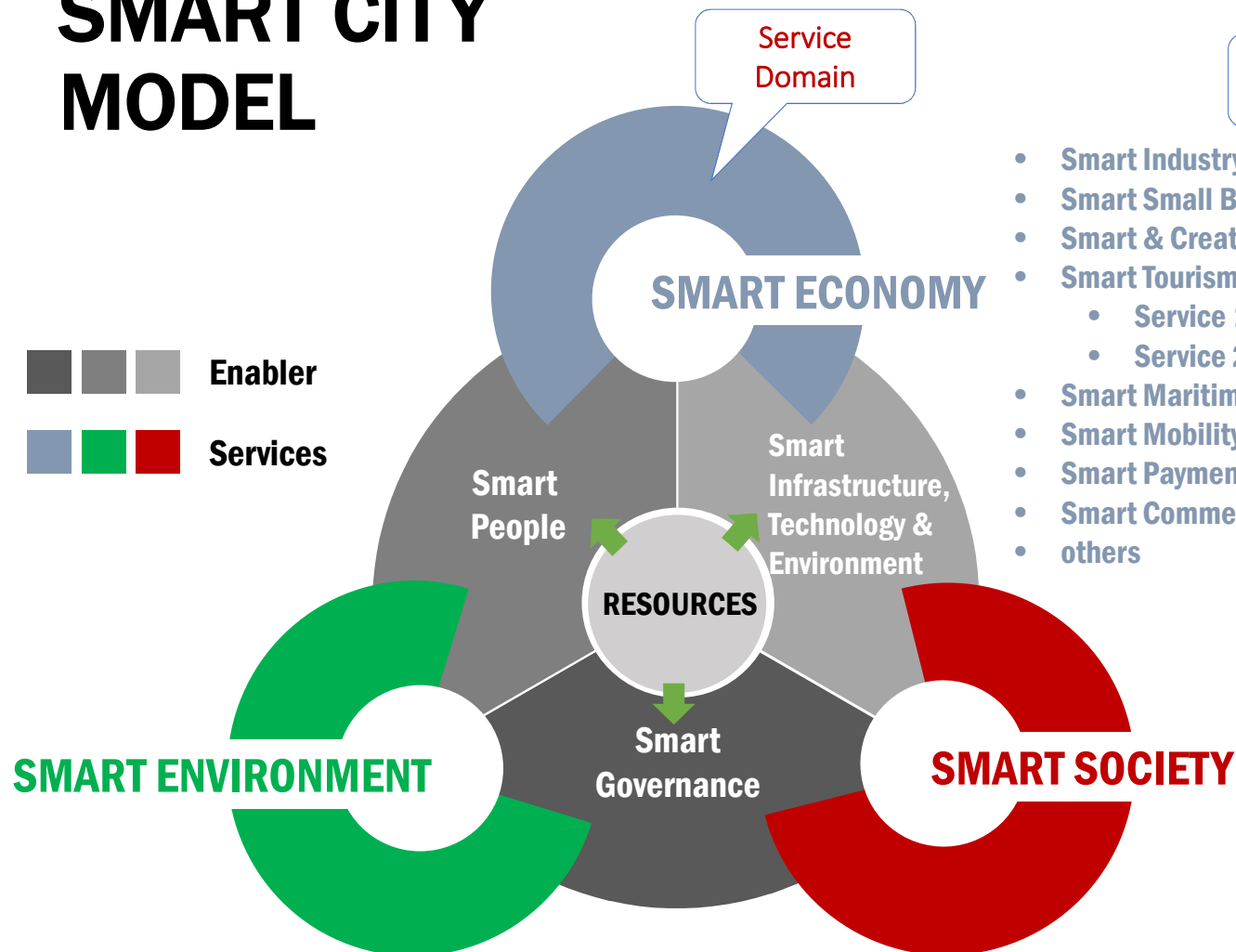
Service

- **Smart Industry**
- **Smart Small Business**
- **Smart & Creative Startup**
- **Smart Tourism**
  - **Service 1**
  - **Service 2**
- **Smart Maritime**
- **Smart Mobility**
- **Smart Payment & Banking**
- **Smart Commerce**
- **others**

SMART ECONOMY

Smart People

Smart Infrastructure, Technology & Environment

RESOURCES

Smart Governance

SMART ENVIRONMENT

SMART SOCIETY

Enabler

Services

Service Hierarchy

Service Domain → Service Cluster → Service Item

Process Life Cycle

Plan/Design

Build/Improve

Operate

Monitor
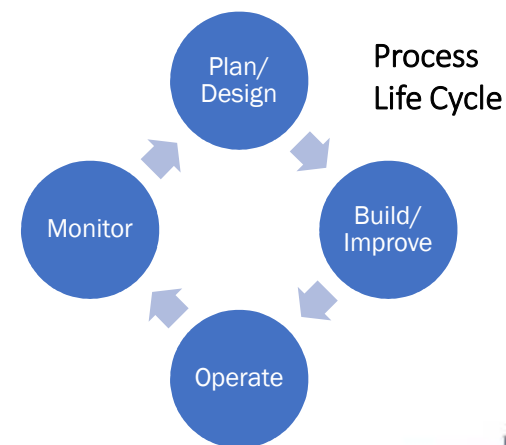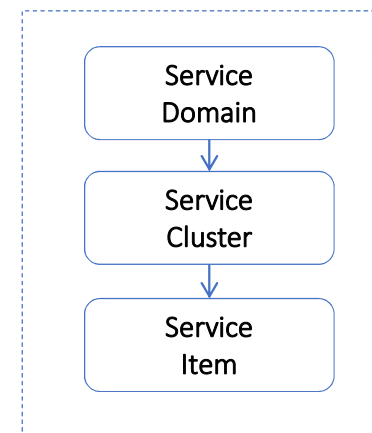
SMART CITY MODEL
SERVICE VIEW

INTERNET OF THINGS
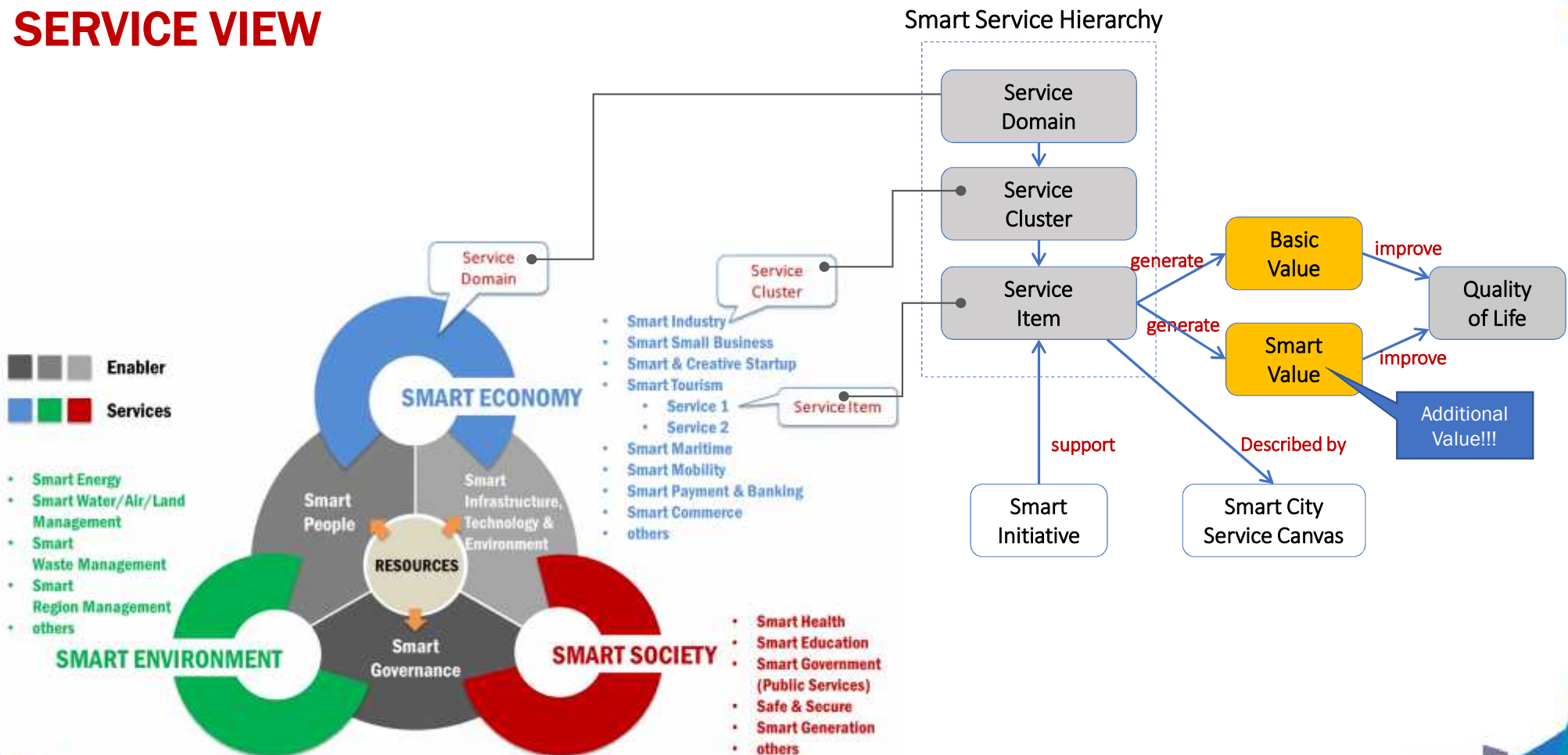
Training Program on "Planning Internet of Things (IoTs) networks"

IOT DEFINITION

Is a network of interconnected objects around the world that are uniquely based on standard communication protocols (RFID Group)

Everything - including "living things" - is connected to the internet regardless of location or other physical restrictions (Gareth Baxendale)

A network of uniquely identified objects that communicate outside human intervention using Intenet Protocol (IDC) connectivity

The Internet of Things (IoT) is The **network** of **physical** devices, vehicles, home appliances and other items **embedded** with electronics, software, sensors, actuators, and connectivity which enables these objects to **connect** and **exchange data**

(Wikipedia)

The Internet of Things (IoT) is the **network** of **physical** objects that contain **embedded** technology to **communicate** and **sense** or **interact** with their internal states or the external environment.
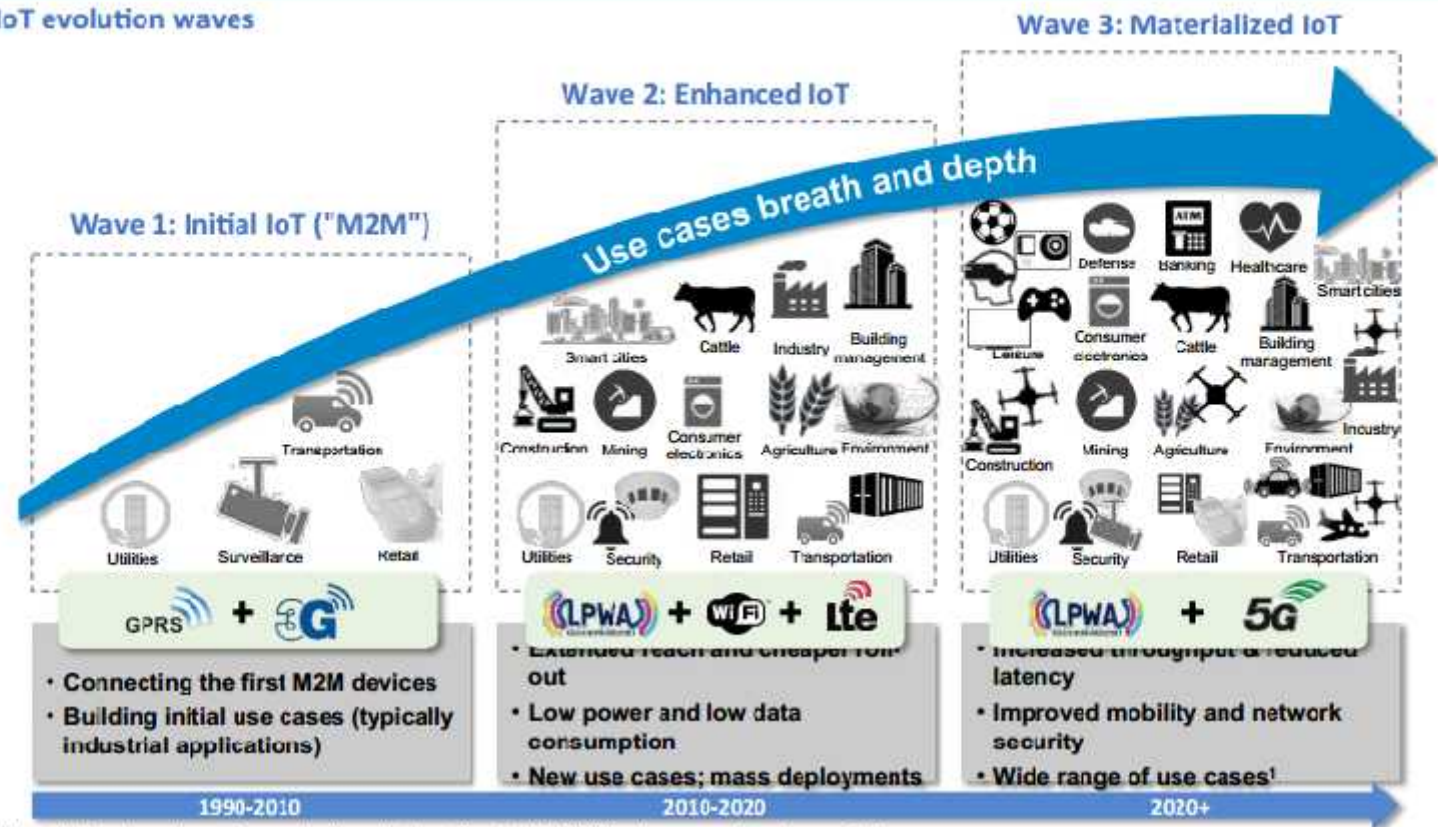
(Gartner)

IOT EVOLUTION

Internet of Things Landscape 2018

Applications (vertical)
- Personal
- Home
- Vehicles
- Enterprise
- Industrial Internets

Platforms (Horizontals)
- Software
- Security
- Connectivity
- Analytics
- Developers
- Payment & Money
- Interfaces
- 3D

Building Blocks
- Hardware
- Infrastructure
- Connectivity
- Partners

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Final version, revised and updated as of February 7, 2018

FIRSTMARK
EARLY STAGE VENTURE CAPITAL

19

IOT

ROBOT

Society in AI Age: Human + Machine

Lead	Empathize	Create	Judge	Train	Explain	Sustain	Amplify	Interact	Embody	Transact	Iterate	Predict	Adapt
Human-only activity				Human complement machines			AI gives humans superpowers			Machine-only activity			
							Human and machine hybrid activities						

Source: linkedin.com/pulse/guidebook-our-human-machine-future-paul-daugherty

EFFECT ON ECONOMY, SOCIETAL & ENVIRONMENT

EMERGING TECHNOLOGIES IMPACTING OUR LIVES
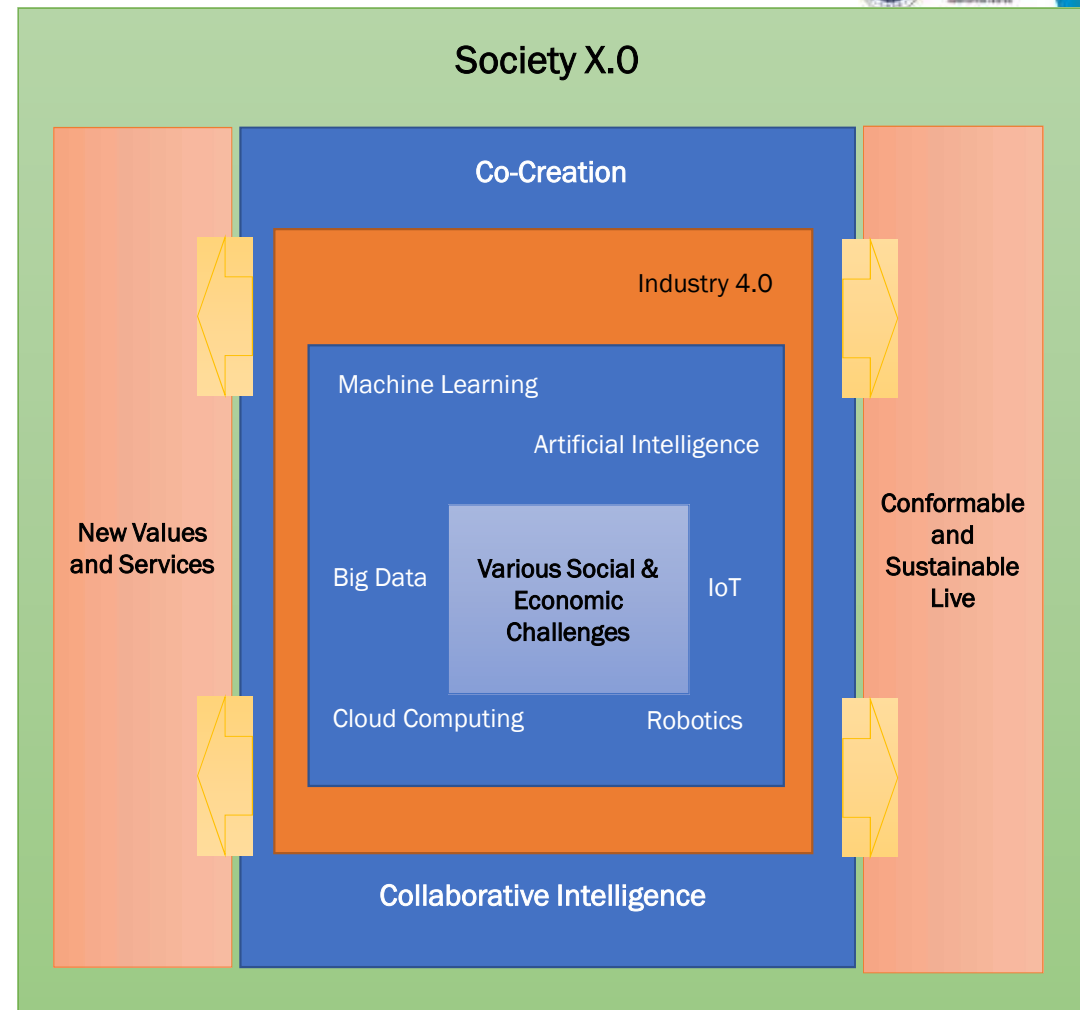
Robotics

Artificial Intelligence (AI) and Machine Learning

Internet of Things (IoT)

Big Data

Basic Value

Smart Value

Improve Quality of life

CO-CREATION

Societal and environmental challenges	The search for solutions become more complex

⬇

inadequate tools to govern our societies

⬇

Co-Creation (people to people, people to organization or companies)

SCCIC ITB, 2018

Society X.0

Co-Creation

Industry 4.0

New Values and Services

Machine Learning

Artificial Intelligence

Big Data   Various Social & Economic Challenges   IoT

Conformable and Sustainable Live

Cloud Computing   Robotics

Collaborative Intelligence

IOT TO SUPPORT THE DIGITAL ECONOMY

POTENTIAL OF INDONESIAN IOT

EXHIBIT 1

The digital revolution has arrived in Indonesia.
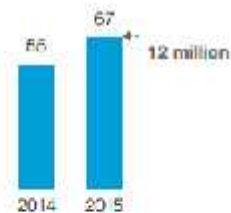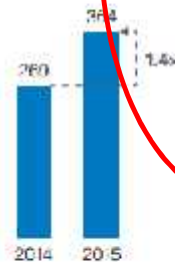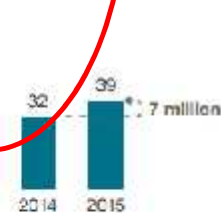
Sector	Estimated 2025 GDP base impact		Operation optimization	Human health and productivity	Product and sales development
Manufacturing		34.4	29.4	3.0	2.0
Retail		24.5	12.5	6.7	5.3
Transport		15.5	13.6	1.9	0.0
Mining		14.8	14.0	0.5	0.3
Agriculture		11.0	10.6	0.3	0.0
Telecom and media		7.9	5.7	1.7	0.5
Healthcare		6.6	2.2	4.3	0.0
Public sector and utilities		4.8	4.7	0.1	0.0
Financial		1.8	1.1	0.1	0.6
Total		121.4	93.8	18.7	8.9

Source: Based on McKinsey Global Institute Study "Unlocking the potential of the Internet of Things," Team analysis adjusting figures for Indonesian context

1 Revenues from public cloud services and cloud IT infrastructure.
2 1 petabyte = 1 million gigabytes.

IoT market share in Indonesia is predicted to reach IDR 444 trillion in 2022 (IoT Forum)

Content and application IDR 192.1 trillion	Platform Rp 156.8 trillion	IoT device Rp. 56 trillion	Network and gateway Rp. 39.1 trillion

ISSUE ON TECHNOLOGY, HUMAN RESOURCE & GOVERNANCE

IOT WIRELESS CONNECTIVITY ECOSYSTEM

Sumber: https://www.i-scoop.eu/the-place-of-lpwan-and-lora-in-the-iot-wireless-connectivity-ecosystem-according-to-the-lora-alliance/

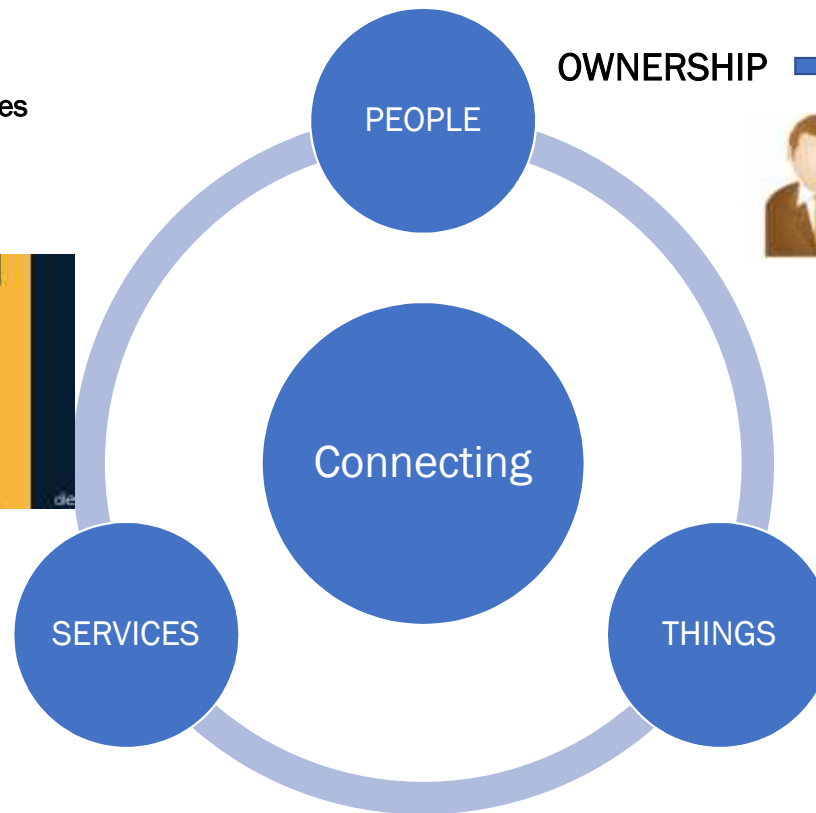## Which technology will be adopted for Industrial IoT implementation in Indonesia

CONNECTING IDENTITY OF THINGS, SERVICES & PEOPLES

Telecommunications Services

Financial and Banking

e - Toll

Insurance

Smart Public Services

PEOPLE

Connecting

SERVICES

THINGS

OWNERSHIP ➡ NIK as Single Identity Reference

INTERNET of THINGS

Who responsible about what the Things did

IOT, AI & BIG DATA IN SMART CITIES

The 3 components for Smart City that utilize AI are Analytics, Data and AI Engine
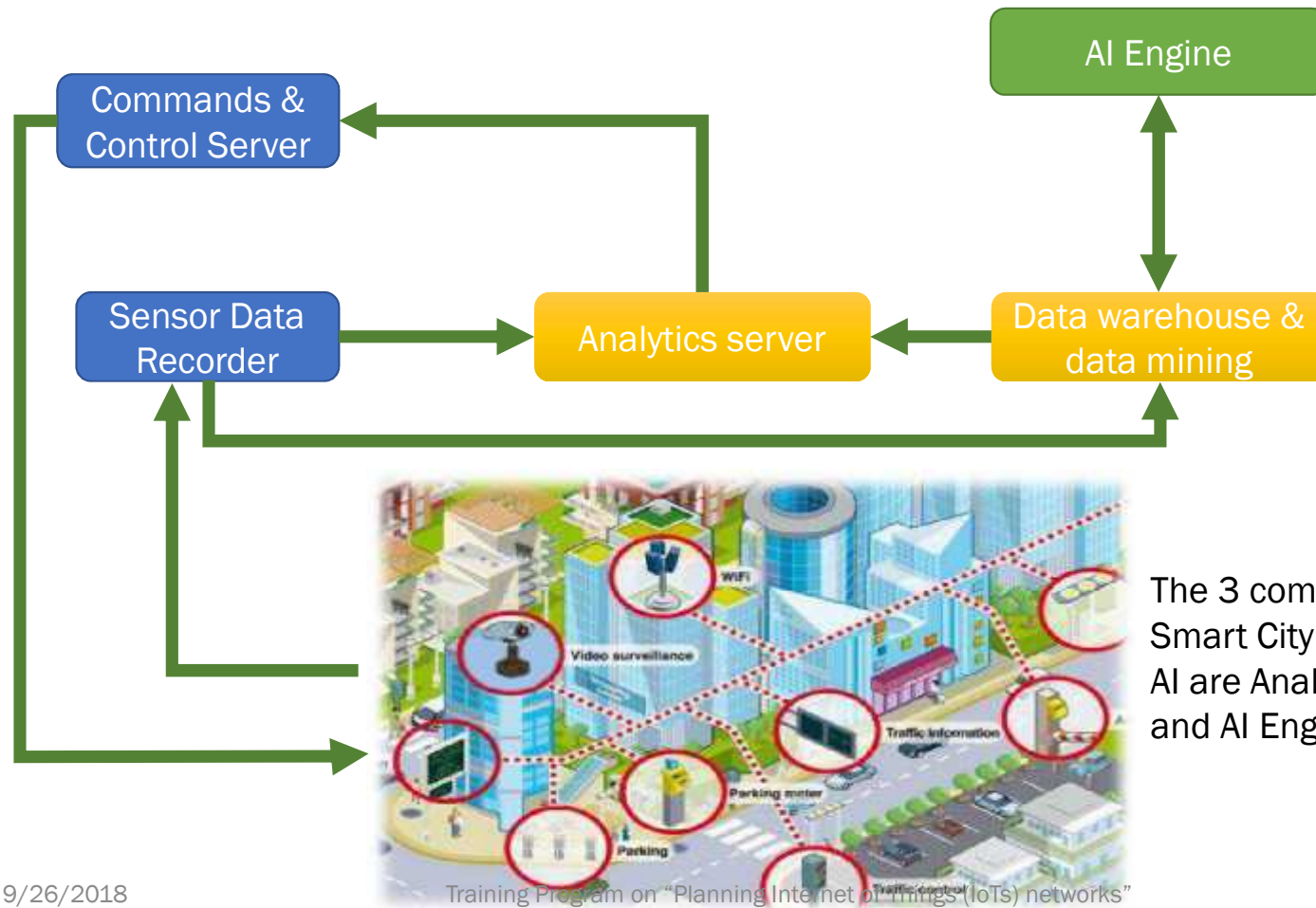
DATA TRANSFORMATION INTO SMART ACTION
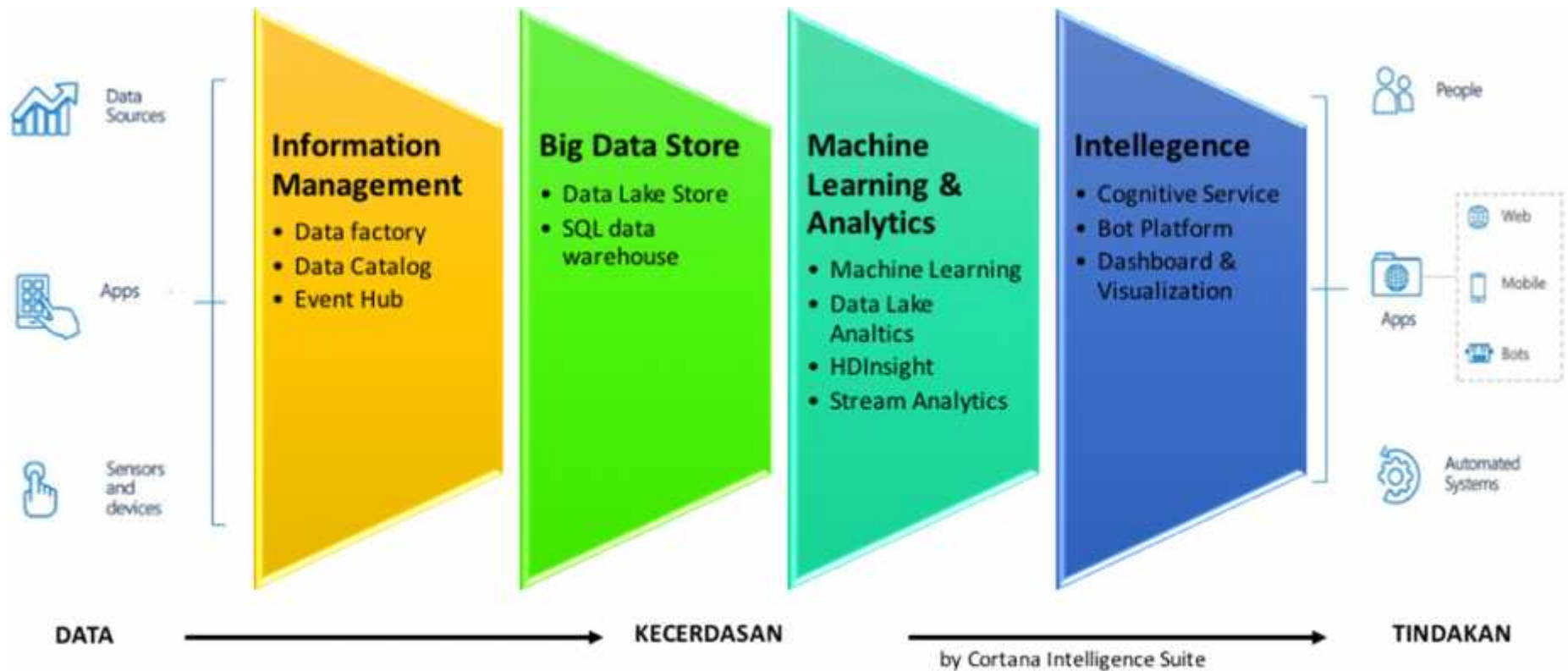
INTEGRATION
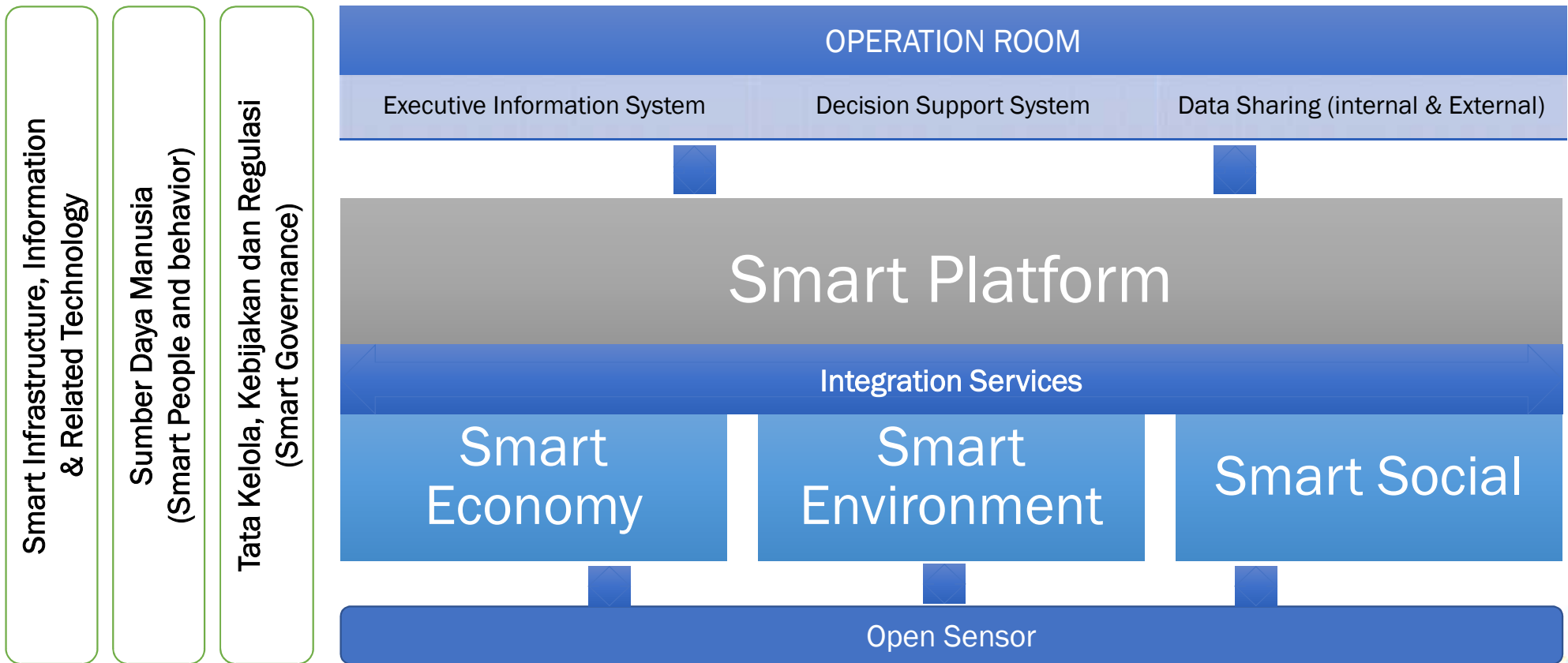
KEY CHALLENGES & ROLES FOR REGULATORS/GOVERNMENT

Security Risks
- Studies Reveal 70% Of IOT Devices Are Vulnerable To Attack.

Data Privacy
- "Right To Be Forgotten" - European Commission Ruling

Data Sovereignty And Data Residency
- With IOT, physical borders between countries have become porous
- Govts. now need to subpoena data physically located in another country

Spectrum Licensing
- Dedicated Spectrum vs. Shared Spectrum framework based on requirements of IOT devices

Utilize Unused White Space Spectrum
- Radio signals have propagation characteristics that make them suitable for travelling long distances and through buildings –apt for IOT deployments

Numbering Systems
- No notable efforts yet to create a universal numbering system for IOT devices
- If the number of IoT devices is to touch over 50Bn then there is an imminent need for this.

Know-Your-Customer (KYC) Requirements
- Removes the flexibility of selling pre-activated off-the-shelf IOT and M2M devices
- KYC leniency is required from regulators for IOT device proliferation

Taxation Schemes
- Impact of SIM Activation Tax - Reforms For IOT & M2M In Brazil & Turkey
- How revenues from IOT services provided by international companies need to be taxed?

Permanent Roaming/ National Roaming
- The ability to offer services globally is critical for many IOT verticals - including automotive and consumer electronics
- Embedded/Soft SIMs and other disruptions are important considerations.

GOVERNMENT & REGULATORY FOCUS

Promote Competition & Investment

- Spectrum Licensing, Numbering Systems, KYC Requirements, Taxation Schemes, Permanent Roaming Regulations

Implement Standardization & Interoperability

- Framework for IOT in the region

Empower & Protect the End User

- Security Risks
- Data Privacy
- Data Sovereignty & Data Residency

Promote the Internal Market

- Legislations that make certain connected services mandatory

EXAMPLES OF LEGISLATIONS THAT CREATE IOT OPPORTUNITIES

Smart Energy & Metering legislations

- UK's Smart Metering Initiative: The initiative plans to cover every consumer and business in the UK by 2020 – this involves replacing over 53 million meters, and provide £6.2 billion in net benefits by 2030

Ontario's Smart Metering Initiative

- The key objective was to install new "smart" electricity meters throughout the province to measure both how much and when electricity is used – in order to introduce time-of-use (TOU) pricing to encourage consumers to shift their electricity use to times of lower demand and pricing

Connected Car legislations

- EU's eCall Initiative: eCall is an European Commission initiative, making mandatory the deployment of internet-connected sensors into cars that enable emergency services to be immediately contacted and requested automatically after a serious road incident within the EU

Smart Traffic Management legislations

- Singapore's Smart Mobility 2030 Initiative: The initiative covers a range of connected and interactive land transport services that are driven by legislations

Many more examples...

Sumber: Ankush Johar - The Role of Regulators and Governments in realizing the promise of IoT & Smart Cities, 19 October 2015

IMPACT ON RISING ADOPTION OF AI & IOT

The Shift in Work

- Increase productivity up to 30%
- Reducing manufacturing labour costs by 18-33%
- Little by little AI changed the role of labour, 47% in America in the risk category replaced by technology.
- Extensive automation of low-skilled jobs, Towards the creation of a workforce that combines fewer numbers of employees with higher productivity.
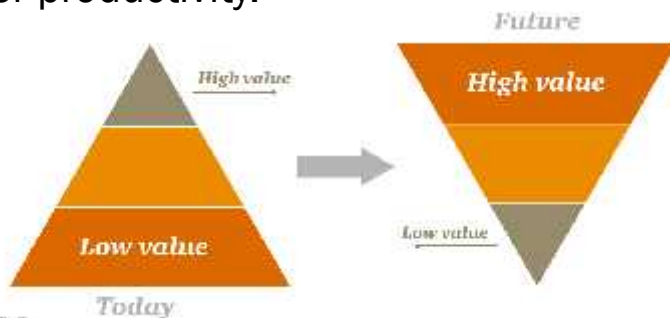
Triggering key changes in the competitive landscape

Higher revenues	Enhanced safety
Reduced losses from accidents and other causes	Lower costs

Enhanced customer experience

Sumber: PWC, Leveraging the upcoming disruptions from AI and IoT

OTHER ISSUES RELATED TO IOT IN INDONESIA

- Data management
  - Data Centre Location
  - Data ownership protection (UU ITE No. 11/2008 & PP No. 82/2012)
  - Data security

- Human Resource Competency Development
  - a number of professions that are needed to support the growth of industry and information technology globally the application architect, business analyst, IT consultant, software developer, web developer, programmer, and network specialist. [1]
  - labour market in Indonesia, as in other developing countries, has an excess number of unskilled workers and a shortage of qualified human resources in the medium to senior level [2]

1) http://m.bisnis.com/amp/read/20170829/12/685118/karier-teknologi-informasi-semakin-berpeluang
2) https://id.techinasia.com/talk/indonesia-mengalami-krisis-tenaga-kerja-di-sektor-teknologi/amp/

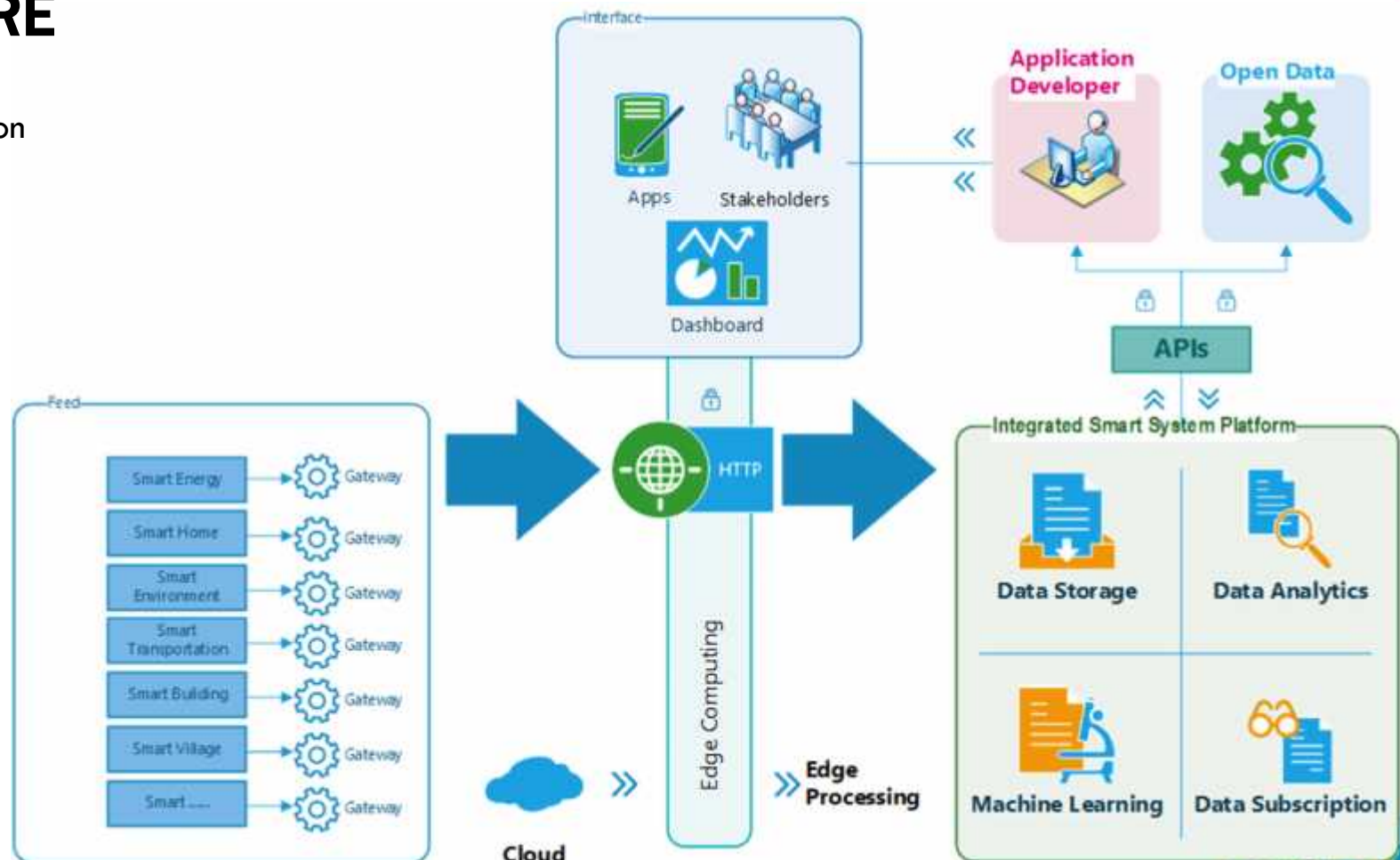# IOT IMPLEMENTATION IN SMART CITIES: CASE STUDY
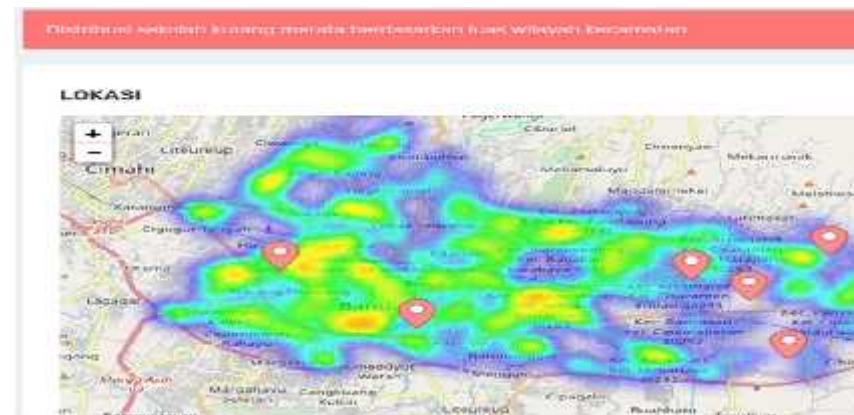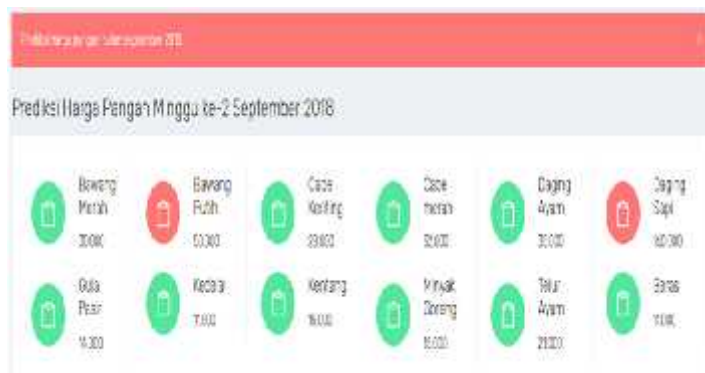
INTEGRATED SMART SYSTEM PLATFORM

- ISSP is a platform that collects some data sources (Sensing). Processing uses Artificial Intelligence (Understanding). Finally, ISSP can provide recommendations based on data that has been processed to provide meaningful data (Acting)

- ISSP as a platform used to support smart cities and community centre in order to improve people's quality of life in terms of safe ,secure, convenience and accessibility

- iSSP serves to integrate existing data and services and simultaneously carry out analytical processes in order to accurately determine the condition of the city / region. iSSP can be connected to various services according to the needs of the city
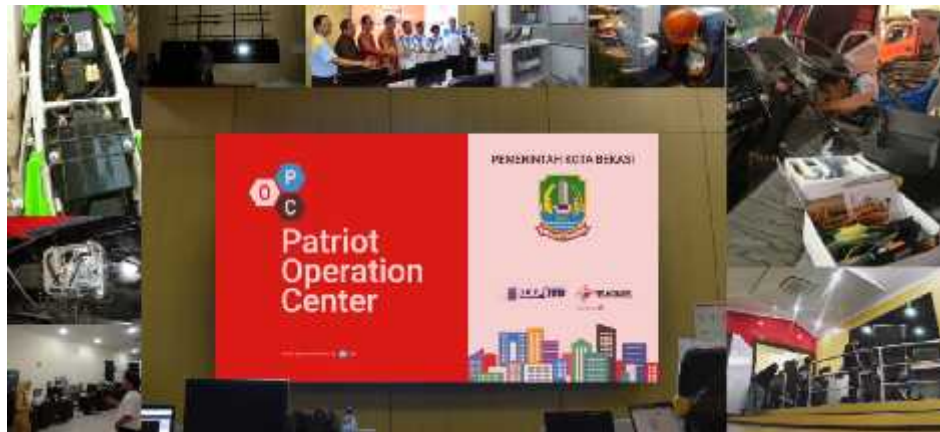
Training Program on "Planning Internet of Things (IoTs) networks"
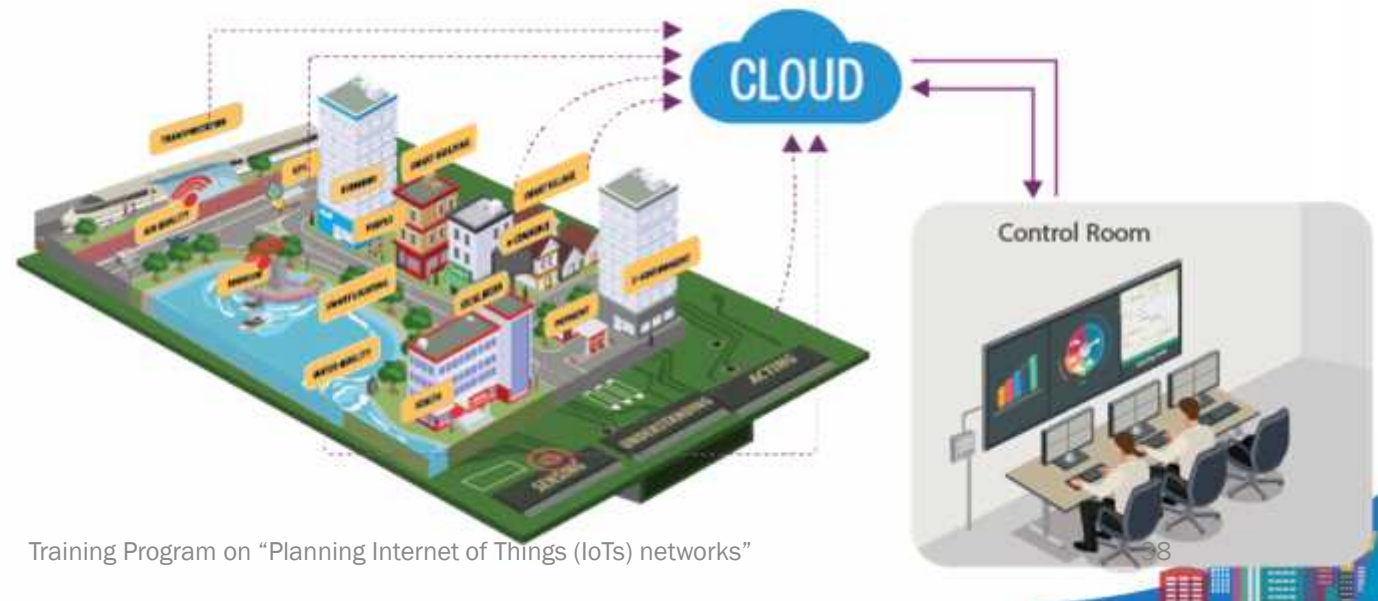
INTEGRATED SMART SYSTEM PLATFORM – ARCHITECTURE

- Data Integration
- Dashboard
- Control Room
- Analytics
- Data Bridging
- Early Warning System

Training Program on "Planning Internet of Things (IoTs) networks"

Training Program on "Planning Internet of Things (IoTs) networks"

Patriot Operation Center – Bekasi

Bogor Green Room – Bogor

Smart Pekerjaan Umum – Semarang

Smart City Living Lab

IOT FOR SMART TRAINS

- Increase efficiency and competitiveness
- Reduce rail noise and vibration, particularly in urban areas.
- Reduce greenhouse gas emissions.
- Safety and security
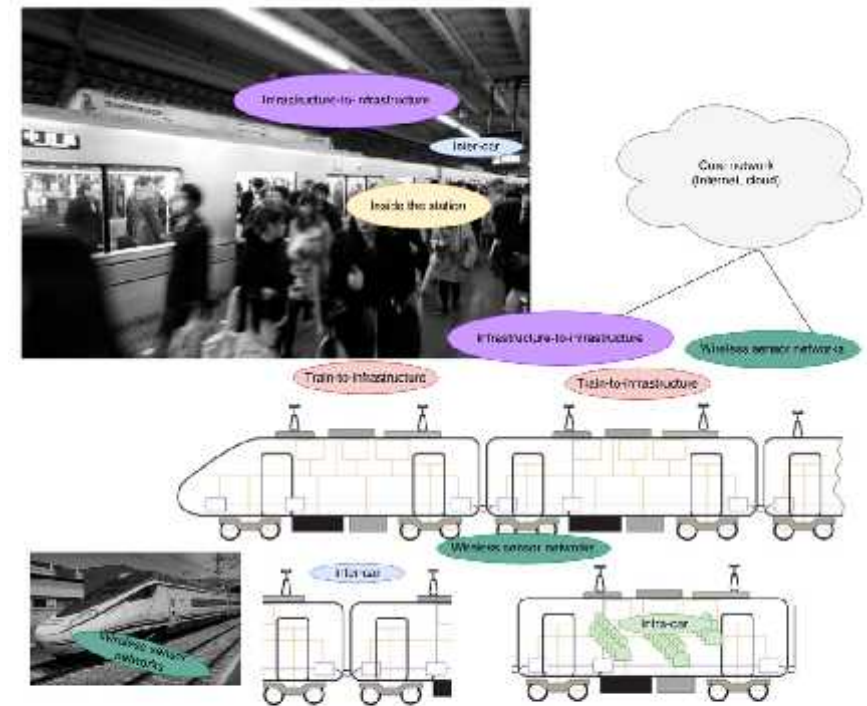- Reduce operation and maintenance costs, augment the capacity of the rail network.

Paula Fraga-Lamas, 2017

Figure 2. Railway communications scenarios (Renfe AVE train and train station pictures are under Creative Commons License). Color meaning: pink (train-to-infrastructure communications), blue (inter-car communications), light green (intra-car communications), yellow (communications inside the station), purple (infrastructure-to-infrastructure communications), and dark green (wireless sensor networks).
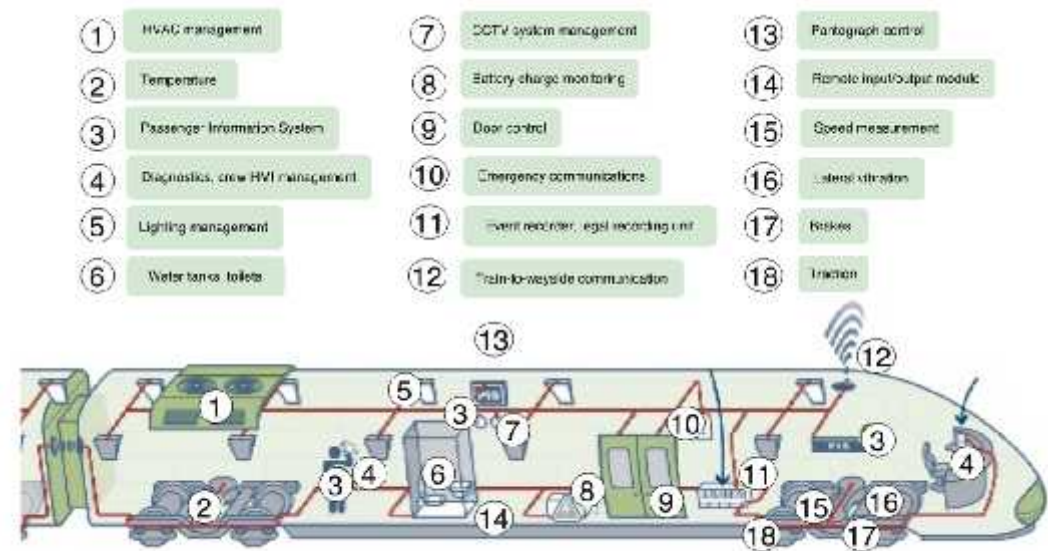
IOT FOR SMART TRAINS
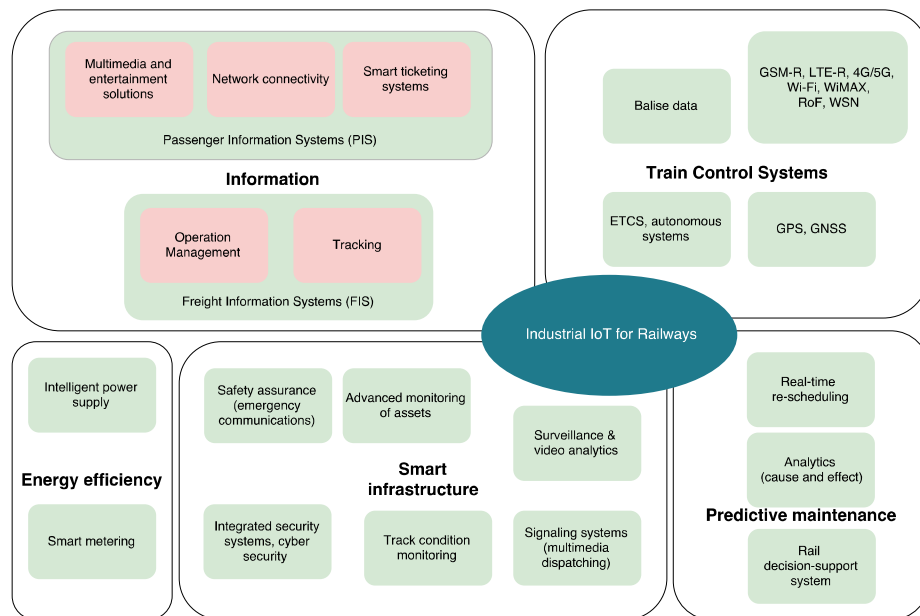
Figure 3. Industrial IoT-enabled services relevant to the rail industry.
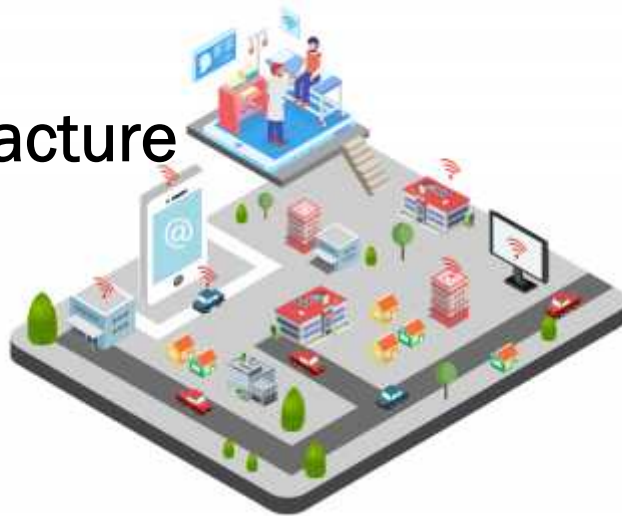

Figure 4. Systems usually monitored in a train.
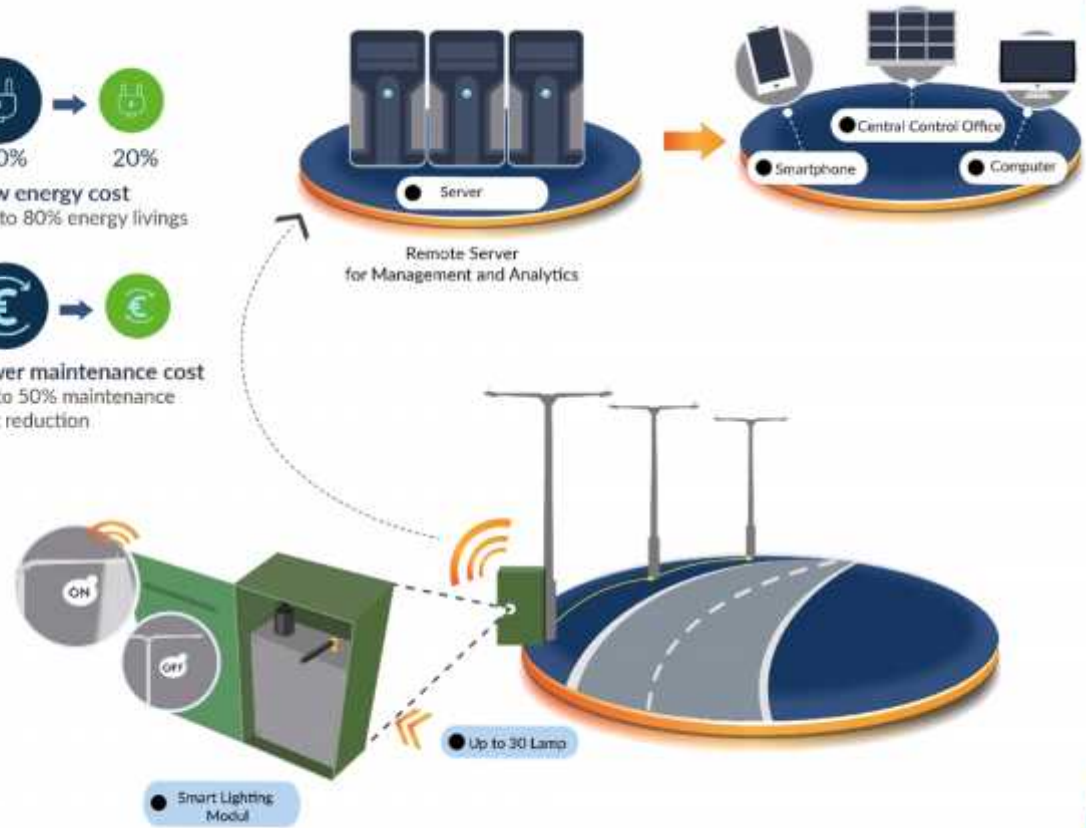
Paula Fraga-Lamas, 2017

Smart Farming

Smart Manufacture

Smart Street Lighting

SCCIC ITB, 2018

SMART BIKE PLATFORM

GARUDA SMART BIKE PLATFORM

Bulit in GPS, Gyro, Compas, dan Accelerometer
Sensor-sensor yang ditanamkan di dalam rangka sepeda

Bike Head Unit
Berfungsi sebagai interface utama pada sepeda yang mengintegrasikan seluruh gadget sepeda dan terhubung ke internet

Solar Power
Sumber energy untuk pengecasan batrei

Emergency Alarm
Menyala dalam kondisi darurat

Night Light
Menyala dalam kondisi gelap

Odometry
Sensor distance

Smart Phone Docking
Docking smart phone, bisa melakukan charging

Built-in Action Camera
Connect ke smart phone untuk mengaktifkannya
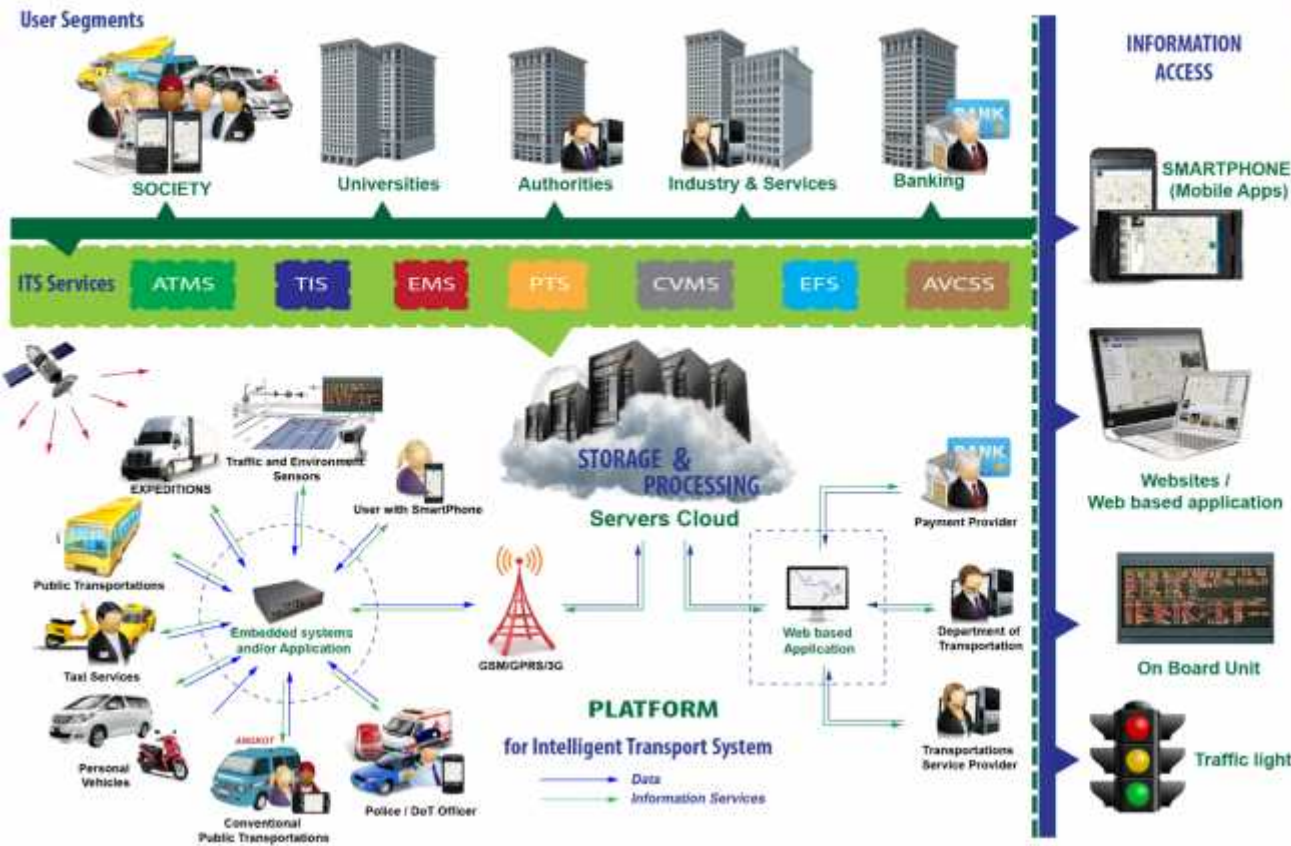
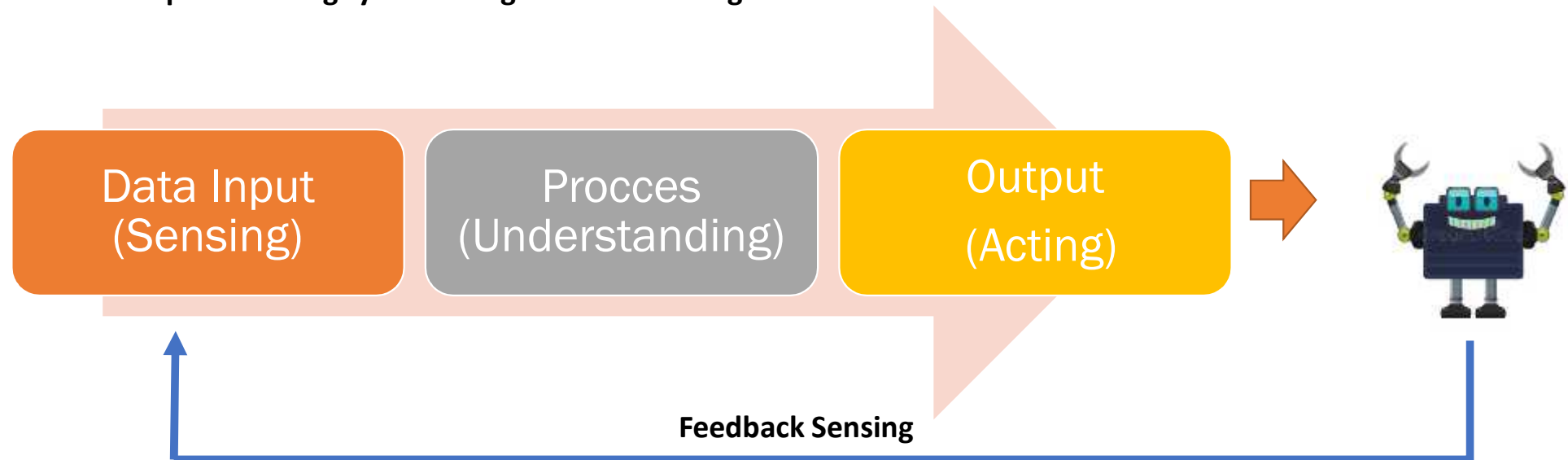# SMART MOBILITY PLATFORM

Desain CCTV Jalan Raya Dengan Fitur Video Analytic
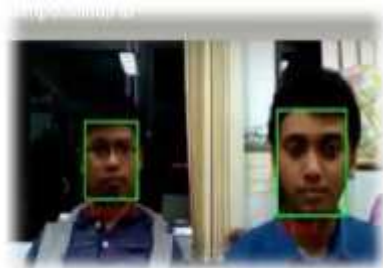
SAFE AND SECURE PLATFORM

Closed-loop monitoring system using Artificial Intellegence

- **Input comes from manual input, sensors, CCTV cameras, and other input devices.**
- **This data is processed and the system will automatically take an action.**

SAFE AND SECURE (USE CASE)

Face Recognition
- Recognize Name
- Detection Unknown People

Crowd Understanding
-Heat Map Analysis
-Trajectory People

Plate Recognition

Traffic Management System

- Detection
- Clustering
- Counting
- Optimization –Traffic Flow Analysis
- Speed Estimation
- Anomali Detection
- Multi-sensor Vehicle Detection and Reidentification
- Trash Detection
- Violance Detector
- E-Tilang
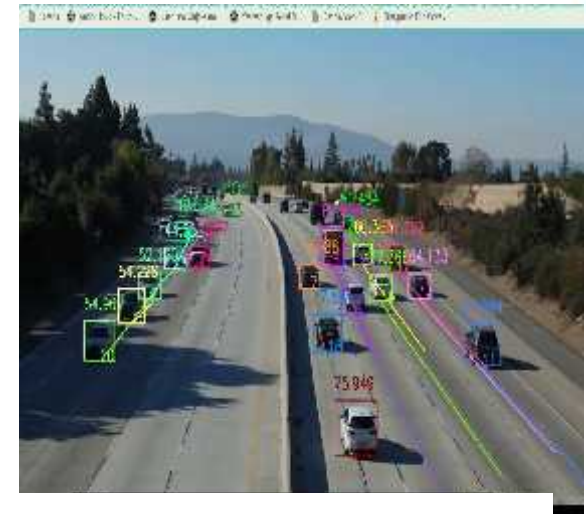
SMART PARKING

Smart Parking System is an integrated parking management platform. This platform offers improved transportation system performance and urban area parking, easy and flexible operation and use, cost efficiency, ease of management, ease of handling complaints, accountability, accessible to the public, accuracy of information, integrated with Smart Tax and Smart Payment systems, can adapt to organizational changes, and information security.
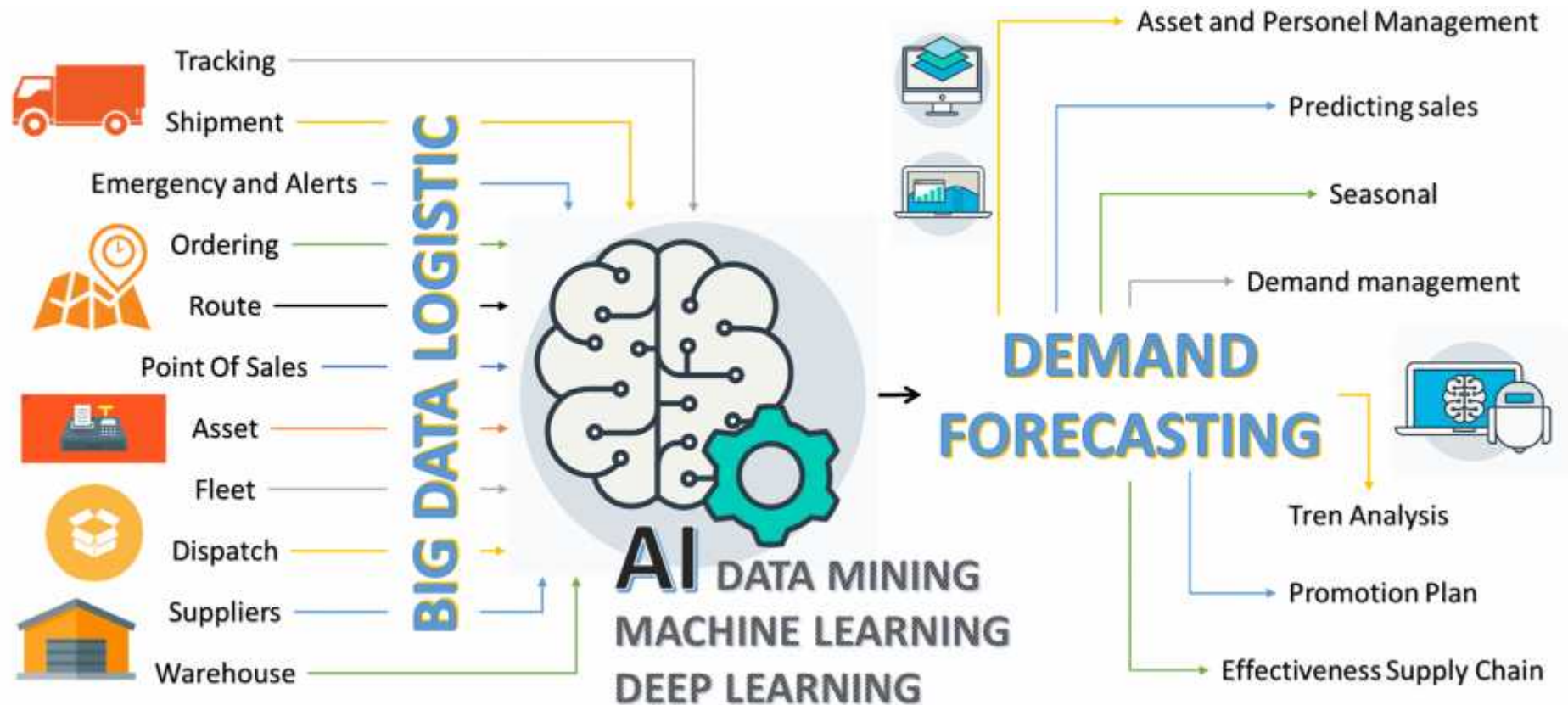

MODUL KOMUNIKASI

SMART SYSTEM PLATFORM
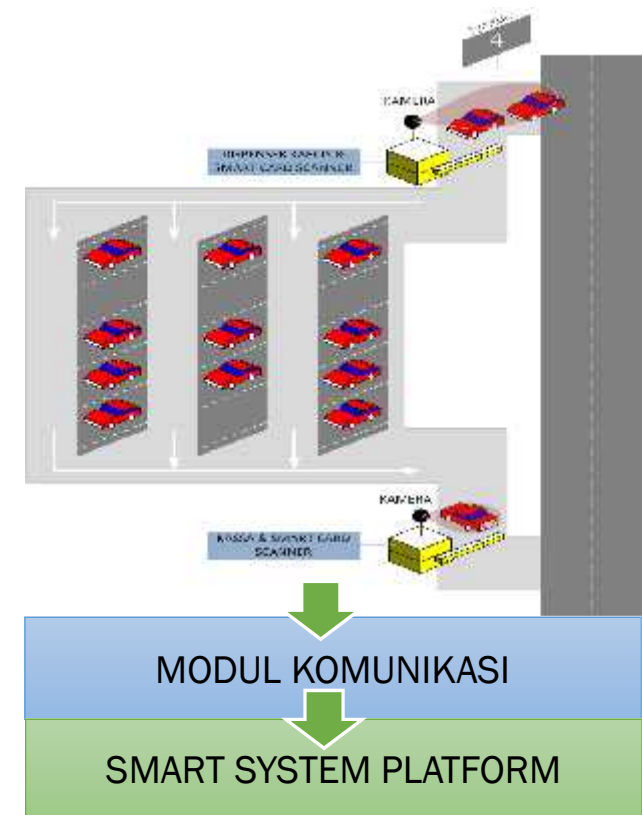
FLEET MANAGEMENT
(GINTARA/FLEETARA)
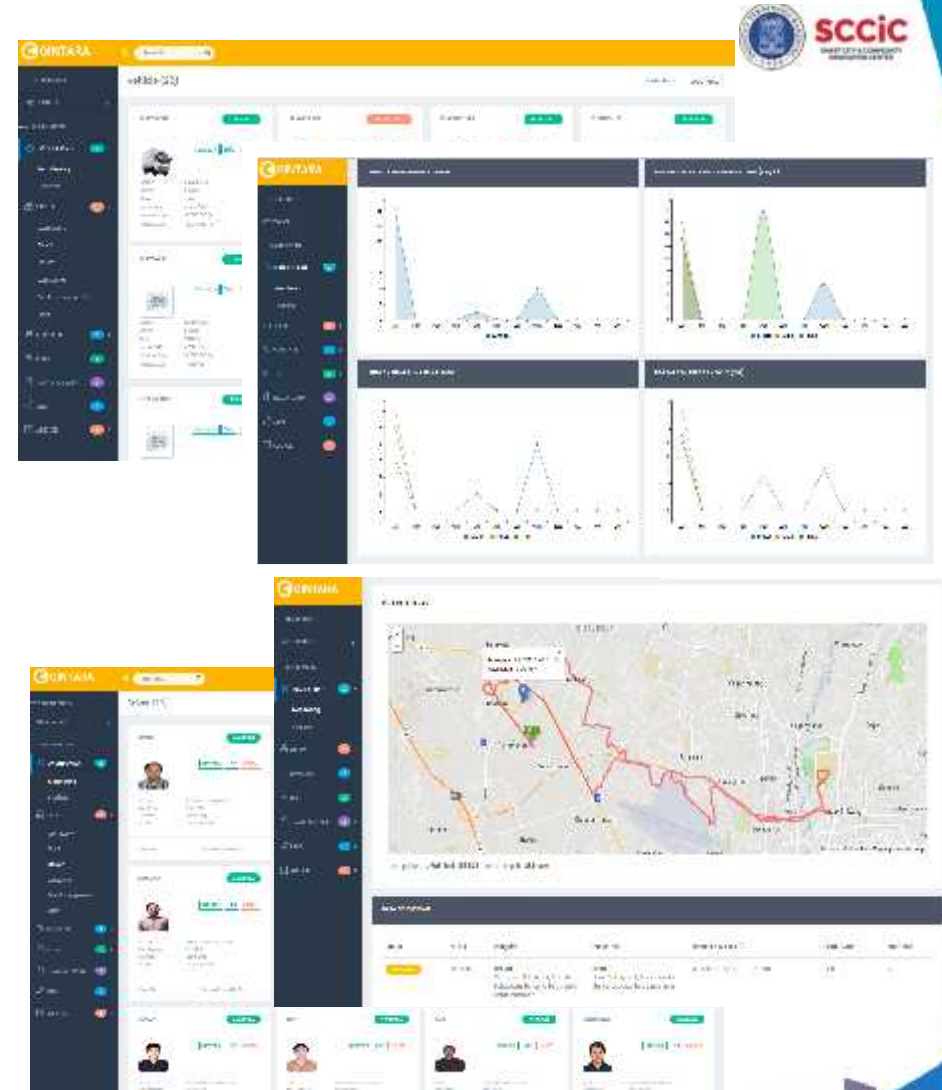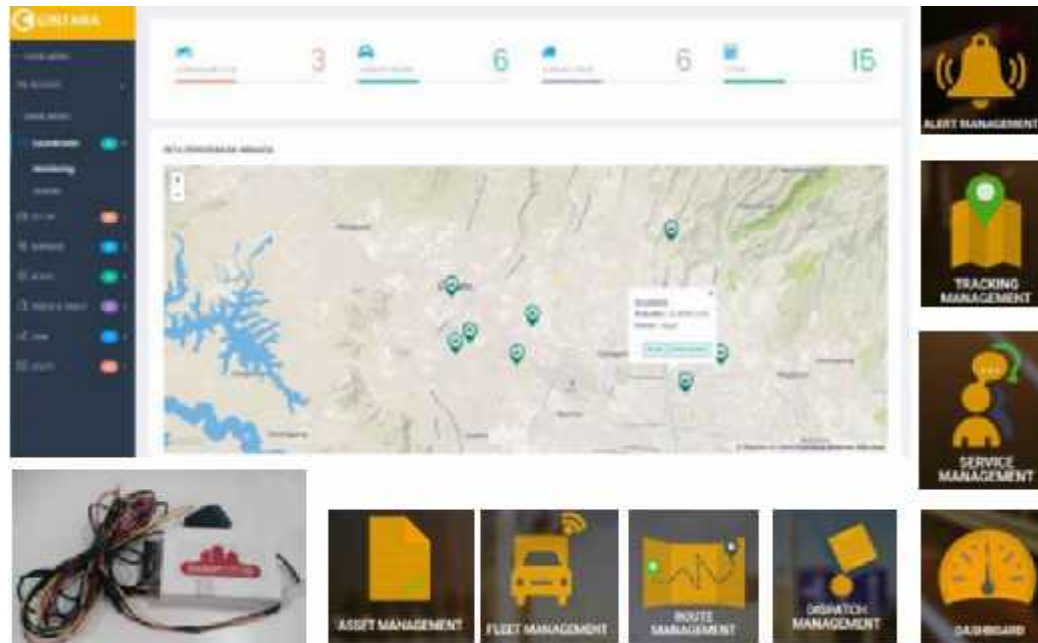
FLEET MANAGEMENT
(GINTARA/FLEETARA)

TRIP PLANNER

tripisia

Initiated due to the absence of smart tourism system in website and application which makes its use more efficient and more accessible in planning and managing your own perfect vacation itinerary and trip plans. Therefore, users can plan a trip through smartphone and users can choose attractions based on the destinations, budget and their preferences.
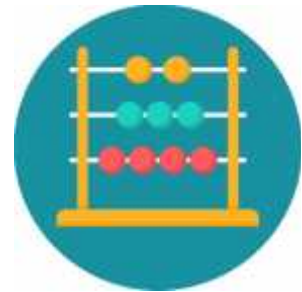
Many existing travel itinerary services are not well-integrated for users to get reliable information to plan a trip, so it always takes time to make an integrated trip plan.

Overview

tripisia

Well-integrated information related

to travel destination in Indonesia

Well-integrated the service

ecosystem of travel online planner

A platform that integrates travel destinations in Indonesia and Tripisia can integrate the service ecosystem of travel online planner for users to manage, plan and find what travel style they want but to easily integrate solutions for their trip plans.

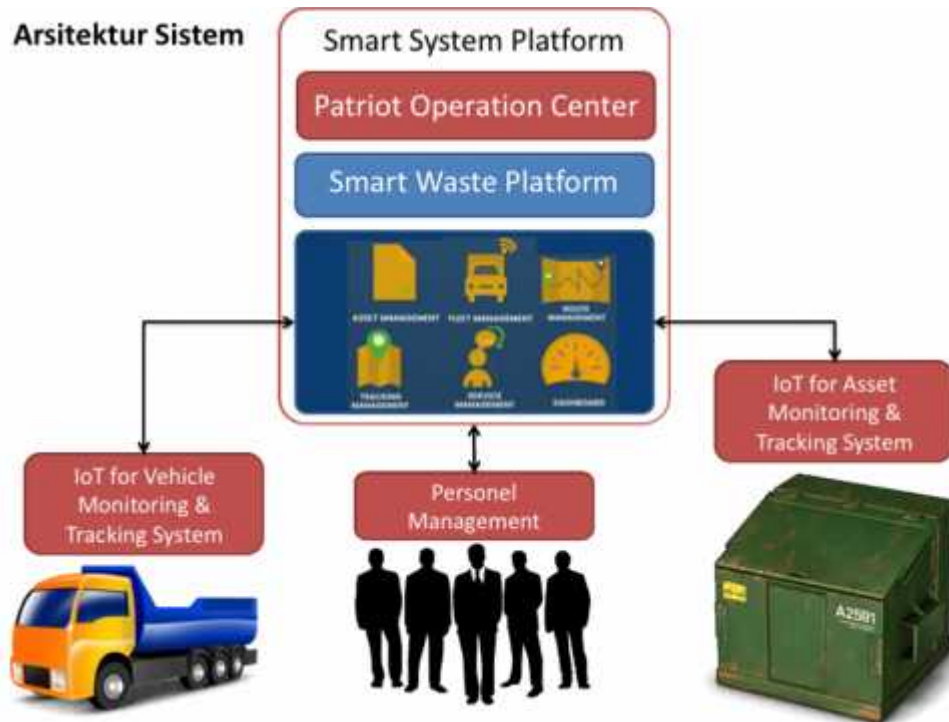> " Every person deserves to have day off, no matter whether they have tight budget or even excessive amount of money. **tripisia** helps them to plan their plan tip, ease the process of planning and supporting local businesses and promoting tourist destinations in Indonesia "
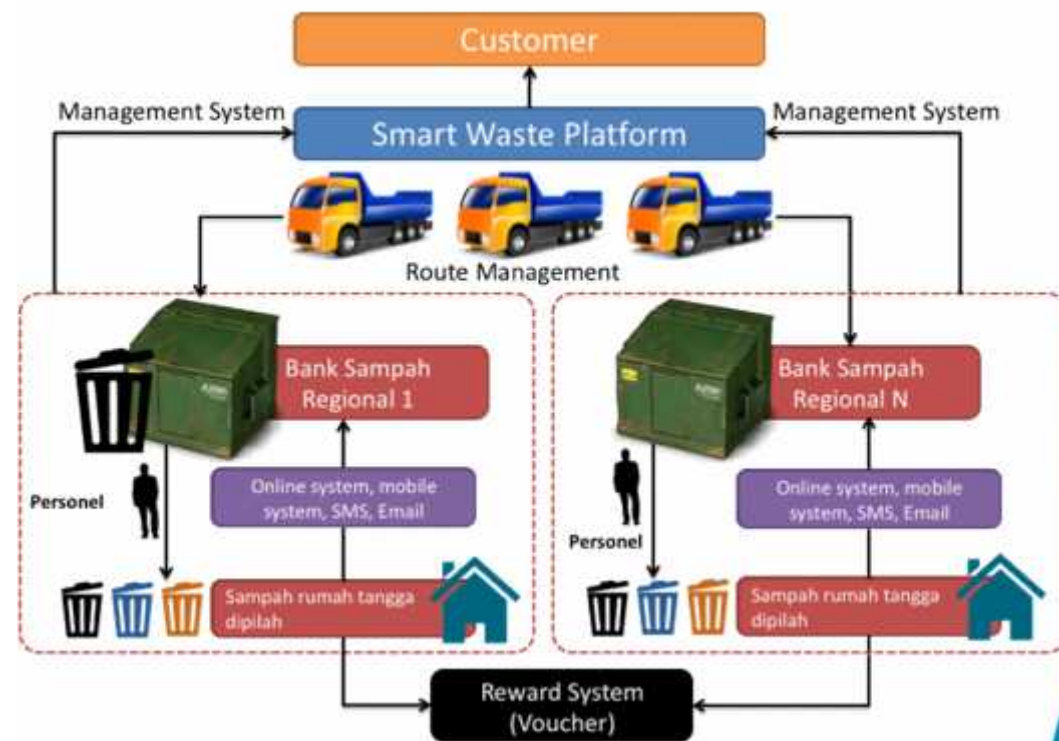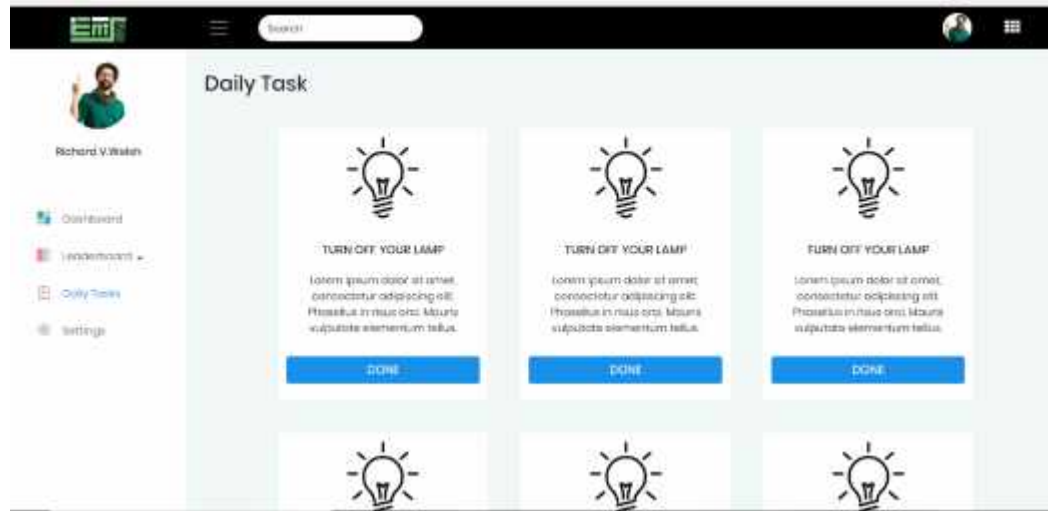
SMART WASTE MANAGEMENT

SCCIC ITB, 2015

SMART HOME (ENERGY MANAGEMENT)

Energy Monitoring and Control

Information

Trivia quiz

Gamification

SMART HEALTH

Klinik

indihealth Klinik adalah aplikasi yang memberikan layanan operasional ke manajemen klinik untuk mengelola data transaksi pelayanan kesehatan di internal klinik.

Apotek

indihealth Apotek adalah aplikasi yang memberikan layanan operasional ke manajemen apotek untuk mengelola data transaksi pelayanan kesehatan di internal apotek.

SmartOffice

- Front Office Rumah Sakit
- Back Office Rumah Sakit

UNIT PELAYANAN KESEHATAN SWASTA
Pengguna

UNIT PELAYANAN KESEHATAN PEMERINTAH
Pengguna

Smart Hospital

MASYARAKAT UMUM
Pengguna

SIMRS

indihealth Rumah Sakit adalah aplikasi yang memberikan layanan operasional ke manajemen rumah sakit untuk mengelola data transaksi pelayanan kesehatan di internal rumah sakit.

HomeCare

Berikan pengalaman yang berbeda untuk pasien dengan menyediakan layanan kesehatan di luar rumah sakit. Dengan memberikan layanan kesehatan melalui komunikasi data antara pasien dan rumah sakit bahkan dengan dokter.

xanesha

indihealth Diabetes atau yang dikenal dengan nama Xanesha Diabetes Console adalah aplikasi mobile yang mendukung gaya hidup dinamis masyarakat yang peduli tentang kesehatan gula darahnya.

Fitur
- Modul HbAIC
- Modul Denyut
- Modul Glukosa
- Grafik Trend
- Modul Reporting
- FAQ Diabetes
- Modul Glukosa
- Modul Aktifitas
- Modul Berat Badan
- Modul Tekanan Darah
- Modul Kandungan Makanan

HalloMoms

indihealth Hallo Moms adalah aplikasi reminder dan logbook untuk aktifitas imunisasi dan tumbuh kembang putra dan putri Anda. Mampu digunakan di smartphone dan mobile phone melalui notifikasi sms.

Fitur
- Pendaftaran
- Pengaturan Profil
- Jadwal dan Reminder Imunisasi
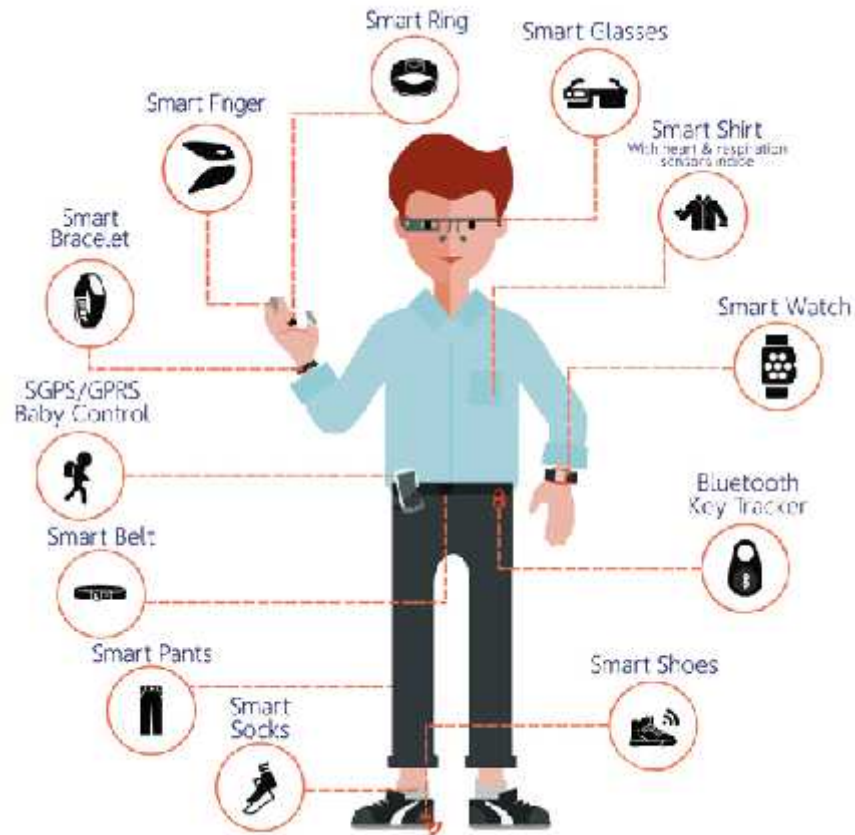- Logbook Tumbuh Kembang
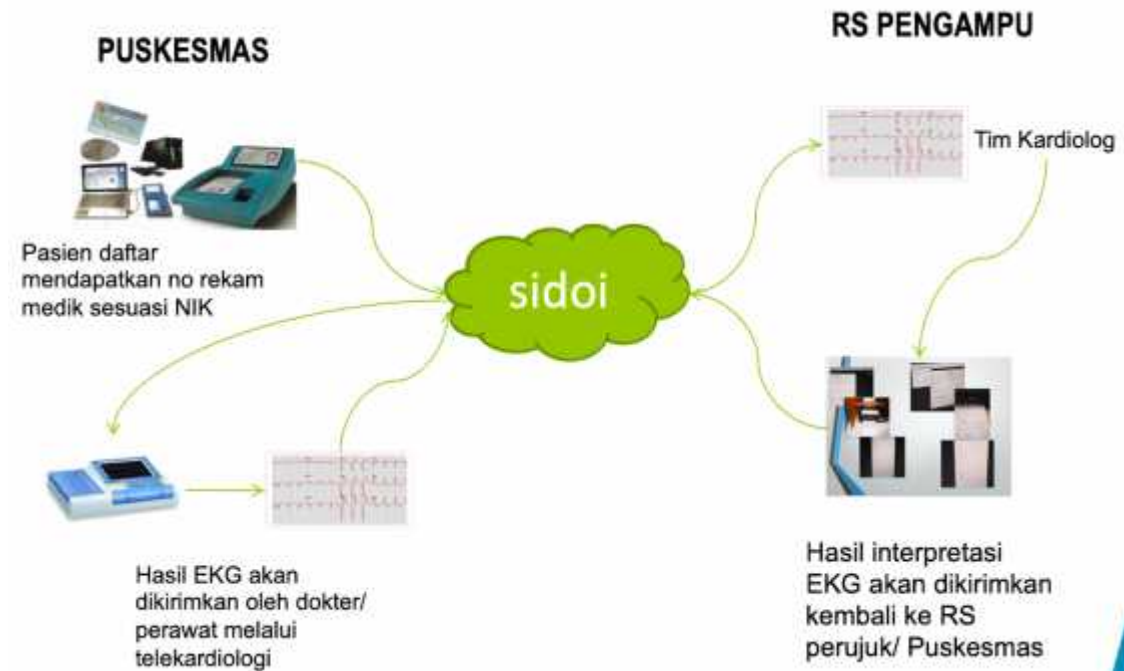- Informasi Vaksin & Kesehatan Anak

PANIC BUTTON - SPGDT

SMART HEALTH

Tele Imaging
(Telekardiologi, TeleUSG, Teleradiologi, Telelaboratorium)

Sumber: https://www.healthpopuli.com/2017/01/13/healthcare-data-ecosystems-e-merge-ces-2017/

SMART IDENTITY MANAGEMENT (SIDAS)

Sidas is a smart identity system, which provides solutions to manage and identify the identity to support of smart city & community.

Training Program on "Planning Internet of Things (IoTs) networks"

identity management solutions for personal business cards and organization business cards using Internet of Things.

identify, publish, manage personal or organizational events, and provide results of analysis & report surveys for the quality of your event.

identify and manage personal and organizational asset identities, and provide accurate report results.

CLOSING REMARKS

KEY CHALLENGES AND OPPORTUNITIES

- Building understanding and collaboration between relevant stakeholders. City must be ready to cope with change better through the development of services based on the Smart City concept, including the implementation of IoT

- One of the biggest challenges is to integrate all solutions.

- Policies and regulations are an important issue in the development of Smart City, but currently lags behind technological developments.

Thank You

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