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”

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SCCIC (Smart City & Community Innovation Center) is a 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**

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.
• 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.

Source: Digital Planet 2017: How Competitiveness and Trust in Digital Economies Vary Across the World
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**
- Development of electrical-powered, assembly-line mass production
- At the dawn of the 20th century
- Marked by the introduction of the automobile.

**Third generation**
- Introduction of computerized automation
- During the 1950s and '60s.

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

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

Source: General Electric Services Blogs
SOCIETY 5.0 & SMART CITY

SOCIETY 5.0

SMART CITY

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

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SMART CITY EVOLUTION

Smart Cities 1.0: Technology Driven

Smart Cities 2.0: Technology Enabled, City-Led

Smart Cities 3.0: Citizen co-creation
ARCHITECTURE OF GSC FRAMEWORK 3.0

Smart City Definition

Smart City Model
- SC Measurement Model
- SC Collaboration Model
- SC Development Model
- SC’s Enterprise Architecture

SC’s Standards
SC Services

City (Smart City)
- SC Development Cycle
- Service Management Cycle
- SC Service Canvas

Citizen

Provide Service to

Measured by

Collaborate Using

Developed by

Described as Architecture by

Standardize by

Conceptually Implemented by

Refer to

SC’s Enterprise Architecture by

SC’s Standards

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CONNECTION BETWEEN GSCF AND (REAL) SMART CITY

SMART CITY FRAMEWORK

Smart City Definition → Refer to
Smart City Model
SC Measurement Model
SC Collaboration Model
SC Development Model
SC’s Enterprise Architecture
SC’s Standards
SC Services

Modeled by
Measured by
Collaborate Using
Developed by
Described as Architecture by
Standardize by

Smart City (Smart City) → City EA & Standard
Smart City Initiative (Project)
Operational Unit

City Plan
Private Plan
Community Plan

Government
Private Sectors
Citizen & Community

Have
Have
Have

Align to
Implement by
Improve by
Deliver
Create
Hand over to

Part of
Part of
Part of

Citizen
Smart City Services
Smart City Collaboration Forum

Measured by
Consumed by
Consumed by
Consumed by
Consumed by

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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.

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

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

Solution should be designed to be sustained for long time
SMART CITY MODEL

SMART ECONOMY
- 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 SOCIETY

SMART ENVIRONMENT

Enabler
Services

Service Hierarchy
- Service Domain
- Service Cluster
- Service Item

Process Life Cycle
- Plan/Design
- Monitor
- Build/Improve
- Operate

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SMART CITY MODEL

SERVICE VIEW

Smart Service Hierarchy

- Service Domain
  - Service Cluster
    - Service Item
      - Smart Initiative
        - Smart Value
          - Basic Value
          - Quality of Life

Described by

Additional Value!!!
INTERNET OF THINGS
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 Internet 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

IOT has evolved to include more connected devices and continues to show potential for growth.
Society in AI Age: Human + Machine

<table>
<thead>
<tr>
<th>Lead</th>
<th>Empathize</th>
<th>Create</th>
<th>Judge</th>
<th>Train</th>
<th>Explain</th>
<th>Sustain</th>
<th>Amplify</th>
<th>Interact</th>
<th>Embody</th>
<th>Transact</th>
<th>Iterate</th>
<th>Predict</th>
<th>Adapt</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Human-only activity</td>
<td>H</td>
<td>Human complement machines</td>
<td>Human and machine hybrid activities</td>
<td>Human and machine hybrid activities</td>
<td>AI gives humans superpowers</td>
<td>Machine-only activity</td>
<td></td>
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</table>

Source: linkedin.com/pulse/guidebook-our-human-machine-future-paul-daugherty
EFFECT ON ECONOMY, 
SOCIAL & 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

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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)

Society X.0

Co-Creation

Industry 4.0

Machine Learning

Artificial Intelligence

Big Data

Various Social & Economic Challenges

IoT

Cloud Computing

Robotics

New Values and Services

Collaborative Intelligence

Conformable and Sustainable Live

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IOT TO SUPPORT THE DIGITAL ECONOMY
IoT market share in Indonesia is predicted to reach IDR 444 trillion in 2022 (IoT Forum)

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content and application</td>
<td>IDR 192.1 trillion</td>
</tr>
<tr>
<td>Platform</td>
<td>Rp 156.8 trillion</td>
</tr>
<tr>
<td>IoT device</td>
<td>Rp 56 trillion</td>
</tr>
<tr>
<td>Network and gateway</td>
<td>Rp 39.1 trillion</td>
</tr>
</tbody>
</table>
ISSUE ON TECHNOLOGY, HUMAN RESOURCE & GOVERNANCE
**IOT WIRELESS CONNECTIVITY ECOSYSTEM**

### Top 7 technologies for IoT connectivity

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LinkLabs</td>
<td>Bi-directional IoT, interference resistance, mostly in the USA</td>
</tr>
<tr>
<td>LoRa</td>
<td>Low power use, good security, expanding worldwide</td>
</tr>
<tr>
<td>sigfox</td>
<td>Longest network, great interference resistance, expanding worldwide</td>
</tr>
<tr>
<td>NB-IoT</td>
<td>High speed, best security, mostly in the USA</td>
</tr>
<tr>
<td>LTE</td>
<td>Best performance, best security, mostly in the USA</td>
</tr>
<tr>
<td>RPMA</td>
<td>High speed, globally available band, mostly in the USA</td>
</tr>
</tbody>
</table>

### Comparison of Networks

<table>
<thead>
<tr>
<th>Local Area Network</th>
<th>Low Power Wide Area (LPWAN)</th>
<th>Cellular Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Range Communication</td>
<td>Internet of Things</td>
<td>Traditional M2M</td>
</tr>
<tr>
<td>40%</td>
<td>45%</td>
<td>15%</td>
</tr>
<tr>
<td>Well established standards</td>
<td>Low power consumption</td>
<td>Existing coverage</td>
</tr>
<tr>
<td>In building</td>
<td>Low cost</td>
<td>High data rate</td>
</tr>
<tr>
<td>Battery Live Provisioning</td>
<td>Positioning</td>
<td>Autonomy</td>
</tr>
<tr>
<td>Network cost &amp; dependencies</td>
<td>Emerging standards</td>
<td>Total cost of ownership</td>
</tr>
</tbody>
</table>

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

CONNECTING IDENTITY OF THINGS, SERVICES & PEOPLES

OWNERSHIP
NIK as Single Identity Reference

Telecommunications Services
Financial and Banking
Insurance
Smart Public Services

Connecting

PEOPLE
SERVICES
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.
INTEGRATION

Smart Infrastructure, Information & Related Technology

Smart Economy

Smart Environment

Smart Social

Sumber Daya Manusia (Smart People and behavior)

Tata Kelola, Kebijakan dan Regulasi (Smart Governance)

Executive Information System

Decision Support System

Data Sharing (internal & External)

OPERATION ROOM

Smart Platform

Integration Services

Open Sensor

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### KEY CHALLENGES & ROLES FOR REGULATORS/GOVERNMENT

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

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

<table>
<thead>
<tr>
<th>Category</th>
<th>Focus Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote Competition &amp; Investment</td>
<td>• Spectrum Licensing, Numbering Systems, KYC Requirements, Taxation Schemes, Permanent Roaming Regulations</td>
</tr>
<tr>
<td>Implement Standardization &amp; Interoperability</td>
<td>• Framework for IOT in the region</td>
</tr>
<tr>
<td>Empower &amp; Protect the End User</td>
<td>• Security Risks, Data Privacy, Data Sovereignty &amp; Data Residency</td>
</tr>
<tr>
<td>Promote the Internal Market</td>
<td>• Legislations that make certain connected services mandatory</td>
</tr>
</tbody>
</table>

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

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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
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.

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INTEGRATED SMART SYSTEM PLATFORM – ARCHITECTURE

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

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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 meanings: pink (train-to-infrastructure communications), blue (inter-car communications), light green (radio communication), yellow (communications inside the station), purple (infrastructure-to-infrastructure communications), and dark green (vehicle 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

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SMART FARMING

100% Low energy cost
Up to 80% energy savings

20% Lower maintenance cost
Up to 50% maintenance cost reduction

SMART STREET LIGHTING

Server
Remote Server
for Management and Analytics

Central Control Office

Smartphone

Smart Lighting Module

Up to 30 Lamps

Smart Manufacture

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SMART BIKE PLATFORM

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

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

Solar Power
Sumber energi untuk pengisian baterai

Night Light
Menyala dalam kondisi gelap

Odometry
Sensor distance

Smart Phone Docking
Docking smart phone, bisa melakukan charging

Emergency Alarm
Menyala dalam kondisi darurat

Built-in Action Camera
Connect ke smart phone untuk mengaktifkannya
SAFE AND SECURE PLATFORM
Closed-loop monitoring system using Artificial Intelligence

- 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
  - Anomaly Detection
  - Multi-sensor Vehicle Detection and Reidentification
  - Trash Detection
  - Violence Detector
  - E-Tilang

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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.
FLEET MANAGEMENT
(GINTARA/FLEETARA)

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FLEET MANAGEMENT
(GINTARA/FLEETARA)

9/26/2018

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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.
Well-integrated information related to travel destination in Indonesia

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

Arsitektur Sistem

Smart System Platform
- Patriot Operation Center
- Smart Waste Platform

IoT for Vehicle Monitoring & Tracking System
Personel Management

IoT for Asset Monitoring & Tracking System

Skema Implementasi: Konsep Bank Sampah

Customer
Management System
Smart Waste Platform
Management System
Route Management

Bank Sampah Regional 1
- Online system, mobile system, SMS, Email
- Sampah rumah tangga dipilah
- Personel

Bank Sampah Regional N
- Online system, mobile system, SMS, Email
- Sampah rumah tangga dipilah
- Personel

Reward System (Voucher)

SCCIC ITB, 2015
SMART HOME (ENERGY MANAGEMENT)

Energy Monitoring and Control

Information

Trivia quiz

Gamification

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SMART HEALTH

PANIC BUTTON - SPGDT
SMART HEALTH

Tele Imaging
(Telekardiologi, TeleUSG, Teleradiologi, Telelaboratorium)


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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.
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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