Smart City ICT Framework

January 31, 2015

NASSCOM®
NASSCOM & Accenture are following a structured approach for developing National Smart City ICT Framework

Current Stage

1. Smart City Definition and Framework
2. Value Chain Mapping for each of smart city sub systems
3. Issues mapping for each of smart city sub systems
4. ICT Solutions for each of smart city sub systems
5. Conceptual Architecture
6. Governance Model
7. Execution Roadmap

Areas included in the framework:

- Energy
- Water
- **Waste & Sanitation**
- Transportation
- Urban Planning
- Healthcare
- Education
- Safe City
- Citizen Services
- Climate Change and Pollution Management
- Governance

Innovation and technology leapfrog

Social Inclusion

Job creation
The development methodology has 4 keys phases

**Phase 1: Analyze**

- **Primary Research**
  - Industry Members
  - Government Organization

- **Secondary Research**
  - Understand Key issues, pain points, challenges faced by stakeholders
  - Deep Dive into various sub systems like water energy, transportation etc. to understand end to end lifecycle and key issues/challenges

**Phase 2: Design**

- **Define the Sub System Value Chain**
  - Define the concept of Smart for each sub system

- **Define key issues/pain points /challenges**

- **Define ICT Conceptual architecture**
  - Define ICT Governance model
  - Propose Implementation Framework

**Phase 3: Validate**

- **Validate the draft report from NASSCOM & MoUD**
  - Validate the draft report from Industry members
  - Validate the draft report from key Govt organizations

- Incorporate the suggestions and finalize the report

**Phase 4: Present**

- Organize Press conference to publish the Smart City ICT framework by Mar end

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The team has consulted multiple industry members to take inputs

Illustrative list of industry members
Definition of Smart City

A Smart City effectively delivers public services to citizens and businesses in a an integrated and resource efficient way while enabling innovative collaborations to improve quality of life and grow the local and national economy.

Smart Cities Deliver Competitiveness
The Smart city framework is comprehensive and holistic; driven by the unique challenges faced due to rapid urbanization in India.
Value chain mapping: Solid Waste Management

1A Waste generation: public areas

1B Waste generation

2A Waste handling

2B Waste handling & Segregation at source

3 Waste collection

3 Waste sorting and segregation

4A Recycle

4B Landfill

4C Incineration

Disposal
Issues Identification: Solid Waste Management

1A. Waste generation: public areas
   - Huge Waste Generation
   - Mixing of waste

1B. Waste generation
   - Inadequate municipal capacity, inadequate access, lack of waste segregation, citizen awareness

2A. Waste handling
   - Inefficient sorting
   - Unhygienic conditions

2B. Waste handling & Segregation at source
   - Manual primary collection
   - Inadequate collection
   - Lack of capacity

3. Waste collection
   - Inappropriate technology:
     - Low Capacity

4A. Recycle
   - Inefficient sorting
   - Unhygienic conditions

4B. Landfill

4C. Incineration

Overall Issues:
- Lack of city waste policy
- Inefficient Business Processes
- Inefficient Workforce & Resource Management

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ICT Interventions: Solid Waste Management

- Sanitation Scheduling Solution
- Citizen mobile app
- Sweeper machines (Non-ICT)
  - Output based performance tracking
- Waste bin sensors with GPS
- Collection scheduling solution
- GPS route optimization
- Segregated transport (Non ICT)
- Advanced recycling
  - Smart Landfill mgmt.
- Pollution sensors
  - Pollution control equipment
- Quick Wins

Common Solutions:
- Integrated Asset Management Solutions
- Integrated Operations Center
- Integrated Multi Channel Customer Interface
- Business Process Automation
- GIS

Non-ICT
- Segregation at Source
- Modify Building code to incorporate garbage chute

Waste bin sensors
- Sensor based sorting

Quick Wins
ICT interventions: Key Outcomes

- **Sanitation Scheduling Solution**: Efficient use of resources for cleaning
- **Sweeper machines**: Increase capacity
- **Output based Performance tracking**: Performance based service
- **Waste collection scheduling solution**: Efficient collection, reduced littering
- **GPS Sensors and devices on waste trucks**: Efficient collection, reduced cost
- **Trucks with Separate containers**: Avoid mixing of waste
- **Waste Bin Sensors with GPS**: Efficient collection, reduced theft
- **Advanced Recycling techniques**: New revenue streams, reduce impact on environment
- **Smart Landfill management**: Reduce environmental impact
- **Pollution Sensors**: Reduce environmental impact
- **Advanced Pollution Control Equipment**: Reduce environmental impact
- **Garbage segregation at source**: Efficient waste management
- **Sensor based Sorting**: Efficient segregation
- **Modify Building code to incorporate garbage chute**: Sustainable buildings
ICT Architecture Principles

- **Human Centered Inclusive Design**
  - User interface and application to be designed in such a way that it is accessible, easier to use and understood by all.

- **Multichannel Platform**
  - Applications should be accessible to stakeholders over multiple channels like mobile, web, phone, kiosk etc.

- **Open Standard Based Design**
  - To ensure standardization, inter operability, flexibility to move from one vendor to another and reduce TCO.

- **Technology & Vendor Agnostic**
  - Solution which is technology and vendor agnostic and helps in achieving cost effectiveness.

- **Service Oriented Design**
  - To ensure technology independent, reusability and interoperability in the long term.

- **Preparedness for failure**
  - Architecture should be designed to tolerate failure and have recovery tools and/or processes defined.

- **Fit for purpose, Unique and reusable**
  - Each capability should be implemented only once without duplication. Web Services/Interfaces should be exposed to ensure reusability/integration.

- **Integrated Approach**
  - Integrate planning, execution & monitoring of applications & systems to ensure the wheel is not reinvented, solutions are not over-engineered and ownership is clear.
## ICT Architecture Layers

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Access Layer</strong></td>
<td>• Access layer provides multi channel (Web/Mobile/Phone/Kiosk/Face to Face) access to stakeholders (citizens, businesses &amp; city mgmt.)</td>
</tr>
<tr>
<td><strong>Security Layer</strong></td>
<td>• Security layer comprises of the comprehensive security framework, standards, policies and tools/solutions for Identity management, Infrastructure/Application/Data/Instrumentation/Physical Security</td>
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<tr>
<td><strong>Application &amp; Intelligence</strong></td>
<td>• Comprises of applications to enable smart city domains like water, energy, transportation etc. and also core enterprise applications like ERP</td>
</tr>
<tr>
<td><strong>Data Layer</strong></td>
<td>• Data layer provide basic (access/storage/retrieval) data management capability and advanced capabilities like master/meter data management, dash boarding, reporting, data management and analytics</td>
</tr>
<tr>
<td><strong>IoT/M2M Layer</strong></td>
<td>• IoT layer simplifies connectivity, device management, sensors/meter data acquisition/management, and provides capabilities to monitor, manage and control connected sensors/meters and devices.</td>
</tr>
<tr>
<td><strong>Communication Layer</strong></td>
<td>• Communication layers provides Wired/Wireless connectivity medium. It includes wired/wireless connectivity medium like GSM/GRPS/3G/Wi-Fi/Proprietary</td>
</tr>
<tr>
<td><strong>Instrumentation Layer</strong></td>
<td>• Instrumentation layer constitutes sensors, meters, devices, controllers, cameras etc.</td>
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ICT Conceptual Architecture

Smart City Core Domains

User Interface
- Interaction Services
  - Face to face
  - Web Portal
  - Kiosk
  - Mobile/Phone
  - Call Centre

Applications
- Domain Applications
  - Energy Mgmt.
  - Water Mgmt.
  - Transport Services
  - Real Estate Mgmt.
  - Legacy & Other

- Core Applications
  - ERP
  - Workflow, BPM
  - Maps/GIS
  - Enterprise Perf.
  - Others

Integration Services
- Web Services
- Flat file
- ESB

Data
- Data Mgmt & Integration Services
  - Master Data Mgmt
  - Dashboards
  - Scorecards
  - Analytics
  - Reporting
  - Custom Apps

IoT / M2M
- Systems Mgmt
- Data Mgmt
- Application Services
- Infrastructure
- Communication

Communications
- Ethernet
- Fiber
- Wifi
- GPRS/3G
- Proprietary

Instrumentation
- CCTV
- Smart Meters
- Traffic
- Flow Meters
- Other sensors/devices

Hosting Infrastructure
- IT Environment
  - Production
  - Test
  - Disaster Recovery

- Hosting Platforms
  - Physical Servers
  - Virtual Machines
  - Private Cloud

Governance
Smart City ICT Governance Framework

National Level PMU

- Allocate budgets at state level
- Review budget assignment
- Ensure alignment with Smart City ICT framework

State Level PMU

- Review and approve the plan and roadmap
- Grant Funding
- Conduct a detailed budgeting exercise to budget for the program

Municipal Level PMU

- Prepare Smart City Development plan includes city infrastructure plan and city digital plan
- Validate with key stakeholders
Financing mechanisms

India will need **7 lakh crores over 20 years** for development of infrastructure\(^1\) and **3 lakh crore over next 10 years** for ICT interventions.

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1. Source: UN ESCAP 2011, Accenture Analysis HPEC Committee
**Execution Roadmap**

**Phase I- Master Planning**

- Smart City development plan
  - City Infrastructure Plan
    - City digital plan
      - 3-5 years roadmap based on unique needs/challenges for each city considering **Smart City ICT framework as baseline**
      - Plan & roadmap approval by Local municipal commissioner, State PMU and National PMU
      - Project Kick off

**Phase II- Procurement**

- Formation of Municipal PMU for procurement and management of the programme for 2-3 years
  - Creation of EOI/RFP by Municipal PMU
  - **Selection** of Lead system integrator and sub system integrators
  - Finalization of the Operating Model
  - Finalization and agreement on the final design by Lead SI
  - Programme Implementation

**Phase III- Build**

**Transition the operations to internal IT team or outsourced to a partner**

**Phase IV- Operate/Run**

- Programme Implementation
Thank You

If you have any feedback/query. You can write to us on
manojit@nasscom.in
Value chain mapping: Energy (1/2)

1. Large scale renewables
2A. Transmission - Inter State

1. Thermal Power
2B. Transmission - Intra State / Sub

1. Hydro Power

3. Distribution
Value chain mapping: Energy (2/2)
Issues identification: Energy (1/2)

- Inadequate evacuation
- High losses
- Lack of RE integration

- Inadequate Supply
- Low generation efficiency
- Difficulties in large scale renewables
- Impact on Climate change

- Grid failure
- Commercial losses

- Transmission - Inter State
  - Inadequate evacuation
  - High losses
  - Lack of RE integration

- Transmission - Intra State / Sub
Issues identification: Energy (2/2)

Overall Issues:
- Inefficient Service delivery:
  - Asset management
  - Operations
  - Resource Management
- Financial
  - High Cap-ex
  - High Op-ex
  - Dues recovery
  - Affordability

- Demand Supply gap - High demand
- Lack of small scale renewables

Energy meters
Service drop
Domestic customer
Sub-transmission Customer
Primary Customer
Captive Power generation
Decentralized energy generation
ICT interventions: Energy (1/2)

Note: Existing government programs such as R-APDRP should be integrated while strategizing ICT solutions.
ICT interventions: Energy (2/2)

Common Solutions:
- Citizen Mobile App

Quick Wins

- Large customer profiling and load management solutions
- Decentralized energy generation
- GIS maps

ICT Solutions:
- Smart Streetlights
- Smart meters
- Smart buildings / individual systems
- Micro grid
- GIS maps

Quick Wins

- Large customer profiling and load management solutions
- Decentralized energy generation
- GIS maps
ICT interventions: Key Outcomes

Consumption
- **Smart Meters (Pre Paid/Post Paid):** Reliable Metering, Accurate Billing, Real-time visibility on energy consumption, Reduced Under-recovery, Remote monitoring, Centralized control
- **Smart Buildings & Energy Management Solutions:** Optimized energy consumption, real time visibility on energy usages, Ability of control devices to ensure optimum usage
- **Smart Streetlights:** Reduced energy consumption in public lighting, Reduced carbon footprint, Central and automated lighting control, Renewable integration
- **Renewables-Decentralized Energy Generation (Solar/Wind):** Reduced demand supply gap, Reduced carbon footprint
- **GIS Mapping:** Efficient asset management, asset geo location, efficient asset maintenance

Transmission
- **Grid Overloading Solution:** Identify root causes of grid overloading, Avoid Grid overloading
- **Self Healing Grid:** Self regulation of load and capacity
- **Power Quality Devices:**
- **Grid Based Storage:** Store excess energy, Reduced demand supply gap

Generation
- **Renewables-Decentralized Energy Generation (Solar/Wind):** Reduced demand supply gap, Reduced carbon footprint
- **Analytics:** Accurate demand projections, Ensure supply efficient planning, Efficient procurement & pricing,
- **Plant Monitoring & Control:** Real time visibility on generation efficiencies, Efficient control
Value chain mapping: Water (1/2)

1. Water source & extraction

2. Water storage and purification

3. Water distribution

- Water source and extraction
- Water storage & purification
- Distribution
Value chain mapping: Water (2/2)
Issues identification: Water (1/2)

Overall Issues:
• Huge energy consumption in pumping
• Aging Water Infrastructure
• Poor Asset Management
• Poor Maintenance & break fix
• Poor Customer Service

Issues:
• Low storage capacity
• Inadequate Purification

Source & extraction
Storage & purification
Distribution

• Supply shortage and unreliability
• High Water losses
• Poor quality
• Social and environmental concerns

• Lack of access
• High water losses
• Water contamination
• High energy consumption
Issues identification: Water (2/2)

• Lack of water conservation
• Lack of rainwater harvesting

• Low treated quantity
• Low quality
• Treated water reuse
• Discharge to water bodies without treatment
ICT interventions: Water (1/2)

Common Solutions:
• Integrated Asset Management Solutions
• Integrated Operations Center
• Integrated Multi Channel Customer Interface
• Business Process Automation
• GIS
• City Performance Management
• Workforce and resource management

Quick Wins

- Predictive Analytics
- Online Hydrology Maps
- Automate ground water access approval process
- Leakages Sensors
- Water Quality Meters
- Ghost Pipe detection system
- Water Supply Analytics

Water source and extraction
- Lakes and rivers
- Underground water

Water reservoir

Water storage and purification

Water Quality Meters

Water tower

Distribution network

Water distribution
ICT interventions: Water(2/2)

Common Solutions:
• Citizen Mobile App

• Advanced rain water harvesting equipment

• Smart Meters
• Water Pricing Analytics:

• Advanced Wastewater Treatment

Water source and extraction
Water storage and purification
Distribution
Consumption
Wastewater management

Water meter
Rain water harvesting tank
Industrial use
Industrial wastewater treatment

Domestic Use

Water Quality Meters

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ICT interventions: Key Outcomes

- **Predictive Analytics**: Real-time visibility on supply, Efficient planning
- **Online Hydrology Maps**: Optimize ground water usage
- **Automated ground water access approval process**: Ability to control usage
- **Leakages Sensors**: Reduce waste, Reduce non revenue water
- **Water Quality Meters**: Reduces health risks
- **Smart Meters**: Accurate billing, visibility on consumption pattern
- **Water Pricing Analytics**: Consumption based pricing
- **Advanced rain water harvesting equipment**: Decentralized water source
- **Ghost Pipe detection system**: Reduces non revenue water due to theft
- **Water Supply Analytics**: Supply visibility, Pricing decisions
- **Advanced Wastewater Treatment**: Efficient reuse
Various government schemes can be leveraged to finance and execute the smart city projects

**Overall**
- Industrial Corridors
- Make in India campaign
- The 100smart cities

**Energy**
- Existing smart Grid pilots
- Metro Rail for mass transportation etc.
- Sarathi
- Vaahan

**Mobility**
- Bhoomi (Land Record e-Management)
- The New Fund to cover 500 Cities renewal
- Aadhar (UID)
- Bangalore-One (Single window citizen services)
- Jan Dhan Yojana
- Restructured Accelerated Power Development & Reforms Programme (R-APDRP)

**Urban Planning**
- Swatch Bharath
- The New Fund to cover 500 Cities renewal
- Crime and Criminal Tracking Network & Systems (CCTNS)
- City Surveillance
- Restructured Accelerated Power Development & Reforms Programme (R-APDRP)

**Solid Waste**
- ICT@school
- Arogyasree

**Education**
- Swatch Bharath
- ICT@school

**Healthcare**
- ICT@school
- Arogyasree

**Safe City**
- ICT@school
- Arogyasree

**Citizen Services**
- Swatch Bharath
- ICT@school

**E-Gov**
- Digital India
- e-District
- ekranti
- e-PDS
- E-Seva
- Income Tax / PAN / GST and other taxation service
- Integrated Framework (CSC, SDC, SWAN and SSDG)
- National e-Governance Plan: NKN, SWAN, NIC, NII2, MMP