Construction and Evaluation of New Type Smart City in China

Prof. Weifeng Lyu
School of Computer Science and Engineering, Beihang University
General Working Group on Chinese Smart Cities Standardization
1. Smart City Construction in China
2. Evaluation Challenges
3. China’s Efforts on Evaluation
Smart City Construction in China
Urbanization Rate in China

1978: 18%
2002: 50%
2016: 57.35%
2030: 70~72%
2050: 75%

Agricultural Civilization → Industrial Civilization → Post-Industrial Civilization → IT Civilization
Common Challenges of Cities in China

Transportation problems.
Need better public services and administrative efficiency

Air pollution, global warming, resource un-sustainability...

Environmental

Soil and Water

Social security problem.
Health care and education.

Need to develop new industries and improving traditional industries.
**Promoting Smart City Development Guidance**

- *Promoting Smart City Sound Development Guidance* is issued in August 2014, and it is co-issued by 8 different ministries.
- This guidance proposed that a group of smart cities should be constructed to 2020, and by that time, their aggregation and radiation effects and comprehensive competitive advantages will be strengthened, which reflected on guaranteeing and improving civic livelihood, innovating social governance, and maintaining Internet safety, etc.
China’s National Strategy

Direction of smart city in China

- Wideband network
- Information technology of management
- Intelligent Infrastructure
- Convenient public service
- Modern industry
- Fine governance
Pilot Studies of Smart City in China

Construction

What Can We Learn? How to Evaluate the Progress?
Evaluation Challenges
Significance of Evaluation

Guided by the evaluation, identify the new smart city working direction

Ask local governments to develop relevant work programs according to the system of the evaluation indicators, identify relevant measures, and effectively improve the effectiveness of smart city construction.

Measured by the evaluation, improve the level of citizen beneficial services

Evaluation can creatively take the feelings of citizens, sense of happiness and fulfillment as important evaluation aspects. Local governments need to focus on construction effectiveness and make the public and enterprises feel the convenience of new smart city.

Deepen by the evaluation, accelerate experience sharing and promotion

Discover best practices, construction experience and common problems during the new smart city construction and promotion in different regions, at different levels and with different city scales. Summarize best practices which can be copied or extended to other cities and share development experience.
Evaluation Proposal in Other Countries

Technische Universität Wien

Smart City Maturity Model in India
Evaluation Proposal in 3 Top SDOs

- ISO/IEC JTC1/WG11 2016 till now
  - ISO IEC 30145 Smart City ICT Reference Framework and
  - ISO IEC 30146 Smart City ICT Indicators

ISO/IEC JTC1/WG11

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Title</th>
<th>Project Editor</th>
</tr>
</thead>
<tbody>
<tr>
<td>30145-2</td>
<td>Smart City ICT Reference Framework: Part 2: Smart City Knowledge Management Framework</td>
<td>Editor: Michael McQuaid (UK)</td>
</tr>
<tr>
<td>30145-3</td>
<td>Smart City ICT Reference Framework: Part 3: Smart City Engineering Framework</td>
<td>Co-editor: François Cailler (CA)</td>
</tr>
</tbody>
</table>

ISO/TC268 Indicators for infrastructure management

ISO/TC268 37150 Review of existing activities relevant to metrics

IEC/SyC on SmC

ITU-T/SG 20 Vice Chair KPIs
China’s Roadmap for Smart City Evaluation

Smart city is a complex giant system with many systems. To achieve sustainable development of economy, society and environment, interactions, merges and collaboration between systems are required.

- **2013**: Pilot Cities by Ministries
  - 28 domains
  - Focus on different Objects for Domains.

- **2014**: Top-level Design
  - From the overall needs of urban development, to design informatization through top-down approach and coordinate resources.

- **2015**: Smart City Standardization
  - Integrate of smart city complex giant system.
  - Promote the safe and controllable interaction of technical cooperation.
  - Push forward the deep integration of industry to achieve urban healthy and sustainable development.

- **2016**: Smart City Evaluation
  - Smart City Assessment Model and Indicators System
  - Push forward Smart City’s
    - construction
    - management
    - reform and transformation by means of Evaluation
China’s Efforts on Evaluation
Under the leadership of the National Standards Commission and other relevant ministries, the National Standardization SmC general group established evaluation standards team, specifically support national SmC evaluation of applications, implementation, verification and indicators test. Our institute undertake the leader of evaluation team.
Current Progress in Smart City Standardization

**Roadmap**

- **Book:** The Guidance for Building SmC in Practice  
  July 2013

- **China SmC Standardization White Paper**  
  Nov. 2014

- **Report of testing the innovative smarter city indicators**  
  Sep. 2016

- **GB/T 33356-2016 Innovative smarter city indicators**  

- **The Guidance of using smart city indicators and standards system**  
  To be published
China’s National Standards System

Systematic Viewpoint of Standards for Smart City

Evaluation is Essential Part

Roadmap

Smart Cities Standard System

General

Supportive Technology

Infrastructure

Construct and Living

Management and Service

Industry and Economy

Security

Data Security

System Security

Security Management

Supportive Technology

Reference Model

Evaluation Metrics

E-Gov

Public Safety

General

Communication

IoT and Sensor Network

Emergency

Business Cooperation

Market Regulation

Computing & Storage

Data Fusion

Service Fusion

Construct and Living

Infrastructure

General Guidance of Standards Application

Water Technology Testing

Land Management

Population Management

Community Management

Transportation Service

Education Service

Cultural Service

Labor Service

Social Service

Medical Service

Pension Service

Housing Service

Travel Service

Plan & Design

Operation Management

Environment

Transportation

Energy

Implementation

New Industry

Industry Promotion

Industry Plan

Financial Service

Logistics Service

E-commerce

Safety Protection

Public Operation Center

Public Platform

Real Estate Management

Domain Knowledge Model

Environment Protection

Instruments

Energy Management

Service
**Perspective of SmC Indicators Standards**

**ISO/TC 268**
- Sustainable cities and communities
- ISO 37120:2014
  - Sustainable development of communities -- Indicators for city services and quality of life
  - 100 quantitative indicators (46 core indicators & 54 assistant indicators) to steer and measure the performance of city services and quality of life

**ISO/IEC JTC1/WG11**
- Smart City
- ISO/IEC JTC1/WG11 WD 30146
  - Information technology — Smart City ICT Indicators
  - Divided into 2 categories: ability Indicators and performance Indicators

**IEC SyC**
- Smart Cities
- Electrotechnical aspects of Smart Cities
- Not yet set
  - To be focused on the electronic and electrical integration, interconnection and interoperability of systems (including equipment, software and services)

**ITU-T Key performance indicators (KPIs)**
- ITU-T Y.4900/L.1600
  - Overview of key performance indicators in smart sustainable cities
- ITU-T Y.4901/L.1601
  - Key performance indicators related to the use of information and communication (ICT)
- ITU-T Y.4902/L.1602
  - Key performance indicators related to the sustainability impacts of information and communication technology (ICT) in smart sustainable cities
- ITU-T Y.4903/L.1603
  - Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals

**In Future**
- Internet of things and smart cities and communities
- e-services and smart services for smart cities and communities (SC&C)
  - ICT related KPIs: use of ICT in smart sustainable cities, ICT impact on sustainability
  - Indicators for cities by global, national, regional, academic and company stakeholders

**IEC**
- Smart City Indicators — Electrotechnical aspects of Smart Cities
- Not yet set

**ISO/TC 268/SC 1**
- Smart community infrastructures
- ISO TR 37150
  - Smart community infrastructures -- Review of existing activities relevant to metrics technical status and performance indicators for community infrastructures

**Roadmap**
- Divided into 3 categories: size, structure and performance
- cover 17 domains: economy, education, energy, environment, etc.
- 39 summary indicators helpful for horizontal comparisons
- piloted by a number of cities

**ISO/IEC JTC1/WG11**
- Information technology — Smart City ICT Indicators

**ISO/TC 268**
- Sustainable cities

**ISO/IEC**
- Electrotechnical aspects of Smart Cities

**IEC SyC**
- Smart Cities

**IEC**
- Smart City Indicators — Electrotechnical aspects of Smart Cities
- Not yet set
China SmC Indicators as inputs to the IS developed by the 3 SDOs

Roadmap

Citizen beneficial service(s) L1
- E-government services L1P1
- Transportation services L1P2
- Pension services L1P3
- Health services L1P4
- Education services L1P5
- Employment services L1P6
- Internet plus services L1P7
- Services for disabled people L1P8
- E-commerce services L1P9

Precise governance L2
- City management L2P1
- Public safety L2P2

Livable environment L3
- Environmental protection L3P1
- Green energy and energy efficiency L3P2

Intelligent facility L4
- Wideband network Infrastructure L4P1
- Time-space geography platform L4P2

Information resources L5
- Sharing and openness L5P1
- Exploitation and usage L5P2

Cyber security L6
- Management of information security L6P1
- Systems and data security L6P2

Innovation L7
- Mechanism reform L7P1

Self selected indicators L9

ISO/IEC JTC1/WG11 WD 30146
Information technology— Smart City ICT Indicators
- ICT applications and services
- ICT infrastructure

IEC
Smart City Indicators — Electrotechnical aspects of Smart Cities
Formulation and Improvement Process of Indicators

Establishment of Indicators is a continuous cycle of improvement process.
Principles of Indicators Selection

Covering all the aspects with reasonable quantity

8 first tier indicators, 21 second tier indicators and 53 sub-second tier indicators

Leading the future development with easy assessment method

To assess the effectiveness of the SmC performance by the citizen’s satisfaction degree.
The indicators continuously included according to the degree of the maturity and readiness.

Scientific and reasonable

The weights are assigned according to the importance degree of the indicators.
Citizen oriented and performance oriented
Large proportion of performance indicators including citizen benefit and citizen experience
Principles of Indicators Selection

Subjective and quantifiable

Collect the corresponding data with a tool
Gain the degree of citizen satisfaction using the survey.

In line with International Standards

Compared with two main ISs:
KPIs of ITU-T/SG 20
ISO 37120:2014
China’s Perspective of Evaluation Indicators

The general framework of indicators in China

Roadmap
The indicators include objective indicators, subjective indicators and optional indicators (measured separately).

**Objective indicators**
Consist of 7 first-tier indicators: 3 productive indicators are citizen beneficial service(s), precise governance and ecological livable which reflect the effectiveness of smart city; 4 directional indicators are intelligent facility, information resources, cyber security, and reformation and innovation which discover cities with great potential for development.

**Subjective indicators**
Refers to “citizen experience questionnaire”, aims at emphasizing public satisfaction and social participation

**Optional indicators**
Refers to self established indicators issued by local government with the aim of reflecting local characteristics
Roadmap

National Smart City Evaluation 2016

To further summarize the experience and put forward the mission of constructing a number of new smart city demonstrations, which has proposed in “13th Five-Year plan”. “Notice on Carry Out the New Smart City Evaluation and Promote the Development of New Smart City "(hereinafter referred to as the “Notice") has been jointly issued by the National Development and Reform Commission, the Office of the Central Leading Group for Cyberspace Affairs and the Standardization Administration of the People's Republic of China (SAC).
National Evaluation 2016 Overview

Comprehensive representation
220+ cities out of 330+ prefecture-level cities have participated into the national evaluation project

Different Viewpoint
Data analysis in individual provinces and different economy areas

Development Inequality
# Case Study — Yichang of Hubei Province

<table>
<thead>
<tr>
<th>N</th>
<th>Second tier</th>
<th>Result</th>
<th>N</th>
<th>Second tier</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Administrative service(s) L1P1 (8%)</td>
<td>Outstanding</td>
<td>11</td>
<td>Public safety L2P2 (5%)</td>
<td>Good</td>
</tr>
<tr>
<td>2</td>
<td>Transportation service L1P2 (3%)</td>
<td>Outstanding</td>
<td>12</td>
<td>environmental protection L3P1(4%)</td>
<td>Outstanding</td>
</tr>
<tr>
<td>3</td>
<td>Pension service L1P3 (3%)</td>
<td>Inadequate</td>
<td>13</td>
<td>Green energy and energy efficiency L3P2 (4%)</td>
<td>Inadequate</td>
</tr>
<tr>
<td>4</td>
<td>Medical Service L1P4 (3%)</td>
<td>Inadequate</td>
<td>14</td>
<td>Broadband network Infrastructure L4P1(4%)</td>
<td>Required improvement</td>
</tr>
<tr>
<td>5</td>
<td>Education Service L1P5 (3%)</td>
<td>Outstanding</td>
<td>15</td>
<td>Time-Spatial information platform L4P2(3%)</td>
<td>Inadequate</td>
</tr>
<tr>
<td>6</td>
<td>Occupation service L1P6 (3%)</td>
<td>Good</td>
<td>16</td>
<td>Sharing and openness L5P1 (4%)</td>
<td>Inadequate</td>
</tr>
<tr>
<td>7</td>
<td>Municipal service L1P7 (7%)</td>
<td>Inadequate</td>
<td>17</td>
<td>Development and utilization L5P2 (3%)</td>
<td>Outstanding</td>
</tr>
<tr>
<td>8</td>
<td>Caring services L1P8 (5%)</td>
<td>Outstanding</td>
<td>18</td>
<td>Network security management L6P1 (4%)</td>
<td>Outstanding</td>
</tr>
<tr>
<td>9</td>
<td>Ee-commerce L1P9 (2%)</td>
<td>Inadequate</td>
<td>19</td>
<td>Security of system and data L6P2 (4%)</td>
<td>Required improvement</td>
</tr>
<tr>
<td>10</td>
<td>City management L2P1 (4%)</td>
<td>Inadequate</td>
<td>20</td>
<td>Mechanism reform L7P1 (4%)</td>
<td>Good</td>
</tr>
</tbody>
</table>
Thanks!

http://www.smcstd.cn