Utilizing Big Data to Solve Urban Issues: The Case of Seoul

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Seoul Urban Solutions Agency
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  - Case 3: Traffic Accidents Analysis for Transportation Vulnerables
Seoul: A City Old and New

Seoul’s journey from ruins in the 1950s to a smart metropolis

Population and Area Growth

Seoul’s Gross Regional Product

GPCI(Global Power City Index)
Seoul’s Growth Trajectory

Transformation of Seoul’s urban development

- **Urban foundation**: Roads and bridges, Subway system, Large scale housing compounds
- **Growing city**: Urban maintenance, Historic preservation, Strategic development, Metropolitan traffic system, Urban railway
- **Sustainable city**: Urban improvement, River rehabilitation, Public transportation, City resilience
- **Quality of life**: Stimulate urban growth, Social economy, Public culture, Disaster resilience
- **SMART city**: Communication with citizens, E-governance, Smart card traffic system
- **Globalization**: Hosting international events, City diplomacy

Source: seoulsolution.kr
# Seoul’s Growth Trajectory, cont’d

## Growth of the city

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Aftermath of the Korean War: Destruction of Seoul’s urban foundation and identity</td>
<td>Rapid post-war reconstruction to establish urban foundation</td>
<td>Expansion of city center to accommodate economic and population growth</td>
<td>Han river rejuvenation in preparation for global events – Seoul 1988 Olympics</td>
<td>Large scale urban regeneration project and new town developments</td>
<td>Installations of physical features to facilitate enhanced quality of life for Seoulites</td>
<td>Transforming to a city with a historical heritage, culture and identity</td>
</tr>
</tbody>
</table>

### Water Purification
- **1941:** Guui water center
- **1948:** Seoul Tap Water Bureau
  - Five water purification plants
  - Installation of tap water pipes
- **1981:** Office of water works established
- **1984:** Water pipes replaced
  - 1991: 100% water supply
- Six water purification plants

### Waste Water Management
- **Sewers 225km**
  - No treatment facilities
- **1976:** First Sewage Treatment Plant (Jungrang)
- **1972~1976:** 4 Septic Soil Sanitary Disposable Plants
  - **1987:** Han River Sewage Mgmt
- Four water reclamation centers
- Advanced treatment installed

### Solid Waste Management
- **Five dump sites**
  - (no designated landfills)
- **1978:** Nanji Landfill opened
  - 1992: Sudokwon Landfill opened
  - 1993: Nanji Landfill closed
  - 1996: First Resource Recovery C. opened
- Four R.R.C under operation

### Transportation
- **1965:** Express buses
- **1968:** Tram ops suspended
- **1974:** Subway line 1
  - **1984~5:** Subway lines 2~4
  - **1989:** Launched TSM
  - **1996:** Bus Card
  - 2004: Public Trans. Reform/BRT

### e-Government
- Computerization
  - Online connection
  - Network formation
  - Smart gov’t + city + society
Seoul as a Smart City: Developments

Seoul as a Smart City grew in line with Network expansion and ICT developments

- Build database
- Developed website
- Online civil complaint system
- Integrated government resources
- Expanded e-government service
- Started mobile service
- Open platform for public info
- Online participation
- Customized spatial service based on citizen needs
- Two-way citizen participation through SNS
- Smart decision-making and communication based on data
Smart City: Meaningful Connections

Leverage technology to serve its citizens and make cities more livable

Convenient Citizen Life

Efficient City Management

Transparent Governance

People

Information

Resources

Things

CONNECT

Network + ICT + Data Analytics
Making of Seoul as a Smart City

1. Understand my city upon Big Data
2. Efficient city management through ICT on infrastructure
3. Smart IoT connections that make the city more livable
4. Provision of platform to stimulate economic growth
5. Facilitate transparency and stimulate citizen participation
6. Intelligent policy making through Big Data Analysis

Citizen Life
City Admin

INCREASE
- Impact
- Efficiency
- Transparency
- Speed
Global Digital Seoul 2020 (SMG 2016)

Vision: New Connection, Different Experiences

Social City
11 Action Plans

Citizen Participation and Communication
- Citizen-led digital governance
- Strengthen citizen communication
- Align cooperation with private sector
- Vitalize public-private open data platform

Diginomics
6 Action Plans

Stimulate Economic Growth
- Vitalize start-ups and incubate ventures
- Digital economy integrated platform
- Converge digital with existing industries
- Support innovation start-ups utilizing Seoul’s big data

Digital Innovation
21 Action Plans

Improve Citizen Life thru Innovative Solution
- Solve urban challenges through digital solutions
- Enhance quality of life through digital technologies
- Recommend policy solutions based on in-depth data analysis

Global Digital Leader

Provide Exemplary Practices
- Early adoption of cutting-edge digital technology
- Build state-of-the-art digital infrastructure
- Build capacity to grow digital business
- Share experiences with the world
Efficient City Management

Smart ICT on Infrastructure

Smart City

Water

Infrastructure Technology

Information Technology

Transportation

Waste Management

e-Government
Connections that Make Cities More Livable

Connecting people, things and places thru concerted public-private efforts

City of Seoul
- Free public Wi-Fi
- CCTV cameras
- Multilingual contents & audio
- Open API for spatial information (Open platform for private sector to develop IoT solutions)

Private Sector
- Tourist solutions
- Resident solutions
- Community solutions

- Smart garbage bins
- Smart tourism
- Parking lot sharing
- Auto indoor temp. regulation
- Children location tracker
- Elderly care service
- Fire prevention
Seoul’s Big Data based Services

24 projects in 4 sectors (2013~2016)

**Transportation**
- Night bus optimal route analysis
- Taxi operation data analysis
- Optimization of local bus routes
- Analysis on road accident blackspots
- Analysis on parking problems
- Impact analysis on traffic signs
- Location analysis for Taxi station

**Welfare**
- Location analysis for life/job planning for retired people
- Location analysis for senior leisure and welfare center
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- Tuberculosis trait analysis
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**Economy**
- Local business district analysis service
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- Social data for crime investigation
- Shinchon Water Gun Festival
- Local festival analysis
- Tourist consumption pattern analysis

**Administration**
- Public Wi-Fi optimal location analysis
- Location analysis for E-Civil Service
- Gentrification Analysis
- Location analysis for city publicity

**Analysis Method**
- Location Analysis
- Demand Forecast
- Effect Analysis
- Unstructured Data Analysis
Seoul’s Policy using Big Data Analytics

BigData@Seoul 2016-2017

2’55”
Becoming “Smart” through Big Data

Collect ➔ Analyze ➔ Understand ➔ Problem Solving

### Issue Finding
Understand the issues, know what and where the problems lie.

- Select Data Pool
- Data Analysis
  - Issue 1
  - Issue 2
  - Issue 3...

Clear understanding of the problems

### Optimized Solutions
Evidence-based approach in generating optimized solutions.

- Select Data Pool
- Data Analysis
  - Fact 1
  - Fact 2
  - Fact 3...

Recommendations for Solutions
Big Data for Problem Solving

Demand based project identification and process of analysis

[ Capture Citizens’ Voice ]

“Ten Million Oasis Imagination”

Complaint Center

NPO Suggestions

*NPO: Non-profit organization

Project Selection

Relevant Data Search

Big Data Analysis

Draw Insights

Offer Policy Recommendation
Case 1: Night Owl Bus

Capturing and responding to the citizens’ demand through Big Data analysis

Late-night bus routes

Why Late-night bus?

“Buses don’t run by the time I get off work. I don’t have a car. I hope there will be buses available at late night...!!”

@gu****

Response of the City

Let’s set-up Late night bus routes

Facing Problems

1. Limited resources – bus, drivers, budget
2. Where are the passengers in mid-night?
3. Where do they want to go?

No public transportation in 01:00 AM ~ 05:00 AM

Subway   Bus   Taxi
Case 1: Night Owl Bus

Background and data used

**Background**
- Pilot Operation of Night Bus (‘13.4.~)
- Increased ridership
- Expansion of Night Bus Service
- Selection of 8 Routes
- Enhanced Usage of Bus Routes (demand data analysis)

**Data Used**

**Taxi Ride Information**
- Period: 1 week (3/18~3/24)
- Usage: 0.6~0.8M ride/day
- Origin of Ride
- Destination

**KT Floating Population Data**
- Period: 1 mo. (3/1~3/31)
- Usage: 100M call/day
- Mobile Base Station
- Phone call
- Destination

*O:Origin, D:Destination*
**Case 1: Night Owl Bus**

### Analysis methodology used

[ Primary Analysis of Demand based on Taxi Ride Information ]

<table>
<thead>
<tr>
<th>OBJECTID</th>
<th>hexagonID</th>
<th>DEMAND</th>
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<tbody>
<tr>
<td>1</td>
<td>391</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2756</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3962</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>3962</td>
<td>2</td>
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<td>5</td>
<td>5984</td>
<td>1</td>
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<td>6</td>
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<tr>
<td>7</td>
<td>4900</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>4909</td>
<td>1</td>
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<td>5202</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>5397</td>
<td>1</td>
</tr>
</tbody>
</table>

1. Taxi ride data by day of given week
2. Building layers based on taxi ride locations
3. Summarized statistics on number of taxi ride
4. Mapping on hexagon → Used as Predicted Demand

[ Adjustment of Route and Dispatch Timetables by Floating Population Pattern Analysis ]

- Floating Population Density Analysis
- Optimization of Routes based on Floating Population
- Adjustment of Dispatch Timetable based on Floating Population
Case 1: Night Owl Bus

Revised bus routes by reflecting results from big data analysis

Late night owl bus routes

Bus route changes thru big data analysis
Case 1: Night Owl Bus

**Results**

*For administration*
- Systematically capturing citizens’ needs and generating viable solution
- 10% increase of ridership without additional routes
- Covers 42% of Seoul residents

*For citizen’s benefit*
- (Enhancing customer satisfaction) 8.9% decrease in taxi refusing a passenger
- (More jobs and safety) 11% increase in women’s activities at night
- Ranked 1st among the top 10 Seoul news in 2013

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**Passengers**
- Average 9,883 persons/day (as of Dec. 2016)
- Student: 11.9%
- Chaffeur Service Driver: 23.5%
- Company Worker: 64.6%

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For who cannot find taxis due to limited no. of taxis
For Safe Trip back home for women
Case 2: Neighborhood (Golmok) Business District Analysis Service

Background & Data Used

- Increase of Subsistence Self-employed
- Demand for Golmok Business District Information
- Need for Market Stabilization through Market Change Outlook

Market-related Data

- Consumption Pattern
- Floating Population
- SNS Trend
- 200B data/yr

Provision of Market Info

- Start-up Risk Index
- Type of Business Index
- Sales Trend
- Competition Index
- Customer/Population Data
- Hinterland Information

Various Unit of Info

- Self-employed
- Policymaker
- Professional

My Store Area

Golmok/Central Business District

Administrative District
Case 2: Neighborhood (Golmok) Business District Analysis Service

Provides various indices such as store records, rent/lease price, degree of competition

- Business District Type: Semi-residential
- Business District Area: 20.103m²
- Business District Area: 38.311m²
- Selected Store Type: Restaurants > Korean
- Overcrowding Scale
- Business Activity Index
- Business Growth Index
- Business Stability Index

Floating Population by Time

<table>
<thead>
<tr>
<th>Time</th>
<th>00-06</th>
<th>06-11</th>
<th>11-14</th>
<th>14-17</th>
<th>17-21</th>
<th>21-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average # of peoples by month</td>
<td>328</td>
<td>338</td>
<td>435</td>
<td>767</td>
<td>749</td>
<td>293</td>
</tr>
</tbody>
</table>

Floating Population by Day of Week

<table>
<thead>
<tr>
<th>Day</th>
<th>Sun</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average # of peoples by month</td>
<td>440</td>
<td>3,234</td>
<td>3,302</td>
<td>3,962</td>
<td>3,091</td>
<td>3,510</td>
<td></td>
</tr>
</tbody>
</table>

Change in Floating Population

- Increasing/decreasing rate compared to previous month: 41.047
- Increasing/decreasing rate compared to previous month and same day: 40.471

Result

- Intuitively grasp start-up risk and district selection
- Existing self-employed can search potential customers
Case 3: Traffic Accidents Analysis for Transportation Vulnerable

Objective: Prevent traffic accidents of transportation vulnerable by finding accident patterns

Data Used:
- Traffic Accident History
- Traffic Safety Facilities
- Taxi DTG
- Car Speed
- Floating Pop
- Weather
- Bus Stop Location

Results:

Children

- Concentrated when commuting to/from school

- Sharp increase in number of accident in 1st Graders

- Child Pedestrian Traffic Accident by Age

Senior

- 65.4% of senior pedestrians result in serious injury or more

- Child and Teenager Pedestrian Traffic Accident by Time

- Senior Non-Senior Pedestrian Accident by Degree of Injury

- Sharp increase in 4 AM and 10 AM

- Senior Non-Senior Pedestrian Accident by Time
Case 3: Traffic Accidents Analysis for Transportation Vulnerable

Results

[ Derived Focal Area within Children Protection Zone ]

Children Traffic Accident

Speed bump

Frequent accident occurred where lacking speed bump
⇒ Need to install speed bump at blackspot

[ Designated additional Senior Zones ]

▲ Vicinity of Bulgwang Sta.
▲ Vicinity of Shin Shilim Market
▲ Vicinity of Cheongnyangni Sta.
▲ Vicinity of Wolgok Sta.

Current Senior Zone

Concentrated around welfare/senior centers

Additional Senior Zone

Centered around blackspot
Case 3: Traffic Accidents Analysis for Transportation Vulnerable

Initiated traffic safety policies for transportation vulnerables

- **Installed speed bumps for road safety**
  - Analyzed blackspots, traffic safety facilities for installation

- **Road safety training for lower grader**
  - Produced educational materials with video clips

- **Improved facilities around blackspots**
  - Installed barriers to prevent jaywalking
  - Installed Accessible Pedestrian Signal for pilot

- **Customized Training for Seniors**
  - Operated Participatory 3D Road Safety Training
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**Analysis Method**
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Sources of Big Data

Where do Big Data come from?

**Public Data**
- Free of charge
- Limited access and use due to legal binds

  - Data from central govt and affiliated agencies
  - Data from city’s IT systems
  - Data from city infrastructure (CCTVs, monitoring systems, transportation, etc.)
  - Data from outside non-profit organizations

**Private Sector Data**
- Limited sourcing
- High cost at times
- Data manipulation (privacy issues)
- Limited access and use due to legal binds

  - Mobile phone related data
  - Finance (credit card) data
  - Floating population, spatial data
  - SNS data, etc.
## Connections that Generate Data

*Seoul’s sample* illustration of data that are captured at various sources

<table>
<thead>
<tr>
<th>Category</th>
<th>Data Source</th>
<th>Types of Data</th>
<th>Usage</th>
</tr>
</thead>
</table>
| Solid Waste Management | Incineration facilities     | Volume and type of waste generated, waste composition, energy generated       | Efficient City Management  
- Resource forecasting and planning  
- Water/energy supply chain management  
- Disaster management  
- Early warning system Augment Policy Design  
- Changes in existing policies  
- Traffic light system rearrangements  
- Public transportation (re)routing New Policy Introduction  
- Based on enhanced understanding of pain points New, Convenient Citizen Applications  
- Mobile ITS services  
- Safer public spaces |
| Transportation      | TOPIS (ITS)                  | Public transport, fleets, traffic speed                                       |                                                                      |
|                     | CCTV                         | Traffic, parking violations                                                  |                                                                      |
|                     | Smart Card                   | No. of passengers, OD info., transfers, distance travelled                    |                                                                      |
| Water Management    | Water quality monitoring system | Source water quality, volume, substance                                       |                                                                      |
|                     | Water purification facilities | Water quality, volume, supply, production                                    |                                                                      |
|                     | Pipe leakage monitoring      | Leaking pipes by region                                                       |                                                                      |
| Energy              | Energy meter                 | Production, supply, consumption                                              |                                                                      |
| e-Government        | Voice of citizens            | Citizen needs, complaints, infrastructure issues                              |                                                                      |
Main Takeaways

What will ensure successful utilization of Big Data Analysis in your respective cities?

1. Big Data Analysis is not of and in itself a solution, rather it is…
   • A powerful mechanism to understanding the problem and
   • An intelligent way of generating solutions
   →Must have an objective to fulfill for data analysis

2. Need minimal data pool
   • Publically generated data
   • Access to private sector data

3. Understand the limitations in using the data
   • Legal and other institutional issues that may prevent from collecting new data and utilizing available data sets
Cases of Seoul’s big data based policy application to other cities

Seoul’s (via SUSA) knowledge transfer on Big Data Analysis

1. **Buenos Aires City**: Neighborhood (*Golmok*) Business District Analysis
   – For supporting and boom up old market and small merchants

2. **World Bank**: Production of Mobile based ITS Guidebook which includes “Seoul Night Owl Bus”
   – Mobile based ITS services for developing countries
   – Pilot Services

3. **Kiev City**: Big Data based Transportation System Improvement Project
   – Feasibility Study on building data based scientific decision making system
Smart Execution: Seoul Urban Solutions Agency

How we work – provide integrated solution

[Areas We Work In]

- Transportation
- Metro Rapid Transit
- Water Treatment
- Sewage Treatment
- Urban Planning and Housing
- Environment
- Waste Management
- e-Government
- Citizen Safety
- Disaster Prevention and Management

[Policy Solution + Business Solution]

- Public Sector Capabilities
- Business Solutions
- Increased quality of life for city dwellers

- City's urban development needs
- Integrated Solutions
  - Policy package
  - Hardware solutions
  - Software solutions
  - Expertise transfer

SEUL METROPOLITAN GOVERNMENT
How we work – SUSA as a agent in delivering the integrated solution

SUSA works as the agent that bridges various players with keen understanding of the role and stake each part has in accomplishing the mission.

Smart Execution: Seoul Urban Solutions Agency

Solutions that improve the quality of life for urban dwellers

International Organizations
Private Sectors
Affiliated Organizations
SMG
Foreign Governments & Agencies
Foreign Cities

Cooperation
G2G Network
Cooperation
Cooperation
Cooperation
Smart Execution: Seoul Urban Solutions Agency

Services SUSA is providing (Samples)

• **Study Visits**
  - India-Korea Smart City Knowledge Exchange (World Bank, September 2016)

• **Training Programs**
  - Establishment of Local Business District Analysis System Using Big Data (Buenos Aires, Argentina, January 2017)

• **Advisory and Consulting**
  - Production of Mobile-based ITS Guidebook for Developing Countries (World Bank, February 2017)
  - Intelligent Transport Systems and Public Transportation Systems Improvement in Kenya (KEXIM, August 2017)
  - Seoul’s Case on Sustainable Tourism Linking Urban Regeneration and Heritage Conservation for Local Economic Development (World Bank, February 2017)
Thank You

www.susa.or.kr