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SUSA
Seoul Urban Solutions Agency

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

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Seoul: A City Old and New

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

Population and Area Growth

Persons/km²   km²

Legend	
Area(km²)	Population Density(persons/km²)
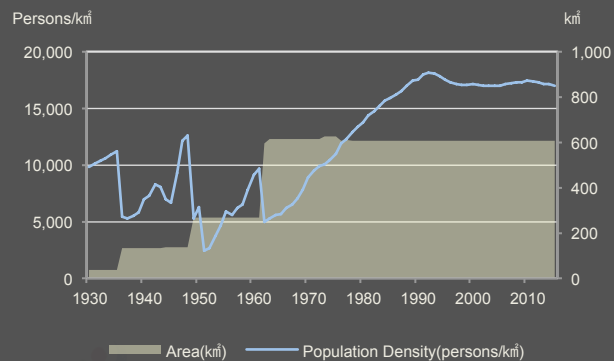
Seoul's Gross Regional Product

$36,693

GPCI(Global Power City Index)

2008 2009 2010 2011 2012 2013 2014

13th 12th 8th 7th 6th 6th **6th**

GPCI(Global Power City Index)

Transformation of Seoul's urban development

Source: seoulsolution.kr

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— GNI per capita [$]
— Population ('000)

4
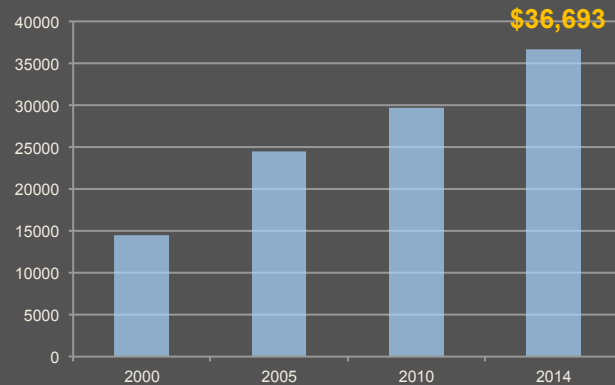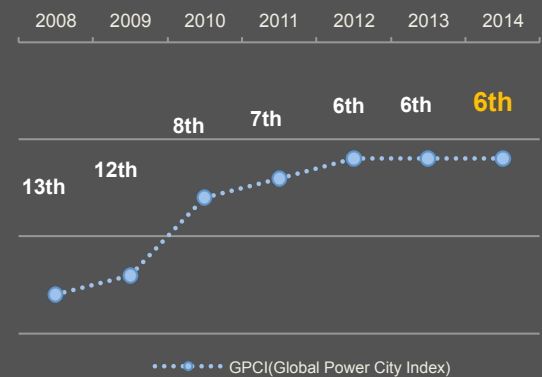
Seoul's Growth Trajectory, cont'd

Growth of the city

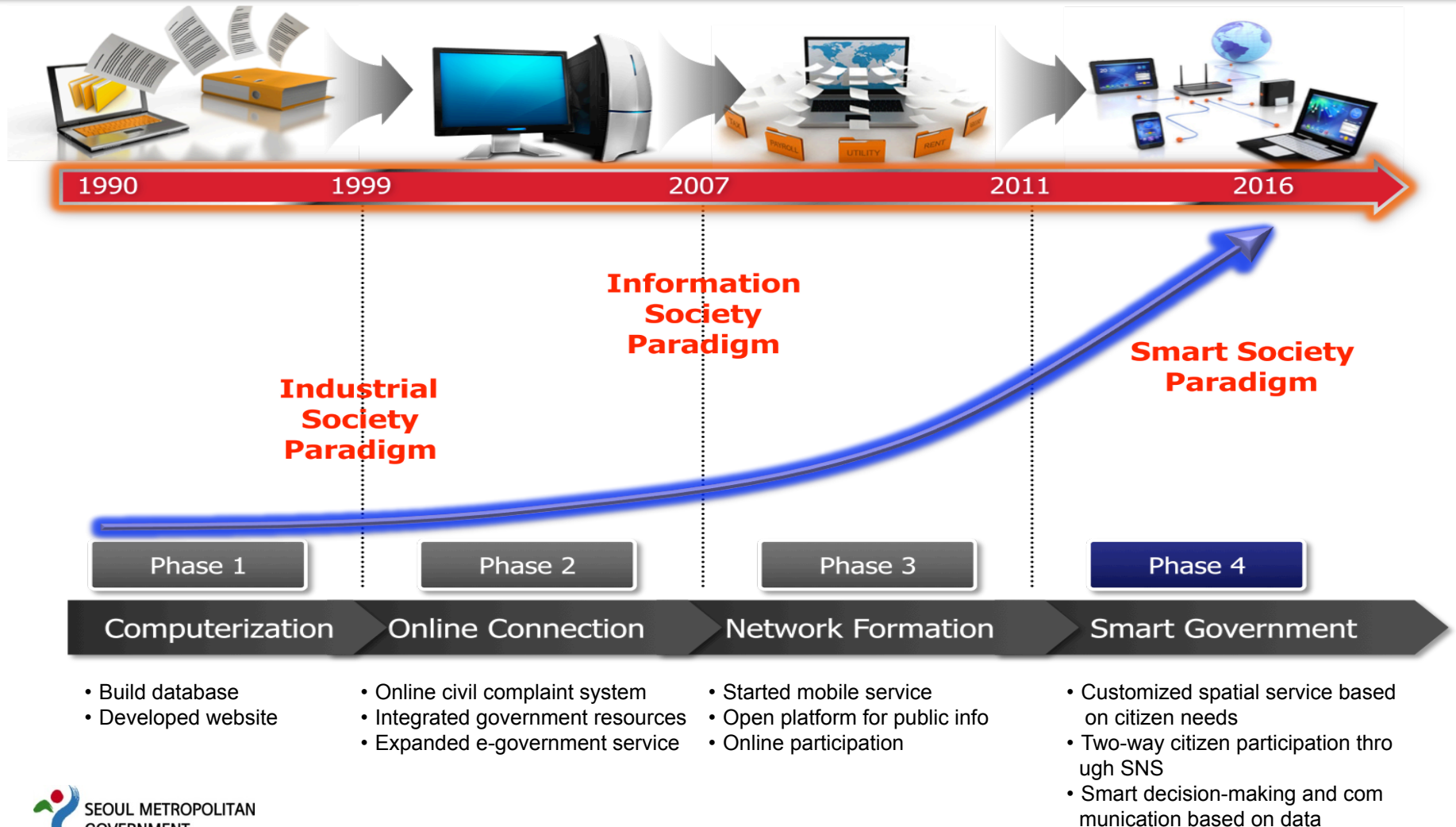|	1950-53 Korean War	1950	1960	1970	1988 Seoul Olympic	1990	2002 World Cup 000	2010
		Aftermath of the Korean War: Destruction of Seoul's urban foundation and identity	Rapid post-war reconstruction to establish urban foundation	Expansion of city center to accommodate economic and population growth	Han river rejuvenation in preparation for global events – Seoul 1988 Olympics	Large scale urban regeneration project and new town developments	Installations of physical features to facilitate enhanced quality of life for Seoulites	Transforming to a city with a historical heritage, culture and identity
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 govt' + city + society			

Seoul as a Smart City: Developments

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

| 1990 | 1999 | 2007 | 2011 | 2016 |

Information Society Paradigm

Smart Society Paradigm

Industrial Society Paradigm

| Phase 1 | Phase 2 | Phase 3 | Phase 4 |

| Computerization | Online Connection | Network Formation | Smart Government |

- 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

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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   **CONNECT**   Resources

Things

Network + ICT + Data Analytics

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Making of Seoul as a Smart City

1 Understand my city (Big Data Analysis)

2 Efficient city management (Smart ICT on infrastructure)

3 Connections that make the city more livable (i.e.: IoT Living Lab)

4 Data access and facilitate platform to stimulate economic growth

5 Optimized solutions through Big Data Analysis

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Becoming "Smart" through Big Data

Collect → Analyze → Understand → Problem Solving

Issue Finding

Understand the issues, know what and where the problems lie.

Data Pool

↓

Data Analysis

↓ ↓ ↓

Issue 1 | Issue 2 | Issue 3...

↓ ↓ ↓

Clear understanding
of the problems

Optimized Solutions

Evidence-based approach in generating optimized solutions.

Data Pool

↓

Data Analysis

↓ ↓ ↓

Fact 1 | Fact 2 | Fact 3...

↓ ↓ ↓

Recommendations
for Solutions

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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
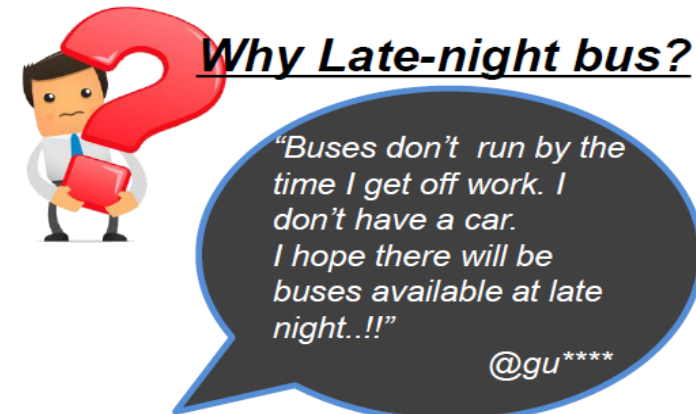
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Case 1: Night Owl Bus

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****

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

Subway   Bus   Taxi

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?

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Case 1: Night Owl Bus

Background and data used

Background

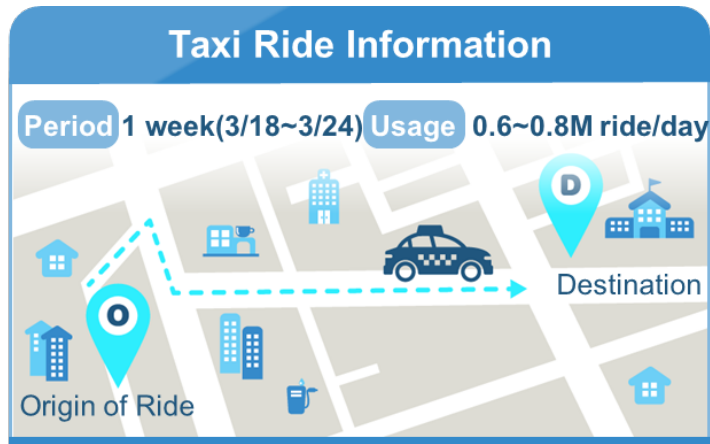**Pilot Operation of Night Bus ('13.4.~)** > **Increased ridership** > **Expansion of Night Bus Service** > **Selection of 8 Routes** > **Enhanced Usage of Bus Routes (demand data analysis)**

Data Used

Taxi Ride Information

Period: 1 week(3/18~3/24) Usage: 0.6~0.8M ride/day

Destination

Origin of Ride

*O:Origin, D:Destination)

KT Floating Population Data

Period: 1 mo. (3/1~3/31) Usage: 100M call/day

Mobile Base Station at phone call

Destination

*O:Origin, D:Destination)

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Case 1: Night Owl Bus

Analysis methodology used

[Primary Analysis of Demand based on Taxi Ride Information]

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
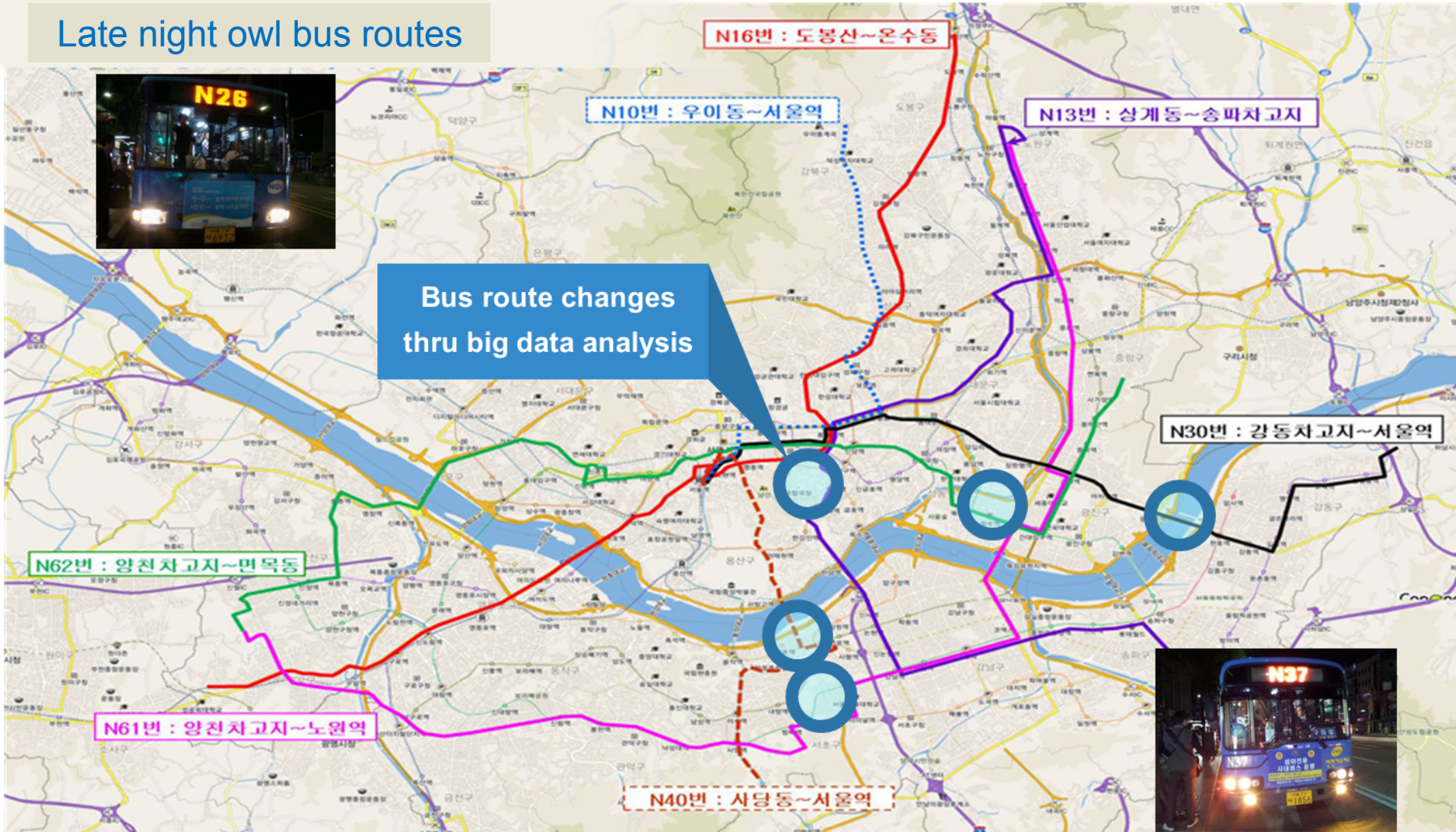

Adjustment of Dispatch Timetable based on Floating Population

Case 1: Night Owl Bus

Revised bus routes by reflecting results from big data analysis

Late night owl bus routes

N16번 : 도봉산~온수동

N10번 : 우이동~서울역

N13번 : 상계동~송파차고지

Bus route changes
thru big data analysis

N30번 : 강동차고지~서울역

N62번 : 양천차고지~면목동

N61번 : 양천차고지~노원역

N40번 : 사당동~서울역

Case 1: Night Owl Bus

Results
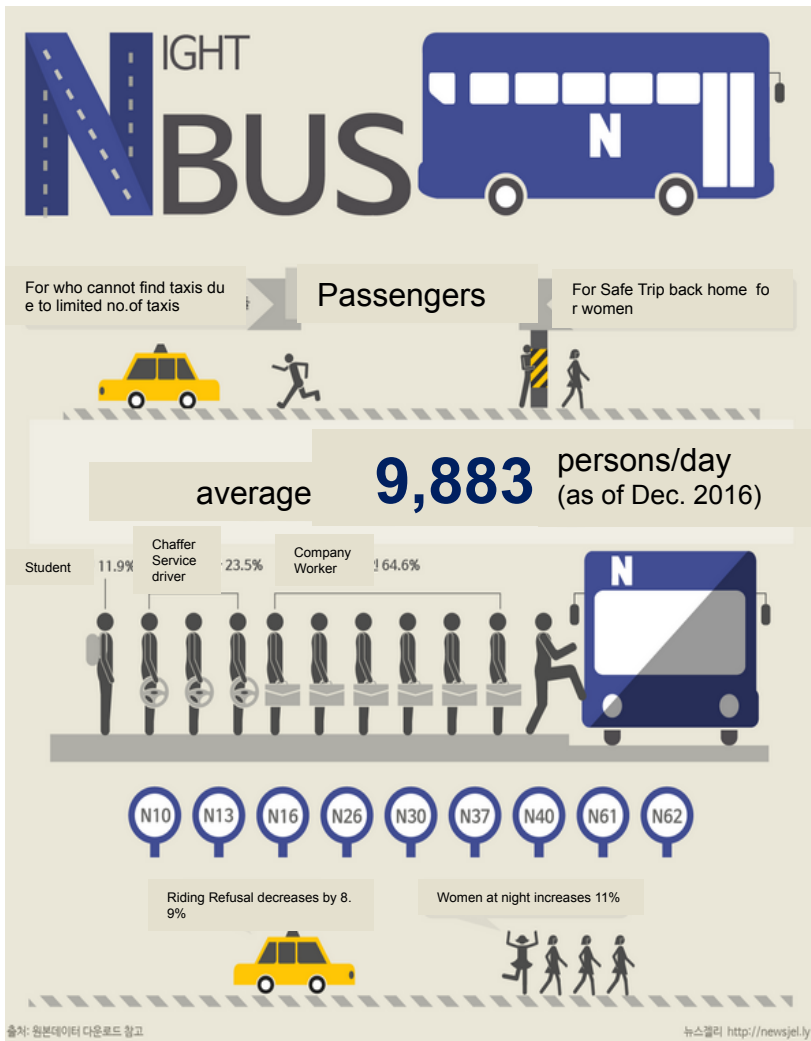
For administration
- ✓ Communication channel for conflict resolution
- ✓ 10% increase of ridership without additional routes
- ✓ Covers 42% of Seoul residents

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

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

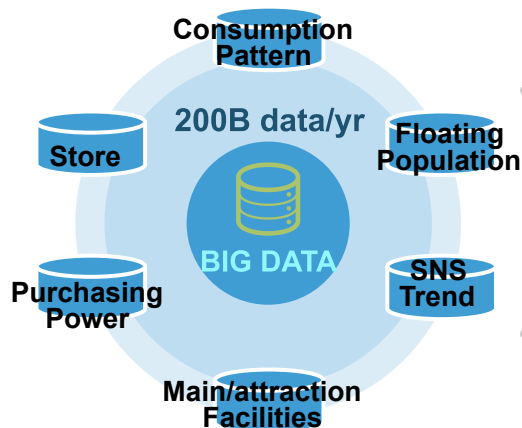## Background & Data Used

Increase of Subsistence Self-employed

Demand for Golmok Business District Information

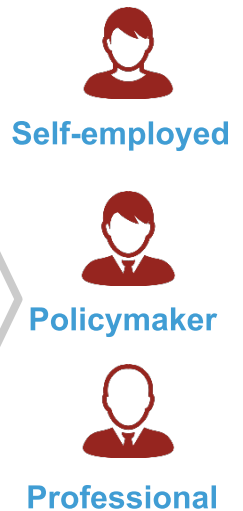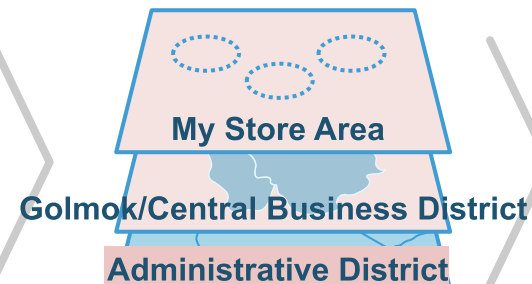**Need for Market Stabilization through Market Change Outlook**

Market-related Data

- Consumption Pattern
- Store
- 200B data/yr
- BIG DATA
- Floating Population
- Purchasing Power
- SNS Trend
- Main/attraction Facilities

Provision of Market Info

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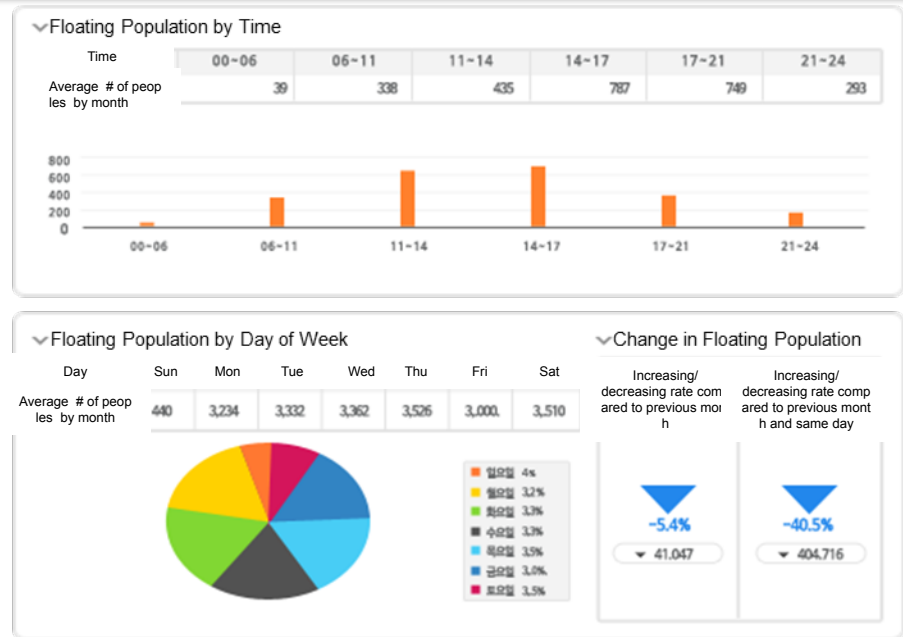- Competition Index
- Customer/Population Data
- Hinterland Information

Various Unit of Info

- My Store Area
- Golmok/Central Business District
- Administrative District

- Self-employed
- Policymaker
- Professional

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

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

Panel 1 (left)

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

Panel 2 (middle-left)

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

Floating Population by Time

Time	00~06	06~11	11~14	14~17	17~21	21~24
Average # of peoples by month	39	338	435	787	749	293

Floating Population by Day of Week

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Average # of peoples by month	440	3,234	3,332	3,362	3,526	3,000.	3,510

Pie chart legend:
- 일요일 4%
- 월요일 3.2%
- 화요일 3.3%
- 수요일 3.3%
- 목요일 3.5%
- 금요일 3.0%
- 토요일 3.5%

Change in Floating Population

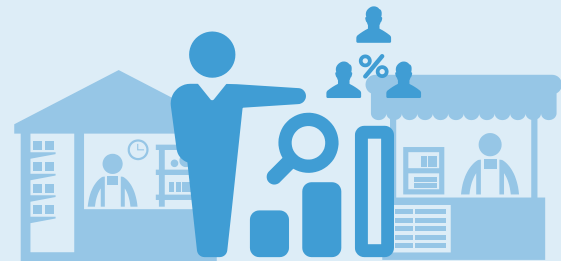| Increasing/decreasing rate compared to previous month	Increasing/decreasing rate compared to previous month and same day
-5.4%	-40.5%
▼ 41.047	▼ 404.716

Result

- Intuitively grasp start-up risk and district selection
- Existing self-employed can search potential customers

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
- Traffic accidents analysis for transportation vulnerable
- Tuberculosis trait analysis
- Operation of taxi service for disabled
- Analysis of moving range of disabled
- Location analysis for braille block
- Adjustment for free shuttle bus for transportation vulnerable

Economy

- Local business district analysis service
- Public Wi-Fi Locational Analysis
- 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**

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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.

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Connections that Generate Data

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

Category	Data Source	Types of Data	Usage
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	

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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

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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

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UN Sustainable Development Goals

How does big data analytics contribute in localizing SDG?

1 Data as a powerful tool to *localize SDG indicators* as well as *measure the progress* against the SDG indicators

2 *Getting closer to the goal* through application of big data analytics in policy-making and problem solving through understanding "As-is" and deriving "To-be" in any SDG

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Thank You

www.susa.or.kr