# Scientific Policy Making based on Data Analysis:

## DASAN Innovation, the Case of NamYangJu City in South Korea[1]

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The purpose of this paper is to introduce the success case of innovative policy making utilizing big data analytics in the city of NamYangJu (NYJ), Gyeonggi Province in South Korea, the one drawn by scientific analysis of data collected from the procedure of service delivery. This paper will first explain current status of NYJ and challenges to NYJ, followed by discussion on innovation and its implementation. After that, this paper will discuss difficulties faced during the implementation and the lessons learned as well as impact of innovation in terms of improvement of service delivery. This city's experience could be utilized in other settings around the world and the City of NYJ is willing to cooperate with other local cities for further improvement of public service delivery.

# Current Status of NYJ

The city of NYJ is located in suburban area of Seoul, the capital city of Korea, being famous for starting points of several express ways and good environment as well. The population of NYJ has been dramatically increased for last 10 years up to 700 thousands in 2016, and also 1million of population will be reached in next 5 years. Most of citizens moved from Seoul, the capital city of Korea very next to NYJ, and 50% of citizens are working in Seoul for their living. Naturally the problems of caring their kids and public transportation to work place have been common main topic requested by citizen.

Every morning in front of bus stop, almost of 60 thousand citizens are waiting for busy shuttle bus and subway for Seoul, especially for the financial street. The mayor of NYJ, SokWoo Lee, decided to face the common problems with innovative approach of data analytics, because he has tried to solve the problem with existing method of policy making, which is reportedly known as 'according to the voice of citizen', but no progress.

SW Lee also wants to cope with the problems in advance, earlier than citizens' request of making it.

## Key Numbers of NYJ

| Category | Amount | Unit |
|---|---|---|
| Number of Civil Officer | 1,700 | |
| Governing Area | 458 | Square Kilometer |
| Annual Budget in 2016 | 1 | Million US $ |
| Number of Service Delivery Office | 16 | |
| Number of Public Library (Number of books) | 12 (1,000,000) | |

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[1] This paper was prepared for delivery at the 2017 Annual Conference of the Asian Association for Public Administration (AAPA) in Astana, Kazakhstan on April 13-14, 2017.

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| Number of Population | 670,000 | As of December, 2016 |
| --- | --- | --- |

# Challenges to NYJ

**Different profile** by each region, in every which almost 100 thousand of citizens are living in small area in apartment complex, made the effectiveness of policy weak and mismatched. General level of service delivery could not meet the characteristics of each region, because age band, income level, occupation for living and expectation of culture are different from each other due to their difference in reference group and in the level of wealth.

**Communication with citizens by different group** are becoming more difficult with existing way of mayor's meeting day by day. It asks more scientific way of targeting and list up the agenda on the problems in advance which will be delivered by mayor in front of the citizens.

**Transportation to work place** has been raised as one of most requested services from citizens as the number of citizens moved from Seoul has grown. In fact, the department of Public Transportation of NYJ has not been supported with numbers which were scientifically measured between origin and destination. So the staff of the department could not help deciding the route of each shuttle bus by their insight without objective proof, such as, based on transaction data of smart card.

**Poor numbers of dashboard at the department of Job Matching** in charge of matching the unemployed citizens to a company that wants to hire employee bothers the staff figuring out the number of the jobless as well as one of employed. The staffs of the department have no choice but the passive way of service delivery that waiting for citizens' visiting and companies' registering rather than scientific report with data analysis of the jobless by demographic characteristics.

# What is Innovation

Definition of Innovation at Wikipedia is as follows;

**Innovation** can be defined simply as a "new idea, device, or method".

However, innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs. This is accomplished through more-effective products, processes, services, technologies, or business models that are readily available to markets, governments and society.

The term "innovation" can be defined as something original and more effective and, as a consequence, new, that "breaks into" the market or society. It is related to, but not the same as, invention.

**The innovation of NYJ** could be characterized into several categories according to SW Lee's key strategies of policy making.

1. The policy should be based on the data
2. The procedure of policy making must be transparent
3. The policy should be compassionate to citizens' expectation
4. The policy should be optimized to circumstances of each region

SW Lee's key strategies are deeply rooted in the Dasan Philosophy, originated by a Neo-Confucian Scholar, Yagyong Chong (1762 ~

實事求是
"Seeking the Truth from the Facts"

1836) who wrote many innovative books.[4]   Key message of Dasan Philosophy is "Wealthy and Strong Nation through Innovation and Openness", of which civil servants of today understand it as speculating the problem as is and suggesting the innovative direction of alternative.

<div align="center">Key Strategies of Policy Making at NYJ</div>

| Key Strategies | |
|---|---|
| 1 | The policy should be compassionate to citizens' expectation |
| 2 | The policy should be optimized to circumstances of each region |

And other characteristics of innovations are included as follows, which will satisfy scientific approach.
1. Collaboration with Central Government and Organization
2. Training the leaders of civil officers into scientific decision making

# How to implement?
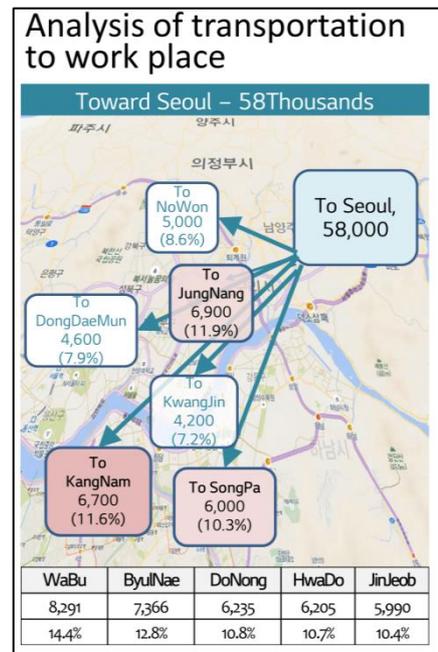
## Definition of common problems typically requested

- Categorizing various kinds of service requests into several area with the number of frequency by descending order
- Focusing on heavily repeated and commonly raised problems which have been called by citizens at same season
- Trying to extract common pattern from highly ranked category of service request

## Selecting the targets, "To cope effectively with common problems before the citizens' calls of service request"

- Not just academic research but for making practical output
- Not just for understanding and explaining the phenomena but for making it fixed effectively
- Prioritization by volume, quickly solved and small changes rather than existing ones such as easiness, impactfulness and importance
- Showing the case for the staffs to easily follow it

## Data Analytics

- To collect key data and merge them into a set for analysis
- Defining the final variables for analysis
- Finalizing the key numbers for dashboard and decision making
- Changing the way of policy making, "Based on Numbers"
- Training the staff for making them familiar to numbers and analytic procedure
- Leading "Big Data Curator" to be a leader in changing their way of policy making with numbers



Analysis of transportation to work place

Toward Seoul – 58Thousands

To Seoul, 58,000

To NoWon 5,000 (8.6%)

To JungNang 6,900 (11.9%)

To DongDaeMun 4,600 (7.9%)

To KwangJin 4,200 (7.2%)

To KangNam 6,700 (11.6%)

To SongPa 6,000 (10.3%)

| WaBu | ByulNae | DoNong | HwaDo | JinJeob |
|---|---|---|---|---|
| 8,291 | 7,366 | 6,235 | 6,205 | 5,990 |
| 14.4% | 12.8% | 10.8% | 10.7% | 10.4% |

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[4] '*Dasan*' is his pen-name meaning 'the mountain of tea. He was one of the greatest thinkers of the later Joseon period (1392~1897) and wrote highly influential books about philosophy, science and theories of government. His philosophical position is often identified with the *Silhak* (practical learning) school, and his concerns are better seen as explorations of Neo-Confucian themes.

**Planning the change to cope with in advance**
- Extracting the pattern from past records and enabling the staff to prepare the plan in advance
- Moving the staff from the field working to strategy for targeting
- Monitoring the performance once policy was changed
- From an obscure expression to concrete number of additional growth on their performance report
- Feedback to optimize the policy with following monitoring

# What strategies to adopt the way of innovative policy making?

### Suggesting the small changes with numbers against existing beliefs
Leading the staffs in charge of service delivery to easily accepting the suggested challenges might be difficult if it is recognized as large or wide one.   It is better to take small challenges into small changes than bigger one but failed if we expect making successful progress.

Helping the staff overcome their existing way of working with numbers at first stage of analysis even though it might be against their own beliefs will be more effective than any other approach.

### Listening carefully the staff's difficulties and alternatives for better service delivery
For making naïve philosophy of the staff's experience into practical one, it is necessary to listen carefully their stories and to summarize them into structured one.

The staffs who worked over10 years at local government must have experienced many kinds of cases in their own business of service delivery.   They already understood the solution for making problems fixed whatever the approach might be possible or not.

Ahead of data analysis, it is strongly recommended to take interview the staff and to catch their own alternatives for better service delivery.

### Making the staff an innovating star
Big Data Team of NYJ chose the strategy to move the service staff's position from passive one to innovative star with high performance evaluated by mayor.   If Big Data Team got good evaluation from mayor for the analysis itself, it might give the service staff uncomfortable feelings. Recommending the staff of service delivery to mayor as a rising star in service innovating might encourage other staffs to keep going on innovative service delivery.

Reporting the staff's initiatives prior to analytical outputs was taken by the team as a writing strategy when it was reported to mayor as a final document.

# Overcoming difficulties

### Making the staff motivated than just push
Traditionally, civil servants have been requested to cope immediately with increasing service request without analysis of data.   It made the staff responsive and passive than aggressive.   Citizens might feel the attitude of civil servants as very lazy and some hard whenever they feel the service delivery. From the civil servants' point of view, they have no choice but keep neutral view point whatever their answer is, because they have no numbers and policy based on data analysis.

However being supported with numbers and data can make the staff confident on their operation and setting right direction, though it might be resulted in small change.

## Writing the report with their easy language and numbers

Most of the analysis report is filled with numbers, jargons of statistics and predictive models rather than business insights and practical alternatives.   It makes civil servants and team leaders confused, and the purpose of analysis is lost.

Data analysis for changing the way of policy making on final report were transformed into suggesting alternatives for better practices.   The words and jargons on report were replaced with easy ones for staffs' quick understanding.   The analytic reports with numbers were generated by the every process of which the staffs took on.   Team leaders might catch the key insight for setting the direction from the report while the working staffs needed the analytic report filled with detail numbers by several kinds of variables to be combined.

## Easing their concerns on innovative policy making at moving forward

Many staffs of civil service delivery feel nervous when they try to change the way of service delivery for better performance.   It might be from lack of confidence in success of newly challenging.

As the data analysis and pilot test shows the scientific rationale, nervous attitude of staffs is becoming ease.   They feel that something concerned might not be happened as they understand the results of analysis.

## Putting the analytics after the staff as a scientific tool

If data analytics were a rising star in changing the way of work, the practical improvement in service delivery could not be possible at all.   The staffs who work at field should be highlighted and be supported as well as be prioritized, because they will change the procedure in the field.

# Lessons learned

### Numbers can change the way of policy making into scientific one

Long experiences of civil servants might build a kind of belief that A (cause) brings B (problem or discomfort) to citizens. If the belief has not been proved with data analysis, it might not be solved easily because the wrong premises were there.

With the numbers from data analysis, the staff's belief could be verified whatever it is proved as one right or not. Once existing believes were verified as right thing, then it could be applied as a principle for policy making at the point. But the existing ones were verified as wrong, and then it could be modified or replaced with right one proved.

### Persuading, Training and motivating the staff strategically

Motivating the staff into aggressive attitude must be more powerful than just training and persuading. For making them motivated, it is efficient to help them realize the power of data analysis and to demonstrate the meaningful outcomes when to apply it to the field.

Regardless of the degree of changes in the staffs' attitude, once he or she understands the rationale, then the session of training in analysis design and skill might be observed. Big Data Team of NYJ provided 2 times of training session every year, grouped by staff's age and grade. Group of similar staffs could feel each other easier than mixed with different age and grade when they are asked to solve the quiz together in small group.

Rather than persuading directly as an official order from mayor, discussing the topic altogether in training session might be a chance to be challenged by other point of view; scientific one. Though not skilled enough, everyone follows the guide to extract insights from data set as well as to design the plan scientifically. Even just following the coaching at training session can be a different input to the staffs who has had existing way of policy making. Very small and soft experience at training session could be a starting point of persuading for the staffs to change the way of policy making and service delivery.

### Pilot test for more completeness

Generally it might difficult to make perfect plan or strategy at first stage. NYJ chose the approach to take pilot project before making full plan and executing. Narrowly targeted topic but including essential components such as key common problems with considerable amount of data to analyze was established and hypothesis was set. While the team limited observation period, the list of data fields was collected in full range, because understanding of the structure of database could be a meaningful outcomes of pilot test.



Making it through pilot test, Big Data Team of NYJ interviewed the staffs several times who in charge of service delivery with selected topics. As the number of interview grows on, degree of understanding the business process is becoming more satisfactory as well as speculating the objectives and expected outcomes when to roll out as a main project.

Feeding the leaders who manage the staffs with information from data analysis could give another
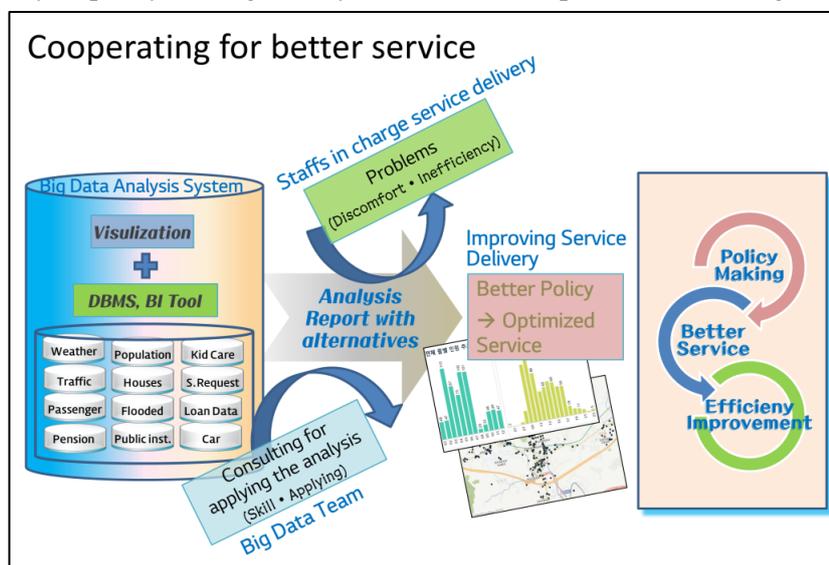
benefit to pilot test.    Being reported with limited numbers as pilot test goes, leaders are likely to feel final outcomes.    Once they convince the outcomes of pilot test, it will be easier to make progress and to cooperate with other departments.

Most valuable benefits of pilot test must be to be more complete for planning the main project.    Main project can be more powerful in generating outcomes and more practical in verifying the alternatives.

In case of Matching the jobless to job-openings, the team of NYJ executed a pilot project with limited conditions such as observation period, targeted region and selected alternatives.    The outcomes of pilot test were summarized and reported to mayor, and it was approved to roll out as main project with NPS (National Pension System) in 2016.    The completeness of the project was distinguished out of other projects at national contest of innovative data analysis, and won the bronze medal, which was number one out of local governments.

## With the big picture, by small stepping

Before dreaming the innovative change in service delivery, Big Data Team of NYJ considered the rationale and phased approached to final goal, so called 'Drawing the Big Picture'.

When to start drawing the big picture, it might be difficult to answer to the questions such as 'What are we looking for?', 'Why are we doing it?', 'How to make it?', 'Who will be in charge of which role?', 'What is timeline?', 'Which outcomes are expected?', 'What will be benefits if applied to the field?', 'What data can we collect from whom?', 'What is the design of data analysis?', 'Which data fields are consisted of it?' ,and so on.    But answering to those questions help the staff to make it clear with concrete planning.

After the making big picture though in draft, next step must be setting the first step.    The first step of acting the big plan must be small and soft one.    If it is beyond the capability of staff's skill and experience, it will be hard to keep going on next steps.    Instead of highly setting goal for first step but failed, accomplishing the first step in low level may give encourages to the staff to challenge next steps.    Following the time line which was structured step by step can lead the staff to final destination with successful learning curve.

# Impact of innovation: Improvement of Service Delivery

## Saved the cost of emergency work

Big Data Team of NYJ interviewed the team in charge of Planning the Safety against natural disaster such as flood and earth quake. As a result from several interviews, the team got some amount of disaster data recorded for several years from Y11 to Y15, and extracted the insight that houses were flooded only if the amount of rain falling exceeds certain level, a kind of threshold; 35mm per hour.

Director in charge of Safety and Organization of NYJ applied the findings to the rule of calling civil servant to work over night when Weather Forecast alarmed the flood.    After NYJ changed the policy of coping with flood alarming, NYJ might call civil servants to standby overnight only if the degree of rain falling per hour exceeds 35mm.
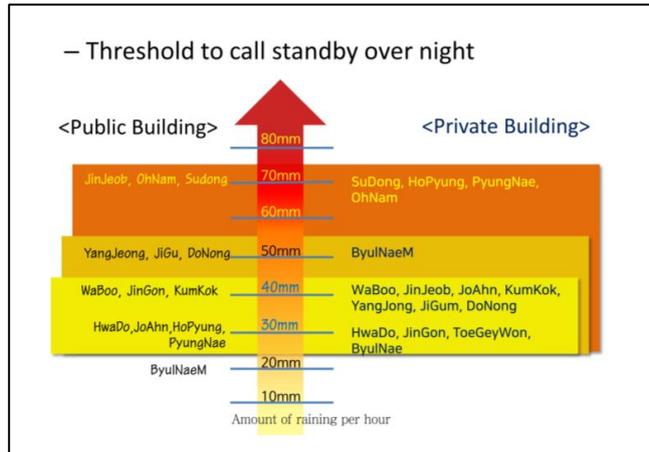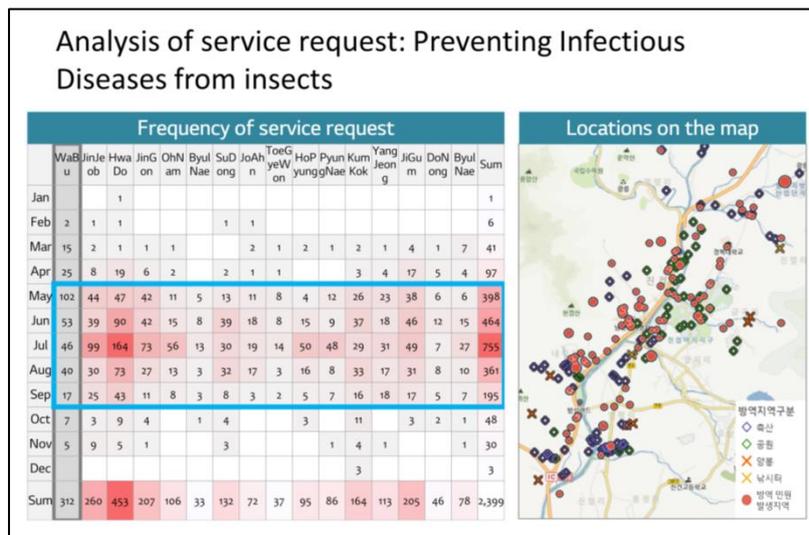
The local government of NYJ saved 200 million KRW(167 thousands US dollar) in 2016, which was unnecessary cost of overnight work, by adopting the outcomes of data analysis, and became confident the value of scientific policy making.

## Reduced number of service request typically raised

When it comes summer season every year, citizens are suffering from insects like a mosquito and small fly bug.    Citizens living near riverside or forest calls service center of NYJ to ask a kind of spraying insecticide especially when it is monsoon period.

Big Data Team interviewed the team in charge of taking preventive measure against infectious disease, and collected the data of calls from citizens for last several years with detail information including address, time of calling and spraying and so on.

Analyzing the data showed typical pattern of repeated service request in terms of heavily calling period as well as common area.    The teams cooperated to draw the calendar for preventing infectious disease from insects, and then the staff can easily find out targeted area in advance and allocate the resources as estimated.

### Analysis of service request: Preventing Infectious Diseases from insects

**Frequency of service request**

| | WaBu | JinJeob | HwaDo | JinGon | OhNam | ByulNae | SuDong | JoAhn | ToeGyeWon | HoPyung | PyungNae | KumKok | YangJeong | JiGum | DoNong | ByulNae | Sum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan | | | 1 | | | | | | | | | | | | | | 1 |
| Feb | 2 | 1 | 1 | | | 1 | 1 | | | | | | | | | | 6 |
| Mar | 15 | 2 | 1 | 1 | 1 | | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 1 | 7 | | 41 |
| Apr | 25 | 8 | 19 | 6 | 2 | | 2 | 1 | 1 | | 3 | 4 | 17 | 5 | 4 | | 97 |
| May | 102 | 44 | 47 | 42 | 11 | 5 | 13 | 11 | 8 | 4 | 12 | 26 | 23 | 38 | 6 | 6 | 398 |
| Jun | 53 | 39 | 90 | 42 | 15 | 8 | 39 | 18 | 8 | 15 | 9 | 37 | 18 | 46 | 12 | 15 | 464 |
| Jul | 46 | 99 | 164 | 73 | 56 | 13 | 30 | 19 | 14 | 50 | 48 | 29 | 31 | 49 | 7 | 7 | 755 |
| Aug | 40 | 30 | 73 | 27 | 13 | 3 | 32 | 17 | 3 | 16 | 8 | 33 | 17 | 31 | 8 | 10 | 361 |
| Sep | 17 | 25 | 43 | 11 | 8 | 3 | 8 | 3 | 2 | 5 | 7 | 16 | 18 | 17 | 5 | 7 | 195 |
| Oct | 7 | 3 | 9 | 4 | | 1 | 4 | | 3 | | | 3 | 2 | 1 | | | 48 |
| Nov | 5 | 9 | 5 | 1 | | | 3 | | | 1 | 4 | 1 | | | 1 | | 30 |
| Dec | | | | | | | | 3 | | | | | | | | | 3 |
| Sum | 312 | 260 | 453 | 207 | 106 | 33 | 132 | 72 | 37 | 95 | 86 | 164 | 113 | 205 | 46 | 78 | 2,399 |

Locations on the map

Policy and planning in advance would reduce the amount of suffering to citizens, needless to say the number of service request from citizens.    Expected amount of reduction in terms of service request from citizens for this year comparing last year is 15%.

## Improvement of efficiency in operating

City of NamYangJu (NYJ) has authority to approve the house-building in the area of NYJ.   The process of approving by civil officer can be very complex and the citizen's time spending might be varied as the number of legal reviews increased.   Spending long time for approving is mainly caused by current structure of government information system and partly caused by the way of staffs' work.

SW Lee, mayor of NYJ, built an application system in 2016, 'Smart Work Navigation', for improving the efficiency in approving the house-building which links all kinds of governmental systems into single one, and the staff in charge of deciding the approval can easily review different regulations with just a few clicks and cooperate immediately with related departments if it needs wide range of reviews and approvals respectively.

Smart Work Navigation was designed through a number of interviews with tens of departments in charge of approval and regulation-review, through the analysis of log data.   The findings from analysis of log data which was recorded as the staff made progress in approval procedure suggested that one of main cause of delayed service was repeated process of cooperating with related department and its slow progress of official approval even though all cooperation was finished.
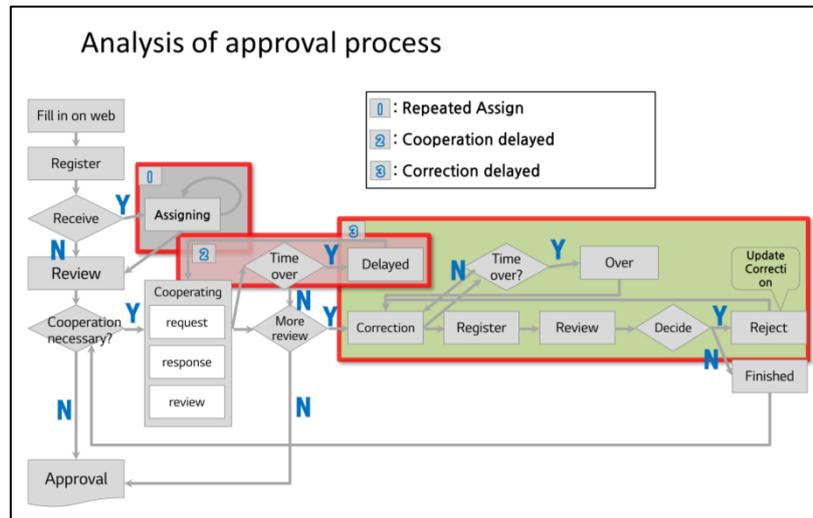


According to the analysis report, the number of days citizens have to wait for getting approval varies from 10 to 40, average one is 21 days.   SW Lee, mayor of NYJ, expects the staff to make efficiency in approval process as much as 15% comparing to existing way of operating by each delivery service office.

This success of innovation at local government of NYJ was highly evaluated by central government last year, and the application system, called Smart Work Navigation, will be recommended as a standard model of innovative delivery service for other local governments.

## Optimizing the service delivery to every different profile by each region

With the report of analyzing and profiling the citizens of each region, in which 70 thousands to 100 thousands of citizens live, the heads of service delivery offices could figure out the characteristics such as income level, kind of job, family type, number of senior, demand of kid care, transportation to work place, etc., by each micro area such as each apartment building.



Every head officers of 8 regional service delivery offices as well as mayor can optimize the service delivery according to the profile by micro level according to suggested information.   Same policy over all
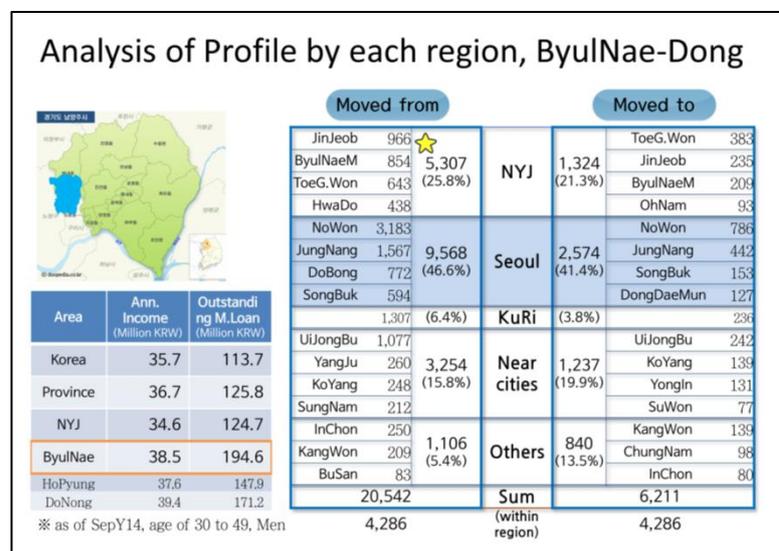
regions are not any more in NYJ but the one optimized respectively to circumstances of each region, that is final fruit of innovative service delivery which is rooted in scientific analysis of data.

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