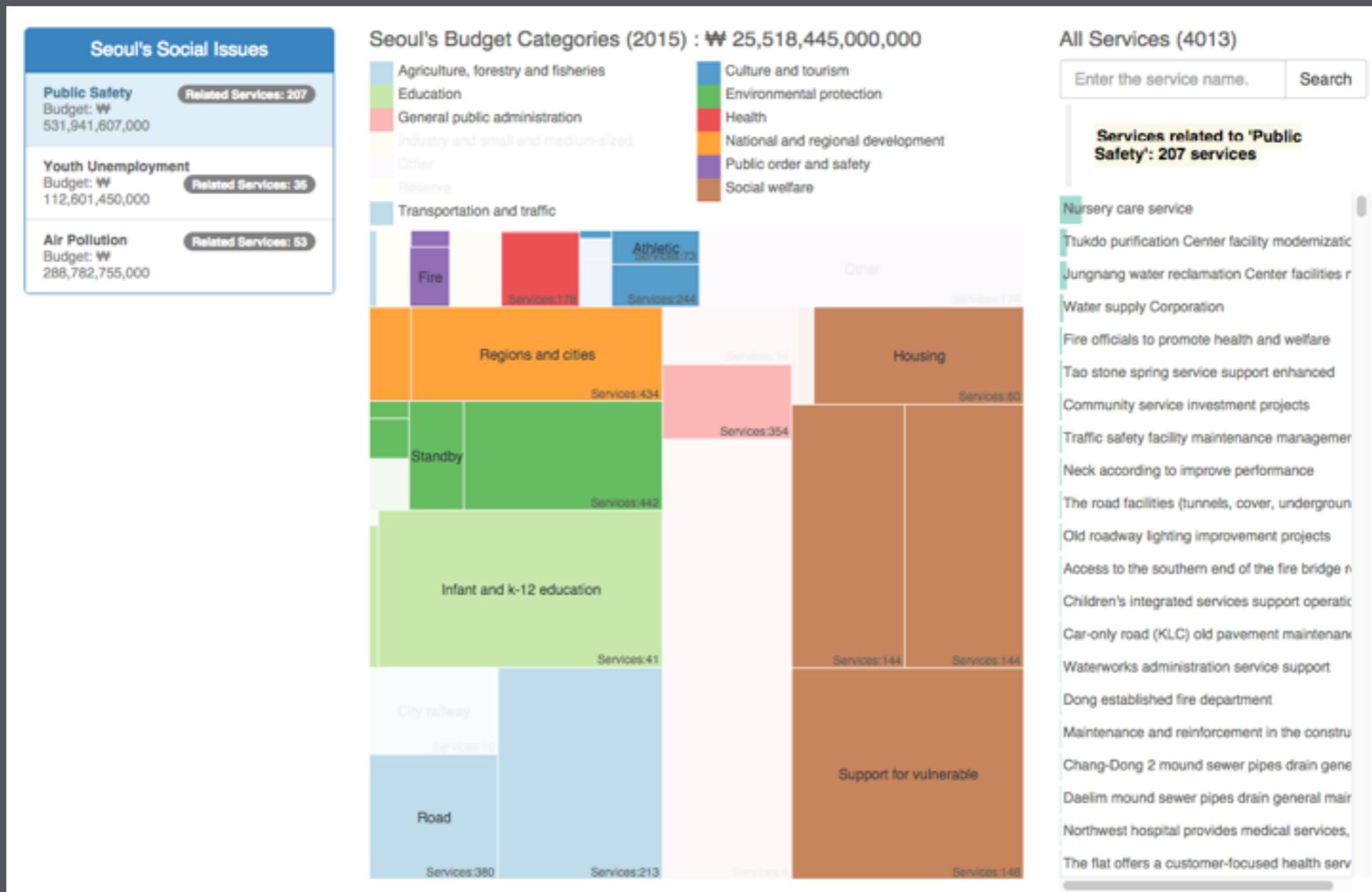


# BudgetMap:

## Engaging Taxpayers in the Issue-Driven Classification of a Government Budget



# BudgetMap:

Engaging Taxpayers in the Issue-Driven  
Classification of a Government Budget



**Nam Wook Kim**  
Harvard



**Jonghyuk Jung**  
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**Changwon Lee**  
KAIST



**Juho Kim**  
Stanford &  
KAIST



**Jihee Kim**  
KAIST

# Sewol Ferry Disaster

Apr 16, 2014,

**294** out of **476** people **died**





**325** of the passengers were secondary school **students** on a field trip.

# Public safety

**Citizens** became **suspicious** about where the **government** spends their **taxes**.





Programs related to the issue are **spread out** across various budget categories

*“The traditional budget classification system is mainly designed for **administrative efficiency.**”*

— A former congressman

# Open Government

*Simply opening up more budget information to the public may not be sufficient.*

Supporting  
the **navigation** of  
a government **budget**  
through **social issues**

Supporting  
the **navigation** of  
a government **budget**  
through **social issues**

---

A **social problem or conflict**  
raised by a society.

from Wikipedia

# Supporting the **navigation** of a government **budget** through **social issues**

- Use **the language of the public**
- Reflect timely **public interests**

# Challenge

How can we **classify budget data** using **social issues**?

# Challenge

How can we **classify budget data** using **social issues**?

- **Huge** amount of budget **data**
- Constantly **changing** social **issues**

# Challenge

How can we **classify budget data** using **social issues**?

- **Huge** amount of budget **data**
- Constantly **changing** social **issues**



**Unsustainable for a government** to handle this problem every time a new issue arises.

# Challenge

How can we **classify budget data** using **social issues**?

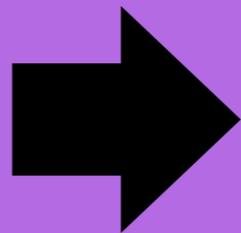
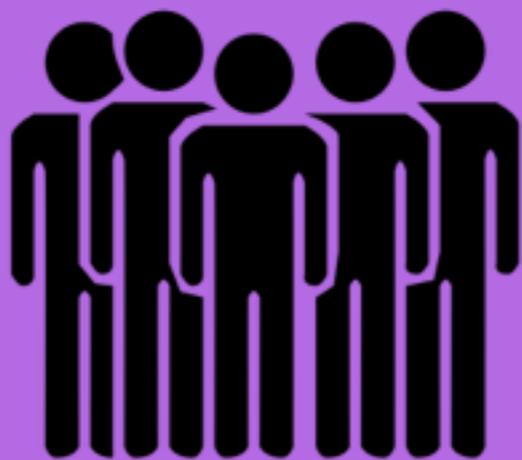
- **Huge** amount of budget **data**
- Constantly **changing** social **issues**

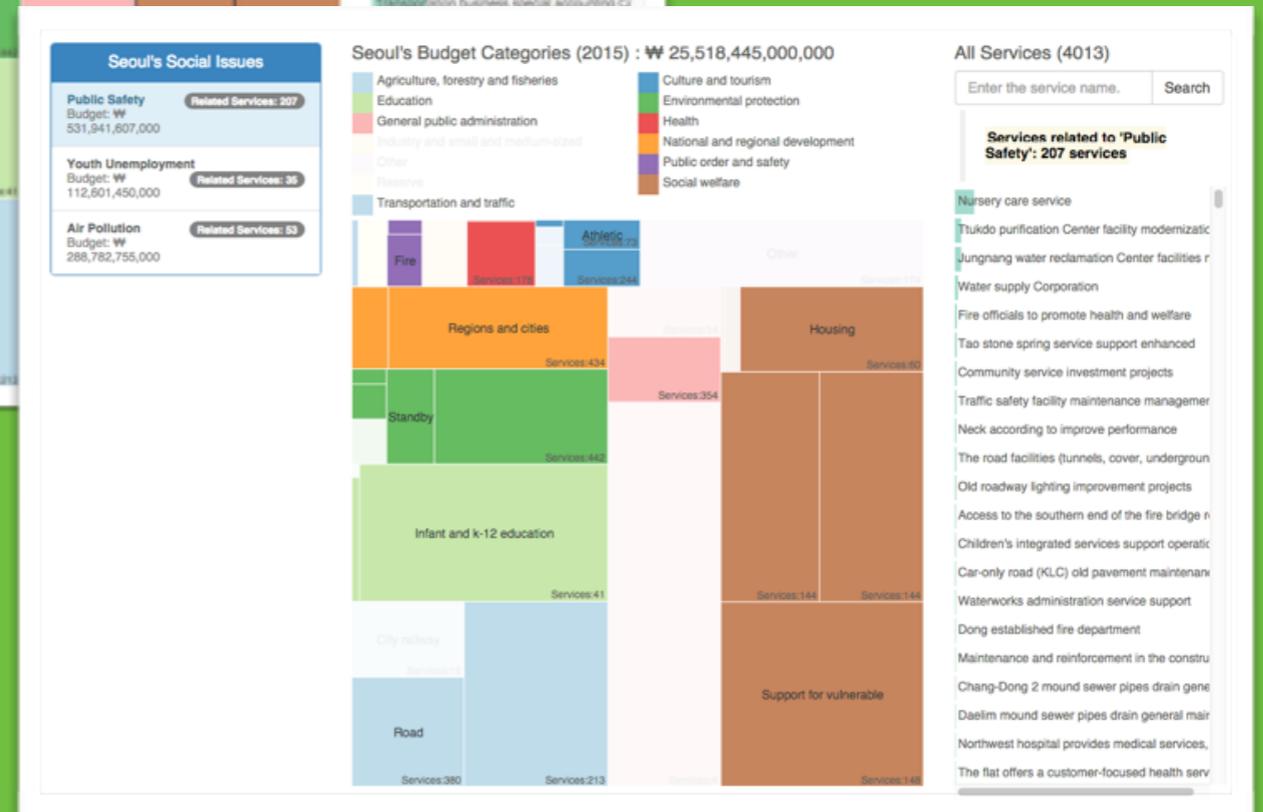
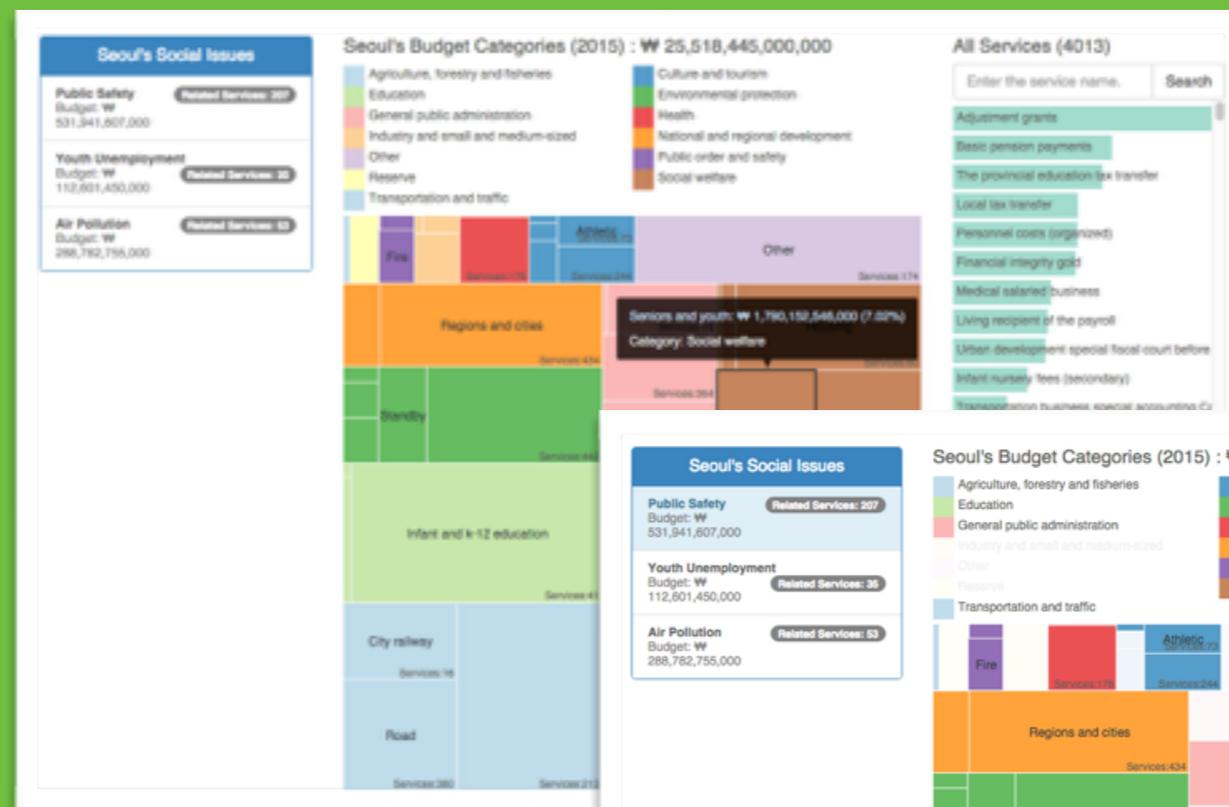


Automated solution may not be able to understand **nuances in social issues**.

# Citizensourcing + Tagging

To turn to **taxpayers**  
to **classify** budget **programs**  
with **social issues**.





# BudgetMap

Solicits taxpayers to identify **issue-budget tags** and facilitates **visual exploration** of the tagged budget data



# Budget Data from the City of **Seoul**

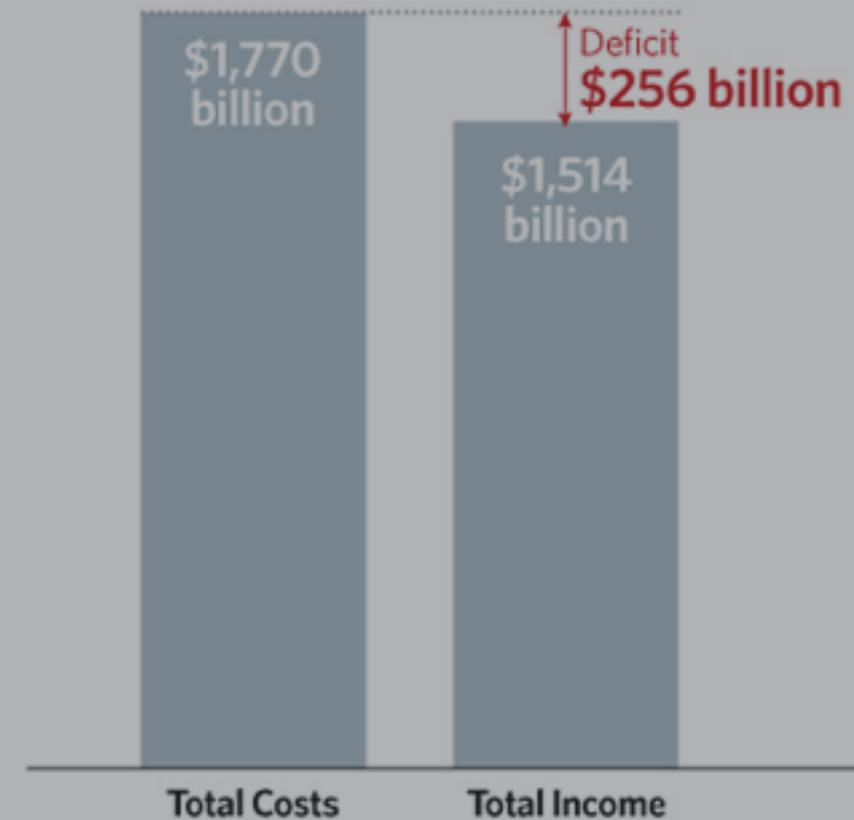
Budget **spending** and  
Budget **categories** for  
**4013 programs** in 2015

**Program** is  
a unit of operating  
**budget** for a set of  
services.

CHART 2

### Disability Insurance Program Faces \$256 Billion Shortfall Over Next 10 Years

FIGURES FOR 2015-2024



**Source:** Social Security Administration, *2015 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds*, July 22, 2015, <http://www.socialsecurity.gov/OACT/TR/2015/index.html> (accessed July 22, 2015).



# Budget Data Model





# BudgetMap Tagging Interface

Experiment Guide

**Start Issue Tagging**

Browse Tags by Issues

My Profile

**Logout**

**Your Rank: 124**  
(Top ranked user tagged:  
12522)

## "Public Safety"

Find Related/Unrelated Budget Programs.

For instance, if you think "Fire Department Vehicle Maintenance" program is related to "Public Safety", click "Related". It is also important to find "Unrelated" programs in order to aggregate total budget for an issue. Your contribution is calculated based on the number of programs you tagged.

Social Welfare > Vulnerable Group Support > Support for Disabled > Support for Local Disabled Community

**Homecare Support for Disabled Women** **≈ \$0.85M**

Related  Unclear  Unrelated

Environmental Protection > Water Supply Sewage > Sewerage Management > Sewage Pipe Line Repair

**Mok-dong & Sinjeong-dong Sewage Pipe Line Maintenance.** **≈ \$1.50K**

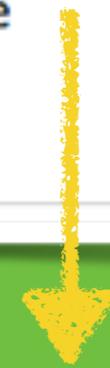
Related  Unclear  Unrelated

# BudgetMap Tagging Interface

The screenshot shows the BudgetMap Tagging Interface. On the left is a sidebar with the following elements: 'Experiment Guide', 'Start Issue Tagging' (highlighted), 'Browse Tags by Issues', 'My Profile', a 'Logout' button, and a 'Your Rank: 124' badge with the text '(Top ranked user tagged: 12522)'. The main content area features a blue header for the selected issue, '"Public Safety"', with the sub-header 'Find Related/Unrelated Budget Programs.'. Below this is a grey text box explaining the tagging process: 'For instance, if you think "Fire Department Vehicle Maintenance" is related to "Public Safety", click "Related" to find "Unrelated" programs in order to aggregate total budget for an issue. Your contribution is calculated based on the number of programs you tagged.' The main content area then displays a list of budget programs. The first program is 'Social Welfare > Vulnerable Group Support > Support for Disabled > Support for Local Disabled Community' with the title 'Homecare Support for Disabled Women' and a budget of '≈ \$0.85M'. It has three radio buttons: 'Related' (selected), 'Unclear', and 'Unrelated'. The second program is 'Environmental Protection > Water Supply Sewage > Sewerage Management > Sewage Pipe Line Repair' with the title 'Mok-dong & Sinjeong-dong Sewage Pipe Line Maintenance.' and a budget of '≈ \$1.50K'. It also has three radio buttons: 'Related', 'Unclear', and 'Unrelated'. A yellow arrow points from the bottom of the second program towards the text 'and the list goes on'.

Explore randomly selected budget programs

and the list goes on



# Majority Voting

**Issue**

Public Safety



**Program**

Special Rescue  
Team Operation

# Majority Voting

Issue

Public Safety



Program

Special Rescue  
Team Operation

## Related if

'Related' Tags



10 people



'Unrelated' Tags



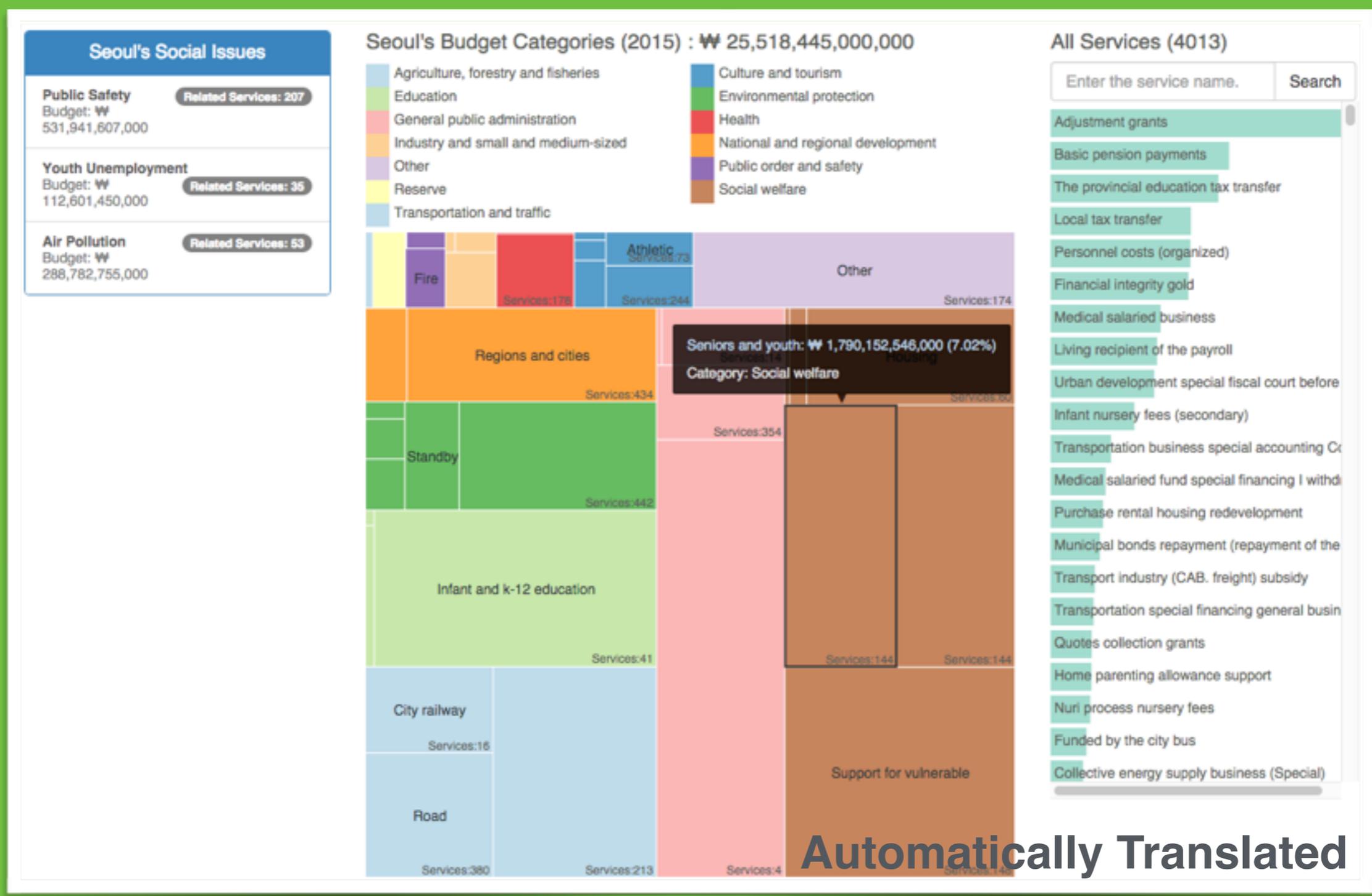
5 people



Threshold (x)

e.g., x=3

# BudgetMap Visualization



Automatically Translated

# BudgetMap Visualization

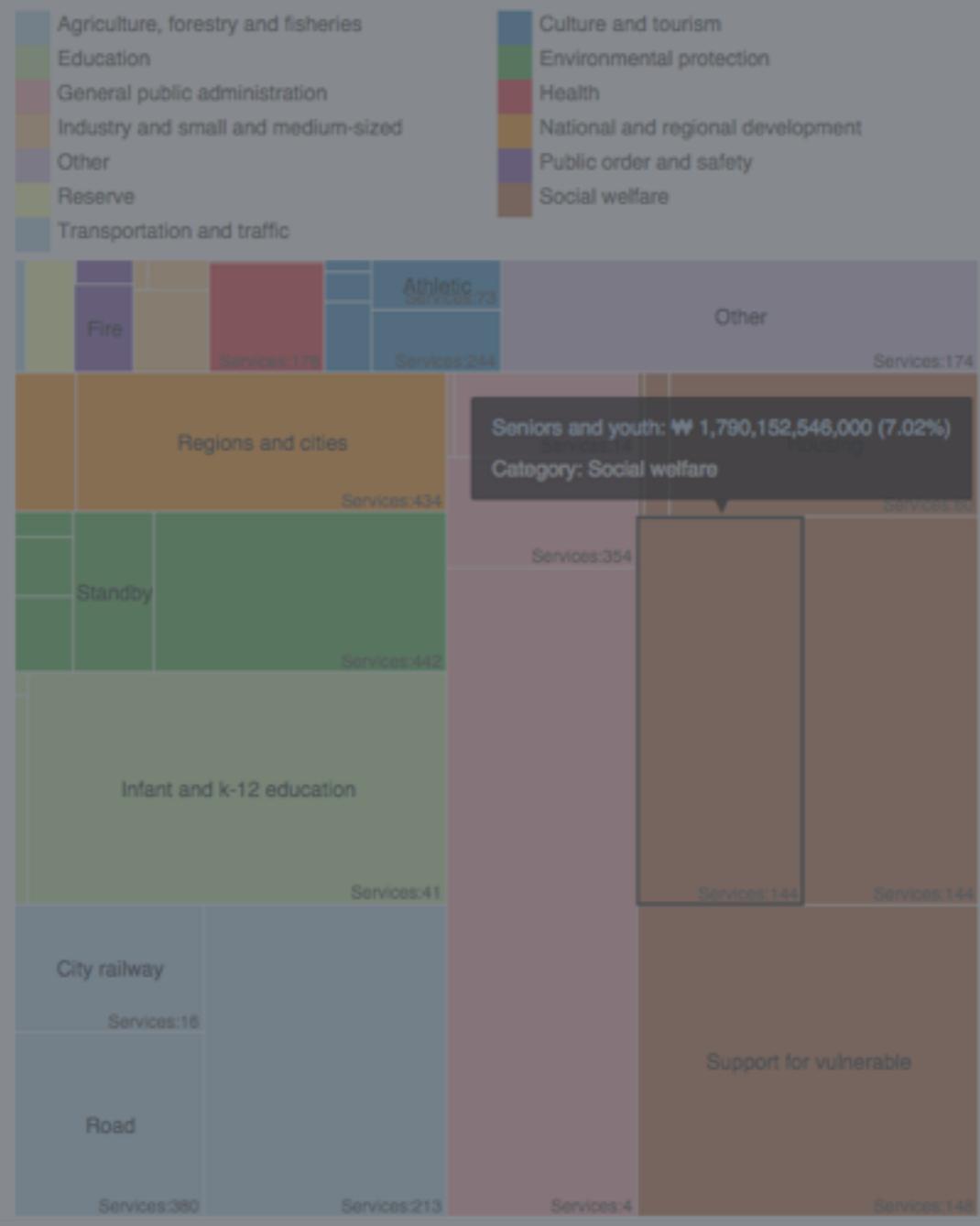
**Seoul's Social Issues**

<b>Public Safety</b> Budget: ₩ 531,941,607,000	<b>Related Services: 207</b>
<b>Youth Unemployment</b> Budget: ₩ 112,601,450,000	<b>Related Services: 35</b>
<b>Air Pollution</b> Budget: ₩ 288,782,755,000	<b>Related Services: 53</b>



**Social Issues**

Seoul's Budget Categories (2015) : ₩ 25,518,445,000,000

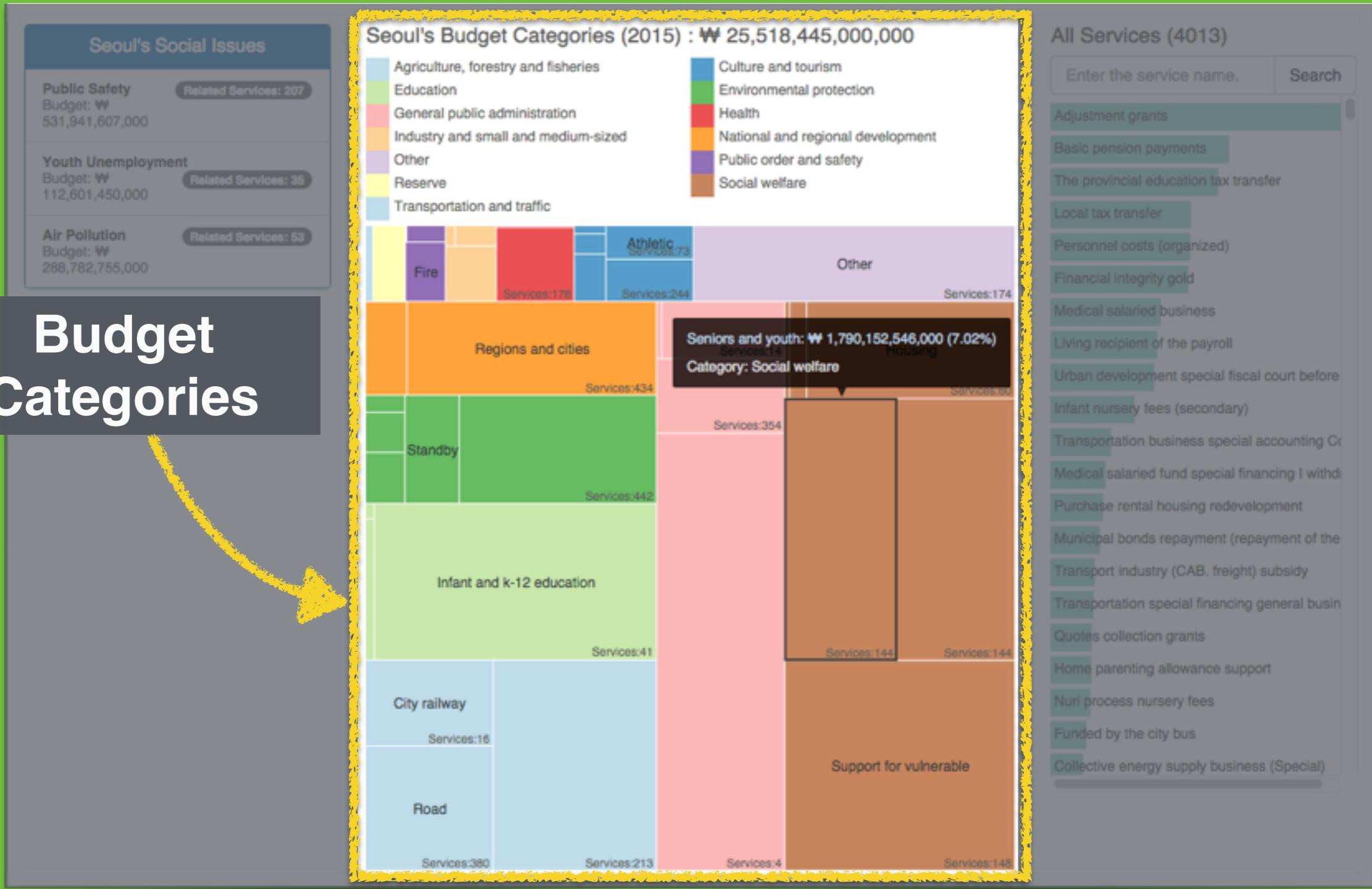


All Services (4013)

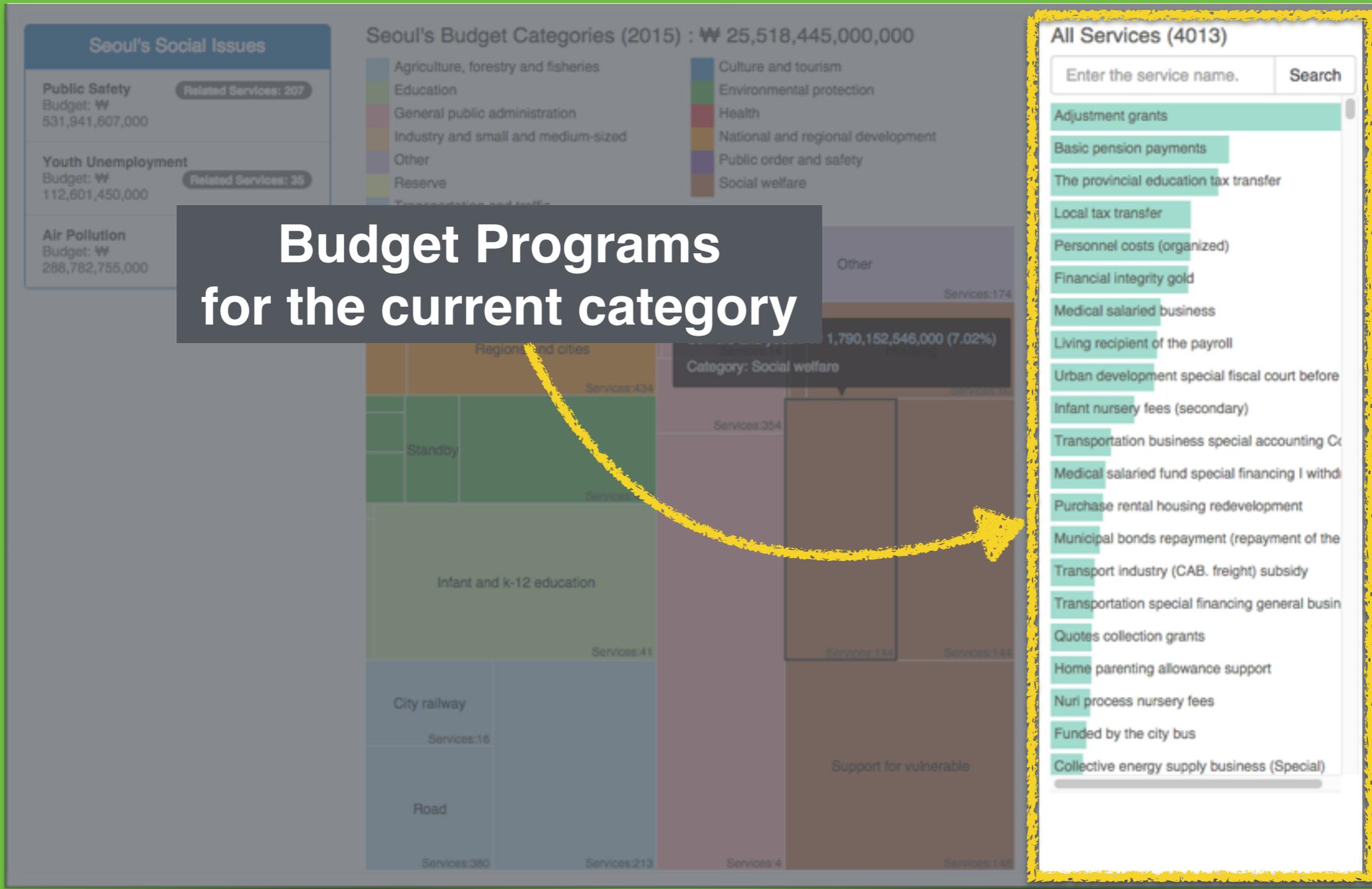
- Enter the service name. Search
- Adjustment grants
  - Basic pension payments
  - The provincial education tax transfer
  - Local tax transfer
  - Personnel costs (organized)
  - Financial integrity gold
  - Medical salaried business
  - Living recipient of the payroll
  - Urban development special fiscal court before
  - Infant nursery fees (secondary)
  - Transportation business special accounting Co
  - Medical salaried fund special financing I withd
  - Purchase rental housing redevelopment
  - Municipal bonds repayment (repayment of the
  - Transport industry (CAB. freight) subsidy
  - Transportation special financing general busin
  - Quotes collection grants
  - Home parenting allowance support
  - Nuri process nursery fees
  - Funded by the city bus
  - Collective energy supply business (Special)

# BudgetMap Visualization

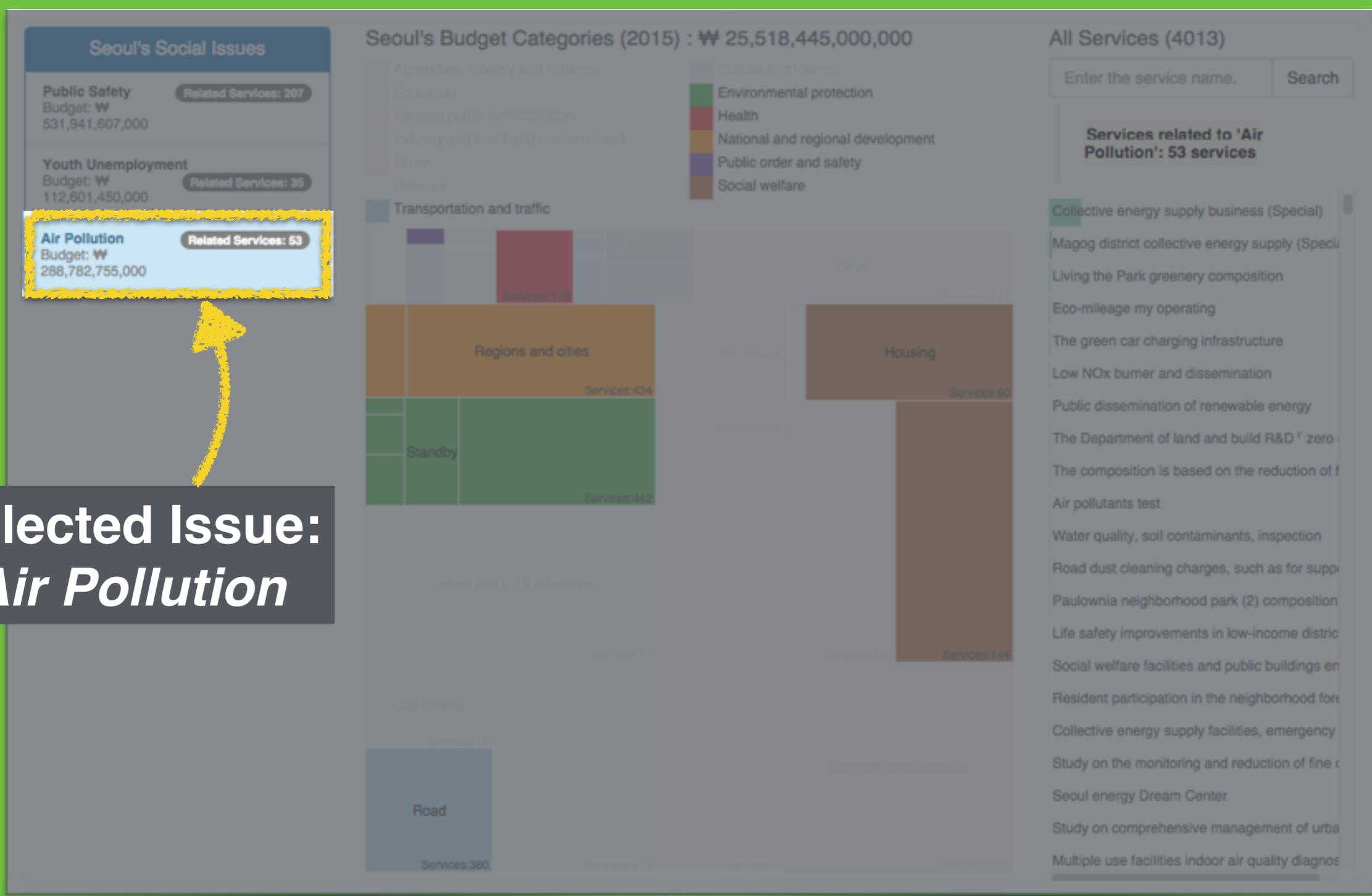
**Budget Categories**



# BudgetMap Visualization



# BudgetMap Visualization



**Selected Issue:**  
*Air Pollution*

# BudgetMap Visualization

**Budget programs related to *Air Pollution***

Seoul's Budget Categories (2015) : ₩ 25,518,445,000,000

All Services (4013)

Enter the service name. Search

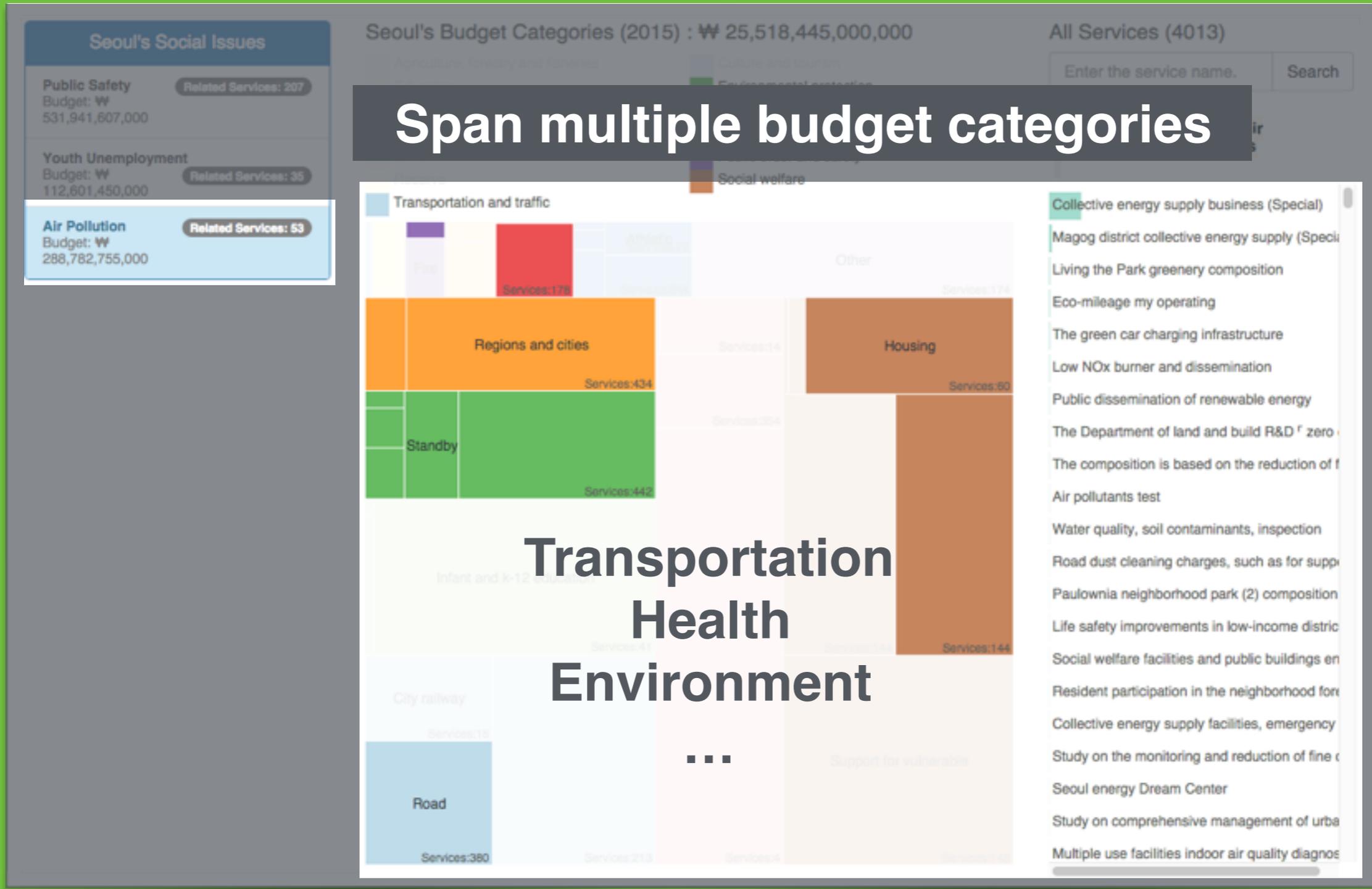
Services related to 'Air Pollution': 53 services

- Agriculture, forestry and fisheries
- Education
- General public administration
- Industry and small and medium-sized enterprises
- Other
- Culture and tourism
- Environmental protection
- Health
- National and regional development
- Public order and safety
- Quality of life

**Air Pollution**  
Budget: ₩ 288,782,755,000  
Related Services: 53



# BudgetMap Visualization



# Evaluation

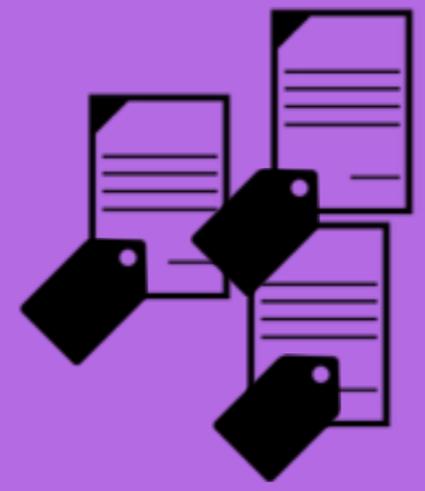
**Tagging results** and  
**perception changes** after  
tagging tasks

# Evaluation: Procedure

**Pre-task  
Survey**



**Tagging  
Task**



**Post-task  
Survey**

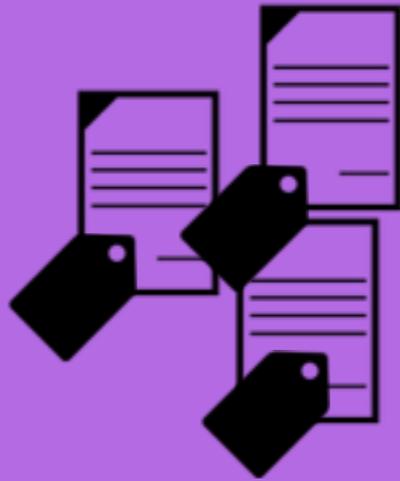


# Evaluation: Procedure

**Pre-task  
Survey**



**Tagging  
Task**



**Post-task  
Survey**



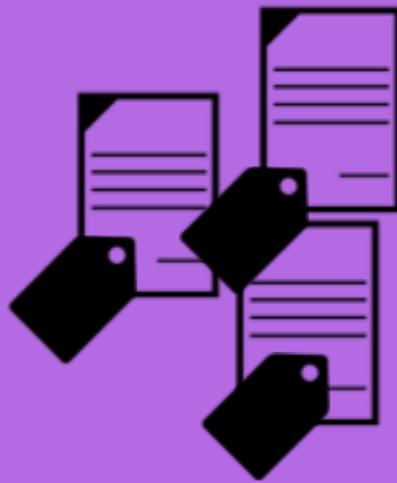
**+ Interviews with budget experts**

# Evaluation: Procedure

**Pre-task  
Survey**



**Tagging  
Task**



**Post-task  
Survey**



**+ Interviews with budget experts**

**Paid for participation**

# Evaluation: Procedure

**Pre-task  
Survey**



**Tagging  
Task**



**Post-task  
Survey**



**Informedness & perspective** on  
the city's budget.

# Evaluation: Procedure

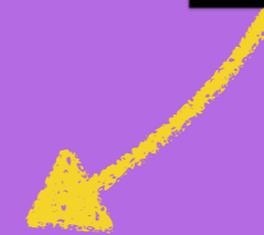
Pre-task  
Survey



Tagging  
Task



Post-task  
Survey

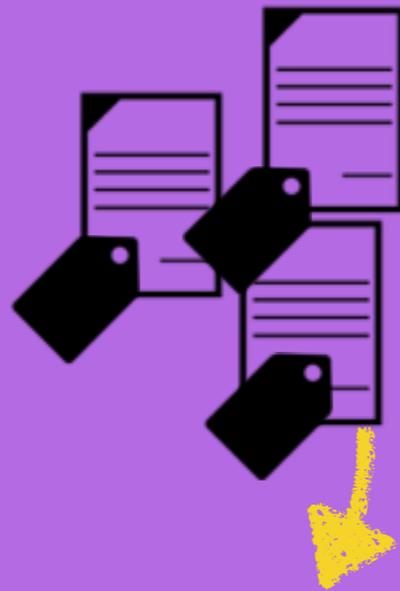


**Changes in informedness & perspective**  
on the city's budget.

Pre-task  
Survey



Tagging  
Task



Post-task  
Survey



Tagging budget programs with:  
1) ***public safety***, 2) ***air pollution***, and  
3) ***youth unemployment***.

## Evaluation: Tag Results

**104 citizens** participated through online communities & social media, generated **730 tags per participant.**

## Evaluation: Tag Results

**104 citizens** participated through online communities & social media, generated **730 tags per participant.**

Compared with a **reference solution** constructed by 3 budget experts

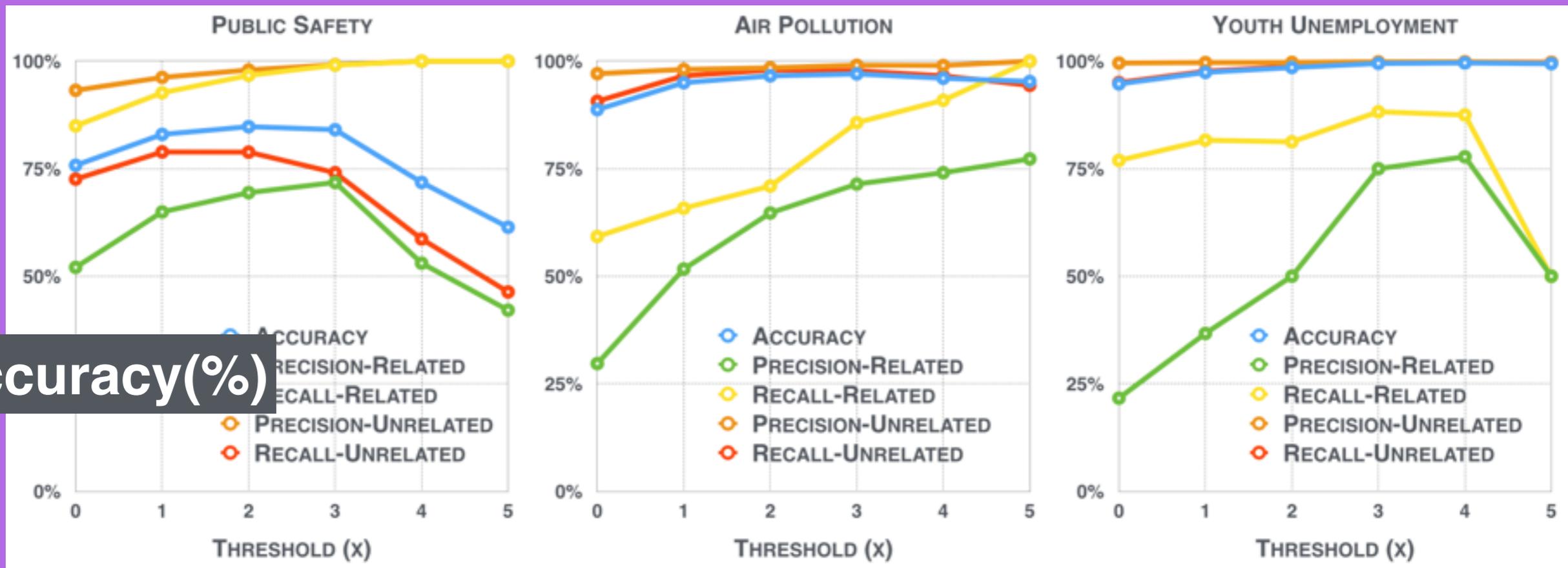
# Evaluation: Tag Results

Evaluated by varying the **threshold (x)** in the **majority voting** formula:

'Related' Tags > 'Unrelated' Tags + threshold (x)

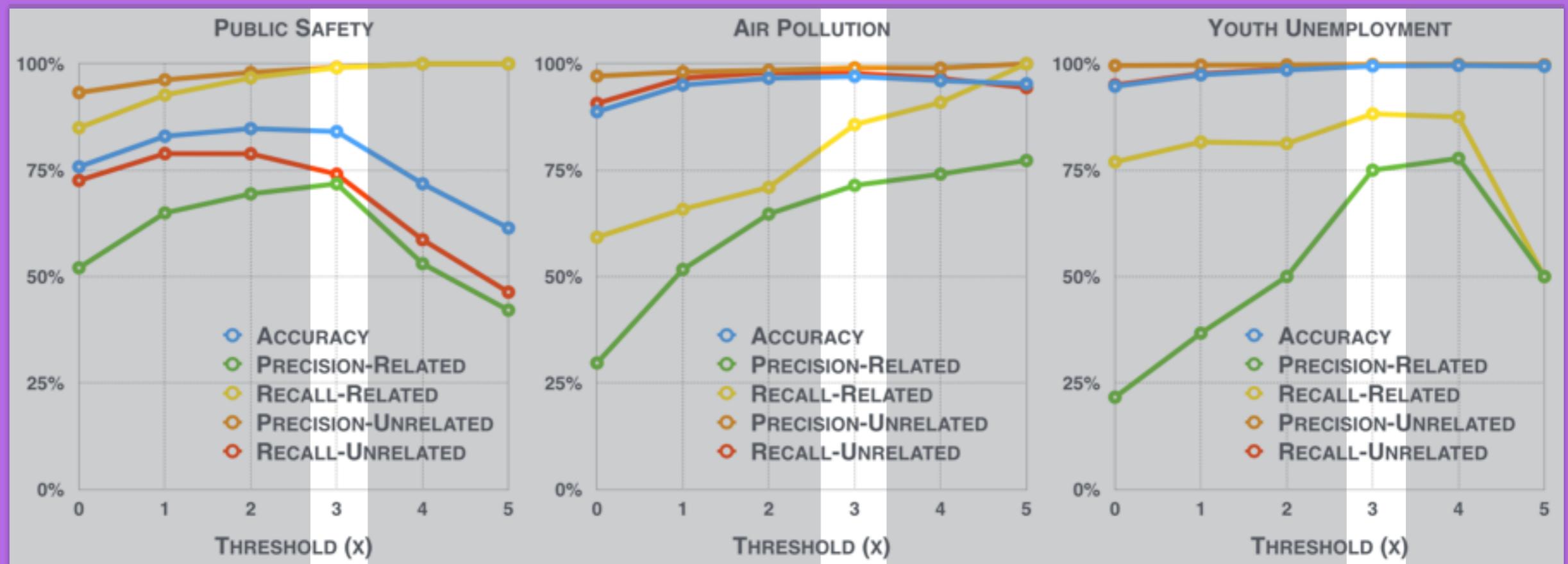
accuracy(%)

threshold(x)

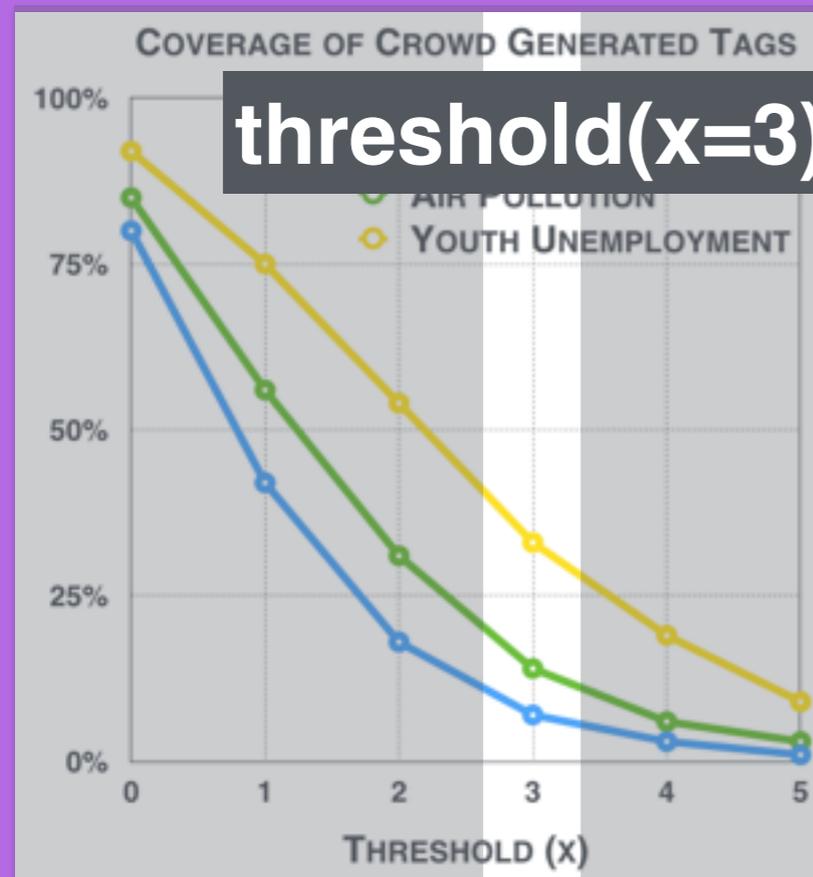


# Evaluation: Tag Results

**84%** ( $x=3$ ) of the issue-budget **tags** were **correctly matched** to the **reference solution**.



# Coverage of Participants' Tags



*Public Safety:*

7% (**843** tags)

*Air Pollution:*

14% (**1685** tags)

*Youth Unemployment:*

33% (**3973** tags)

**Out of Total Possible Tags**

**3** issues x **4,013** programs = **12,039** tags

People are capable of  
contributing  
**expert-quality tags**

Participants' level of **informedness** significantly **improved** after tagging tasks

“I know in which budget programs Seoul's tax revenues are spent.”

Their **perspective** on government spending **marginally improved**, remaining on the **negative** side.

“The city government is executing its budget in the right direction regarding public safety.”

People gain  
**informational**  
**benefits** from doing  
tagging tasks.

# Lessons

**Confirmed** the  
**Feasibility** of  
Issue-Driven Approach

*“We encounter social **issues in our daily lives**. They made it easier for me to evaluate the suitability of budget programs.” — p045*

*“Understanding government budget spending through issues would be effective in **solving social problems.**”*

— p026

*“The issue-driven approach would be more **intuitive to the general public.**”*  
— Officer in the Seoul government

# More importantly,

*By looking into  
the **differences** among **tags***

**No ground truth for  
issue-program tags**

**Individuals have  
different perspectives**

Dealing with  
**opinionated crowds**  
calls for a different  
kind of quality control.

Important to  
incorporate  
**diverse,**  
**contextual,** and  
**localized** viewpoints

# Limitations & Future Work

*Allow people to create new issues  
& Live deployment  
& Data spanning multiple years*

# BudgetMap is a step toward participatory democracy

Leverage open  
government data



Build systems for  
civic engagement



Improve awareness  
on budgetary issues



**BUDGETWISER**

POLICY MAKING AS A PUBLIC-DRIVEN PROCESS

**Make  
Government  
Great  
Again!**



Seoul's Social Issues	
<b>Public Safety</b> Budget: ₩ 531,941,607,000	Related Services: 207
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**BUDGETWISER**  
POLICY MAKING AS A PUBLIC-DRIVEN PROCESS  
[budgetwiser.org](http://budgetwiser.org)

- 150 Stone Spring service support enhanced
- Community service investment projects
- Traffic safety facility maintenance manager
- Neck according to improve performance
- The road facilities (tunnels, cover, underground
- Old roadway lighting improvement projects
- Access to the southern end of the fire bridge n
- Children's integrated services support operatic
- Car-only road (KLC) old pavement maintenanc
- Waterworks administration service support
- Dong established fire department
- Maintenance and reinforcement in the constru
- Chang-Dong 2 mound sewer pipes drain gene
- Daelim mound sewer pipes drain general mair
- Northwest hospital provides medical services,
- The flat offers a customer-focused health serv

**Thank you**  
[namwkim@seas.harvard.edu](mailto:namwkim@seas.harvard.edu)