

엑셀을 사용한 도시 계획 지원 툴

A Costing Spreadsheet to Support City Planning Decision Making

AI, Hisatoshi @ The University of Tokyo

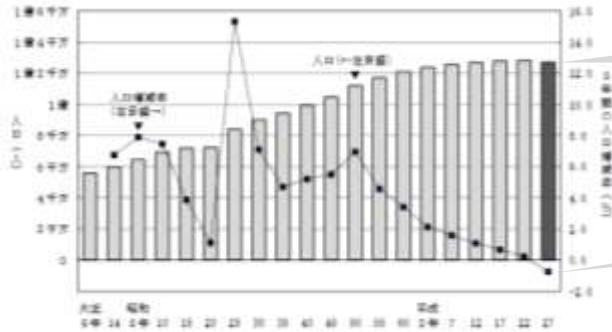
KATAGIRI, Yukiko @ Tokyo Metropolitan University

Presented at CSIS-KRIHS international joint seminar, Kashiwa, JAPAN. Nov 14. 2018

Minor revision from ppt presented at ICSAM 2018, Tokyo, JAPAN

Introduction

- Rapid aging and population decline in Japan



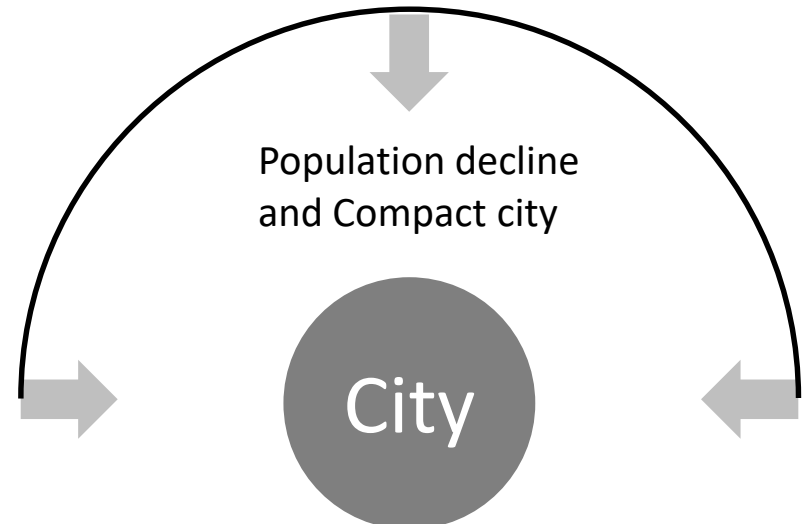
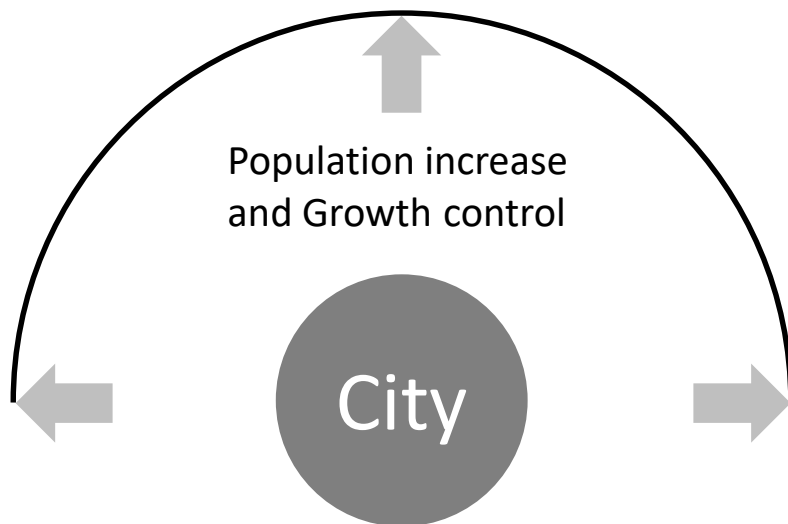
Population decreased from 2010 to 2015

MINUS population change ratio

総務省「平成27年国勢調査 人口等基本集計結果」

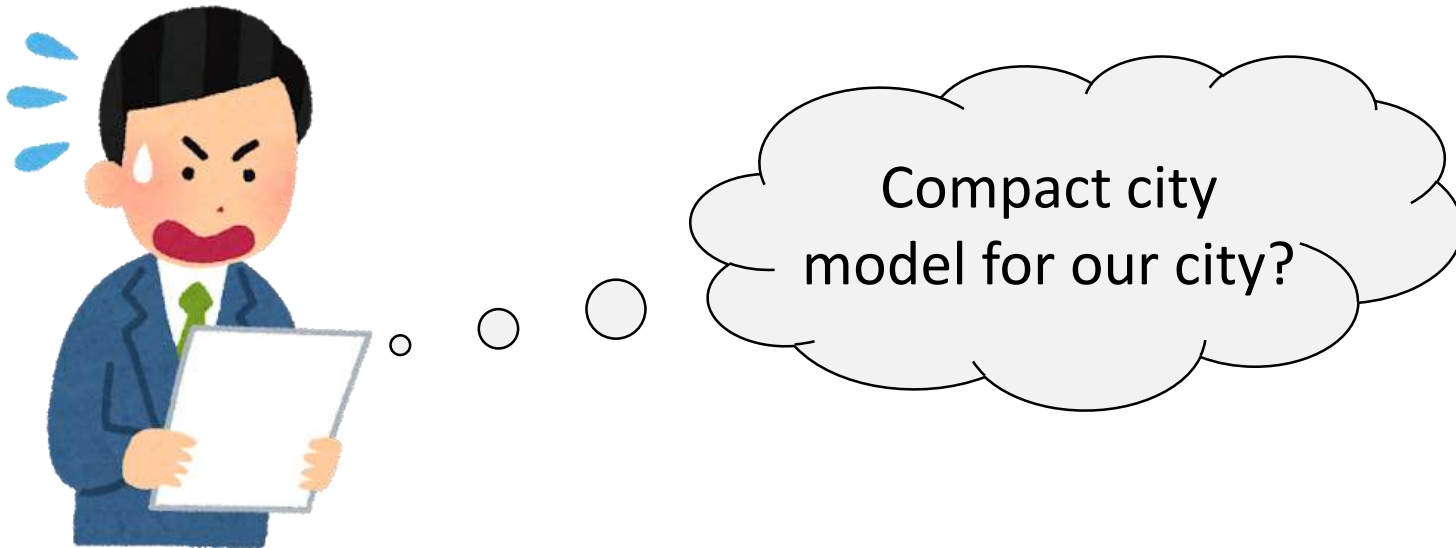
Ministry of Internal Affairs, Summary of the results of the 2015 population census

- New city planning strategies and models needed
- Key concept is to make cities more compact



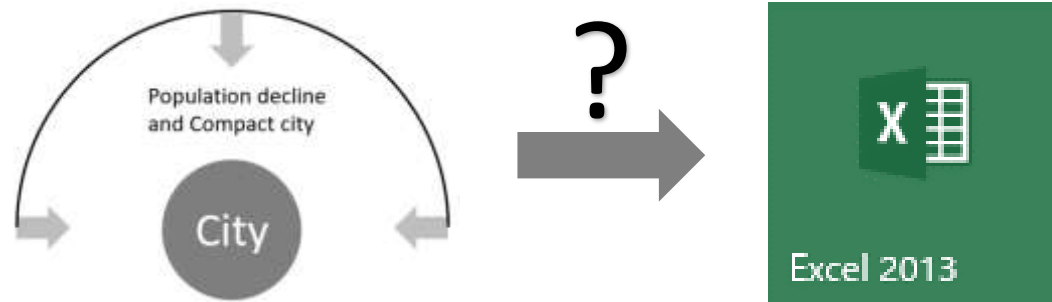
Motivation

- Many compact city models proposed in earlier studies
- Models are designed for some certain city based on detailed case study
- Some cities have already developed compact city plan
- Compact city planning is urgent issue for all cities in Japan
- Interactive tool for planning and monitoring is needed



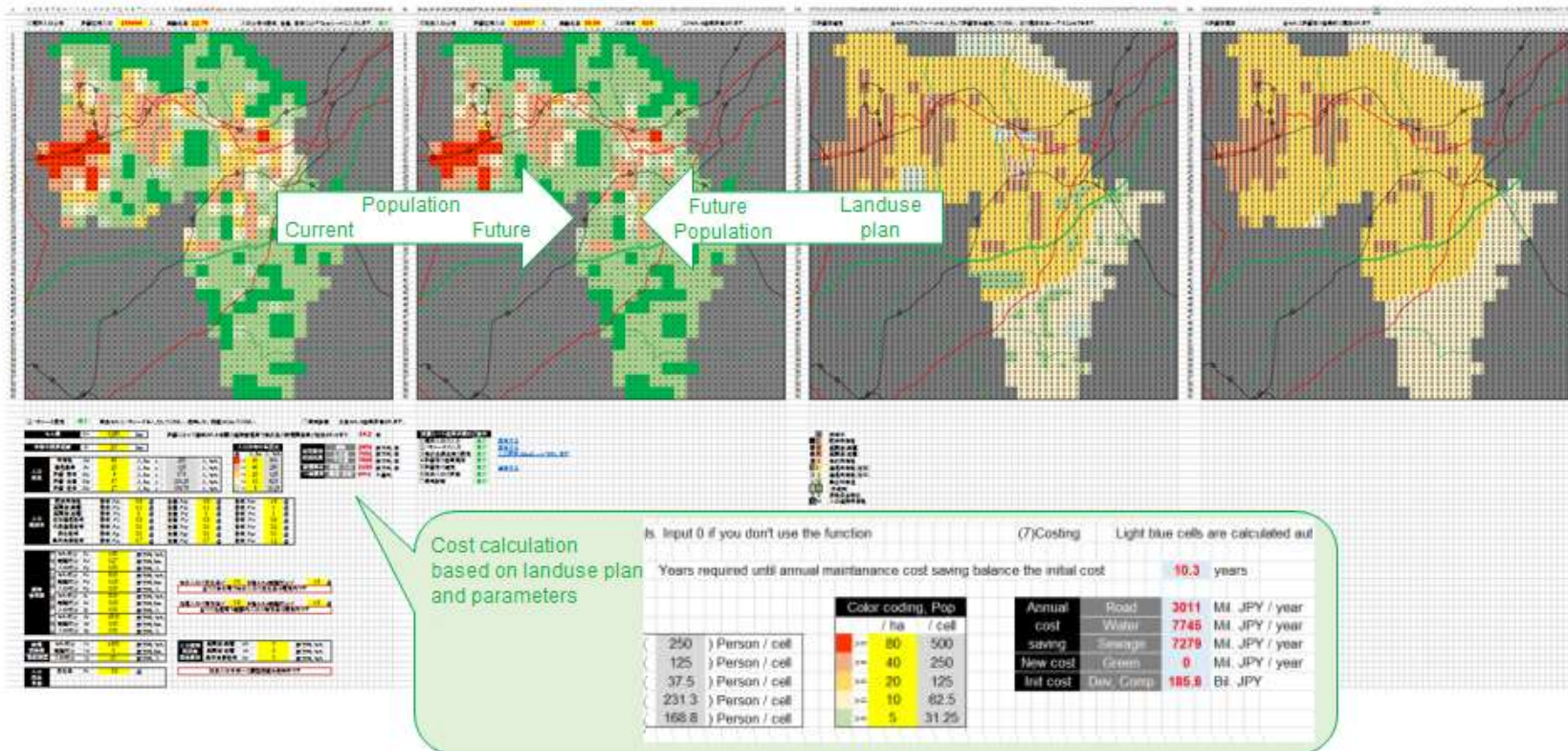
City Planning with EXCEL?

- Most municipality officials and local residents are unfamiliar to GIS and spatial models
- How about using EXCEL for city planning decision making?
- EXCEL is used for daily work
- But how?



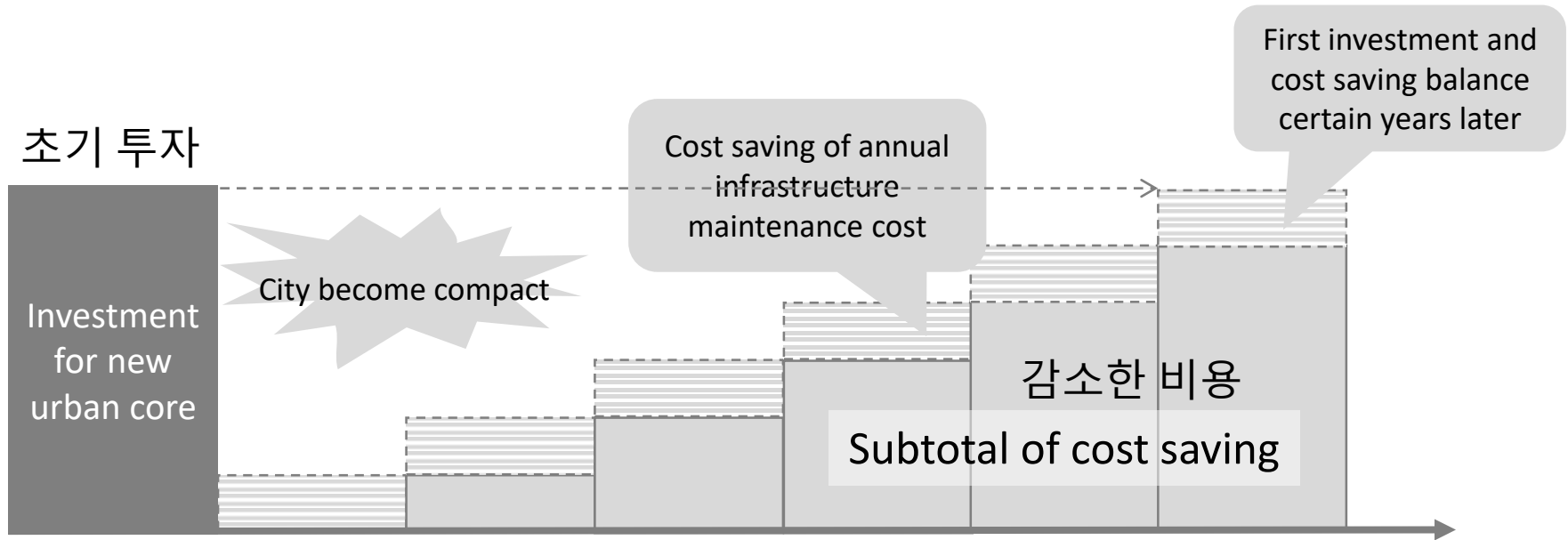
Outline of the costing sheet

- Urban area is represented with 60 by 60 cells
- All steps from input to output complete on EXCEL
- Automatic costing calculation

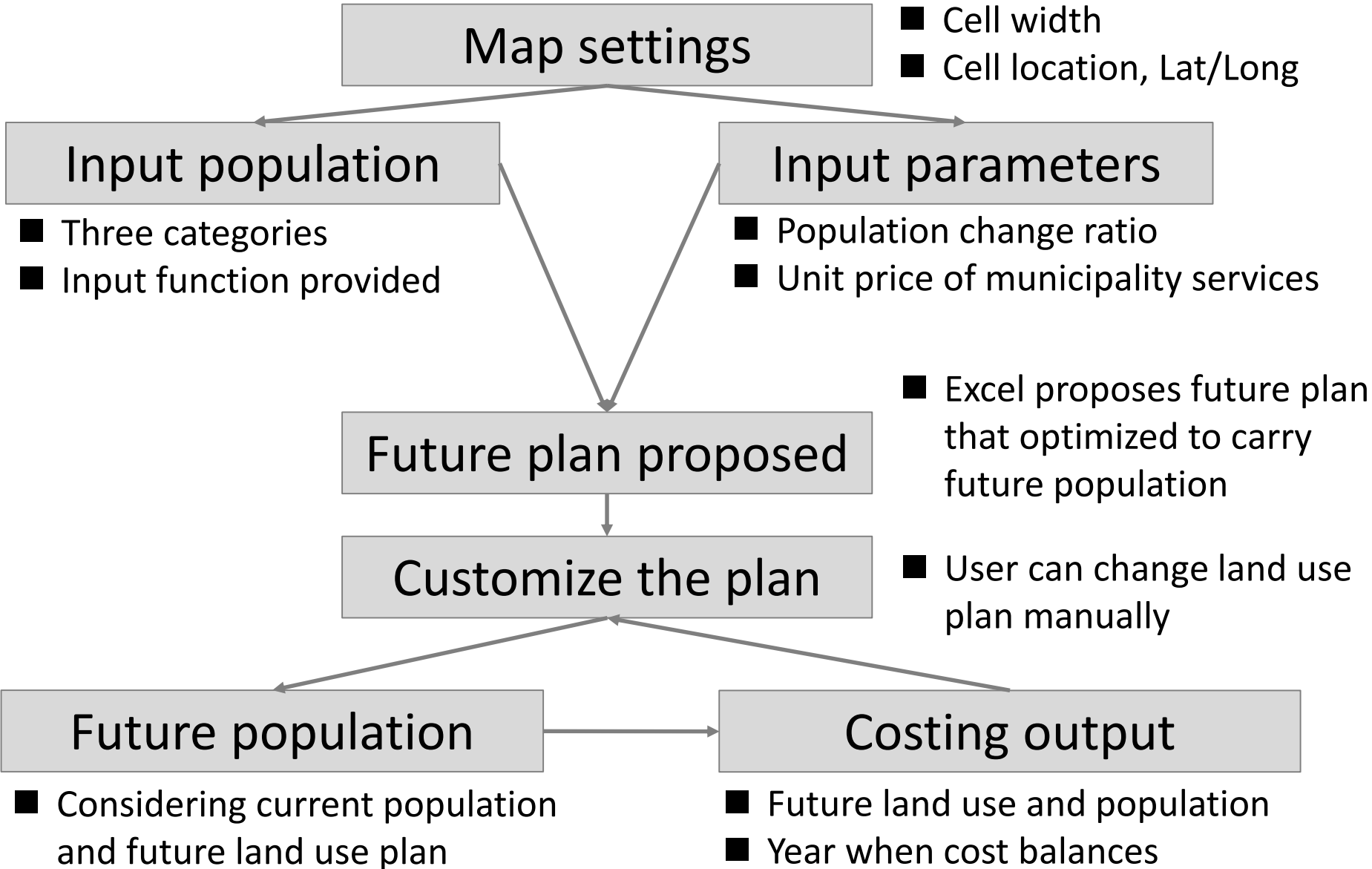


Basic idea of the costing

- Compact city enables the municipality to save annual cost
- To make the city compact, investment should be made at the early stage to make sub centers attractive
- In certain years, saved cost reaches first investment

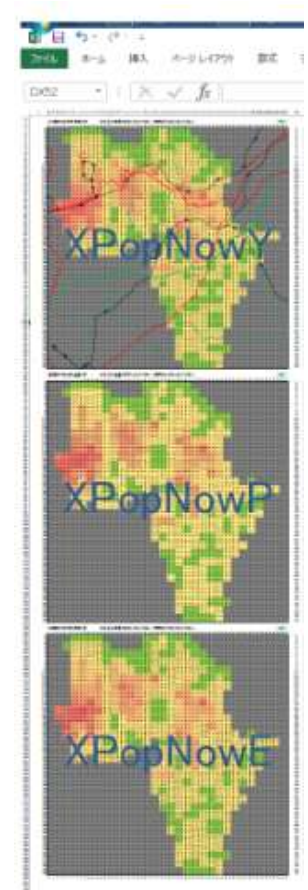


How to use? Flow of costing



Input the population data

- User have to input current population distribution
- Population in 3 categories, e.g. young, productive, elderly
- Input $3 \times 3600 = 10,800$ cells manually?
- Worksheet for easy data import provided



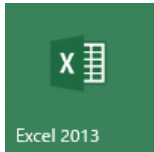
Population data import function

- Accepts population data accompanied with mesh code
- Japanese mesh code represents its Lat/Long coordinate
- Costing sheet calculates which mesh code corresponds to which cell on the sheet

MESHCODE	Pop 1	Pop 2	Pop 3
534030692	12	34	20
534030684	109	413	287
534030792	35	114	58



User:
Copy & paste mesh code
and population data set



EXCEL:
Assign the data into 60x60 cells
based on cell location and mesh code

MESHCODE	Pop 1	Pop 2	Pop 3
534030692	12	34	20
534030684	109	413	287
534030792	35	114	58

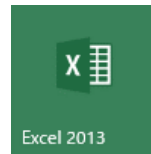


Population data import function

- Also accepts population data with Lat/Long coordinates
- Costing sheet calculates which location falls into which cell on the sheet

X = Longitude	Y = Latitude	Pop 1	Pop 2	Pop 3
140.120313	35.7572863	12	34	20
140.123438	35.7572883	109	413	287
140.126563	35.7572883	35	114	58

User:
Copy & paste Lat/Long coordinate
and population of the location



EXCEL:
Assign the data into 60x60 cells
based on cell location and mesh code

経度X	緯度Y	人口1	人口2	人口3	区市郡	上下期		セル番Ow			人口
140.120313	35.7572863	0	0	0		1					
140.123438	35.7572883	0	0	0		2					
140.126563	35.7572883	0	0	0		3					
140.129688	35.7572883	0	0	0		4					
140.132813	35.7572883	0	0	0		5					
140.135938	35.7572883	0	0	0		6					
140.139063	35.7572883	0	0	0		7					
140.142188	35.7572883	0	0	0		8					
140.145313	35.7572883	0	0	0		9					
140.148438	35.7572883	0	0	0		10					
140.151563	35.7572883	0	0	0		11					
140.154688	35.7572883	0	0	0		12					
140.157813	35.7572883	0	0	0		13					
140.160938	35.7572883	0	0	0		14					

Parameter settings

- User have to set the following parameters for the calculation
- Cells for parameter are highlighted with yellow color

Cell width, e.g. scale of the map

Max. dist. of sub center from CBD

Population density

Population change ratio, strategy

Maintenance cost

Development cost

Population change, forecasted

Location, coordinates

12)Parameter												7)Costing																																																																																																																																							
Set parameters in yellow cells. Input 0 if you don't use the function												Light blue cells are calculated automatically																																																																																																																																							
Cell size						Years required until annual maintenance cost saving balance the initial cost						Distance of usage flow																																																																																																																																							
Cell size Cw 3.250 km						19.3 years						(1) Input Pop. Now Done																																																																																																																																							
Max CBD radius Cr 2.8 km						Color coding Pop						(2) Set Parameter Done																																																																																																																																							
Pop density						Annual cost saving						(3) Priority for compact Done																																																																																																																																							
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Future plan proposition

- From current population, EXCEL designates urbanized cell
- EXCEL also proposes which cells should be sub centers
- Land use is expressed by following alphabets
- Annual cost and population change differ by land use code

Code	Explanation	Proposed	Customized
X	Outside of target region	*	*
D	CBD	*	*
H	Redevelopment of CBD with high rise houses		*
R	Redevelopment of CBD with low rise houses		*
S	Proposed to be a sub center	*	*
I	To be disengaged, close to CBD	*	*
O	To be disengaged, distant from CBD	*	*
A	Agricultural land		*
G	Green environment prevention area		*
M	Planned to maintain current population		*

Outcome of the costing

- Future population distribution is shown as a map
- Project duration calculated by comparing initial cost and annual cost savings



(7) Costing Light blue cells are calculated autor

the initial cost 10.3 years

Annual cost	Road	3011	Mil. JPY / year
	Water	7745	Mil. JPY / year
saving	Sewage	7279	Mil. JPY / year
New cost	Green	0	Mil. JPY / year
Init cost	Dev. Comp	185.8	Bil. JPY

← Year when initial investment and annual saving balance

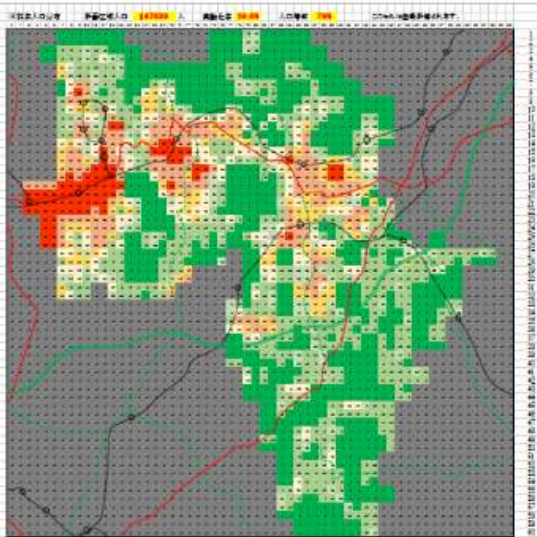
Usage of recalculation

- Recalculation is one of the powerful tool of EXCEL
- If user changes the data in some cell, equations in other cells referring that cell will be automatically calculated again
- This enables user to design future plan interactively

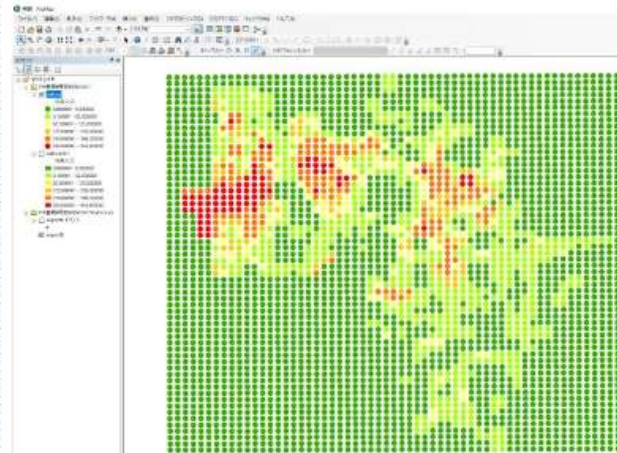
Costing outcome export function

- Worksheet prepared for export is an array of Lat/Long coordinates, population, land use, etc.
- User can plot this data as point data set on GIS

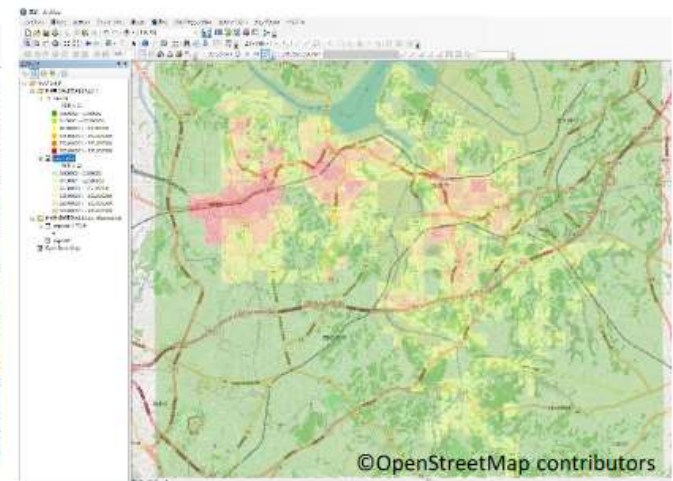
How the map
looks on EXCEL



Plotted as point
data on GIS



Overlaid on
other layers



Conclusion

- EXCEL based costing sheet targeting municipality officials and local residents to design future plan of their city
- No GIS skills or spatial modeling knowledge requested
- Recalculation enables interactive planning by the users
- New functions equipped for smooth data input and output