

New evaluation model to improve the decision-making process of municipal governments for disaster management

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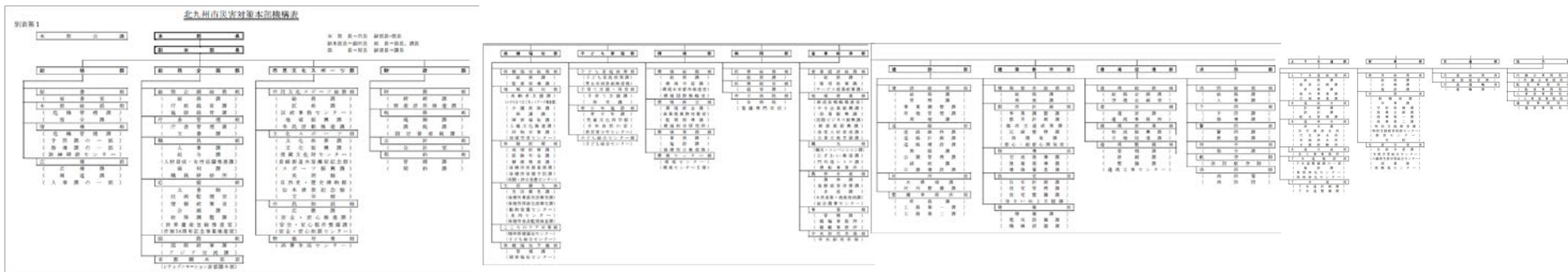
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Disaster management organization in Japanese municipal governments

Existing organizational structure is used maximally.

- Collection of existing sections with new tasks and communication routes among them
- Ordinary task jurisdictions are maintained and expanded.



Typical organizational structure for disaster management
c.f. Incident command system

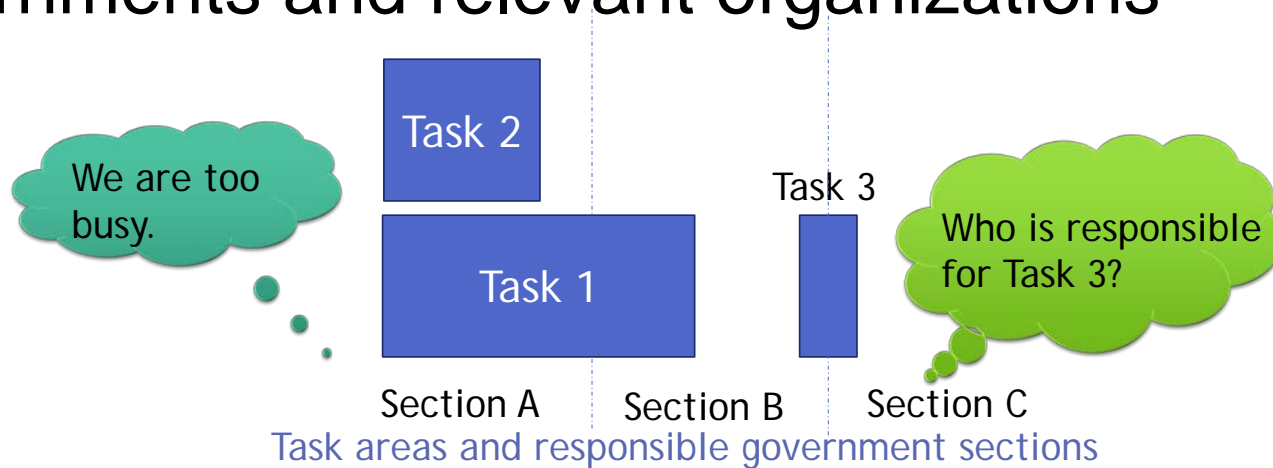
Major communication channel is by phone.

- Email and ICT tools are in limited use.

Records of organized activities in actual disasters are very limited.

Objectives

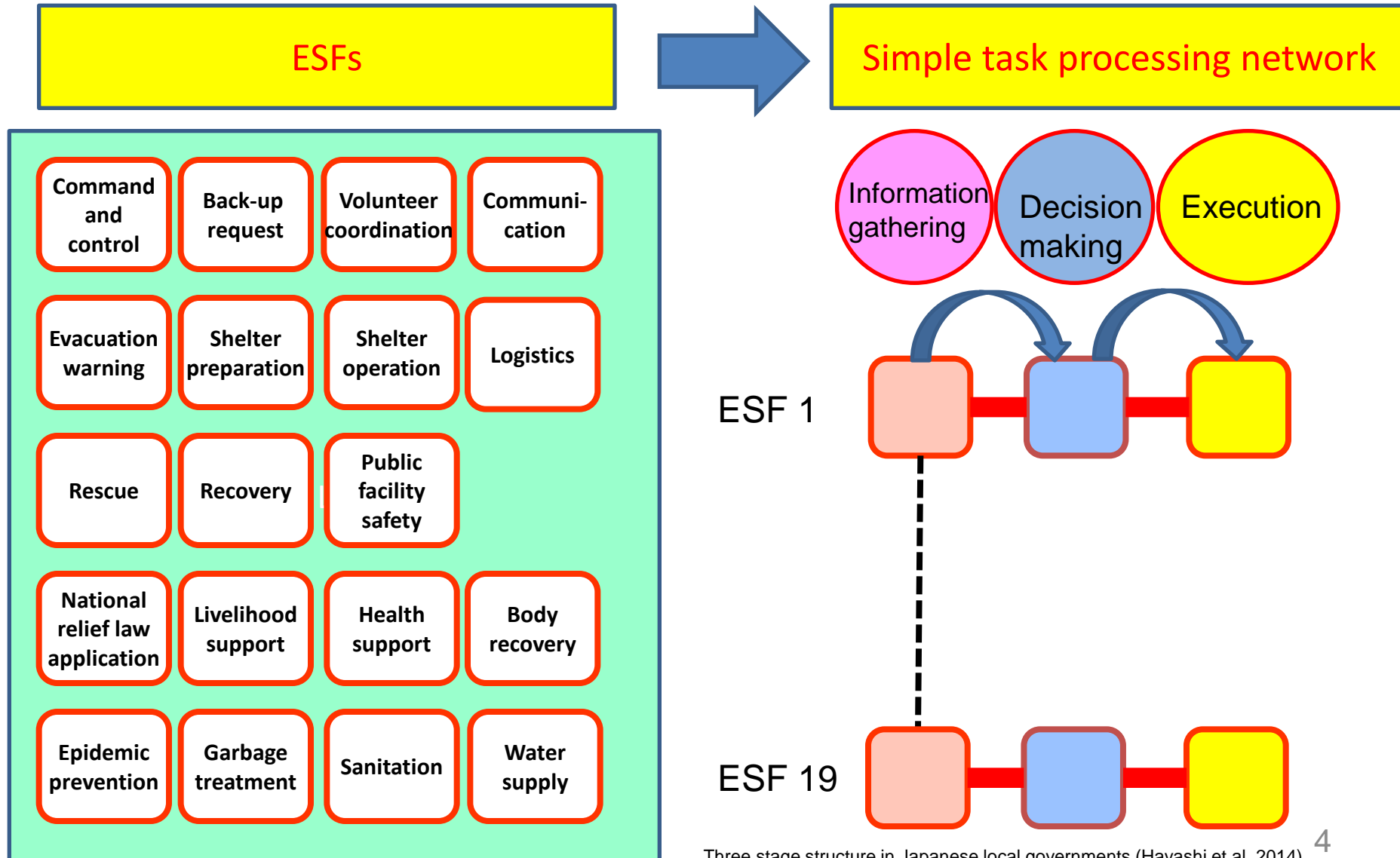
- Create a new exercise and its support tool that help effective coordination among sections in local governments and relevant organizations



Task distribution problem in disaster management

- Quantitatively evaluate coordinated disaster management capacity through functional exercises

Creation of simplified decision making network for every emergency support function (ESF)



Our focus: Functional exercises

Controller

Player

Simulator



Earthquake characteristics	
Time	9:00
Epicenter	Chikuho
Depth	30 km
Magnitude	6.8
Tremor	7 Tobata
	6 plus Yahata-nishi, Yahata-higashi
	6 Kokura-kita, Kokura-minami, Wakamatsu
	5 plus Moji
Lifeline	In-house power generation working, Water supply stopped.
Communication	Telephone network heavily congested Email and satlite phones work
9:05	Call from a citizen in Yahata-nishi Three houses collapsed. It seems some pepople trapped inside.
9:10	Call from a factory in Tobata inflammable gas leakage. Needs evacuation of nearby houses.

Disaster narrative

Inject
Harmful gas
leakage
from a factory



Evaluator

Recording
Players'
responses

Info gathering
e.g. Fire Department



Decision
e.g. Emergency Management
Section



Execution
e.g. Environmental
Monitoring Section



Coordinated responses
are expected

Problems in functional exercises

1. Objectives are often ill-defined

What are we checking?

2. Weakness in evaluation

- Cannot find problems in task processing networks
- Results are descriptive and not quantitative

3. Lots of work for preparation

Disaster narrative, documents, analysis

Based upon our interviews to local government officials and literature review (Zujyo Ensyu Kenkyukai (2011) and Fire and Disaster Management Agency (2009) among others)

Our functional exercise

1. Clear objectives

- Examine coordination capacity
- Resource allocation for prioritized tasks

2. Quantitative evaluation

- Weakness and strength by disaster management functions
- Bottlenecks of prioritized task processing
- Standard reporting formats facilitating comparisons

3. Preparation support library

- Disaster narratives
- Task processing networks

Prioritized injects, task processing network, and check points

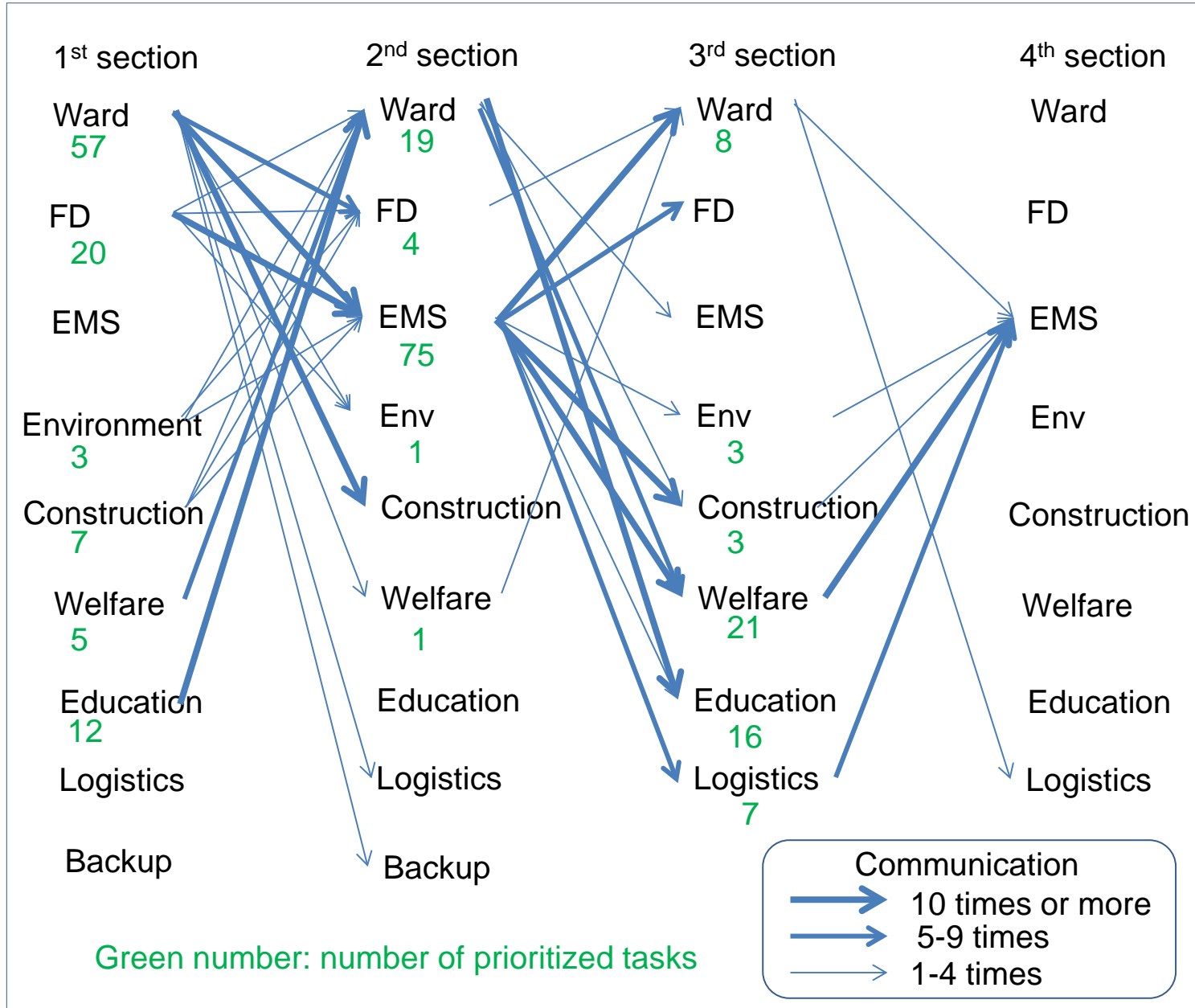
Prioritized Inject: Life safety, incident stabilization, and property/environmental preservation

Land slide occurred in Wakamatsu Ward and 20 plus residents are apparently berried. Need immediate help.

Players

Info gathering	Decision	Execution	
Fire Department (FD)	Emergency Management Section (EMS)	Ward Office	<i>Task</i> Shelter preparation
<i>Task</i> Share info with EMS Operate field units	<i>Task</i> Issue evacuation warning Share info with Ward Office and Architecture Section	Architecture Section	<i>Task</i> Housing damage inspection
Check point 1	Check point 2	Check point 3	

Summary of prioritized task processing



Support tool: Detailed recording of task processing

Evaluator
Task monitoring
and measuring time

Simulator
Send injects according
to disaster narrative



Exercise example

Simulated date: January 17, 2014 (Fr)

Location: Kitakyushu City, Japan
(pop 970 thousand)

Simulated earthquake

9:00 Epicentral earthquake

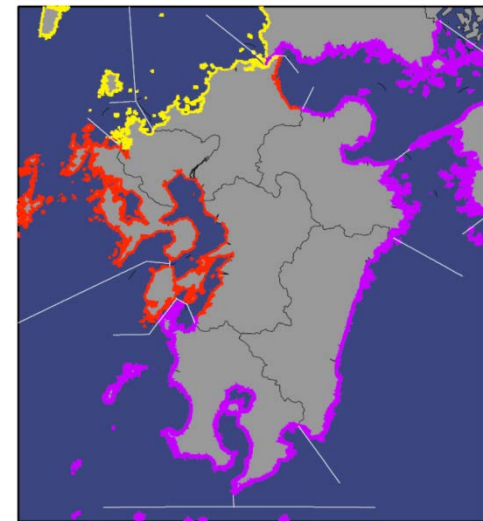
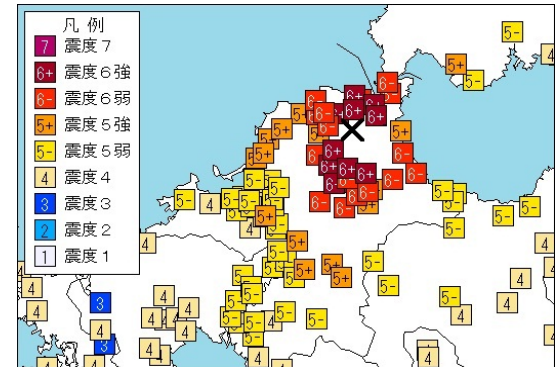
(Seismic intensity level: 6 plus)

9:10 Inter plate earthquake

in North East Pacific ocean

(Seismic intensity level: 5 plus)

Tsunami approaching

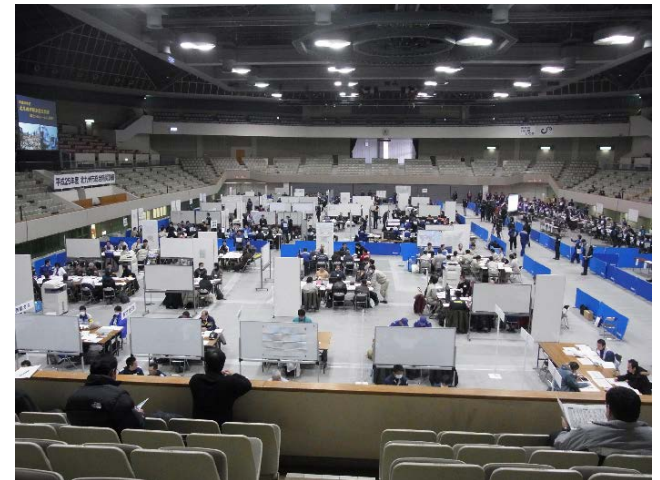
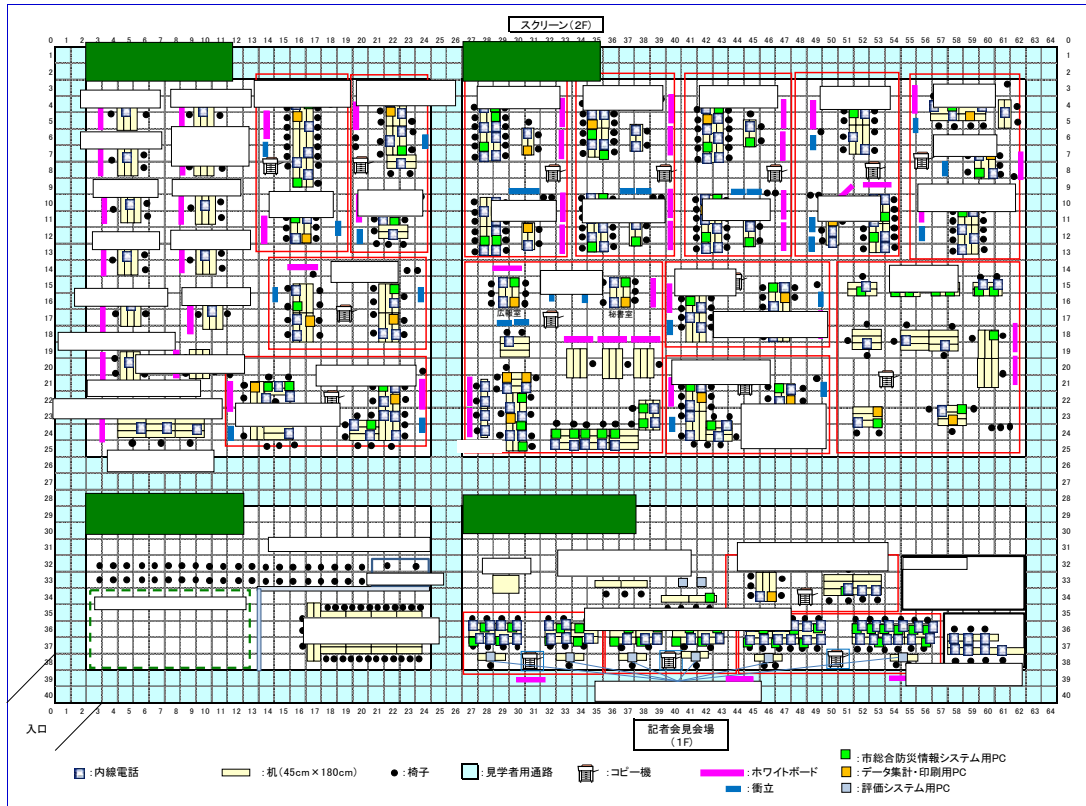


Exercise example

Exercise time: Jan 18, 2015 9:00 – 12:30

Participants: 488 people

- 24 sections of Kitakyushu City Government
- 15 regional organizations

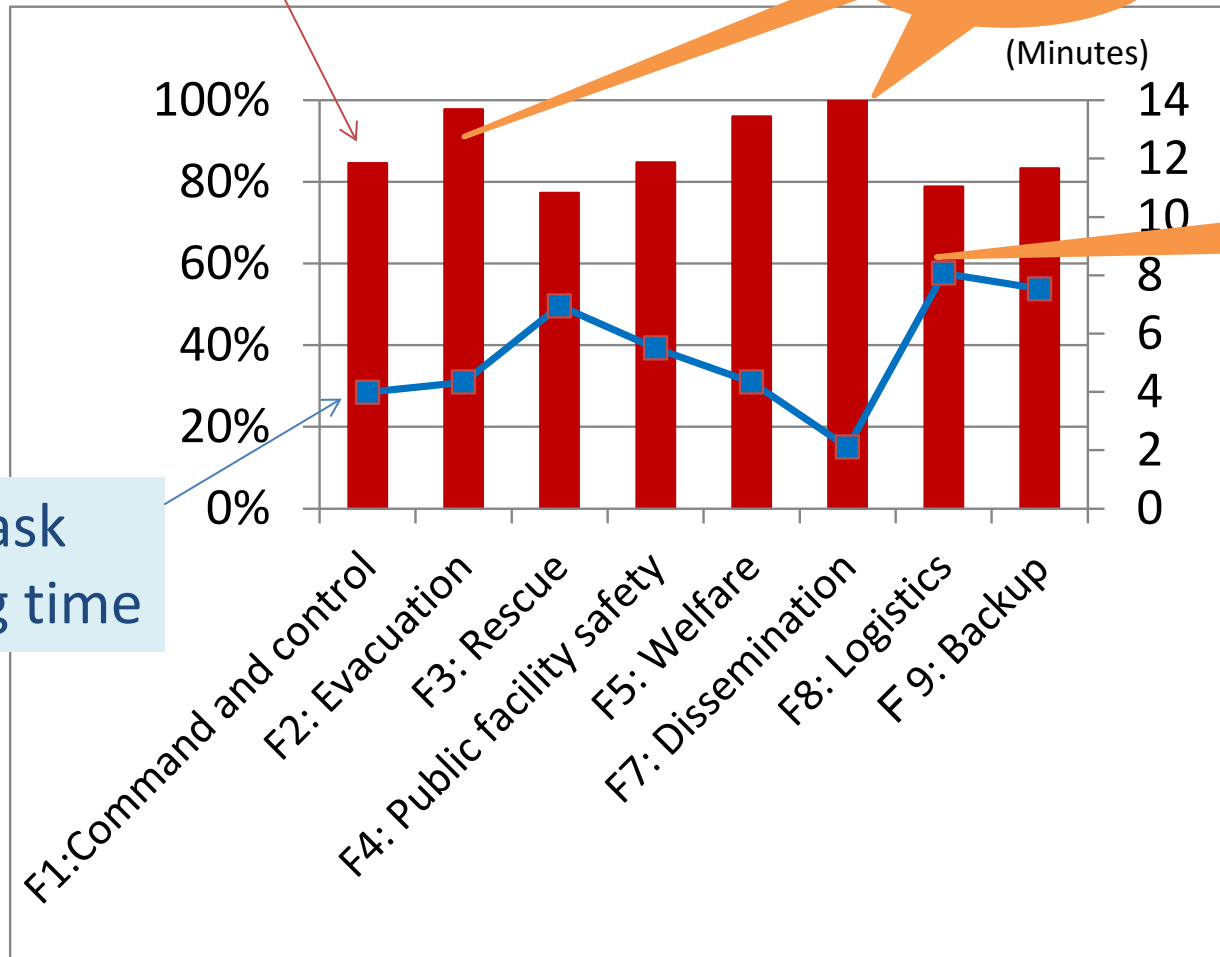


Simulation room

Simulation room set up

Weakness and strength of Kitakyushu City Government

Prioritized task completion by deadline



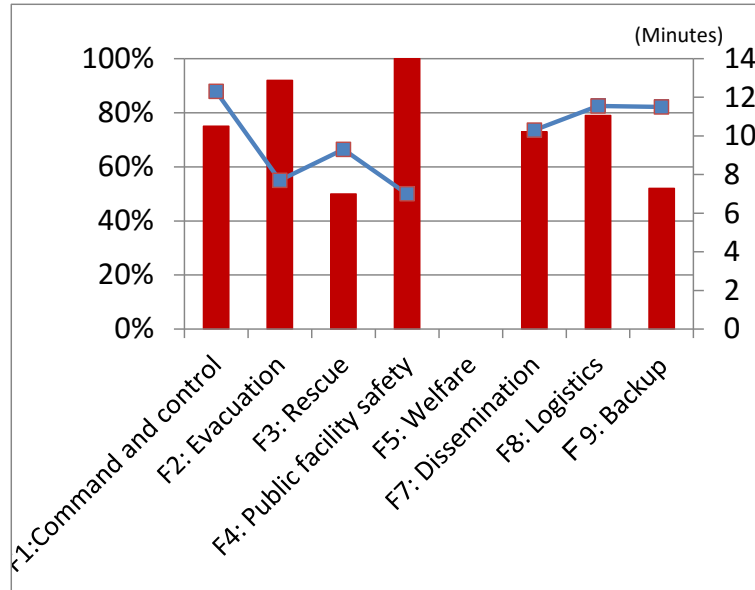
Mean task processing time

Strength

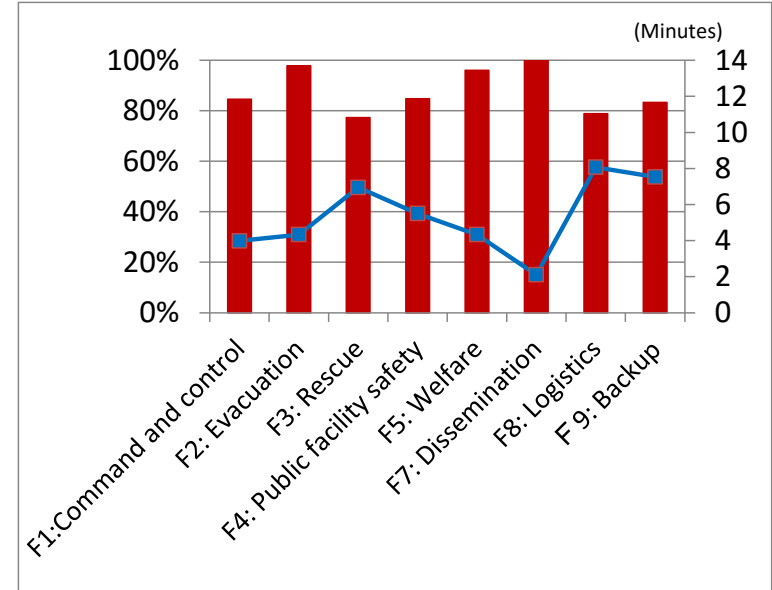
Weakness

Comparison between exercises

2007 heavy rain



2014 earthquake



Overall performance

Prioritized task completion

76%

88%

Improved

Mean processing time

10.1 min

5.7 min

Time reduced

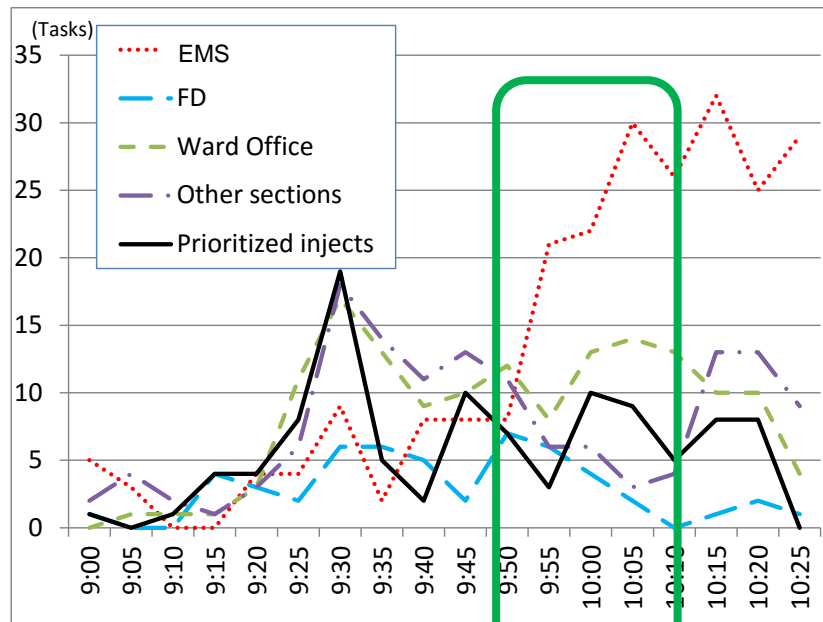
Bottleneck analysis

EMS overwhelmed

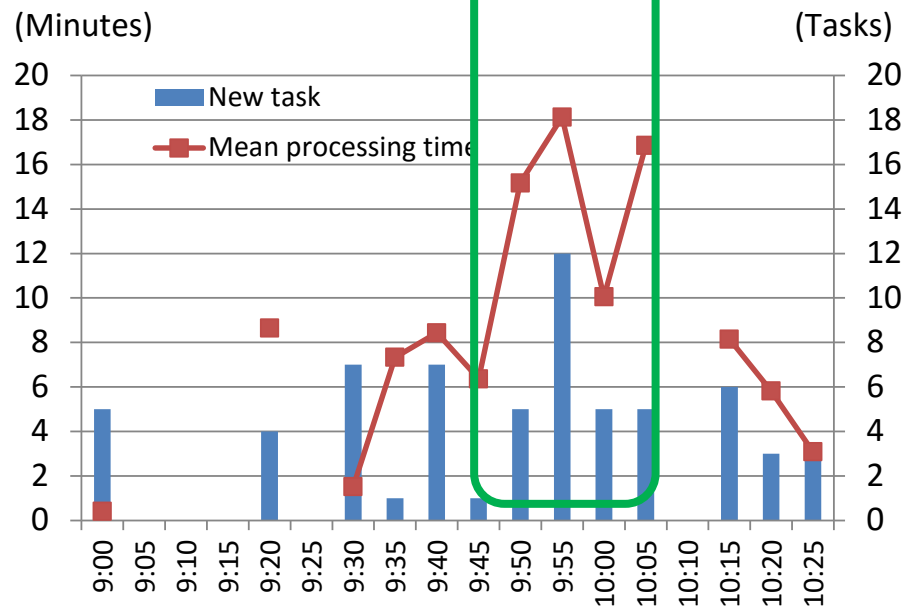
Exercise gives a hint to
Improve EMS

Minimum number of staff

Timing of back up



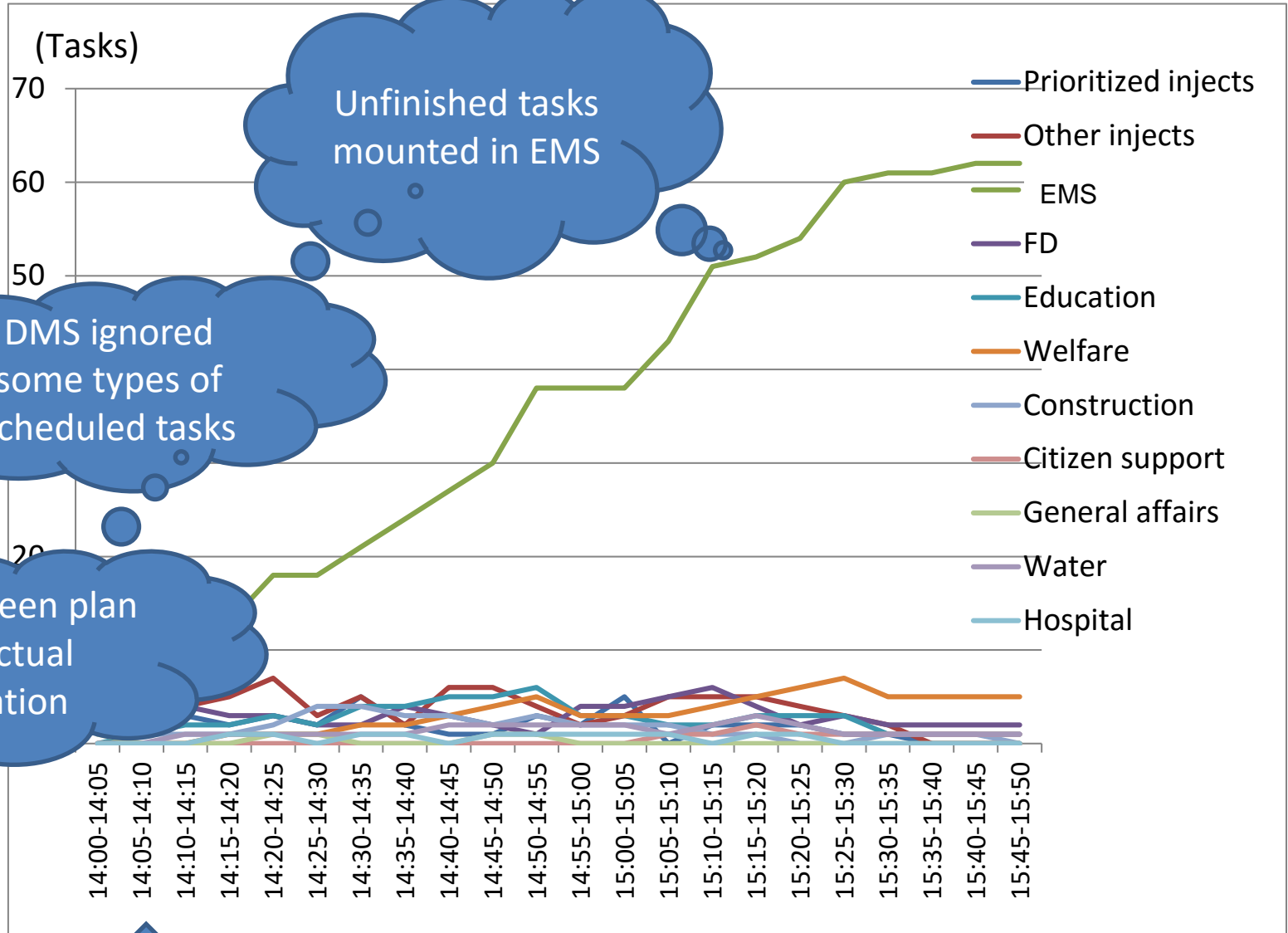
Tasks under processing



DMS activity

Bottleneck analysis: Unexpected gap

Tasks under processing



Gap between plan and actual operation

Unfinished tasks mounted in EMS

DMS ignored some types of scheduled tasks

Earthquake

Conclusions

New exercise method and its support tool developed

- Efficient expansion of coordinated disaster management capacity for municipal governments
- Quantitative evaluation
- Easy preparation

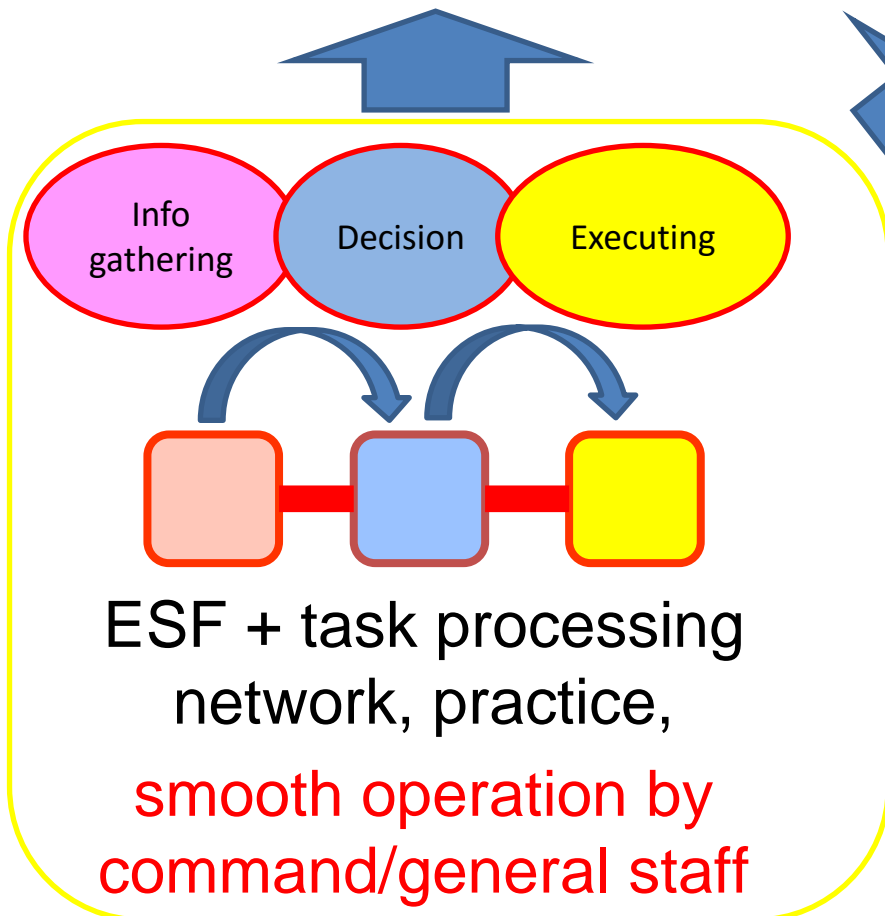
Our new targets are:

- Emergency medical activities
- Evacuation in large gatherings

Planning to improvise

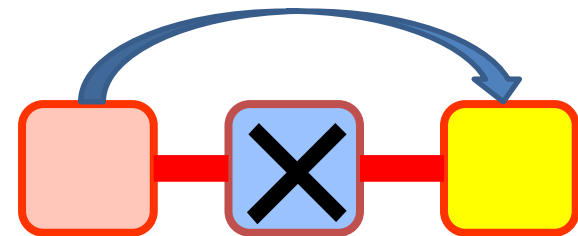
Keep more resource for
higher level decision
making

Back-up request, etc.



DMS understands strength and weakness of their organization

Autonomous back-up by staff



The title of this slide is a modification of a section title in T. Wachtendorf and J. M. Kendra (2006) Improvising Disaster in the City of Jazz: Organizational Response to Hurricane Katrina http://understandingkatrina.ssrc.org/Wachtendorf_Kendra/

Survey of task processing network structure in Japanese municipal governments

Objective:

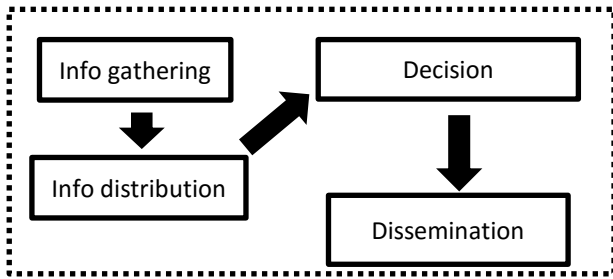
To identify the common section structure that conducts info gathering, info distribution, decision, and dissemination of evacuation warnings

Questionnaire:

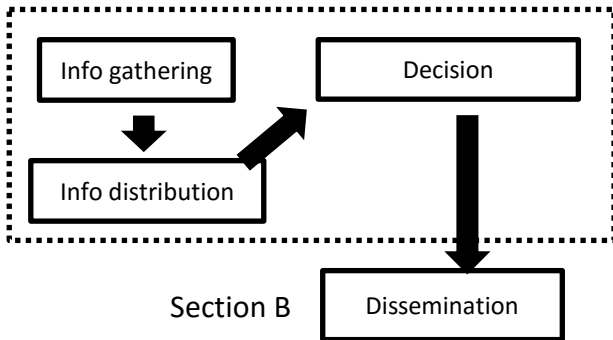
City category	Sent	Recovered	Response rate (%)
Designated large city	20	11	55.0
Core city	47	24	51.1
Prefectural capital	12	9	75.0
Tokyo ward	23	12	52.2
100-300 thousand	13	7	53.8
50-100 thousand	16	6	37.5
Less than 50 thousand	15	4	26.7
Total	146	73	50.0

Task processing network

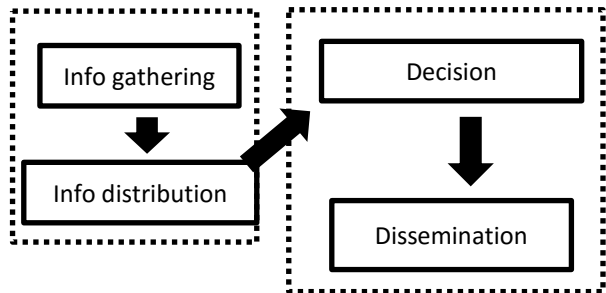
1 section structure 5 cases



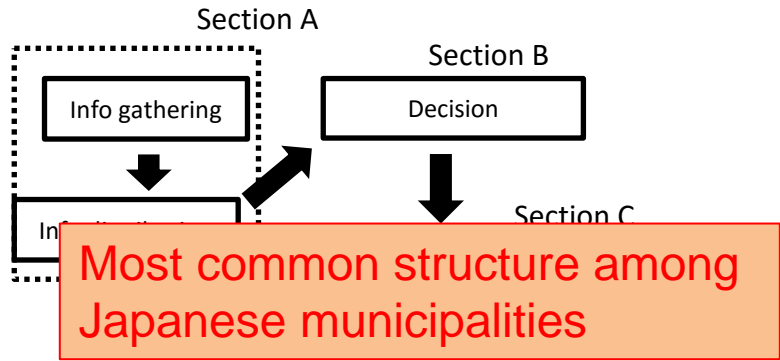
2 section structure 15 cases



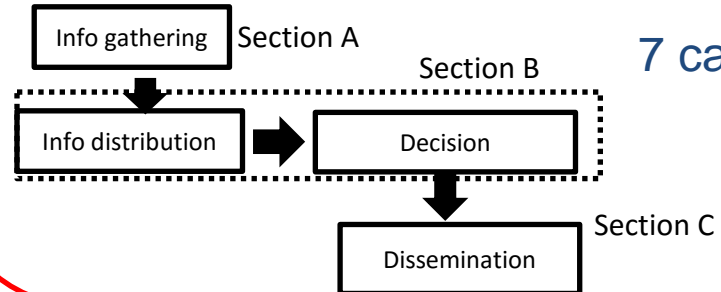
3 section structure 7 cases



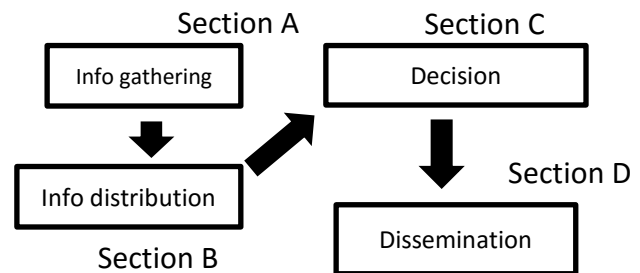
3 section structure 25 cases



3 section structure 7 cases



4 section structure 14 cases



References

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