

# Performance Comparison of Post Disaster Humanitarian Logistics

## in the Aftermath of the Tohoku Disasters and the Kumamoto Earthquakes

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### 1. Introduction

#### Difficulty of Post-disaster Humanitarian Logistics (PD-HL)

■ A major obstacle: **Poorly understood PD-HL** (:: **Low occurrence of catastrophic events**).

#### Two catastrophic events, the 2011 Great East Japan Earthquake and Tsunami and the Kumamoto earthquakes

■ Kumamoto earthquakes: **New PD-HL system** was implemented through the lessons learned from the Tohoku experience.

✓ Purpose: To identify **systematic problems of the new PD-HL system**, and present lessons and **corresponding research needs**.

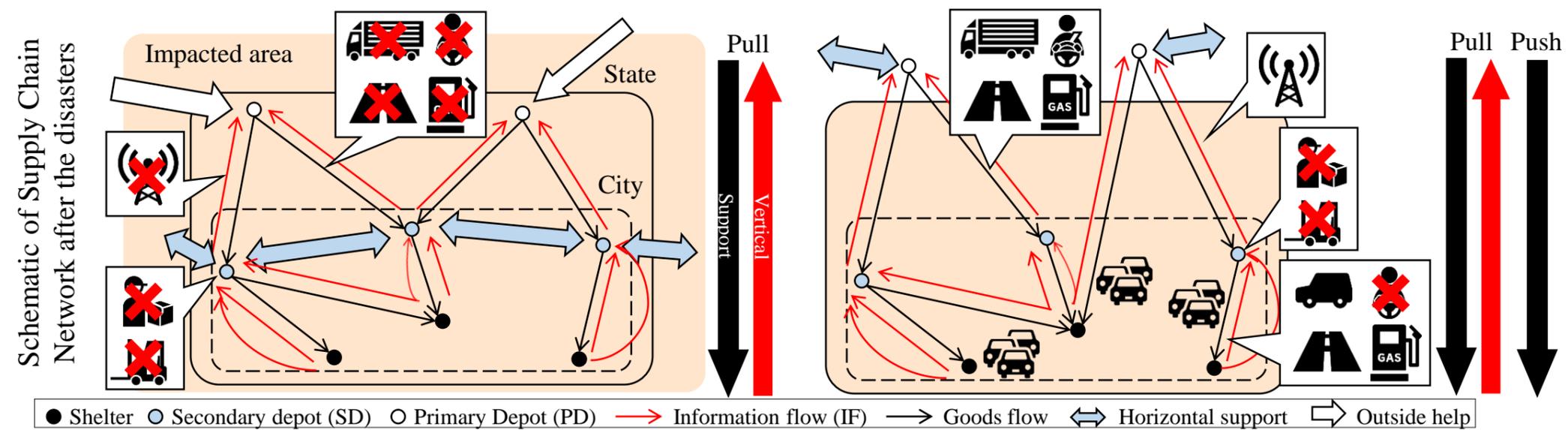
✓ Method: To compare two disasters for preparedness and response (transshipment(TS), transportation(TP) and communication)

### 2. Tohoku Disasters

### 3. Kumamoto Earthquakes

#### Comparison of HL activities in Kumamoto and Tohoku (**Physical damage problem** / **Systematic problem** / **Improvements**)

	Tohoku Disasters	Kumamoto Earthquakes
Events	<ul style="list-style-type: none"><li>■ 9.0 Mw (on March 11th, 2011) and Max.39m tsunami</li><li>■ People impacted: 386,739 evacuees (peak)</li><li>■ Road damaged: Complete reopening road after a week</li><li>■ Comm damaged: global (approx. 1.9 million lines)</li></ul>	<ul style="list-style-type: none"><li>■ 6.5 Mw and 7.3 Mw (on April 14th and 16th, 2016).</li><li>■ People impacted: 183,882 evacuees (peak)</li><li>■ Road damaged: Emergency vehicles can access after 2days</li><li>■ Comm damaged: local (approx. 2,100 lines)</li></ul>
Preparedness	<ul style="list-style-type: none"><li>■ Vertical support: Only Pull-mode support<ul style="list-style-type: none"><li>✓ Bottleneck: IF between SDs and shelters</li><li>✓ A shortage of goods for about a week</li></ul></li><li>■ Horizontal support: Impacted city-level governments</li><li>■ Tsunami wiped out pre-stocks in shelters</li></ul>	<ul style="list-style-type: none"><li>■ Vertical support: Push and Pull-mode support<ul style="list-style-type: none"><li>✓ After 4 days, push-mode goods were delivered.</li><li>✓ Non-priority (NP) goods were included.</li></ul></li><li>■ Horizontal support: State-level governments</li><li>■ Pre-stock planning for local disasters was insufficient.</li></ul>
Response	<ul style="list-style-type: none"><li>■ TS: PDs: Private facilities with ample space and good access, but improvised and took a long time to prepare PDs.</li><li>■ SDs: Public facilities unsuitable for logistics (based on a lack of <b>space</b>, <b>electric power</b>, <b>equipment</b>, and <b>experts</b>)</li><li>■ TP: Vehicle: Injured drivers and damaged trucks</li><li>■ Road: Heavy damaged (cf. Events). Almost impassable.</li><li>■ Gasoline: The only refinery in Tohoku stopped</li><li>■ Comm: Hard to relay information regarding needs (:: Global comm damage (cf. Events))</li></ul>	<ul style="list-style-type: none"><li>■ TS: New system: Transportation without going through SDs</li><li>■ TP: Vehicle: Injured drivers and damaged trucks.<ul style="list-style-type: none"><li>✓ SDs to Shelters: small-capacity vehicles were used</li></ul></li><li>■ Road: Almost passable. Heavy congestion happened.</li><li>■ Comm: Multiple complex IFs led to missing requests.<ul style="list-style-type: none"><li>✓ Centralized IFs (e.g., using iPad) solved this problem.</li></ul></li></ul>



✓ **Systematic problems** can be identified (not surfaced after the Tohoku disasters due to physical damages).

i) NP goods by push-mode / ii) Disruption of SDs / iii) Heavy congestion/ iv) Multiple complex IFs

### 4. Discussion: lessons learned and research needs

#### i) Disaster management plans for worst-case scenarios

- Improvements: Push-mode and widely horizontal supports
- Long push-mode can lead to **mismatching**.  
→ Find **the optimal border** to switch the push-mode

#### iii) Effective last mile transportation

- Three requirements: vehicle, road and gasoline
- New systematic problem: **Heavy congestion**  
→ Modeling with **dynamic (non-fixed) lead time**

#### ii) Preventative measures against the disruption of SDs

- Common problem: Poor PD-HL operation at SDs
- Preventative measure: **“Direct Supply”**  
→ **Necessary and sufficient conditions** for “Direct Supply”

#### iv) Flexible information system based on comm damaged

- Comm was limitedly damaged in the Kumamoto area.
- **Multiple complex IFs led to mismatching problems**.  
→ Find **the optimal strategy according to comm damaged**