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Smart and Inclusive Early Warning: Lessons from Korea

Purpose: Information
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Smart and Inclusive Early Warning: Lessons from Korea

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- Korea's Early Warning System (4 slides)
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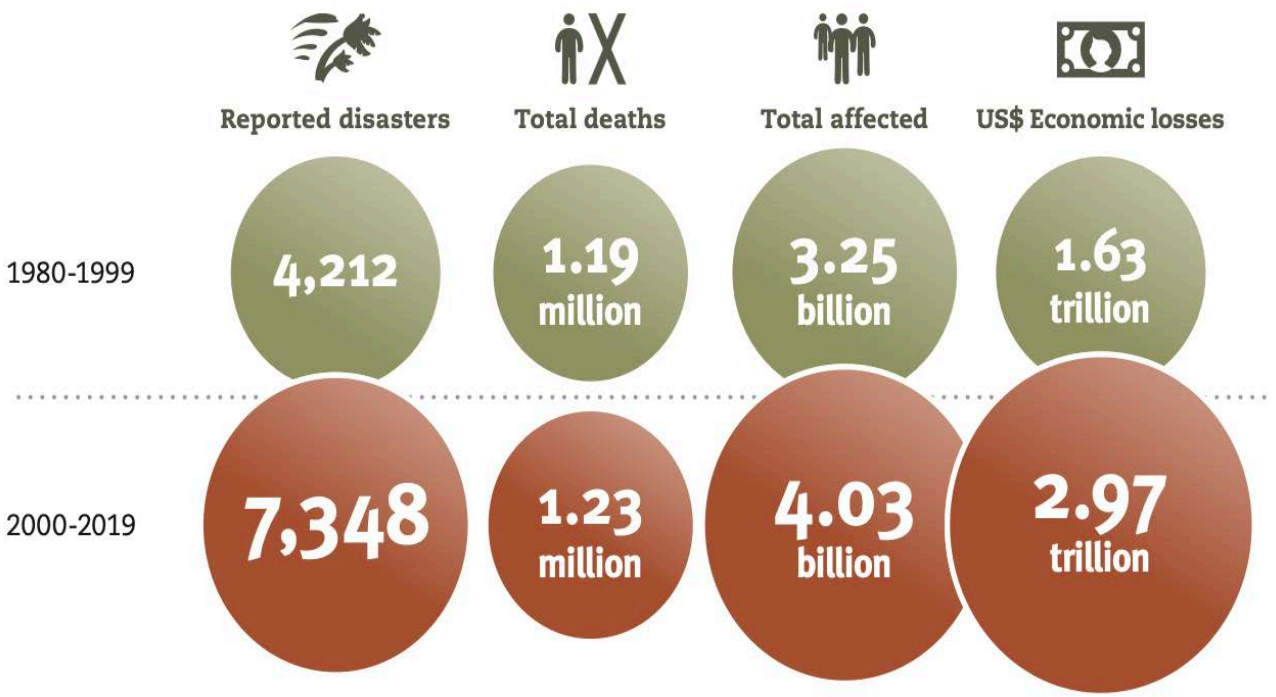
Climate Change & Increasing Disasters

Global Disaster Impacts



- (Sources: UNDRR 2020, APEC 2021, APEC Regional Trends Analysis)

APEC Region

- Over 70% of global disasters occur here
- US$100B in annual disaster losses
- Vulnerable groups hit hardest

(the poor, women and girls, migrants, Indigenous Peoples, rural/remote areas)

Why Early Warning Systems Matter

- UN ”Early Warning for All” initiative (2022):
  - Goal: All people on Earth must be protected by early warning systems by 2027
- Benefits of EWS
  - Every US$ 1 invested yields an average of US$ 9 in benefits (GCA)
  - US$ 800M Invested in developing economies → US$ 3B–$16B Annual Loss Avoided annually
  - 24-hour early warning can cut disaster damage by 30%
- Global Gaps Remain
  - Only half of the world population is protected by Multi-Hazard EWS
  - 30% lack any early warning coverage

- (Sources: UNDRR website, WMO website)

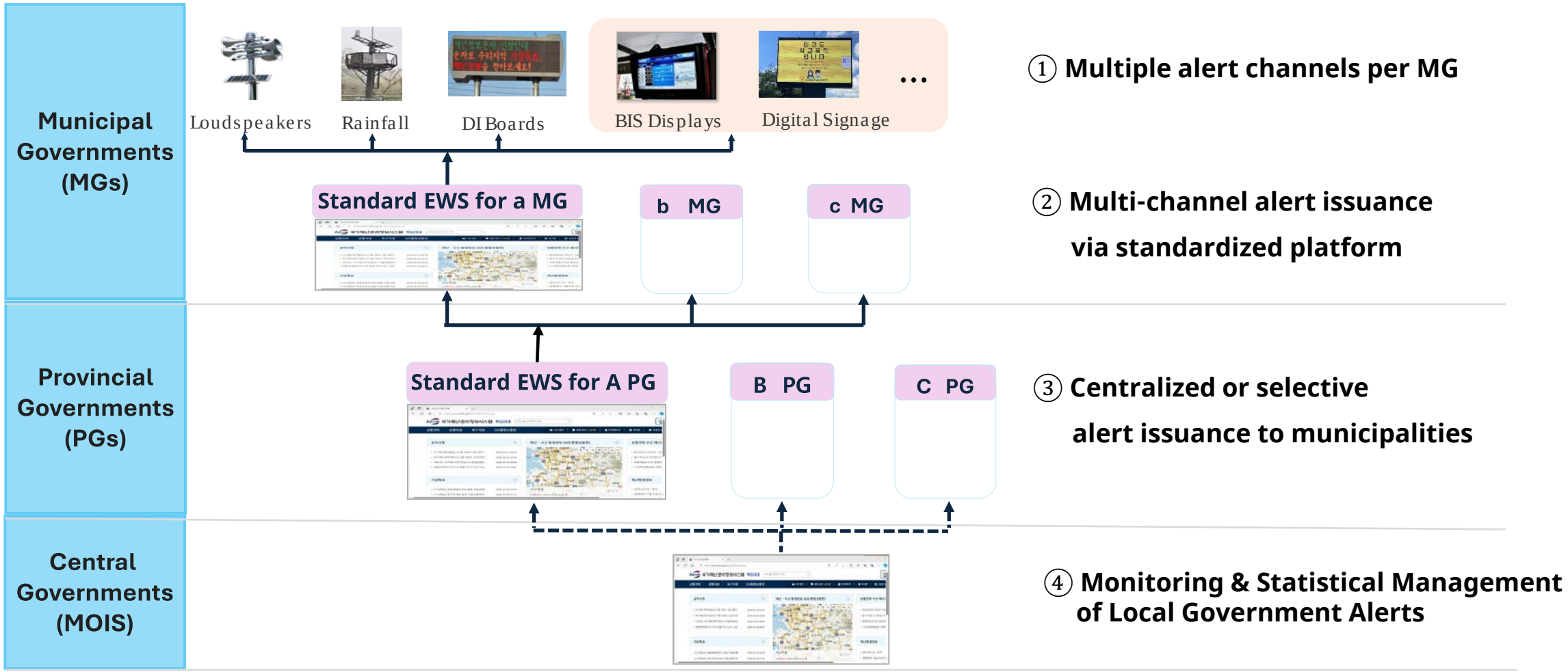
Korea's EWS: Economy-wide Platform

- Integrated Disaster Information Dissemination Platform
  - A unified platform jointly used by 20+ central agencies and 200+ local governments
  - Multi-channel Alerts *(Mobile phones, Car Navigation systems, TV caption, Radio voice)*
  - About 20,000 alerts issued annually

Integrated Disaster Information Dissemination Platform

Korea's EWS: Local Integration

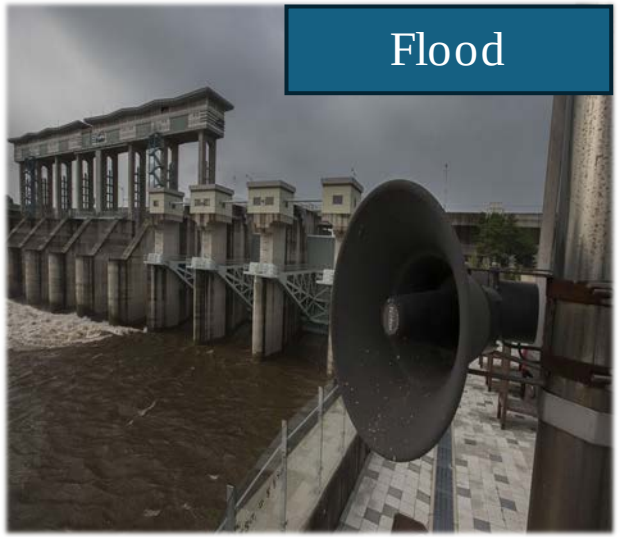
- EWS of Local Governments



Korea’s EWS: Sectoral Systems

- Agency-Specific Specialized EWS

- Lead Agency: MOIS
- 2,000+ sirens/loudspeakers
- Satellite backup for continuity



- Lead Agency: FCO
- AI + Physical model based forecasting
- 900+ rainfall & water-level monitoring stations
- 10-30 minutes for forecasting

- Lead Agency: KMA
- 430 seismic stations
- 5-10 second warning time

Korea’s EWS: Inclusive Alerts

- Inclusive Early Warning for Vulnerable Groups

Citizens with Disabilities

- **Emergency Alerts with TTS**
- Planned: Sign Language Support
- 61 Action Guidelines
- 5 Types of Disaster Shelters

Foreigners

- **Multi-language Alerts** (5 languages)
- Embassy info & Emergency Services
- Action Guidelines & Shelters

Seniors

- AI & Robot-assisted **smartphone training**
- 800 **elderly tutors** trained to help seniors with digital skills (Digital Everywhere Supporters)
- Mobile Digital Training Buses for Seniors

Case Study: 2025 Yeongnam Wildfire Overview

- Worst wildfire in Korea (Mar-Apr 2025)
  - Affected area: 1,047 ㎢
  - Fatalities: 32, Evacuees: 37,000
  - Damages: KRW 1 trillion
  - Impacted Regions: 11 municipalities
- Key Characteristics
  - Wind speed: 27m/s (strong tropical storm)
  - Spread speed: 8.2 km/h (running speed)
  - Evacuation alerts were delayed due to unpredictable fire spread

Case Study: Early Warning Gaps and Improvements

Category	Identified Gaps	Proposed Improvements
Evacuation Timing & Information	• Unpredictable wildfire spread made it difficult to issue timely evacuation orders • Lack of clear guidance on evacuation shelters and routes	• Develop **fire spread prediction models** • Define **5-hour (risk)** and **8-hour (potential risk)** zones • Issue **advance evacuation orders** based on forecasted spread
Alert Delivery & Recipient Accessibility	• Over-reliance on **CBS (Cell Broadcast)** • Alert delivery failed in areas with **telecom outages** (e.g., destroyed base stations) • **3G-only phones** (mainly seniors) couldn't receive alerts • Even when alerts were received, **digital illiteracy** limited response actions	• **Multi-channel early warning approach** based on – **Channel traits** (coverage, resilience, data format) – **Recipient profiles** (e.g., elderly, remote villages) • **In-person delivery** in extreme cases (e.g., telecom outages)

Conclusion: A **predictive, inclusive, and multi-channel EWS** is essential to minimize disaster impacts.

Case Study: Illustrative Multi-Channel Alerting Strategy

Urban Areas

- **Digital-First Approach**
  - CBS on mobile phones
  - Subway digital signages, BIS displays
- **Mobile Applications**
  - Anjeon-Didimdol App (for citizens)
  - Emergency Ready App (for foreigners)
- **Social Media Channels**
  - Via KakaoTalk, Facebook emergency alert functions

Rural Areas

- **Traditional Analog Channels**
  - Village loudspeakers
  - Vehicle-mounted PA system
- **Civil Defense Alarm**
  - Loudspeakers with satellite backup in case of wired network failure
- **In-person Delivery**
  - Through village leaders, community patrol groups

Technology Opportunities to Strengthen EWS

Detection & Monitoring

- **LEO Satellites**: Thermal & smoke detection
- **HAPS**: High-altitude wide-area surveillance
- **AI Drones**: Autonomous local patrol
- **AI CCTV**: Real-time smoke and flame detection
- **IoT Sensors**: Temperature, humidity, wind tracking

◆ Early detection in remote & high-risk areas

Analysis & Prediction

- **AI Models**: Real-time fire path & speed forecasting
- **Digital Twin**: Virtual scenario simulation
- **Cloud Computing**: Big data analysis
- **Machine Learning**: Risk prediction based on historical data

◆ Improved forecasting & timely evacuation decisions

Warning & Alert

- **Direct-to-Cell Satellite**: Alerts without base stations
- **Multi-Channel Broadcast**: TV, radio, public loudspeakers
- **Smart Speakers**: In-home audio alerts
- **Mobile Apps**: Age/location-specific guidance
- **Community Networks**: Support from local leader & volunteer groups

◆ Inclusive alerts for elderly & remote populations

Key Takeaways

- Effective early warning requires **adaptation to local needs and conditions**
- Delivering **alerts through multiple channels** is essential to ensure no one is left behind
- **New technologies** can greatly enhance the reach, speed, and reliability of EWS