



DOTS

DISASTER ORGANIZATIONS,
TECHNOLOGIES AND STRATEGIES

Research Report Series

#Issue 1 June 2025



Exploring organizational cases that address humanitarian challenges

A collaborative project by:

UCL
SCHOOL OF
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INTRODUCING DOTS RESEARCH REPORT SERIES

Disaster Organizations, Technologies and Strategies (DOTS) is a collaborative research initiative between [UCL School of Management](#) and [Tohoku University](#) that examines organizations that address societal grand challenges. The DOTS research report series explores innovative organizational initiatives in contexts of disasters, humanitarian crises, global food systems, and social challenges. Each DOTS research report briefly examines one specific organization, outlines its strategic challenges, discusses human-technology interaction processes, and generalizes lessons learned from the case for organizations. DOTS aims to facilitate impactful collaborations amongst research institutions, businesses, technology firms, public policy institutions and transnational agencies.

DOTS Research Report Issue #1 focuses on how humanitarian organizations develop, deploy, test and scale digital technologies including AI in Japan's disaster context. This report provides critical insights for humanitarian practitioners developing and using technologies in contexts characterized by technological sophistication yet persistent vulnerability. Japan's advanced systems navigate complex organizational entanglements across national, prefectural, and municipal levels while managing protracted crisis response requirements.

CASE CONTEXT: HUMANITARIAN CRISES IN JAPAN

ABOUT

Japan exists perpetually on the [precipice of disasters and crisis](#), with its geographical position subjecting it to earthquakes, tsunamis, typhoons, and volcanic eruptions at frequencies unmatched globally. This omnipresent threat [necessitates that humanitarian organizations operating within Japan's borders develop](#) sophisticated technological capabilities that span the complete disaster management continuum. These organizations must orchestrate complex data flows across hazard monitoring, early warning dissemination, real-time response coordination, and long-term recovery management phases.

The technological tasks confronting humanitarian actors in Japan encompass seismic data analysis from [over 2,000 monitoring stations](#), satellite imagery processing for damage assessment, social media mining for survivor location, and cross-jurisdictional information sharing among hundreds of agencies. During acute response phases, organizations must synthesize meteorological forecasts, crowd-sourced incident reports, medical resource availability, and infrastructure damage assessments into actionable intelligence. These diverse data streams arrive at varying velocities and volumes, requiring sophisticated analytical capabilities to transform raw information into life-saving decisions.

The [deeply intertwined nature of these technological tasks](#) creates cascading dependencies that prove exceptionally difficult to manage. A single earthquake event triggers simultaneous demands for seismographic analysis, tsunami modeling, casualty estimation, shelter coordination, medical resource allocation, and infrastructure assessment—each requiring different technological systems operated by distinct organizational entities. This interdependency intensifies during protracted recovery phases, where humanitarian organizations must maintain operational continuity while transitioning from emergency response to long-term reconstruction support, creating additional layers of technological and organizational complexity.

STRATEGIC CHALLENGES

Humanitarian organizations deploying digital technologies across Japan's disaster management phases confront three fundamental strategic challenges that persistently complicate their operational effectiveness.

First, technological interoperability across organizational boundaries critically impedes humanitarian response. [Japan's disaster architecture](#) spans national ministries, 47 prefectures, 1,700 municipalities, international agencies, and private partners—each deploying proprietary systems. The Japan Meteorological Agency's earthquake early warning system must simultaneously interface with municipal loudspeakers, mobile carriers, railway controls, and broadcast media using incompatible data formats and protocols. During the 2011 Great East Japan Earthquake, 35% of tsunami-zone residents [never received evacuation warnings](#) due to this fragmentation. International responses compound the problem when foreign teams arrive with non-compatible platforms.

Second, balancing technological sophistication with operational reliability creates strategic tensions. Japan's AI-powered systems—including earthquake aftershock algorithms and flood prediction neural networks—offer advanced capabilities yet prove fragile during actual disasters. The [2016 Kumamoto earthquakes](#) exposed this paradox when power failures disabled municipalities' digital emergency systems, forcing reversion to paper-based coordination. Organizations must maintain expensive dual architectures: cutting-edge predictive systems alongside analog backups, significantly increasing operational complexity.

Third, data protection requirements versus humanitarian imperatives generate operational dilemmas. Japan's Act on the Protection of Personal Information restricts data sharing even during emergencies, impeding access to population registries, medical records, and vulnerability assessments essential for resource allocation. Privacy-preserving technologies like differential privacy algorithms remain computationally intensive for crisis deployment. International humanitarian involvement adds complexity through conflicting cross-border data regulations. This challenge intensifies during protracted crises when immediate humanitarian justifications diminish but recovery planning still requires sustained data access.

IN FOCUS: SPECTEE PRO'S AI-DRIVEN CRISIS INTELLIGENCE ECOSYSTEM

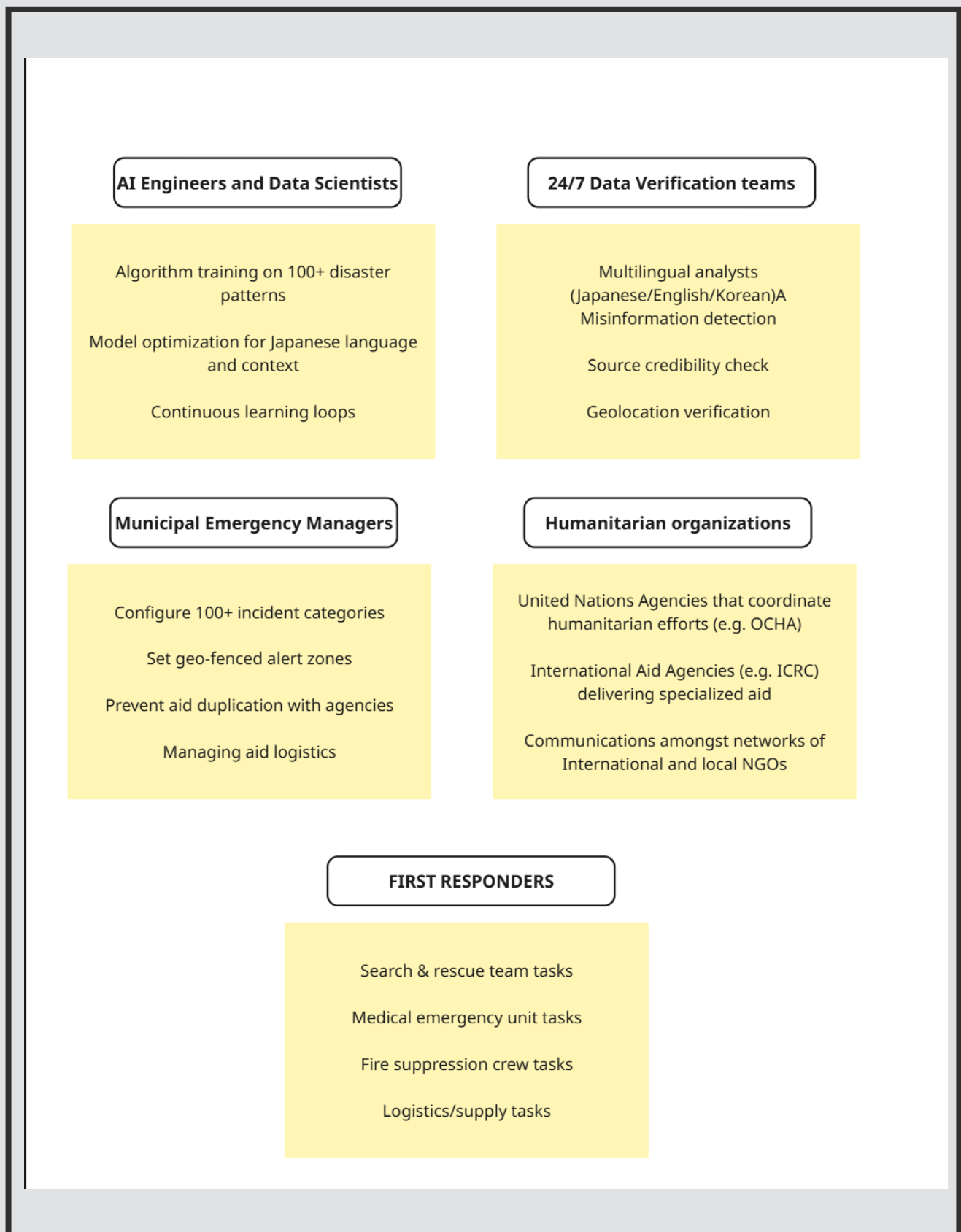
[Spectee Pro](#) emerged from the catastrophic information failures of the 2011 Great East Japan Earthquake, where social media proved more reliable than traditional channels for real-time damage assessment and survivor location. Launched commercially in 2020 after six years of development, this AI-powered crisis management service has fundamentally transformed how Japanese humanitarian organizations harness crowd-sourced intelligence across all disaster phases—from early warning through protracted recovery. The system's deployment during the 2024 Noto Peninsula earthquake, Japan's deadliest seismic event since 2011, demonstrated the intricate human-technology choreography required for effective humanitarian response.

The human agents within Spectee Pro's ecosystem encompass diverse stakeholders operating across organizational boundaries. At Spectee Inc.'s headquarters, teams of AI engineers continuously refine machine learning algorithms based on patterns identified from over 100 disaster types. These engineers work alongside disaster response specialists who possess deep domain expertise in interpreting social media signals during crises. The company employs 24/7 human verification teams—multilingual analysts trained in detecting misinformation patterns, verifying geolocation data, and assessing source credibility. During the Noto earthquake, these teams processed over 50,000 social media posts per hour at peak intensity.

Local government emergency managers represent critical human nodes, configuring the system's 100+ incident categories to match regional hazard profiles and establishing geofenced alert zones for their jurisdictions. During the Noto response, officials from 47 municipalities used Spectee Pro's customizable dashboards to track evolving situations—from initial tremor reports through weeks of aftershock management. Fire department commanders, police coordinators, and Japan Self-Defense Forces (JSDF) liaison officers access real-time intelligence feeds through role-specific interfaces, each calibrated to their operational requirements.

The non-human agents comprise sophisticated technological components operating in orchestrated layers. At the foundation, web crawlers continuously harvest data from Twitter/X (35 million Japanese users), LINE (95 million users), Facebook, Instagram, and Yahoo! Japan's real-time search trends. Natural language processing engines, trained on Japanese disaster-specific vocabularies including dialect variations, parse incoming text for critical keywords, sentiment indicators, and location references. Computer vision algorithms analyze uploaded images and videos, identifying collapsed structures, fires, flooding, and injured persons through pattern recognition trained on millions of disaster images.

Figure 1: Humanitarians and other (human) stakeholders at Spectee Pro



IN FOCUS: SPECTEE PRO'S AI-DRIVEN CRISIS INTELLIGENCE ECOSYSTEM

The system's proprietary credibility assessment algorithms evaluate source reliability through multiple parameters: account history, follower networks, posting patterns, and cross-correlation with verified sources. Geospatial processing engines triangulate location data from post metadata, textual references, and visual landmarks. Machine learning models continuously update threat assessments based on emerging patterns, with specialized algorithms for earthquake aftershock prediction, tsunami arrival estimation, and fire spread modeling. All processed intelligence flows through API gateways that interface with government emergency systems, media broadcast platforms, and international humanitarian databases.

System Operation Across Crisis Phases

During pre-disaster monitoring, Spectee Pro functions as an ambient intelligence system, establishing baseline social media activity patterns for normal conditions. The system's anomaly detection algorithms identify unusual clustering of keywords like “jishin” (earthquake), “yurete iru” (it's shaking), or location-specific concerns. On January 1, 2024, at 16:06—four minutes before the magnitude 7.6 [Noto earthquake](#)—Spectee Pro detected abnormal Twitter activity from users reporting unusual animal behavior and minor tremors along the peninsula's western coast. While insufficient for formal warning, this intelligence was flagged to emergency managers in Ishikawa Prefecture.

At 16:10, when the earthquake struck, Spectee Pro's systems immediately shifted to acute response mode. Within 20 seconds, the platform aggregated over 3,000 social media posts containing earthquake keywords from the affected region. The AI classified these into categories: building collapse (312 posts), tsunami sightings (89 posts), fire reports (67 posts), and requests for rescue (156 posts). Human verification teams validated high-priority reports, confirming a major fire in Wajima's traditional market district within 3 minutes—faster than official fire department reports. This intelligence enabled JSDF units to pre-position firefighting assets before formal deployment requests..

IN FOCUS: SPECTEE PRO'S AI-DRIVEN CRISIS INTELLIGENCE ECOSYSTEM

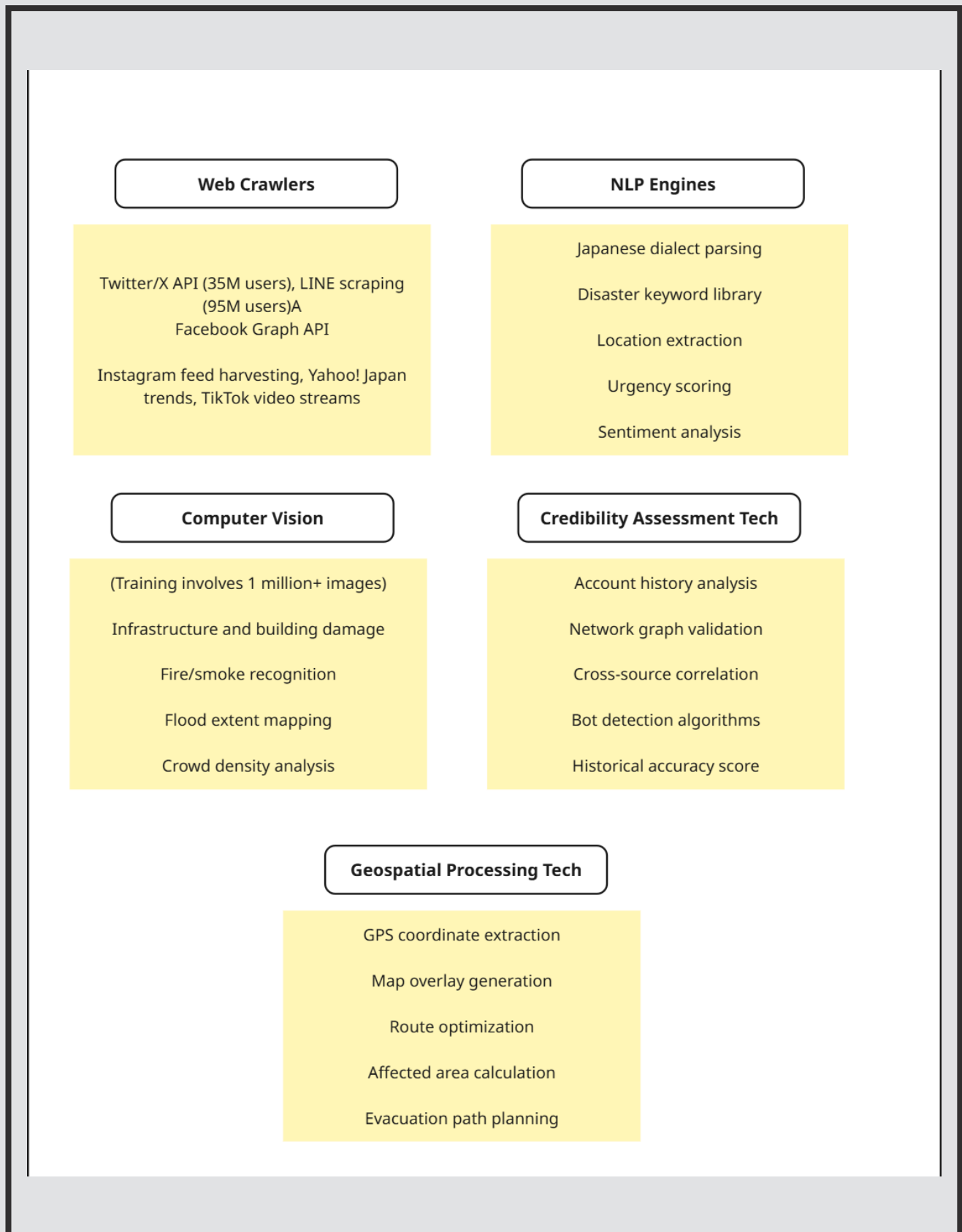
The system's computer vision algorithms proved particularly valuable in assessing tsunami impacts. By analyzing videos uploaded to Twitter and TikTok, Spectee Pro identified tsunami arrival times at 28 coastal locations, correlating closely with later scientific measurements showing waves reached some areas within one minute of the mainshock. The platform's multilingual capabilities also captured distress messages from foreign residents and tourists, with Korean and Chinese language posts automatically translated and routed to appropriate consular emergency teams.

During the extended response phase spanning weeks after the mainshock, Spectee Pro transitioned to sustained operations mode. The system tracked evolving needs across 521 evacuation centers, aggregating social media reports of supply shortages, medical emergencies, and infrastructure failures. When conventional communication networks failed in isolated mountain communities, residents' sporadic social media posts—sent during brief connectivity windows—provided the only intelligence on local conditions. The platform identified 37 communities completely cut off by landslides, enabling authorities to prioritize helicopter reconnaissance and supply drops.

The system's pattern recognition capabilities revealed critical emerging threats. By analyzing clustered reports of elderly evacuees exhibiting confusion and weakness, Spectee Pro's algorithms identified hypothermia risks in under-heated evacuation centers—a factor that ultimately contributed to [30% of the earthquake's indirect deaths](#). This intelligence prompted immediate deployment of heating equipment and medical teams specialized in cold-exposure treatment.

In the protracted recovery phase [continuing through 2025](#), Spectee Pro has evolved into a community resilience monitoring platform. The system tracks reconstruction progress through geotagged images showing infrastructure repairs, analyzes sentiment patterns indicating mental health concerns among displaced populations, and identifies emerging social tensions in temporary housing complexes. Local governments use these insights to allocate psychosocial support services and community-building programs. The platform's longitudinal analysis revealed that social media activity patterns in affected communities remained 40% below pre-disaster baselines even six months post-earthquake, indicating persistent psychological trauma requiring sustained intervention.

Figure 2: Technological stakeholders at Spectee Pro.



IMPLICATIONS FOR RESEARCHERS AND PRACTITIONERS ON HUMANITARIAN CRISIS CONTEXTS

For Researchers:

Researchers investigating human-technology implementations in humanitarian contexts should examine how organizational boundaries become simultaneously more porous and more rigid during crisis events. The Spectee Pro case demonstrates that while technology enables unprecedented information sharing across traditional institutional silos, it also creates new boundaries defined by technical standards, data formats, and system access privileges. Future research should investigate how these techno-organizational boundaries reshape power dynamics during humanitarian responses, particularly examining whose knowledge becomes privileged when mediated through standardized technological interfaces versus traditional communication channels.

Researchers can also develop new methodological approaches that capture the temporal dynamics of human-technology collaboration across different crisis phases. Traditional ethnographic methods prove insufficient when technological systems process thousands of decisions per second while human operators make strategic choices over hours or days. Mixed-method approaches combining computational trace data analysis, participant observation, and retrospective interviews offer promise for understanding these multi-scalar temporal dynamics. Research should particularly focus on moments of

breakdown and repair, where human improvisation compensates for technological failures.

Researchers can investigate how artificial intelligence and machine learning systems encode cultural assumptions about disaster response that may not translate across contexts. Japan's disaster management AI systems embed specific cultural values regarding collective responsibility, hierarchical information flow, and technological trust that differ markedly from Western humanitarian contexts. Comparative research examining how identical humanitarian technologies perform differently across cultural contexts would illuminate the sociotechnical nature of disaster response systems..

IMPLICATIONS FOR RESEARCHERS AND PRACTITIONERS ON SOCIETAL GRAND CHALLENGES

For Practitioners and Policymakers:

Humanitarians need to recognize that technological entanglements in humanitarian contexts are not problems to solve but realities to manage through continuous negotiation and adaptation. The Spectee Pro case suggests that attempting to create perfectly integrated systems proves less effective than developing robust protocols for managing partial connections and information gaps. Organizations should invest in boundary-spanning roles—individuals who understand both technological capabilities and humanitarian imperatives—rather than expecting seamless technical integration.

Practitioners can, ideally, design technological systems with explicit accommodation for human override and improvisation capabilities at every level. Japan's most resilient disaster response operations maintain parallel analog communication channels and decision-making processes that activate when digital systems fail. This redundancy appears inefficient during normal operations but proves essential during actual crises when infrastructure damage, power failures, or network overloads compromise technological systems. Training programs should emphasize these hybrid human-technology workflows rather than assuming technological systems will function as designed.

Practitioners can also develop data gov-

ernance frameworks that explicitly address the tension between privacy protection and humanitarian effectiveness before crises occur. Japan's experience demonstrates that attempting to negotiate data-sharing agreements during active disasters wastes precious time and limits response effectiveness. Pre-positioned data-sharing agreements with clear activation triggers, sunset clauses, and audit mechanisms can enable rapid humanitarian response while maintaining public trust. These frameworks should acknowledge that data entanglements persist long after immediate crisis response ends, requiring ongoing governance attention during protracted recovery phases.



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