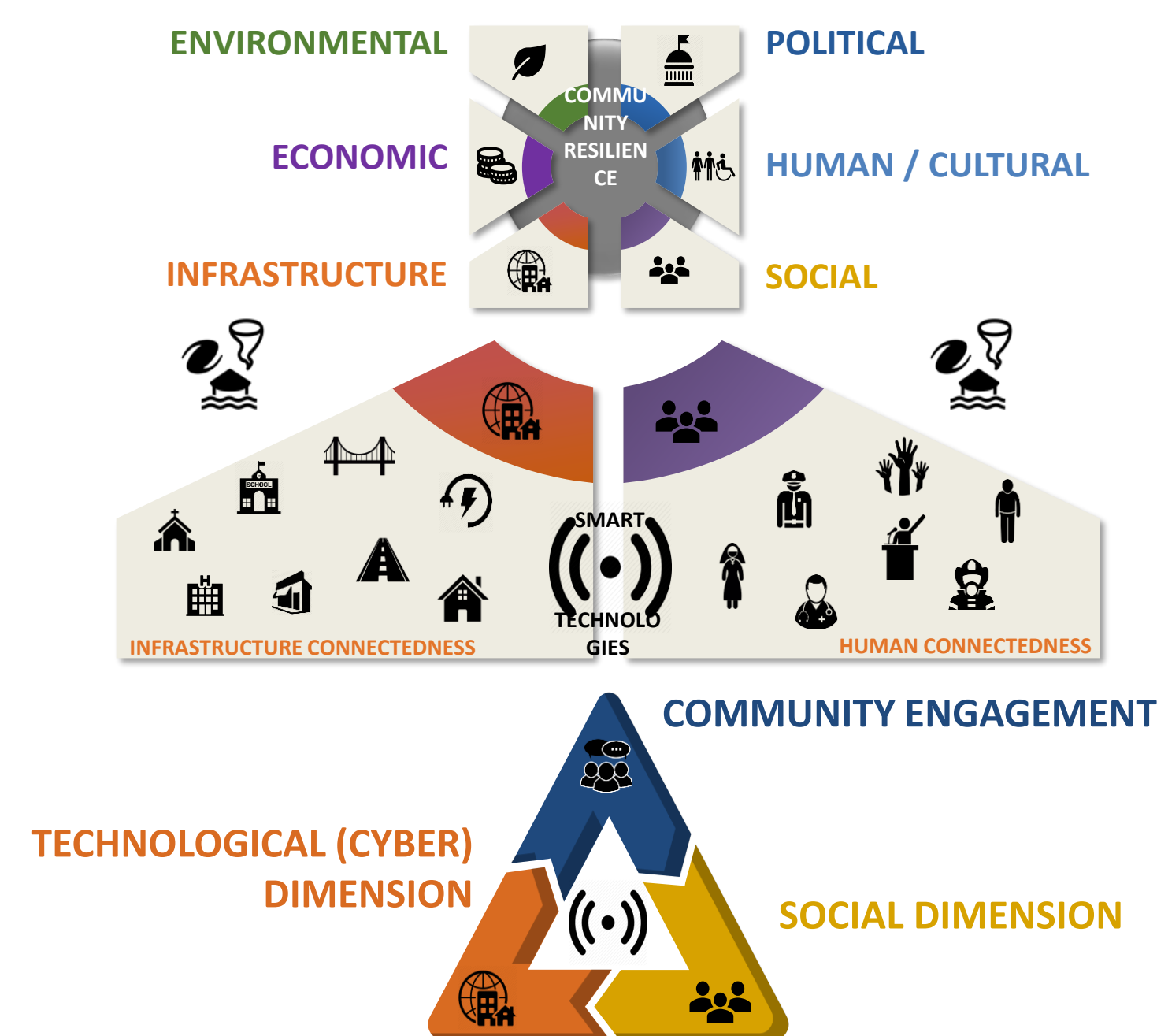


Leveraging Smart Technologies and Managing Community Resilience through Networked Communities and Cross-Sector Partnerships

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Community-identified Problems

- Community resilience is a shared responsibility of stakeholders among all sectors through partnerships in the networked communities.
- Technological advances in the big data era have enabled effective preparedness for and timely responses to the adverse impacts of natural disasters.
- This project leverages existing community partnerships and resources and evaluates the information technology (IT) applications aided by artificial intelligence (AI) in enhancing community resilience management and timely, effective, and collective decision-making to strengthen community capacity.
- The East Central Florida (ECF) region is selected as a testbed.

Intellectual Merits

The research involves

- Developing an integrative framework to evaluate smart technology advances that foster community partnerships and enhance community connectedness in resilience management.
- Filling research gaps in modeling community partnership characteristics and examining the design and implementation networks among cross-sector partners for community resilience efforts.
- Creating a holistic approach to comparing community resilience functionality changes by research intervention and an actual hazard event.
- Building *Community Resilience Data Depot* (CoRD²) for resilience data sharing and integration among public, private, and nonprofit sectors to support real-time collective decision making.

The novel methodologies include

- Collecting and calibrating multi-dimensional data from behavioral surveys, policy and plan documents, social media posts, and an in-house drill with pre-/post-surveys.
- Creating converged metrics for evaluating community resilience from an organizational perspective; providing next-generation computational solutions for processing disaster response data flowing in the CoRD² as peak influxes.
- Developing real-time machine learning algorithms and software capacities for social media big data analytics (texts and images).
- Modeling organizational resilience capacity and multidimensional community resilience functionality.

Integration of Interdisciplinary Research and Community Engagement



Project Activities and Outcomes to Date (Informed by Community Needs)

- Emergency Managers and Operators Web Survey in Florida.** Studying the role of public-private partnerships (PPPs) in emergency management systems, designing a comprehensive conceptual framework for analyzing the interdisciplinary processes and organizational-level outcomes of emergency management PPP networks, designing a quantitative web survey based on the conceptual framework, working directly with the Florida Emergency Preparedness Association (FEPA) to distribute the survey to all emergency managers and operators (EMOs) in the State of Florida, and presenting findings at multiple conferences.
- Community Resilience Policy and Plan Documentations Network Analysis.** Developing a codebook for the detailed content analysis to capture necessary information about agencies, developing matrices for creating network visualization and network figures, obtaining data from Comprehensive Emergency Management Plans (CEMPs), sending the organization list to each county emergency management director for their review and validation, submitting a manuscript for publication, and presenting the findings at different conferences.
- Social Media Analysis on Organization Social Networks in Emergencies.** Collecting tweets from 252 agencies from the ECF region during Hurricane Irma and the COVID-19 period, augmenting Twitter data of each organizational account by adding county/state level Emergency Support Function (ESF) found in the content analysis codebook, which resulted in the creation of a comprehensive list of 377 relevant organizations with their ESFs, producing engagement scores compared to other levels of organizations, conducting literature reviews, and presenting at conferences.
- 311 Non-Emergency Call Reports Analysis in Orange County.** Conducting a series of preliminary analyses that focused on the COVID-19 pandemic using the complete set of 311 requests made in Orange County, presenting findings at conferences, and publishing manuscripts.
- East Central Florida (ECF) Community Resilience Data Depot (CoRD²) Development.** Designing a new web-based software system called CoRD², porting all the existing data, collected by East Central Florida Regional Planning Council, into this platform, extending web-based CoRD² to mobile devices, designing a semantics-aware optimization for data-intensive applications using hybrid program analysis (SODA), extending the functionality and usage of LOTIS (Land Overlaid on Transportation Information System) to more counties and updating it based on new Census and Crash Data, and implementing a deep neural model that can well rank images for the level of natural disasters.
- Emergency Operators' Decision-Making Behaviors Drill Planning.** Contacting the local community to conduct evacuation drills and evaluate the evacuate route system, developing a web-based survey to analyze dynamic evacuation strategies of emergency managers, developing an interdisciplinary research architecture focused on the integration of fundamental engineering and science principles, completing an interdisciplinary evacuation model, and submitting research papers.
- Emergency Operator Drills vs. Real Events.** Developing an evacuation drill application and comparing the data quality between the drill application with STAVA, developing a mobile application to extract individual trajectory data during a drill event, and developing a novel approach to capture the speed-slope relationship for modeling evacuee walking speed based on the empirical trajectory dataset.
- Project Evaluation and Broader Impacts.** Documenting activities undertaken, as well as outputs, outcomes, and impacts generated by the subprojects and community outreach activities, and developing a performance management approach to evaluate project progress.

Broader Impacts

(Immediate Impact on Society)

- Providing a deeper understanding of the understudied aspects of emergency management PPPs and creating opportunities for emergency managers, policymakers, and researchers to use the proposed conceptual EMO PPP framework in other settings.
- Identifying potential gaps between the design and implementation by analyzing policy, plan, and actual partnerships.
- Understanding which specific local agencies are leading in disseminating information on social media platforms during a disaster, measuring the engagement of these agencies with respect to their crisis-communication posts, and understanding whether the ESFs of these agencies correlate with the engagement of their crisis-communication posts.
- Leveraging 311 data analyses results to develop opportunities for more effective crisis communication and decision-making support, and reveal Wi-Fi access disparities as evidence for Orange County to add Wi-Fi capacity to socially vulnerable communities to disasters in using web and mobile services to report non-emergency and emergency needs.

Broader Impacts

(Sustainability and the Lasting Impact on Communities Beyond This Project)

- Helping emergency managers across multiple sectors and policymakers to better understand the factors that contribute to organizational resilience as well as the effectiveness and institutionalization of PPPs in emergency management.
- Providing empirical information about the leading agencies in risk communication and offering recommendations for improving the communication across multiple sectors.
- Establishing a solid baseline to better understand opportunities for municipalities to allocate resources more effectively to improve community resilience.
- Improving understanding of image and text information on the web regarding natural disasters.
- Enabling communities to prepare for natural hazards through the use of strategically placed leaders.
- Applying the drill mobile application in communities with low technology aptitude, thus offering a greater outreach capability among the at-risk population.

Next Steps

- Further analyzing the data collected through the EMO survey and composing policy recommendations.
- Using the plan and policy matrices to depict a network through UCINET and providing a snapshot of each separate organization, and the relationships amongst agencies across different organizations.
- Using the findings of different subprojects to publish book chapters, research papers, and/or conference proceedings.
- Revising the evacuation drill mobile app for a Central-Florida-based emergency decision-making app that will be used in an emergency drill in Orlando metro area.
- Conducting multi-modal analyses on all the collected organizational and community resilience data through this grant project, and quantifying community resilience functionality changes by research interventions and/or real emergency events.