CSPRI Blockchain–DRR Research Themes
To see the future in real time

Dec 16, 2020
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Blockchain and DRR

New opportunities for research at the intersection of disciplines
- Information science
- Machine learning
- Network analysis
- Social systems
- Cognitive science

Commonalities among type of disasters imply commonalities in solutions
Role of cognition and risk visibility
Race between escalation of disaster impact and means to mitigate impact

DRR Target before COVID-19

- Hurricanes
- Fires
- Floods

DRR Target after COVID-19

- COVID-19 – 100K Deaths / week
- Climate – millions of people affected
- Famine / Water – millions of people affected
- Cyber – Millions of networked systems

New Technologies

- Blockchain, Dapps, Web3
- Machine Learning
- CRISPR-Cas9
- mRNA / and other molecular vaccine innovation
- Social network analysis

To address increasing threats

Potential outcomes

1) Manageable Loss
2) Unacceptable Catastrophe

100K Deaths / year

Governance Social behavior

Disaster Incidents
DRR – Obstacles
Resistance in responding to cognitively distant outcomes

**Needs**
Sendai Framework (2015)
1. Understanding disaster risk;
2. Strengthening disaster risk governance to manage disaster risk;
3. Investing in disaster risk reduction for resilience;
4. Enhancing disaster preparedness for effective response, and to "Building Back Better" in recovery, rehabilitation and reconstruction.

**Challenges**
From Daniel Ariely
1. Impact is in the future.
2. Affects others more than me.
3. Impact is probable, not certain.
4. Human brains are not built to take in exponential change.
5. Cause is hidden.
6. Efficacy - Invisible impact of individual action; lack of individual incentive to do the right thing.

Need to expand cognitive vision in space and time – to see impact on other geographies and impact on future populations.
- Incentivize investment in DRR Infrastructure
- Incentivize behavior change in populations
Challenge of slow moving, high-impact disasters

- Pandemic preparedness
  - Detection
  - Vaccine development capability
  - PPE supplies
  - Means for behavior change – governance, norms
- Climate change – impacts on food, water, land, health
- Aging and chronic disease
- Deteriorating infrastructure
## Blockchain, Disaster Risk, and Incentive Visibility

<table>
<thead>
<tr>
<th>Cognitive Barrier</th>
<th>Climate</th>
<th>Pandemic</th>
<th>Infra-structure</th>
<th>Chronic Disease</th>
<th>Education</th>
<th>Cyber Attack</th>
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<tbody>
<tr>
<td>Long-term impact</td>
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<td>✓</td>
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<tr>
<td>Slow change</td>
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<tr>
<td>Exponential growth</td>
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<td>Linear/ resource limited</td>
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<td>✓</td>
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<tr>
<td>Affects others more than me (individual versus social)</td>
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<td>Individual</td>
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<td>Probabilistic</td>
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<td>Hidden causes</td>
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<td>Lack of individual incentive</td>
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</tbody>
</table>
Blockchain’s role in social behavior change

Impact Tracking

Behavior Monitoring

Social Network Analysis

Blockchain Data Records

Analytics

- Incentives – social, monetary
- Impact visibility
- Permanent behavior record and visibility
- Synchronization of behavioral events
Slowly Changing Fragile Systems

Examples:

- Satellite collision avoidance
- Chronic disease (onset of acute incidents)
- Water resource management
- Pandemic control

Features

- Small amount of information need to describe state
- Perturbations matter
- Potential cascading effects of incidents
- A little attention goes a long way
  (Preventing or isolating an incident interrupts cascade of destructive impact)
What blockchain can do for DRR

• Connect behavior with incentives
• Provide interoperable access to data and to people
• Provide trusted record of responsive actions
• Management of Slowly Changing Fragile Systems
• Behavior change in networked populations

Goal: To reduce the information needed to manage behaviors in populations
Means: Synchronization and Consensus (what blockchain is good at)