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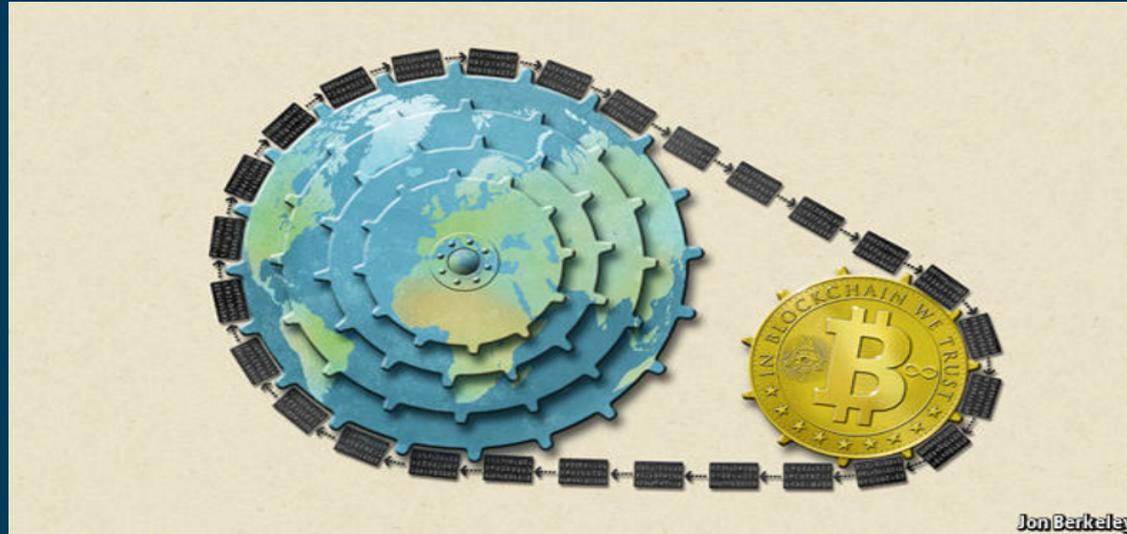
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Blockchain and DRR

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**

100K Deaths / year

DRR Target *after* COVID-19

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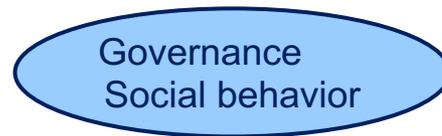- **Cyber – Millions of networked systems**

New Technologies

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

To address increasing threats

Disaster Incidents

Governance Social behavior

Potential outcomes

1) Manageable Loss

2) Unacceptable Catastrophe

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

Cognitive Barrier	Climate	Pandemic	Infra-structure	Chronic Disease	Education	Cyber Attack
Long-term impact	✓	✓	✓	✓	✓	
Slow change	✓		✓	✓		
Exponential growth	Linear /resource limited	✓		Linear /resource limited	✓	
Affects others more than me (individual versus social)	Social	Social	Social	Individual	Individual	✓
Probabilistic	✓	✓	✓	✓		✓
Hidden causes	✓	✓		✓		✓
Lack of individual incentive	✓		✓			

Blockchain's role in social behavior change

Impact Tracking

Blockchain Data Records

Behavior Monitoring
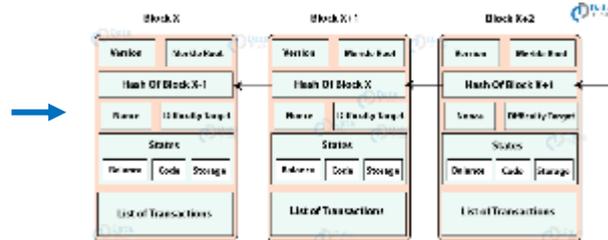
Analytics

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

Social Network Analysis

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)

Network Models of Behavior

Aggregated, synchronized time-behaviors