

Adam Rose (USC)

Noah Dormady (Ohio State)

Alfredo Roa-Henriquez (Ohio State)

Heather Rosoff (USC)

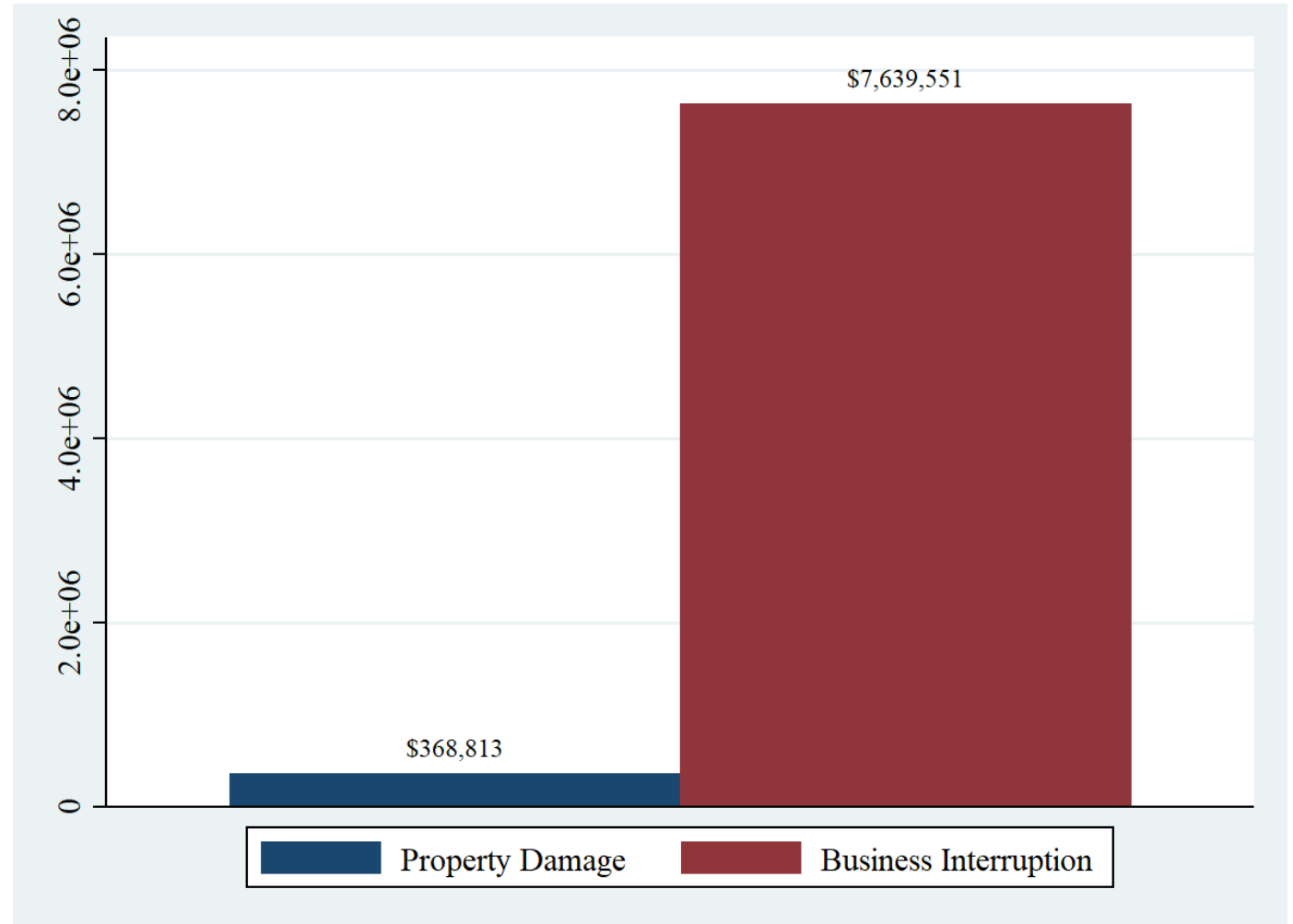
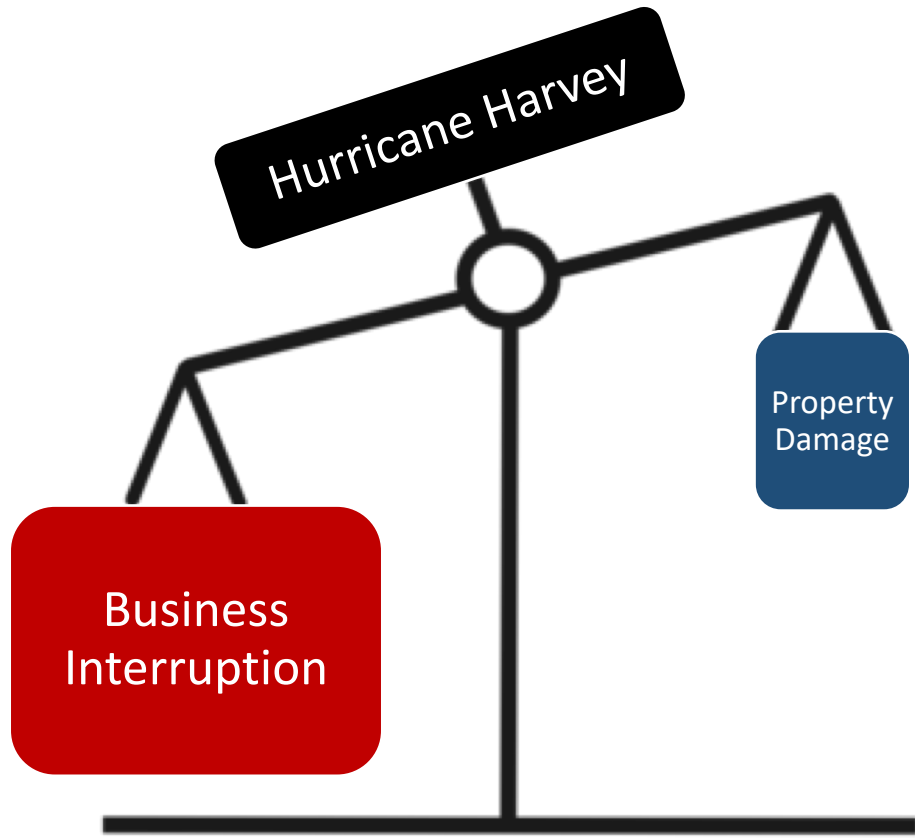
Tech Transition
**Measuring Business & Economic
Resilience in Disasters**

April 10, 2019

Background

- Most studies of the economic consequences of terrorism and natural disasters focus on property damage (PD)
- However, there is increasing attention to business interruption (BI), typically measured in terms of GDP or employment losses
- BI begins when the disaster strikes but extends to the point of recovery
- BI has exceeded property damage in recent actual events/simulations
 - 9/11: PD = \$40B; BI = \$175B
 - Katrina: PD = \$100B; BI = \$150B
 - ShakeOut: PD \$120; BI \$80B
- Resilience is a way to reduce BI by maintaining business continuity and promoting recovery

Background



Background

- Need to help businesses recover from a disaster without wasting money
- Help them manage resilience for their own survival & region's economy
 - Estimate the cost-effectiveness of economic resilience (business continuity) tactics
 - Develop a Business Resilience Calculator to identify/gauge progress on resilience
- Millions of businesses are operating without adequate information about actions they can pursue to most cost-effectively respond to disasters
- No one has attempted to develop a rigorous, evidence-based and tractable metric for assessing the cost-effectiveness of disaster response

Economic Resilience Defined

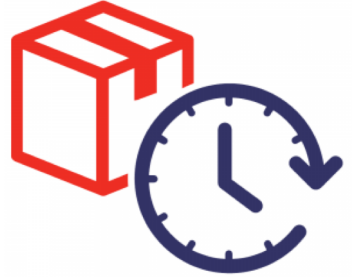
- **Static:**
 - General Definition: Ability of a system to *maintain function* when shocked.
 - **Economic Definition:** *Efficient use of remaining resources at a given point in time to maintain production.*
- **Dynamic:**
 - General: *Ability & speed* of a system to *recover*.
 - **Economic:** *Efficient use of resources over time for investment in repair/reconstruction, including expediting the process.*

Also, resilience is a process – can build capacity ahead of time

Static Resilience Tactics – Customer Emphasis

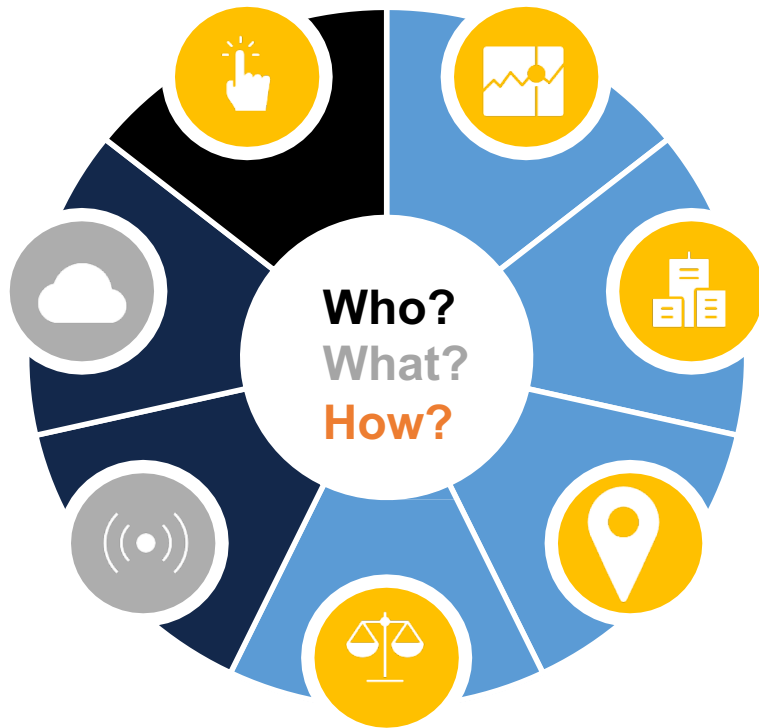
Resilience Tactic	Definition (Activities Involved)
Conservation	Maintaining production or service levels using lower amounts of an input
Resource Isolation	Modifying a portion of business operations to run without a critical input
Input Substitution	Replacing a production input in short supply with another
Inventories	Using emergency stockpiles and ordinary working supplies of inputs
Excess Capacity	Using plant or equipment that was idle
Relocation	Moving some or all of the business activity to a new location
Management Effectiveness	Improving the efficiency of business operations
Import Substitution	Obtaining needed production inputs from other regions
Technological Change	Improvising a production process
Production Recapture	Making up for lost production by working overtime or extra shifts
Resource Pooling/Sharing	Re-contracting, creating new partnerships, clearinghouses, etc.

Market Needs



- Intended customer of the technology?
 - medium- and small-size businesses facing various hazard threats
 - large infrastructure providers who need to know how customers respond
 - government officials who need to support private sector continuity efforts & not duplicate them
- Customer needs addressed
 - decision support tool for business continuity
 - capability to assess own resilience, compare with best practices & chart improvement

IBC Assessment of Market Needs



Resilience Industry

- \$28 billion market by 2023
- Small and large businesses alike are increasing demand for resilience

Industry & Location

- Companies in disaster-prone areas see themselves at higher risk
- Manufacturing/construction companies and their supplies are affected

Small & Medium Companies

- SMEs are particularly susceptible to disasters due to their limited resources
- Generally do not have resilience in place

Customer Needs

Disruptions (2000-2018)

- Terrorism: 9/11 attacks (2001)
- Power Outage: Northeast Blackout (2003)
- Financial Crisis (2008)
- Natural Disasters: Hurricane Katrina (2005), Hurricane Sandy (2012), California Wildfire (2018)



Business Continuity and Disaster Recovery (BC & DR)

- Processes that help organizations to **prepare** for and **respond** to disruptive events
- The combination of BC and DR results from industry recognition of enhancing the **collaboration** between business and technology executives



Drivers for Growth



Environment will become the most important risk (World Economic Forum 2018)



>75% of businesses fail within three years after a major disaster



Research shows that companies with resilience plans recover faster following an emergency



28 Billion Dollars
U.S. Business Continuity and Disaster Recovery
Market by 2023



What is the BRC?

Disaster Resilience defined:

The ability of an organization to **resist, absorb, recover from and adapt** to business disruption in an ever changing environment.



Layers of Resilience

	People
	Process
	Infrastructure
	Leadership
	Culture



Introduction to the BRC

- A **decision support** software system for companies
- Based on detailed **survey** of businesses that have gone through disasters
- Focuses on the **cost-effectiveness** of individual resilience tactics and the formulation of strategies



Functionality

- Evaluates an **inventory of tactics** to **reduce future losses**
- **Fills the gaps in user data** with default values from **previous research**
- Provides a **resilience score** based on an evaluation of the business in the face of threats
- Improves productivity by **optimizing the use of remaining resources** after disasters



The BRC is a software tool that helps businesses learn from previous disasters and prepare to recover from new ones in a cost-effective manner

to

Approach

- Decision support tool
 - user-friendly
 - User's Guide documentation
 - makes extensive use of business's own data
- Address market needs
 - unique tool that fills market niche
 - cloud-based capability for continuous updating



Business Resilience Calculator (BRC)

CIRI | CRITICAL INFRASTRUCTURE
RESILIENCE INSTITUTE
A DEPARTMENT OF HOMELAND SECURITY CENTER OF EXCELLENCE

Business Resilience Calculator User Interface Version 1.0

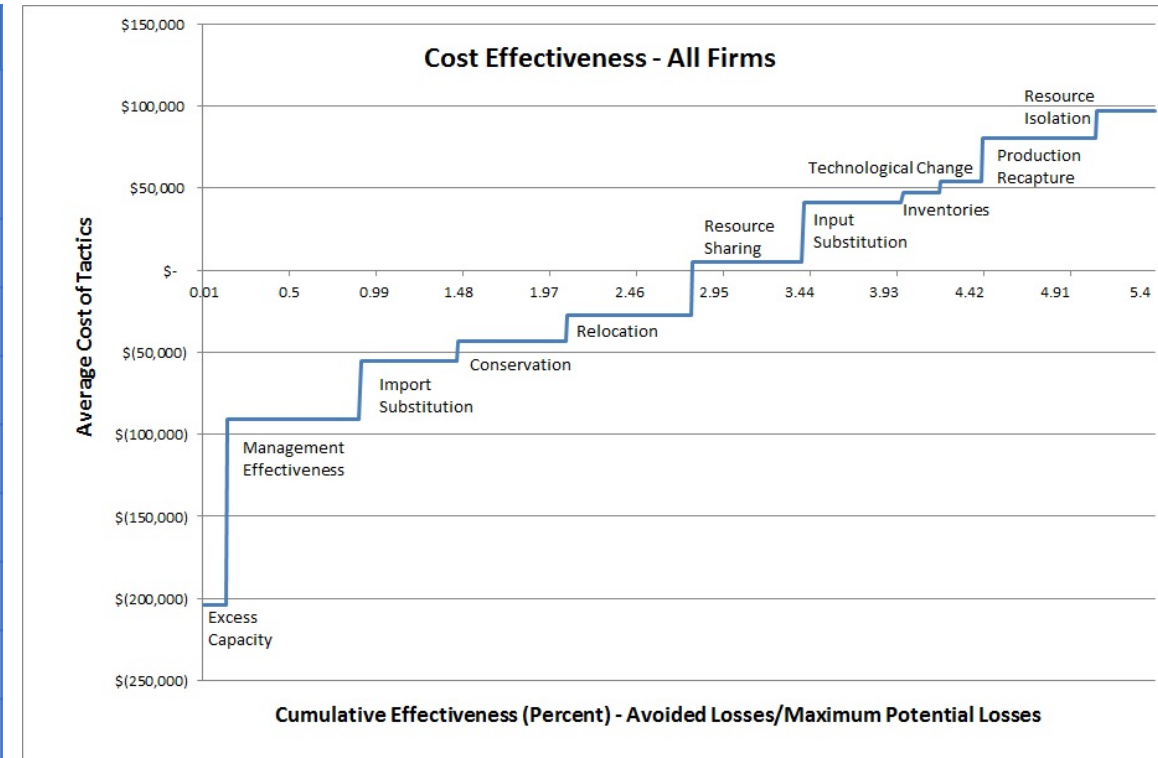
Business Information	Resilience Scores	Resilience Tactics Effect and Cost	Improvement Strategies	Input Data
<ul style="list-style-type: none">○ General○ Secure	<ul style="list-style-type: none">○ Current○ Targeted	<ul style="list-style-type: none">○ Product # 1○ Product # 2○ Product # 3	<ul style="list-style-type: none">○ Intra-firm○ Inter-firm○ Deregulation○ Gov't subsidy	<ul style="list-style-type: none">○ General○ Secure

Resilience Score 2018: Actual (Cost-Effectiveness)

	Product 1		Product 2		Product 3	
	Your Score	Sector Avg	Your Score	Sector Avg	Your Score	Sector Avg
Conservation	-1.5	-2.1	-1.8	-2.5	-1.0	-2.1
Resource Isolation	16.3	10.2	n.a.	n.a.	25.5	8.0
Input Substitution	8.1	6.2	20.3	9.1	12.4	12.4
Inventories	5.4	4.3	5.4	4.3	8.3	7.0
Excess Capacity	2.1	1.5	2.6	1.8	2.1	1.5
Relocation	4.6	2.9	4.6	3.5	4.6	3.8
.						
.						
.						
Production Recapture	15.1	18.0	16.2	20.5	16.4	20.2

Measuring Economic Resilience

Tactic	Implementation Cost			Effectiveness (Avoided Losses)			Cost-Effectiveness
	Total Cost (Net)*	Average	Median	Total Effectiveness (Net)	Average	Median	Effectiveness / Marginal Cost Ratio**
Conservation	-\$921,120	-\$25,586	-\$1,000	\$1,0695,663	\$297,101	\$27,250	-11.60
Resource Isolation	441,090	11,921	0	6,149,022	170,806	39,000	14.30
Input Substitution	1,201,875	38,770	100	9,539,292	307,719	38,750	7.94
Inventories	3,490,610	64,640	0	4,119,222	77,721	30,000	1.20
Excess Capacity	-2,357,800	-157,186	0	2,834,450	188,963	67,850	-1.20
Relocation	676,100	18,780	4,750	11,706,813	325,189	42,618	17.32
Mgt Effectiveness	-4,870,720	-69,581	-125	12,469,063	180,711	29,375	-2.59
Import Substitution	-1,016,700	-46,213	0	8,457,967	422,898	25,000	-9.15
Technological Change	-1,513,625	-40,908	2,000	4,565,845	130,452	24,500	-3.19
Production Recapture	6,543,615	145,413	250	11,723,025	266,432	31,062	1.83
Resource Pooling	504,855	9,708	0	9,872,387	201,477	32,250	20.80



Economy-wide (mean): \$4.20 : 1
Firm-level (mean): \$25.70 : 1

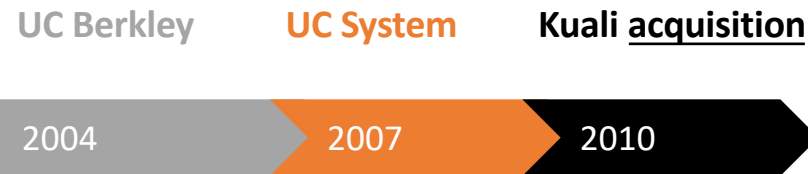
Competitor Analysis

Compare with BRC:

	BRC	KR	SUQ
Resilience score	✓		
Potential solutions	✓	✓	
Cost-effect analysis	✓		
Impact to resilience	✓		
Threat specific analysis	✓	✓	
Business cont. plan		✓	
Database of info	✓	✓	
Industry-specific	✓	✓	✓

Kuali Ready

- Business continuity planning web application
- Delivered software-as-a-service with subscription based model



Market reach:

- **70+** international colleges/ universities
- KualiCo **\$9.22M** in sales

Utilized **testbed markets** to **develop software** and **identify the customer** before hitting the international market



- SmartUQ specializes in data analytics
- Successfully spun-off into a standalone company in 2012

Market reach:

- SmartUQ **\$138K** in sales

Differentiated to **target 12 industries** with specific data analytics challenges

Academic spinoffs have formed standalone companies and been acquired by larger organizations, however, having a targeted industry is instrumental to differentiating and marketing the product

Transition Activities

- Developed sound theoretical and empirical base for BRC
- Mocked-up User Interface and outcome screens
- Engaged stakeholders and potential users regarding BRC functionality
- Had formal marketing assessment performed by Illinois IBC
- Engaged with CIRI regarding potential to transition primary research to transition product



UI & UX Design

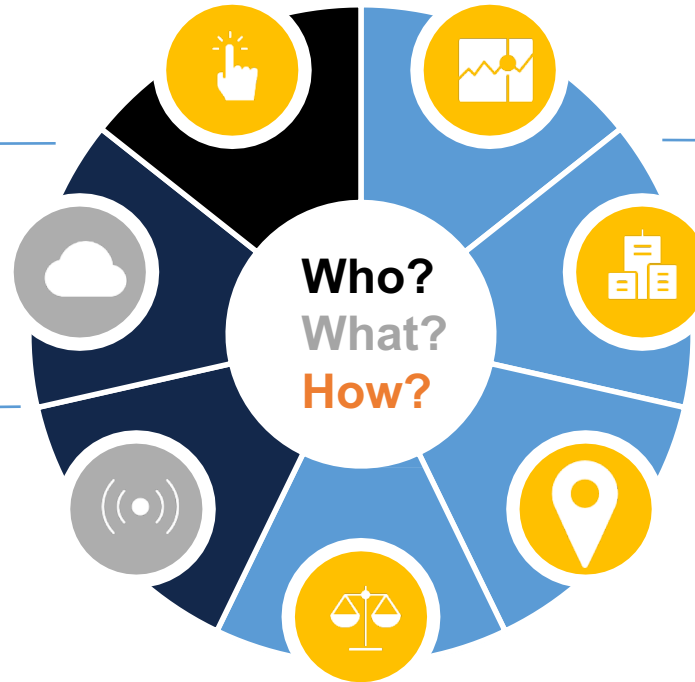
- Minimalistic and intuitive interface
- Emphasize features unique to the BRC, such as cost-benefit analysis

Cloud-based Platform

- Low-cost and scalable
- Flexible payment and updates
- Industry standard

Marketing Tactics

- Consumers want comprehensive tutorials and demos to understand product
- Testimonials are effective and widely used



Resilience Industry

- \$28 billion market by 2023
- Small and large businesses alike are increasing demand for resilience

Industry & Location

- Companies in disaster-prone areas see themselves at higher risk
- Manufacturing/construction companies and their supplies are affected

Small & Medium Companies

- SMEs are particularly susceptible to disasters due to their limited resources
- Generally do not have resilience in place

Target Market Needs

- Human Capital & Communication: Coordinating with and supporting employees is a major post-disaster goal
- ROI & Quantitative Metrics: Cost-benefit analysis helps businesses decide on specific actions; Proven efficacy from survey data
- Reluctance towards resilience: Disasters are seen as rare anomalies, not worth investment

The BRC should target SMEs in disaster-prone areas and address their reluctance towards resilience by providing a cloud-based, user-friendly platform with metrics and marketing that prove its effectiveness

Summary

Developed sound theoretical and empirical base for BRC

Implement suggestions from marketing assessment by Illinois IBC

Continue discussion of BRC formulation and use with stakeholders

Test the BRC in pilot cases

Work toward commercialization of the Business Resilience Calculator Software Tool