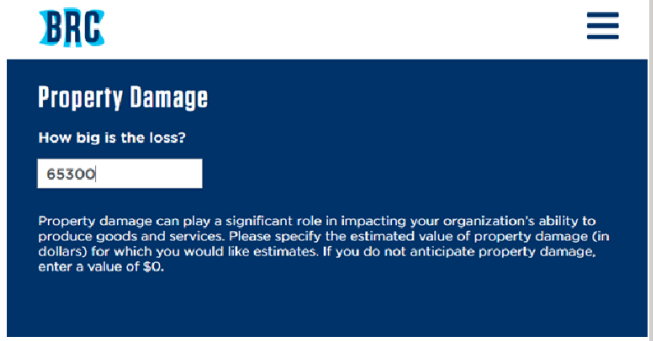
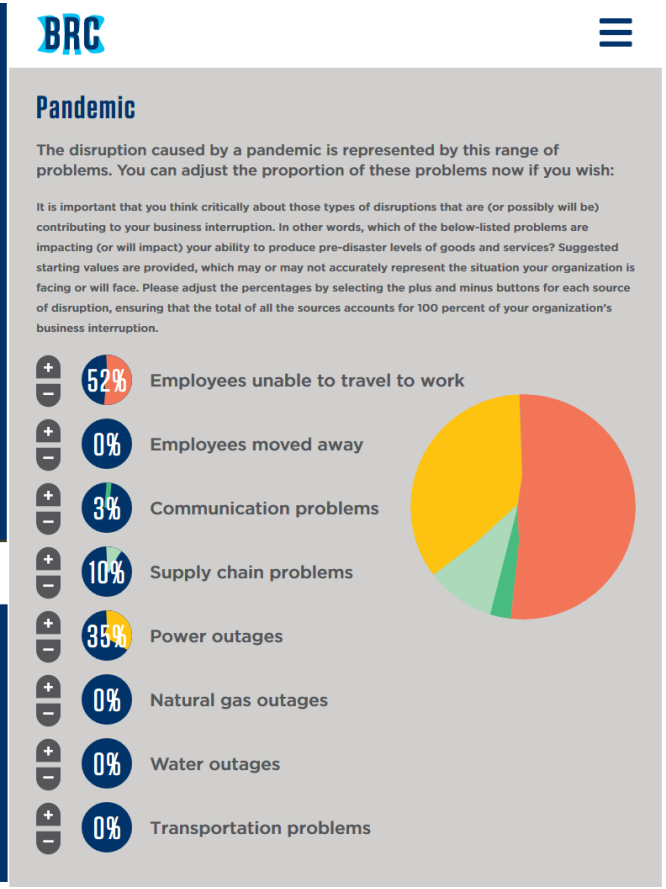
# The Business Resilience Calculator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CIRI | CRITICAL INFRASTRUCTURE RESILIENCE INSTITUTE
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# Overview

1. Background & Motivation for BRC — Adam Rose
   - Defining Resilience, Tactics and Metrics
   - Potential Customers
2. Methodology Behind BRC — Noah Dormady
   - BRC Video for Pandemic application
   - Background data and statistical modelling framework
   - Metrics, Modules & Capabilities
3. BRC Live Demo — Noah Dormady
4. Q/A

# Background on Economic Resilience

- Two major perspectives:

  1. Include everything done to reduce losses, pre- and post-disaster (focus is mitigation of property damage)
  2. Limit to actions implemented after the disaster strikes (but resilience is a process; can build resilience capacity)
     - e.g., emergency drills, back-up generators, alternative suppliers
     - however, these are not implemented until after the disaster hits

- The latter perspective may strike some as odd:

  - How can you reduce property damage post-disaster?

  - You can't; but you can reduce business interruption (BI) (our definition of resilience is synonymous with business continuity)

# Economic Resilience

- Static
  - General Definition: Ability of a system to *maintain function* when shocked.
  - Econ Definition: *Efficient use of remaining resources* at a given point in time to keep producing as much as possible.
- 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 & adapting to change.

○ *Operational Metric*: *averted BI losses as % of potential BI losses*

# Resilience Tactics (Actions)

| Resilience Tactic | Definition (Activities Involved) |
|---|---|
| Conservation | Maintaining intended production using lower amounts of an input or inputs |
| 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 | Continuing business operations using emergency and ordinary stockpiles |
| Excess Capacity | Using idle plant or equipment idle in place of a damaged ones |
| Relocation | Moving some or all of the business activity to a new location |
| Management Effectiveness | Improving the efficiency of business operations in the aftermath of a disaster |
| Import Substitution | Importing needed production inputs when not available from local suppliers |
| Technological Change | Improvising the production process without requiring a major investment |
| Production Recapture | Making up for lost production by working overtime or extra shifts. |
| Resource Pooling/Sharing | Recontracting, selective exchange of resources, creating new partnerships |

# Measuring Economic Resilience of 9/11

- 95% of over 1,100 WTC area firms relocated after 9/11
- If all of firms in the WTC area went out of business, direct business interruption (BI) loss would = $58.4B
- If all relocation were immediate, then BI = $0
- Businesses relocated 2 to 4 months, BI = $16.1B
- Resilience Metric: Avoided Loss ÷ Max Potential Loss

$42.3B ÷ $58.4B = 72%


Temporarily
CLOSED
pandemic

# The robust growth of the resilience market shows opportunities for BRC to enter the market

## 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 the industry recognition of enhancing the **collaboration** between business and technology executives

## Drivers for Growth

Environment 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**

IBM Microsoft Gremlin

The increasing number of disruptions faced by companies lead to the robust growth of the resilience market and enable BRC to enter the market

Statista | Frost & Sullivan | Gartner

# The current market presents a value proposition that will be conducive for CIRI to launch the BRC

**Benchmark:** Small companies are those organizations generating less than an annual revenue of $50M

## SMEs are particularly susceptible to disruptions

| | |
|---|---|
| **Over 50%** | Of small business don't survive beyond 5 years |
| **67%** | Of small businesses lack a written disaster recovery plan |

## Effects

- Losses of key customers or personnel can lead to disproportionately massive impacts on SME operations
- Can quickly lose market share to competitors

## Current State of market

**Survey: 391** respondents (senior executives); **39%** of the responses from businesses generating less than **$500m** and **48%** of the responses from firms generating more than **$1Bn**

IBM conducted a survey in which **56%** of the firms generating more than $10B had an integrated business resilience strategy in place

### Re-working business continuity strategies


### Developed an integrated business resilience strategy


The % in the plots show the percentage of the respondents who initiated the said action

### Creating a business continuity plan


The BRC can be very useful for small and medium companies as they clearly have shown signs of deficiency in implementing business resilience strategies

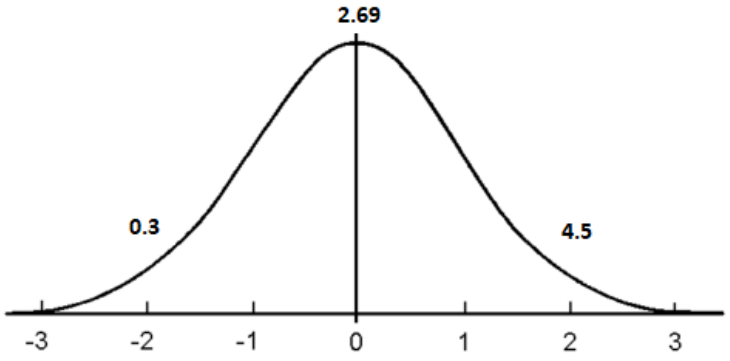
# Measuring Resilience (3 Main Metrics)

## Benefit-Cost Ratio (BCR)

$$\mu_t \left[ {}^{AvoidedLosses_{it}} / _{Expenditures_{it}} \right]$$

Represents the mean (mu) ratio of avoided losses to expenditures across firms (subscript i) for each selected tactic (subscript t). In other words, it provides the bang-for-buck values for the tactic that have been observed by other firms.

"Firms like yours avoided an average of $2.69 in sales revenue losses for every dollar spent on Production Recapture. Best performers avoided $4.50 or more for every dollar spent on Production Recapture."



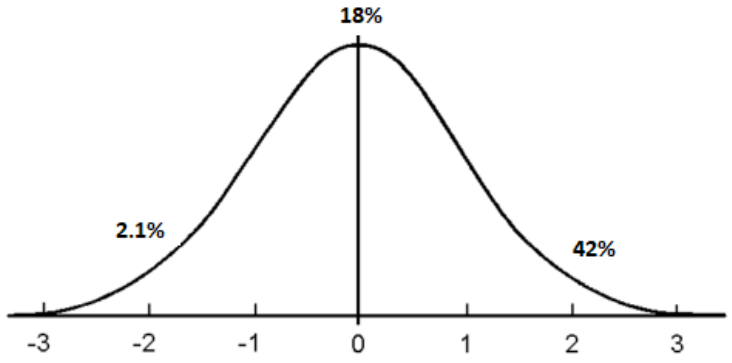
# Measuring Resilience (3 Main Metrics)

## Resilience Metric (RM)

$$\mu_t \left[ {Avoided\ Losses_{it}} / {Max\ Potential\ Losses_i} \right]$$

The RM represents the formalized measure of resilience observed by other similarly-situated firms observed by utilizing the tactic. In other words, it provides share of the firm's maximum potential losses (i.e., the total sales revenue it would have lost if it had done nothing) to actual losses avoided. This metric is a standard metric used in the resilience literature.

"By using Production Recapture, the average firm like yours avoided 18 percent of its maximum potential sales revenue losses. Best performers avoided 42 percent or greater."



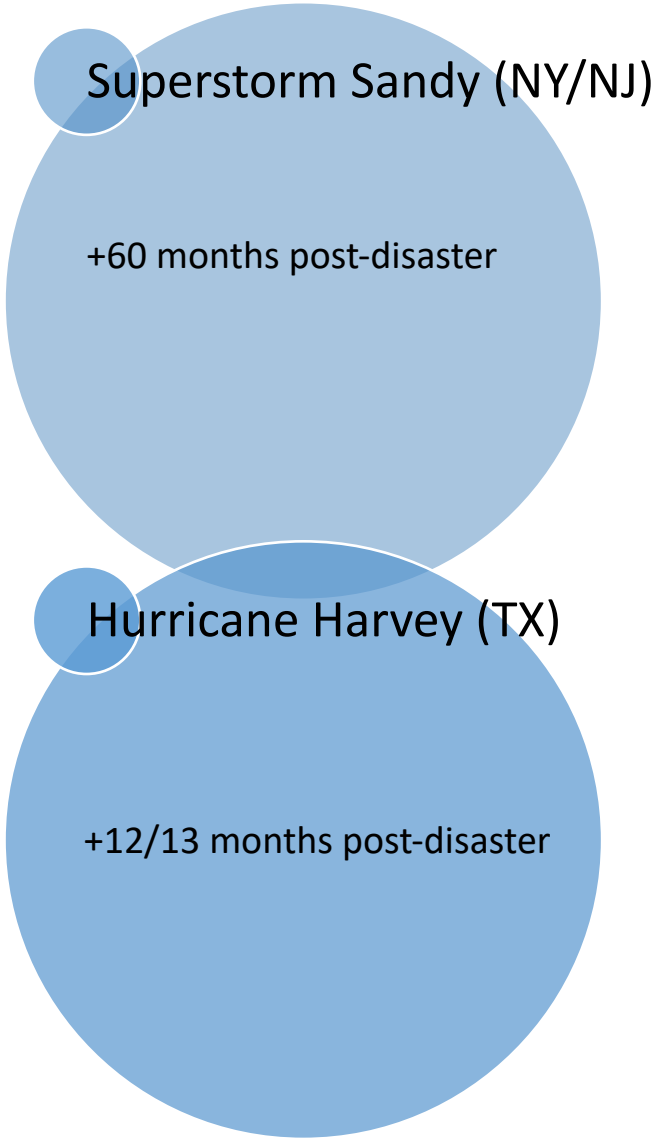
# Survey Methodology

**Sampling**

- ❑ Firms affected by disaster with either BI, or BI and PD
- ❑ Predominantly SMEs
  - ❑ Oversampled firms +10 employees
  - ❑ Oversampled on PD
- ❑ Sourced and sampled by RTi Research
- ❑ Respondents must have been responsible for financial decisions of firm
- ❑ Paid surveys (completion credits ~$60)

**Initial Sample**

- ❑ Post data cleaning sample of 249 firms→ 1,150 tactics
  N=1,150
- ❑ 62% of firms in sample had *both* BI + PD

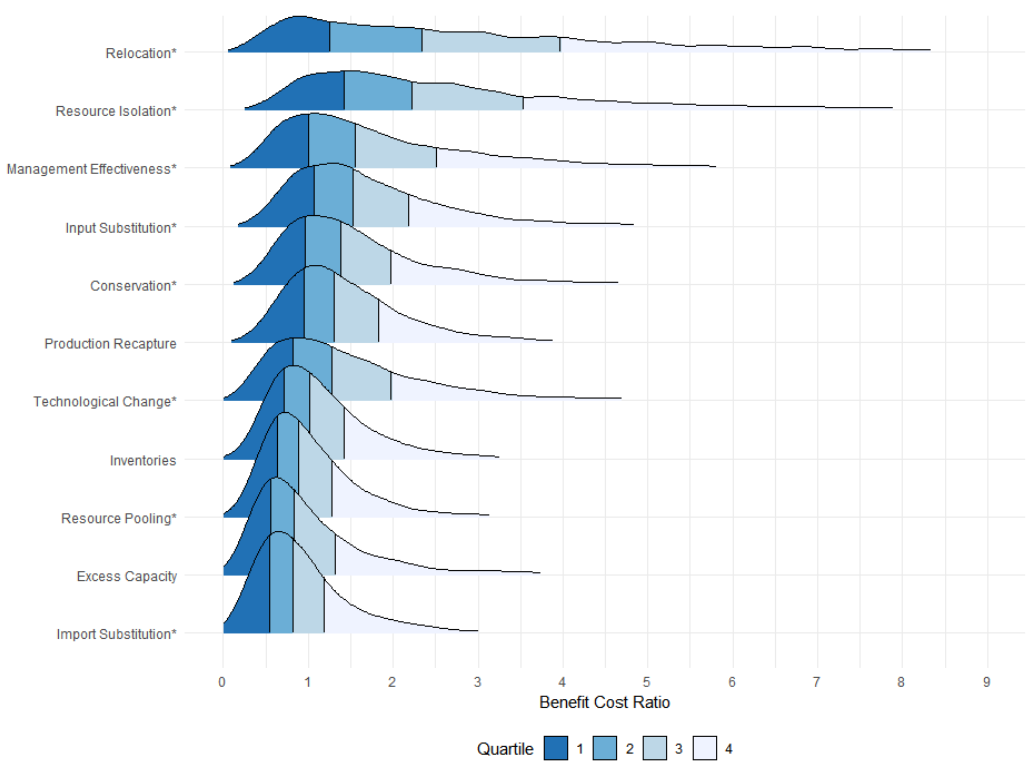


# Cost Effectiveness of Resilience Tactics

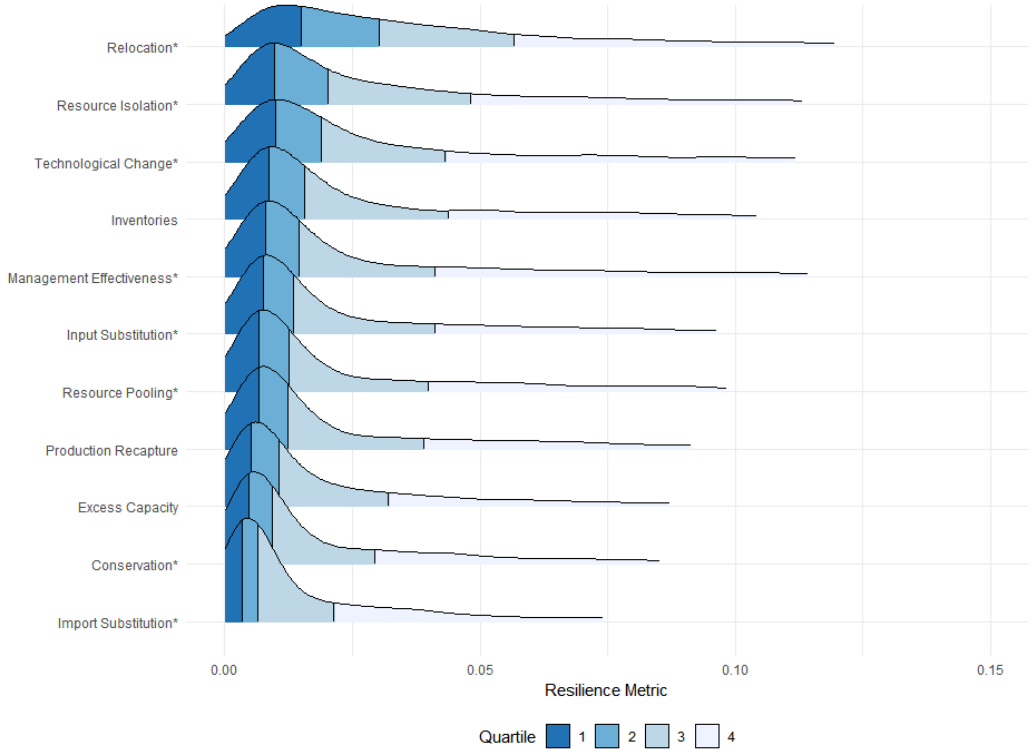
| | **Total Effectiveness** (Net Avoided BI) | **Total Cost** (Net Expenditures on Tactics) | **Cost-Effectiveness** |
|---|---|---|---|
| Superstorm Sandy | $57,340,503 | $12,051,427 | $4.76:1 |
| Hurricane Harvey | $27,102,750 | $6,440,180 | $4.21:1 |
| TOTAL | $84,443,253 | $18,491,607 | $4.57:1 |

On average, firms observed a 450% return on resilience investments
(excludes largest firms)

# Statistical Modelling Approach




BCR Metric




RM Metric

Note: Modeling results from manufacturing sector; sector-median input parameters of 450 FTE employees, $100k property damage; sector-median BI disruptions. * indicate tactic is capable of adaptive resilience.

# BRC Demo

**2 Use Cases**

- ❑ Manufacturing firm responding to Covid-19 disruptions
- ❑ Transportation/Logistics firm responding to Hurricane disruptions

# BRC Modules

| Evaluative (Retrospective) Module | Planning (Prospective) Module |
| --- | --- |
| Enables firms to evaluate their performance relative to other similarly-situated businesses<br><br>Provides three resilience metrics to gauge their own performance<br>• Benefit-Cost Ratio (BCR)<br>• Resilience Metric (RM)<br>• Relative Cost-Effectiveness (RCE)<br><br>Users provided with checklist and reference points<br>• Default<br>• Best practices<br><br>Matched with comparable firms<br>• Same industrial sector (NAICS codes)<br>• Same firm size (# of employees)<br><br>Scenario event planning<br>• Level of property damage (dollars)<br>• Type(s) and levels of infrastructure disruption | Enables firms to make cost-effective resilience planning decisions<br><br>Provides three resilience metrics (with ranges)<br>• Benefit-Cost Ratio (BCR)<br>• Resilience Metric (RM)<br>• Relative Cost-Effectiveness (RCE)<br><br>Users are provided with metrics for tactics applicable to their own business<br><br>Matched with comparable firms<br>• Same industrial sector (NAICS codes)<br>• Same firm size (# of employees)<br><br>Scenario event planning<br>• Level of property damage (dollars)<br>• Type(s) and levels of infrastructure disruption |

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# Q/A

# Backup slides

# The Important Distinction Between ‘Mitigation’ & ‘Resilience’

Resilience: Often refers to *any action* that reduces hazard losses

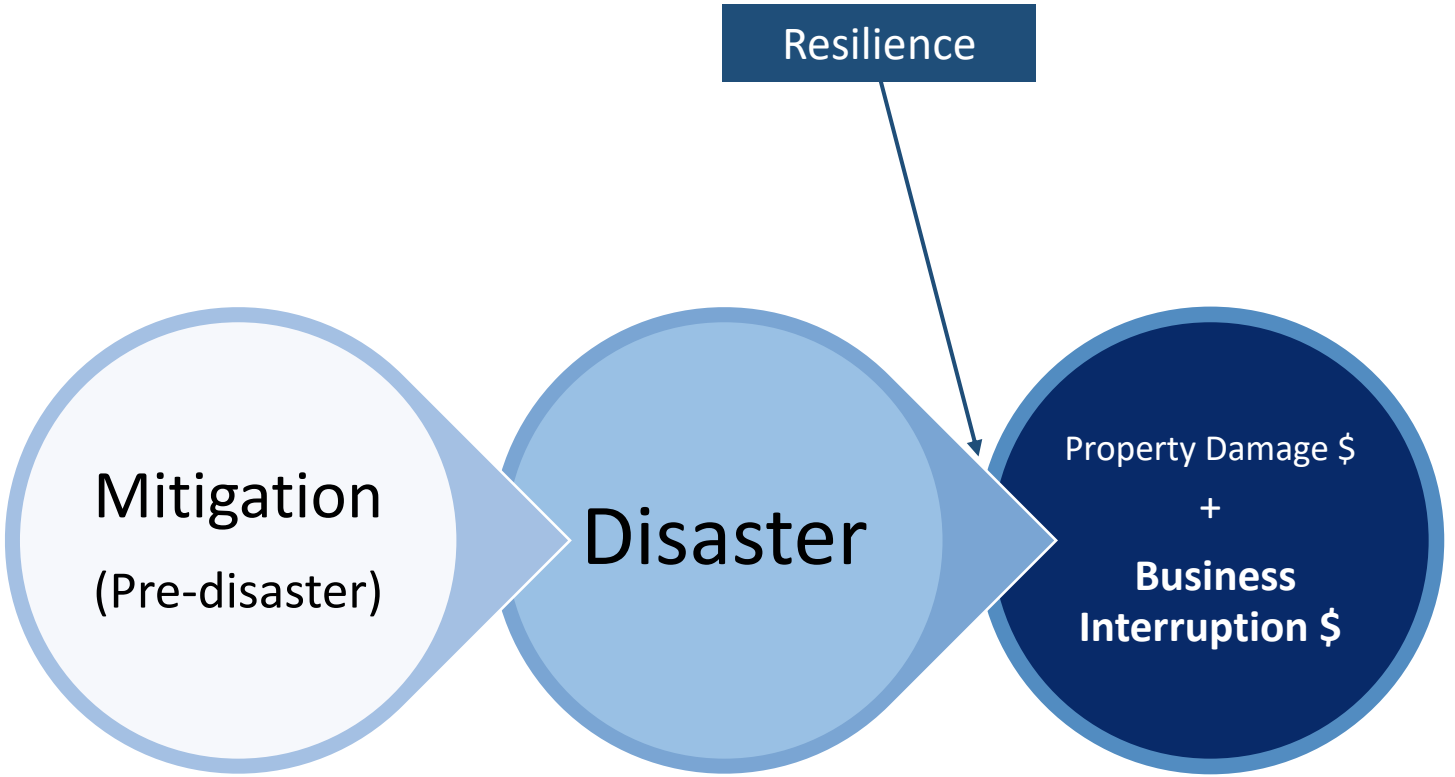
But, there’s a perfectly good word for actions taken ***before*** the event – “mitigation”

Best use of “resilience” – actions taken ***after*** an event

- can *build up resilience capacity beforehand* – it’s a process
  (inventories, resource agreements, identify back-up locations)
- but these tactics are *not implemented until after* the event

***Can only prevent property damage before the event, but can reduce *business interruption* afterwards**

- begins when the disaster strikes & continues until recovered
- measured in terms of lost sales revenue, GDP, employment



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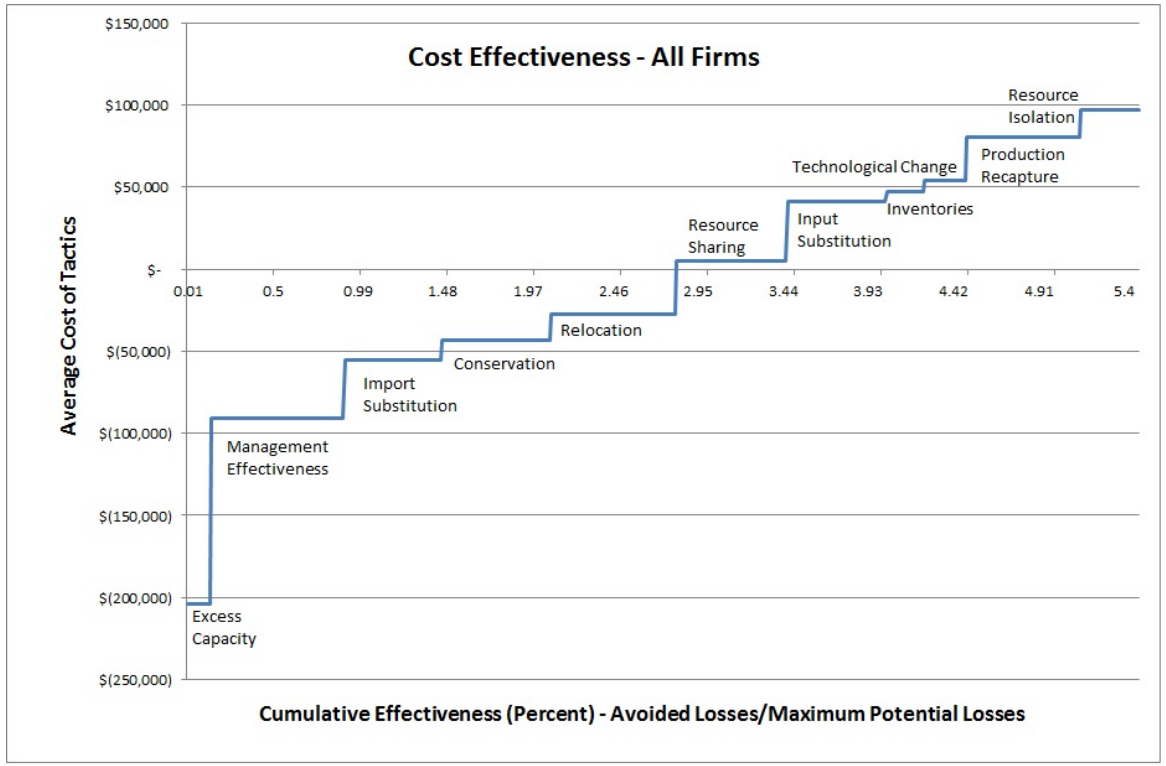
# Why BI Matters

| Superstorm Sandy (NY/NJ) | Property Damage Median | Business Interruption Median | Ratio |
|---|---|---|---|
| Among *only* firms physically damaged | $100,000 | $180,000 | 180% |
| All firms | $25,000 | $100,000 | 400% |

| Hurricane Harvey (TX) | Property Damage Median | Business Interruption Median | Ratio |
|---|---|---|---|
| Among *only* firms physically damaged | $56,000 | $725,000 | 1,294% |
| All firms | $5,000 | $575,000 | 11,500% |

# 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**