Business Resilience Calculator (BRC)
Transition Product from Measuring Business & Economic Resilience in Disasters

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Project Overview: The BRC

- **What**: Data-driven decision-support software tool
- **Purpose**: To safeguard business continuity in a cost-effective manner
- **Users**: private enterprises, as well as Fed government including FEMA, SBA, NIST, Emergency Managers
- **Knowledge Gap**: Primary data & statistical analysis for business resilience decisions
BRC Video

https://www.youtube.com/watch?v=INd1cUetVVk
Testing & Validation

• Transition Product (Software) Testing and Validation

• Internal Software
  • A) Comprehensive technical review of software results/outputs; B) Developed thorough proficiency check of modeled results for pandemic-related outputs; C) Conducted secondary data analysis on proficiency check results to ensure the absence of irregularities in results; D) Model comparison and evaluation to ensure software results from 2wav match internal model results (i.e., ensure that software gets all the math right!); E) Developed file sharing and workflow platform (using Basecamp) to ensure efficient task completion and collaboration between PIs and software developers

• User Review
  • A) Developing approach for further validating results from users in the field; B) Presented primary research at conference and to SBA representative; C) Demos and feedback platform from multiple users currently underway
Transition Approach

- Gather feedback from users on Covid-19 Pre-release
- Collaborate with CIRI and software partner (2wav) on gathering user information and data
- Conduct customer and user interviews from interested agencies (e.g., SBA, NIST)
- Develop guidance for improving business resilience
- Incorporate user input into software updates/revisions
- Develop corporate spin-off strategy
Major Milestones & Accomplishments

- Theoretical Foundation for BRC
  - Published in Leading Peer-reviewed Journal → Done
- Designed & Administered Large-Area Resilience Surveys
  - NY & NJ (SuperStorm Sandy) & TX (Hurricane Harvey) → Done
- Developed Data-Driven Predictive Analytics
  - Formal Econometric Models for BRC → Done
- Developed Software Minimum Viable Product → Done
- Wide Release Covid-19 Special Application Module → + 1 Week
- Develop Remaining Module & Metrics → + 9 Months
- Develop Optimization Learning Algorithm → + 9 Months
Project Impact

- Built decision-support tool to promote cost-effective individual business continuity
- Represents a key component of community resilience
- Reduces need for federal funding of disaster recovery (e.g., FEMA, SBA)
- Collected immense primary data set through surveys and business self-reporting
- Sound modeling approach validated by peer-review & statistical goodness-of-fit
- Trained PhD students and post-docs working on homeland security
Backup Slides
Testing & Validation

- Testing and Validation of Basic/Primary Research
  - Peer-reviewed/published on underlying theory in leading journal
  - Rigorous survey/sampling approach
    - A) GIS/satellite imaging; B) Professional survey administration; C) Rigorous programming of internal validity checks; D) Thorough qualification instruments within survey; E) Stratified random sampling ensuring balanced sample
  - Rigorous data evaluation and “cleaning”
    - A) Extensive review of survey responses; B) Targeted location evaluation; C) Detailed review of use of resilience tactics, disruptions, and other key variables
  - Comprehensive statistical/econometric approach to data analysis & projection
    - A) Extensive exploratory analysis to ensure model appropriateness; B) Rigorous evaluation of model results; C) Designed testing and evaluation software to validate results; D) Secondary data analysis on modeling results to ensure robustness and validity; E) Customized algorithm for construction of standard errors and confidence intervals
Resilience Tactics (Cost Curve)
## Resilience Tactics (Actions)

<table>
<thead>
<tr>
<th>Resilience Tactic</th>
<th>Definition (Activities Involved)</th>
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<tbody>
<tr>
<td>Conservation</td>
<td>Maintaining intended production using lower amounts of an input or inputs</td>
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<tr>
<td>Resource Isolation</td>
<td>Modifying a portion of business operations to run without a critical input</td>
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<tr>
<td>Input Substitution</td>
<td>Replacing a production input in short supply with another</td>
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<tr>
<td>Inventories</td>
<td>Continuing business operations using emergency and ordinary stockpiles</td>
</tr>
<tr>
<td>Excess Capacity</td>
<td>Using idle plant or equipment idle in place of a damaged ones</td>
</tr>
<tr>
<td>Relocation</td>
<td>Moving some or all of the business activity to a new location</td>
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<tr>
<td>Management Effectiveness</td>
<td>Improving the efficiency of business operations in the aftermath of a disaster</td>
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<tr>
<td>Import Substitution</td>
<td>Importing needed production inputs when not available from local suppliers</td>
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<tr>
<td>Technological Change</td>
<td>Improvising the production process without requiring a major investment</td>
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<tr>
<td>Production Recapture</td>
<td>Making up for lost production by working overtime or extra shifts.</td>
</tr>
<tr>
<td>Resource Pooling/Sharing</td>
<td>Recontracting, selective exchange of resources, creating new partnerships</td>
</tr>
<tr>
<td>Evaluative (Retrospective) Module</td>
<td>Planning (Prospective) Module</td>
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<td>Enables firms to evaluate their performance relative to other similarly-situated businesses</td>
<td>Enables firms to make cost-effective resilience planning decisions</td>
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| Provides three resilience metrics to gauge their own performance  
  • Benefit-Cost Ratio (BCR)  
  • Resilience Metric (RM)  
  • Relative Cost-Effectiveness (RCE) | Provides three resilience metrics (with ranges)  
  • Benefit-Cost Ratio (BCR)  
  • Resilience Metric (RM)  
  • Relative Cost-Effectiveness (RCE) |
| Users provided with checklist and reference points  
  • Default  
  • Best practices | Users are provided with metrics for tactics applicable to their own business |
| Matched with comparable firms  
  • Same industrial sector (NAICS codes)  
  • Same firm size (# of employees) | Matched with comparable firms  
  • Same industrial sector (NAICS codes)  
  • Same firm size (# of employees) |
| Scenario event planning  
  • Level of property damage (dollars)  
  • Type(s) and levels of infrastructure disruption | Scenario event planning  
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## BRC Intended Users

### Industry
- Private-sector firms prospectively planning for resilience to build resilience capacity
- Private-sector firms retrospectively evaluating their own resilience in recovering from a disaster, comparison to other similar firms

### Government
- Supporting regional economic development, and building regional community resilience
- Supporting individual firms/sectors in planning for, and preparing for catastrophic events and building resilience capacity

### Insurers & Reinsurers
- Gauging and calculating resilience capacity of insured
- Setting risk premia and actuarial assessment
The robust growth of the resilience market shows opportunities for BRC to enter the market

Disruptions (2000-2018)
- Terrorism: 9/11 attacks (2001)
- Financial Crisis (2008)

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

The increasing number of disruptions faced by companies lead to the robust growth of the resilience market and enable BRC to enter the market
Successful academic spin-offs utilize niche industries and markets to successfully launch

### Compare with BRC:

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<th></th>
<th>BRC</th>
<th>KR</th>
<th>SUQ</th>
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</thead>
<tbody>
<tr>
<td>Resilience score</td>
<td>✔</td>
<td>✔</td>
<td></td>
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<tr>
<td>Potential solutions</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Cost-effect analysis</td>
<td>✔</td>
<td></td>
<td></td>
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<tr>
<td>Impact to resilience</td>
<td>✔</td>
<td></td>
<td></td>
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<tr>
<td>Threat specific analysis</td>
<td>✔</td>
<td>✔</td>
<td></td>
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<tr>
<td>Business cont. plan</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Database of info</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Industry-specific</td>
<td>✔</td>
<td>✔</td>
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### Kuali Ready
- Business continuity planning web application
- Delivered software-as-a-service with subscription based model

**UC Berkley** 2004  | **UC System** 2007  | **Kuali acquisition** 2010

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

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

### Market reach:
- SmartUQ $138K in sales

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
Industry competitors focus on general solutions based on appropriate industry best practices

<table>
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<th>Products/Criteria</th>
<th>BR C</th>
<th>ROne</th>
<th>Catalyst</th>
<th>Fusion</th>
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<tr>
<td>Resilience score</td>
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<td>Efficacy of solutions</td>
<td>✅</td>
<td></td>
<td></td>
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<tr>
<td>Cost/benefit analysis</td>
<td>✅</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business continuity plan</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Threat-specific analysis</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
<td></td>
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<tr>
<td>Dependency mapping</td>
<td></td>
<td>✅</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual sales</td>
<td>—</td>
<td>$1.3M</td>
<td>$3.6M</td>
<td>$9.0M</td>
</tr>
</tbody>
</table>

**Competitor Analysis**

- Identified **leading competitors** (as ranked by Gartner)
- Do not target a particular industry, but identified at least 5% of customers in manufacturing or construction
- In general, their products identify threats and recommend **best practices** to address them
- Lack of competitors targeting specifically manufacturing or construction

**BRC Advantage**

BRC benefits from increased credibility via survey data that informs which tactics are proven to be effective paired with a cost/benefit analysis that helps companies make informed decisions and take the most efficient course of action.

While many broad resilience software solutions are available, the BRC can leverage its proven efficacy of recommended tactics, cost-benefit analysis, and efficient approach to differentiate.