USING THE RISK INDEX FOR DECISION MAKING

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Informing Decision Making

- Anchoring to Facts
- Resilience Analysis
- Insurance
  - Purchasing
  - Growth Opportunities
- Corporate Risk Profiling
  - Tailoring the index to a company
City Resilience Analysis

- City Risk Index 2018 used in Greater Manchester’s Preliminary Resilience Assessment 2018
- Underscores significant threats that impact the city-region economy
- Highlights Greater Manchester’s economic exposure to a range of threats
- Advanced the case for exploring how to build a more resilient economy
- Comparison with similar cities worldwide
- Helping city region in its vision to be one of the most resilience places in the world
If all cities increased their resilience by one ranking, GDP@Risk decreases by $40bn to $537bn, a 7% reduction in expected loss.

Asia
$22bn reduction from resilience
$13bn reduction from natural catastrophe risks

Shanghai: -17.3%, $1.57bn
Taipei: -14.2%, $1.84bn
Manila: -12.7%, $1.75bn

Middle East and Africa
11% reduction from increasing resilience
Of which 13% comes from geopolitical risks

North America and Europe
Resilience is relatively high
Largest threats have short-term impact to GDP

Resilience Improvement 2018-2019
Absolute (US$ Bn)
Relative (%)
0 - 0.05
0.05 - 0.1
0.1 - 0.2
0.2 - 1
1+
0
19%
Site Risk Assessment

US Sites (Global Risk Index 2019 Analysis)

Whiting Refinery A

Top 10 Threats to Revenue at Whiting Refinery A
Site Risk Protection Through Insurance

Top productivity units by threat
Select threat:
All Threats

Top 10 productivity units with revenue at risk from All Threats
- With insurance
- Without insurance

- Whiting Refinery A
- Prudhoe Bay Oil Field
- Cherry Point Refinery
- Thunder Horse Installation
- Atlantis Installation
- NM San Juan Basin
- Na Kika Host Facility
- Mad Dog Installation
- BP-Husky Toledo Refinery
- CO San Juan Basin

Expected loss from business outage ($m)

Insurance could reduce the total expected loss from All Threats business outage from $154.0m to $95.48m.
Site Risk Protection Through Insurance

Insurance exceedance probability curve

Loss process:
- Business Outage
- Repair cost

Exceedance probability curve for business outage
- Without insurance
- With insurance

Indicate a loss level (in $m) of concern
100

A business outage loss level of $100m has a 28.9% chance of being exceeded without insurance and a 2.6% chance of being exceeded with insurance.

Indicate an exceedance probability (%) of concern:
5

There is a 5% chance of exceeding a business outage loss level of $350.0m without insurance and $50.0m with insurance.
Cost of Risk Analysis

Locations ranked by business outage Cost of Risk

Thunder Horse Installation
Prudhoe Bay Oil Field
Whiting Refinery A
Cherry Point Refinery
Atlantis Installation
Na Kika Host Facility
Mad Dog Installation
NM San Juan Basin
Husky Toledo Refinery
CO San Juan Basin
Texas City Chemicals
Cooper River Chemicals

Cost of capital (%):
10

Risk appetite return period:
100
## Mapping Lines & Exposure to Threats

<table>
<thead>
<tr>
<th>Insurance Lines</th>
<th>Type of Exposure</th>
<th>Finance</th>
<th>Economics &amp; Trade</th>
<th>Geopolitics &amp; Security</th>
<th>Natural Catastrophe &amp; Climate</th>
<th>Technology &amp; Space</th>
<th>Health &amp; Humanity</th>
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</thead>
<tbody>
<tr>
<td><strong>Commercial Property</strong></td>
<td>Physical Damage</td>
<td>1</td>
<td></td>
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<td></td>
<td>Revenue Loss / Business Interruption</td>
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<td></td>
<td></td>
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<td>3</td>
<td>2</td>
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<td></td>
<td>Contingent Business Interruption</td>
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<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Commercial Political Risk / War Market</strong></td>
<td>Physical Damage</td>
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<td></td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
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<td>3</td>
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<td></td>
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<tr>
<td></td>
<td>Human Injury, Illness or Death</td>
<td></td>
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<td>2</td>
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<tr>
<td></td>
<td>Financial Asset Devaluation</td>
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<tr>
<td><strong>Casualty Liability</strong></td>
<td>Duty of Care to 3rd Party</td>
<td>2</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>Human Injury, Illness or Death</td>
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<td></td>
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<td>2</td>
<td>2</td>
<td></td>
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<tr>
<td><strong>Liability D&amp;O; E&amp;O</strong></td>
<td>Financial Asset Devaluation</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td><strong>Workers Comp</strong></td>
<td>Human Injury, Illness or Death</td>
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<td>3</td>
<td>2</td>
<td></td>
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<tr>
<td><strong>Credit and Surety</strong></td>
<td>Financial Asset Devaluation</td>
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<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>Personal Accident</strong></td>
<td>Human Injury, Illness or Death</td>
<td>2</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
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<tr>
<td><strong>Cyber Liability</strong></td>
<td>Digital Asset Loss</td>
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<tr>
<td><strong>Life &amp; Health</strong></td>
<td>Human Injury, Illness or Death</td>
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<tr>
<td><strong>Pensions &amp; Annuities</strong></td>
<td>Financial Asset Devaluation</td>
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<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>
Product Alignment with Risk

For selected cities

<table>
<thead>
<tr>
<th></th>
<th>Istanbul</th>
<th>Jakarta</th>
<th>Kuala Lumpur</th>
<th>Manila</th>
<th>Seoul</th>
<th>Singapore</th>
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</thead>
<tbody>
<tr>
<td>Insurance Penetration</td>
<td>2.0</td>
<td>0.5</td>
<td>2.7</td>
<td>0.9</td>
<td>4.7</td>
<td>0.7</td>
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<tr>
<td>Recent Growth Rate</td>
<td>V High</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Finance, Economics and Trade</th>
<th>Moderate</th>
<th>Low</th>
<th>High</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geopolitics and Security</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Natural Catastrophe and Climate</td>
<td>High</td>
<td>Moderate</td>
<td>Low</td>
<td>V. High</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Technology and Space</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Health and Humanity</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

| Commercial Property | 3 | 2 | 1 | 3 | 2 | 1 |
| Commercial Political Risk / War | 3 | 2 | 1 | 3 | 3 | 1 |
| Casualty Liability      | 3 | 3 | 3 | 1 | 3 | 2 |
| Liability D&O; E&O      | 2 | 2 | 3 | 1 | 2 | 3 |
| Credit and Surety       | 3 | 2 | 3 | 2 | 2 | 3 |
| Personal Accident       | 3 | 2 | 2 | 3 | 2 | 1 |
| Cyber Liability         | 2 | 1 | 2 | 1 | 3 | 3 |
| Life & Health           | 3 | 3 | 3 | 3 | 2 | 2 |
| Pensions & Annuities    | 2 | 1 | 3 | 1 | 2 | 3 |

Risk-driven alignment with insurance product

- Strong Alignment
- Moderate Alignment
- Weaker Alignment
Mapping a Corporate Global Footprint
Mapping Supply Chains to Cities

Apple iPhone

Starbucks Coffee

Nike Sports shoes

Blackberry Phone

H&M Clothing - Jacket

Adidas Sports shoes
Global Risk Index to Corporate Resilience Framework
Integrated risk profile of internal and external risks

Internal Risk Register
Company-specific identification of threats

External Risk Register
Taxonomy of global threats to business and economic activity

Company-Specific Inputs
Business Network
Locations and revenue sources

Activity matrix
Productivity units

Operational Structure
Business lines and subsidiaries
Example Scenarios that reach Severe Loss Threshold

Scenarios that cause loss of over $20 M to either output (supply shock) or consumption (demand shock) include the following examples:

- Sovereign Crisis in Malaysia
- Extreme SE Asia Regional Monsoon Flooding
- Human Epidemic in SE Asia
- Separatism and Social Unrest in UEA
- Financial Crisis Property Crash Emerging Markets
- War between North and South Korea
- War between China and Japan

Similar internal risk scenarios might include:

- Litigation from a major trading partner
- Mass action by consumers, under new regulations
Workshop being run by Cambridge for senior executives of a global financial services company to evaluate emerging geopolitical risks and develop scenarios for their risk management response. July 2018