24 January 2017

Cambridge Centre for Risk Studies Research Showcase

Towards the Resilient Enterprise:
Corporate Risk Profiling

Dr Michelle Tuveson
Executive Director
Centre for Risk Studies
Complex Footprints of Global Corporations

- Perform large range of business activities
  - Discovery and Innovations/R&D
  - Product Manufacturing
  - Supply and commercialisation
  - Sales

- Geographically dispersed functions and staff
- Multiple stakeholder communities
- External threats
- Legal and regulatory jurisdictions
- Counterparties and secondary supply chains

Where might risks lie in a corporation? What is an effective way to report risks?
Interview Results: Problem Definition

- **External threats:** Corporations do not have a consistent or comprehensive model for identifying and evaluating risks to the corporation from external threats.

- **Geography:** Do not have a consistent and comprehensive model for evaluating risks to the corporation in relation to geography.
  - e.g. Assets, counterparties, secondary supply chains, legal and regulatory jurisdictions

- **Stress testing:** Do not have a consistent and comprehensive approach to stress testing the state of their corporation

- **Reporting:** How to complement existing reporting requirements with meaningful enterprise risk insights and address multiple stakeholder communities

- **Methods and Metrics:** Methods are consistent approaches; metrics allow normalization across other costs
Gaining Greater Accuracy in Corporate Risk Profiling

**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
- Scenarios from internal risk register

**Outputs and Applications**
- Annual report risk declarations
  - 10K and other reporting
- Regulatory risk reporting
  - Long term viability statements
- Insurance purchasing strategy
- Crisis and continuity management
  - Management stress tests
- Emerging risk monitoring and stress test design
- Monitoring of risk metrics for business units
CRS View of Corporate Risk Profiling

- Overlay corporate value chain onto view of world
  - Physical structure, asset, activity, value chain mapping provided
  - Manufacturing, Local operating company, Localized mapping to markets, Retail

- Geographical mapping of corporate operations with overlay to threats.
- Data standard needed. V0.1, V0.2
Corporate Risk Profiling
Using CRS Research Outputs in Managing Business Risks

Threat Maps

Risk Models

Scenarios

Software Platform

Exposure Data

Use Cases

Network Models

Private Portals

- Use cases envisioned by CRS partners
- Reflective of the stages of research at CRS
  - Scenarios
  - Taxonomy of global threats
  - Severity and likelihoods
Developing Business-Ready Tools: “Use Cases”

- A major innovation of Centre for Risk Studies has been to standardise shock assessment
  - Express costs & benefits of resilience via financial metrics for risk, like GDP@Risk

- Corporate Risk Profiling for quantifying balance sheet risk
  - Assets@Risk for manufacturing and finance
  - Revenue@Risk for disruption of markets

- Insurance & Finance
  - Insurance@Risk for probable maximal loss
  - Underwriting@Risk for (new) insurance products
  - Investments@Risk for financial portfolios

- Government policy
  - Infrastructure@Risk
  - Security@Risk

- International capital markets
  - Accounting standards for expected losses from shocks
Geographical Mapping of All the Threats

- Earthquake
- Volcano
- Windstorm
- Flood
- Tsunami
- Drought
- Freeze
- Heatwave
- Market Crash
- Sovereign Default
- Oil Price Shock
- Interstate War
- Separatism
- Terrorism
- Social Unrest
- Power Outage
- Cyber Attack
- Solar Storm
- Nuclear Meltdown
- Human Epidemic
- Plant Epidemic
Events Defined as Footprints

- Scenarios will be re-defined as geographical footprints that can impact multiple cities
- Create a plausible ‘event set’ of representative scenarios
- Scenarios will be super-sets of current individual city scenarios
City Interconnectivity

- How cities are related economically
- How a catastrophe for one city will also affect its primary trading partners
- Propose to develop an economic interdependancy matrix between the cities
- Catastronomics modelling will quantify the expected impacts of consequential economic shocks on city trading partners
Meaningful Metrics for Corporations?

### Top 5 Scenarios Impacts

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Revenue</th>
<th>EBIT</th>
<th>EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Finance, Economics &amp; Trade</td>
<td>80</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td>2. Geopolitics &amp; Security</td>
<td>110</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>3. Technology &amp; space</td>
<td>80</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>4. Natural Catastrophe &amp; Climate</td>
<td>80</td>
<td>90</td>
<td>130</td>
</tr>
<tr>
<td>5. Health &amp; Humanity</td>
<td>120</td>
<td>120</td>
<td>130</td>
</tr>
</tbody>
</table>
Global Catastrophe Exceedance Probability Curve

- $1tr events have an 8 year return period
- $10tr events have a 47 year return period
- $16tr events have a 100 year return period
- $22tr events have a 200 year return period

- 8yr
- 47yr
- 100yr
- 200yr

- Mt Fuji Eruption at VEI VII
- Worst case hurricane season NE USA
- Solar storm impacting North America & Europe
- Level 4 interstate conflict between China & India
- Major global market crash
- Global virulent pandemic
Defining a Risk Strategy Aligned to Corporate Objectives

1. Identification of Key Operational Risks
2. Define Loss Scenarios
3. Assess Exposure
4. Determine Risk Metrics
5. Formulate “Insurance” Purchasing Strategy
Gaining Greater Accuracy in Corporate Risk Profiling

**Internal Risk Register**
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### Company-Specific Inputs
- **Business Network**
  - Locations and revenue sources
- **Activity Matrix**
- **Scenarios from internal risk register**

### Outputs and Applications
- **Integrated Risk Profile**

- **Annual report risk declarations**
  - 10K and other reporting
- **Regulatory risk reporting**
  - Long term viability statements
- **Insurance purchasing strategy**
- **Crisis and continuity management**
  - Management stress tests
- **Emerging risk monitoring and stress test design**
- **Monitoring of risk metrics for business units**
Corporate Risk Disclosure Requirements

Since 2005, the SEC has required all public companies in USA to disclose "the most significant factors that make the company speculative or risky" (Regulation S-K, Item 503(c), SEC 2005)

Where appropriate, provide under the caption “Risk Factors” a discussion of the most significant factors that make the offering speculative or risky. This discussion must be concise and organized logically. Do not present risks that could apply to any issuer or any offering ...

The risk factors may include, among other things, the following:

1. Your lack of an operating history;
2. Your lack of profitable operations in recent periods;
3. Your financial position;
4. Your business or proposed business; or
5. The lack of a market for your common equity securities or securities convertible into or exercisable for common equity securities

See https://www.sec.gov/about/forms/form10-k.pdf.
Sample 10-K 1A Risk Factors: 2016 Aerospace Corporation

- Heavy dependence on US Government for business
- Business and reputation risk for failure to comply with procurement laws and regulation
- Profitability and cash flow dependent on US government procurement policies
- Financial performance could be impacted by increased competition and bid protests
- Dependent on subcontractor, supplier, and partner performance
- Uncertainty of international markets
- Cyber, security or other disruptions
- Failure to manage acquisitions, divestitures, investments
- Uncertainty about profitability and cost estimations regarding recent acquisitions
- Business risks outside of indemnity or insurance
- Meeting employee pension fund obligations
- Future costs associated with environmental protection and remediation imposed by regulations
- Outcome of legal proceedings and litigations
- Maintaining qualified workforce
- Accuracy of financial estimates and projections
Sample 10-K  1A Risk Factors: 
2016 Insurance Sector

- Market conditions
- Investment portfolio, concentration of investments, insurance and other exposures
- Reserves and exposures
- Liquidity, capital and credit
- Business and operations
- Regulation
- Competition and employees
- Estimates and assumptions
Summary of 10-K Risk Disclosures

- Risk factor disclosures coverage sizeable in 10-K
  - Risk factors 7% average length of 10-K; 1% - 30% range
  - Highest coverage by Technology, Telecommunications, and Utilities sectors

- Wide variation in the number of risk factors reported
  - Average risk factors across all firms (22)
  - Most risk factors reported by Healthcare, Telecommunications, Utilities

Source: The Corporate Risk Factor Disclosure Landscape, IRRC Institute, Jan 2016
Review used baselined data from Jan 2015. The study normalised all reported risks to 17 different categories and binned the risk section of 50 companies (5 largest in 10 sectors) into those bins.
Summary of 10-K Risk Disclosures (cont)

- Generic risks reported – 70% or more of companies report common risks

<table>
<thead>
<tr>
<th>Percent Reported</th>
<th>Common Risk Disclosures</th>
</tr>
</thead>
<tbody>
<tr>
<td>92%</td>
<td>Corporate finance and operations</td>
</tr>
<tr>
<td>90%</td>
<td>Capital markets and economic conditions</td>
</tr>
<tr>
<td>90%</td>
<td>Government and regulation</td>
</tr>
<tr>
<td>78%</td>
<td>Cyber, physical assets and data security</td>
</tr>
<tr>
<td>76%</td>
<td>Corporate growth strategy</td>
</tr>
<tr>
<td>74%</td>
<td>Competitive landscape</td>
</tr>
<tr>
<td>72%</td>
<td>Litigation and legal liabilities</td>
</tr>
</tbody>
</table>

- Lack of common language for risk disclosures

Source: The Corporate Risk Factor Disclosure Landscape, IRRC Institute, Jan 2016
Review used baselined data from Jan 2015. The study normalised all reported risks to 17 different categories and binned the risk section of 50 companies (5 largest in 10 sectors) into those bins.
Disclosure of risk management efforts
- Investing in R&D, Purchasing insurance coverage, using hedging tools, implementing greater compliance controls, managing counterparty risk of suppliers and distributors

Disclosure of risk factor trends
- Increased likelihood of cyber attacks
- Increasing challenging regulatory environment (Dodd-Frank, Consumer Protection Act, Patient Protection, Affordable Care Act, Greenhouse gas emissions)

Source: The Corporate Risk Factor Disclosure Landscape, IRRC Institute, Jan 2016
Review used baselined data from Jan 2015. The study normalised all reported risks to 17 different categories and binned the risk section of 50 companies (5 largest in 10 sectors) into those bins.
Questions Regarding Risk Disclosures

- How informational are risk disclosures? Do they accurately represent the risks posed to company?
  - Limitations of “materiality” threshold
- Do risk disclosures hold any predictive capability on company performance?
- How to include Likelihood and Impact into risk disclosures?
- Relationship of risk disclosure and insurance coverages

1-in-100 risk requirements?
Summary of 10-K Risk Disclosures (cont)

Less common risks reported – 30% or less of companies report

<table>
<thead>
<tr>
<th>Percent Reported</th>
<th>Common Risk Disclosures</th>
</tr>
</thead>
<tbody>
<tr>
<td>28%</td>
<td>Key personnel</td>
</tr>
<tr>
<td>22%</td>
<td>Power and communications infrastructure</td>
</tr>
<tr>
<td>18%</td>
<td>Company reputation</td>
</tr>
<tr>
<td>16%</td>
<td>Governance matters</td>
</tr>
</tbody>
</table>

Key personnel risk factor present in all sectors except Health Care and Industrials.

- Importance of certain executives to the company’s growth strategy, operations, culture, company success

Source: The Corporate Risk Factor Disclosure Landscape, IRRC Institute, Jan 2016
Review used baselined data from Jan 2015. The study normalised all reported risks to 17 different categories and binned the risk section of 50 companies (5 largest in 10 sectors) into those bins.
### Risk Factor Categories of 10-K Risk Disclosures (cont)

- **Disclosure language is vague**
- **Sectors providing more specificity in risk factor disclosures**
  - Consumer Staples
  - Financial Services
  - Health Care
  - Technology

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**Capital markets and economic conditions** — Currency fluctuation and devaluation, debt and equity markets, credit risks, interest rate risk, macro and regional economy (including housing markets), inflation, employment and consumer spending, effects of monetary and fiscal policies

**Company reputation** — Public perception of company, questions over ethical nature of company business or actions, controversies which may tarnish company image, such as headline-making news on supply chain

**Competitive landscape** — Competitors (traditional and new/emerging) and competing products and services, including from counterfeiters

**Consumer power** — Consumer preferences, demographics, regulatory changes and other drivers affecting customer demands, such as health and safety considerations, customer concentration level and related company vulnerabilities

**Corporate finance and operations** — Revenue forecasts and other estimates and assumptions, short- and long-term investments, hedging, profit margins, performance and operating and financial results, goodwill, impairments, working capital management, internal controls, pension and health care costs, product and service quality, contracts and counterparty risk, insurance, inventory, property, plant and equipment

**Corporate growth strategies** — Strategies such as global expansion efforts, merger and acquisition and divestiture activity, joint ventures and strategic alliances

**Cyber, physical assets and data security** — Physical or electronic break-ins, data breaches, misappropriation of sensitive information, related human error and malfeasance, electronic fraud

**Energy and natural resources** — Pricing of fuel, energy and commodities, access to water and other natural resources

**Governance matters** — Dual-class stock structure, anti-takeover mechanisms

**Government and regulation** — Taxes and import/export duties, legislation and regulatory requirements, compliance requirements, financial reporting, accounting rules, political instability, nationalization of companies/industries

**Human capital** — Access to qualified labor, satisfactory relations with labor unions, retention, worker health and safety

**Innovation and competitiveness** — Research and development, intellectual property rights and protections, transition process for new products and services and related technology, adjustments to effects of technological change on company business model, product and service offerings and the scale of investment needed to maintain competitiveness

**Key personnel** — Continued service and availability of key individuals shaping company strategy, succession planning

**Litigation and legal liabilities** — Litigation, including potential and ongoing claims, legal compliance matters, related liabilities

**Natural and human disruptions** — Natural disasters, severe weather events, climate change, earthquakes, fires, war, terrorism, health pandemics and other public health crises, pollution

**Power and communications infrastructure** — System failures, network disruptions, communications lines and capacity, power shortages

**Supply chain and third party** — Sourcing, production, distribution and related logistical services, performance of vendors and distributors, access to and availability of third-party intellectual property, content and support

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Source: The Corporate Risk Factor Disclosure Landscape, IRRC Institute, Jan 2016
Potential ‘Use Cases’ for Pandora

- Scenario Identification Framework
  - Overlay AIG insurance portfolio and prioritize the scenarios that are most impactful
  - Track ‘Emerging Risks’ over time: index the changing prioritization of scenarios

- ‘Clash’ modeling
  - Identify the scenarios of greatest threats to ALM and Underwriting

- Evaluation of Insurance Opportunities
  - Identification of under-insured markets and perils that could represent future expansion opportunities
  - Develop 5-10 year insurance market projections

- Corporate risk profiling
  - Overlay the geographical offices of a company and derive the threats to the revenues and operations of the enterprise
  - Quantify balance sheet risk and supply chain disruption potential
The Improving Resilience of Banks

TLAC (Total Loss Absorbing Capacity) of G-SIBs is near completion

But eight large US banks downgraded by S&P Dec 2015 because now less likely that Federal Reserve will bail them out if they get into difficulties
Overview

- What do we mean by resilience?
- Insurance industry approaches to resilience
- Some challenges of today’s approaches
- We could improve the world if… - opportunities to improve resilience to consider
What Do We Mean by Resilience?

Reaction to events, based on purely arbitrary distinctions for illustrative purposes

<table>
<thead>
<tr>
<th>Frequency</th>
<th>‘Never noticed’</th>
<th>‘Acceptable disruption’</th>
<th>‘Serious manageable problem’</th>
<th>‘Unrecoverable event’</th>
</tr>
</thead>
</table>

Pre-event mitigation / avoidance

Ability to withstand event that occurs
Insurance Industry Approaches to Resilience

Illustrative examples of how insurance companies improve resilience today

**Insured-oriented**

- Provide external perspective / signal to insured as to risk level through pricing and risk selection
- Incentivize insureds to reduce expected loss by rewarding risk mitigation / avoidance investments (e.g. training, technology deployment, inbuilt redundancy)

**Insurer-oriented**

- Use human experience of many clients to inform judgements
- Leverage technology to improve risk selection and pricing models
- Invest in technology / research to reduce insureds’ expected loss

**Pre-event mitigation / avoidance**

- Pay indemnity to ‘make good’ loss
- Provide post-loss services to increase effectiveness and speed of recovery

**Increased ability to withstand event**

- Hold sufficient capital to withstand even low frequency events
- Diversify risk through reinsurance / other capital transactions
- Assume more risk to achieve diversification benefits against larger earned premium received
Some Challenges of Today’s Approaches

Selected points for reflection

1. 1-year insurance contracts limit effectiveness of insurer-insured interaction

2. Limited ability to see across insurer results, coupled with very different ingoing insurer objectives and beliefs, make deriving a market signal difficult

3. Low data volumes / limited pool of comparable clients in some spaces mean high pricing model uncertainty for individual risks and some portfolios

4. Computational and statistical techniques exist that can reduce model uncertainty; but are typically black box and difficult to combine with human judgement

5. Understanding more potentially catastrophic events than peers is a competitive advantage in resilience for insurers; but potentially a disadvantage in winning business
We Could Improve Resilience If…

Possible opportunities to improve resilience to consider

...we had longer term insurer–insured relationships, aligning interests more tightly and enabling co-investment

...we could tell more readily how insurer results compared to those of peers, so we had a better idea of what the market was telling us

...insurers could aggregate much more data from insureds, to derive signals from data that never seemed relevant before

...insurers selectively and anonymously pooled data with the backing of insureds, insurers, regulators and Government, to create sufficient data sets to truly improve resilience

...we could move the debate from ‘who has the data’ to ‘who can use the data most insightfully’

...we invested in talent and their understanding of advanced models, so they can effectively combine human judgement and cutting edge data science

...insurers took into account a similar set of risk scenarios, to reward insurers who invest in understanding more, not those who avoid discovering threats to resilience