University of Cambridge Judge Business School

Cambridge Centre for Risk Studies

RESEARCH AND ACTIVITIES PROSPECTUS 2018

Centre for **Risk Studies**

UNIVERSITY OF CAMBRIDGE
Judge Business School

Research Supporters of the Centre for Risk Studies at the University of Cambridge Judge Business School

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Foreword

The Centre for Risk Studies at the University of Cambridge Judge Business School enters its ninth year of research and activities programme with a strong set of achievements and a world-class team of researchers, associates, and supporters. The Centre for Risk Studies provides frameworks for recognising, assessing and managing the impacts of systemic threats to the global economy and to organisations with international ecosystems. Our research focusses on catastrophes and how their impacts ripple across an increasingly connected world, with severe consequences for international trade, financial markets and institutions with global stakeholders.

The past year has been a major period of dissemination of key findings and publication of the Centre's research achievements, with the release of a suite of report publications, combined with public presentations. The Centre is known for its scenario stress tests and its analytics platform, the Cambridge Risk Framework, which quantifies economic losses and other damage caused by catastrophes beyond direct impacts. Macro shocks can escalate rapidly and unexpectedly, and often have a localised origin with worldwide contagion via international supply chains and other networks of global connectivity. Yet the message from our research outputs is clear: The impacts of systemic macro shocks are measurable and foreseeable.

At the same time, accountability of organisations and of individual board members for managing foreseeable risks is rising. Large organisations — commercial, municipal, and governmental, non-profit etc. — need to grasp the nettle of foreseeable losses from macro shocks. This is driven by growing and unstoppable demand for quantified risk at the enterprise level, from markets and investors. Our engagement programme has continued to build, with another highly successful Risk Summit, our flagship conference, and a full and active programme of seminars and workshops that are a vital part of the two-way street that enables applied research to provide business value.

The Centre experienced some new and important milestones in recent months:

- The next release of the Cambridge Global Risk Index is planned for Spring 2018. This Index, ongoing since 2014, estimates the average annualised GDP loss to the world's top cities, by GDP output, caused by a comprehensive set of catastrophic threats from wars, financial market crashes and cyber catastrophes through to traditional natural disasters.
- Our cyber risk assessment research encompasses cyber losses in insurance and corporates across a host of threat drivers coming out of technology, economics and geopolitics. Our September workshop on "Probabilistic Cyber Insurance Loss Estimation" represented the latest in worldwide cyber scenario research. Our work on cyber-physical threats, in the operational technology arena, continues to develop in tandem with exploring and quantifying cyber terrorism impacts.
- The Global Exposure, Accumulation, and Clash (GEAC) initiative is developing open source data standards for insurance companies to quantify their exposures to catastrophes that hit multiple lines of insurance at the same time. As part of the GEAC Initiative, the Centre ran a workshop on "Best Practices in Scenario Development and Usage: Present and Future".

This report describes the research programme of the Centre for Risk Studies and its objectives for the next several years. We continue our ambitious programme of research into systemic and complex risk in business and are attacking this on numerous fronts. In 2018 we look forward to challenges and developments in our risk research, reflecting engagement and collaboration with external organisations.

We thank our supporting organisations for their ongoing inputs and guidance. We are grateful to them for sharing our vision and engaging with us on the problems they face. Our triple mission of engagement, risk research and academic output could not be sustained without you.

Professor Danny Ralph, Academic Director

Dr Michelle Tuveson, Executive Director

Simon Ruffle, Director of Research and Innovation

Dr Andrew Coburn, Director of Advisory Board

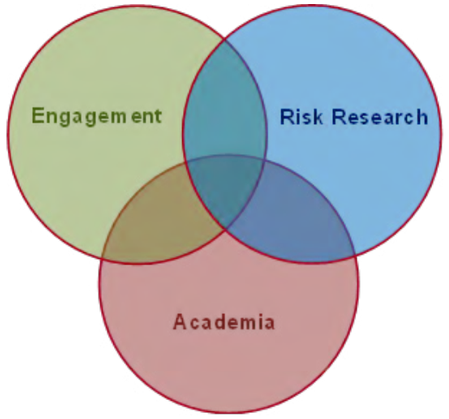
Strategy of the Centre for Risk Studies

The mission of the Centre for Risk Studies is to be the world's leading academic centre for research into systemic risk in business, the economy, and society.

A Focus on Systemic and Complex Risks

The Centre for Risk Studies originated from a fusion of specialised research interests into both complex systems and catastrophe risk analysis. Being located in the Judge Business School at the University of Cambridge has enabled the Centre to apply these interests to the business community and to structure an appropriate multi-disciplinary team.

The research of the Centre maintains a focus on systemic and complex risks – i.e. processes where loss occurs through the disruption of business, infrastructure and social systems and cascades through interrelated networks in complex and non-intuitive ways. This poses a wide range of analytical and methodological challenges for the academic community to tackle. The management and governance of complex risk has attracted interest and support from several sectors of the business community and government policy-makers, including the financial services industry, the energy sector, and major corporations. These different stakeholders form the community served by the Centre for Risk Studies.



Demonstrating Impact through Engagement

The Centre is proactive in disseminating its research outputs and demonstrating that such outputs have business value to a community of subscribers. The Centre's programme of dissemination and community-building, detailed in this report, ensures that our research is relevant and has real impact.

The Centre leads an active programme of events in which academics, business leaders and other stakeholders discuss risk-management issues. Over the past several years the Centre has established a reputation for thought-provoking meetings that tackle leading edge issues, attracting senior executives and influential attendees.

Engagement has been the principle method of identifying supporters and ensuring that research is aligned with the issues of most importance to the community served by the Centre.

Risk Research Programme

A full research programme is being pursued, expanding the active research team and working in a number of challenging areas. Achievements include methodology breakthroughs, conceptual innovation, and development of new tools and approaches that have attracted positive peer review and external attention.

A number of inter-related tracks of investigation have been developed and are described in the following sections. Research involves the proposal of methodological advances, the structuring of conceptual frameworks, compilation of data, and the development of models to explore issues. Research that is aligned with real-world business problems is valued by the University in terms of its impact.

Academic Output

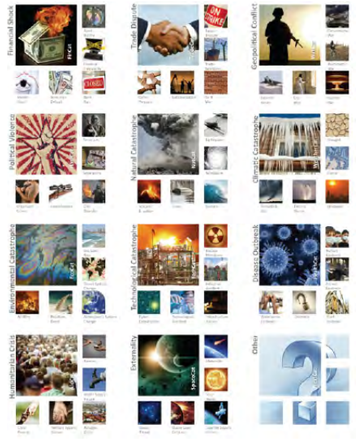
The Centre contributes to the educational priorities of the Judge Business School and engagement with the students through its MBA elective in Risk Management and the award of the annual Cambridge-McKinsey Risk Prize. The current research programme is intended to produce high quality management science publications as well as contribute to the MBA/MPhil teaching curriculum and the school's Research Excellence Framework Assessments.

Risk Research at the Centre for Risk Studies

The Centre continues to produce world leading research on understanding and managing systemic risk. This includes scenario development, network analysis techniques, and macroeconomic modelling of shock events.

The Cambridge Risk Framework

The Cambridge Risk Framework is a foundational element of the research programme of the Centre for Risk Studies. It provides an extensive set of objectively-defined scenarios of potential external shocks that could arise from any of 22 different threat types to locations of interest all across the world. The macro risks and threat types include financial crises, geopolitical risks, natural catastrophes, technological threats, and disease and external threats which identify emerging and system risks. The research focusses on business applications of management science to reduce risk.



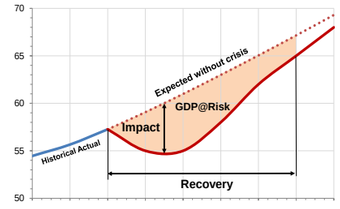
The Cambridge Taxonomy of Threats

Over the past few years the research has progressed from identifying a 'Taxonomy of Threats', to compiling a 'state-of-knowledge' for several of the threat types, and the exploration of the consequences of a stress test scenario for a number of selected threats.

A key contribution of the research is the standardisation of scenario selection (e.g. 1% annual probability of exceedance as a '1-in-100' event) for emerging risks. An innovative methodology has been developed to assess the different facets of scenario impact, ranging from direct loss, to macroeconomic consequences, to investment portfolio effects. This involves developing techniques of network analysis, including gathering and visualising data on the interconnectivity of the global economy.

GDP@Risk: A Metric for Comparing Different Types of Shocks

The research continues to explore the similarities and contrasts between shocks from different types of threats, initially using scenarios and their variants analysed in detail. A key research output is a metric – 'GDP@Risk' indicating loss of economic output – to measure the severity of shocks from widely different causes. This metric has been well received and has proven to be a useful and versatile benchmark for assessing the magnitude of catastrophes on the macroeconomy. It has enabled historical events to be recalibrated and compared with hypothetical events, and to allow comparison of widely different types of threat events. It provides a financial measure that can be used to assess the value of investment in risk management.

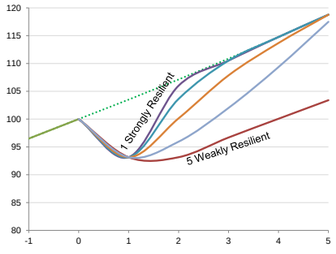


GDP@Risk - measuring economic output loss

Catastronomics: the Economics of Catastrophe

Assessing the macroeconomic impact of catastrophes involves understanding how shocks cause output loss, how different types of threats influence specific macroeconomic variables, and how these flow through the economic system, as well as which factors affect the severity of the initial shock and what processes determine how quickly the economy recovers.

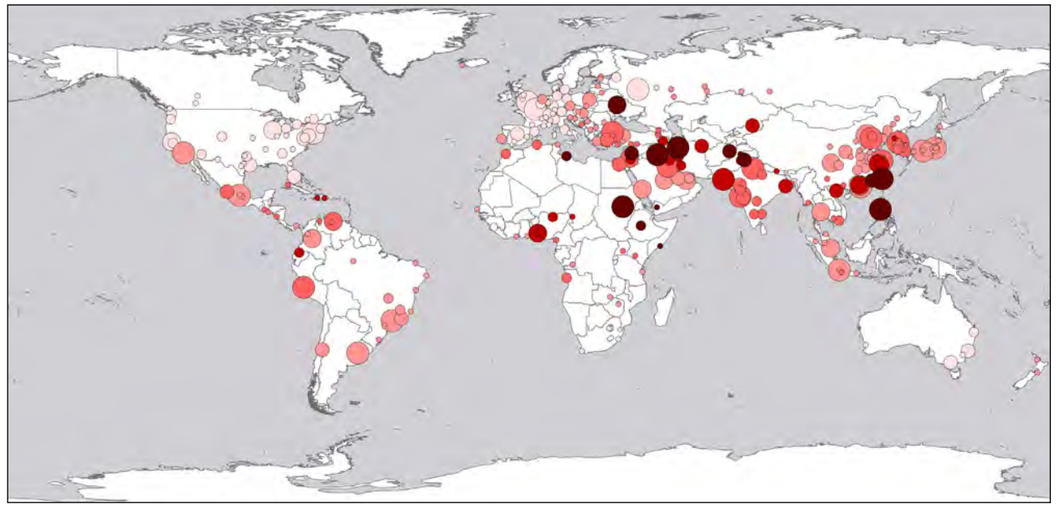
GDP@Risk estimation techniques have been successfully applied to various catastrophe classes. Modelling the economic impact of catastrophes is a key area of focus for this research.



'Catastronomics': resilience of an economy determines recovery speed and affects total GDP@Risk

A Global Risk Index

The Cambridge Risk Framework is used to provide a Global Risk Index: a quantitative assessment of the risk of all of the significant systemic shock threats to the global economy. The Cambridge Global Risk Index uses GDP@Risk assessments to derive economic output loss at city level for the most significant cities of the world, responsible for over half of global GDP.



Cambridge Global Risk Index: Baseline View of Risk. Source: GDP@Risk. Centre of Risk Studies

Project Pandora

The index makes use of an extensive data set collated on cities, threat maps, and historical precedents for 22 different threats. The resulting model provides a holistic estimate of future catastrophe cost from each of the major threats in our taxonomy for the global economy. We believe this is a major advance in the field of catastrophe studies and provides a platform for the Centre's research. The integration of datasets and multiple threat models constitutes Project Pandora – a specific research track on multi-threat analytics.

Emerging and Systemic Risks

The Centre for Risk Studies provides research into emerging risks and potential sources of catastrophes that are less well understood. Ongoing research into cyber risk includes tracking the changing landscape of hacker technologies and motivations, and the potential for correlated cyber attacks causing losses to multiple companies. For insurance companies and others to use cyber stress test scenarios in their business requires standardised data structures, and the Centre plays a data secretariat role in developing data schemas for analytics.

Resilience in Business Risk Management

How businesses manage a range of risks to their balance sheets, operations, and investment assets is an important focus of the Centre's research. We work with organisations to apply these research areas to find ways of improving the resilience of an organisation. Expressing the risk metrics for management monitoring, regulatory reporting, and other decision-support is a key area of exploration with our business support partners.

Risk Research Application Areas

Research application areas explored through the Cambridge Risk Framework are described in more detail in the following pages. For 2018, we envision leveraging the Centre's past work to focus on four main research application areas: Integrated Risk Assessment, Risks and the Digital Economy, Trend Risks, and Understanding Corporate Risks.

A. Integrated Risk Assessment Updating, improving, and extending the framework, datasets, and analytics of the Cambridge Global Risk Outlook, developing standardised risk metrics for multiple threats to the global economy.	**B. Risks and the Digital Economy** Research into the risks inherent in the growth of the digital economy, examining themes such as: cyber threats from social, political, economic or ideological actors; the role of nation states; and the proliferation of big data.
C. Trend Risks Continuing the research into individual threats, developing scenarios, and improving the understanding of emerging and rapidly changing risks such as: climate change; conflict; social inequality; technology; the digital economy and the Fourth Industrial Revolution; and the rise of general liability.	**D. Understanding Corporate Risks** Aligning the research activities and outputs to business decisions and practical applications in improving risk management practices in business and policy-making.

Methodology Development: Catastronomics

The economic consequences of major catastrophic shocks of different types are not well understood. The Centre has strong relationships with economists and specialists in macroeconomic analysis. One track of research is to improve methodologies of catastronomics and expand our understanding of how economic shocks translate into market impacts on asset values in an investment portfolio.

Additional Application Areas

In addition to our major application areas, we address research topics that are aligned with our objectives of populating the Cambridge Risk Framework, in particular threat specialisations, or other areas of business decision-making. Recent topics have included how climate change risk will affect investment portfolio strategies; improving risk assessments of geopolitical instability; and macroeconomic consequences of extreme natural catastrophe events.

Research Platform Infrastructure

The Cambridge Risk Framework makes use of a cloud-based research platform for data compilation, model development, and research output. This platform is currently being enhanced to improve its usefulness in the research and presentation of outputs, including enabling research supporters to interact with data and analytics developed at the Centre.

Understanding Complex Business Exposure

We are continuing to populate the Cambridge Risk Framework with datasets about the international economy, business interconnectivity, elements at risk from shocks, and threat information. These datasets represent 'complex business exposure' – counterparty relationships, trading flows, supply chains, market dependencies, transportation and communication lines – that are vulnerable to the disruption of business processes. Developing a useful data architecture for this exposure and publishing data schemas for improved adoption of representations of complex business exposure is an important objective for our future research.

Research Application Area A: Integrated Risk Assessment

A key objective for our research is to develop a comprehensive risk analysis of major shocks to the global economy. This has been a vision and objective of the Centre for Risk Studies since its inception. We have an annual cycle of updating and improving the analysis of threats, and integrating the risk assessment into decision-support applications. The analysis framework and its updates are geared to making the outputs more useful to business decision makers.

Project Pandora: A Global Risk Outlook

The Centre is continuing to develop a platform for comprehensive risk analysis of major shocks to the global economy, financial markets and the insurance industry. Our multi-threat integrated scenario-based risk assessment, Project Pandora, encompasses over 12,000 scenarios in 22 different threat categories across a set of major world cities representing about half of global GDP. The consequences of these scenarios are quantified in terms of their 'GDP@ Risk'.

We are continuing to develop and improve our underlying models and optimise our data sources. We are carrying out case studies and developing proof of concept tools to carry out risk assessments of individual companies and exploring the risk mitigations available through a range of insurance products.

Global Risk Index 2018

The 2018 update of our annual Global Risk Index sees a significant increase in risk from a number of threats, combined with growth of economic output. The index provides information for decision-support applications for use by business decision makers.

The 2018 Global Risk Index shows that while the wealth of the global economy continues to grow, the increase in risks posed to that wealth surpasses it: year after year, the GDP of the cities in the Global Risk Index increased while the GDP@Risk from the combined 22 threats has increased more. The theme underlying 2018's Risk Outlook is geopolitics. 2017 saw further entrenchment of geopolitical tensions, both in internal unrest and interstate conflict. Natural catastrophes were also prevalent in 2017, demonstrating the potential devastation caused by climate change. Cyber-attacks also increased in frequency and severity, but are yet to show signs of systemic economic impact.

This year's update focussed on improving the data provenance underlying the risk assessment. Some significant efforts toward standardisation include the use of city boundary definitions and city GDP estimates and the derivation of resilience metrics using the InfoRM Index for Risk Management. The annual update also involves a detailed horizon scan of events and developments for each of the individual threat types to assess changes to the long-term risk baseline.

The Global Risk Index is now presented as a three-year outlook, rather than a ten-year outlook as in previous years. This outlook period better aligns with that of business decision makers.

Research Application Area A: Integrated Risk Assessment

	Market Crash	Sovereign Crash	Price Shock	Interstate War	Terrorism	Separatism Conflict	Social Unrest	Earthquake	Volcano	Tropical Windstorm	Temperate Windstorm	Flood	Tsunami	Drought	Freeze	Heatwave	Power Outage	Cyber Attack	Solar Storm	Nuclear Accident	Human Epidemic	Plant Epidemic
Market Crash	4	3	3	2	3	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sovereign Crash	3	4	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Price Shock	2	2	4	2	2	2	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Interstate War	3	3	3	4	3	3	3	1	1	1	1	1	1	1	1	1	2	3	1	2	2	2
Terrorism	2	2	2	2	4	3	2	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2
Separatism Conflict	2	3	3	3	3	4	3	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1
Social Unrest	2	2	2	2	3	3	4	1	1	1	1	1	1	1	1	1	2	2	1	2	1	1
Earthquake	2	2	2	1	1	1	2	0	0	1	1	1	3	0	0	0	3	0	0	3	2	1
Volcano	2	2	2	1	1	1	2	0	0	0	0	0	0	0	2	0	2	0	0	0	2	1
Tropical Windstorm	2	2	2	1	1	1	1	0	0	0	0	3	0	0	0	0	3	0	1	1	1	0
Temperate Windstorm	1	1	1	1	1	1	1	0	0	0	0	2	0	0	1	0	3	0	1	0	0	0
Flood	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	2	0	0	1	2	0
Tsunami	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0
Drought	1	2	3	2	1	1	2	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
Freeze	1	1	2	1	0	0	2	0	0	0	0	0	0	0	0	0	3	0	1	1	1	1
Heatwave	1	1	1	2	1	2	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Power Outage	1	2	2	1	0	0	2	1	1	1	1	1	1	1	1	1	4	0	0	2	1	1
Cyber Attack	1	2	1	2	0	1	2	0	0	0	0	0	0	0	0	0	3	4	0	2	0	0
Solar Storm	2	2	2	0	0	0	2	0	0	0	0	0	0	0	1	1	3	0		2	0	0
Nuclear Accident	2	2	1	2	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Human Epidemic	3	3	3	1	1	0	2	1	1	1	1	1	1	1	1	1	2	1	1	1	2	0
Plant Epidemic	2	2	3	2	1	2	2	0	1	0	0	0	0	1	1	1	0	0	0	0	0	2

Primary Trigger

Consequential Threat

0 **No causal linkage**
No significant ability to exacerbate

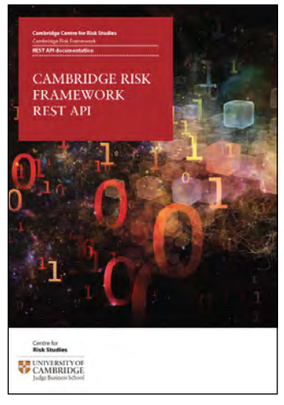
1 **No causal linkage**,
but would exacerbate consequences if they occur

2 **Weak potential**
to trigger threat occurrence

3 **Strong potential**
to trigger threat occurrence

4 Ability to trigger
Other threats within same type class

Threat Correlation Matrix, how one shock might cascade into another



The Cambridge Risk Framework API

The Cambridge Risk Framework Application Programming Interface (API) is available to our development partners. The API allows programmatic access to data and models within Project Pandora and makes possible direct integration with corporate systems, apps, and web viewers. Partners get access to underlying model assumptions which they can then calibrate for their own organisations to produce bespoke risk assessments. The API, launched during 2017, gives programmatic access to our data and models allowing our research supporters to quickly and conveniently obtain up-to-date data to integrate with their internal systems.

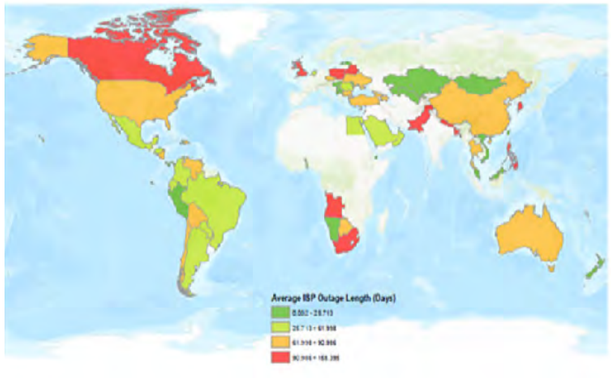
Business Use Cases and Project Partners

The Centre for Risk Studies works with selected organisations as part of a multi-year partnership to develop and exploit Project Pandora. The Centre works with a steering committee of research supporters representing different aspects of potential business users. This development consortium will shape the applications of the research to meet the needs of their specific use cases. The nature of the partnerships will facilitate the practical usage and benefits of the research output towards business applications.

Research Application Area B: Risks and the Digital Economy

The Centre for Risk Studies continues to research the risks inherent in the growth of the digital economy, examining themes such as cyber threats from social, political, economic or ideological actors, role of nation states, and proliferation of big data, big data risks, and social inequality.

Risks range from society and businesses' vulnerability to cyber attacks, to social transformation problems, privacy and rights issues, and potential geopolitical instabilities.



Centre for Risk Studies: 2017 Internet Service Provider Outages.
Source: BGP Stream

Risks and the Digital Economy

The 'fourth industrial revolution', embracing big data, artificial intelligence, robotics, and machine learning, is likely to be disruptive, with new winners and losers in the economy, societal shifts in productivity, changes to the nature and characteristics of employment, and possible structural differences in the way wealth is distributed. The Centre's research is exploring the potential nature of a future digital economy, and the risks that the transformation to this new economy could pose, to provide risk management guidance for business managers and policy-makers in navigating through the coming changes.

Cyber Risk Research

The Centre for Risk Studies continues to be a leader in cyber risk research, analysing patterns of cyber loss, monitoring and publishing annual assessments of the cyber risk landscape, and developing scenarios and stress tests for regulators and practitioners. The Centre has contributed to the growth of the cyber insurance market through its work in designing an open source cyber insurance exposure data standard, publishing scenarios of potential cyber accumulation risk, and addressing issues such as probability assessment of cyber loss.

Cyber risk research at the Centre continues with monitoring latest developments in the cyber threat landscape and interpretation of new incidents, assessment of global differences in international cyber risk and loss patterns, and improving techniques for understanding the cyber risk profile of individual businesses and sectoral characteristics. The impact of cyber losses on businesses and the economy overall is a continuing theme, improving the understanding of the full cost of cyber risk to the global economy, its impact on business operations, balance sheet and viability, and its multipliers in the economy through suppliers and counterparties. Our cyber risk research increasingly addresses corporate solutions to managing cyber risk, together with societal and policy-making measures to reduce cyber threat overall.

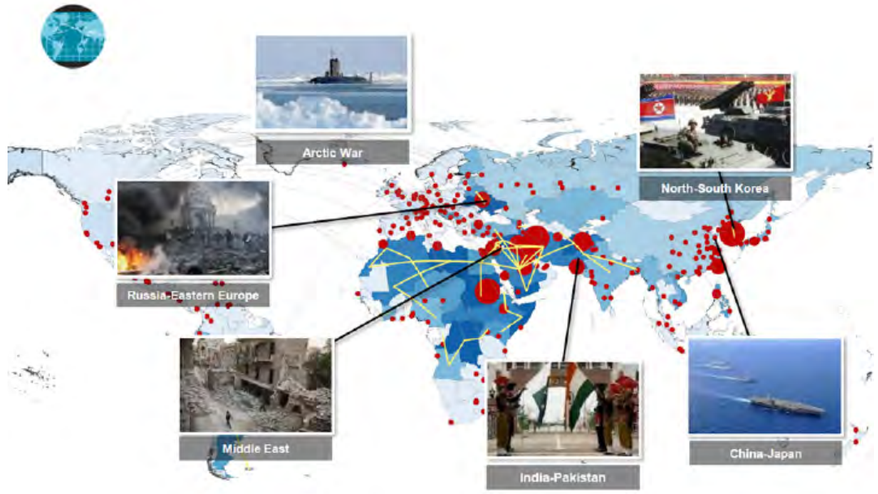
Cyber Terrorism Research

Cyber is becoming an increasingly significant component of geopolitical risk, as national cyber operations teams in many countries act as extensions of military and national security capability, and target the information infrastructure of potential adversaries.

The Centre's research explores potential future consequences of digital conflict as a dimension of geopolitical risk, tracking threat actors, capabilities, and motivations. This continues past work at the Centre on cyber terrorism and asymmetrical threats to society, financial services, and the economy. Cyber capabilities are transforming the traditional landscape of geopolitical risk and creating new orders and polarities of potential international conflict. Helping businesses and policy-makers understand this new risk environment and manage it appropriately is the focus of this programme of research at the Centre for Risk Studies.

Research Application Area C: Trend Risks

Continuing the research into individual threats, developing scenarios, and improving the understanding of emerging and rapidly changing risks such as climate change, conflict, social inequality, technology, digital economy, gender risk, and rise of general liability.



Changes in Interstate War Landscape. Source: Cambridge Centre of Risk Studies

Trend Risks and Possible Futures

The consequences of global warming, though increasingly nearer and more cogent, have not been at the forefront of political debate since the optimism and consensus of the Paris agreement at COP 21 in December 2015. Yet continued pressure at the micro level, worldwide, seems to be increasing. Shareholders are forcing firms to account for their role in CO_2 emissions and develop urgent management plans for decarbonization. Advocacy against cutting greenhouse gas emissions has caused even a coal producer to withdraw from the World Coal Association. Legal challenges against large multinational corporations over local manifestations of climate change are becoming widespread as case law becomes more established. International NGOs and central banks are stepping forward to help set standards for the financial services sector in their financing practices and decarbonization of their portfolio holdings.

The impact of weather catastrophes and how climate change is impacting extreme events is part of the Centre's ongoing analytics development for quantifying corporate risk. The threat of climate change will also be a key discussion topic at the 2018 Risk Summit.

Tension and Conflict

The Cambridge Global Risk Index has shown elevated risk levels within the class of Geopolitics and Security threats in 2018. This is a continuing reflection of what can be considered the retreat from globalisation in developed economies, manifested most obviously in the UK Brexit referendum and the Trump's presidential win in the US in 2016 and, in 2017, right wing political success in Austria and Spain's constitutional crisis in the form of succession demands from Catalonia.

The impact of popular movements and politics on traditional views of economics and international trade has also created heightened conditions of instability with examples such as the rise of authoritarianism in Turkey and continued conflict in the Middle East. Localised animosity towards trends in globalisation may manifest in political upheaval, regulatory regime change, creating uncertainty and rising compliance costs, especially in the financial service sector. Geopolitics and Security remains a priority for the Centre given the lack of standardised quantitative methodologies for risk assessment and risk management for this threat class.

Research Application Area C: Trend Risks

Rise of Liability

Emergent liability risks include the health impacts of widespread industry practices. In food preparation, for instance, refined carbohydrates including sugars have been linked to an obesity epidemic and rising rates of diabetes, a portent of a major public health challenge. The nature of liability is also changing depending on the issue and the regulatory region. In Europe, professional liability is becoming an increasingly significant risk exposure for medical professionals and senior officers of firms, while a vast eruption of gender discrimination cases is possible in the USA on the basis of salary discrepancies over many years. Liability is one of the four main pillars of the Global Exposure Accumulation and Clash (GEAC) Project which includes a subschema covering medical malpractice, directors and officers insurance, and professional indemnity.

Total Exposure Value: Commercial Lines. Source: Centre for Risk Studies GEAC Database

Technology as an Emerging Risk

Cyber risk as "threat du jour" has overshadowed other technology threats of which biological and material sciences are two main areas undergoing rapid and radical development. In biology, the ability to manipulate genes has far reaching consequences, evidenced by three FDA approvals of new gene therapies since August 2017. The darker side of gene manipulation is multifarious, including a warning from Microsoft founder Bill Gates, "The next epidemic could originate on the computer screen of a terrorist intent on using genetic engineering to create a synthetic version of the smallpox virus ... or a super contagious and deadly strain of the flu." The threat of pandemic, which is key to the Cambridge Global Risk Index, is updated annually with the 2018 launch planned for spring.

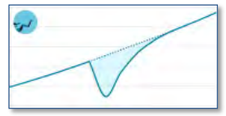
Nanotechnology remains the poster child for material science with well-articulated fears about its emergence as a systemic threat. The analogy between carbon nanotubes with asbestos has made the insurance industry acutely aware of health risks posed by new materials. Indeed the "next asbestos" is a recurring theme, recently mentioned at our September 2017 workshop on "Best Practices in Scenario Development and Usage".

Research Application Area D: Understanding Corporate Risks

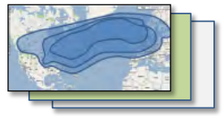
Expectations of businesses by shareholders and wider society are increasing on many levels. The ability to understand and quantify the true state of a corporation's collective risks at any moment in time is becoming more pressing. The risks might be internally focussed such as those related to talent and culture or be driven by external exogenous events. This track of research explores the methodologies and applications of the Centre's research for risk profiling of corporations and focusses on the use of research outputs in improving business decision-making.

Threat Maps

Risk Models
& Output Data



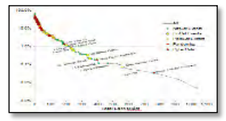
Scenarios



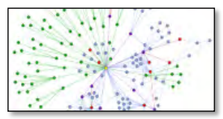
Software Platform
(Cambridge Risk Framework)

Exposure Data

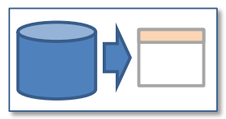
Use Cases
Business Applications



Network Models



Private Portals
APIs & Modelling Interfaces



A toolkit for risk science: quantifying resilience

Enterprise Risk Management

Multinational corporations today face very different threats to their businesses than in previous decades when dominant forms of risk and compliance practices were formed. Active areas of research support the hypothesis that corporations' overall risk profiles have increased, simply from the effects of a more globalised and closely networked world. The Centre's corporate engagement activities have validated that corporations are seeking to improve their risk management practices by adopting a more comprehensive and quantifiable threat assessment framework.

The Cambridge Risk Framework provides an extensive set of objectively defined scenarios of potential external business shocks that could arise from any of 22 different threat types, to principal locations of business activity all across the world. The macro risks and threat types include financial crises, geopolitical risks, natural catastrophes, technological threats, and disease and external threats which identify emerging and systemic risks to business operations. The framework can help gain insights into the macro risks posed to an overall sector.

Scenarios for Business Management

Understanding new threats through the development of scenarios is a technique that is used extensively at the Centre for Risk Studies, building on many years of precedents in management science. The Centre continues to refine methodologies for developing scenarios and improving their usefulness in decision support. Scenarios are used in many different aspects of business, from preparedness planning, to financial stress testing, insurance accumulation control and deterministic loss estimation, regulatory requirements, and strategy planning. Our research continues to define best practice in the design and use of scenarios, particularly the assessment of severity and likelihood, sensitivity to major variables, and uncertainty distributions in scenario variants.

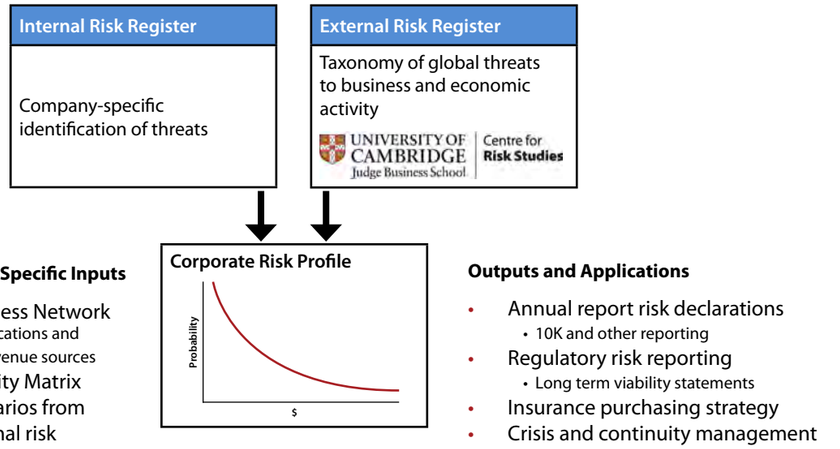
Data Schemas

Scenarios are more useful if they can be applied to the specific activities of a particular company. Analyzing the impact of a scenario on a company requires a set of information about the company and its activities. Use cases help define a standard set of information – a data schema – that can be used to map a scenario to business activity and derive impact assessments. We propose to develop a data schema for international companies to map their global operations and market activities to assess their impacts from global risk scenarios.

In insurance, there are many lines of business that have clash potential, where losses could be experienced across multiple exposure categories by emerging and systemic threats. Developing a multi-line exposure data schema is a priority for the insurance use cases of research at Centre.

Research Application Area D: Understanding Corporate Risks

Some of the more extreme scenarios result in market shocks, and have investment portfolio impacts. We propose to develop and publish a standardized data schema to describe representative asset classes in institutional investment portfolios, to enable investment managers to assess their likely impacts from scenarios.



Company-Specific Inputs

- Business Network
  - Locations and revenue sources
- Activity Matrix
- Scenarios from internal risk registers

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

Risk Reporting

Reminiscent of efforts leading up to the development of the Solvency II and Basel directives, governments and corporations are seeking to incorporate concepts related to viability and de-risking insolvency into regulatory frameworks for corporations. This includes the mandatory filing of viability statements for corporations in the UK and expanded risk factor disclosures in the 10-K public filings in the US.

Companies can augment their internal risk registers with external threat assessment checklists, such as our Cambridge Taxonomy of Threats. Our research outputs are used for annual report risk declarations such as 10-K reporting, regulatory and shareholder reporting, long term viability statements, insurance purchasing strategies, crisis and continuity management, and monitoring of risk metrics across internal business units. We will be engaging with support partners to improve research outputs for use in these business applications.

The field of risk management and its supporting research will need to expand to address the demand for greater clarity in modelling and communicating collective risks and foreseeable harm that corporations might face in the future, and better understanding their financial implications. Organisations taking the lead in identifying and assessing risks that today are both nonstandardised and foreseeable are creating a competitive advantage for themselves.

Use Case: Enterprise Risk Management for a Multinational Corporation

Enterprise Risk Management for a Multinational Corporation

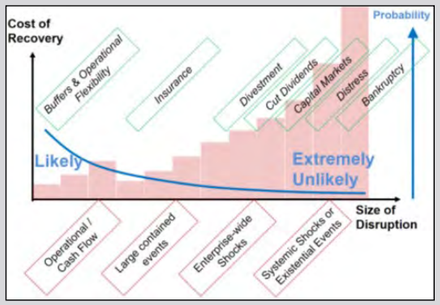
The Centre for Risk Studies believes that companies that base their risk management activities on a comprehensive threat assessment with strategic contingency plans will be more resilient, with improved credit ratings, investor confidence, and shareholder value.

The Cambridge Risk Framework provides an extensive set of objectively defined scenarios of potential external business shocks that could arise from any of 22 different threat types, to principal locations of business activity all across the world. The macro risks and threat types include financial crises, geopolitical risks, natural catastrophes, technological threats, and disease and external threats which identify emerging and systemic risks to business operations. The framework can help gain insights into the macro risks posed to an overall sector.

The Cambridge Pandora Project integrates and harnesses Cambridge's Global Risk Index such that the multi threat research can further important business decision making within a multinational corporation such as one within the commodity or energy sector. The Pandora Project identifies the risks of catastrophic disruptions to the business activities of the corporation from extreme systemic risks.

In addition to identifying meaningful comparative metrics, the research provides analytics to address the following manner of questions:

- Which threats cause the maximum revenue losses?
- Which type of assets are most at risk with respect to revenue loss?
- If company assets were better able to withstand impacts of threats how much additional revenue could be earned?
- If company assets were better able to withstand impacts of threats how much cost would be saved on plant repair and replacement?
- If climate change increased intensity or frequency of certain threats, what effects could this have on average revenue and physical damage?



Use Case: Insurance Purchasing Framework

Insurance Purchasing Framework

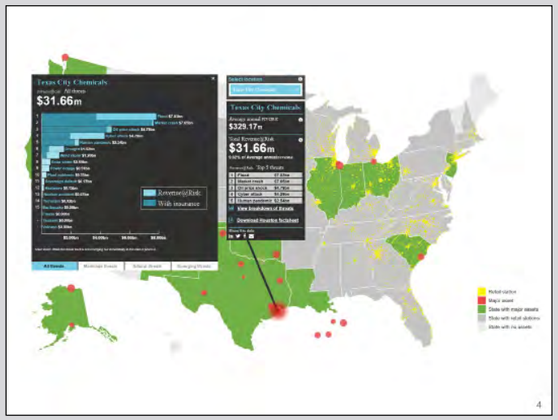
The Centre for Risk Studies is researching the types of events that could cause severe loss to a company and risk mitigation strategies for these threats. This specific use case of the Cambridge Pandora Project integrates and harnesses the Centre's Global Risk Index research to support important business decision making within a corporation in managing its overall risk.

The Insurance Purchasing Framework helps identify the risk of catastrophic disruptions to the business activities of a corporation from extreme systemic risks. The use of analytical outputs from the Pandora Project helps provide a holistic view of risks to a corporation's assets operating in defined geographical regions.

This research provides meaningful metrics for comparison across asset types such as Revenue@Risk. The research also provides a framework to address questions such as:

- Which threats cause the maximum revenue losses?
- Which kinds of assets are most at risk with respect to revenue loss?
- If a corporation's assets were better able to withstand impacts of threats, how much additional revenue could be earned or how much cost would be saved on plant repair and replacement?
- If climate change increased intensity or frequency of certain threats, what effects could this have on revenue and physical damage?
- Identify potential insurance prouducts that could mitigate identified risks.

This research will provide visualisation and quantification approaches to overlaying insurance products, their policy terms and exclusions to get a consolidated picture of a company's exceedance probability (EP) curves.



Risk profile for a particular facility at a location. Source: Centre for Risk Studies

Use Case: Importance of Resilience in Economic Recovery

Importance of Resilience in Economic Recovery

The Cambridge Risk Framework provides a foundation for modelling interconnected risks in a disaster. Improved quantification and modelling of risks allows for more efficient consideration of market solutions. In the case of developing countries, the use of GDP as a broad measure of economic recovery and growth may not adequately assess the welfare of the population and other consequences after a disaster. The interconnected nature of risks is particularly evident in understanding conflict dynamics in relation to other risks such as ocean risk, flooding, food security, terrorism, and geo-politics.

The Centre for Risk Studies is researching the processes that allow for greater resilience after major events and risk management actions which promote increased economic and social recovery. The Centre uses a case study approach to study recovery dynamics spanning regions across both developing and developed countries.

Photo Credit: Doug Syme

Our analysis seeks to answer questions such as the following:

- How does the destruction of physical assets translate to output losses (flow), and what are the factors affecting the respective response functions?
- Are there country-level similarities or differences in the recovery dynamics?
- What is the value of insurance and other financing mechanisms in the reconstruction and recovery processes?

2018 Planned Event Calendar for the Cambridge Centre for Risk Studies

23 January

Centre for Risk Studies Advisory Board

The Centre for Risk Studies will hold the meeting of its Advisory Board, with attendees representing the supporting organisations of the Centre, academic advisors, and invited guests. The executive team of the Centre for Risk Studies will present a progress report on the past year's activities, the current positioning and research strategy of the Centre.

25 January

Cambridge CRO Council Roundtable Discussion - London
Leading Ideas in Risk - Market Transitions in a De-carbonized Future

Discussion of the risks and opportunities for risk managers as the world transitions to lower carbon societies amidst climate change concerns, e.g. the "Bank of England's Response to Climate Change". Topics will cover divestment, stranded assets, portfolio structure, and other risk topics facing the investments of banks.

Deadline: 6 March

The 2018 Cambridge-McKinsey Risk Prize

The deadline for submission for the Centre's annual Cambridge-McKinsey Risk Prize.

6 March

Cyber Seminar - New York

The Centre for Risk Studies will hold a cyber seminar with partner RMS in New York.

13 March

Cyber Seminar - London

The Centre for Risk Studies will hold a cyber seminar with partner RMS in London.

March

CyRim Cyber Scenario Workshop - Singapore

The Centre for Risk Studies is researching the applications of its cyber models in the Asia-Pacific region and will be holding a workshop in March in Singapore exploring cyber scenarios as part of engagement for this research track.

March

Launch of *'Scenarios for Systemic Risk Management: Understanding & Navigating Risks in a Hyper-Connected World'* report - London

The Centre for Risk Studies and Citi Global Research will hold a launch event in London for the publication of a new report in the *Citi GPS* series. This report examines how we can better understand and navigate the global risk landscape.

April

Launch of the Global City Risk Index 2018

The Centre for Risk Studies in collaboration with Lloyd's will be launching the City Risk Index for 2018. The Cambride Risk Framework of 22 threat categories will be modelled against 279 global cities.

20 June

Cambridge Centre for Risk Studies 2018 Risk Summit - London

Risks Beyond Boundaries

In 2018, the Summit will be held in London for the first time, in One Birdcage Walk, Westminster, and followed by an evening drinks reception. The change in location complements the choice of this year's theme: 'Risks Beyond Boundaries'.

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2017 at a Glance

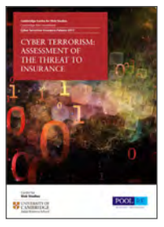
Centre for Risk Studies Research Outputs and Publications

A diverse look at the shifting risk landscape

In 2017, the Centre for Risk Studies took a diverse look at the current and shifting risk landscape, with a particular focus on emerging risks that the global economy faces, including the possibility of cyber threats and terrorism. This was reflected in our research output, including four highly detailed and influential reports, that contributed to emerging understanding of these threats in the broader business community. Launch events were held in London for the '*Cambridge Global Risk Outlook*', *'Cyber Risk Landscape'* and '*Cyber Terrorism: Assessment of the Threat to Insurance*' reports and a virtual launch event was held for the publication of the '*Multi-Threat Risk Analysis and Insurance Growth Opportunities'* report. The publication of these reports generated significant media interest and conversation (see opposite page).

Multi-Threat Risk Analysis and Insurance Growth Oppurtunities

Produced in collaboration with the American International Group (AIG). This report is part of the Cambridge Risk Framework and uses findings from the Cambridge Global Risk Index. This report aims to answer questions related to the process of insurance uptake in key cities in the global economy.



Cyber Terrorism: Assessment of the Threat to Insurance

An assessment of the current status and future shape of the cyber terrorist threat to the UK mainland and economy. The research was undertaken over the course of two years in collaboration with Pool Re Ltd., the national terrorism pool, and provides the basis of a change in policy to the Pool Re Scheme that will go into action in April 2018.

2017 Cyber Risk Landscape

The cyber risk landscape is changing rapidly. In collaboration with RMS, the Centre for Risk Studies summarised the latest trends and outlooks for cyber risk in information technology systems and cyber-physical attacks.

Cambridge Global Risk Outlook for 2017

The Cambridge Global Risk Outlook for 2017 launched the Centre's 2017 index, the Cambridge Global Risk Index, which analysed the exposure to shocks of the global economy against a calculated baseline and provided an overview of risk for the world's economy for the next 10 years.

2017 at a Glance

Selected Press Features

Express, 'Isis 'Cyber Caliphate' could target Britain's 'critical national infrastructure", 31 December 2017

Cambridge News, "Threats of 'cyber terrorism' on the rise say Cambridge experts," 29 November 2017

Insurance Times, "Pool Re to extend cover to include physical damage from cyber terrorism," 28 November 2017

Reuters, "UK terrorism reinsurance fund to include cyber coverage from next year", 28 November 2017

Judge Business School Insight, "Cyber terrorism," 28 Novemebr 2017

Raconteur, "From Brexit to festivals, tools must measure a new generation of risks," 27 November 2017

Scientific American, "Future solar storms could cause devastating damage," 18 October 2017

Institute of Risk Management, "Realizing Greater Competitive Advantages from Risk Management in a Corporation: Marrying the Upside and Downsides of Risk", 2017

Cable, "New report predicts 90% of the UK could have 5G by 2026", 4 October 2017

Computer Weekly, "Consistent service, not speed, key to UK's 5G future, say researchers," 3 October 2017

Judge Business School Insight, "Consistency over speed," 2 October 2017

Sputnik News, "US Military needs solar power to keep ops running if grid collapses - expert," 26 September 2017

Risk and Insurance, "Harvey hampers third of U.S. refining capacity," 5 September 2017

Reinsurance News, "Harvey could take $60 billion off Houston's GDP output in a year: report," 1 September 2017

Windpower Monthly, "Keeping hackers at bay," 8 September 2017

Cambridge Network, "Paper on risk and railroads wins prestigious prize," 29 June 2017

Judge Business School Insight, "Risk and railroads," 28 June 2017

Institutional Investor, "The slippery business of manager mergers," 2 June 2017

Strategic Risk, "Waging war on big business," 31 May 2017

Raconteur, "Management of business risk must be a science," 30 May 2017

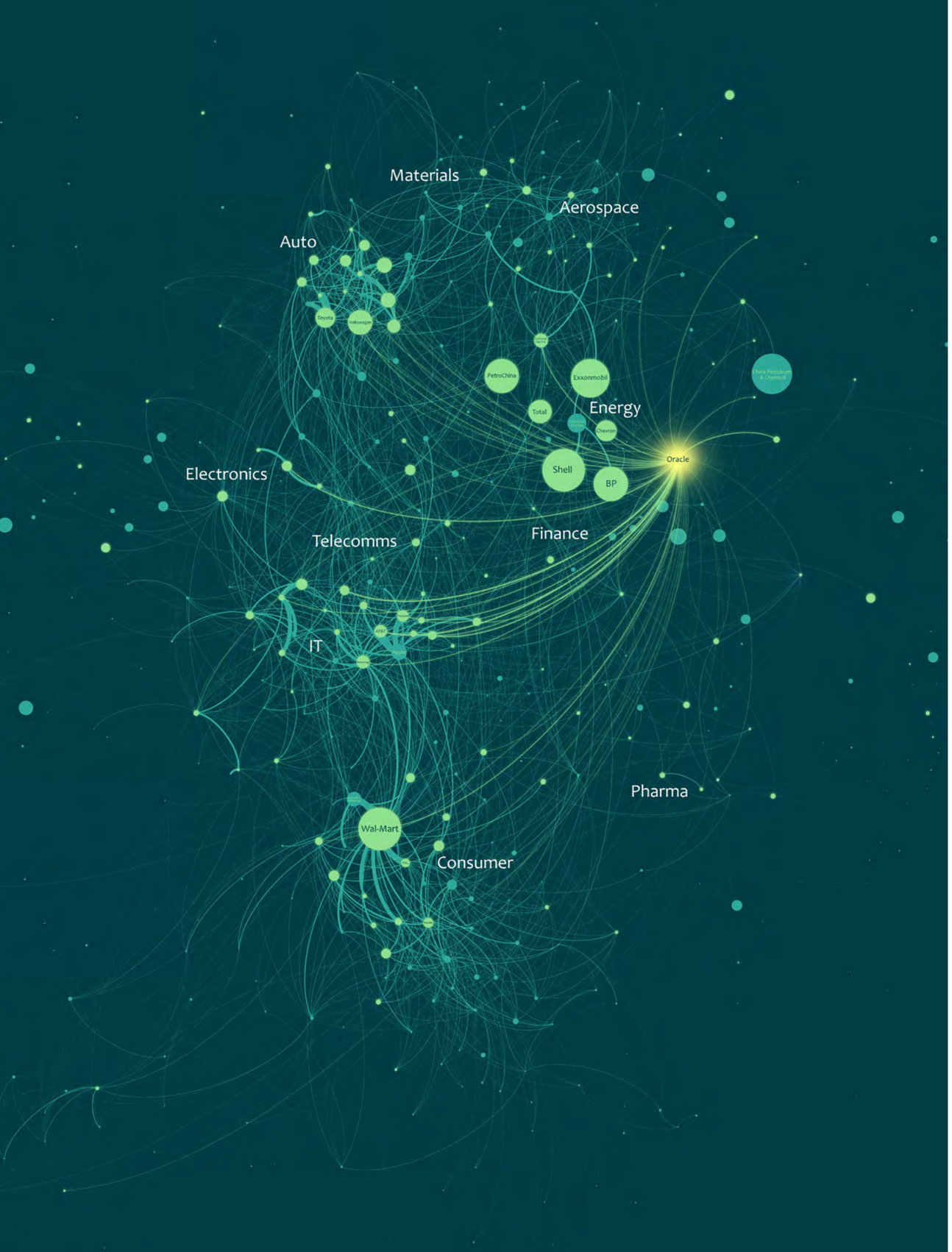
Washington Examiner, "How two different cyberattack threats could have a catastrophic effect on the US", 16 May 2017

Cambridge Business Magazine, "Storm force", 1 March 2017

The Systems Scientist, "Solar storms could cost USA tens of billions of dollars", 17 February 2017

The Christian Science Monitor, "Researchers calculated the economic cost of a major solar storm - and it's big," 23 January 2017

Bloomberg, "How Space Could Trigger a Future Economic Crisis," 19 January 2017



"Systemic Cyber Threats", the world's largest commercial companies and their trading relationships, showing the systemic linkages through major software providers, using Oracle as an example; *created by Dr Andrew Skelton*

2017 at a Glance

Engagement Activities

The Centre continues to expand its research dissemination and engagement activities for the wider research and business communities. The Centre's dissemination strategy involves publishing reports and creating a multi-channel process for publicising and distributing them. This enables the Centre to tailor reports to specific audiences and areas of expertise in 2017.

Formal launches are often held to increase visiblity of newly released reports. Examples include the *'Cyber Terrorism: Assessment of the Threat to Insurance'* report, in association with Pool Re and the *'Multi-Threat Risk Analysis and Insurance Growth Opportunities'* in association with AIG.

FT 125 Strategy Live Session with Andrew Hill, Dr Michelle Tuveson and Sir Mick Davis. Photo credit: Rosie Hallam

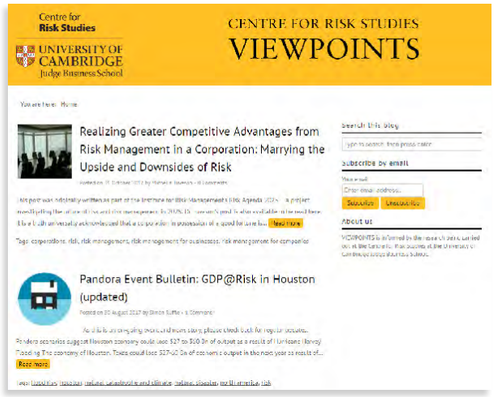
Third party speaking and general participation requests for external conferences and workshops are frequent as the Centre sustains and grows its reputation for high quality risk research and thought leadership. Centre members continue to serve on boards and as senior advisors for external publications and academic series. Examples include the World Economic Forum Global Risk Report, the IEEE's Publication on the Ethical Considerations in the Design of Autonomous Systems, Journal of Network Theory in Finance, Elevate City on Gender Diversity Initiatives, and Executive Education Curriculum Design.

Centre for Risk Studies' Viewpoints Blog

The Centre's Viewpoints Blog provides an easily accessible platform for commentary and insights from the research team on salient topics. Recent columns include:

- Artificial Intelligence and 'smart' technology
- Amazon Cloud outages
- Cyber extortionists targeting Apple
- 2017 Tower Bridge attack
- Hurricane Harvey and its impacts

Blog posts are available to be read here:
https://risk-studies-viewpoint.blog.jbs.cam.ac.uk



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2017 at a Glance

Calendar of Events

24 January	**Centre for Risk Studies Advisory Board** Research strategy review by the members of the Centre for Risk Studies Advisory Board.
25 January	**Cambridge CRO Council Roundtable Discussion - London** Leading Ideas in Risk - Implications of FinTech and Greater Automation to the Financial Services Industry
6-7 February	**Risks and Benefits of Artificial Intelligence and Robotics** A workshop for media and security sectors in collaboration with the United Nations.
Deadline: 6 March	**The 2017 Cambridge-McKinsey Risk Prize** An award presented for the best submission on risk management by a current graduate student at the University of Cambridge at the 2017 Risk Summit in June.
May	**Cyber Risk Landscape Seminars** Presented in collaboration with RMS.
22-23 June	**Centre for Risk Studies 2017 Risk Summit** In June 2017 the Centre for Risk Studies held its annual Risk Summit conference. The theme of the 2017 conference was "Managing Risk in a Smarter World".
27 July	**Probabilistic Cyber Insurance Loss Estimation Workshop** A workshop focusing on cyber catastrophe risk management in collaboration with partner RMS.
July-October	**Pathfinder Webinar Series** As a related part of the GEAC initiative, in collaboration with RMS, the Centre for Risk Studies presented two webinars in the summer and autumn of this year, showcasing ongoing research tracks at the Centre.
6 September	**Best Practices in Scenario Development and Usage: Present and Future** The Centre for Risk Studies held a workshop on scenario development and usage as part of the GEAC initiative, in collaboration with RMS and Praedicat.
25 September	**Global Exposure and Accumulation Clash (GEAC) Workshop - New York** The Centre for Risk Studies held a workshop in New York for the Global Exposure and Accumulation Clash (GEAC) initiative, in collaboration with partner RMS.
17 November	**Counterfactual Risk Analysis Seminar** A presentation on the risk insights gained by insurers, banks, and other stakeholders by rejecting the anthropocentric view that the past was inevitable by Dr Gordon Woo.
28 November	**Launch Event for *'Cyber Terrorism: Assessment of the Threat to Insurance'* report** The Centre for Risk Studies, in collaboration with Pool Re Ltd., the national terrorism pool, held a launch event in London on November 28 for the publication of a new report 'Cyber Terrorism: Assessment of the Threat to Insurance'.
December	**Launch Event for *'Multi-Threat Risk Analysis and Insurance Growth Opportunities'* report** The Centre for Risk Studies held a virtual launch for the publication of the 'Multi-Threat Risk Analysis and Insurance Growth Opportunities' report, in collaboration with partner AIG.

2017 at a Glance

Calendar of Events

Artificial Intelligence and Robotics Workshop with United Nations, February 2017

Risk Summit 2017

Probabilistic Cyber Insurance Loss Estimation Workshop 2017

The Cambridge-McKinsey Risk Prize

The Centre for Risk Studies in partnership with McKinsey & Company will present the 2018 Cambridge-McKinsey Risk Prize at our annual Risk Summit in June. This year, the Risk Prize entries will be open to all postgraduate candidates from any academic department within the University of Cambridge. We believe that submissions from different disciplines and fields will bring fresh and unique perspectives on risks.

The Centre launched the 2018 Cambridge-McKinsey Risk Prize and invited interested students to discuss their ideas with Centre staff and Directors.

The three finalists will be announced in June 2018. The winner will be awarded a prize at the Centre's annual conference on 20 June 2018. The prize award ceremony will be at a plenary session attended by finance, industry and academic delegates. Judges will include members of both McKinsey & Company and the Centre for Risk Studies.

Past McKinsey Risk Prizes

In 2017, the Cambridge-McKinsey Risk Prize was awarded to Executive MBA candidate at the Cambridge Judge Business School, Steven Cooney, for his paper on the US coal industry and railroads: *"I Think I Can, I Think I Can", can US railroads navigate the decline of the domestic coal industry?*. Honourable mentions went to Stuart Barr, executive MBA candidate at the Judge Business School and Ashish Srivastava, MFin Candidate at the Judge Business School. The three finalists' papers are available to be read at: **https://www.jbs.cam.ac.uk/faculty-research/centres/risk/the-risk-prize**

Previous Risk Prize Winners and Finalists Steve Cooney, Stuart Barr and Ashish Srivastava

2015 Risk Prize winner Siobhan Sweeney with judges Daniel Ralph and Sven Heiligtag

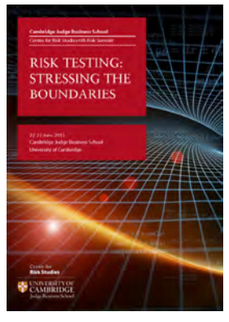
Cambridge Risk Summit - 2018

On 20 June 2018 the Centre for Risk Studies will bring together leaders and decision makers from businesses, governments, academia and NGOs to explore salient topics in risk management. The Summit will be held in a London venue: One Birdcage Walk, Westminster. The change in venue to an international city at the heart of diverse global networks and systems complements the theme of the 2018 Summit: '*Risks Beyond Boundaries'.*

This year's Summit will be an exploration of risks that transcend national boundaries and jurisdictions and are truly systemic and international in nature. Our global economy and political infrastructure have not developed adequate means to deal with many of these types of risk.

Recent geopolitical, societal and technological changes amplify the absence of global governance and responsibility in addressing emerging and rapidly developing risks. From these perspectives, risks related to globalisation, climate change, and the convergance of digital and physical worlds will be explored through expert presentations and interactive panel sessions. Registration for the event will open in Spring 2018.

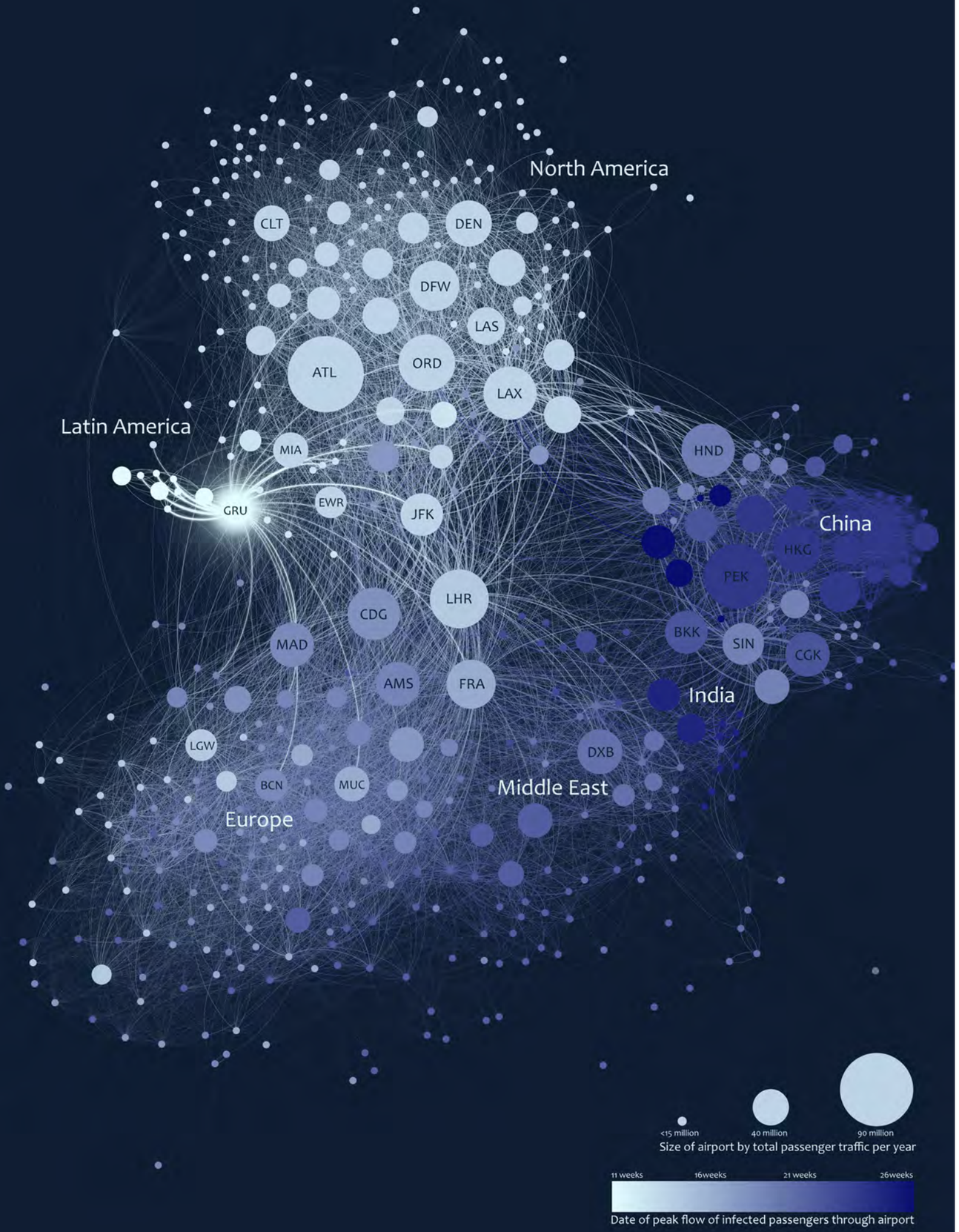
Past Cambridge Risk Summits



Cambridge Risk Summit conferences, held annually, are the Centre's flagship event for outreach. By combining industry, policy and academic views on the platform, Cambridge Risk Summits have established an international reputation as a premier platform for thought leadership on the evolution of risk issues and risk management.

Previous years' topics have included risk in a 'smart' technological world, risk culture, the application of stress tests to financial institutions and business management, and the implications of big data and greater information access for individuals and businesses.

Proceedings, speaker biographies, presentations and photos of the event are available here: **https://www.jbs.cam.ac.uk/faculty-research/centres/risk/news-events/risk-summits**



"Conduit for Pandemic Spread", Sao Paolo Virus Pandemic stress test spread through the global air traffic network; *created by Dr Andrew Skelton*

Current Team and Resources at the Centre for Risk Studies

Executive Team

Professor Daniel Ralph, Academic Director

Dr Michelle Tuveson, Executive Director

Dr Andrew Coburn, Director of Advisory Board

Simon Ruffle, Director of Research & Innovation

Research Associates

Jennifer Copic, Research Associate

Jennifer's research is on financial and organisational networks. She holds a BS in Chemical Engineering from the University of Louisville and a MS in Industrial and Operations Engineering from the University of Michigan.

Dr Jennifer Daffron, Research Associate

Dr Jennifer Daffron focuses on modelling the impact of cyber threats on global business and socioeconomics.

Dr Andrew Skelton, Risk Associate

Andrew is helping to develop a dataset of the world's largest enterprises that drive the global economy and their relationships with each other. He has previously held a research post in the Centre for Climate Change Mitigation Research (4CMR) where he completed his PhD research on the influence that regions, industries, and enterprises have over greenhouse gas emissions stemming from their global supply chains.

Risk Researchers

Dr Jay Chan Do Jung, Risk Researcher

Jay is interested in examining various aspects of risk elements in the network of financial services institutions and developing tools that can monitor and analyse behaviour of financial networks.

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Dr Scott Kelly, Senior Risk Researcher

Dr Scott Kelly is a Research Principal at the Institute for Sustainable Futures (ISF) at the University of Technology Sydney (UTS). His research interests include sustainability economics, risk analysis and the economics of climate change. He is a research affiliate at the Centre for Risk Studies and an associate of the Centre for Climate Change Mitigation Research.

Éireann Leverett, Senior Risk Researcher

Éireann conducts research that focuses upon technological disasters and the economic impacts of computer security failures or accidents.

Dr Duncan Needham, Risk Researcher

Duncan works on financial history for the Centre. Duncan is also Director of the Centre for Financial History at the University of Cambridge and a Dean and Senior Tutor, Darwin College.

Research Assistants

James Bourdeau, Research Assistant

James Bourdeau researches cyber terrorism at the Centre of Risk Studies. He has a background in political science and international relations.

Oliver Carpenter, Research Assistant

Oliver Carpenter's primary focus at the Centre is on Project Pandora, which aims to develop a risk analysis framework to understand and model impacts from various natural and man-made global catastrophes.

Jennifer Copic, Research Associate

Jennifer's research is on financial and organisational networks. She holds a BS in Chemical Engineering from the University of Louisville and a MS in Industrial and Operations Engineering from the University of Michigan.

Dr Jennifer Daffron, Research Associate

Dr Jennifer Daffron focuses on modelling the impact of cyber threats on global business and socioeconomics.

Tamara Evan, Research Assistant and Editorial Associate

Tamara oversees the completion and final production of the Centre's research publications. She also assists in social sciences research, holding an MA from UCL in Historical Studies.

Arjun Mahalingam, Research Assistant

Arjun is working on data research at the Centre for Risk Studies. His main focus is currently on Project Pandora. Arjun is a mechanical engineer by training and has two postgraduate degrees, from TU Delft and the London School of Economics.

Olivia Majumdar, Research Assistant

Olivia assists in the editorial production of the Centre's research content and with social science research at the Centre. She has an academic background in the languages and area studies of the Indian sub-continent.

Kelly Quantrill, Research Assistant

Kelly supports research in multi-line insurance exposure, cyber risk, and Project Pandora, which models the risks of multiple threats to global and city-level economies. Her primary interests are in data management, catastrophic planning, and the risk management of natural hazards.

Andrew Smith, Research Assistant

Andrew Smith has a background in economics and data modelling. Andrew's independent research has focused on international macroeconomics with an emphasis on fiscal policy. At the Centre for Risk Studies, he is working on multi-line insurance exposure and cyber risk.

Kayla Strong, Research Assistant

Kayla supports research in multi-line insurance exposure and cyber risk. She holds a BES in Geography and Environmental Management from the University of Waterloo, and a MA in Risk from Durham University.

Jessica Tsang, Research Assistant

Jessica works on the risk modelling of multiple threat types to the global and city-level economy. Jessica joined the Centre following an MPhil in Planning, Growth and Regeneration from the University of Cambridge, focusing on housing policy and urban economics.

Advisors and Fellows

Professor Kern Alexander, Risk Fellow

Lee Coppack, Senior Advisor, Insurance & Risk Media

Andrew Freeman, Risk Fellow

Administration

Jayne Tooke, Administrator

Ruth Newman, Web Editor

Georgie Cohen, Communications Officer

Cambridge Judge Business School, Finance, Legal and Administration Offices

Cambridge Centre for Risk Studies Alumni

Many members of our research team continue on to successful careers in academia and business.

Some of our recent alumni and their respective post-Centre positions include:

- **Dr Ali Rais Shaghahi, Research Assistant, 2017**
  Data Scientist, McLaren Applied Technologies
- **Viktorija Kesaite, Research Assistant, 2016**
  PhD Candidate in Economics at the University of Exeter
- **Dr Kristen MacAskill, Risk Researcher, 2016**
  Construction Engineering Masters Associate Course Director at the Department of Engineering, University of Cambridge
- **Dr Eugene Neduv, Risk Researcher, 2016**
  VP Business Solutions, Financial Network Analytics, Ltd.
- **Siobhan Sweeney, Risk Fellow, 2016**
  Founder and CEO of Cambridge Legal Risk Analytics
- **Jaclyn Zhiyi Yeo, Research Assistant, 2016**
  Senior Risk Analyst at Marsh & McLennan Companies
- **Ganchi Zhang, CCRS Risk Researcher 2016**
  Associate in Market Risk Capital Analysis at Goldman Sachs
- **Dr Grace Campbell, CCRS Risk Researcher 2015**
  Geologist at Arup Group
- **George Cooper, CCRS Risk Intern 2015**
  Risk Analyst, Model Development & Evaluation, SCOR Global P&C
- **Dr Fabio Caccioli, CCRS Research Associate 2014**
  Lecturer, Financial Computing and Analytics, Faculty of Engineering Science, University College London
- **Dr Roxane Foulser-Piggott, CCRS Research Associate 2014**
  Model Application Specialist, Suncorp Group; Brisbane, Australia
- **Benjamin Leslie, CCRS Risk Researcher 2014**
  R&D Engineer, Oxford Technical Solutions
- **Dr Gary Bowman, CCRS Research Associate 2013**
  Assistant Professor of Global Strategy, Faculty of Business, Bond University, Australia

Executive Committee of the Cambridge Centre for Risk Studies

Professor Daniel Ralph

Academic Director, Cambridge Centre for Risk Studies

Professor Daniel Ralph is a Founder and Academic Director of the Centre for Risk Studies, Professor of Operations Research at Cambridge Judge Business School, and a Fellow of Churchill College.

Daniel received his PhD in 1990 from the University of Wisconsin Madison. He was a faculty member of the Mathematics & Statistics Department at the University of Melbourne before coming to Cambridge University for a joint appointment in the Engineering Department and Cambridge Judge Business School.

Daniel's research interests include: risk in business decision making; risk aversion in electricity markets; methods and models for optimisation problems and equilibrium systems. Specific projects undertaken in collaboration with the banking and insurance industry (Catlin, HSBC, ICBC, Lloyd's, Munich Re, Risk Management Solutions, Swiss Re) cover emerging risk scenarios, financial stress testing and a global ranking of cities by risk exposure. Engagements with other sectors include electricity consultancies (Artelys, LCP), oil and gas (Shell Exploration, Statoil) and retail (BT Retail, Gap) on decision making under high uncertainty. Public service contributions to the UK Cabinet Office, UK Industry and Parliamentary Trust, UK Office of the Government Chief Scientific Advisor, and United Nations World Humanitarian Summit.

Professor Ralph is a member of the Australian Mathematical Society, INFORMS, the Mathematical Optimization Society and SIAM. He was Editor-in-Chief of Mathematical Programming (Series B) from 2007-2013 and has served on the editorial boards of Mathematics of Operations Research and the SIAM Journal on Optimization, as well as the SIAM-MPS book series on optimisation.

Dr Michelle Tuveson

Executive Director, Cambridge Centre for Risk Studies

Dr Michelle Tuveson brings 20+ years of corporate experience within the technology and consulting sectors to further the development of better risk models for the future. During Dr Tuveson's tenure, the Centre for Risk Studies has become a world leading provider of research and thought leadership in scenario-based modelling of multi-disciplinary risks to businesses. Her responsibilities include the overall executive leadership at the Centre. This includes developing partnership relationships with corporations, governments, and other academic centres.

Dr Tuveson leads the Cambridge Chief Risk Officers Council, chairs the Centre's Annual Risk Summits, is an IEEE Standards Committee Member on the General Principles for Artificial Intelligence, is an advisory board member to Elevate City, and former advisory board member to the World Economic Forum's Global Risk Report. She is a frequent commentator and speaker and her articles have been published in reports such as Banking & Financial Services Policy Report (Wolters Kluwer) and Financial Times Special Report on Risk Management. Dr Tuveson has worked in corporations within the technology sector with her most recent position in the Emerging Markets Group at Lockheed Martin. Prior to that, she held positions with management strategy firm Booz Allen & Hamilton, and U.S. R&D organisation MITRE Corporation. Dr Tuveson's research topics include risk culture and governance, corporate risk profiling, and the role of the Chief Risk Officer. She has been awarded by the Career Communications Group, Inc. as a Technology Star for Women in Science, Technology, Engineering and Maths (STEM). She earned degrees from the Massachusetts Institute of Technology, Johns Hopkins University, and University of Cambridge.

Executive Committee of the Cambridge Centre for Risk Studies

Dr Andrew Coburn

Director of the Advisory Board, Cambridge Centre for Risk Studies

Andrew manages research project tracks at the Centre for Risk Studies and coordinates programme activities to ensure alignment with the business objectives of supporting organisations. Andrew's principal interests are in the risk of catastrophic collapse of complex systems, and how the risks of increasing interconnectivity in the global economy can be managed.

Andrew is Senior Vice President at Risk Management Solutions (RMS), the leading provider of catastrophe risk models to the insurance industry. He is one of the leading contributors to the creation of the class of catastrophe models that over the past 30 years has come to be an accepted part both of business management in financial services and of public policy making for societal risk.

He has extensive experience in developing risk models and using them for business decision support. Andrew has also provided research inputs into government policy. Andrew has published widely and is an Editorial Board Member of *Journal of Network Theory in Finance*. He is a Bye-Fellow at Christ's College, Cambridge.

Simon Ruffle

Director of Research & Innovation, Cambridge Centre for Risk Studies

Simon plays a key coordinating role in the Centre's research programme, and leads several research projects. He is developing methods for storing and applying the Centre's stress test scenarios and other risk assessment tools to macro-economic analysis, the financial markets and insurance loss aggregation. He is researching how network theory can be applied to understanding the impact of catastrophes in a globalised world, including city and country economies, supply chains, insurance and banking.

He is working on multi-threat integrated scenario-based risk assessment, encompassing over 12,000 scenarios in 22 different threat categories across almost 300 cities around the world representing about half of global GDP. The consequences of these scenarios are quantified in terms of their 'GDP@Risk' – a unified metric that can be used to compare and standardise different types of threat.

He is working on data interchange standards for multi line insurance and is developing proof of concept tools to carry out risk assessments of individual companies and explore the risk mitigations available through a range of insurance products. He is a member of the Centre's Executive Team and manages external sponsor relationships. He advises government and speaks regularly at seminars and conferences.

Centre for Risk Studies Advisory Board

The Cambridge Centre for Risk Studies at the University of Cambridge Judge Business School continues to be widely recognised as one of the world's leading academic centres providing impactful research and thought leadership in risk management.

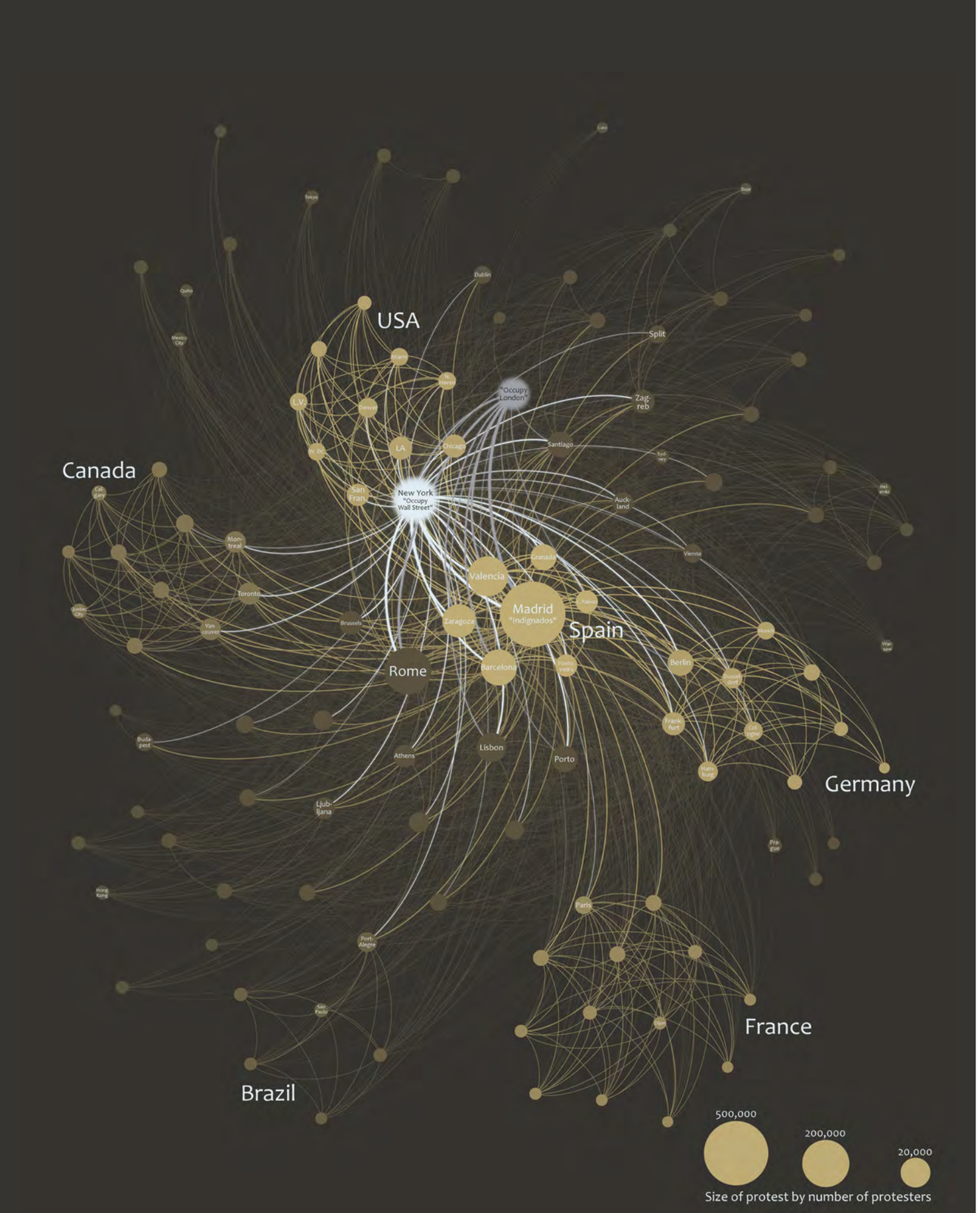
The Cambridge Centre for Risk Studies is very grateful to have the participation and support from the members of the Centre's Advisory Board. We view the Advisory Board as being critical to guiding the management strategy and research agenda objectives of the Centre. Advisors are invited from the Centre's partnership organisations, external academics, and subject matter specialists. The Centre's recent research and associated reports have gained visibility and positive media attention through the advocacy of our advisory board members and their respective organisations.

Cambridge Centre for Risk Studies Advisory Board Members

Steve Coates, Chief Underwriting Officer, Pool Re
Brad Fischtrom, Commercial Risk Officer, AIG
Rowan Douglas CBE, CEO Capital, Science and Policy Practice, Willis Towers Watson and Willis Research Network
Jonathan Gale, Chief Executive, XL Catlin
Anna-Marie Greenaway, Director of International University Relations, BP
Dr Sven Heiligtag, Senior Partner, McKinsey & Company
Dr Trevor Maynard, Head of Innovation, Lloyd's
Andrew Pitt, Global Head of Citi Investment Research, Citigroup
Dr Mohsen Rahnama, Chief Risk Modeling Officer, Risk Management Solutions, Ltd.
Alan Smith, Global Head of Risk Strategy and Chief of Staff, HSBC Holdings PLC
Matthew Swibel, Director, Enterprise Risk and Sustainability, Lockheed Martin
Markus Wadé, Senior Risk Manager, Integrated Risk Assessment, Munich Re
Carolyn Williams, Director of Corporate Relations, Institute of Risk Management

Academic Advisors

Professor Michael Barrett, Professor of Information Systems & Innovation Studies and Director of Research, Cambridge Judge Business School
Professor John Rees, Risk Research Coordinator, UK Research Councils (RCUK)



"Systemic Social Unrest", Geographical spread of the "Occupy" movement's hashtags between September-October 2011 coordinating simultaneous protests in 950 cities across the world; *created by Dr Andrew Skelton*

Advisory Board Member Biographies

Steve Coates

Chief Underwriting Officer, Pool Re

Steve is Chief Underwriting Officer and a member of the Executive management team at Pool Re. Steve has responsibility for all aspects of underwriting and claims, including exposure management and modelling. Prior to this, Steve spent 12 years at Allianz UK, latterly as Head of UK Property and Casualty. He also spent a year with Allianz Australia in 2005/6. Before that he worked for Independent Insurance for 10 years, ending up as UK property underwriting manager. Steve started his career with Eagle Star where he worked in a variety of commercial underwriting roles. Steve is an associate of the Chartered Insurance Institute and is also an expert witness in insurance matters.

Brad Fischtrom

Commercial Risk Officer, AIG

Brad Fischtrom is the Chief Risk Officer for AIG's Commercial Insurance business. He is accountable for design and facilitation of AIG's Enterprise Risk Management (ERM) framework across the firm's global Commercial Insurance operations and legal entities, including the effective management of all key insurance, market, credit, operational, and strategic risks. Since joining the company in May, 2010, Brad has led several diverse ERM teams and initiatives, covering AIG's stress testing and scenario analysis process, risk aggregation, and management of AIG's risk officers stationed within the Americas region.

Brad's background represents all aspects of ERM, with particular focus in the areas of economic capital / risk modeling, risk governance, catastrophe risk management, and operational risk management. He also has substantial experience in Property Casualty (PC) insurance underwriting, broking, and actuarial science. Prior to AIG, Brad has held positions within Willis Towers Watson's risk management consulting unit and at Aon Risk Services.

Brad holds a Bachelor of Science degree in Finance and Business Administration from the University of Richmond. He is a Chartered Property Casualty Underwriter (CPCU) and an Associate in Risk Management (ARM).

Rowan Douglas CBE

CEO Capital, Science and Policy Practice, Willis Towers Watson and Willis Research Network

Rowan Douglas is CEO Capital, Science & Policy Practice at Willis Towers Watson, a leading global advisory, broking and solutions company. Previously, he served on the Board of the Group's reinsurance division, Willis Re, as CEO Global Analytics.

In 2011, Rowan was appointed to the UK Prime Minister's Council for Science & Technology; he is also a member of the Royal Society's Working Group on Resilience to Climate Risk and Extreme Weather and chairs the Willis Research Network of fifty universities world-wide.

He has held various appointments within the UN and other international organisations and was awarded a CBE in the 2016 New Year's honours for services to the economy through risk, insurance and sustainable growth. Rowan sits on the Executive Committee of the International Insurance Society (IIS), New York from which he received the Kenneth R Black Award in 2014.

Advisory Board Member Biographies

Anna-Marie Greenaway

Director of University Relations, BP

Anna-Marie Greenaway was appointed BP Director of University Relationships in 2015, which is a global role encompassing technical and policy research to support BP's strategic objectives, recruitment, executive education and international research partnerships. Prior to this she was BP's VP Science and Technology at the University of Cambridge and still retains accountability for this strategic partnership. She is a member of the Board of the BP Institute and sits on the Advisory Board of the Scott Polar Institute and the Clean Energy Centre at Tsinghua University, Beijing. Previously, Anna-Marie spent four years in BP's Group Strategy team where she led the 2030 Energy Pathways research programme covering the US, EU, China, India and Brazil. This involved bringing together local, international and multi-disciplinary teams from across BP and incorporating external perspectives from wider industry sectors, government bodies and leading academics.

Earlier roles at BP have spanned special assignments to support Group Technology and Safety & Operations, Head of Downstream Change Leadership Capability and leading the Technical & Commercial Partnership between BMW & Castrol across Western Europe. Prior to BP, Anna-Marie spent 10 years in retail operations, advertising and corporate communications with Exxon after joining their graduate programme in 1989 as a capital investment analyst. She holds a BRc from the Dept of Earth Science RHBNC University of London and a Masters degree in Sustainability Leadership from the Department of Engineering, University of Cambridge.

Jonathon Gale

Chief Executive, XL Catlin

On 1 January 2017, Jonathan assumed the role of Chief Executive at Bermuda Reinsurance for the XL Catlin group of companies.

When the XL Group acquired Catlin in July 2015, Jonathan was installed as Chief Executive of Reinsurance London for the newly formed XL Catlin, and Joint Active Underwriter of Syndicate 2003, the largest Syndicate at Lloyd's.

During his career he worked for a spell in the US broker market and spent almost five years in the Bermuda market running Catlin's nascent Bermudian underwriting business from 2003 to 2008. The majority of his time has been spent in the Lloyd's market.

Jonathan started in the London and Lloyd's market in 1987 specialising in US medical malpractice and in particular reinsurance of PIAA companies and specialist risk retention groups.

Dr Sven Heiligtag

Senior Partner, McKinsey & Company

Sven is Senior Partner in McKinsey & Company´s Hamburg office. Sven is a leader in McKinsey´s Risk Management Practice as well as in the Electric Power & Natural Gas Practice. He is responsible for all Corporate Risk topics and is leading our energy trading and risk management survey in Europe.

He has deep experience in advising clients in the energy and natural resources industries on challenges in risk management, corporate finance, strategy and organization.

Sven has a master's degree and a PhD in Chemistry from the University of Hamburg.

Advisory Board Member Biographies

Dr Trevor Maynard

Head of Innovation, Lloyd's

Trevor Maynard was appointed Head of Exposure Management and Reinsurance at Lloyd's in 2011. Prior to this, he was Manager of Emerging Risks and an Actuary at Lloyd's. He was educated at the University of Warwick and received a doctorate in Statistics from the London School of Economics in 2016.

Andrew Pitt

Global Head of Research, Citi Investment Research, London

Andrew has been Global Head of Citi Research since 2008 where he is responsible for managing all of Citi's independent investment research across Economics, Politics, Equities, Fixed Income, FX and Commodities. Citi Research employs over 1,100 staff in almost 30 countries and publishes around 65,000 research reports per annum. Andrew launched the publically available Global Perspectives & Solutions (Citi GPS) research series in 2011 which has become an industry leading research brand addressing the key challenges and opportunities of the 21st century. Analysis of the global risk landscape is a key part of the Citi GPS research framework.

Between 2003 and 2008 Andrew ran Citi's European Equity Research team. Between 1991 and 2003 he worked in investment research as an Insurance sector analyst, joining Citi in 1996. Andrew was regularly top rated in public surveys of investment analysts and held the number one position in the 2003 Thomson Extel poll just before he moved into a management role.

Andrew has a BA and a Masters' degree (M.St.) from Pembroke College, Oxford University. He taught as a full time College Lecturer at Keble College, Oxford, before joining the Banking industry.

Dr Mohsen Rahnama

Chief Risk Modeling Officer, Risk Management Solutions, Inc.

Mohsen leads model development for RMS, which includes a global team of scientists and engineers responsible for the creation of RMS' catastrophe models, financial model, and exposure and data analytics.

Since joining RMS in 1999, Mohsen has led the development of many of RMS' major models. He is currently overseeing the development of RMS' high-definition, simulation-based flood, earthquake, and typhoon models for RMS(one), Cyber Model, exposure and data analytics and financial modelling. He has more than 25 years of experience in earthquake engineering, seismic structural analysis and de-sign, building performance evaluation, catastrophe modelling, and risk assessment. He holds a master's degree and doctorate in earthquake and structural engineering from Stanford University.

Advisory Board Member Biographies

Alan Smith

Global Head of Risk Strategy and Chief of Staff, HSBC Holdings PLC

Alan Smith is Global Head of Risk Strategy and Senior Executive Officer of Group Risk within the Global Risk function of HSBC Holdings, one of the world's largest financial services organisations. He is a member of HSBC's Global Risk Management Board, which oversees the 25,000 member Global Risk Function and of the Group Asset and Liability Management Committee. He co-chairs its Stress Testing, Model Risk and Pensions Risk Oversight Committees.

Alan has worked with HSBC for 21 years in a variety of senior finance, risk and capital management roles in the Group Head Office, in its Global Banking and Markets Business, in London and in Saudi Arabia. Prior to HSBC, Alan worked with KPMG London from 1987 to 1994. Alan is a Fellow of the Institute of Chartered Accountants of England and Wales and has an MBA in Finance from Cass Business School, City University in London which he attended as a UK Commonwealth Scholarship winner after completing his undergraduate degree at the University of the West Indies in Jamaica.

Outside of work, Alan has a keen interest in cricket, theatre and travel, amongst others. He sits on the Audit Committee of the Commonwealth Secretariat, on the Finance Committee of an international faith based organisation working with university students, and on the Advisory Board of the Centre for Risk Studies at Cambridge University's Judge Business School. He is a Fellow of the Royal Society of Arts, Manufactures and Commerce.

Matthew Swibel

Director, Enterprise Risk and Sustainability, Lockheed Martin

Matt directs sustainability strategy, reporting and stakeholder engagement at Lockheed Martin Corporation, which under his tenure was added to the Dow Jones Sustainability Index and became the top-ranked Aerospace & Defense prime contractor named to CR Magazine's 100 Best Corporate Citizens list. He led Lockheed Martin's inaugural report in 2012, and its first core issues assessment, formal stakeholder summits and GRI-based report in 2013. He reports to the corporate vice president - Ethics & Sustainability, and sits on the Corporate Sustainability Council, which oversees ethics & business conduct, diversity & inclusion, and sustainability policy & performance.

From 2008 to 2012, Matt was Director of Enterprise Communications, where he led a team supporting the CFO, Executive Office of the Chairman and other corporate officers. In this role, he developed and planned multiple aspects of integrated communications including employee and supplier engagement, advertising and outreach to investors and financial/environmental media. Matt spent almost a decade as a journalist, most recently as Associate Editor of Forbes, where he co-edited the World Billionaires issue and was recognised by the Overseas Press Club for his business reporting from abroad. Prior to Forbes, he was a staff reporter at Washington Business Journal, where his coverage of marketing and web-based political fundraising each earned Maryland-DC-Delaware and Virginia Press Association awards. He taught as an adjunct professional lecturer at American University's School of Communication from 2005 to 2008. Matt graduated cum laude from American University (DC) with degrees in Communications and Sociology and earned an MBA from the University of Maryland. He is an independent director of Cornerstone Capital.

UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

Advisory Board Member Biographies

Markus Wadé

Senior Risk Manager, Integrated Risk Management, Munich Re

Markus Wadé works as a Senior Risk Manager in Munich Re's Integrated Risk Management Division. His main responsibilities are the development of accumulation scenarios for Munich Re's global business operations and the refinement of risk identification tools and methods, especially with regard to emerging and complex risks. Markus is part of the editorial team of Munich Re's quarterly internal risk report for the Board of Management and Supervisory Board.

Before joining Munich Re, Markus worked in quantitative credit risk management with various financial institutions. His responsibilities included the development and implementation of rating and LGD models. Markus holds a PhD in statistics with a thesis on the estimation of country risks for credit portfolio models. He studied economics at the University of Regensburg and Wesleyan University (USA).

Carolyn Williams

Director of Corporate Relations, Institute of Risk Management

Carolyn Williams is Director of Corporate Relations at the Institute of Risk Management, the leading international educational and training body for the risk management profession. She is responsible for communicating the work of the IRM to a variety of audiences and for building partnerships with risk teams.

She joined IRM in 2006 from Lloyd's of London, where she was responsible most recently for training and communication for the risk management team. This followed several years as Secretary to the Lloyd's Regulatory and Market Boards and many years supporting various Lloyd's committees and working parties through interesting times.

She has an MA in Politics, Philosophy and Economics from Oxford University, is a Chartered Insurance Risk Manager and also a Certified Member of the Institute of Risk Management. In her spare time she helps run a local arts festival and wonders how her son became a rock drummer.

Academic Advisors

Professor Michael Barrett

Professor of Information Systems & Innovation Studies and Director of Research, University of Cambridge Judge Business School

Michael is the 2016 Distinguished Scholar for the OCIS Division at the Academy of Management. As part of the ESRC's Expert Advisory Group, he helps inform their strategic engagement of the Global Challenges Research Fund (GCRF); a £1.5 billion fund distributed across multiple delivery partners to be spent on international development research over the next five years. He has served as head of the Organization Theory & Information Systems group, Director (Associate Dean) of Programmes, and Director of the MPhil in Innovation, Strategy & Organisation (ISO) programme at Cambridge Judge Business School. He is currently Academic Director of Cambridge Digital Innovation and has served on the Steering Board of the Cambridge Service Alliance. Michael has also served as a member of the Management Executive Group of the knowledge translation research group. Collaborations for Leadership in Applied Health Research and Care (CLAHRC).

He has had several editorial responsibilities including: Senior Editor of MIS Quarterly, Associate Editor of Information Systems Research, Senior Editor of Information & Organization and Senior Editor of the Journal of the Association of Information Systems. Michael has also served as a member of the Editorial Board of Organization Science. He has contributed to articles in The Economist, The Times, and The Financial Post, and has served as an external examiner at Oxford University, the University of Edinburgh and the London School of Economics.

Michael has worked as an industrial engineer for Colgate Palmolive and won the Most Valuable Employee award for consulting and business development at Oracle Canada. He continues to work closely in research and executive education for a number of organisations, including Thomson Reuters, Statoil, Bank of China, China Mobile, BT, IBM, HP, PricewaterhouseCoopers, Coventry Building Society, Shell Exploration, and the World Health Organization.

Professor John Rees

Head of Risk and Resilience Research, Natural Environment Research Council (NERC)

Professor John Rees heads Risk and Resilience research at the Natural Environment Research Council (NERC). Previously he was Risk Research Champion at the UK Research Councils - during which time he co-led the UN Science and Technology Group, leading to the Sendai Framework - following a period as the Natural Hazards Theme leader at NERC. He is based at the British Geological Survey (BGS) where he is Director of Earth Hazards and Observations. Before this he was Head of Corporate Policy and Science Coordination – after 15 years primarily researching urban and coastal hazards. His interests, though, are extremely broad ranging across much of science and technology. He has a major interest in enhancing the use of science, particularly in policy development and is an advocate of modelling interoperability. He has collaborated extensively across sectors, disciplines and internationally. He was educated in Sussex, at Sheffield University and at Trinity College Dublin.

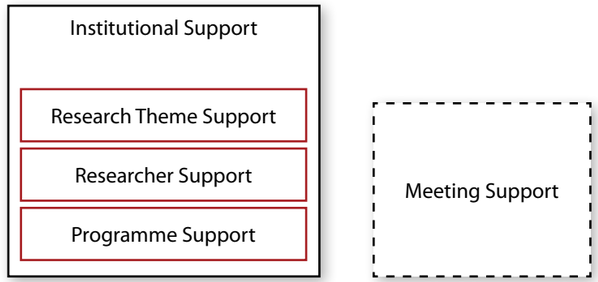
"Systematic Impact of War"; impact of Sino-Japanese War stress test on global imports and exports networks; *created by Dr Andrew Skelton*

Funding Opportunities and Support Contribution Structure

Confidential

The Cambridge Centre for Risk Studies is grateful for the financial support from its contributing funders as well as the University of Cambridge Judge Business School. The Centre is privileged to be part of the Cambridge Judge Business School infrastructure. The Centre is also grateful to the many individuals and institutions who provide in-kind support.

The Centre for Risk Studies works with external supporters of our research through funding donations that guide components of an overall programme of work towards understanding the risks faced by international businesses. External supporters can participate at different levels according to their interests and degree of involvement they are willing to engage in, and level of support that they are willing to provide. This document is an indicative guide.



Institutional Support

The Centre is actively seeking institutional funding – a single company or individual interested in having a named centre or professorial chair and prepared to make an endowment to support the longer term sustainability of the research work at the Centre for Risk Studies. We would welcome the opportunity to discuss this if this might be of interest.

Research Theme Support

Within the overall research directions of the Centre for Risk Studies, there are several themes of focus. Research themes involve a multi-member research team exploring an issue within the Cambridge Risk Framework. Where a funder has interest in driving a particular research agenda or exploring a specific theme within our risk framework, the Centre for Risk Studies can accommodate this by dedicating a research team to that topic. A research team typically consists of a Project Investigator (a tenured academic project lead) supported by a Senior Research Associate, a Research Associate, and others where appropriate. Other senior academics are likely to participate on a part time basis in contributing subject matter expertise. The Centre for Risk Studies can facilitate and coordinate research themes involving a range of University departments, such as the Faculty of Economics, Centre of Applied Mathematics, Computer Laboratory, etc. If appropriate, the research theme can be based in a specific department, and managed by CRS.

As a Research Theme Supporter:

- Funder is invited to nominate two members of the Centre for Risk Studies Advisory Board
- Funder oversees progress review meetings specifically held for that research theme, and guide the prioritization of the current and future research agenda.
- Funder is invited to participate in the progress review meetings of the overall research activities of the Centre, and to assist with the prioritization of the current and future research agenda.
- Funder benefits from having the research team participate with company staff, disseminate current research understanding, and involve the broader company membership in emerging risk issues.
- The Project Investigator and the research team discuss the Funder's priorities with the funder's senior managers and ensure that these objectives are fully reflected in the research.

Researcher Support

Our typical level of engagement from supporting companies on our advisory board is a donation to fund an individual researcher who is added to the research team and who focuses on the areas of most benefit for that funder. Our ability to attract good post-doctoral research associate candidates is greatly increased by being able to offer three year contracts, so our strong preference is to secure multi-year commitments by funders where possible.

- Funder is invited to nominate a member of the Centre for Risk Studies Advisory Board, to attend the progress review meetings and to assist with the prioritization of the current and future research agenda.
- Funder benefits from having the researcher visit the company, disseminate current research understanding, and involve the broader company membership in risk issues.
- The researcher will discuss the Funder's priorities with the funder's senior managers and ensure that this is reflected in the research activities of the researcher and the broader team.

Programme support

Our ongoing research programme entails maintaining a team of technical specialists, editorial contributors and subject matter experts, and administrative support staff. Programme support provides resources for core research projects.

As a Programme Supporter:

- Funder is invited to nominate a member of the Centre for Risk Studies Advisory Board, to attend the progress review meetings and to assist with the prioritization of the current and future research agenda.
- Funder has access to research teams and subject matter specialists.

Meeting support

The Centre for Risk Studies seeks supporters for its annual Risk Summit conference. We attract over 200 attendees from corporate risk management professionals, academia, and government policy-makers. We offer packages of support including Meeting Partner status, Principle Knowledge Partner or Sustaining Meeting Partner status.

As a Meeting Supporter:

- Funder is recognized as a corporate sponsor, with co-branding on the annual conference collateral with other meeting supporters
- Funder will be part of the organizing committee of the annual conference, and asked to propose speakers and content.
- We can offer space for display materials and incorporation of corporate materials in the attendee handout packs
- Other meetings can also be arranged with co-branding, for a private seminar on a relevant theme for funder and its guest invitees, on terms to be arranged.

Contact information for all support enquiries

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Cambridge Centre for Risk Studies, *Research and Activities Prospectus 2018,* January 2018

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Join our LinkedIn group at Cambridge Centre for Risk Studies

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