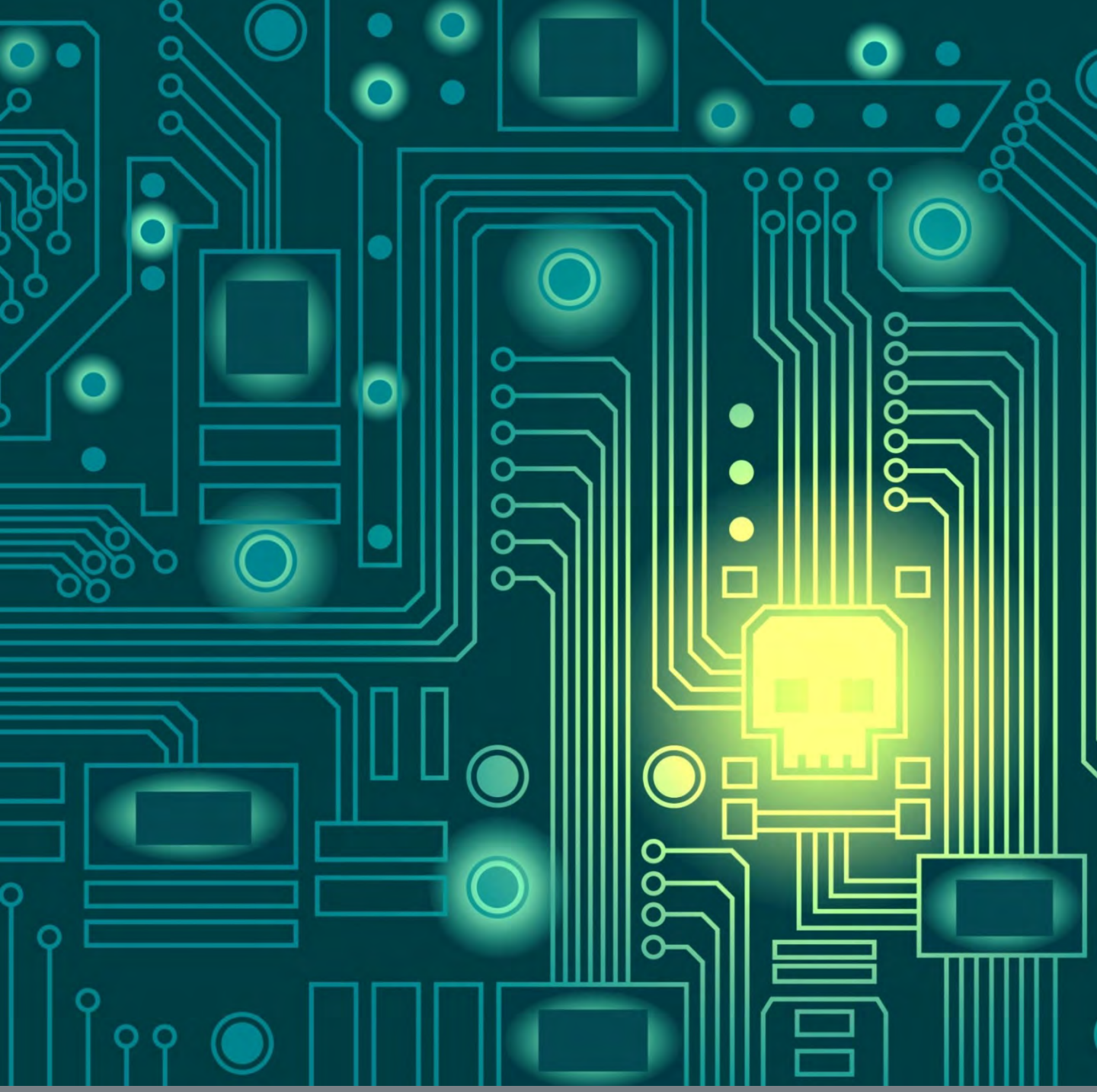


Cambridge Centre for Risk Studies Seminar

20 March 2014

Emerging Risks Scenarios for Risk Management

Centre for Risk Studies

UNIVERSITY OF CAMBRIDGE
Judge Business School

In collaboration with

OXFORD ECONOMICS

Cambridge Centre for Risk Studies
University of Cambridge Judge Business School
Trumpington Street
Cambridge, CB2 1AG
United Kingdom
enquiries.risk@jbs.cam.ac.uk
http://www.risk.jbs.cam.ac.uk/

The Cambridge Centre for Risk Studies acknowledges the generous support provided for this research by the following organisations:

Institute of Catastrophe Risk Management

This seminar presents hypothetical scenarios developed as stress tests for risk management purposes. They do not constitute predictions. The Cambridge Centre for Risk Studies develops hypothetical scenarios for use in improving business resilience to shocks. These are contingency scenarios used for 'what-if' studies and do not constitute forecasts of what is likely to happen.

Agenda

Lecture Theatre 3, Judge Business School

08:45 **Registration open**

09:30 **Welcome and Seminar Objectives**
Professor Daniel Ralph, Academic Director, Centre for Risk Studies

09:45 **Emerging Risks - Threats and Opportunities**
Dr Andrew Coburn, Director of the External Advisory Board, Centre for Risk Studies

10:15 **Scenario 1: A Geopolitical Conflict – 'China-Japan Conflict'**
Subject Matter Specialist: Joshua Wallace, Cytora
Project Lead: Dr Gary Bowman, Research Associate, Centre for Risk Studies

11:00 Coffee Break — Common Room

11:30 **Panel Discussion 1 - Good Practice for Managing Emerging Risks**
Chair: Trevor Maynard, Head of Exposure Management and Reinsurance, Lloyds
Rowan Douglas Managing Director Willis Analytics, Willis
Dr. Robert Muir-Wood, Chief Research Officer, RMS
John Scott, Chief Risk Officer, Zurich Global Corporate, Zurich Insurance Group
Dr. Markus Wadé, Senior Risk Manager, Integrated Risk Management, Munich Re

12:30 Lunch — Common Room

13:30 **Scenario 2: A Cyber Catastrophe - 'The Sybil Logic Bomb'**
Subject Matter Specialist: Éireann Leverett, IOActive.
Project Lead: Simon Ruffle, Director of Technology Research, Centre for Risk Studies

14:15 **Ask the Audience**
Professor Daniel Ralph, Academic Director, Centre for Risk Studies

14:45 **Scenario 3: A Human Pandemic - 'Sao Paolo Virus Pandemic'**
Subject Matter Specialist: Mary Chang, RMS
Project Lead: Dr Andrew Coburn, Director of the External Advisory Board, Centre for Risk Studies

15:30 Tea Break — Common Room

16:00 **Assessing the Macroeconomic Implications of Emerging Risks**
Prof. Gabriel Stein, Director, Asset Management Services, Oxford Economics

16:30 **Panel Discussion 2 – Preparing for Emerging Risks**
Chair: Alan Laubsch, Director & Head of Risk Products, Financial Networks Analytics
Jonathan Clark, Head of Business Solutions & Syndicate Claims Management and Member of SCOR Emerging Risks Groups for P&C claims, SCOR SE
Kay Haggis, Group Head of Operational Risk and Head of Catlin Emerging Risk Committee, Catlin
Matt Harrison, Syndicate Exposure Manager, Hiscox
Jeremy Hindle, Head of Enterprise Risk Aggregation, XL

17:30 **Summing Up & Closing Remarks**
Professor Daniel Ralph, Academic Director, Centre for Risk Studies

18:00 Close

19:00 Drinks Reception and Seminar Dinner — Downing College

Seminar Information

Wi-Fi

Connect to: **CJBS-Conference**

PSK/Password: **29481256**

Venues

All sessions will be held in Lecture Theatre 3. Access to LT3 is from the fourth floor.

Refreshment breaks will be held in the Common Room, the café area on the second floor.

Bags and Coats

Coats can be left on the racks in the reception areas on the ground floor, at the owner's risk. A luggage storage room will be available on the fourth floor (W4.06). This room will be locked after the seminar has begun and unlocked at the end of the day. Please contact Pippa Savage if you need access to your luggage during the day. Alternatively there will be a limited amount of space in the lecture theatre. Please remove all items from the building at the end of the meeting as the building will be inaccessible in the evening.

Feedback forms

Feedback forms will be provided. We would appreciate these being filled out and left with one of the seminar organizers at the end of the day, please.

Directions

For directions to Judge Business School please see information at http://www.jbs.cam.ac.uk/contact/

Please note: Parking at Judge Business School is very limited. It is advisable to arrive by public transport, or use the Park and Ride service if arriving by car. If you need to park closer to the venue, please contact the meeting organisers for direction to city car parks.

Dinner Information

Seminar Dinner at Downing College

West Lodge, E Staircase

Downing College, Regent St, Cambridge CB2 1DQ

7:00 pm Drinks Reception – **Music Room**, Downing College

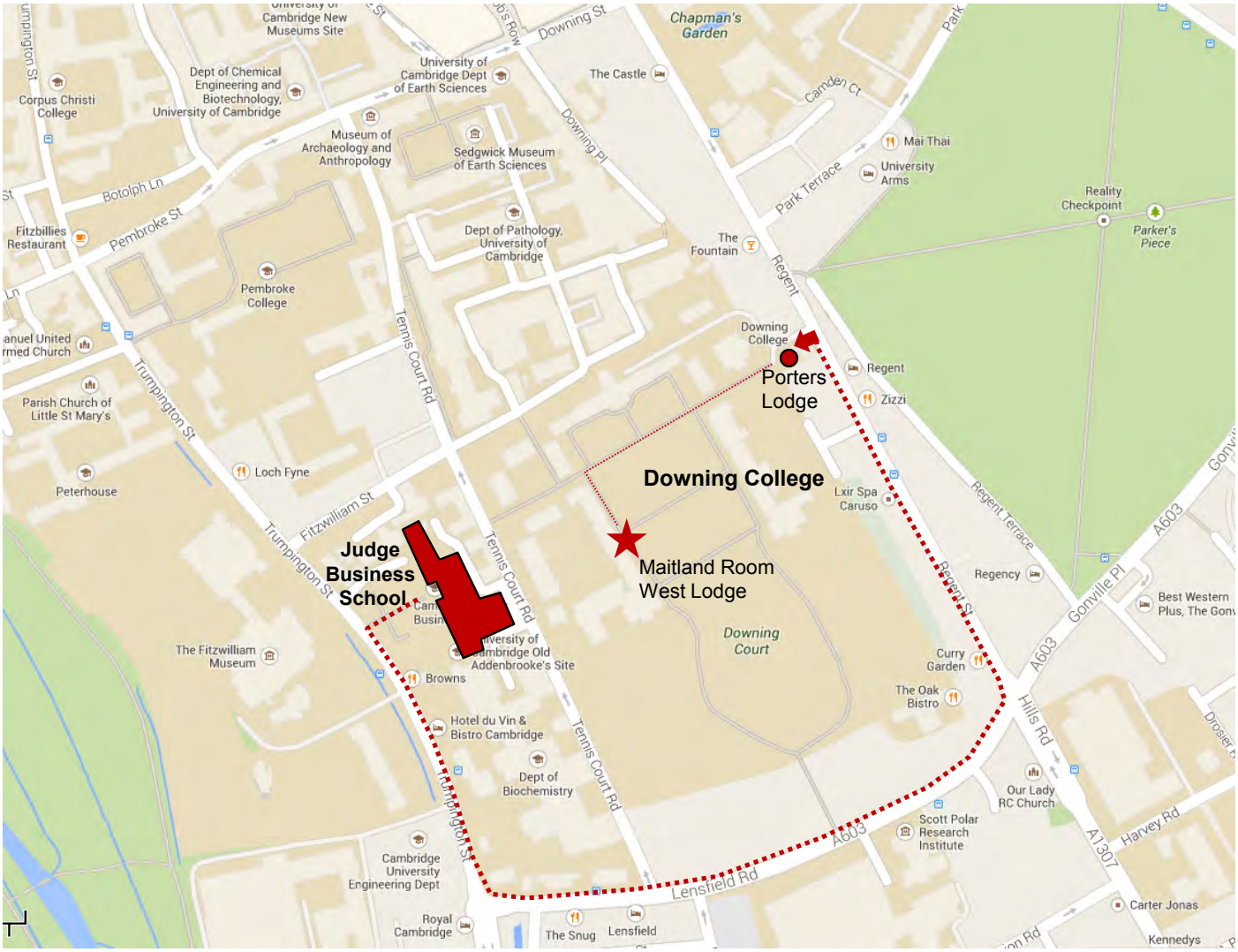
7:30 pm Dinner – **Maitland Room**, Downing College

If you have booked a place at the seminar dinner, this will take place at Downing College.

Downing College is a short walk from Judge Business School.

A group will walk over from Judge Business School to Downing College. Please meet in the Judge Business School reception area at 6:50.

A location map is attached should you wish to make your own way there – if you are staying in Cambridge overnight there should be time to return briefly to your hotel before dinner. Directions to the West Lodge can be obtained at Downing College Porters Lodge, and will be sign posted.



Guest Speaker

OXFORD ECONOMICS

Assessing the Macroeconomic Implications of Emerging Risks

Professor Gabriel Stein

Director, Asset Management Services, Oxford Economics and Visiting Professor, Department of Economics, Royal Holloway University of London

Gabriel Stein graduated from the Stockholm School of Economics in 1980. Following a year in Israel, where he worked at the Israeli Ministry of Finance, he returned to Stockholm and set up his own economics research and public affairs consultancy, Stein Brothers.

In 1990 he moved to London, where he continued to run Stein Brothers for a year. A year later he joined Lombard Street Research to help set up that company's World Service, becoming a Director of the company in 1995. During more than 20 years as LSR Chief International Economist, he wrote and commented on all the major world economies.

From August 2012 to December 2013, Gabriel ran Stein Brothers (UK), a macroeconomic research consultancy. In January 2014, he joined Oxford Economics as Director, Asset Management Services. He is also Chief Economic Advisor to OMFIF (the Official Monetary and Financial Institutions Forum). As of 1 June 2013, he is a Visiting Professor in the Department of Economics at Royal Holloway University of London. He is a Senior Fellow of the Adam Smith Institute and a Non-resident Senior Fellow of the Chongyang Institute for Financial Studies at Renmin University of China.

Gabriel has written and commented extensively on topics such as the problems of monetary unions, demographics and pensions issues, broad money and credit flows and on sectoral financial balances. In 2005 he predicted that central bankers would lose their semi-divine status through failure to control asset-price bubbles, a forecast confirmed by the Great Recession of 2008-2010. He is a frequent speaker at international conferences and appears regularly on radio and television.

Gabriel has written Tänk Bakât (a short biography of Vilfredo Pareto), and a dictionary of financial terms (both in Swedish) and two pamphlets for the think-tank Politeia. He has also written an historical novel which has received a number of kind letters of rejection; and he has an MA in Military History from the University of Buckingham.

Subject Matter Specialists

Subject Matter Specialist: Geopolitical Conflict

Joshua Wallace

Co-Founder, Cytora

Joshua is a political scientist and co-founder of Cytora, providers of political risk analytics. A key subject matter specialist on geopolitical risk, he assists the Cambridge Centre for Risk Studies with the development of stress test scenarios for geopolitical conflict and social unrest. With a background in political science, management and IT consultancy and international development, Joshua is passionate about how new technologies can be applied to the world's most vexing problems. He co-founded Cytora, where he is head of research. His time in consultancy saw him advise some of the world's biggest companies such as GlaxoSmithKline while his development work has taken him to Ghana, Sierra Leone, Swaziland and India. Joshua has an MSc in Political Science from University College London and a BA in History from the University of Manchester.

Subject Matter Specialist: Cyber Catastrophe

Éireann Leverett

Senior Security Consultant, IOActive

Éireann Leverett is a cyber security specialist and works for IOActive in their world class Industrial Systems Security team. He advises clients on technology security. Éireann has been a key subject matter specialist on cyber risk, assisting the Cambridge Centre for Risk Studies with the development of the cyber catastrophe scenario. Éireann studied Artificial Intelligence and Software Engineering at Edinburgh University and went on to get his Masters in Advanced Computer Science at Cambridge. He studied under Frank Stajano and Jon Crowcroft in Cambridge's computer security group. In between he worked for GE Energy for five years and had an engagement with ABB in their corporate research department.

Subject Matter Specialist: Pandemic

Mary Chang

Medical Research Analyst, RMS

Mary Chang MPH is the principle subject matter specialist on human pandemic risk, assisting the Cambridge Centre for Risk Studies with the development of the human pandemic scenario. Mary is a Medical Research Analyst in the LifeRisks team at RMS where she developed and manages the RMS Infectious Disease Model, used by life insurance companies to manage their risk of pandemic loss. Mary has a Master of Public Health from the School of Epidemiology and Public Health at Yale University and works at RMS headquarters in Newark, California, USA.

Panel Discussion 1

Good practice for managing emerging risks

Chair

Trevor Maynard

Head of Exposure Management and Reinsurance, Lloyds

Trevor Maynard is Head of Exposure Management and Reinsurance at Lloyd's of London. He is responsible for monitoring reinsurance quality, aggregations of risk, catastrophe modelling and emerging risks. Trevor set up Lloyd's first formal emerging risks team in 2007 and has produced research on a wide variety of insurance relevant topics including: cyber risks, pandemics, climate change, behavioural risks, nanotechnology, space weather and food/water security. Trevor is a Director of the open catastrophe modelling framework - OASIS. Trevor is a Fellow of the UK Actuarial Profession and holds degrees in pure mathematics.

Panellists

Rowan Douglas

CEO, Capital, Science & Policy Practice and Chairman, Willis Research Network, Willis Group

Rowan leads the Capital, Science and Policy Practice at Willis Group. The Practice confronts large scale challenges of risk, resilience and sustainable growth at global and local scales through public, private and mutual mechanisms. Willis Group is an insurance and reinsurance broker with approximately 20,000 personnel operating in around 100 countries. Rowan is also Chairman of the Willis Research Network which he founded in 2006. The WRN has grown to become the world's largest collaboration between public science and the finance sector supporting around fifty universities and science institutions to support improved policy making and capital management.

Previously Rowan served as CEO Global Analytics of Willis Re and then across Willis Group. He began his career underwriter reinsurance with Syndicate 1095 at Lloyd's before founding the risk information company WIRE Limited in 1994 which was acquired by Willis Group in 2000.Rowan has two public appointments in the UK serving on the Prime Minister's Council for Science and Technology and also the Natural Environment Research Council which oversees approximately $500m of annual environmental science expenditure.

More widely he chairs the United Nations International Strategy for Disaster Reduction Private and Financial Sector Working Group preparing the second UN Hyogo Framework for Action Agreement in 2015 and the World Meteorological Organisation Expert Advisory Group on Financial Risk Transfer preparing for the UN Agreement on Climate Services in 2015. He is also a member of the Political Champions for Disaster Reduction Committee chaired by the UNDP Secretary General and the UK Secretary of State of International Development.He is a member of the Global Earthquake Model Foundation Governing Board, Pavia Italy; the Advisory Board of the Earth System Laboratory, NCAR, Boulder CO and the Royal Society's Working Group on Human Resilience to Climate Change due to report in late 2014. Rowan read Geography at Durham University (BA Hons); Geographical Sciences at the University of Bristol (M.Phil) and is a Fellow of the Royal Geographical Society.

Dr Robert Muir-Wood

Chief Research Officer, RMS

Robert Muir-Wood is CRO of Science and Technology Research at RMS. In this role, Robert heads the branch of RMS responsible for enhancing approaches to natural catastrophe modelling and developing models for new areas of risk. Based in London, he has more than 20 years' experience in developing probabilistic catastrophe models and has most recently focused on the clustering of catastrophic events and the potential for M9 earthquakes as well as the expansion of catastrophe modelling to support non-insurance related applications around disaster risk reduction. Robert was lead author on Insurance, Finance, and Climate Change for the 2007 Intergovernmental Panel on Climate Change (IPCC) Assessment Report, and is the author of six books, as well as numerous papers and articles in scientific and industry publications. Robert has recently focused on new models for clustering, time varying activity rates, loss amplification and Super Cats. He is also a member of the OECD High Level Advisory Board of the International Network on Financial Management of Large-Scale Catastrophes. He holds a first class degree in natural sciences and a PhD in Earth Sciences, both from the University of Cambridge, and was a junior research fellow at Trinity Hall, Cambridge.

John Scott

Chief Risk Officer, Zurich Global Corporate, Zurich Insurance Group

John Scott is Chief Risk Officer for Zurich Global Corporate. He joined Zurich in 2001 becoming Head of Risk Insight in 2007 and took on his current role in 2009. John leads the global, regional and local implementation of the Group's enterprise risk management strategy across Global Corporate.

A graduate of Oxford University, with a PhD in geology, John's early career was in the upstream oil and gas industry, where he gained wide-ranging international experience with BP. In 1995 he gained his MBA at Cranfield and joined BOC, as a key member of the Group Strategy & Planning team, and then later became General Manager of BOC's Edwards business division.

John is a member of the Institute of Directors in the UK and currently chairs the CCSA (Carbon Capture and Storage Association) group on risk.

Dr Markus Wadé

Senior Risk Manager, Integrated Risk Management, Munich Re

Markus Wadé has been a senior risk manager in Munich Re's Integrated Risk Management division for the last four years.

Within the Group Accumulation and Emerging Risks team, he is responsible for the development of accumulation scenarios for Munich Re's global business operations and the refinement of risk identification tools and methods. Special focus of his work is currently the analysis of complex accumulations of risks.

Before joining Munich Re Markus was working for about 10 years in quantitative credit risk management in various financial institutions. His responsibilities included the development and implementation of rating and LGD models and their Basle II audits.

Markus holds a PhD for a thesis about the estimation of country risks for credit portfolio models. He studied economics at the University of Regensburg and Wesleyan University (USA).

Panel Discussion 2

How should a business monitor emerging risks and manage their occurrence?

Chair

Alan Laubsch

Director and Head of Risk Products, Financial Networks Analytics

Alan Laubsch has over 20 years of risk management experience and has advised global banks, asset managers, and sovereigns on enterprise risk management.

As a co-founder of the RiskMetrics Group, Mr Laubsch ran the RiskMetrics Labs division in Asia. His research focused on next generation risk management practices, including methodologies for early warning, stress testing, systemic risk, and a framework for integrated risk management.

Alan Laubsch joined FNA in 2013 as head of Risk Products, which includes the HeavyTails systemic risk monitor. Previously, Mr Laubsch was a vice president at JPMorgan's Risk Advisory Group, where he helped financial institutions implement enterprise risk management in Latin America, Middle East and Asia. Mr Laubsch joined JPMorgan in New York in 1993 after receiving a BS in Industrial Engineering from Stanford University. As a researcher in the Corporate Risk Management Group, Mr Laubsch worked on hedge fund risk analysis, default risk modeling, economic capital allocation and market and credit risk integration.

Mr Laubsch authored Risk Management: A Practical Guide and research at RiskMetrics. Mr Laubsch has also published articles in the Asia Wall Street Journal and other financial media.

Panellists

Jonathan Clark

Head of Business Solutions & Syndicate Claims Management and Member of SCOR Emerging Risks Groups for P&C Claims, SCOR SE

Jonathan joined SCOR in January 2013 to head SCOR's London-based Business Solutions claims team and to be responsible for the Claims Management of the Channel Syndicate. A claims professional for over 30 years, Jonathan has held international executive positions with Crawford and Cunningham. He was claims director at the Financial Services Compensation Scheme from 2007 to 2009. As a practicing loss adjuster his professional work has focussed on financial losses particularly those arising from contractual liabilities in manufacturing industries. He has dealt with claims in over 40 countries and also lectured on the investigation and management of business interruption and product liability claims particularly in industrial processing, life sciences and chemical industries. Jonathan is a graduate in biochemistry and biochemical engineering from Oxford and London Universities. A Chartered Loss Adjuster and Chartered Insurer, he is a past Chair of the Faculty of Claims and current President of the London Business Interruption Association.

Kay Haggis

Group Head of Operational Risk and Head of Catlin Emerging Risk Committee for Operational Risk, Catlin

Kay is the Group Head of Operational Risk at Catlin Group, an international specialty insurer and reinsurer. Kay has over 30 years' experience of operational risk and insurance and has held several senior positions in the financial industry, leading global teams, including Royal Bank of Scotland where she was Head of Operational Risk and overall Group Head of Business Continuity, Direct Line, Barclays Bank, The Woolwich and Aviva.

Matt Harrison

Syndicate Exposure Manager, Hiscox

Matt is the Syndicate Exposure Manager for Hiscox Syndicates. Amongst other duties, he is responsible for the Catastrophe Modelling and Exposure Management of the Insurance business written by the Syndicate and the Group wide clash models.

These Clash models are designed to explicitly parameterise the Groups exposure to correlating, but non-Cat modelled, risks and therefore include emerging risks.

Matt holds a PhD in Physics.

Jeremy Hindle

Head of Enterprise Risk Aggregation, XL

Jeremy Hindle, Head of Enterprise Risk Aggregation for XL Group, is responsible for managing day-to-day reporting of catastrophe risk, with audiences as diverse as rating agencies, regulators, XL's 50 businesses as well as the Board of Directors. As owner of the Internal Catastrophe Risk Model, he leads the Enterprise Catastrophe Risk Practice group, which oversees selection, blending, and usage of cat models across XL that are used for capital management, ORSA and Solvency II reporting. In addition, he is leading the development of new systems and tools to collect, aggregate, analyse and report on "Non-CAT" clashing risks, providing transparency into XL's key risk accumulations across insurance, reinsurance and investments.

Prior to this role, he was Ceded Reinsurance & Underwriting Risk Manager for XL Re, responsible for managing the risk profile of the business for both catastrophe and non-catastrophe risks and the placement of all Group retrocession for Aviation, Casualty, Marine and Property business. Previously he had spent over 20 years as an underwriter, mainly focused on property reinsurance responsible for International business. This included positions as Director of Property for XL Re Europe (previously Le Mans Re) in Paris, Senior Vice-President, International Underwriter at XL Re Ltd (previously Mid Ocean Re) in Bermuda, having started his career at Swiss Re (UK) Ltd in London, culminating with a position as Senior Underwriter.

He has a keen interest in natural and man-made disasters and emerging risks. He was part of the original group that launched the Risk Prediction Initiative in Bermuda in 1994, that continues to fund academic research relevant to the insurance industry, including sponsoring paleoclimatological techniques that enable scientists to extend historical datasets to thousands of years to provide a better understanding of the trends in tropical cyclone activity.

Scenario Research Project Team

Cambridge Centre for Risk Studies Research Team

Professor Daniel Ralph, *Academic Director*
Dr Michelle Tuveson, *Executive Director*
Dr Andrew Coburn, *Director of External Advisory Board*
Simon Ruffle, *Director of Technology Research*
Dr Gary Bowman, *Research Associate*
Dr Fabio Caccioli, *Research Associate*
Dr Scott Kelly, *Research Associate*
Dr Roxane Foulser-Piggott, *Research Associate*
Dr Louise Pryor, *Risk Researcher*
Andrew Skelton, *Risk Researcher*
Ben Leslie, *Risk Researcher*
Dr Duncan Needham, *Risk Associate*

Consultants and Collaborators

Oxford Economics Ltd., with particular thanks to Fabio Ortalani, *Senior Economist*
Financial Networks Analytics Ltd., with particular thanks to Dr Kimmo Soramaki, *Founder and CEO*; and Dr Samantha Cook, *Chief Scientist*
Cambridge Architectural Research Ltd, with particular thanks to Hannah Baker, *Graduate Research Assistant*
Axco Ltd., with particular thanks to Tim Yeates, *Business Development Director*
Dr Andrew Auty, *Re: Liability (Oxford) Ltd.*
Antonios Pomonis, *Independent Consultant*
Dr Gordon Woo, *RMS, Inc.*

Leads

Geopolitical Conflict Project Lead:	Dr Gary Bowman, *Research Associate*
Cyber Catastrophe Project Lead:	Simon Ruffle, *Director of Technology Research*
Pandemic Project Lead:	Dr. Andrew Coburn, *Director of External Advisory Board, Centre for Risk Studies, and SVP, RMS, Inc.*

Subject Matter Specialists

Geopolitical Conflict Subject Matter Specialists:

Richard Hartley, *Co-Founder, Cytora Ltd*.
Joshua Wallace, *Co-Founder, Cytora Ltd.*
Dr Ivan Ureta, *College of Economics and Political Science. Sultan Qaboos University, Oman*

Cyber Catastrophe Subject Matter Specialists:

Éireann Leverett, *Senior Security Consultant, IO Active Ltd.*
Dr Rob Watson, *Cambridge Computer Labs, University of Cambridge*
Dr Richard Clayton, *Cambridge Computer Labs, University of Cambridge*
Dr Frank Stajano, *Cambridge Computer Labs, University of Cambridge*

Pandemic Subject Matter Specialist:

Mary Chang, *Medical Research Analyst, RMS, Inc.*

2014 Centre for Risk Studies Research Agenda

The research programme of the Centre for Risk Studies focusses on business applications of management science to reduce risk. A number of interlinked research themes are being explored. They share a common approach and risk analysis framework – the 'Cambridge Risk Framework' – which has been developed at the Centre for Risk Studies to address the issues of complex risk.

Cambridge Risk Framework

The Cambridge Risk Framework is an approach to evaluating complex risk, involving

- Developing a 'Taxonomy of Threats': Understanding the broad spectrum of potential causes of events that could impact an international business process or the global economic system. A threat definition (minimum thresholds of consequences) is used for inclusion, and a systematic approach taken to threat identification through historical and scientific source review. Threats are grouped by cause and categorized hierarchically.
- Compiling a review of the 'state-of-knowledge' for selected threat types by literature review with the identification of a Subject Matter Editor to provide expert insight. Threat evaluation is standardised across threat types by considering the frequency-severity distribution of the global magnitude of threats that can be expected, and benchmarking relative importance by assessing the severity of event with, e.g. 1% annual probability of exceedance – a '1-in-100' event.
- Definition of a scenario for a threat class of interest that illustrates an example of the severity of an event with a benchmark probability (e.g. 1% annual probability of exceedance) for use as a stress test. A scenario consists of a detailed narrative, a timeline, a 'footprint' of geographical, sectoral or other impact, and a standardised data structure for estimating initial impact within the footprint.
- Assessing the impact consequences of the scenarios in how they affect specified categories of assets, liabilities and economic business sectors. This has entailed developing models of how consequences flow through business networks, and macroeconomic and financial systems.
- Representation of global business systems as different networks of activity, using a standardised graph theory representation of networks and imposing a uniform data architecture. Compiling data on the global networks of the macroeconomy enables models and scenarios to be applied.

Research Platform

A cloud-based research platform for the Cambridge Risk Framework has been developed, for data compilation, model development and research output: http://www.CambridgeRiskFramework.com

Research Themes

Research themes being explored through the Cambridge Risk Framework in 2014 are:

1. **Global Complex Risk Landscape**: Establishing a comprehensive taxonomy of future large scale threats, tracking 'Emerging Risks', and developing stress-test scenarios.

2. **Understanding Complex Business Exposure**: Compiling data on the interconnectivity of the business world, and exploring networks' propensity for and vulnerability to cascading failure

3. **Financial Catastrophe Risk**: Using the Cambridge Risk Framework to explore the stability and potential for cascading failure and phase changes in financial networks

4. **Resilient International Supply Chains**: Developing metrics of loss, 'efficient resiliency', and benefits of strategic improvements to global supply chains and business relationships.

5. **Cyber Catastrophe Risk**: Developing a more rigorous framework for the evaluation of extreme cyber risk, as one of the most significant threat classes in the taxonomy.

2013 Centre for Risk Studies Research Outputs

Working Papers

Resilient International Supply Chains

Ralph, D.; Bowman, G.; Coburn, A.; Ruffle, S.;
Cambridge Centre for Risk Studies Working paper 2013.01; January 2013.
Global supply chains are vulnerable to systemic failure. Analysing the systems that provide the apparatus for modern business activity and synthesising best practice in risk mitigation helps us identify key strategic and operational issues for supply chain management.
http://cambridgeriskframework.com/getdocument/3

Cambridge Risk Framework: A Taxonomy of Threats for Macro-Catastrophe Risk Management

Andrew Coburn, Danny Ralph, Michelle Tuveson, Simon Ruffle, Gary Bowman
Cambridge Centre for Risk Studies Working Paper 201307.20; July 2013
The objective of the Cambridge Risk Framework is to develop a systematic and evidence-based approach to threat assessment and risk management for macro-catastrophes.
http://cambridgeriskframework.com/getdocument/4

Survey of Leading Opinions: Developing a Research Agenda for Understanding Financial Catastrophe Risk

Andrew Coburn, Gary Bowman, Fabio Cacciolli
Cambridge Centre for Risk Studies Working Paper 201303.31, Draft: May 2013
Summary of recommendations for prioritisation of academic research into financial catastrophe risk resulting from a survey of leading opinions in the field.
http://cambridgeriskframework.com/getdocument/12

Cyber Catastrophe: Cambridge Risk Framework - Profile of a Macro-Catastrophe Threat Type

Simon Ruffle, Andrew Coburn, Danny Ralph, Gary Bowman
Cambridge Centre for Risk Studies Working Paper 201307.02, July 2013
This document presents a profile of the Macro-Catastrophe threat type 'Cyber Catastrophe' along with the Specification of the fictional scenario "The Sybil Logic Bomb".
http://cambridgeriskframework.com/getdocument/9

Geopolitical Conflict: Cambridge Risk Framework - Profile of a Macro-Catastrophe Threat Type

Joshua L. Wallace, Richard G Hartley, Gary Bowman, Andrew Coburn, Simon Ruffle
Cambridge Centre for Risk Studies Working Paper 201308.02; August 2013
This document presents a profile of the Macro-Catastrophe threat type 'Geopolitical Conflict' along with the specification of a fictional scenario, "Sino-Japanese Conflict in the East China Sea".
http://cambridgeriskframework.com/getdocument/17

Human Pandemic: Cambridge Risk Framework - Profile of a Macro-Catastrophe Threat Type

A. Coburn, M. Chang, D. Ralph, M. Tuveson, S. Ruffle, G. Bowman
Cambridge Centre for Risk Studies Working Paper 201303.01; Draft: March 2013
This document presents a profile of the Macro-Catastrophe threat type 'Human Pandemic' (note: this paper is a work-in-progress).
http://cambridgeriskframework.com/getdocument/8

Social Unrest: Cambridge Risk Framework - Profile of a Macro-Catastrophe Threat Type

Andrew Coburn, Joshua Wallace, Richard Hartley, Gary Bowman, Simon Ruffle
Cambridge Centre for Risk Studies Working Paper 201312.01; December 2013
This document presents a profile of the Macro-Catastrophe threat type 'Civil Disorder' (note: this paper is a work-in-progress).
http://cambridgeriskframework.com/getdocument/5

Conference Proceedings and Academic Journal Activities

Risk and Uncertainty Beyond Supply Chains

Andrew Coburn, Giovanni Giallombardo, Daniel Ralph, Simon Ruffle
Proceedings of "Informatics Rising", The Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, Phoenix, AZ Oct 2012
https://informs.emeetingsonline.com/emeetings/formbuilder/clustersessiondtl.asp?csnno=17948&mmnno=220&ppnno=65652

Bayesian Probit Models for Dichotomous Decisions Using Survey Data

Michelle Tuveson, William Fitzgerald
Working Paper, Dec 2012

Pricing Risk Under Risk Measures: an Introduction to Stochastic-Endogenous Equilibria

Ralph, D. and Y. Smeers, 2011, Working paper, Social Science Research Network; SSRN 1903897, http://ssrn.com/abstract=1903897

Can Oil Prices be a Proxy for Consumer Sentiment?

Michelle Tuveson, Daniel Ralph
Proceedings of "Informatics Rising", The Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, Phoenix, AZ Oct 2012
https://informs.emeetingsonline.com/emeetings/formbuilder/clustersessiondtl.asp?csnno=17815&mmnno=220&ppnno=63785

Evolving Risk Frameworks: Modelling Resilient Business Systems as Interconnected Networks

Alan Punter, Andrew Coburn, Daniel Ralph, Michelle Tuveson, Simon Ruffle, Gary Bowman
Proceedings of 'Think Outside the Risk', Aon Benfield Hazards Conference, Gold Coast, Australia, 22-24 September 2013
http://cambridgeriskframework.com/getdocument/15

Sentiment Component in Oil Demand Models

Michelle Tuveson, William Fitzgerald
Working Paper, Oct 2013

Application of Random Forest Learning Algorithms to Oil demand Models

Michelle Tuveson, William Fitzgerald
Working Paper, Oct 2013

Possible Futures, Present Logics: A Neo-Institutional View of the Scenario Planning Process

Gary Bowman, Ryan Parks; 33rd Strategic Management Society Annual International Conference; Atlanta, October 2013.
http://atlanta.strategicmanagement.net/tools/schedule/sessionDetails?id=222

The Practice of Scenario Planning: An Analysis of Inter- and Intra-Organizational Strategizing

Gary Bowman, Southern Management Association 2013 Meeting, New Orleans, November 5-9, 2013.

Risky Capacity Equilibria in Complete Financial Markets: A Risk Analysis of Capacity Investment with Endogenous Probabilities

Ralph, D. and Y. Smeers, 2013, Working paper. Submitted for publication.

A Taxonomy of Threats for Complex Risk Management

A Cambridge Centre for Risk Studies Report

Report Summary

This report proposes a taxonomy of macro-catastrophe threats that have the potential to cause damage and disruption to social and economic systems in the modern globalized world. It presents the threat taxonomy developed as part of the Cambridge Risk Framework and describes the methodology used, including a detailed historical review and a categorization based on causal similarity.

Complex risks cause macroeconomic impacts

These threats are of interest because they are complex risks – they impact the networks of activities that underpin the global economy, disrupting the interrelationships that drive business, and causing losses in unexpected ways and places. They have multiple consequences, in causing severe direct losses, but also operational challenges to business continuity, cascades of effects on counterparties and the macroeconomy in general, and on the capital markets and investment portfolios.

Use of the Taxonomy by Stakeholders

The framework and the taxonomy are intended for use in a number of applications, including use in insurance accumulation management for complex threats that can impact multiple lines of business. The taxonomy provides a framework for populating with more detailed studies of each threat.

Using the Taxonomy to develop Stress Test Scenarios

This report proposes a method of benchmarking and comparing between the threats, based on developing stress-test scenarios that illustrate the severity of event that might be expected with 1% annual probability of exceedance.

The stress tests are aimed at providing an illustration of the effects of an extreme event, to help a general audience understand the potential for events of this type to cause disruption and economic loss. It is aimed at informing the risk management decisions of a number of different communities.

The consequences of these stress-test scenarios can be assessed from their impact on specified categories of assets, liabilities and economic business sectors, and a standardized data structure for developing scenarios is outlined. Individual stress-test scenarios are described in subsequent reports in the Cambridge Centre for Risk Studies Report series.

A Taxonomy of Threats for Complex Risk Management

A Cambridge Centre for Risk Studies Report

Citation: Coburn, A.W.;, Bowman, G.; Ruffle, S.J.; Foulser-Piggott, R.; Ralph, D.; Tuveson, M.; 2014, ***A Taxonomy of Threats for Complex Risk Management***, Cambridge Risk Framework series; Centre for Risk Studies, University of Cambridge.

If you would be interested in being a reviewer of the draft report, please contact a member of the project team at Cambridge Centre for Risk Studies.

Draft copies of this report are available at the Publications section on http://www.risk.jbs.cam.ac.uk/

Taxonomy of Threats

Cambridge Risk Framework

Financial Shock

Asset Bubble

Financial Irregularity

Market Crash

Sovereign Default

Bank Run

Trade Dispute

Labour Dispute

Trade Sanctions

Cartel Pressure

Nationalization

Tariff War

Geopolitical Conflict

Conventional War

Asymmetric War

External Force

Civil War

Nuclear War

Political Violence

Terrorism

Separatism

Organized Crime

Assassination

Civil Disorder

Natural Catastrophe

Earthquake

Windstorm

Volcanic Eruption

Flood

Tsunami

Climatic Catastrophe

Drought

Freeze

Tornado & Hail

Electric Storm

Heatwave

Environmental Catastrophe

Sea Level Rise

Ocean System Change

Wildfire

Pollution Event

Atmospheric System Change

Technological Catastrophe

Nuclear Meltdown

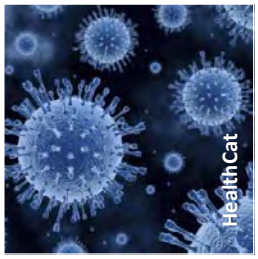
Industrial Accident

Cyber Catastrophe

Technological Accident

Infrastructure Failure

Disease Outbreak



Human Epidemic

Animal Epidemic

Waterborne Epidemic

Zoonosis

Plant Epidemic

Humanitarian Crisis

Famine

Water Supply Failure

Child Poverty

Welfare System Failure

Refugee Crisis

Externality

Meteorite

Solar Storm

Space Threat

Ozone Layer Collapse

Satellite System Failure

Other

UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

Taxonomy of Complex Risk Threats

Major classes of threat type and sub-categories of causes of macro-catastrophes with the potential to cause damage and disruption to global social and economic systems.

Stress Test Scenario

China-Japan Conflict

A Cambridge Centre for Risk Studies Report

Report Summary

We are currently living through one of the longest periods of peace in history, and this has caused many commentators to suggest that traditional wars may not be a threat that modern society needs to prepare for. However history shows that similar periods of apparent peace and implausibility of war can be shattered by unexpected conflict. This report examines how the modern connected world could be impacted by a major nation-state conflict, and presents a stress test scenario for practitioners to incorporate into risk management.

China-Japan Conflict

A regional conflict between a major military power and a client state of another superpower as the level of severity is the type of conflict likely to occur with approximately a 1-in-100 chance per year. As a stress test, we site this regional conflict as a military conflict between China and Japan – two states with historical enmity and a current tense relationship. These are the second and third largest economies in the world and their symbiotic relationship means that conflict between the two has severe consequences for the global economy.

Scenario and its variants

The report presents a scenario narrative and timeline where provocations escalate into full military engagement, with destruction targeted on the commercial activities of both national territories. The war is brief but halts the shipping, air traffic, and commercial export and import activity in the region. The scenario is presented with three variants of the duration and severity of conflict – nine months, two years and five years.

Consequence analysis

The report assesses the consequences of the hypothetical conflict in terms of the direct losses that would occur, the potential insurance payouts for different lines of typical coverage, the macroeconomic impacts on different countries and for various economic metrics, and finally assesses the likely effect this would have on the markets and a typical high-quality investment portfolio.

The scenario shows that the consequences of a conflict between major economies would flow far beyond the theatre of military activity to affect the networked activities of the world, including trade flows, national economies, business operations and productivity, and investment markets. It derives a series of lessons for risk managers in different business areas and geographies.

Stress Test Scenario

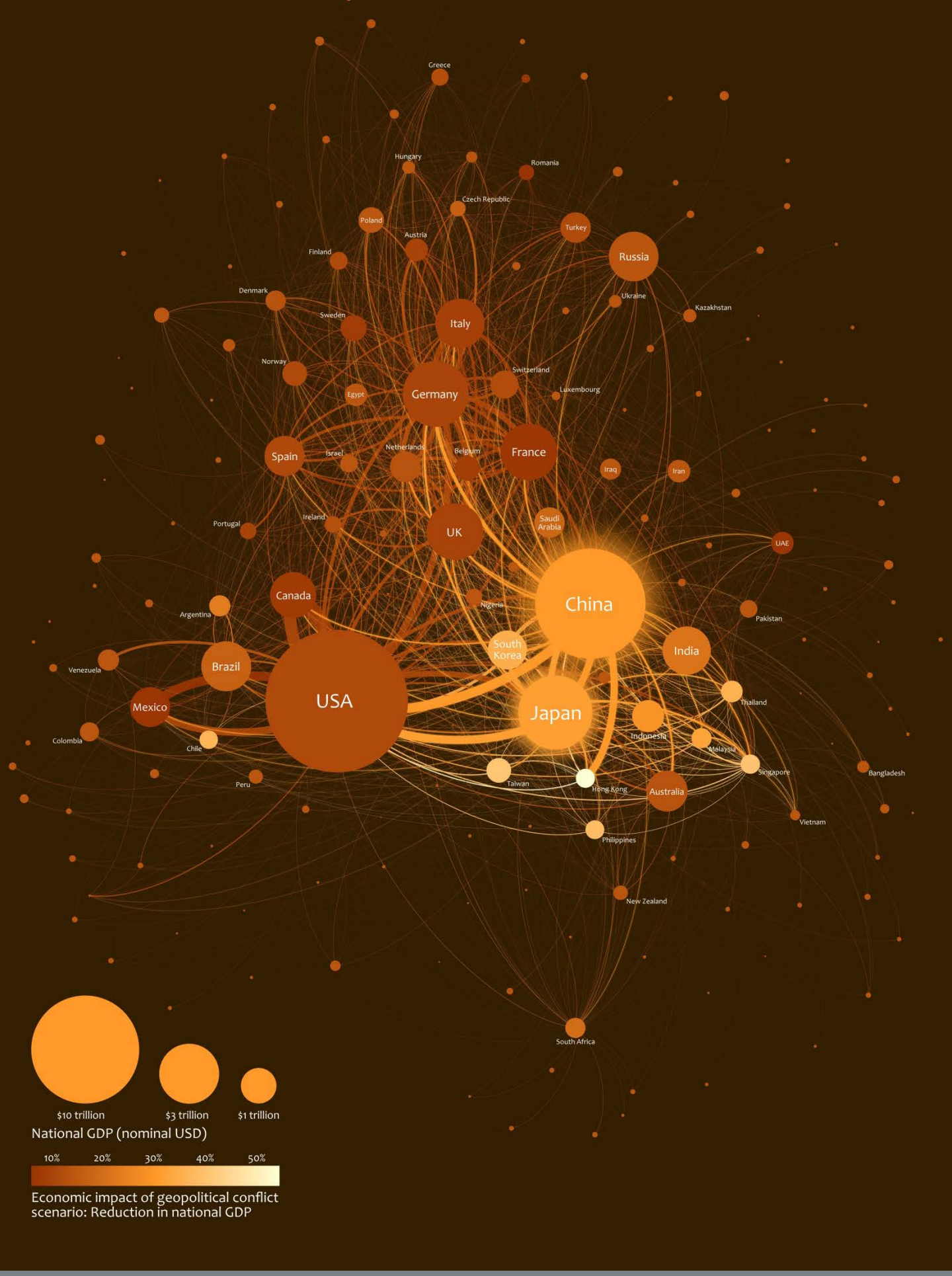
China-Japan Conflict

A Cambridge Centre for Risk Studies Report

Citation: Bowman, G.; Caccioli, F.; Coburn, A.W.; Kelly, S.; Ralph, D.; Ruffle, S.J.; Foulser-Piggott, R.; 2014, ***Stress Test Scenario: China-Japan Conflict***; Cambridge Risk Framework series; Centre for Risk Studies, University of Cambridge.

Report in preparation. If you would be interested in being a reviewer of the draft report please contact a member of the project team at Cambridge Centre for Risk Studies.

When published this report will be available at the Publications section on http://www.risk.jbs.cam.ac.uk/



UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

The Global Economy: Potential Impact of War

Imports and exports between the world's national economies. Colour coding shows the economic impact of the Sino-Japanese geopolitical conflict scenario on each country.

Stress Test Scenario

Sybil Logic Bomb Cyber Catastrophe

A Cambridge Centre for Risk Studies Report

Report Summary

Global productivity has been boosted by information technology, and it has rapidly become a key component of daily life and developed into a business dependency. The potential for a disruption to core IT systems is an increasing concern of risk managers. This report examines the potential for widespread, simultaneous impact on a large number of companies that are active in the cyber economy, through a selected stress test scenario.

A cyber risk framework

Cyber risk analysis is less mature than other risk analysis fields. The historical catalogue of disruptive events is comparatively short, and data is sparse. This research proposes a framework for considering the severity of impacts of cyber-attacks with the penetration levels that could be achievable through different mechanisms of attack. The framework proposes metrics for revenue-at-risk from cyber disruption to major enterprises.

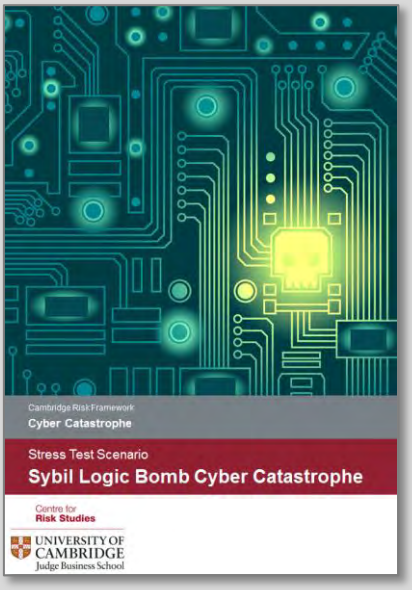
Sybil Logic Bomb stress test scenario

The stress test scenario envisages a combination of high penetration of large number of companies with severe disruption to business productivity resulting from corruption to a major fictional data platform, 'Sybil', used by many companies for algorithmic applications. The malware is insidious and remains undetected for some time, causing difficult-to-diagnose problems in business activities. This undermines trust in customers and leads to a wide range of types of losses, some of which are sufficient to cause business failure.

Consequence analysis

The consequences of the scenario are analyzed using a specially-compiled enterprise network of the global economy. It looks at the potential for losses and liabilities arising from IT defects and consequences for global macroeconomics, potential market effects and the likely impacts on a typical high-quality investment portfolio.

This '1-in-100' scenario demonstrates the potential for 'information malaise' – distrust of the digital economy – to severely impact the productivity gains that have been won with IT advances. It provides stress test context that challenges standard business assumptions and provides narrative, examples, and structured approaches to helping improve the understanding of cyber risk and assist with preparedness and risk management.



Stress Test Scenario

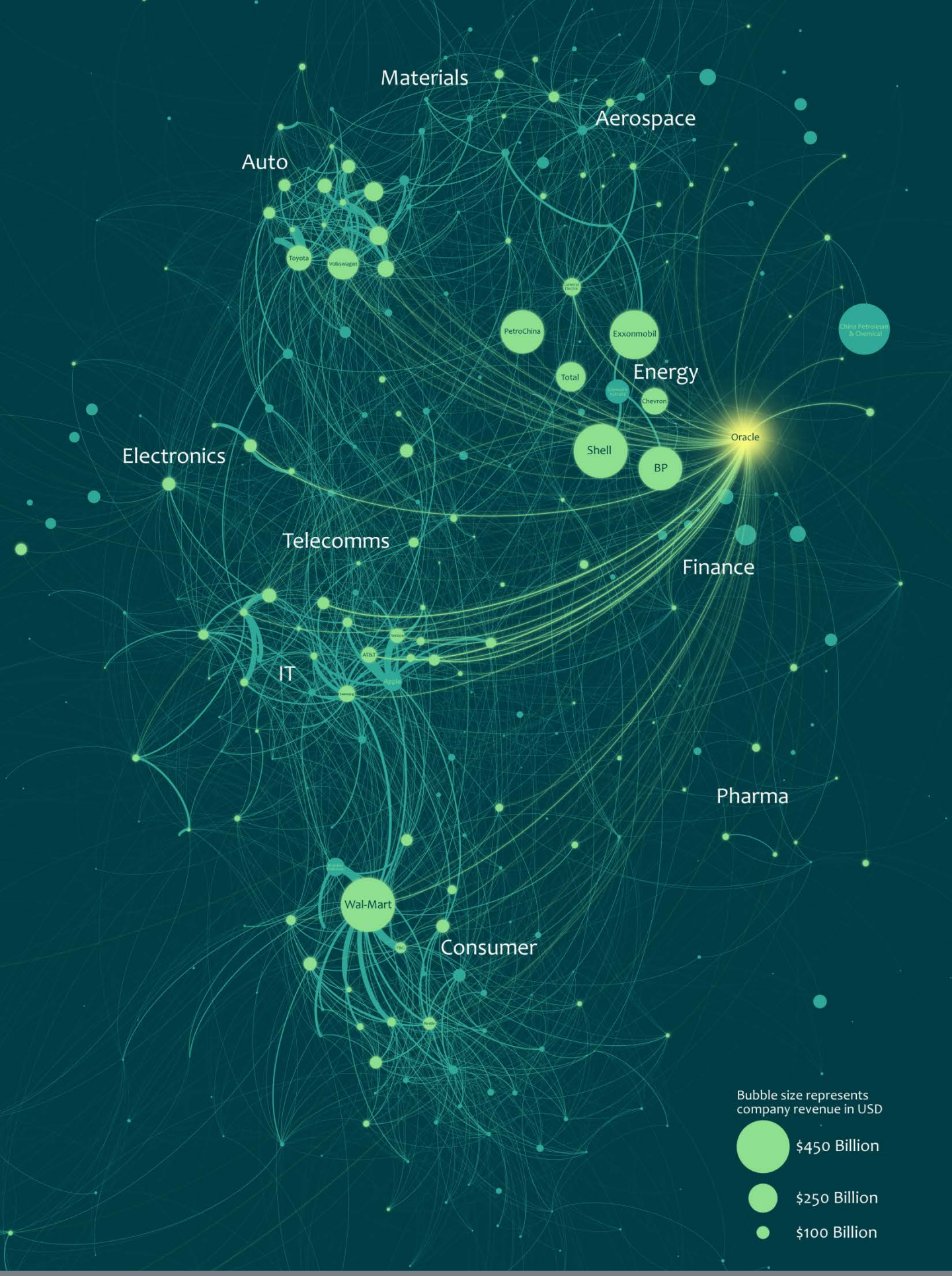
Sybil Logic Bomb Cyber Catastrophe

A Cambridge Centre for Risk Studies Report

Citation: Ruffle, S.J.; Bowman, G.; Caccioli, F.; Coburn, A.W.; Kelly, S.; Leslie, B.; Ralph, D.; 2014, *Stress Test Scenario: Sybil Logic Bomb Cyber Catastrophe*; Cambridge Risk Framework series; Centre for Risk Studies, University of Cambridge.

Report in preparation.

When published this report will be available at the Publications section on http://www.risk.jbs.cam.ac.uk/



UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

Enterprise Network of the Global Economy: 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.

Stress Test Scenario

São Paolo Virus Pandemic

A Cambridge Centre for Risk Studies Report

Report Summary

Disease epidemics have been the causes of some of the worst socio-economic shocks throughout human history. Public healthcare has conquered endemic infectious diseases but nature retains its capacity to produce new mutations of pathogens that overcome human immune systems and for which modern medicine has no treatment. A pandemic resulting from a new genetic variant of a virus is a significant threat to today's highly interconnected world. This study examines the potential for pandemics to disrupt social and economic activity.

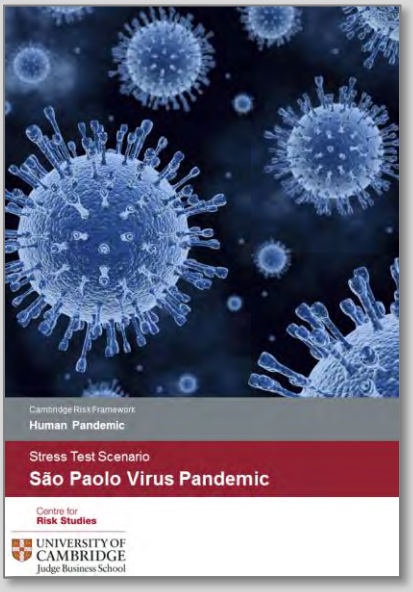
Pandemic scenario

The scenario explores the impact of illness-triggered absenteeism and fear of infection on economic activity and business operations. A pandemic scenario representing a 1% probability of exceedance (1-in-100) was chosen from the RMS Infectious Disease Model, by permission of RMS. A novel influenza scenario was selected for its high infectiousness, infecting 43% of the world's population over a nine month period. The scenario simulates an outbreak occurring in Brazil, and being spread rapidly around the world through the global air traffic network.

Social and business impacts

The report provides a timeline and narrative for the pandemic's spread across the globe. The scenario assesses the illness rates that result, and the public healthcare load, with estimates of absenteeism in the workplace and the loss of productivity that is likely to result. The pandemic also suppresses demand as fear spreads and confidence drops. Many businesses are forced to close and the consequences flow through the trading relationships of the economy. The report considers the insurance lines affected, the impact on the global economy, and assesses the likely effect this would have on the markets across the world and how it would change the returns for a typical high-quality investment portfolio.

The report explores the issues and potential patterns of loss for a highly infectious disease threatening the modern world, and which spreads around the world before a vaccine can be developed. The report derives a series of insights for risk managers, business executives, policy-makers and the general public.



Stress Test Scenario

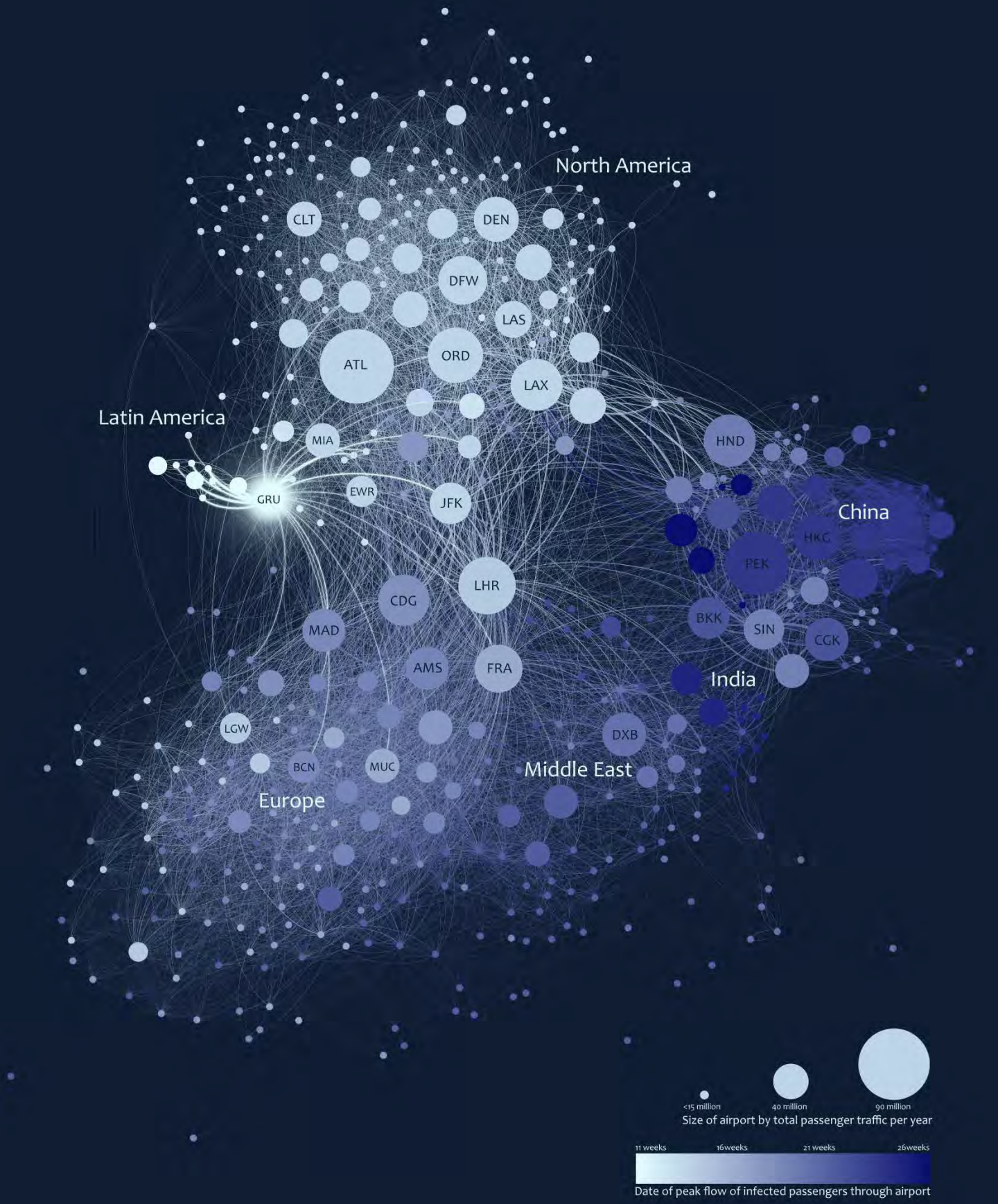
São Paolo Virus Pandemic

A Cambridge Centre for Risk Studies Report

Citation: Coburn, A.W.; Bowman, G.; Caccioli, F.; Chang, M.; Kelly, S.; Ralph, D.; Ruffle, S.J.; 2014, ***Stress Test Scenario: São Paolo Virus Pandemic***; Cambridge Risk Framework series; Centre for Risk Studies, University of Cambridge.

Report in preparation. If you would be interested in being a reviewer of the draft report please contact a member of the project team at Cambridge Centre for Risk Studies.

When published this report will be available at the Publications section on http://www.risk.jbs.cam.ac.uk/



UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

Air Traffic Network of the World: Conduit for Pandemic Spread

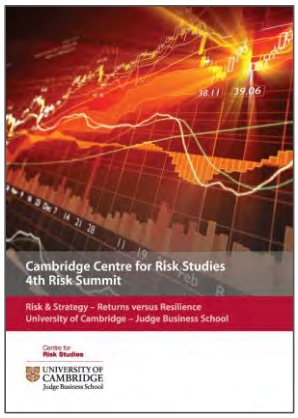
Infected passengers spread the pandemic from country to country. Colour coding shows the simulated spread of the São Paolo Virus Pandemic over time.

Cambridge Centre for Risk Studies 5th Risk Summit 23 & 24 June 2014

The Pulse of Risk: From Big Data to Business Value

University of Cambridge – Judge Business School

Meeting Overview



In June 2014 the Cambridge Centre for Risk Studies will bring together leaders and decision makers from businesses, governments, intergovernmental organisations, academia and NGOs to explore salient topics in risk management. The summit will be held at the University of Cambridge Judge Business School with a conference dinner at Emmanuel College, Cambridge.

This year's summit theme will explore implications of "Big Data" and its opportunities and risks to businesses. The democratisation of information access has provided enormous opportunities for individuals and organisations while creating growing debate on its consequential use. Big data holds potential for research, innovation and productivity, while posing complex questions of ownership, value, aggregation, and the broader benefits to society.

Speakers

- Paul Appleby, Head of Energy Economics, Group Economics Team, BP
- Dr Tobias Baer, Master Expert, Risk Practice, McKinsey & Company
- Professor Domenico Giardini, Chair of Seismology & Geodynamics, ETH Zurich
- Professor Ian Goldin, Professor of Globalisation & Development at the University of Oxford, and Director, Oxford Martin School
- David Harding, Founder & President, Winton Capital Management
- Dr Michael Lynch, Founder & Technology Entrepreneur, Invoke Capital Fund
- Paul VanderMarck, Chief Products Officer & Group Executive, Product Management, RMS

Registration

Registration is now open. Please register online at:

http://www.risk.jbs.cam.ac.uk/news/events/risksummits/risksummit2014.html

where the latest agenda details can be found.

Resilience through the Management of Societal & Economic Risk

Cambridge Centre for Risk Studies
University of Cambridge
Trumpington Street
Cambridge, CB2 1AG
United Kingdom
enquiries.risk@jbs.cam.ac.uk
www.risk.jbs.cam.ac.uk

Office of External Communications
University of Cambridge Judge Business School
Trumpington Street
Cambridge, CB2 1AG
United Kingdom

Centre for
Risk Studies

UNIVERSITY OF
CAMBRIDGE
Judge Business School