# Innovation and Emerging Risks

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Innovation and Emerging Risks Team
Kentucky Captive Association Conference
16th June 2017

# Contents

# Our new definition: Innovation

## Defining the boundaries

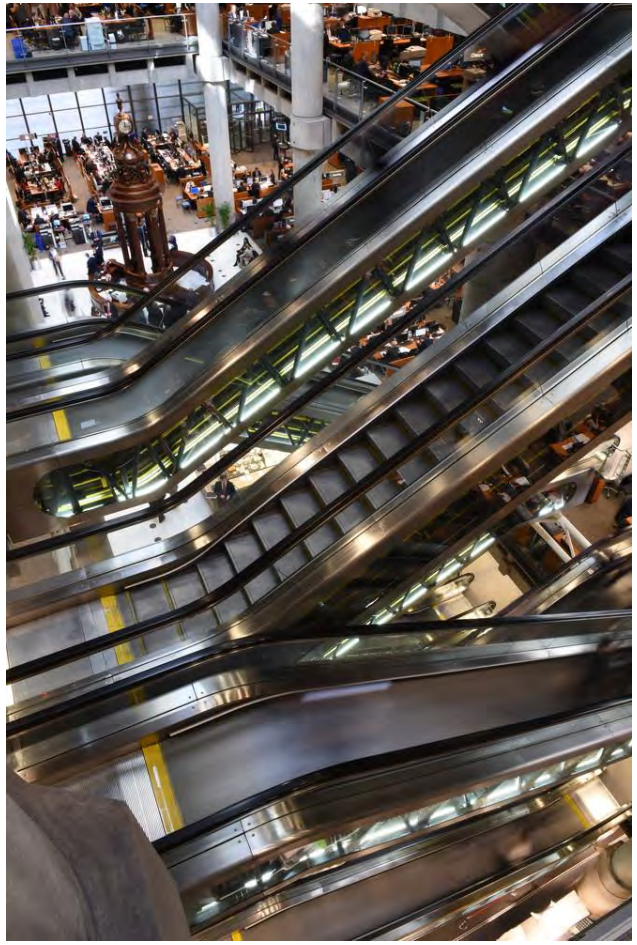
Innovation is the practical and realisable development and application of novel thinking, methods, practices and tools, to both existing and emerging challenges faced by the insurance industry, our Corporation and our key stakeholders

Lloyd's: March 2017

# Why Innovate?

Standing still is not an option

- Industrial and social progress creates a downward escalator effect, driven by the pace of change.
- Stand still on the escalator and you head downwards.
- Keep pace by climbing upwards against the escalator and you hold your ground, but that is not flourishing.
- To progress, compete and grow, you need to outpace the downward escalator and climb faster and higher



# Where might we see innovation?

Anywhere within or in connection with Lloyd's in:

- How we assess risk
  - Emerging Risk innovation
- The products offered by Lloyd's
  - Market innovation
- The way we run and regulate
  - Process innovation
- The way we interact with the rest of society
  - Cultural and social innovation

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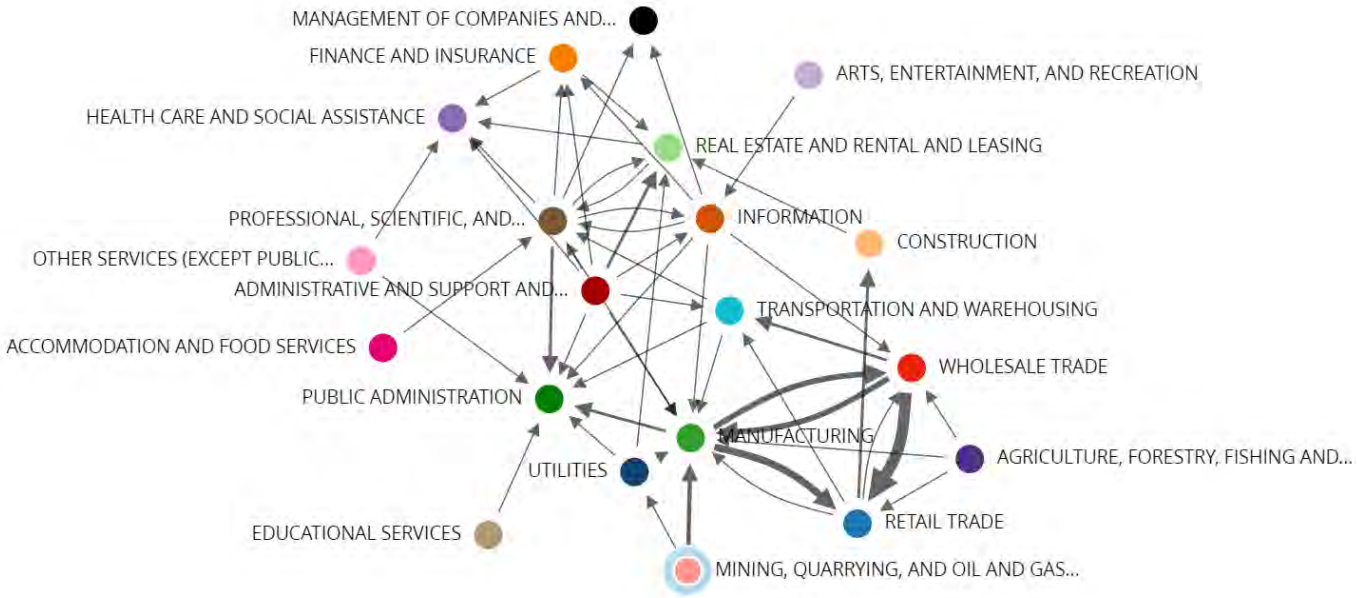
# Current example of innovation

## Arium: A new way to look at Liability

Natural Catastrophe risk is modelled across a geographical landscape to understand the exposure carried

Working with the Lloyd's Emerging Risk Team, Arium postulated that maybe Liability could be modelled too? The first step in this innovative development was to consider Liability to be a loss generating event that passes through an Economic landscape





Arium's approach was innovative and Lloyd's took a supportive, almost 'incubator' role. Now owned by AIR and with a modelling approach now available, there is fresh opportunity in the market for product innovation

# What is an emerging risk?

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# Our new definition: Emerging Risk

## Defining the boundaries

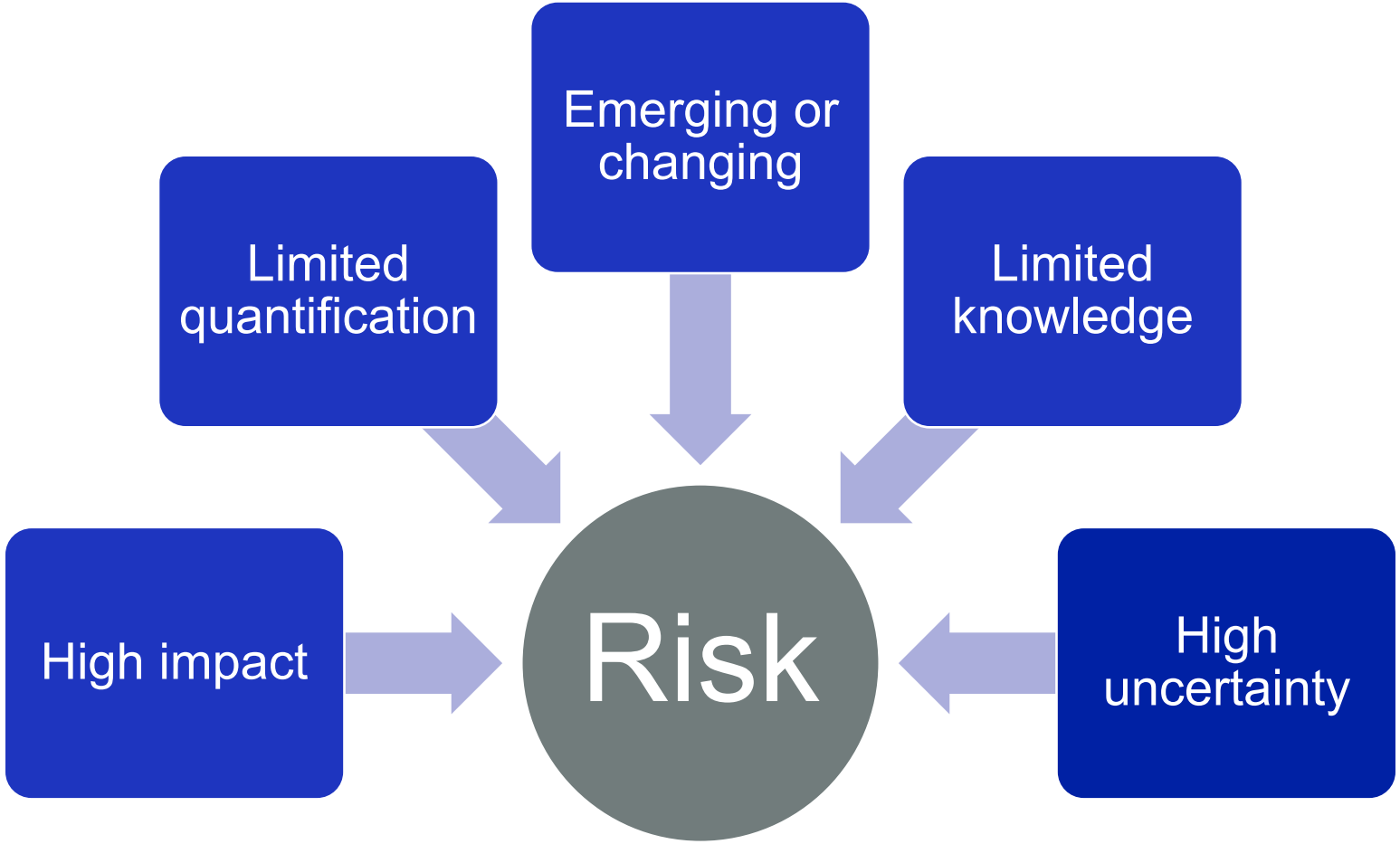
A risk which is yet to be fully understood that may have significant consequences for the insurance industry.

Lloyd's: January 2017

*Note: This definition builds on the standard ISO definition of a risk: "the effect of uncertainty on objectives".*

# Emerging risk features

What makes them worth considering



# Classifying and managing "Emerging Risks"

The Lloyd's emerging risks team has responsibility for research, scenario development and informing innovation strategy.

## Natural environment

- Understanding the dynamic changes underway in the earth's natural environment is critical to effective risk management and disaster risk resilience

## Society & security

- Social, political and economic forces are creating new risk exposures through faster and wider global connectivity

## Technology

- Innovation and expanding access are transforming the role of technology in society

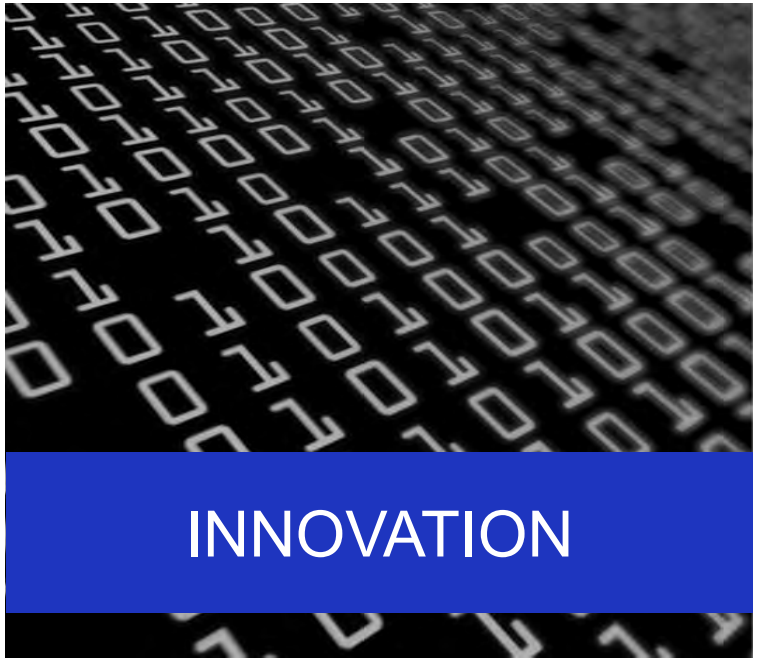
## Understanding risk

- The latest developments in scientific research on risk

# Emerging risk team

- Reduce uncertainty by providing information – not to predict the future!
- **P**rotect – **P**rovide - **P**romote





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# Emerging risks management

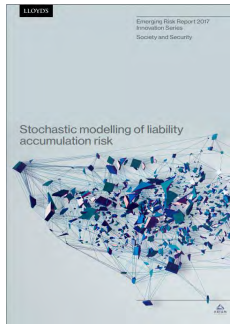
## A journey of knowledge growth

**Identification**

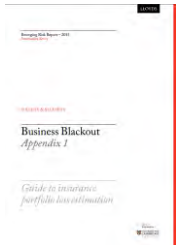
Horizon scanning

**Evaluation**

Judgment of significance








**Awareness**

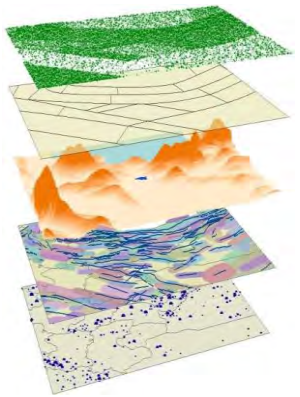
Thought leadership

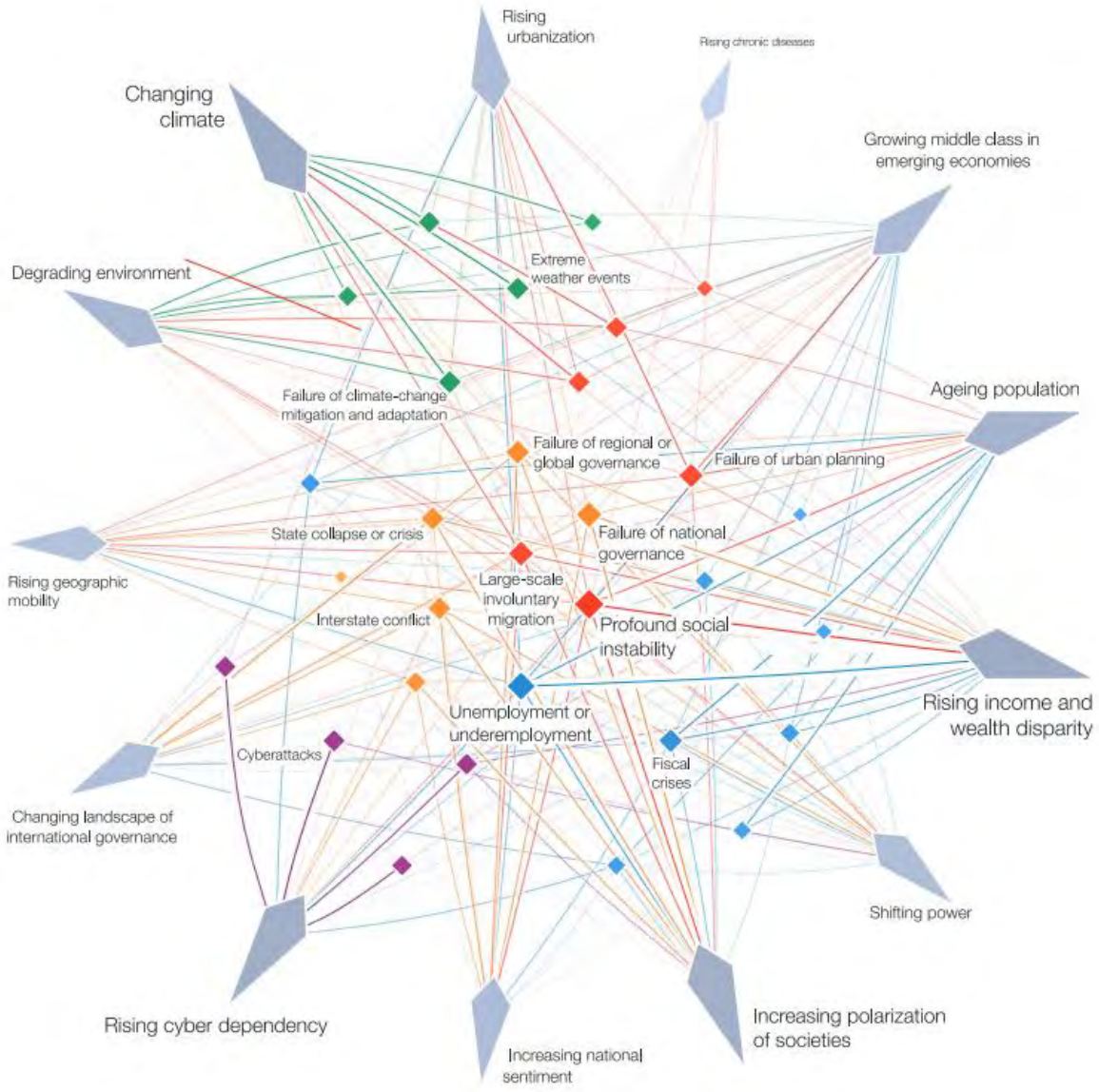
**Assessment**

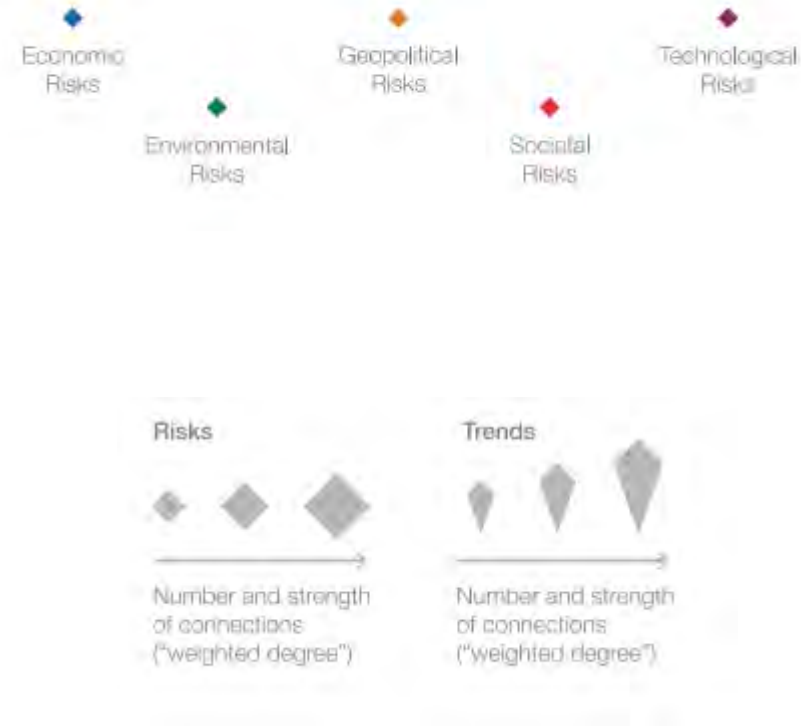
Decision-making resources (scenarios)


**Quantification**

For product innovation & exposure management






World Economic Forum (WEF) Global Risks Perception Survey 2016
Published in WEF 2017 Global Risks Report 12th Edition

# History can work against you…

"Neither RedBox nor Netflix are even on the radar screen in terms of competition," he said. "It's more Wal-Mart and Apple."

- Jim Keyes, CEO of Blockbuster (2008)

# Four megatrends

## Climate change

## Urbanisation

## Digital revolution

## Globalisation

# Four megatrends

## Climate change

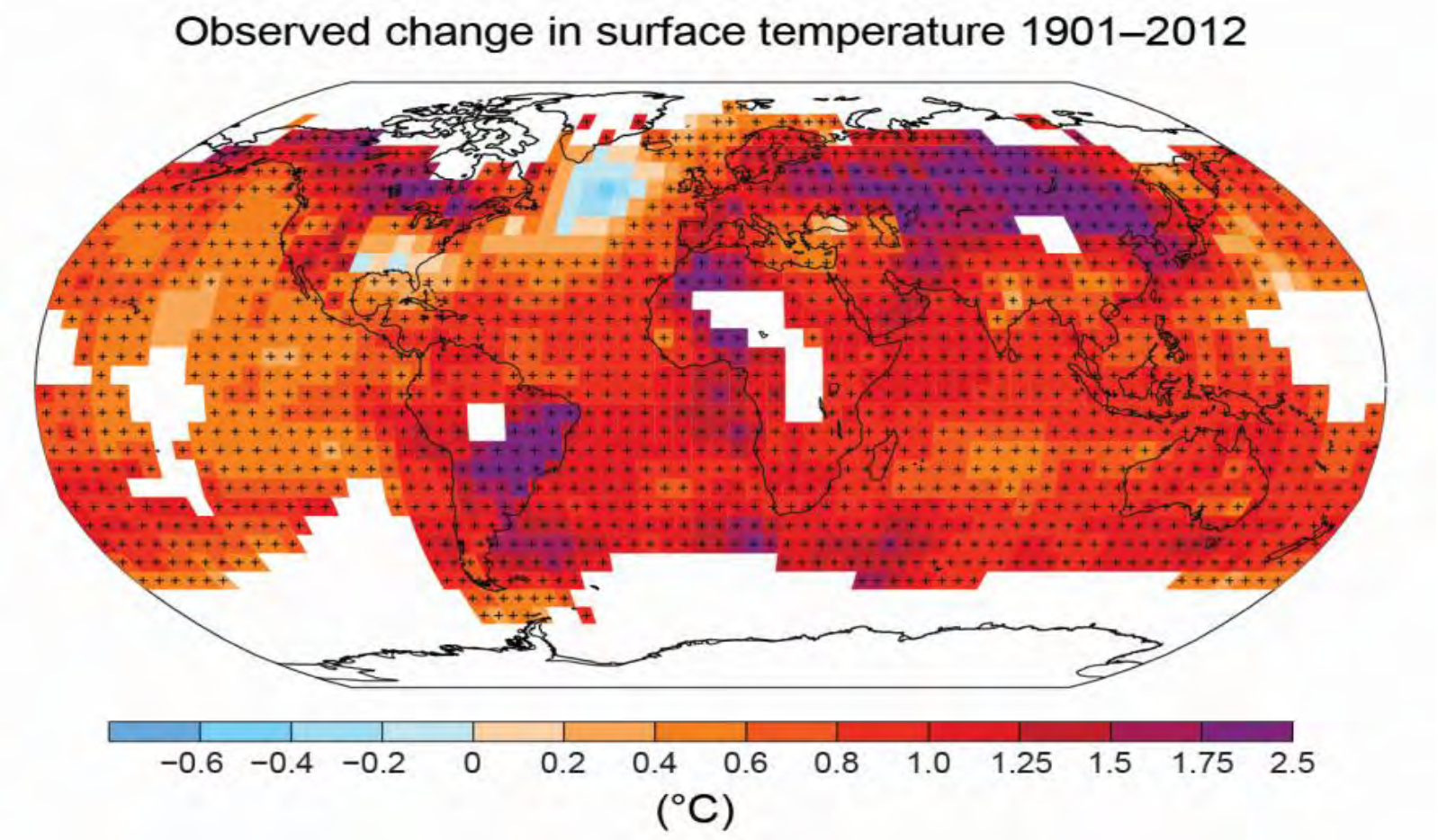



# Climate change

A risk multiplier rather than a peril

- The IPCC assesses that the current trajectory is for an additional 2.6 – 4.8°C of global warming by the end of the century

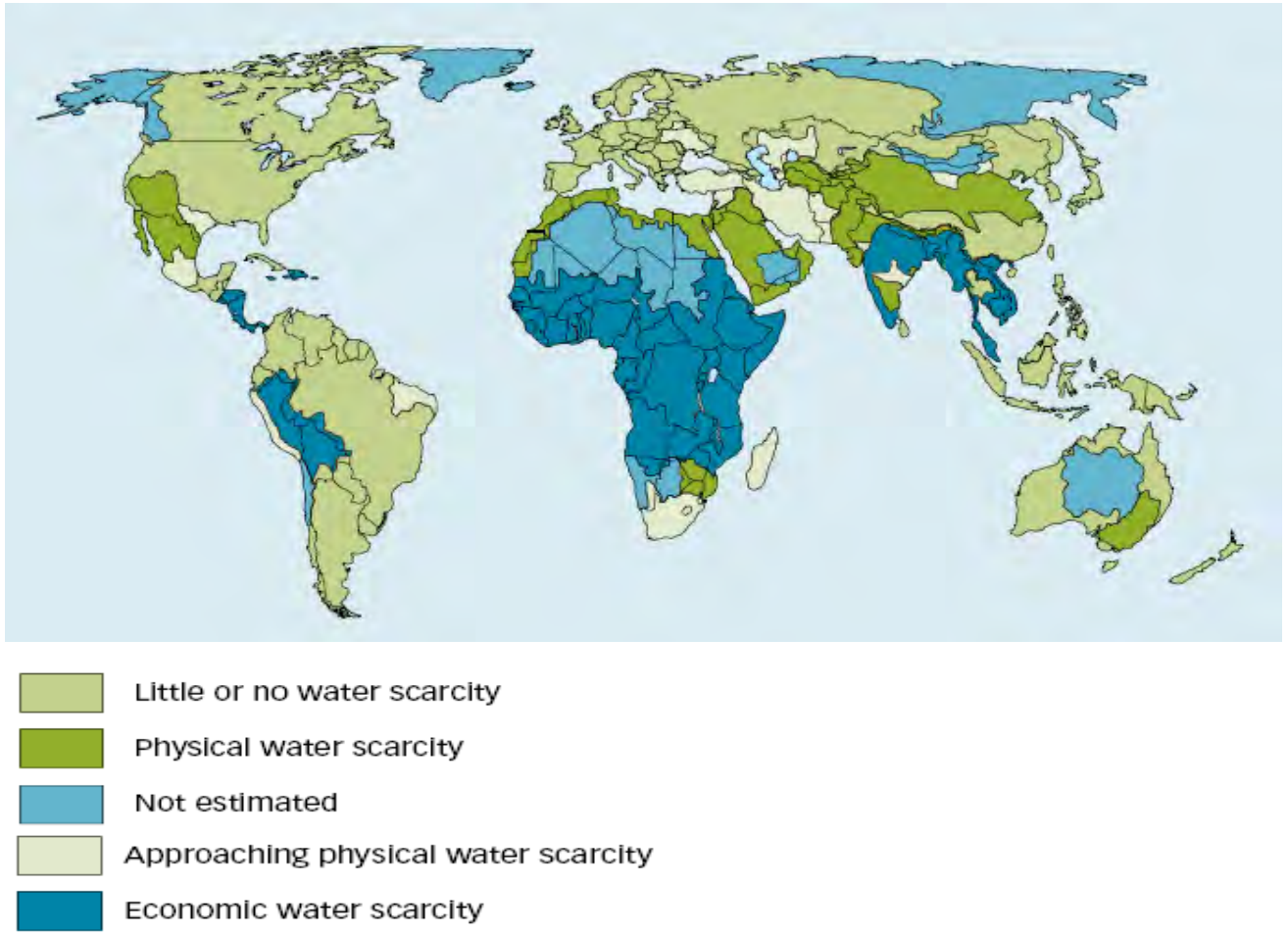
- This figure will **not** be uniform – there will be global variation



# Not enough water

## Climate change and security

- People typically live where water is; if it moves, they move
- Access to water will be seen as a strategic weapon
- "Building a dam could be seen as an act of aggression"
- Key risks:
  - Nile
  - Tigris/Euphrates
  - Indus
  - Mekong

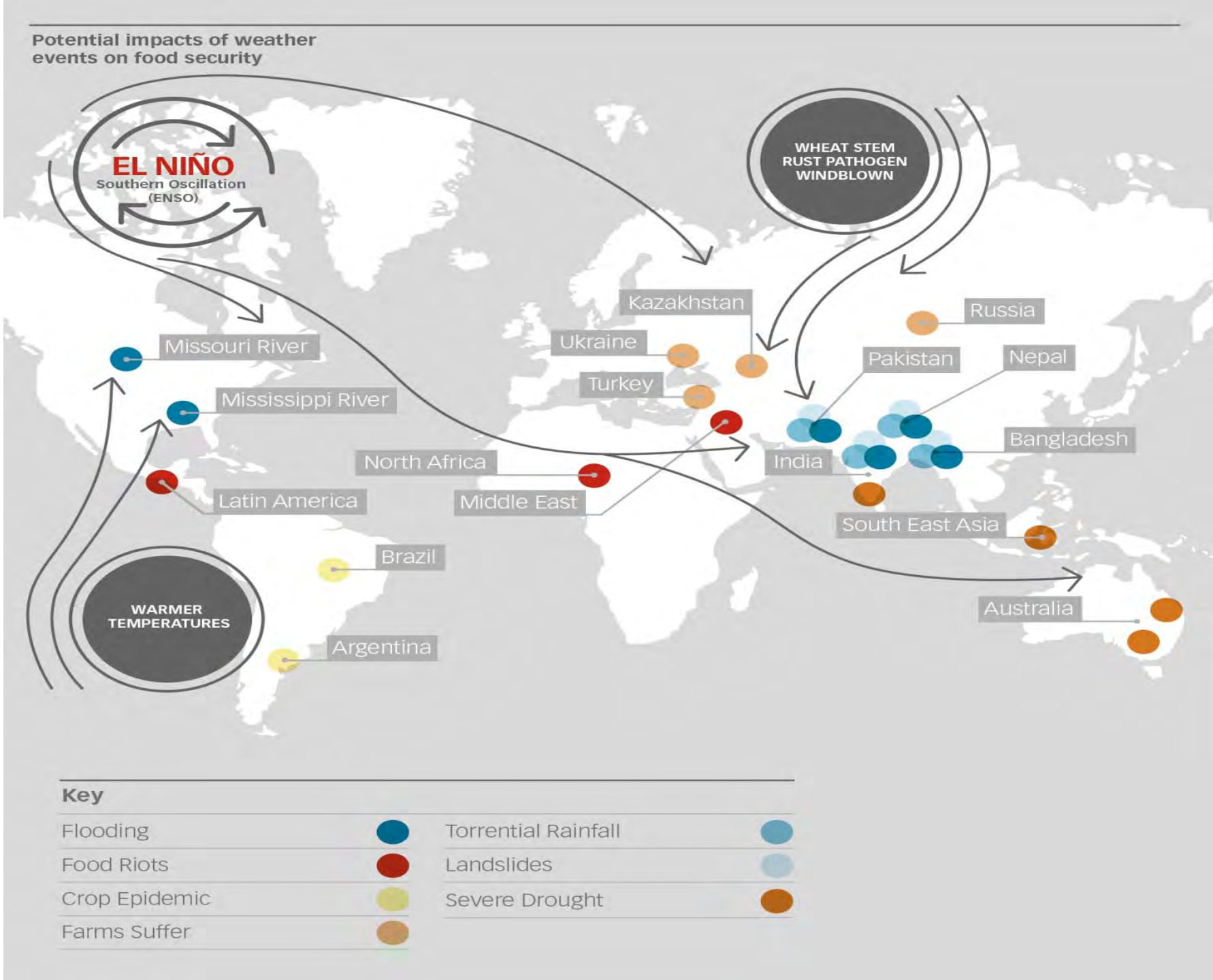



# Food Security

The world's population is expected to reach 9bn by 2050

Climate change is expected to increase the risk of extreme weather events

Modern societies depend on global connected food systems



# Insurance Impacts

Where do we see impacts within our sector

- Terrorism and Political Violence
- Political Risk
- Business Interruption
- Marine and Aviation
- Agriculture
- Product Liability and Recall
- Environmental Liability





# Stranded assets

The transition to a low carbon economy: overview for the insurance industry

- **Rise in potential from:**
  - Technology and regulation
  - Extreme events
  - Confluence of new risks may make some assets more prone to stranding
- **Significant and accelerating**
  - Rarely understood or considered
  - Significant benefits associated with managing these risks.

**Environmental challenges**
(e.g. climate, water, biodiversity)

**Falling clean technology costs**
(e.g. solar and onshore wind)

**Litigation & changing statutory interpretations**
(e.g. directives, state-aid, carbon liability, fiduciary duty)

**New government regulations**
(e.g. carbon pricing, air pollution regulation)

**Changing resource landscapes**
(e.g. shale, fertilisers)

**Evolving social norms**
(e.g. divestment) and consumer preferences

# Developing solutions – Disaster Risk Facility

$400m capacity for natural catastrophe risks:

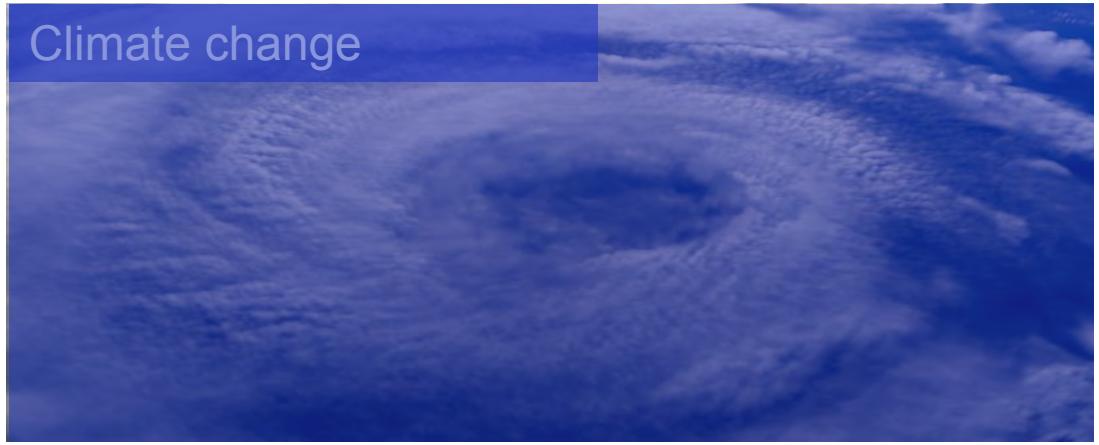






# Four megatrends

## Urbanisation






# Urbanisation

World cities population: 1990

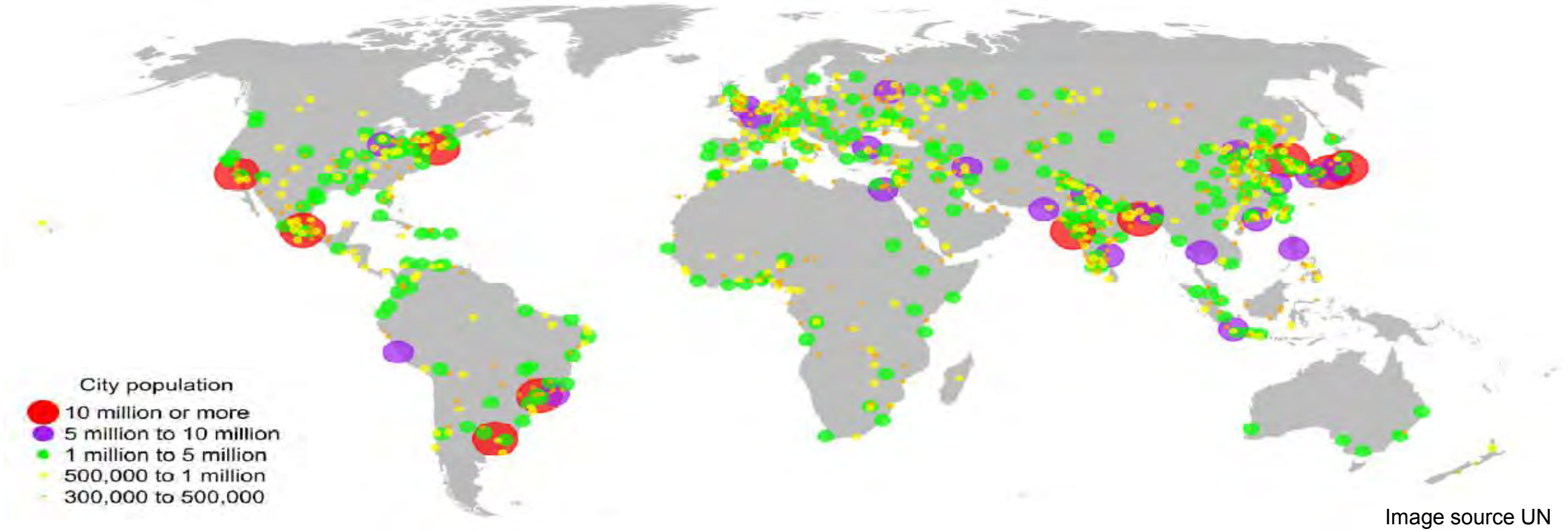



Image source UN

# Urbanisation

World cities population: 2014

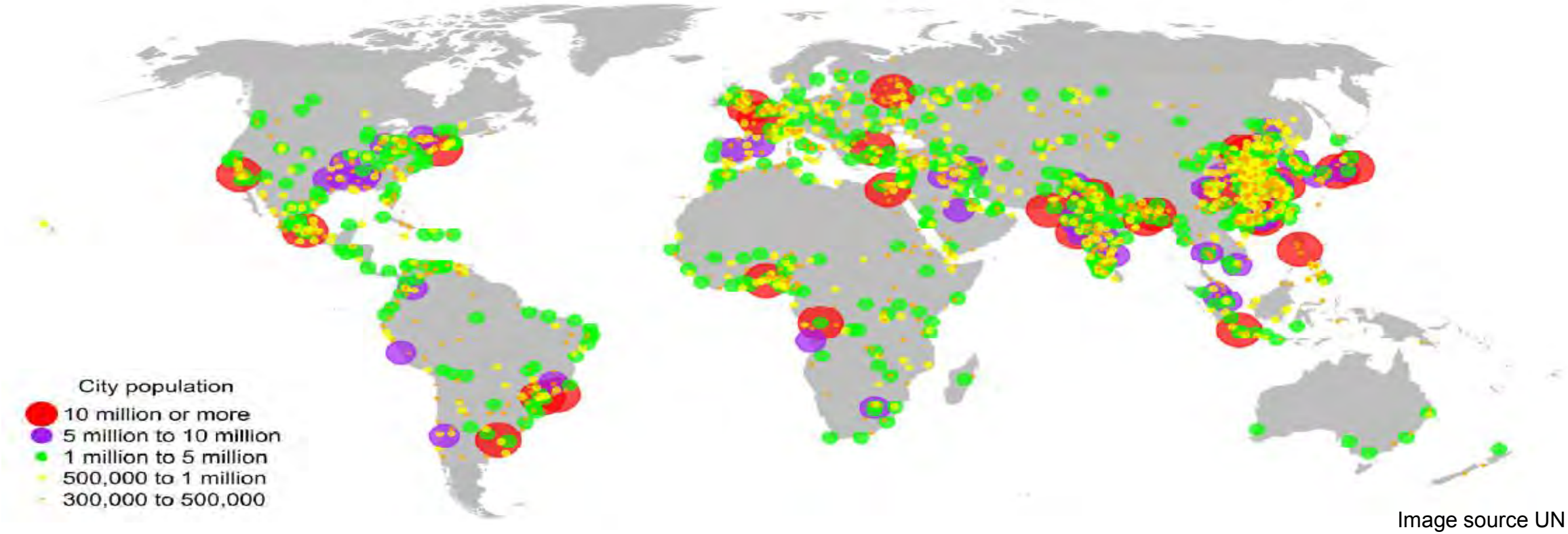



Image source UN

# Urbanisation

World cities population: 2030

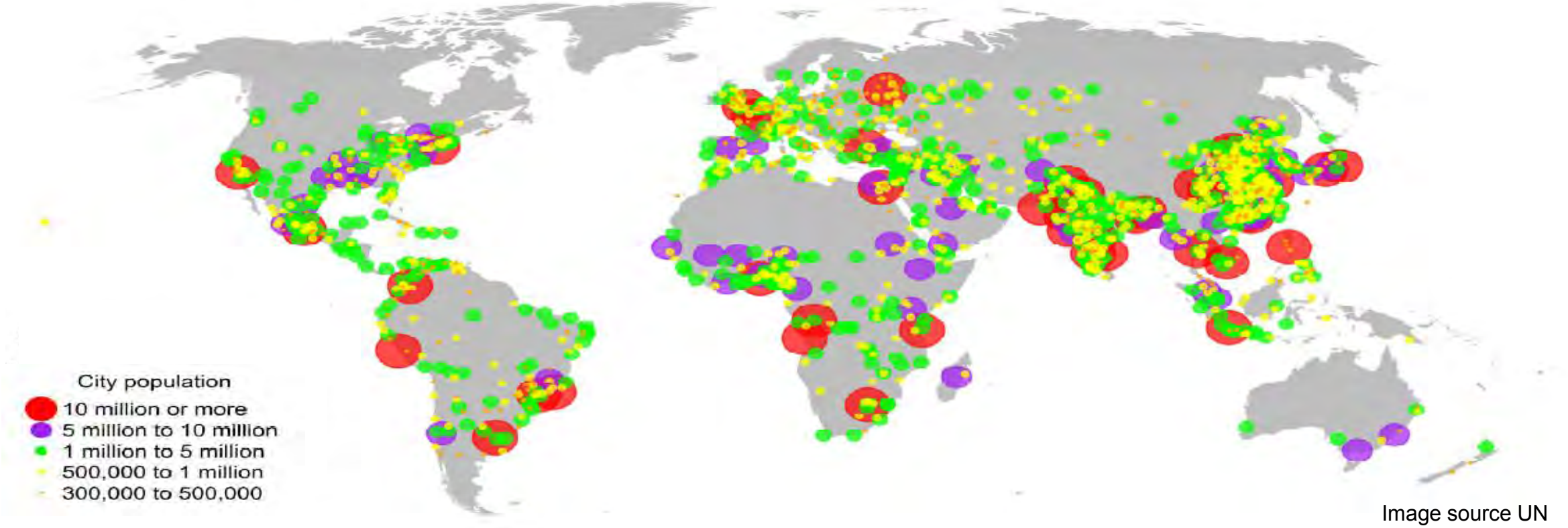



Image source UN

# Dubai 1990

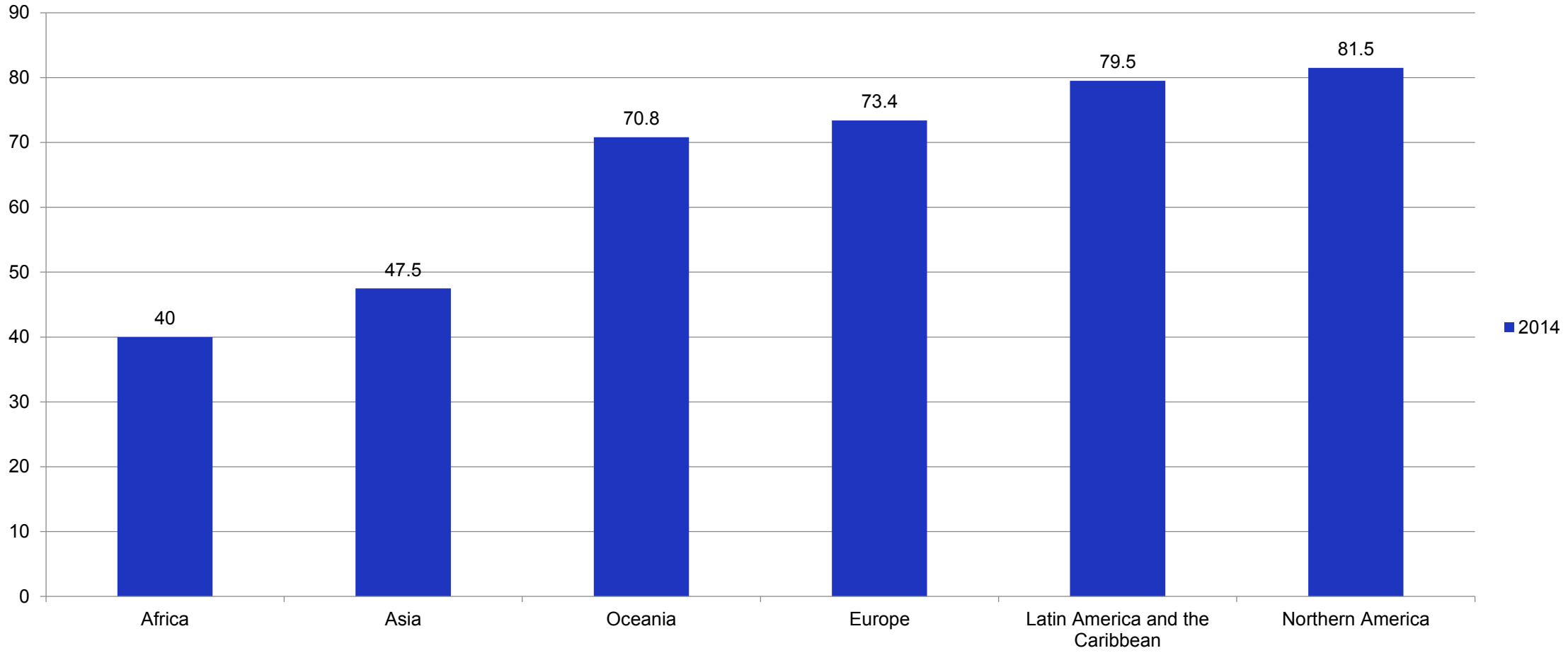
Sheikh_Zayed_Road

# Dubai 2004

# Dubai 2015

# Urban population

## % of total population in 2014

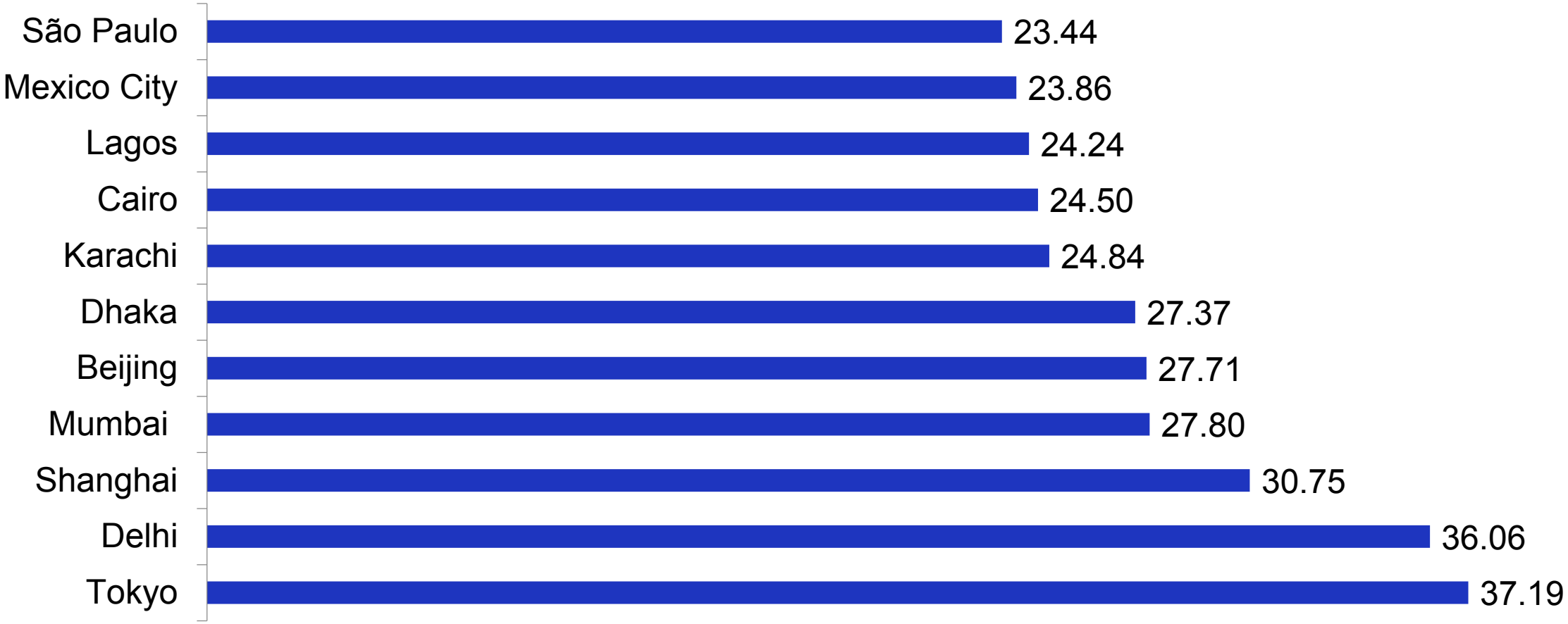





Source: United Nations Department of Economic and Social Affairs/Population Division.
World Urbanization Prospects: The 2014 Revision https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf

# World's biggest cities in 2030

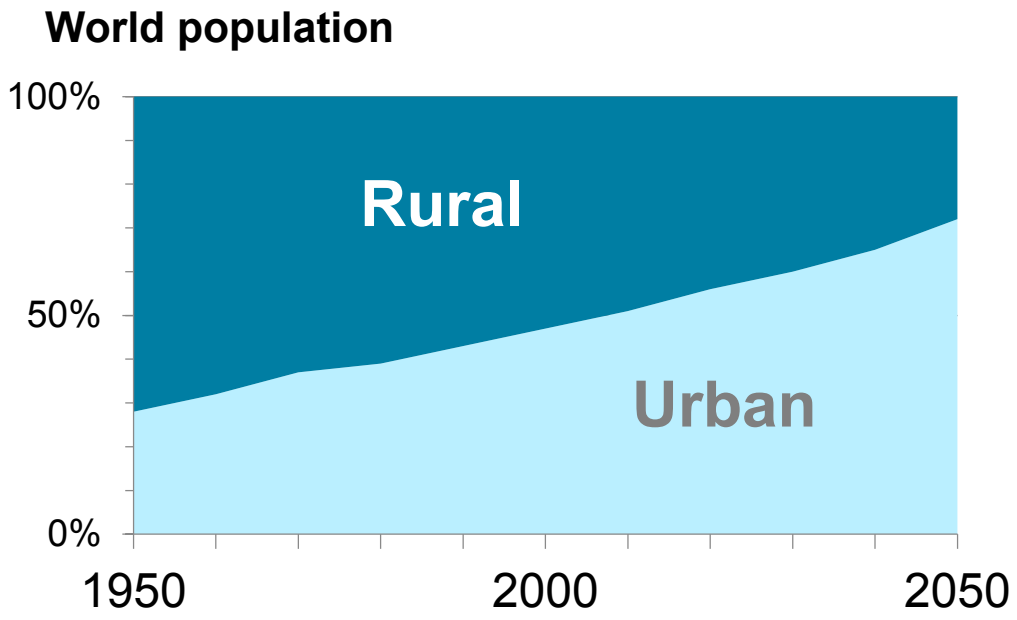
## Latin America

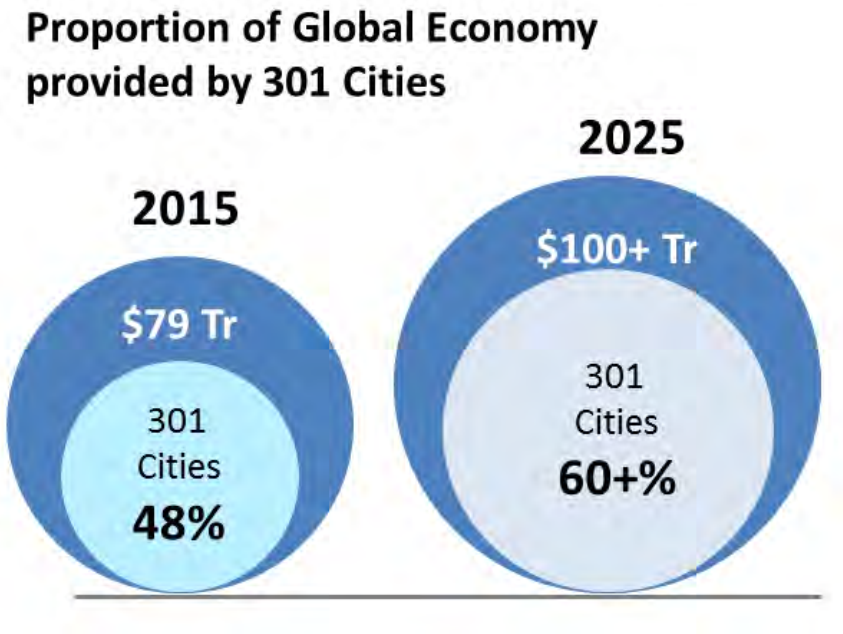





Source: United Nations Department of Economic and Social Affairs/Population Division.
World Urbanization Prospects: The 2014 Revision
https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Report.pdf

# Urbanisation of the economy




**For example…**

London economic region has increased its share of UK output from **15%** in 1960s to **45%** today

# Lloyd's City Risk Index

## **Total GDP@Risk All Cities:** $4.56trn

301 cities

50 cities analysed in greater depth

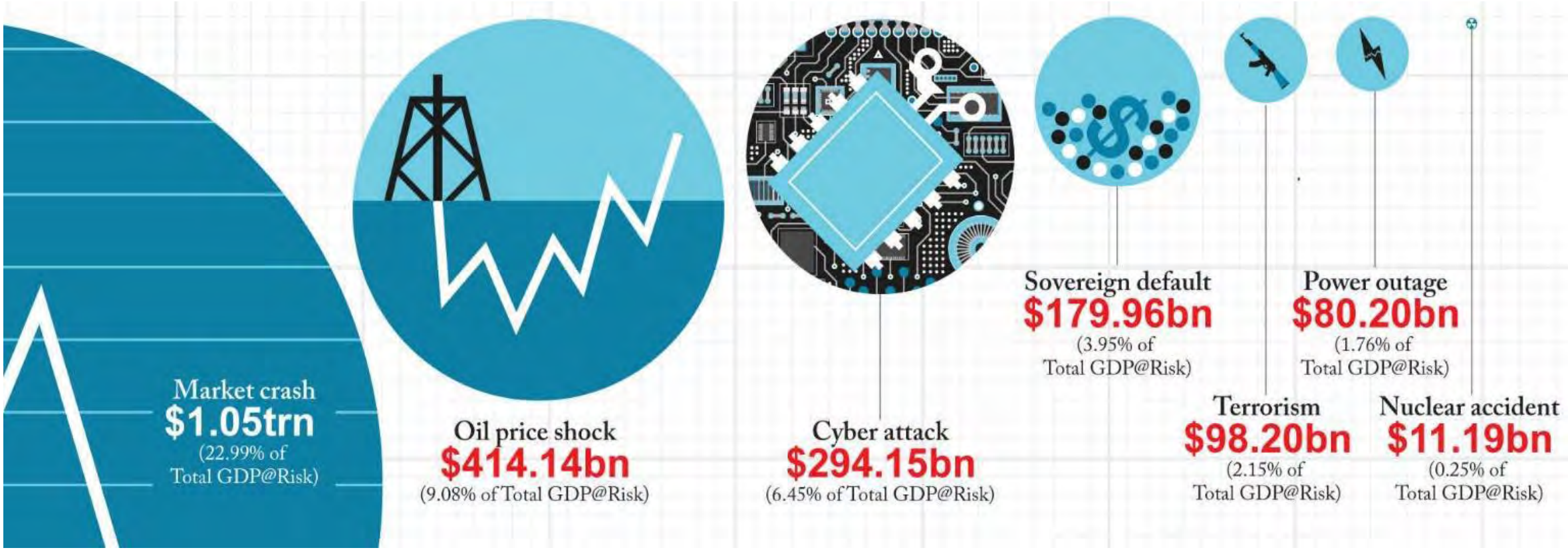
Downloadable city factsheets

Three threat types:

- Manmade
- Natural
- Emerging

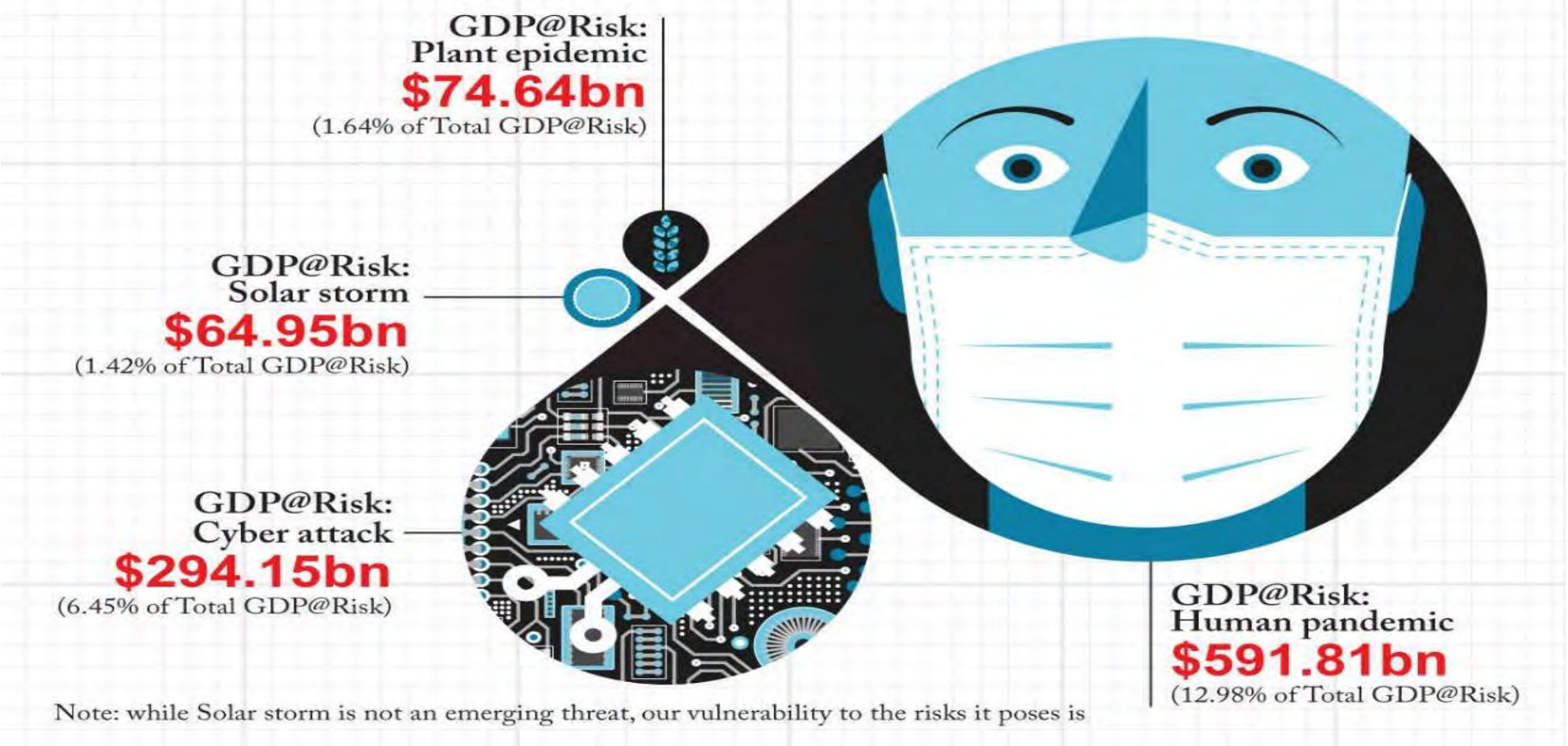
# Manmade threats are becoming increasingly significant

Total GDP@Risk: $2.13trn



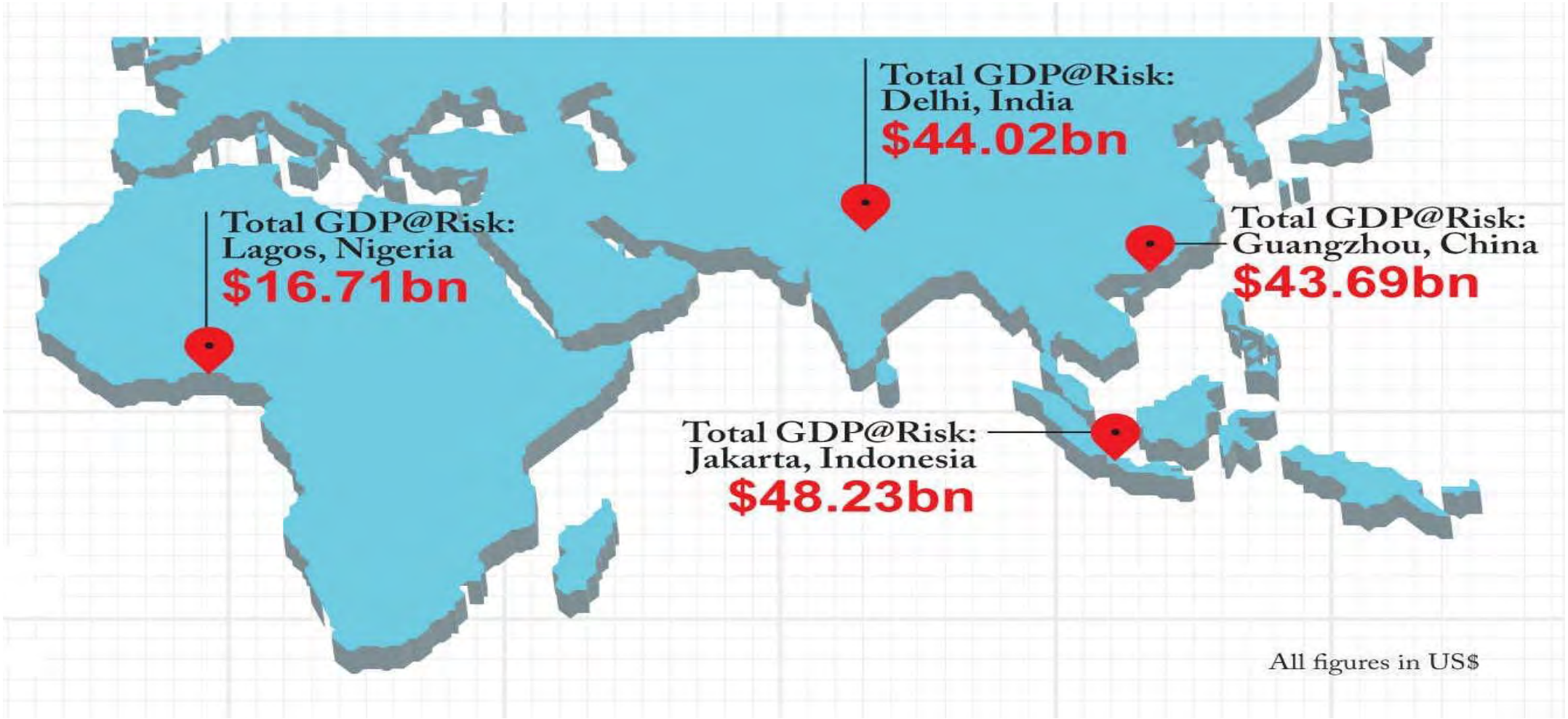
# New or emerging threats are having a growing impact

Total GDP@Risk: $1.03trn



# Emerging economies have the most to lose

Total GDP@Risk: $3.26trn

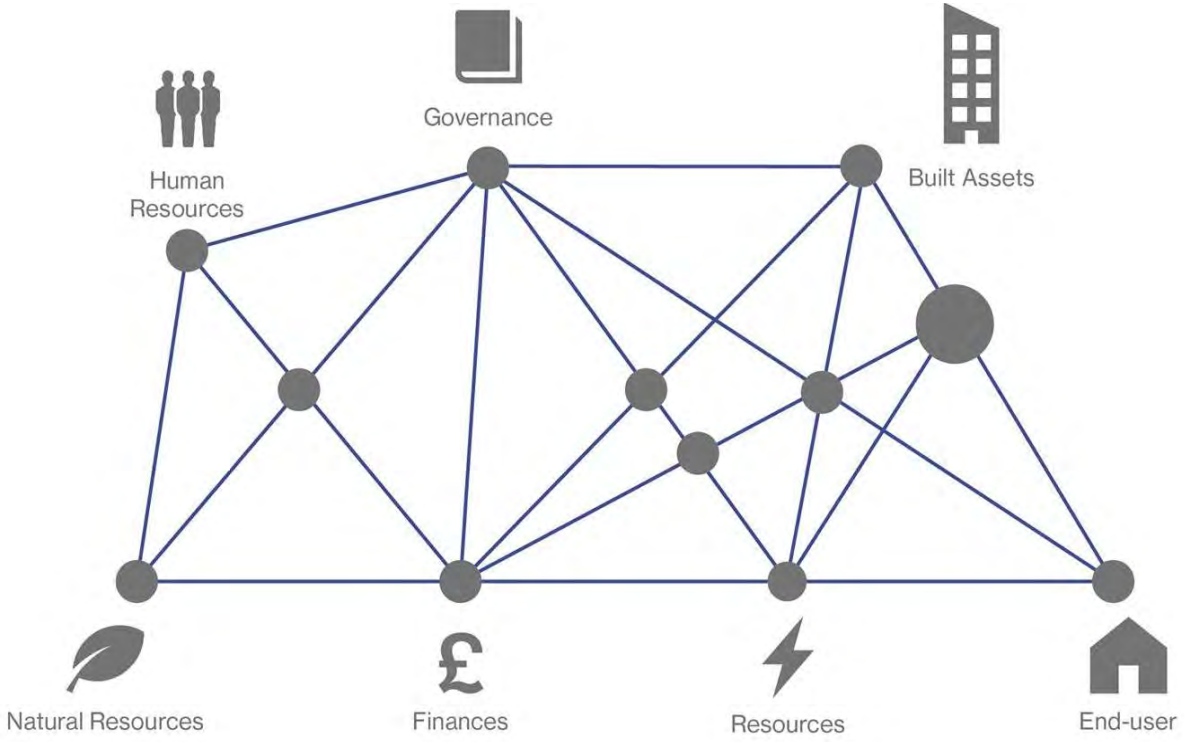


# Underwriting human progress has never been more important for cities

## Protecting growth and development by focusing on resilience

### Cities are complex and the cost of disasters is growing:

- Rapid economic development and urbanisation are key reasons for natural catastrophe exposure growth
- Cities must mitigate risks to protect development
- City infrastructure supports complex interconnections






Source: Lloyd's 2017 https://www.lloyds.com/~/media/files/news%20and%20insight/risk%20insight/2017/arup/lloyds_arup%20future%20cities%202017.pdf

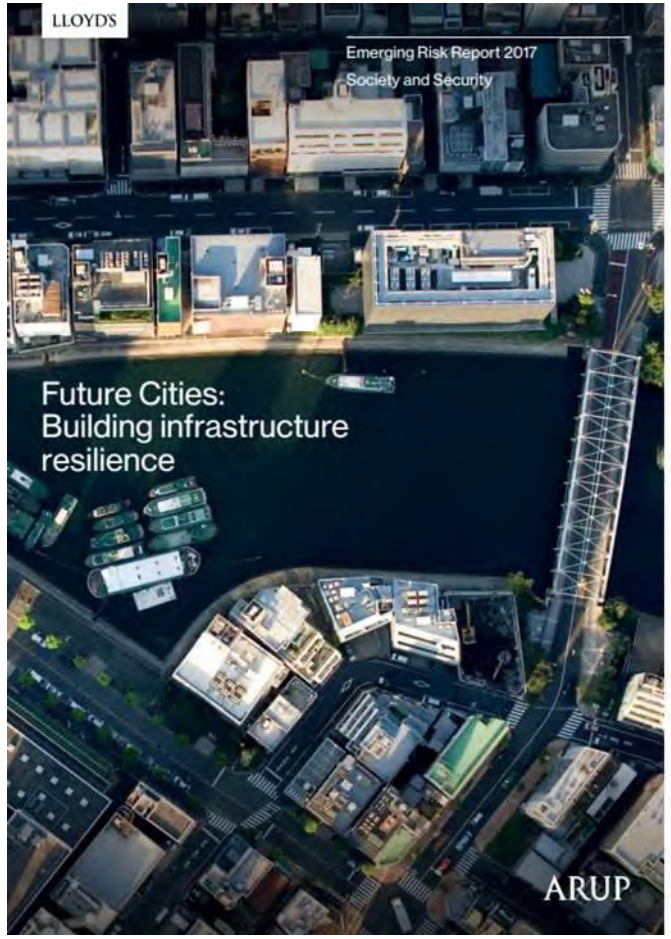
# Future cities – building infrastructure resilience

Category: Society and security; natural perils; manmade; global economy

**Key findings:** Clear pathways and principles to guide action; Building resilience requires collaboration; Nine areas for collective action to build city resilience

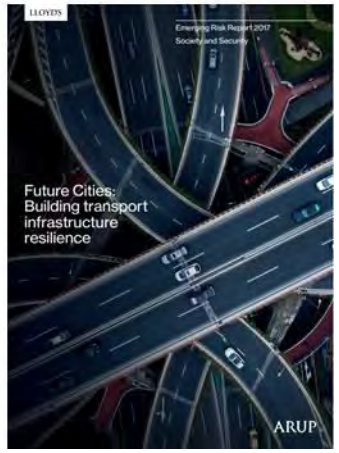
**Why?:** Cities are complex; complex interactions; risks and changings; keen to assess opportunities for insurance

**Partner:** Arup; Lloyd's market; sector experts



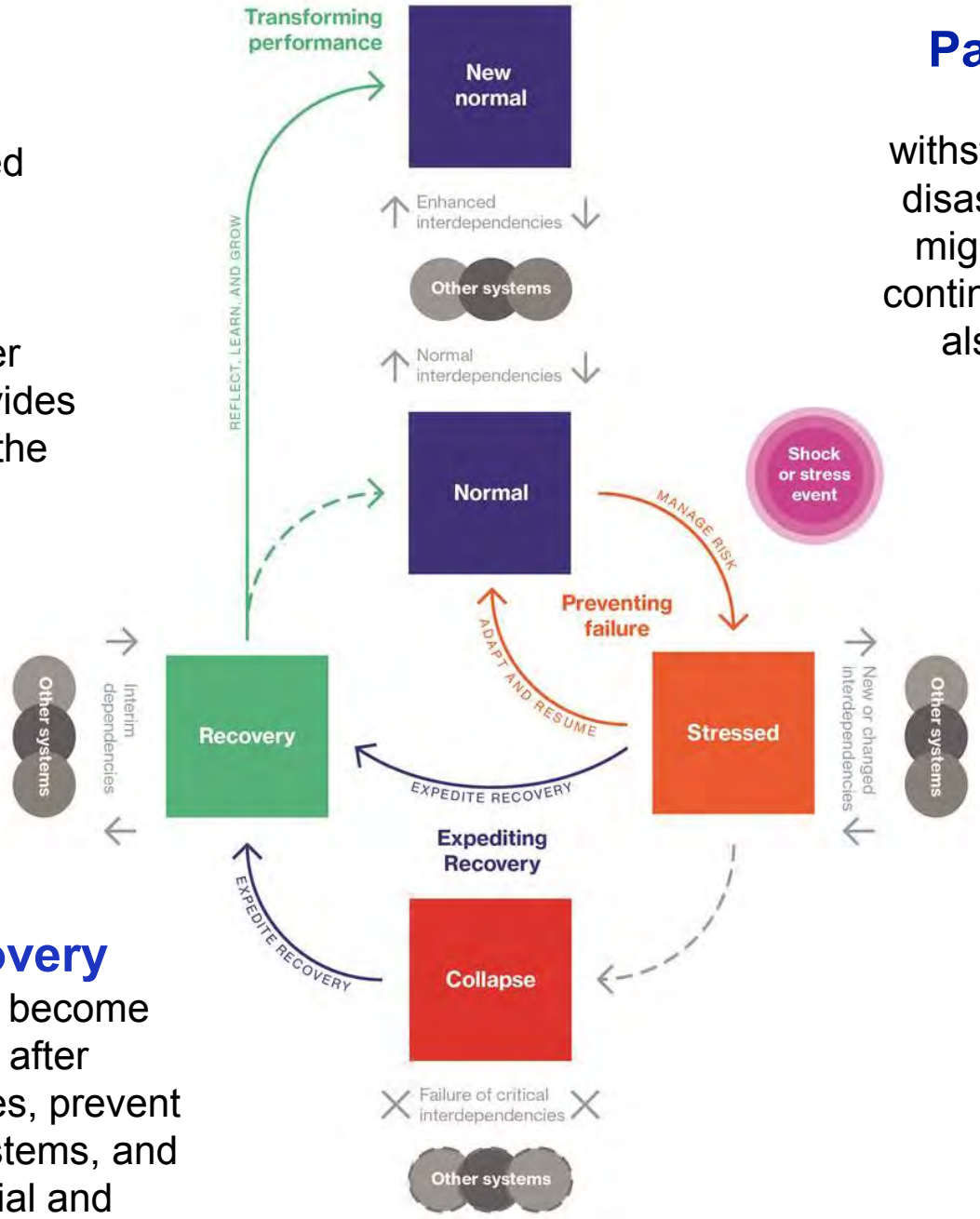






## Pathway 3:
## Transforming performance

Working towards a new and improved state, rather than simply reverting to ‘business as usual’. This requires reflection on successes and failures, learning, and growing. Recovery after infrastructure failure or collapse provides a crucial opportunity - although not the only avenue for such change.




## Pathway 1: Preventing failure

Ensuring infrastructure systems can withstand the direct and indirect impact of disasters. Though individual components might fail temporarily, the overall system continues to fulfil its normal functions, and also support any additional emergency demands that arise.

## Pathway 2: Expediting recovery

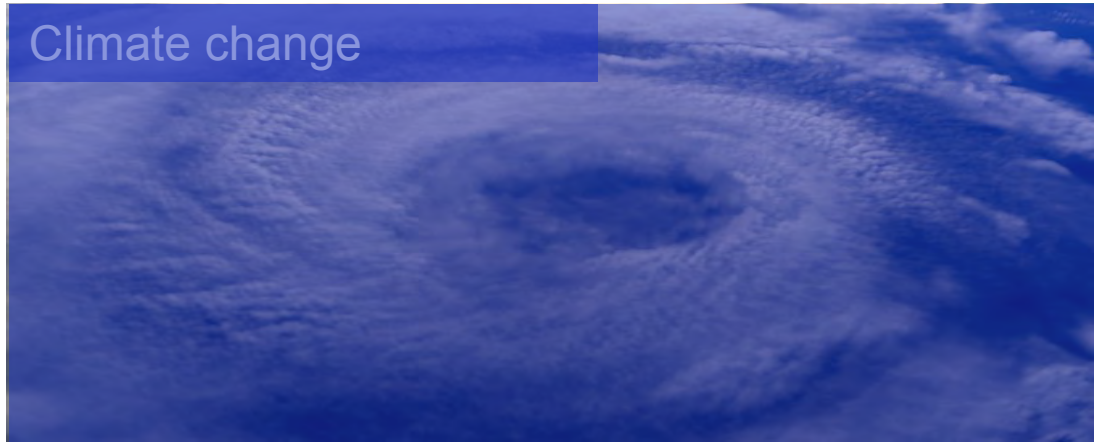
Supporting infrastructure systems to become functional again as soon as possible after stress or collapse. This can save lives, prevent ‘cascading failure’ of other urban systems, and minimise potentially-devastating social and economic outcomes.

# Nine areas for collective action to build city resilience

1. Improving data collection
2. Using this new data to quantify the risk and help inform stakeholder decision-making
3. Establishing metrics to enable the development of indices and models to assess resilience
4. Finding ways to incentivise investment by making resilience assessments available
5. Incentivising policyholders to take risk mitigation measures through risk-based pricing
6. Developing collaborative models and tools that provide a transparent, comprehensive and accessible approach to analysing and pricing risk
7. Encouraging the creation of indices that can be used by insurers to incorporate levels of resilience into the underwriting process
8. Creating shared understanding of how the components and stakeholders of cities interact and what the key areas and concerns are for each stakeholder
9. Considering resilience services which draw on facilities management, disaster recovery, build and operate contracts and insurance

# Four megatrends

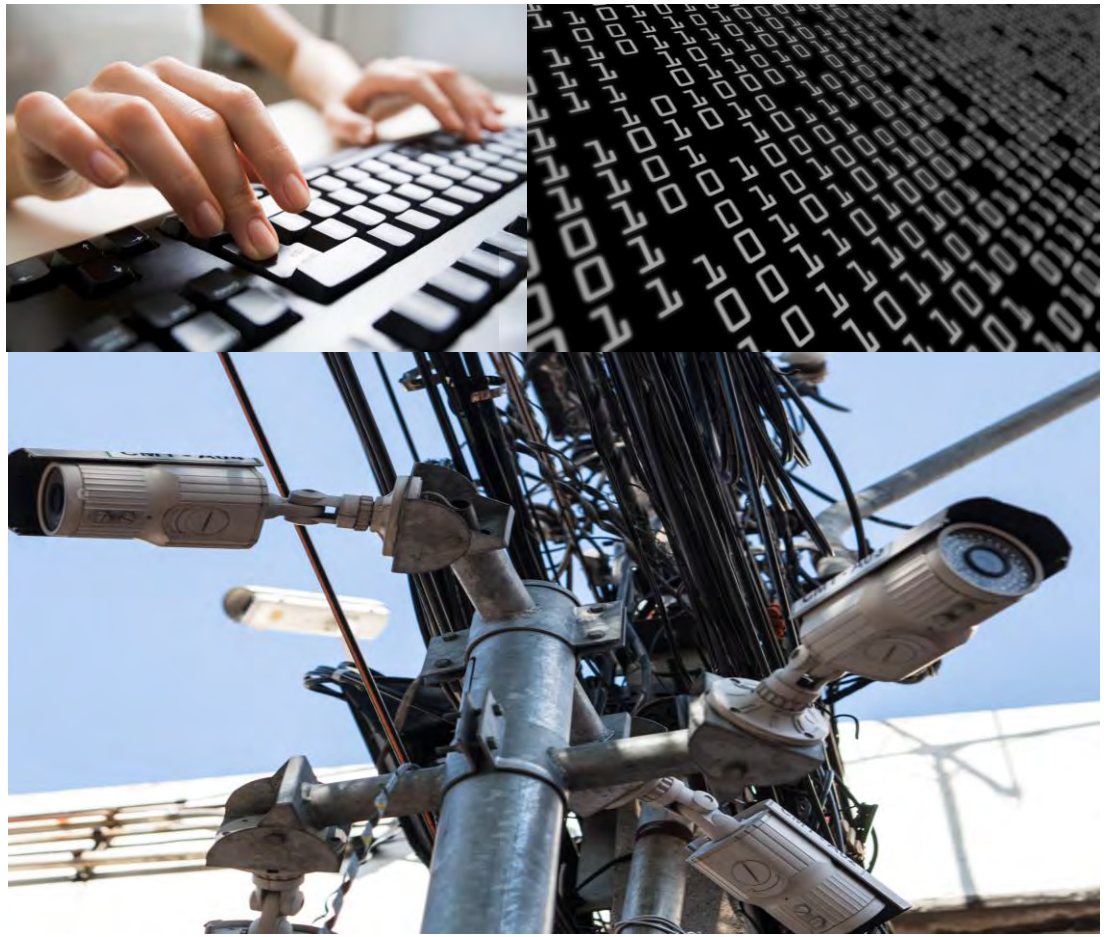
## Digital revolution






# Digital revolution

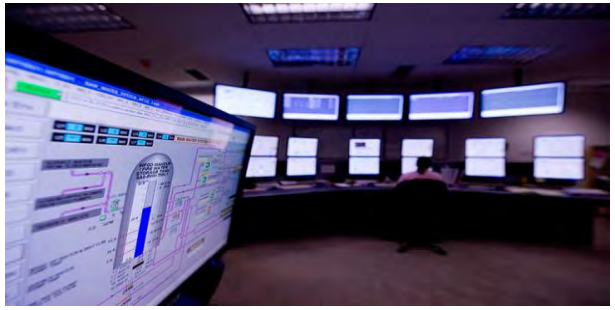
- Every aspect of our lives is becoming digital
  - Sharing economy
  - 'There's an app for that'
  - Internet of things
- The threat of cyber attack is growing and changing
  - Denial of Service
  - Virus and worms
  - Ransom ware
- Terrorism and ICT
  - Encryption wars
  - CCTV



# Erebos cyber blackout scenario

Fictitous event, but plausible

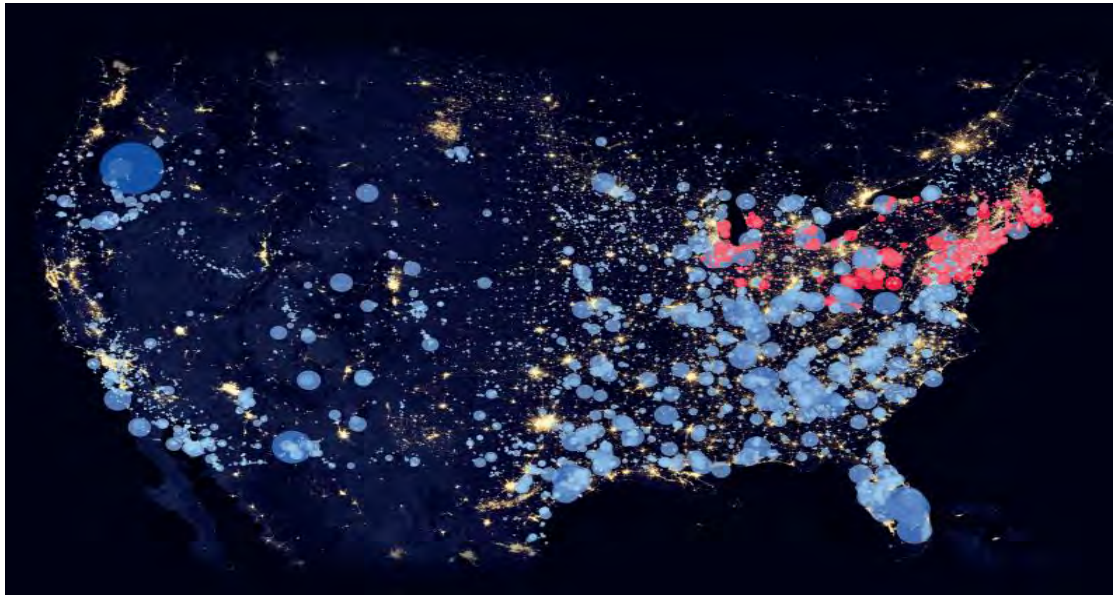
- On July 8 – during peak summer demand for electricity  there is a coordinated simultaneous attack targeted at two regions of United States power grid (NPCC and RFC)
- Malware finds 50 generators that it can control and forces them to overload and burn out
  - in some cases causing additional fires and explosions
- Electricity blackout that plunges 15 US states and Washington DC into darkness
- 93 million people without power
- More than 17 TW-Hours of generation is lost – around 12% of supply



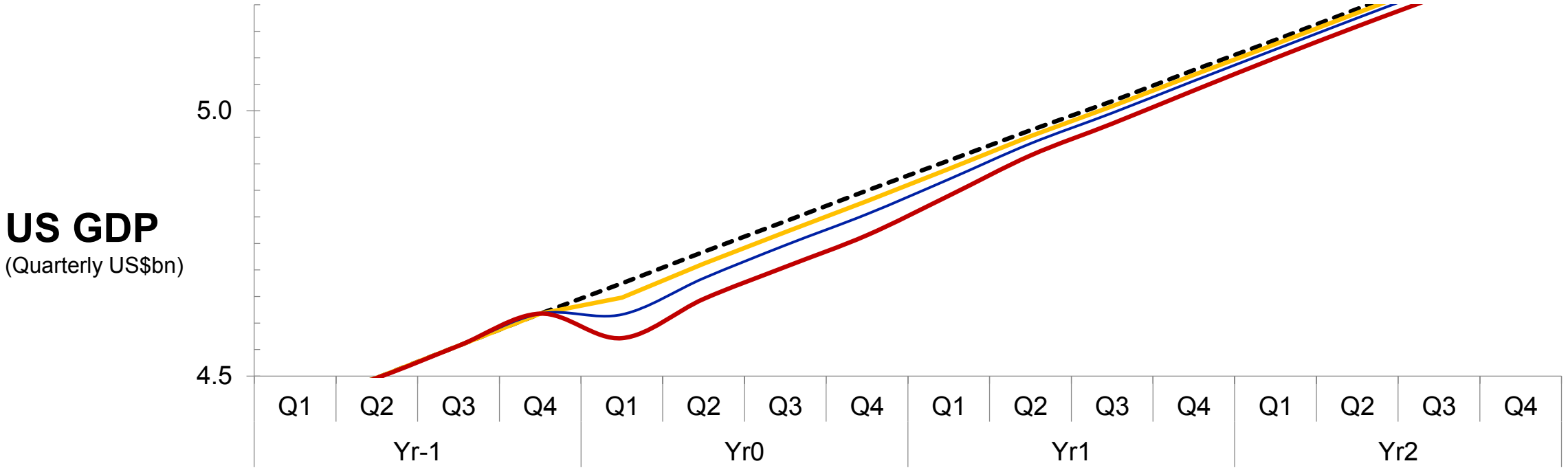
# Business blackout: Scenario creation

Year 1 | Year 2 | Year 3+

Research → Dormancy → Activation → Blackout → Aftermath



# Economic impact of blackout event




| Scenario Variant | Outage Duration (to 90% reconnect) | Consumption | Labour | Exports | Confidence | GDP@Risk (5 Yr) |
|---|---|---|---|---|---|---|
| **S1** | 2 Weeks | 0.6% | 0.6% | 1.3% | 5% | **$243bn** |
| **S2** | 3 Weeks | 1.3% | 1.3% | 2.8% | 10% | **$544bn** |
| **X1** | 4 Weeks | 2.2% | 2.2% | 4.9% | 20% | **$1,024bn** |

# Insurance loss estimates for Business Blackout scenario

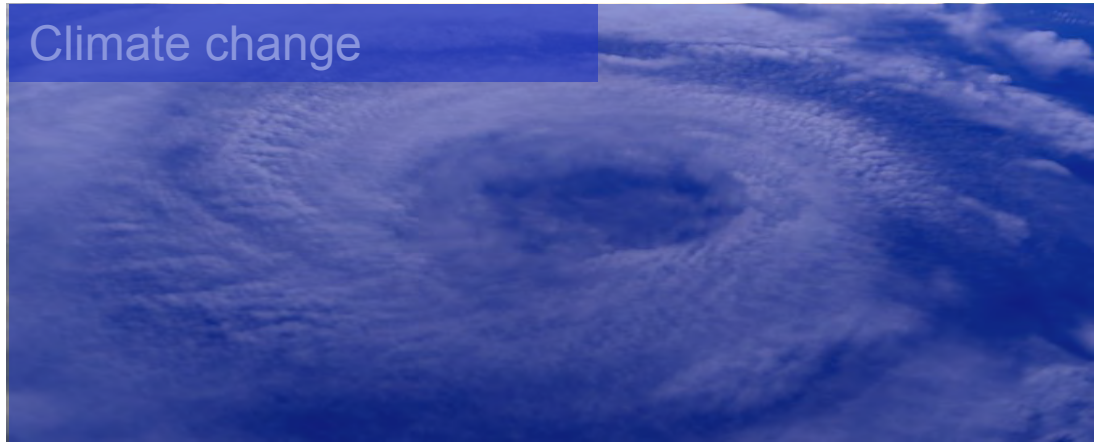
| Scenario Variant | Outage Duration (to 90% reconnection) | Number of Generators Damaged | Economic Output Lost GDP@Risk | Insurance Industry Loss Estimate |
|---|---|---|---|---|
| S1 | 2 Weeks | 50 | $243bn | $21.4bn |
| S2 | 3 Weeks | 50 | $544bn | $39.9bn |
| X1 | 4 Weeks | 100 | $1,024bn | $71.1bn |

For context - 2015 $ value :

- Total insurance catastrophe losses 2014 = $45bn
- Hurricane Katrina 2005: $80bn
- Tohoku Earthquake Japan 2011: $38bn
- Superstorm Sandy 2012: $37bn
- Hurricane Andrew 1992: $28bn
- 9/11 WTC 2001: $26bn

# Four megatrends

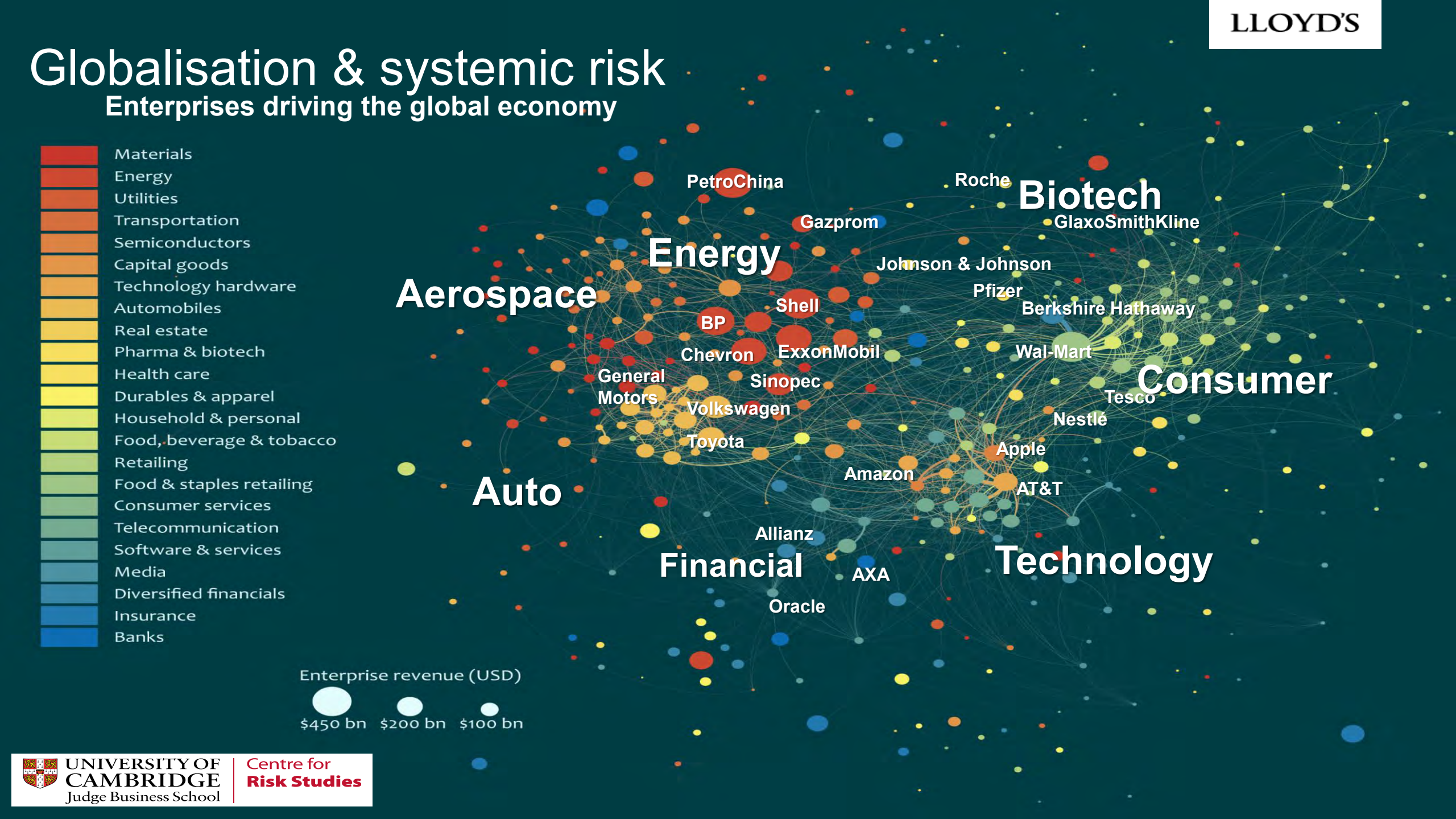
## Globalisation






# Globalisation & systemic risk

## Enterprises driving the global economy

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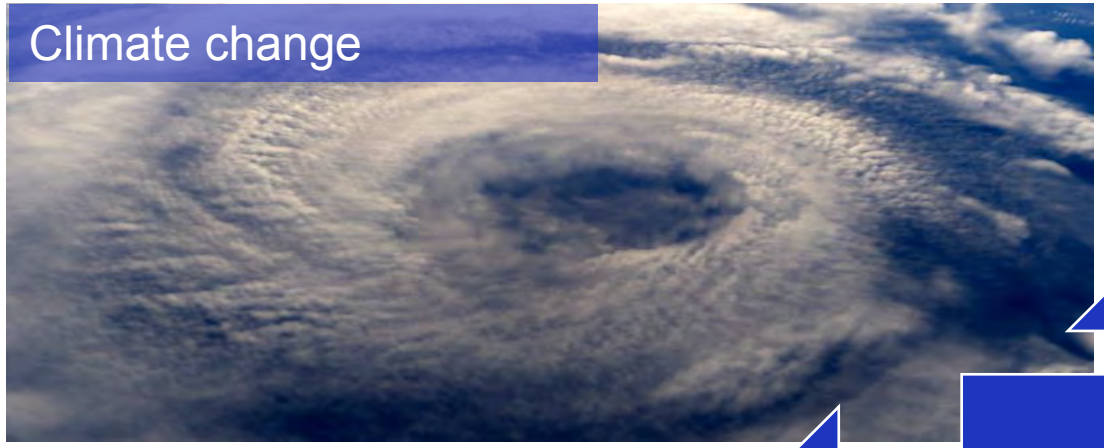
UNIVERSITY OF CAMBRIDGE Judge Business School | Centre for Risk Studies

# Four megatrends





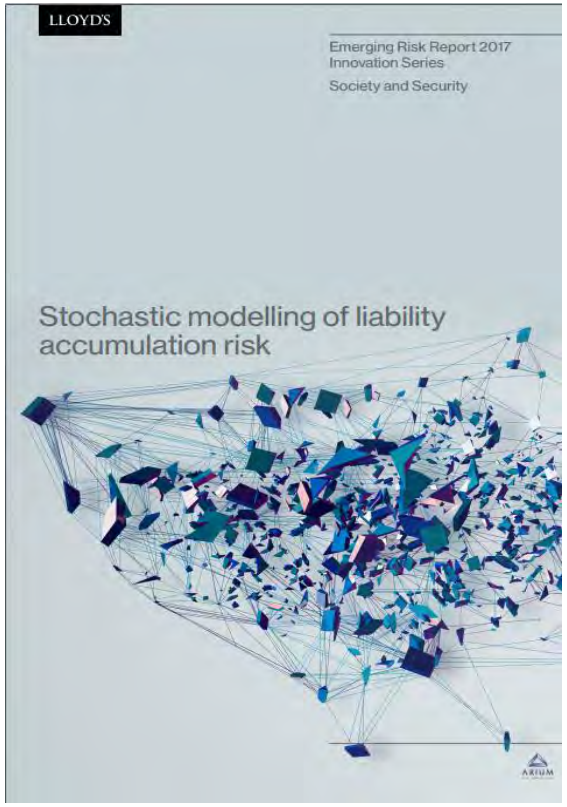
Understanding risk

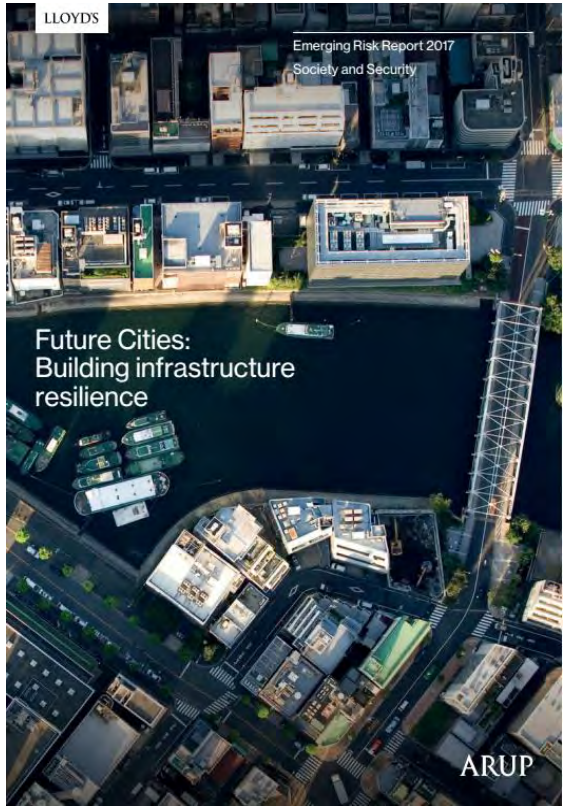

# Research outputs


PANDEMIC
POTENTIAL INSURANCE IMPACTS
ELECTROMAGNETIC FIELDS
RECENT DEVELOPMENTS
DIGITAL RISKS
SPACE WEATHER:
IMPACT ON EARTH
RISKS
THE HERBERT HOOVER DIKE
BEHAVIOUR
BEAR, BULL OR LEMMING?
CLIMATE CHANGE LIABILITY
HRT
EAST LONDON
EXTREME RAINFALL
RISKS
NANOTECHNOLOGY
RECENT DEVELOPMENTS, RISKS
AND OPPORTUNITIES
LONDON 2012
OLYMPICS 2012
RISKS FACING LONDON
SYNTHETIC
BIOLOGY
GLOBAL WATER SCARCITY
SPACE WEATHER
MANAGING RISK IN
THE 21ST CENTURY
GLOBAL RECESSION:
THE MAGNIFYING
GLASS FOR POLITICAL
INSTABILITY
CLIMATE CHANGE
AND SECURITY:
INSURANCE IN
DEVELOPING COUNTRIES:
EXPLORING OPPORTUNITIES
IN MICROINSURANCE
SUSTAINABLE
ENERGY SECURITY
CANCELLATION
ORDERS
AVAILABILITY
CREDIT
MAJOR ASSET PRICE
CURRENCY
FLUCTUATION
GLOBAL BUSINESS
LEADER SURVEY:
RISK PRIORITIES
AND PREPAREDNESS
FORECASTING RISK
THE VALUE OF LONG-RANGE FORECASTING
FOR THE INSURANCE INDUSTRY
MANAGING THE ESCALATING RISKS OF
NATURAL CATASTROPHES
IN THE UNITED STATES
ENERGY
DRILLING IN EXTREME ENVIRONMENTS:
SHALE GAS EXTRACTION:
A SPECIAL FOCUS ON HYDRAULIC FRACTURING
GEOMORPHOLOGY AND
CHANGING FLOOD RISK IN THE UK
ARCTIC OPENING:

# Published in 2017

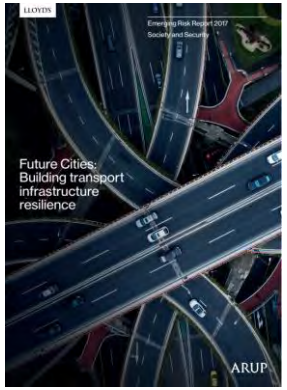
More coming up!





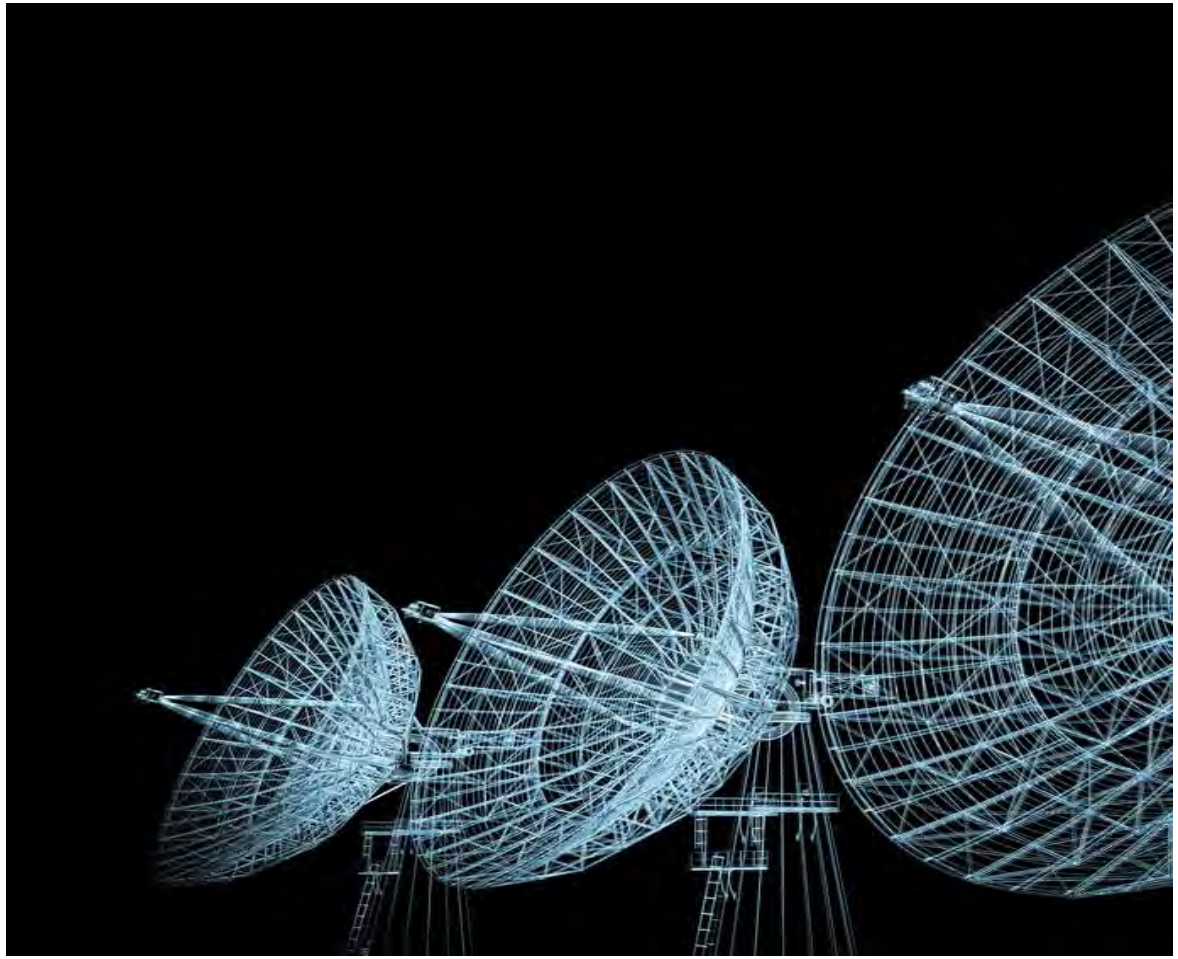


# On the Horizon

# Space

New actors in the space economy

- Brazil is developing technology to send domestically-made satellites into space with its own rockets by 2020.
- Elon Musk – Space X, reusable rockets
- Mining in space – Luxembourg. Harvesting resources from outer space!
- MBA grads – space economy
- Virgin Galactic and Blue Origin, space tourism





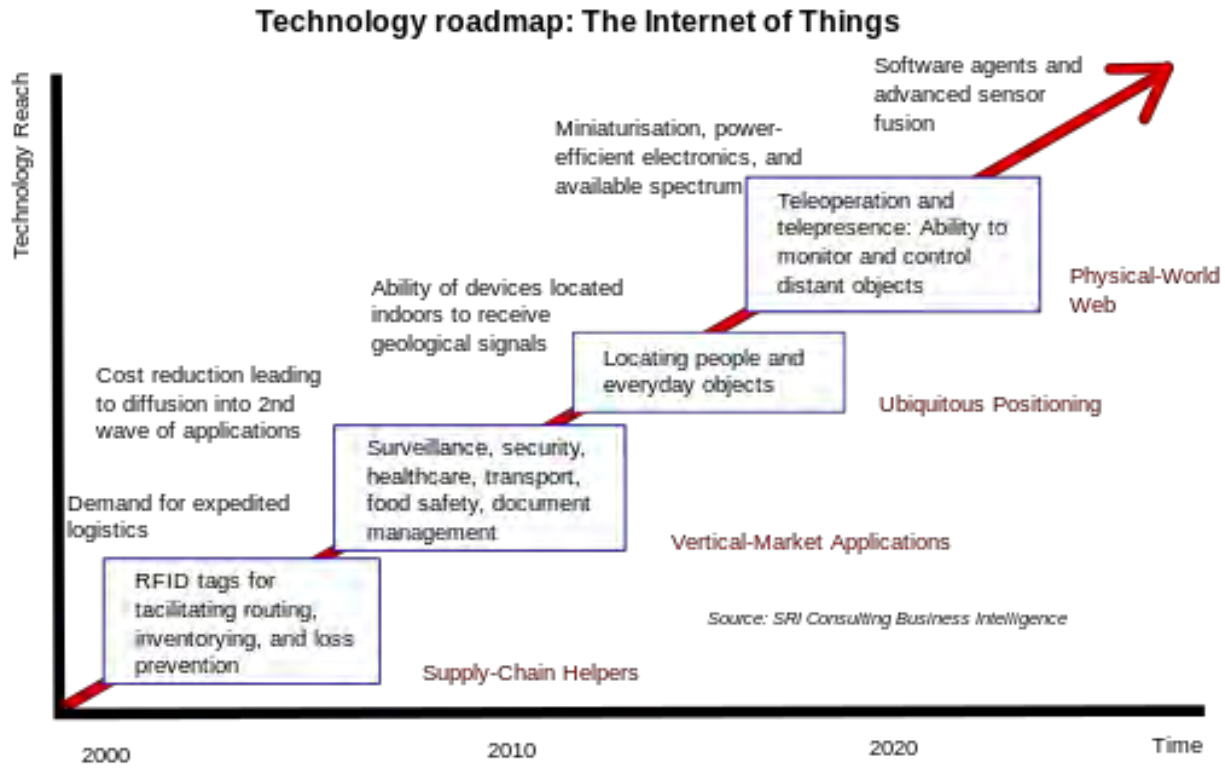
Source: Reuters 2017 http://uk.reuters.com/article/us-brazil-satellite-idUKKBN16T2BD
Sharing Earth Observations Resources 2016 https://directory.eoportal.org/web/eoportal/satellite-missions/p/perusat-1

# The Internet of Things (IoT)

Lifestyle and Cyber threat changes

When simple 'Things' become connected, we create a new complex system. Complex systems exhibit a number of characteristics:

- **Emergence** of new unexpected behaviours
- **Sudden transitions**
- **Large events** occurring from small changes
- **Self Organisation** and a resistance to being organised
- **Evolution** towards new norms



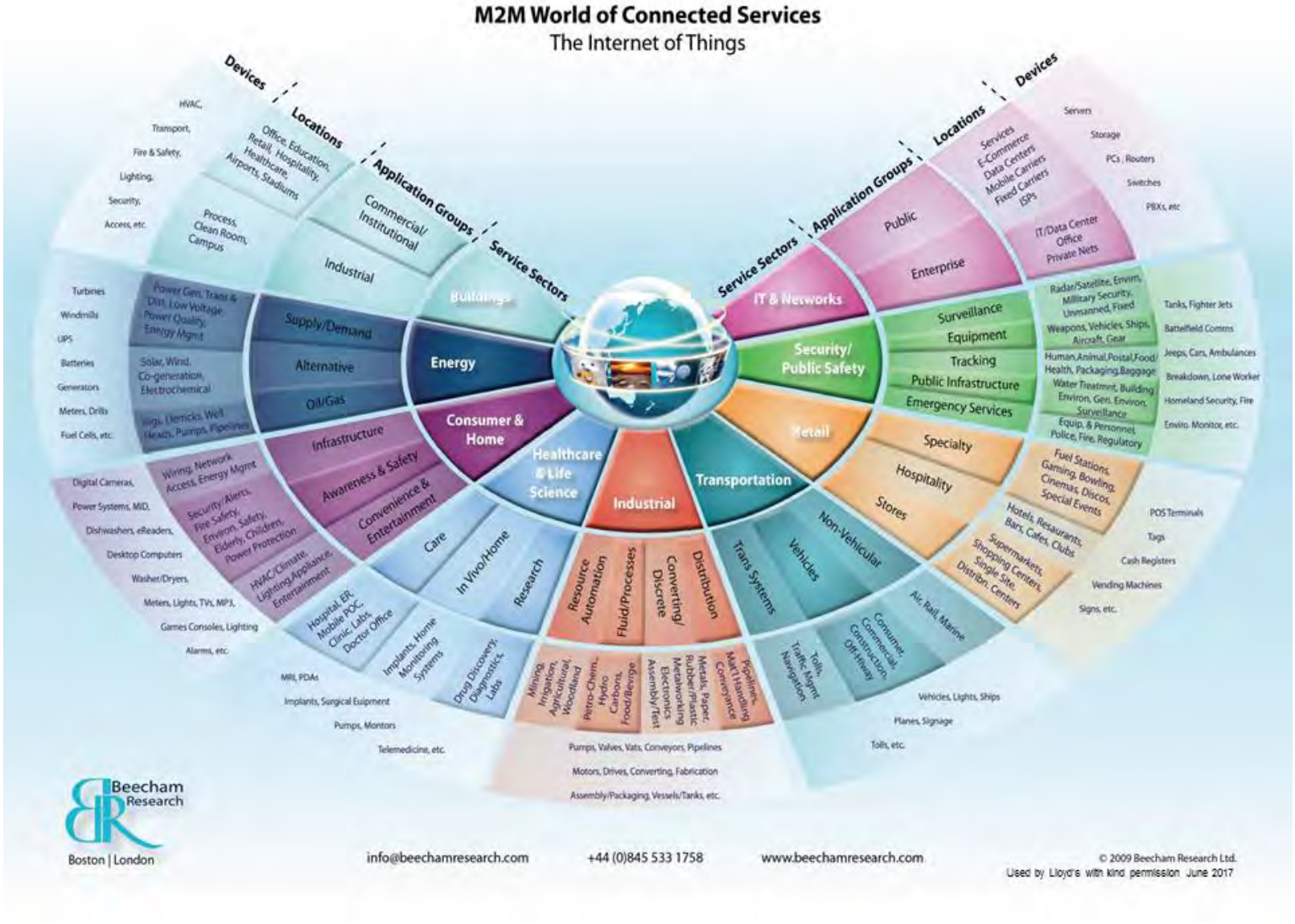

**Cisco estimate that by 2022, there will be over 50 Billion connected devices**

# Internet of Things

Connected Services

We will see new opportunities as a society but we will also see new threats

- Dyn attack in October 2016 used 'chipped' devices to launch a DoS attack
- San Francisco Transport system was a ransomware attack on connected devices



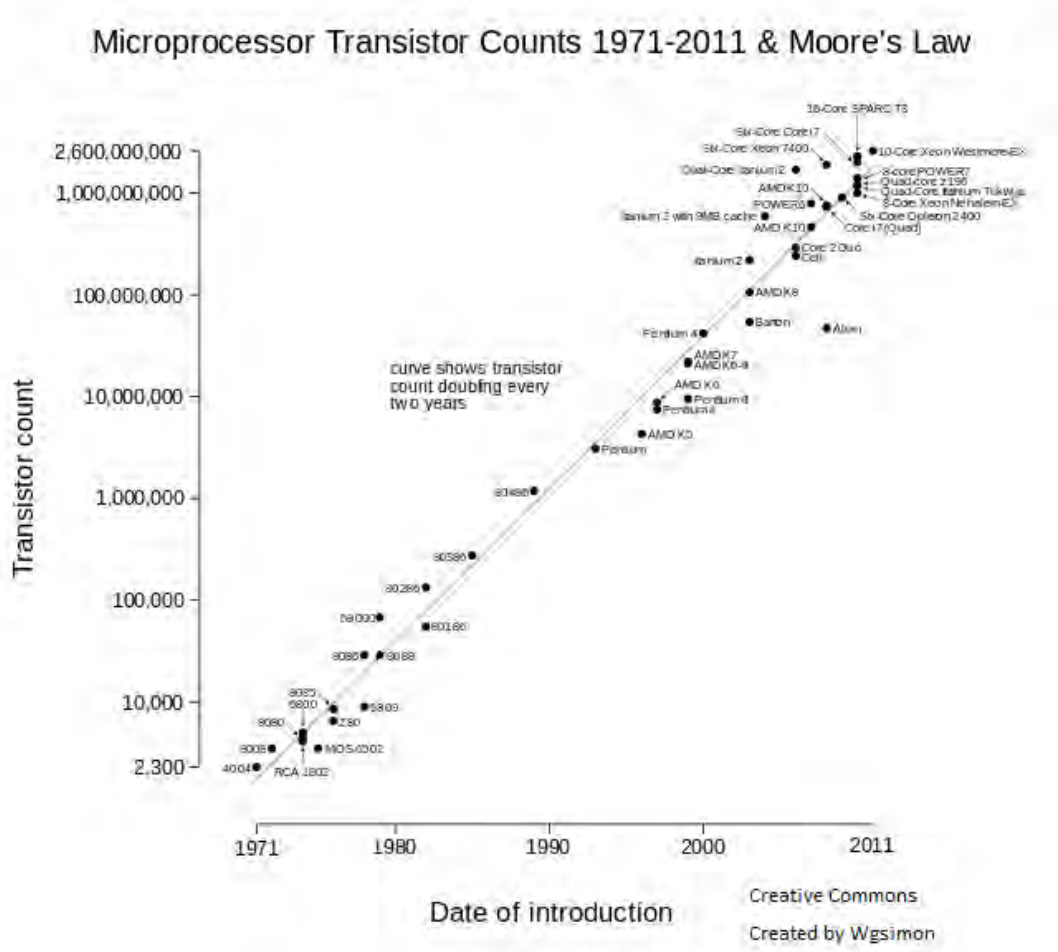
# Limits to Classical Computing

## The end of Moore's Law

Moore's law comes in many forms, but the most frequently quoted is that the number of transistors on a chip will double every 2 years. This is based on a view expressed by Gordon Moore who originally worked for Fairchild and later Intel.

Problem is, to double in such a way, the size of transistors needs to shrink exponentially. And when transistors get to be 5nm in size, quantum effects mean they will no longer work. Many feel we will reach this limit in 2025.

There are new transistor types on the horizon, but at the moment it looks like Moore's law has run its course.

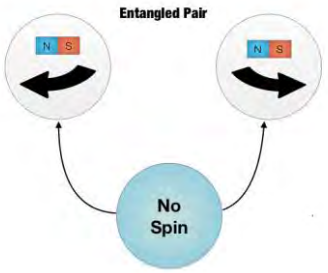


# Quantum Computing and Quantum Devices

A new approach to computation

- Classical computing uses Binary state electronics Bits
  - Switch on, switch off. 1 and 0.
- Quantum computers will use Qbits
  - At any point in time, providing it has not been measured, a Qbits can be a 0 and a 1 at the same time
- So what?
  - Quantum computers may solve problems not solvable using Classical computers because they have a high degree of parallel computation
  - Quantum computers are good at cracking codes. So current encryption methods will become “crackable”

0 1 0




EPSRC predicts that within 5 Years we will see:

- Nanoscale biological temperature sensors
- Single molecule MRI
- Gravity sensors
- Single atom image sensors
- Electromagnetic detectors

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# Conclusion

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- The focus of emerging risks management is to reduce uncertainty – not to predict the future
- By exploring and understanding uncertainty, risks can be explored to develop opportunities
- Key problem lies in challenging assumptions based on experience & behavioural bias
- Scenarios are useful tools
- A common theme in emerging risks is complexity driven by the pace of globalisation
- A lot more reports! http://Lloyds.com/emergingrisks
- And lots more to do ……

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# Thank you

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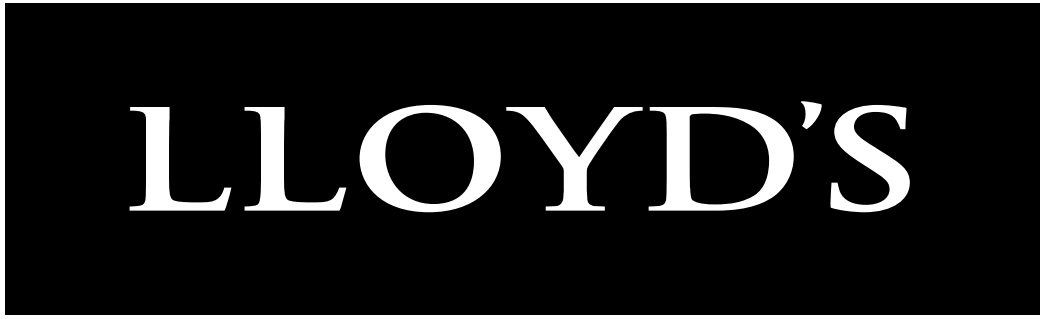
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