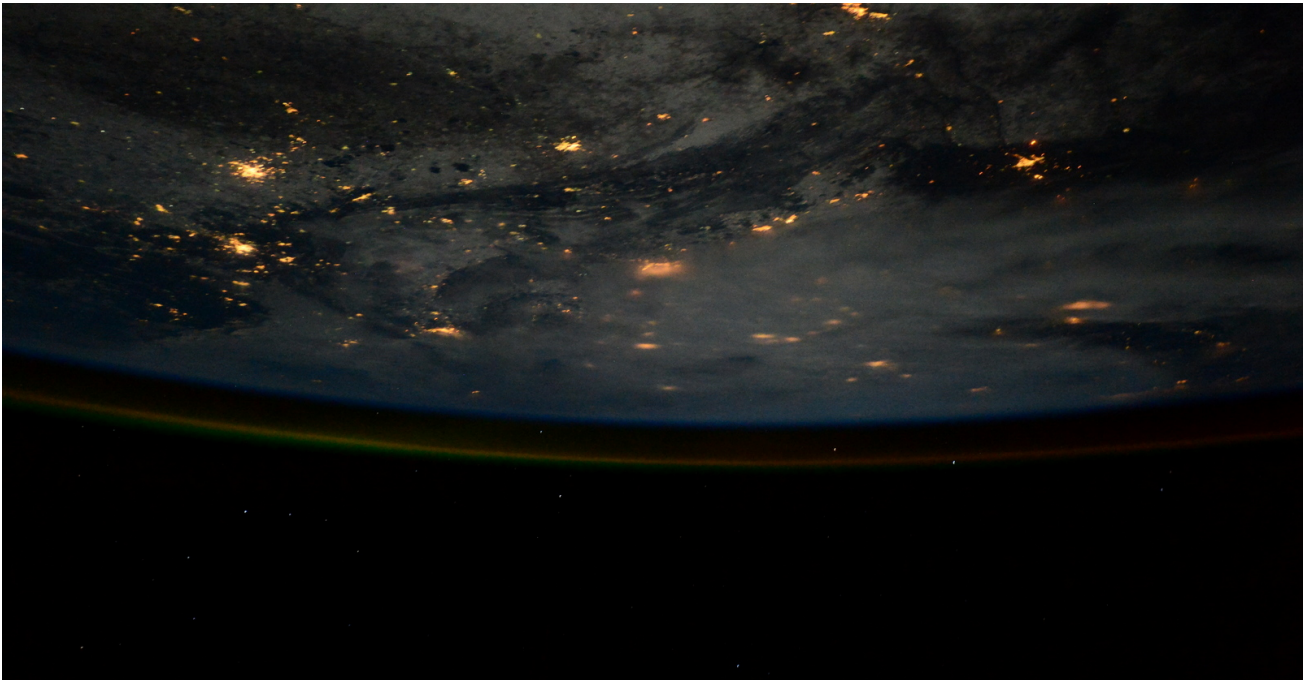### 19th January 2016: Taking a Global View

Research gaps

This forum examined what is needed to improve the ability of planning systems and decision makers to incorporate knowledge of risk into developing appropriate response measures and resilient systems for shaping cities. This encompassed the difference between developed and developing contexts and new ways to model risk.

Discussing earthquake risk, Professor James Jackson suggested exposed countries (mainly on the Pacific Rim) are well prepared due to greater wealth, awareness of the threat and actioned policy. The damage suffered is mainly counted in capital. Conversely, Continental Asia faces problems that lead to a high death rate after an earthquake. These include the following: the large geographic distribution of earthquakes (leading to local complacency); concentrated population in geologically sensitive areas; lack of communication between, or responsibility taken by, various stakeholders (e.g., scientists, engineers, policymakers and the public); reliance on baseless short-term earthquake prediction as a mitigation strategy; and competing short-term priorities. A complex mixture of corruption, poverty and particularly a lack of education must be tackled to rectify these problems.

Dr Elisabete Silva examined problems linked with risk, resilience, the planning system and datasets. Risk and risk reduction are complicated metrics and often need to be related to social economics. These create datasets that are aspatial and these can conflict with spatially explicit planning systems. Additionally there are conflicting scales of time. To successfully incorporate resilience the planning system needs to utilise dynamic data and metrics; however, most datasets and metrics currently used are static. To combat this, we need to create adaptive models and, in turn, flexible policies that account for changing scenarios produced by dynamic data.

Professor Danny Ralph introduced the work of the Centre for Risk Studies in assessing the risk of economic loss in 300 major world cities as a result of a wide variety of catastrophes (including earthquakes, pandemics, war, market crashes, etc.). A key aim is to make tools for visualising and managing systemic risk that can be used by ordinary firms and organisations. Such an assessment helps identify and confront areas where there is a lack of knowledge or models. It is crucial to try and discuss all threats to challenge gaps in current governmental and risk management thinking. A critical problem is the challenge of understanding resilience, particularly when a thorough assessment starts to extend towards broad topics such as social, commercial or legal mechanisms. Furthermore, translating resilience indexes into practical steps to build resilience needs further examination.

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Wicked problems and questions generated by the open discussion:

Dr Anand offered an extended comment on the first two witness perspectives. He highlighted recent research into the correlation between corruption and earthquake mortality and suggested there needs to be more preparedness and systems which enable quick responses to disaster. **Society as a whole needs to decide in a transparent manner what is considered an acceptable or optimal level of risk**, as not all risk can be mitigated. As things stand, redistribution after a disaster is favoured over mitigation beforehand, and this balance needs to be shifted. Engagement with public and private mechanisms is crucial for this process. With regards to the data dynamism in planning systems, Dr Anand had three questions: **can we adapt static datasets for quasi-dynamic usage**, **can planning systems and decision-making become dynamic in their responses to data,** and **can planning systems adapt to the dynamic expectations of various individuals to shape a city?**

How can we make planning systems more adaptive? Big data combined with dynamic data means that modelling scenarios are constantly being updated, but often planning systems are not flexible enough to incorporate these changes without substantial delays. Perhaps a more flexible system incorporating certain milestones will allow dynamic models to be fully utilised.

How can knowledge about risk and resilience be shared at an urban planning level? Cities and institutions are not effective at learning from each other. Risks such as telecommunication issues after a disaster or air traffic control issues in cities with central airports are entirely predictable but experience is not effectively imparted to other decision makers.

What is the role of insurance in creating resilience? The population is generally not fully aware of risk which can lead to complacency when rebuilding or creating mitigation measures. Planning is crucial to increasing resilience, but integrated development plans are not always put into practice. The insurance industry and the development process need better cohesion at government and developer or constructor levels. Social insurance as opposed to private insurance is also a possibility that should be considered. A related question is **how can we overcome short-term timeframes?** Insurance policy and modelling practices or government election cycles can mean long-term resilience is overlooked.

How can we increase levels of community trust and cohesion at all levels of society? A collective response helps a community cope with a disaster. Additionally, in terms of mitigation strategies, the public need to understand and trust decisions concerning when an area can or cannot be protected from disaster on account of cost or resources.

What is the relationship between different catastrophes? Having two successive 1 in 50 year events may increase or decrease the overall effect of the catastrophe and the relationship between events needs further modelling. **How can we model direct and indirect effects of catastrophes on areas outside the original impact centre**? For example, the Icelandic volcano, Eyjafjallajökull, affected air transport across Europe and a pandemic, war or economic crisis would have wide-ranging impacts. This introduces more complexity and uncertainty into a model.

How much redundancy or resilience should be built into infrastructure? There is a balance between added cost versus the reduction in risk. Unexpected shocks to a system can have an overwhelming effect as properly implemented engineering construction usually performs well when dealing with known risk, as opposed to unforeseen events. Where the consequences of disaster are high or functionality will be needed post-disaster, such as in a nuclear power plant or hospital, it is preferable to overdesign buildings. However, overdoing this approach can have unintended consequences; for example, too much rigidity in a building affected by an earthquake may cause such internal damage that the building is rendered dysfunctional.

How do we introduce redundancy into social systems? Redundancy in physical systems is relatively easy to model. But incorporating elasticity into socio-economic systems is more challenging and often overlooked. Expecting logical behaviour from individuals in a crisis is unrealistic. Thus, better preparation on the behalf of planners is needed so that physical resilience measures are used appropriately.

Witness profiles

Professor James Jackson
Professor of Geophysics, Geodynamics and Tectonics, Head of the Department of Earth Sciences, University of Cambridge

James is an earth scientist whose work mainly attempts to understand the deformation and geological evolution of the continents. He uses earthquakes, space-based geodesy and imagery, as well as observations of landscape and Quaternary geology, to investigate the tectonic processes that shape the continents. He is part of the Dynamic Earth and Geohazards group (formerly the COMET project), the National Centre for Earth Observation and the Centre for the Observation and Modelling of Earthquakes and Tectonics. He is also the lead PI on the Earthquakes without Frontiers Project, a joint NERC-ESRC consortium working to help increase resilience to earthquakes in countries in Asia.

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Professor Danny Ralph
Professor of Operations Research, Academic Director of the Centre for Risk Studies (CRS), Judge Business School, University of Cambridge.

Danny is a founder and director of the CRS and Professor of Operations Research at Cambridge Judge Business School. He is also 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. He is interested in risk aversion in electricity markets, risk in business decision-making and methods and models for optimisation problems and equilibrium systems.

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Dr Elisabete A Silva
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Elisabete's research interests are centred on the application of new technologies to spatial planning, especially city and metropolitan dynamic modelling through time. She is a Fellow of the Royal Institution of Charter Surveyors, a member of the Royal Town Planning Institute, the Chair of the AESOP NTTG research working group and is currently the Chair of the AESOP "Best Paper Price Committee" which nominates the best annual paper published amongst 48 peer review journals.

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Dr PB Anand
Reader in Environmental Economics and Public Policy, Bradford Centre for International Development, University of Bradford

Dr Anand is a specialist in environmental economics and public policy for promoting equality, human development and sustainability. He has over 25 years experience including 8 years in public and private sector positions. Countries of his expertise include: India, China, Mongolia, Tajikistan, Nigeria, Ethiopia and the Caribbean. Amongst other activities, he was the team leader and principal author of the Mongolia National Human Development Report 2011 for UNDP and has been instrumental in developing a strong link with China Development Bank and Barclays Capital.

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