

## IOAF workshop on Infrastructure dependencies and interdependencies

30 October 2017

### Summary of discussions

#### 1. Introduction

IOAF Working Group 5 (WG5) has been making progress on developing a tool to help identify and assess infrastructure dependencies and interdependencies. There is now agreement within the WG that the proposed matrix-based approach could provide a practical means of identifying and mapping interdependencies, and of capturing supporting evidence towards identifying solutions (e.g., adaptation measures).

This workshop looked to explore the potential utility of this approach more widely with IOAF members, and to consider options for developing the matrix further to better meet organisational requirements.

#### 2. Potential uses within individual organisations

It was noted that there are many ways of using the matrix. One possible approach could be to map the current, baseline situation with respect to interdependencies and then to overlay extra stresses caused by, for example, the impacts of climate change, and to aggregate up. This could help identify where interdependencies and priorities change in both the short and long term. The next step would be to quantify the risks identified and/or to use the matrix to compile an evidence base to inform solutions.

A range of strengths and weakness of the matrix approach were identified:

##### a. Strengths

- Provides a useful approach as companies are used to working with matrices from a risk management perspective.
- Provides a common framework and starting point, facilitating cross-sector and cross-departmental comparability.
- Flexible. Can be used at different levels depending on organisational maturity with respect to adaptation, available data etc.
- Can be used at different levels of detail; broad approaches give general information, more tightly focussed activities support specific actions
- Can be used to support a consistent message, possibly also using consistent standards (1 in 100 years, %, likelihoods etc.)
- Asset managers have a wealth of knowledge and experience in their own areas which can be captured using the matrix.
- Can act as a depository of evidence to support decisions.
- Can help encourage asset managers to think of risks more broadly.
- Helpful for oversight e.g. regulators.
- Possibly avoids duplication of effort across common sites/utilities.
- Can incorporate climate thresholds and scenarios, rather than projections.
- Can be applied on a regional basis to highlight geographical stresses.
- A common framework can promote the sharing of expertise and capacity building.

## b. Challenges

- No baseline or historical data is available in many organisations (or not collected on a common and useful basis).
- Needs to be embedded in corporate systems, to also prevent knee-jerk responses to immediate problems e.g. flooding, drought, requiring instant action. May need to differentiate between ‘normal interdependencies’ under a certain climate scenario, and those influenced by e.g. extreme events. Companies tend to be focussed on near-term events.
- Need to drill down to a deeper level to realise real impact, but this can take considerable resources and needs to have high-level buy-in and scheduled work time.
- How to capture the ‘known unknowns’ (how other providers might share your infrastructure space) and the ‘unknown unknowns’?
- Scenarios, uncertainty and scenario planning are difficult concepts and take time to understand. There could be value in using common scenarios but difficult in getting leadership on this. Outputs from UKCP18 may help.

## c. Value of a common basis, sharing information

Using a common matrix approach should help facilitate the sharing of information. But there are well-known barriers to the sharing of information especially with respect to critical national infrastructure. There needs to be a willingness to start the discussion and such a matrix could provide a mechanism to help this. Trade associations and sector-based groups may also be able to help.

## 3. Suggestions for developing the matrix

- ‘ICT’ is too broad a category and needs to be disaggregated: e.g. data, telecoms, providers.
- ‘Services’ is also too broad and should be expanded, e.g. ‘life-critical services’.
- Guidance on definitions of each heading would be useful, or encourage companies to use their own headings and definitions appropriate to individual circumstances.
- Provide the option of filling in the grey boxes: to help comparisons within a sector.
- Provide guidelines on approach and common terminology.

## 4. Related activities

**ASC:** In its 2017 progress report to Parliament, the ASC highlighted infrastructure interdependencies as an adaptation priority. Funding is now being sought to support research to map and measure interdependencies using a matrix approach, and then to test this approach in a small pilot study (possibly using a climate scenarios). Outputs need to be directed to inform on-going ASC work.

**NERC:** within the Environmental Risks to Infrastructure Innovation Programme, two relevant projects have just been funded:

- [Playing Games to Understand Multiple Hazards and Risk from Climate Change on Interdependent Infrastructure](#) (PI: Prof S Tett, University of Edinburgh, Nov 2017 – Apr 2018, with Transport Scotland, Scottish Water, SGN, SEPA, Inverclyde Council, National Centre for Resilience, Climate Ready Clyde, Adaptation Scotland/SNIFFER).  
Looking to develop a game based approach to understand climate change impacts and adaptation on interdependent infrastructures. Using Inverclyde as a case-study, a transferable approach will be developed that identifies local scale interactions and interdependencies, and allows diverse infrastructure partners to jointly think of adaptation solutions. Could possibly use the matrix to inform the approach.

- [Risk and Vulnerability Decision Support System: An industry-friendly resilience-based interdependency assessment tool - case study North Argyll](#) (PI: Dr D Hajjalizadeh, Anglia Ruskin University, Nov 2017 – Apr 2018, with Transport Scotland, Scottish Water, SSE, Atkins and ARU Partners' Challenge)  
Aiming to adopt a newly developed DSS to model infrastructure interdependencies of three critical infrastructure networks (water, transport, energy) providing a measure of network resilience in response to hazardous events, and to apply this to a case study of North Argyll.

**EPSRC:** is supporting the establishment of the £125m UK Collaboratorium for Research on Infrastructure and Cities ([UKCRIC](#)). This aims to improve infrastructure resilience by the development of new materials, techniques and novel technologies, as well as research into issues such as investment in rail systems, roads and flood and water management.

**EA:** is working with the [ITRC/Mistral](#) research project on national-level flooding.

**Energy UK:** is completing a project with Water Resources East, Mott Macdonald, Atkins and others. Looking at water-focussed interdependencies (with agriculture, EA, water industry etc.)

## 5. Next steps

Feedback from the workshop was generally positive and very constructive. There is interest within the IOAF in taking this work forward and linking with on-going work in the academic community (NERC, EPSRC), within the policy community (Defra/ARP, ASC, NIC) and at the regulatory level (UKRN).

Possible areas where the IOAF could contribute:

- Individual organisations test the use of the matrix and develop case studies.
- Develop guidelines for the matrix approach particularly at the different levels: strategic, asset level, city scale, regional level.
- Develop the matrix to focus on an issue of primary interest e.g. flooding, as a useful lens for testing the approach across organisations.
- Continue to work across the academic/stakeholder barrier to find practical ways of taking related research outputs forward into user communities. Encourage research projects to use the matrix within their own work with stakeholders.
- Work with external organisations also looking at interdependencies to provide a cross-cutting forum for discussion.

In practice, an iterative approach to developing the matrix will probably be necessary. Information from this workshop needs to be incorporated within the current matrix which can then tested by IOAF member organisations to provide feedback for further improvements. Any evidence of effective application within organisations will help drive this process.