Assessing flood risk management: United Kingdom

Key Messages

- Advanced Multi-criteria-analysis (MCA) approaches are used for assessing flood risk management measures in the UK.
- The United Kingdom is actively factoring in the effects of future climate change in flood risk management strategies.
- The UK Foresight Report on reducing risks of future disasters (UK Government, 2012) argued that, especially in times of austerity, cost-benefit-analysis (CBA) continues to be an important tool for prioritizing efficient disaster-risk-management (DRM) measures.
- Shifting emphasis from infrastructure-based (hard) options to preparedness & systemic (soft) interventions, other tools such as cost-effectiveness analysis, multi-criteria analysis and robust decision-making would deserve more attention.

Context

UK flood risk management institutions date back to the 19th century. In 1879, the UK Parliament passed the Flood Act, providing for flood walls to be constructed around London within the Thames tidal flood plain. Major floods in 1928 and 1953 led to the construction of the Thames Barrier east of the city. A series of floodgates and barriers prevent tidal flooding along the river prior to the Thames Barrier. More recently, significant flooding in 1998, 2000, 2005, 2007 and 2009 led successive UK Governments to review and improve risk management practices for flood and erosion damage around the country. The strategy of the Department for Environment, Food and Rural Affairs (Defra) from 2004 ‘Making Space for Water’ laid out the national response to flood risk, signifying a paradigm shift from land drainage to reducing and managing risk from floods. In contrast, the previous approaches to flood risk focused on centrally-funded drainage infrastructure and urban flood defence (Johnson and Priest, 2008). The 2004 guidance proposes a multi-level strategic analysis of flood risk management in the UK that considers environmental and social facets of flood damage, as well as adverse impacts on economic activity. It also takes a proactive approach to creating natural solutions to flood risk management, such as the expansion of existing wetland habitats and improvement of rural land management to better accommodate water levels.

After flooding in the summer of 2007 caused the largest peacetime emergency since World War II, Sir Michael Pitt was commissioned to study the UK’s flood risk management process. His review of existing procedures called for several reforms including improved flood modelling, wider capacity at the local council level for flood risk management and a general opening of attitudes around risk. This comprehensive review also cautioned that increased rainfall and extreme sea-level rise required that climate change impacts be seriously considered by the government, with its first recommendation that “the Government should give priority to both adaptation and mitigation in its programmes to help society cope with climate change.” (Pitt 2008). The review notes that the UK Environment Agency and Meteorological Office are world leaders in flood risk management and have highly advanced models and mapping technologies.

Defra is responsible for flood and coastal erosion risk management and provides funding through grants to the Environment Agency which also administers grants for capital projects to local authorities. The Agency is responsible for understanding and planning for a changing climate; forecasting, warning and responding to floods; maintaining, renewing, improving and operating flood defences; and overseeing the work on flood defences owned by others.

Regional/local authorities and Internal Drainage Boards are responsible for planning for flood events by producing flood plans and recovery/continuity plans; dealing with the consequences of flooding such as humanitarian assistance, emergency housing and clear up operations; and by providing advice to local communities on what actions they can take before, during and after a flood.
These separate duties are not always distinct. For example, the Environment Agency operates Regional Flood Defence Committees that oversee flood defences on major waterways, while local authorities retain responsibility for managing flood risk on ordinary waterways and Internal Drainage Boards cover low-lying agricultural property. NGOs, businesses and charities also play a role in managing flood risk. The National Flood Forum advocates on behalf of those at risk from flooding. The UK approach to flood risk management has revolved around collaboration between stakeholders and implementing agencies at several levels. However, cuts in government spending in the UK have affected programmes aimed to reduce flood risk. While a special allocation was made to repair damages from floods in the winter of 2013-2014, overall funding for flood risk management in England fell by 10% from 2010-11 to 2013-2014.

Policy and methodological developments

UK policy on flood risk management is in line with Directive 2007/60/EC of the European Parliament and of the Council on the assessment and management of flood risks. This Directive requires member states to produce preliminary flood risk assessments, flood hazard and risk maps and flood risk management plans. Within the UK, these responsibilities are carried out by the central Government for England and devolved to regional Governments in Scotland, Wales and Northern Ireland.

National level

National policy around flood risk management and climate variability is contained in the UK Treasury guidance for economic valuation and appraisal, known as the Green Book. The UK Government, specifically Her Majesty’s Treasury (HMT), issued official guidance in 2009 for factoring in risk from climate change into project and programme appraisals. Risk assessments for Government appraisals are required to assess whether climate change will have direct, indirect or systemic impacts. The UK Climate Impacts Programme (UKCIP) Adaptation Wizard helps analysts assess vulnerability to climate change and suggests solutions to respond to projected impacts. In addition to direct impacts, risk assessments are directed to consider timing of a project, any threshold effects that may be triggered by an activity, international effects that may have a bearing on UK activities and flexibility in decision-making over the lifetime of a project. According to the guidance, climate adaptation measures must be effective, efficient and equitable, per Government guidance.

Measures to address uncertainty include incorporating decision flexibility over time, increasing resilience to climate scenarios and identifying low-cost solutions that deliver large benefits. To help value policy options under uncertainty, HMT guidance encourages the use of Real Options Analysis (ROA), which accounts for various decision paths and the likelihood of choosing any number of options. Appraisals are required to assess the suitability of ROA in initial risk assessments. The Environment Agency has responsibility for managing risk from flooding from main rivers and the sea. As funding resources are limited, the Environment Agency uses economic appraisal methods to prioritise requests for grants. Flood and erosion risk management projects in the UK must utilize Flood and Coastal Erosion Risk Management (FCERM) appraisal procedures developed by the Environment Agency.

The portfolio of flood management planning is comprised of a hierarchy of strategies. It is clear, that high-level catchment and coastal plans must collaborate with a range of other environmental considerations. By requiring engagement with local stakeholders, the FCERM process balances strategic and local interests in project planning. Project appraisals are generally conducted via Cost-Benefit Analysis (CBA), with Cost-Effectiveness Analysis used when a legal requirement is present, if the project aims to sustain the present standard of service, or after CBA to establish the best option to accomplish a desired outcome. In addition to incorporating climate risk into planning and project evaluation, continual review of progress against plans and milestones is essential for measuring progress of any risk management programme. The United Kingdom set up an independent technocratic committee to provide reliable guidance on climate policy. This Committee on Climate Change (CCC) produces regular reports on climate risk in the United Kingdom that
serve to evaluate progress on policies and goals. In 2015, the Adaptation Sub-Committee of the CCC reviewed the National Adaptation Programme, noting satisfactory progress but calling for greater ambition in the country’s response to climate change.

**Regional level**

Scotland passed the Flood Risk Management Act in 2009, which establishes the Scottish Environmental Protection Agency (SEPA) as the responsible party for managing flood risk. Flood risk management districts are set up around river basins to manage watershed-specific risks, for which SEPA prepares risk assessments. The legislation requires SEPA to include long-term developments, including any impact of climate change on the occurrence of floods, within risk assessments.

Wales established its own national strategy for flood and coastal erosion risk management in 2011. This strategy takes a similar approach to the central UK Government’s ‘Making Space for Water’, shifting attention and resources to account for environmental damages and involving community members in raising awareness. Welsh Government guidance requires that responsible local and regional authorities maximise opportunities to adapt to climate change in flood risk management investments. This National Strategy is due for review and update in 2016.

Northern Ireland’s 2009 Water Environment Regulations implement the Floods Directive in the country. The Northern Irish Department of Agriculture and Rural Affairs coordinates risk assessments and management plans for local authorities in Northern Ireland. Preliminary risk assessments are required to consider the likely impact of climate change on the occurrence of floods. Review of existing management plans is required by 2021.

**Local level**

Local authorities are permitted to undertake works on flood, sea and coastal defences where they are not the responsibility of the Environment Agency or Internal Drainage Boards. The latter is responsible for action to reduce inland flooding in specific districts with special drainage needs. All projects receiving Environment Agency funding must follow FCERM appraisal guidelines as outlined above. Local flood risk management efforts must include:

- Applying a Sequential Test which guides new developments to areas with the lowest probability of flooding;
- Exception Test: development in a zone with high flood risk have wider sustainability benefits to the community that outweigh flood risk & that the development will be safe for its lifetime (taking account of the vulnerability of its users);
- safeguarding land from development (required for current & future flood management);
- using opportunities offered by new development to reduce the flood causes & impacts;
- relocation of development, including housing, to more sustainable locations where necessary.

In Scotland, local authorities must submit flood risk management plans to SEPA for review and approval.

**Thames Estuary 2100 (TE2100) - an example of Real Options Analysis (ROA)**

The Thames Estuary 2100 (TE2100) project serves as an example of how climate change plays a central role in flood risk management. TE2100 is a major review of options for managing flood risk in the Thames Estuary, which includes London and the south east of England. Climate change impacts are considered in TE2100 in impacts from sea level rise, uncertainty in systemic impacts and increased winter rainfall. Impacts from climate change on the Thames estuary are expected to include a 20-90 cm sea level rise and increased rainfall of up to 40% by 2080. TE2100 commenced in 2002 and identified 23 geographic ‘policy areas’ to be assessed for flood risk through 2170. Multi-Criteria Analysis was employed to quantify the impacts of various options that evaded monetary valuation. This approach quantified impacts of flooding and mitigation efforts on non-monetary measures such as water quality, damages to critical infrastructure, sense of community,
Once the impact of each option was determined on the 23 individual policy units, the Environment Agency was able to recommend the preferred course of action for a given geographic area. The **Real Options Analysis (ROA) approach** identified alternative infrastructure projects to be activated after a review of climate projections and existing circumstances in 2050. To test the integrity of the options analysis under different climate change scenarios, costs and benefits were calculated over four different scenarios of possible sea level rise, from 0.5 metres to 2.7 metres of sea level rise by 2100. Sensitivity testing showed that higher sea level rise would move damages forward in time and increase the costs from flood damages. If sea levels rose to the highest scenario tested, total property damages from pursuing the top ranked action would be expected to rise as high as £3.5 billion, compared to £1.3 billion under the current models relied on by Defra. As climate change is expected to exert upward pressure on costs from flood damages in the Thames Estuary, sensitivity testing builds a stronger case for reducing the risk of damages and updating appraisal values on options at regular time intervals.

**Main implications and recommendations**

The UK case study shows the complexity of decision-making of flood risk protection at national, regional and local levels. The Environment Agency has responsibility for managing risk from flooding from main rivers and the sea, including the approval and funding of flood risk management projects undertaken by local authorities and water drainage boards. The other countries analysed show different characteristics: (1) Austria: central government, in coordination with the regional governments (Länder), is responsible for the designation of flood hazard areas, (2) the Netherlands: flood protection standards for the whole country are written in law and central government and its services play a key role in overall flood risk management and (3) Czech Republic: the central government has an important coordinating role in the development of the multi-annual programme of flood prevention. In all the case study countries, regional and local authorities play distinctive but varying roles in various elements of flood risk management (flood control, flood damage mitigation, preparedness, emergency planning and recovery).

The UK uses rather advanced **MCA approaches** such as MCA optimisation methods. **ROA** is not a substitute for **CBA**, but rather an extension. It has not yet entered the standard toolbox of project appraisal, but it offers interesting possibilities for the appraisal of complex, long-term investments in flood protection. Also compared to the other three analysed countries, as yet, there is no single superior decision-making tool to fit all circumstances. We found that there is growing recognition across Europe, also promoted by the EU Floods Directive, that participatory approaches to decision-making should be employed, whenever this is feasible.

The United Kingdom is actively factoring in the effects of future climate change into flood risk management strategies. The sophistication of the approaches to factor in the effects of future climate change ranges from simple updates of protection design standards based on one ‘most-likely’ scenario of future (climate) changes, to complex applications of **‘Real Options Analysis’**. The evidence suggests that the approaches have by no way settled yet: governments, government agencies and academic researchers are experimenting with approaches and are actively evaluating and developing the options. In this context, the European Commission has rightly argued that in investment projects, climate change-related risk management should be integrated into existing project lifecycle appraisal approaches to manage the additional risk from climate change. These existing approaches can vary between countries and sectors. From a practical perspective it is important that risk management approaches complement existing project appraisal processes but not replace them.

**Bibliography**

[http://dx.doi.org/10.1080/07900620801923146](http://dx.doi.org/10.1080/07900620801923146).


Further Information
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