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Sustainable development in cities: collaborating to improve urban climate resilience and develop the business case for adaptation

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Abstract

Sustainable development, climate adaptation and urban resilience are becoming increasingly important issues for municipal governments. However, councils cannot address these issues alone, and are often hindered by a lack of clarity around the potential costs and benefits of taking action. This article sets out how public bodies can use alternative, collaborative approaches to understand climate risks better and thereby support the business case for adaptation. It highlights how Newcastle City Council worked with other local stakeholders to develop a shared understanding of how a major storm could affect services and infrastructures across North East England. This helped the authority to identify the potential costs of an extreme weather event, and informed its decision to invest in infrastructure that will help to protect future generations from similar incidents.

Keywords

Local government, resilience, wicked issues, climate adaptation, business case

Introduction

In a recent issue of Public Money and Management, Christopher Pollitt (2015) called for public management scholars to undertake more research into how state and non-state actors were addressing the challenge of climate change. This article uses an English case study to respond to his call in three ways. First, it sets out how the local authority in Newcastle upon Tyne worked with key actors in the city to develop a common understanding of the nature of climate risks. Second, it explains how this joint approach – combined with the experience of dealing with the impact of a severe storm – helped to inform the Council's business case for climate adaptation. Third, it highlights how this process helped the city to develop an effective collaborative strategy for urban resilience and provided a feedback loop that framed emergency responses to flood events. Although the article focuses on the English city of Newcastle upon Tyne, it should be of interest to academics and practitioners both elsewhere in the UK and overseas.

The article begins by discussing how public bodies need to collaborate with other organisations when they plan to deal with wicked, interdependent issues such as climate change. Following a section on methods, it sets out how Newcastle City Council engaged other stakeholders in the city to generate a common understanding of the challenges they might face if a major storm hit the area, and how they could reduce the potential impact of such an event in future. Finally, the article summarises its key findings, and explains how they have wider implications beyond climate adaptation and the English local government context.

Tackling wicked issues across organisational boundaries

Recent issues of Public Money and Management have described climate change as the 'ultimate wicked issue' (Pollitt, 2016; Ferry and Eckersley, 2016). According to Rittel and Webber (1973), 'wicked issues' are fundamentally different from traditional policy 'problems', which fit comfortably within a certain policy sector, are easier to identify and scope out and can be 'solved' by employing readily-available techniques. This is because wicked issues encompass a range of stakeholders and require decision-makers to integrate objectives across different policy sectors, as well as engage more widely with non-state actors. Furthermore, their uncertain and often undefined nature mean that governing actors have to take decisions based on incomplete or contradictory knowledge, and therefore it can be very difficult to agree a common way forward (Tucker 2010). Indeed, some stakeholders may even disagree about the nature or extent of the problem – yet they often need to change their behaviour to address the issue effectively.

Issues such as terrorism, migration, drug trafficking and teenage pregnancy fit into the 'wicked' category, but climate change is probably the most important and intractable issue currently facing humanity. Moreover, climate *adaptation* (putting the mechanisms in place that will reduce the impact of climate change on human and natural systems) is inherently more complex than *mitigation* (reducing greenhouse gas emissions to try and limit the rise in global temperatures). This is because adaptation involves a wider array of impacts and climatic variables, as well as a degree of uncertainty in the timing and magnitude of these factors. Furthermore, the costs and benefits of adaptation initiatives are likely to be shared out disproportionately between actors (Boyce and Adams, 2011; Priemus *et al*., 2008; Gray *et al*.,

2014; Bebbington e*t al*., 2014), which means that we need to develop more complex business models to support them.

The UK's Committee on Climate Change (2016) has pointed out that homes, businesses and the infrastructure that supports food distribution networks, utilities and the emergency services are all vulnerable to climate risks such as flooding, storms, heatwaves and droughts. These threats are particularly acute in cities, which are more at risk from climate-related events such as flash-flooding, heavy storms and coastal erosion (Nicholls *et al.*, 2008, World Bank, 2010, IPCC, 2014) and also rely heavily on complex interdependent infrastructures and systems that are especially vulnerable to extreme weather events (Rosenzweig *et al*. 2010). This complexity can lead to 'cascade' and 'convergence' failures, where one failure causes another, or multiple failures occur together. Since more than half of the world's population now lives in urban areas, and this number is set to increase significantly in the next half-century (United Nations 2014), a failure to address such risks could have serious consequences for a huge number of people across the globe.

The interdependent nature of city-wide systems means that public, private and voluntary organisations need to collaborate effectively on longer-term adaptation planning and emergency responses to extreme weather events (Committee on Climate Change 2016). At the same time, because severe weather impacts tend to be location-specific, municipal policy-makers have a specific responsibility to help build shared capacity and resilience to climate threats (Walsh *et al*., 2013). In other words, not only do subnational governments have to play an important role in implementing global climate *mitigation* initiatives (Bulkeley and Betsill 2003; Ferry and Eckersley, 2016), but they are also key actors in *adaptation*. As Heidrich *et al.* (2013) found, however, local authorities in the UK have tended to concentrate

more on the former than the latter. This suggests that some areas of the country may be badly affected by extreme storms and climatic changes in the future, if they have not been able to future-proof their systems and services and thereby limit the extent to which climate change will have an adverse impact.

Echoing these concerns, Pollitt (2015) called for public management scholars to undertake much more research into how societies and governments are responding to climate change. Amongst other things, he highlighted the need to examine governance arrangements that involve other public, private and non-profit actors, study policy co-ordination and implementation, and analyse approaches to evaluation and monitoring. Along with Bebbington and Larrinaga (2014), he also stressed the importance of taking an interdisciplinary approach to researching both mitigation and adaptation. In particular, Pollitt pointed out that such an approach would help to inform governance actors about the potential costs (and benefits) of climate change initiatives, as well as the strategies they might want to adopt.

This article responds to Pollitt's call by examining how the city of Newcastle upon Tyne in North East England developed a collaborative approach to climate resilience that involved a range of other local actors, including social science and engineering academics at a local university. This collaboration helped to inform the business case for undertaking adaptation initiatives that will reduce the city's vulnerability to extreme weather events. It also created a feedback loop mechanism, which enabled actors in the city to discuss how they responded to emergency flood events and learn from shared experiences.

Method

The article builds on an in-depth study of Newcastle's climate change policy-making approach (Eckersley, 2016), which relied on 19 interviews with 18 different people in the city, as well as Council policy documents, minutes from meetings, media sources, other academic studies, and 'grey' literature such as audit or think tank reports. These interviews, which were undertaken between 2012 and 2015, sought to analyse how the city developed and implemented its climate change policy, and focused particularly on the influence of different national and local actors in decision-making processes. The interviewees worked for the Council, Newcastle University, Your Homes Newcastle (the city's arms-length management organisation that manages social housing), Science Central (a publicly-funded body that was established to oversee the redevelopment of a large brownfield site in the city centre), and the third sector.

In order to generate a fuller understanding of the city's collaborative approach to adaptation, in spring 2016 we held subsequent discussions with one more Council employee and three academics at Newcastle University – two from the Business School and one from Civil Engineering and Geosciences. These four individuals had helped to organise and participate in two 'decision theatre' workshops in late 2011 and early 2012, which aimed to develop a common understanding of the risks of severe weather events and climate change amongst local hospitals, care providers, utility companies, and voluntary bodies. The first workshop focused on simulating how their services might be affected by a severe storm and heavy rainfall, whilst the second sought to identify how they could change the city's infrastructures to reduce climate risks over the medium term. In total, 23 senior and middle managers from seven different organisations attended the two events.

Coordination for climate resilience in Newcastle

Officers at Newcastle City Council were fully aware of the key role that they had to play in overseeing climate policy in the city, as well as the importance of involving other local actors in a coordinated approach (Eckersley, 2016). The authority's *Citywide Climate Change Strategy* set out the Council's objectives on carbon dioxide reduction, and contained actions to better understand how the area's current and future exposure to extreme weather could affect the operation of vital public services (Newcastle City Council, 2010). Notably, the strategy highlighted how local authority staff were particularly conscious of the potential impact of surface water flooding on low-lying areas of the city centre. This awareness stemmed from studies into the projected impacts of climate change on the North East of England (Climate North East 2008) and the UK more generally (Jenkins *et al*., 2010), which found that flooding represented the key climate risk for the area.

However, although the North East study stressed the importance of a coherent, cross-sectoral approach to dealing with this threat, the fragmented institutional landscape made it difficult for Newcastle to develop a co-ordinated plan for climate adaptation. Unlike municipal authorities in some other developed countries, Newcastle City Council has no direct responsibility for utilities, drainage infrastructure or watercourses, which makes it difficult to co-ordinate climate adaptation initiatives across the city. Furthermore, although the Council is responsible for dealing with surface water flooding, a separate regional company (Northumbrian Water) is in charge of the sewerage system, and the national Environment Agency oversees defences from river and sea flooding. In the same way, infrastructures such as electricity and gas grids, as well as emergency services and public transport provision, are

all controlled by other organisations. Finally, pressure from run-off is influenced by the wider built environment and issues such as surface permeability and waste water discharge – factors that are influenced by a range of different private and public actors.

This fragmented landscape means that different agencies are more likely to make sense of climate risks according to how they might affect their own individual operations, assets or objectives – rather than those of the interconnected systems that support urban living. In addition, they may have conflicting interests and goals (Davies, 2009) or might be characterised by contrasting patterns of behaviour and managerial approaches (Kavanagh and Richards, 2001). Therefore, actors may not fully appreciate the roles of other agencies in contributing towards desired outcomes, or how to engage with them to develop a common understanding of shared problems (Wilson *et al*., 2016). Despite these difficulties, however, municipal governments have taken a leading role in climate adaptation in most developed countries. In many cases they have adopted 'enabling' modes of governance (Bulkeley and Kern, 2006) to try and coordinate the activities of numerous stakeholders and thereby improve the locality's ability to cope with adverse events (Mees 2016; Klein *et al.* 2016).

This approach of encouraging businesses and wider society to take precautions against external threats, and thereby build *resilience*, extends beyond climate adaptation to include issues such as terrorism or cyberattack. Various scholars have argued that the UK is relying on such a strategy more heavily than other developed countries (Joseph, 2013; Boas and Rothe, 2016). For example, although local authorities in England and Wales have a statutory duty for flood risk management related to small watercourses and surface runoff (such as from roads and hard landscaping), they are not legally required to protect housing. In order to try and clarify this situation for local people and businesses, Newcastle City Council has

sought to communicate the different roles that various actors have to play when preparing for extreme weather. For example, the Council website points out that "residents have an individual responsibility to help protect their properties from flooding" – such as by purchasing and deploying sandbags (Newcastle City Council, 2013a, 23).

However, some organisations in the city were less keen than the Council to collaborate across organisational boundaries, and/or had lower general awareness about the importance of building shared capacity and resilience to climate impacts. Perhaps unsurprisingly, they focused on the potential threats to their own infrastructures and services, rather than considering how they interlocked with other agencies as part of an overall city-wide system. One municipal employee felt that the Council lacked the resources and remit to co-ordinate and resource an adaptation plan that encompassed the range of climate hazards and risks to sectors across the whole city. The authority was also hindered by the fact that other local actors focused on the potential risks to their own operations, as dictated by business interests or legislation (interview with Newcastle City Council officer, 24 March 2016). In addition, several organisations were not statutorily required to plan for severe weather, which meant that senior executives did not view it as a priority. Similarly, awareness of climate adaptation and predicted impacts was low because there had not been a major flooding or other climate-related event in the city for many years, and the UK Government had paid little attention to the agenda (interview with Newcastle City Council officer, 24 March 2016).

Perhaps most importantly, however, stakeholders found it difficult to adopt the kind of accountancy approach and business case for environmental adaptation initiatives that scholars such as Hopwood (2009) have proposed. This was partly because officers had very little information about the potential cost of 'doing nothing' (i.e. estimating the scale and impact of

a severe weather event on the city if the Council did not take preventative action) and how this compared to the cost of improving flood resilience. However, it was also due to the fact that public bodies would not need to pay the full costs of dealing with severe weather events, because they would be borne largely by insurance companies, businesses and private individuals. As a result, different actors were reluctant to take responsibility for managing the risks associated with climate change, and funding initiatives to reduce them.

Yet, as Giddens (2009) has argued, the public will always expect government bodies to step in to ensure that vital services (such as utilities or transport infrastructure) continue to be delivered in the event of failure. Indeed, in some cases local authorities are statutorily and morally obliged to fund any resilience initiatives that would lessen the overall impact of severe weather events (interview with Newcastle City Council officer, 24 March 2016). With this in mind, the Council assumed responsibility for developing a more coordinated approach to climate adaptation. However, it struggled to estimate the costs and benefits of engineering and technical solutions that might prepare the city for the range of longer term climatic changes that are likely to arise. It also lacked the capacity to create a common understanding of how severe weather events and climate change might affect interdependent systems within the city.

The 'decision theatre' events

Officers at the Council turned to Newcastle University for help with these difficulties. In response, the University agreed to set up two 'decision theatre' events in which key local actors could consider the range of impacts of a severe weather event on the region. Decision theatre workshops use computer models to explore how different scenarios are likely to

unfold, and allow participants to view the potential consequences on a series of large screens in a dedicated room. They aim to be interactive and dynamic, and the modelling software allows participants to change the inputs in order to see how this would deliver different results. Ideally, these potential eventualities then act as a trigger for discussion between participants, lead to an improved understanding of common challenges and ultimately result in better-informed decision-making. As wicked issues – by definition – involve multiple actors that may have conflicting priorities and interests, we might expect decision theatres to be particularly beneficial in these contexts (Walsh *et al*., 2013).

Since the University - a local institution that was both highly respected and politically neutral - agreed to host and facilitate the workshop, other organisations in city were more likely to engage with the process (Adams *et al*., 2011). The first workshop, which took place in late 2011, aimed to create a dedicated environment in which employees from the Council and other local bodies could understand how a severe weather event would affect overall systems within the city, and take informed decisions about building resilience accordingly.

The scenario under consideration was a major storm, incorporating both heavy rainfall (at levels that were estimated to occur once every century on current evidence) and very strong winds. The storm would then be followed by severe flash flooding in the city centre. Using data collected from a variety of sources (including local knowledge, analysis of how storms affected nearby Carlisle in 2004 and 2005, and the impact of flooding elsewhere in the UK in summer 2007), a computer simulation played out the potential impact of such an event on transport and energy infrastructures, homes, businesses, care providers, schools and hospitals. This scenario was used to start a conversation between the relevant stakeholders about the extent to which each of their services were interconnected, and how they could be affected as

a result. For example, a flood-risk modelling tool that predicted the impact of extremely heavy rainfall at five minute intervals enabled stakeholders to pinpoint those locations that were most at risk. They could also identify how such an event could result in electricity blackouts in care homes and schools, lead to gridlock on various key roads and the Metro light rail network, and make it much more difficult to access hospitals and other emergency services.

The event generated a common understanding of the potential impacts of such a severe weather event and provided a catalyst for further discussion and joint working between relevant stakeholders. Previously, each of the organisations involved had undertaken business continuity and resilience planning to identify how storms and flash flooding could affect their own operations. However, there was significant scope to improve their understanding of how much they relied on external infrastructures and services, the overall impact of extreme weather events on interdependent city-wide systems, and the longer-term investment and changes that the city would need to undertake in order to adapt effectively. In other words, by providing a trigger to generate a shared understanding of how the area would be affected by a major storm, the workshop helped participants to identify the potential scale and nature of these impacts and generated momentum for the city to improve its resilience to climate change impacts.

A second, follow-up, event was held some months later, which focused on testing and evaluating the effectiveness of a range of policy options to help with surface water management. These included the deployment of green roofs, improved drainage, and permeable pavements that could lower the risk of flooding by reducing the amount of run-off from hard surfaces. The format of the event was broadly the same, but with a more focused

set of stakeholders involved in flooding and water management. Alongside wider arrangements required by the Flood and Water Management Act 2010, the process also laid the foundations for future collaborative and partnership working. For example, it established a narrative and context for longer-term planning, into which the Council and its partners could feed back key learning points after a severe storm affected the area several months later. As Rodin (2015) has identified, a lack of adequate feedback loops often mean that cities and organisations struggle to learn from severe shocks, but the decision theatres established an effective platform for local actors to discuss their experiences and suggest proactive changes to processes and procedures.

Perhaps even more importantly, the workshop gave all partners a better understanding of the potential costs of maintaining and retrofitting infrastructures that would improve Newcastle's resilience to severe weather events. As a result, the Council was able to begin comparing these figures to the impact that such events could have on the city's systems, and use this analysis to inform a business case for climate adaptation. Notably, decision theatre approaches are now receiving much more widespread attention as a result of the European Commission's Climate Services roadmap, with companies including Deltares and Royal HaskoningDHV developing similar tools.

Dealing with the reality of an extreme weather event

Incredibly, Newcastle was hit by a severe storm within a few months of the second decision theatre workshop. On 28 June 2012, a day that became known locally as 'Thunder Thursday', over 50mm of rain fell in the city within the space of two hours. This was equal to the expected rainfall for the entire month of June and resulted in the flooding of over 1,200

homes and businesses (Newcastle City Council, 2013a). As predicted in the decision theatre, the storm also affected local, regional and national infrastructure: the Metro network and main East Coast rail line were suspended, numerous public buildings and roads (including two key river crossings, the Redheugh Bridge and the Tyne Tunnel) had to be closed, and a power cut affected 28,000 homes. In total, the Council had to pay over £8m to repair roads and damaged public buildings – and households, businesses and other service providers also faced substantial bills. Subsequent estimates have estimated the total economic impact as equating to £78m of Gross Value Added (GVA, which equates to Gross Domestic Product after subsidies are added and taxes are deducted) from the regional economy (BlueGreenCities, 2016).

In addition, Thunder Thursday occurred shortly after the collapse of a major culvert in the Newburn area of the city, which had begun to raise awareness of how extreme events could affect local residents and businesses (Newcastle City Council, 2013b). Taken together, these events made flood risk and emergency management much more important priorities for the authority, as members of the public engaged Councillors about their impacts. In addition, despite the human and physical devastation that Thunder Thursday left behind, its storm clouds had silver linings: they bolstered the evidence base and business case for long-term climate adaptation planning within the city (interview with Newcastle City Council officer, 24 March 2016). Crucially, they had clarified just how easily surface water flooding could bring the city to a standstill and ruin homes and businesses, and the resulting public pressure made it easier for the Council to act. One interviewee stressed how it helped to persuade private companies to consider the importance of resilience, regardless of their views about the anthropogenic nature of climate change:

> The whole climate change thing, we don't get involved in that debate any more. We just say, we can see the weather, the impact of flooding, we've got all the evidence here. Whether you believe it's man-made, or whether you believe it's a natural cycle, it doesn't matter – you've still got to do something about it (interview with voluntary sector organisation, 10 June 2014).

The Council's response can be viewed as an example of 'transformative' adaptation – where a confluence of different events produce a fundamental shift in approach and way of thinking (Lonsdale *et al*., 2015). For example, the political momentum now existed to undertake an independent review into how the city responded to Thunder Thursday (Newcastle City Council 2013b), which helped the authority and its partners identify a range of actions to improve resilience to extreme weather. The Council also joined 'Mayors Adapt', an EU initiative on preparing for climate change, shortly afterwards. As part of this commitment, the Council agreed to report progress to the European Commission every two years, conduct a city-wide climate risk and vulnerability assessment and produce an adaptation strategy.

The authority has continued to develop and refine its climate risk management approach since the decision theatre events and Thunder Thursday. For example, drainage and sewerage data now feature more heavily in scenario planning, because officers have a better understanding of how underground and surface water systems in the city would respond to another extreme weather event. Moreover, Council officers have modelled how improvements to these systems, and particularly a shift towards utilising existing 'blue-green infrastructure', could reduce the impact of similar storms in future. 'Blue-green infrastructure' refers to the use of natural techniques (such as sustainable urban drainage systems) to store and manage excess rainfall. As part of its climate adaptation strategy, Newcastle has sought to implement new features of this nature, as well as improve the capacity of existing ones. Indeed, the Council has worked with partners to position itself as a

demonstration city for blue-green infrastructure, in recognition of its knowledge of how rivers, culverts, streams and drains interlock with parks and gardens and affect the level of flood risk in the area. Through a project funded by the Engineering and Physical Sciences Research Council, Newcastle has developed one of the only drainage models that connects surface and sub-surface flows, and has been able to test different blue and green infrastructure options (BlueGreenCities 2016). As a result, it is now able to manage excess rainfall better and keep it away from homes, businesses, key transport connections, utilities and other public services.

In parallel, the City Council, Northumbrian Water and the Environment Agency have embraced these approaches in more traditional schemes. For example, these three organisations are now diverting a section of the Ouseburn (a tributary of the main river Tyne) at Brunton Park in order to reduce the risk of flooding downstream in the city centre (Henderson 2016). Most recently, they have worked on a much more comprehensive study to address flooding in the face of economic growth, climate change and urban creep. This outlined the creation of four blue-green corridors in the city, comprising 70 projects at an initial estimated cost of £78m. In addition to grant and government funding, the Council is exploring a range of other options to finance these initiatives – including investment predicated on discounted future insurance rates, local taxation options and pooled funding to tackle flooding. These approaches have also had wider legacies: the Council has collaborated with several universities to secure follow-on funding for a further three year research project, and worked with the European Investment Bank to assess the climate resilience of two of its major regeneration projects.

Nonetheless, some challenges remain. In particular, although the Council can provide a strategic overview to improve the city's climate resilience, it is still unable to direct other stakeholders to invest in certain projects – even if they might deliver wider benefits to the community. Instead, it has to rely on partnership working and developing shared understanding and common purpose – an approach that may be more fruitful over the longer term but will probably take longer to coordinate. Furthermore, the timescales, budgets and contracts of different agencies do not align. Northumbrian Water has five-yearly asset management periods, whilst the Environment Agency has a six-year programme, and the city Council has a three-year capital programme and annual revenue budget. This makes it tricky to coordinate activity across organisations (or even between departments in the authority). There is also the added difficulty of attempting to deliver ambitious plans at a time when overall local authority spending in England is under significant pressure. Overall, therefore, in spite of the progress it has made in sharing information and facilitating a common understanding of potential risks and costs, functional fragmentation and capacity constraints within the city remain significant barriers to ensuring that it can adapt to climate change and cope with severe weather events.

Conclusion

This article has responded to Christopher Pollitt's (2015) call for public management scholars to investigate how state and non-state actors are addressing the challenge of climate change. Drawing on the example of an English local authority, it has highlighted the importance of collaboration for effective action. In the case of Newcastle, partnership working helped to develop a common understanding of the nature of climate risks, informed the Council's business case for adaptation initiatives that will reduce the impact of severe weather events,

ensured that urban systems continue to serve future generations effectively and generated a feedback loop to frame emergency responses to future flood events.

The article has also identified some of the factors that can make developing such a collaborative approach difficult. For example, functional fragmentation may mean that organisations prefer to focus on how external shocks might affect their own immediate operations rather than interconnected systems. Furthermore, if information about the potential costs and benefits of potential adaptation initiatives is lacking, and/or do not accrue to the organisation that invests in them, these bodies may be even less likely to contribute towards a shared approach. In trying to plan for the threat of severe flooding, Newcastle City Council faced all of these hurdles. Following the decision theatre events, however, it was able to generate a common understanding of the issues that each organisation faced, and how they could reduce the risks to city-wide systems and services. This helped the Council and its partners to develop a holistic and coordinated plan to deal with severe flooding, and calculate the potential costs and benefits of investing in infrastructure that would reduce the impact of extreme weather. In addition, Thunder Thursday gave officers a real-life opportunity to identify how incidents of this nature might affect the city, and helped to make the business case for investing in adaptation initiatives more robust.

Although the article has focused on the specific case of an English city, it is important to note that the cross-cutting and 'wicked' nature of climate change (and indeed a growing number of public policy problems in general) mean that Newcastle's experience is also relevant in other contexts. This is particularly the case in jurisdictions where responsibilities have been 'hived off' from departmental bureaucracies, or outsourced to external providers in line with New Public Management ideas, since this diffuses decision-making and reduces the amount of

hierarchical control that central officials can exercise over service delivery. In such situations, decision-makers need to build capacity within the network of organisations that have responsibilities for public services, rather than expect that technological or engineering mechanisms will 'solve' wicked problems alone. These lessons transcend both urban sustainable development and the English local government context, but they nonetheless relate directly to Pollitt's call for more public management research into climate mitigation and adaptation. We echo that call and would welcome further research.

References

Adams, C.A., Heijltjes, M.G., Jack, G., Marjoribanks, T. and Powell, M. (2011), The development of leaders able to respond to climate change and sustainability challenges: the role of business schools. *Sustainability Accounting, Management and Policy Journal, 2*, 1, pp. 165-171.

Bebbington, J. and Larrinaga, C. (2014), Accounting and sustainable development: an exploration. *Accounting, Organizations and Society* 39 (6), pp. 395-413.

Bebbington, J., Unerman, J., and O'Dwyer, B. (eds.) (2014), *Sustainability Accounting and Accountability* (Routledge).

BlueGreenCities (2016), *Delivering and Evaluating Multiple Flood Risk Benefits in Blue-Green Cities: Key Project Outputs* (www.bluegreencities.ac.uk).

Boas, I. and Rothe, D. (2016), From conflict to resilience? Explaining recent changes in climate security discourse and practice. *Environmental Politics, 25*, 4, pp. 613-632.

Boyce, G. & Adams, C. (2011), *Incorporating climate change impacts and adaptation into capital investment decision making*. Victorian Centre for Climate Change Adaptation Research Think Tank Report.

Bulkeley, H.A. and Betsill, M.M (2003), *Cities and Climate Change: Urban Sustainability and Global Environmental Governance* (Routledge).

Bulkeley, H.A. and Kern, K. (2006), Local Government and the Governing of Climate Change in Germany and the UK. *Urban Studies, 43*, 12, pp. 2237–2259.

Committee on Climate Change (2016), *UK Climate Change Risk Assessment 2017 Synthesis Report: priorities for the next five years* (www.theccc.org.uk).

Climate North East (2008), *North East England Climate Change Adaptation Study* (www.climatenortheast.com).

Davies, J.S. (2009), The limits of joined-up government: towards a political analysis. *Public Administration*, *87*, 1, pp. 80–96.

Eckersley, P. (2016), *Local climate governance in England and Germany: Converging towards a hybrid model?* PhD thesis, Newcastle University (http://hdl.handle.net/10443/3172).

Ferry, L. and Eckersley, P. (2016), "Debate: Climate change and COP21 in Paris – addressing the ultimate wicked issue", *Public Money and Management*, *36*, 4, pp. 241-242.

Giddens, A. (2009), *The Politics of Climate Change* (Polity).

Gray, R., Adams, C.A., and Owen, D. (2014), *Accounting, Social Responsibility and Sustainability: Accounting for Society and the Planet* (Pearson).

Heidrich, O., Dawson, R.J., Reckien, D. and Walsh, C.L. (2013), "Assessment of the climate preparedness of 30 urban areas in the UK", *Climatic Change, 120*, 771-784.

Henderson, T. (2016), Newcastle helps lead the way in blue-green cities move to combat flood risk. *Newcastle Evening Chronicle*, 19 February (www.chroniclelive.co.uk).

Hopwood, A. (2009), Accounting and the environment. *Accounting, Organizations and Society*, *34*, 3-4, pp. 433-439.

IPCC (2014), *Climate Change 2014: Impacts, Adaptation and Vulnerability - Summary for Policymakers*. Geneva: Intergovernmental Panel on Climate Change (https://ipcc-wg2.gov).

Jenkins, G., Sexton, D., Lowe, J., Jones, P. and Kilsby, C. (2010) *UK Climate Projections: Briefing report (Version 2)* (www.ukclimateprojections.metoffice.gov.uk/).

Joseph, J. (2013), Resilience in UK and French security strategy: an Anglo-Saxon bias? *Politics*, *33,* 4, pp. 253–264.

Kavanagh, D. and Richards, D. (2001), Departmentalism and joined-up government: back to the future. *Parliamentary Affairs*, 54, 1, pp. 1-18.

Klein, J., Juhola, S. and Landauer, M. (2016), Local authorities and the engagement of private actors in climate change adaptation. *Environment and Planning C: Government and Policy*. DOI: 10.1177/0263774X16680819.

Lonsdale, K., Pringle, P. and Turner, B. (2015), *Transformative adaptation: what it is, why it matters & what is needed*. UK Climate Impacts Programme, University of Oxford, Oxford, UK

Mees, H. (2016), Local governments in the driving seat? A comparative analysis of public and private responsibilities for adaptation to climate change in European and North-American cities. *Journal of Environmental Policy & Planning*. DOI:10.1080/1523908X.2016.1223540.

Newcastle City Council (2013a), *Summer 2012 flooding in Newcastle upon Tyne: a report on the experiences of residents and non-residential property managers* (www.newcastle.gov.uk).

Newcastle City Council (2013b) *The Newburn Culvert Collapse and Citywide Flooding: A review of extreme events in Newcastle 2012* (www.newcastle.gov.uk).

Newcastle City Council (2010), *Citywide Climate Change Strategy and Action Plan* (www.newcastle.gov.uk).

Nicholls, R.J., Hanson, S., Herweijer, C., Patmore, N., Hallegatte, S., Corfee-Morlot, J., Château, J. and Muir-Wood, R. (2008), *Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes* (OECD Working Papers).

Pollitt, C. (2016), Debate: climate change – the ultimate wicked issue? *Public Money and Management*, *36*, 2, pp. 78-80.

Pollitt, C. (2015), Wickedness will not wait: climate change and public management research, *Public Money and Management, 35,* 3, pp. 181-186.

Priemus, H., Flyvbjerg, B. and van Wee, B. eds (2008), *Decision-Making on Mega-Projects: Cost–Benefit Analysis, Planning, and Innovation* (Edward Elgar).

Rittel, H.W.J. and Webber, M.M. (1973), Dilemmas in a general theory of planning. *Policy Sciences*, *4*, 2, pp. 144-169.

Rodin, J. (2015), *The resilience dividend: Managing Disruption, Avoiding Disaster, and Growing Stronger in an Unpredictable World* (Profile Books).

Rosenzweig, C., Solecki, W., Hammer, S.A. and Mehrotra, S. (2010), Cities lead the way in climate change action. *Nature, 467*, pp. 909-911.

Tucker, C.M., Eakin, H. and Castellanos, E.J. (2010), Perceptions of risk and adaptation: Coffee producers, market shocks, and extreme weather in Central America and Mexico. *Global Environmental Change, 20*, 1, pp. 23-32.

United Nations (2014), *World's population increasingly urban with more than half living in urban areas* (www.un.org).

Walsh, C.L., Glendinning, S., Dawson, R.J., England, K., Martin, M., Watkins, C.L., Wilson, R., McLoughlin, A., Glenis, V. and Parker, D. (2013), Collaborative platform to

facilitate engineering decision-making. *Proceedings of the Institution of Civil Engineers*, *166,* 2, pp. 98–107.

Wilson, R., Jackson, P. and Ferguson, M. (2016), Editorial: Science or alchemy in collaborative public service? Challenges and future directions for the management and organization of joined-up government. *Public Money and Management*, *36*, 1, pp. 1-4.

World Bank (2010), *Cities and Climate: Change: An Urgent Agenda* (www.worldbank.org).