Using Learning and Action Alliances to build capacity for local flood risk management

Shaun Maskrey[a], Tudorel Vilcan[b], Emily O'Donnell[c,*], Jessica Lamond[d]

[a] *Environment Agency, King's Meadow House, King's Meadow Road, Reading, RG1 2DQ, UK*
[b] *Open University, Milton Keynes, MK7 6AA, UK*
[c] *University of Nottingham, Nottingham, NG7 2RD, UK*
[d] *Centre for Architecture and Built Environment Research, University of the West of England, Bristol, BS16 1QY, UK*

ARTICLE INFO

ABSTRACT

Learning and Action Alliances (LAAs) are becoming an increasingly popular method for overcoming the challenges associated with participatory forms of governance, where decision making requires collaboration between stakeholders. In flood risk management, LAAs provide a mechanism through which institutional participants can come together, share knowledge, innovate, and devise solutions to 'wicked' problems. While the social learning generated at LAAs is now well understood, the mechanism by which this learning is translated into action is less so. In this paper, we argue that in order to maximise the potential for action, LAAs must attend to different elements of capacity building, in order that action can diffuse outwards, from the individual members of the LAA, to their organisations and society beyond. By investigating two UK case study examples, we illustrate how different elements might be utilised in combination, to maximise the potential for longer-term, longer-lasting change. We conclude that the architects of participatory processes, including LAAs, should attend to different elements of capacity building, and consider those best suited to their individual contexts and objectives.

1. Introduction

Water management in general, and flood risk management in particular, across many parts of the world, has undergone a shift from centralised to local management, with many roles and responsibilities devolved to local stakeholders (Butler and Pidgeon, 2011). As these responsibilities spread downwards and outwards to a growing number of individuals and organisations with increasingly distributed expertise, knowledge and skills, stakeholder engagement and participation have come to the fore (Pahl-Wostl et al., 2007; van Herk et al., 2011; Koontz, 2014). Effective decision-making in this arena calls for more flexible, hybrid and collaborative forms of governance that can overcome some of the challenges experienced by stakeholders working in isolation (Pahl-Wostl, 2019; Van der Molen, 2018).

Social learning is one of the most prominent concepts proposed for tackling the challenges of resource constraints, communication difficulties, complex responsibility arrangements and siloed thinking (Bryson et al., 2015). It facilitates the sharing of knowledge, experience and best practice, such that subsequent decisions are better informed (Pahl-Wostl et al., 2008). It is a process of learning through social interactions, in which actors develop alternative perspectives that can then inform collective decision-making (Bos et al., 2013). The multi-dimensional nature of social learning gives rise to different personal experiences of participation depending on, for example, the participant's reflective skills, their level of commitment and engagement with the process, and the value they place on the knowledge co-produced and negotiated during interactions.

Drawing inspiration from the social learning literature, Learning and Action Alliances (LAAs) present a mechanism through which stakeholders can address complex, 'wicked' environmental problems such as those posed by water and flood risk management (Ashley et al., 2012). They provide an open and transparent environment in which stakeholders from different organisations, and often harbouring conflicting viewpoints, come together to co-produce a negotiated vision based on their collective aspirations. Shared interest in the problem allows a joint understanding to be developed through rational criticism and discussion (Ashley et al., 2012). The socio-technical nature of the water system, which comprises physical, organisational and social systems, as well as the growing number of stakeholders involved, make it an ideal candidate for utilising multi-agency platforms such as LAAs

---

* Corresponding author.
E-mail addresses: shaun.maskrey@environment-agency.gov.uk (S. Maskrey), tudorel.vilcan@open.ac.uk (T. Vilcan), emily.o'donnell@nottingham.ac.uk (E. O'Donnell), jessica.lamond@uwe.ac.uk (J. Lamond).

(Newman et al., 2011). In particular, the voices of stakeholders from different disciplines can facilitate the development of multifunctional solutions that address a range of wider social and environmental issues in addition to tackling challenges within the water system (O'Donnell et al., 2018).

The organisational structure of LAAs breaks down many of the traditional barriers to the vertical and horizontal sharing of information and accelerates the uptake of new information. Typically, LAAs are initiated by one or more stakeholders, who identify a complex problem and invite other interested stakeholders to co-develop solutions. Stakeholders are encouraged to step outside of existing institutional settings and enter into discussions where there are no established experts (Gourgoura et al., 2015). LAAs originated from Learning Alliances (LAs), defined as "a group of individuals or organisation with a shared interest in innovation and the scaling-up of innovation on a topic of mutual interest" (Batchelor and Butterworth, 2008). The addition of 'action' broadens the role of an LAA, to include the creation of tangible outputs, bringing about change in stakeholder and institutional behaviour, and influencing wider policy and regulation.

LAAs facilitate social learning, and by bringing stakeholders together, encourage them to learn from one another in a way that is not possible in isolation. If the aim of LAAs is to produce action and change, then processes of social learning must build the 'capacity [within and between institutions] to achieve joint solutions and to make stakeholder participation effective in terms of achieving the goals of water management' (Pahl-Wostl et al., 2007, *emphasis added*). The notions of capacity building and social learning are complex, interrelated and challenging to separate. Arguably both occur in tandem, and regardless of whether action is achieved, or is successful, capacity will have automatically being built. The inseparable relationship between capacity building and social learning is implicit in the LAA literature. For example, Ashley et al. (2012) state that 'LAAs are helping to *build the capacity* in … professional stakeholders to do things differently' (p. 17); Newman et al. (2011) argue for the need to engage in *building the capacity* of stakeholders to break out of institutional silos and foster an understanding of other stakeholders' perspectives (p. 101); and Dudley et al. (2013) stress that for LAAs to become vehicles though which to address complex problems such as flood risk management, they must focus on '*capacity building, via active learning*' (p. 1, *emphasis added in all quotes*). However, there are few that explore the key role that capacity building plays in planning for and delivering action, its constituent elements, and what LAAs might do to ensure they are designed to maximise it.

Capacity building presumes by its very nature that, prior to social learning taking place, a capacity or set of capacities must be missing, or if present, be incomplete or underutilised. It takes many forms, and may not always lead to action or lasting change. Take for example, an LAA that works together to develop a novel solution that is modelled, subsequently fails, and is therefore not implemented. Although there is no action per se, the collaborative exploration of options, the confidence to develop something new, and the lessons learnt from its failure all contribute to the stakeholders' capacity to make better, more informed decisions. It follows that capacity building is inherently complex, as multi-dimensional as the learning that is critical to its development, and occurs at multiple scales. Individuals participating in an LAA meeting will each undergo a different experience, each building different capacities at different rates, and may use these to modify their own actions and influence the actions of others both inside and outside of the meeting. It is critical in LAAs, to better understanding the subtleties of capacity building in different situations, and how different elements might be woven into their design such that shared goals have the best chance of being realised.

In this paper, we contribute to the literature on LAAs by exploring how one can attend to capacity building in both their design and development, such that they build the most effective combination of capacities to suit the needs of their specific context. While LAAs are a

form of collaboration, they are also distinct from other collaborations due to their focus on learning and innovation. We begin by outlining the central role of social learning in LAAs and go on to use the 'triple-loop' learning model (Argyris and Schön, 1978) to frame how social learning and capacity building are interrelated. We critically analyse the assumption that social learning will lead to capacity building, which in turn will lead to action. We further develop the notion of capacity building, by examining five critical elements that combine to facilitate the transition from learning to action. Finally, using examples from two LAAs (Tewkesbury and Newcastle) we investigate the challenges and opportunities that come with building capacity as part of LAAs.

2. Social learning in LAAs

Over the last decade, LAAs have become a popular platform for facilitating innovative thinking and the co-development of solutions to 'wicked' problems in several European projects, including EU INTER-REG IVB projects MARE (Managing Adaptive Responses to Changing Flood Risk in Europe) and SAWA (Strategic Alliance for Integrated Water Management Actions) (Dudley et al., 2013). Subsequently, a number of multi-agency groups in both the UK and across continental Europe have adopted the term 'LAA' (Fig. 1).

Social learning has been a conceptual cornerstone during the development of LAAs. It is well known to occur on an individual level through observation of others (Bandura, 1977), however more recent research shows that the effects may diffuse outwards and contribute to collective learning and institutional change. The differing nature of social learning at different scales is partially captured by the concept of triple-loop learning: occurring on an individual level as participants develop trust and explore their own practice (single-loop), gain a greater understanding of the limitations of institutional and governance structures (double-loop), and begin to challenge accepted norms and beliefs (triple-loop) (Hurlbert and Gupta, 2017). In LAAs that are influenced by the governance structure in which they are embedded, the effects of social learning can diffuse outwards to both the meso and macro scales (Fig. 2) (Pahl-Wostl et al., 2007):

- **micro scale**: on short timescales between collaborating stakeholders (single-loop learning)
- **meso scale**: on medium term timescales as changes in actor networks (double-loop learning)
- **macro scale**: on longer timescales at governance and society levels (triple-loop learning)

In the LAA literature, social learning is understood to generate stakeholder engagement in several ways; e.g. providing a platform for stakeholders to engage with different perspectives, facilitating holistic understanding of institutional contexts, and engendering more effective engagement in partnerships and collaborations. However, in a thematic analysis of the academic literature on water management collaborations (of which LAAs are a distinct type), Porter and Birdi (2018) identified that the highest ranked and most important theme was that 'stakeholders have the capacity to act'. While social learning is well-established as a process occurring at several scales both within and outside of an LAA, the role of capacity building, and how its management results in action and change, is less well explored, and is critical to understanding the different ways LAAs achieve their collective goals.

A study by Laing and Wallis (2016) exemplifies how capacity building can be viewed differently in different contexts. Their study brought together researchers and politicians to investigate strategies for increasing the policy relevance of scientific research. Challenging whether social learning leads to capacity building, they argued that while single and double loop social learning were successful, they had 'far less certainty that the workshop had developed capacity such that participants would do better at the exercises if they were to repeat the process' (Laing and Wallis, 2016, p. 30). Although their study did not
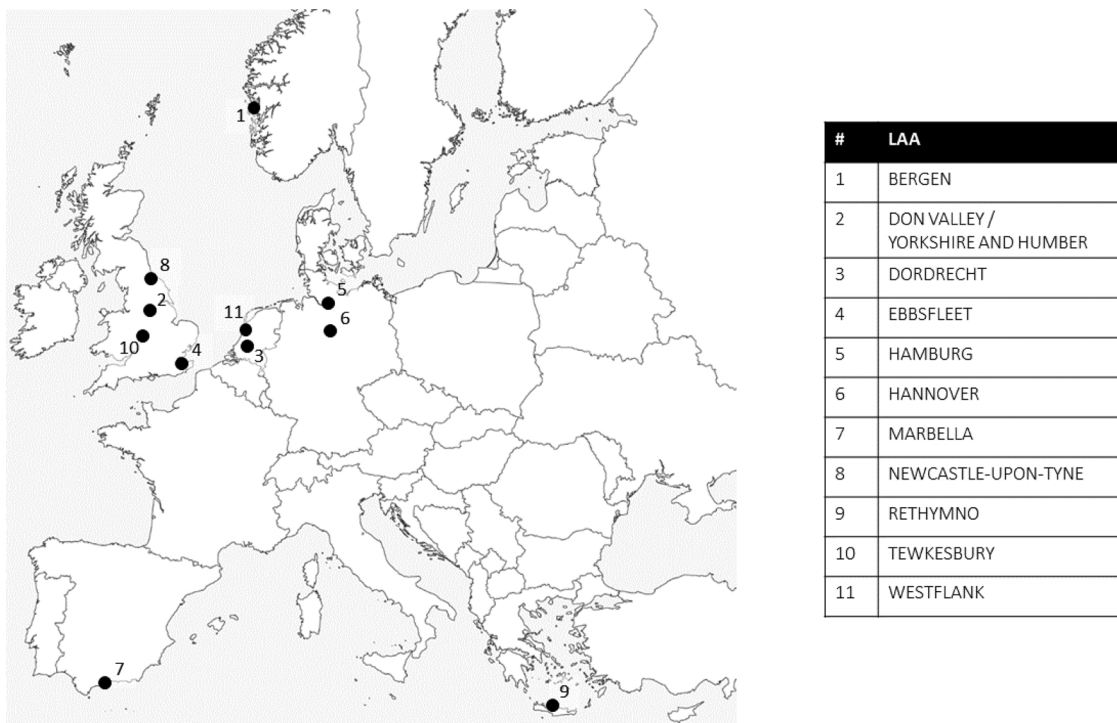
#	LAA
1	BERGEN
2	DON VALLEY / YORKSHIRE AND HUMBER
3	DORDRECHT
4	EBBSFLEET
5	HAMBURG
6	HANNOVER
7	MARBELLA
8	NEWCASTLE-UPON-TYNE
9	RETHYMNO
10	TEWKESBURY
11	WESTFLANK

Fig. 1. European Learning and Action Alliances (to 2018).

result in a measurable difference in capacity, the process each partici-pant (and the group as a whole) went through would arguably have developed their capacities to understand more complex issues and see problems from different perspectives. This example acts to illustrate that one's definition of capacity building, and their subsequent assess-ment of the success of a collaboration to build capacity, is highly con-text-specific and far from universal.

3. Capacity building in LAAs

For the purposes of exploring how different capacities might be built within the context of an LAA, we broadly define capacity building as including both the mechanical process of building capacity where it does not exist, and developing (managing, enhancing and retaining) existing capacities (CADRI, 2011). Capacities are considered the
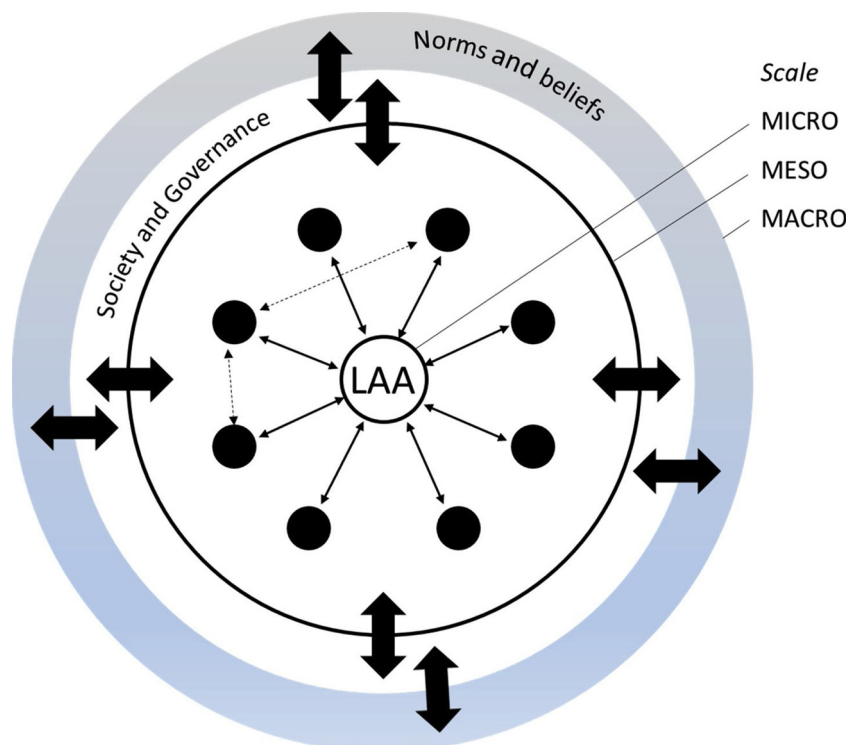

Fig. 2. Multi-scale social learning (modified after Pahl-Wostl et al., 2007). Effects of social learning diffuses outwards between scales. The changes produced at the micro scale of the LAA are cascaded outwards through networks of institutions and actors and may result in changes to society, governance, norms and beliefs.

Table 1

Elements of capacity building with examples from flood risk management. GIS (Geographical Information Systems), LiDAR (Light Detection and Ranging).

Element	Description	Flood risk example/s
Material resources	Equipment, technology, material goods and outputs.	Flood risk models, modelling outputs, mapping, other GIS data layers and shapefiles (e.g. LiDAR).
Human resources	Skills, knowledge and awareness.	Training in specific areas of flood risk management, site visits and walkovers, access to experts and their knowledge.
Structures	Institutions, partnerships, initiatives, roles, responsibilities and policy.	Understanding the role and responsibilities of local authorities and water companies under current legislation.
Processes	Decision-making, coordination and delivery.	Understanding the process of applying for central government funding and the actors involved.
Enabling mechanisms	Political support, incentives, advocacy and funding.	Understanding funding available from water utilities, knowledge of local plans and development areas.

'aptitudes, resources, relationships and facilitating conditions necessary to act effectively to achieve some intended purpose' (Brinkerhoff, 2010, p. 66). Consequently, most LAAs require a unique combination of capacity building elements (e.g. material, structural and human resources) to come together to achieve their desired goals.

An initial emphasis on technical capacities (such as the provision of expertise, training and the transfer of resources) is increasingly being seen as insufficient for the potential of capacity building to be fully realised (Hagelsteen and Becker, 2013; Few et al., 2016). These technical capacities must be carefully complemented by functional aspects of capacity building (Lucas, 2013), such as 'improving coordination, decision-making processes and fostering an enabling environment' (Few et al., 2016, p. 157). These functional aspects act to support long-lasting behavioural and societal change.

Building on CADRI (2011); Brinkerhoff (2010) and Few et al. (2016), we can start to appreciate the multi-dimensional nature of capacity building as including, but not limited to, the elements described in Table 1. The technical elements of capacity building refer mostly to material and human resources, while the functional aspects include structures, processes and enabling mechanisms (Few et al., 2016).

It is important to revisit the multi-dimensional nature of capacity building, as a process occurring on multiple interconnected and interrelated scales (see Fig. 2). At the individual level capacity building relates to the specific capabilities of people, while at an organisational level reflects the internal workings that allow institutions and organisations to perform their functions. These are contained within societal and governance environments which reflect a 'broader system within which individuals and organisations function that can either facilitate or hamper their existence and performance' (CADRI, 2011, p. 9). This environment can either promote or stifle the conditions that enable capacities built at the individual and organisational scales to filter outwards and result in societal change (Few et al., 2016). We suggest that an LAA should aim to build capacity on all three levels; from the individuals engaged in the LAA itself, to the organisations of which they are part (and with which they engage), and ultimately to the wider environments in which they are embedded.

Having identified several elements of capacity building, we propose that a combination of these elements is required for any LAA to successful achieve its goals. The nature of those goals will naturally inform the specific combination of elements required. Take for example, an LAA that is assembled with the goal of increasing the uptake of property level protection in a local community. The LAA will most likely benefit from building capacity in the areas of human resources, enabling mechanisms and structures. In terms of human resources, they may seek to better understand the different resilience options available to residents, and what information they need before choosing the best options for each property. In enabling mechanisms, the group might benefit from understanding the funding support available nationally to support property level resilience, and whether incentives exist for particular areas/demographic groups. Finally, in structures, LAA members might need an improved knowledge of flood insurance mechanisms in order to

successfully allay fears and misconceptions from residents thinking about installing resilience measures. Careful consideration of the different capacities required for an LAA based on its desired goals will support informed decisions about scope, stakeholder identification/prioritisation, group activities and structure.

Echoing CADRI (2011) and Few et al. (2016), we argue that successful capacity building, and the subsequent action it seeks to achieve, benefits greatly from a receptive environment. Arguably for LAAs, it is the development of enabling mechanisms, such as political support and funding sources, which help create and sustain this environment. These enabling mechanisms, perhaps due to the fact they are trying to achieve action at wider scales, are often more challenging and complex, requiring a longer timeframe in which to be produced that other elements (Fig. 3).

4. Capacity building in practice

4.1. Case study locations and methodology

We evaluate the role of capacity building in two LAAs; Tewkesbury (UK), that constituted the demonstration phase of a research project evaluating the uptake of low cost resilience for properties at risk of flooding (Lamond et al., 2017), and Newcastle-upon-Tyne (UK), established in 2014 by the Blue-Green Cities research project to develop and implement a blue-green vision for the city (O'Donnell et al., 2018).
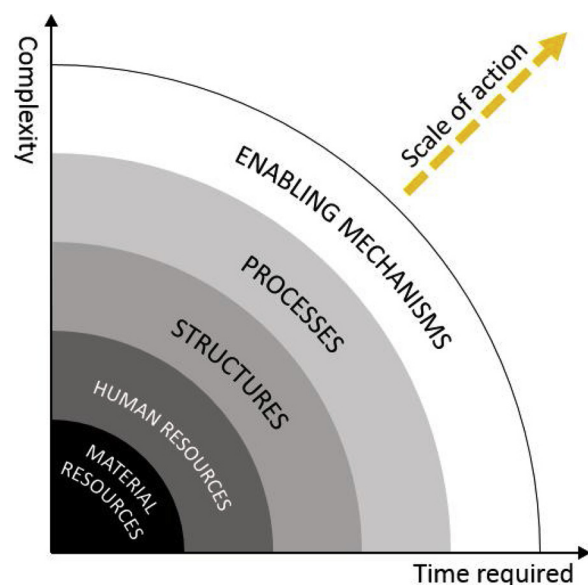

Fig. 3. Conceptualisation of the effort and time required to realise different elements of capacity building. The resulting scale of action is a function of the complexity of the capacities being developed and the amount of time required (adapted from Brinkerhoff, 2010, p. 74).

These LAAs differ in three key areas. First, the nature of the human environment; Newcastle is a large industrial city and Tewkesbury is a small town with outlying rural areas. Second, the focus; the Newcastle LAA explored strategies to overcome the 'wicked' problems of flood risk and water management, whereas the Tewkesbury LAA investigated low-cost flood resilience designed to reduce the damage of future flood events. Third, the LAA membership; in Newcastle, this primarily comprised professional stakeholders from local authorities, water utilities, the Environment Agency (quasi-governmental regulator), estate managers and environmental groups whereas the Tewkesbury LAA membership was predominantly residents from local communities.

Methodologically, obtaining primary data from LAAs can be difficult, as the format precludes any formal minutes or recordings of the meetings to be made. In the case of Newcastle, we use a combination of participant observation (knowledge and understanding gained through discussion with the research team involved in the LAA), and documents and materials produced as part of the LAA (including the vision, strategic objectives and summaries of key outputs from each meeting). For Tewkesbury, we draw primarily from the final project report, 'Supporting the uptake of low cost resilience' (Lamond et al., 2017). This comprises a detailed description of the LAA objectives and activities. Importantly, it contains an independent evaluation of the process, in which a focus group of participants reflect on the outcomes of the LAA.

4.2. Tewkesbury LAA

The aim of the Tewkesbury LAA was to identify barriers to the adoption of resilience measures and to propose and pilot interventions to overcome these, both within communities at flood risk and among networks of professionals engaged with the flood resilience process (Lamond et al., 2017). These resilience measures were aimed at a range of stakeholders including local businesses, professionals (surveyors, loss-adjustors, etc.) as well as residents themselves.

The Tewkesbury LAA was premised on a theory of change, which meant that from the outset, there was attention given to how the activities of the LAA would generate outcomes and impacts (Table 2). These were envisioned to be translated into impact on wider scales, in terms of changes to the way individuals in the community relate to flooding, by employing flood resilience measures themselves and taking ownership of their flood risk. Consistent with LAA and triple-loop learning literature, there was a presumption that action would cascade outwards from the micro to the macro scale.

The Tewkesbury LAA evaluation report identified several successful outputs, including a series of *material resources*, which were utilised outside of the LAA. For example, many of the resilience materials, checklists and solutions were considered more comprehensive than the templates currently used by the flood risk industry, as they encompassed a wider range of novel solutions (Lamond et al., 2017). Participants expressed the hope that many of the materials, guides and checklists developed would outlive the LAA itself and become part of its legacy (*ibid.*).

The LAA also reported benefits to the social circles and networks associated with its members. These can be understood in terms of the *human resources* and *structures* elements of capacity building. There was evidence to suggest that members of the LAA and local property support network were already having discussions with friends, colleagues or relatives, which had resulted in increased awareness of resilience measures and increased likelihood of adoption of these measures. This was attributed to working with the LAA during the demonstration phase.

Social learning held a central role in the architecture of the Tewkesbury LAA. The evaluation report suggests that LAA meetings were seen as a crucial component, 'giving it direction and focus' and 'gluing the group together' (Lamond et al., 2017, p. 96). Furthermore, 'focus group participants expressed that they had personally learned from the LAA meetings and the process of developing the innovations and the demonstration' (*ibid.,* p. 92). The main benefits identified by LAA participants were 'sharing of knowledge and expertise', 'facilitating communication between stakeholders' and 'creating a platform for stakeholders to discuss and learn, which will hopefully outlive the project' (*ibid.*, p. 92), indicating increases in the *human resources* and *structures* elements of capacity building.

Despite the success of some outputs, the evaluation report highlights that the LAA fell short of the longer-term 'impacts' as predicted in the theory of change (Table 2), arguing for example that there was 'limited evidence of homeowners taking up low cost resilience measures' (*ibid.*, p. 98) and 'no evidence as yet of longer-term changes in the behaviour of home owners in Tewkesbury as a result of the project's demonstration phase' (*ibid.*, p. 90). It is stressed that some outcomes and impacts emerging from the project may remain hidden, making their extent impossible to assess.

It is clear that a number of the elements of capacity building, including *human resources* (e.g. sharing experiences with others affected by flooding) were inseparable from the social learning that occurred between the members of the LAA. Other elements were a combination of learning in the LAA and other activities outside of the group. For example, the success of the resilience checklists, a *material resource,* relied on collaboration, coordination and delivery with individuals and organisations that had not been part of the LAA.

The LAA was less successful in establishing an environment that enabled longer term change. The evaluation report provides some of the reasons for this. For example, flooding was not at the top of the agenda for local residents due to the extended time period since the last flood. Similar initiatives were occurring at the same time in the locality, creating competition for airtime when it came to communications about flooding in Tewkesbury. Finally, time constraints were substantial and limited the amount of engagement that could be achieved inside of the LAA.

These barriers may have resulted in the absence of *enabling mechanisms*, such as political support or incentives for continuing engagement. This is most visible in the reflections of a focus group formed from a subset of LAA members. These members suggested that going forward a more holistic understanding of the flooding problem and potential solutions was required. For them, sustainable long term change would require focus on (or new approaches to): framing of the

Table 2

Selection of predicted outputs from the Tewkesbury LAA theory of change (Lamond et al., 2017). The property support network represents the wide range of professional trades, commercial interests and businesses that householders will turn to for advice and be influenced by, when making decisions about their property.

| Outcomes | | Impacts |
Short-term/local	Long-term/national	
Improved knowledge of participants regarding resilience measures, increasing likelihood that they will implement measures in future	Materials / strategies to support wider understanding and ownership of flood risk	Increased understanding of flood risk
Learning which materials / strategies are effective and may be replicated	Technical knowledge within property support network to support uptake of low-cost measures	Increased uptake of low-cost flood resilience measures
Improved understanding / engagement with local property support network	Improved understanding / engagement with national property support network	Increased ownership of flood risk

problem, engagement, dissemination and links with other initiatives. Most importantly, it was thought that 'future initiatives might benefit from following a more all-round approach to flooding encompassing aspects of both prevention and resilience to get people engaged' (Lamond et al., 2017, p. 96).

4.3. Newcastle LAA

The Newcastle LAA was established in the aftermath of the 2012 pluvial flood event in Newcastle that affected over 1200 properties and internally flooded over 500 homes (Newcastle City Council, 2013). Core membership comprised Newcastle City Council and their main partners in delivering flood and water management schemes; Northumbrian Water and the Environment Agency, who together aspire to greater implementation of collaborative schemes to deliver blue-green infrastructure (BGI). BGI systems, including ponds, wetlands, green roofs, rain gardens and retention basins, aim to restore the natural functioning of the water cycle and deliver benefits to the environment (e.g. flood and water management, biodiversity improvements, carbon sequestration) and society (improved aesthetics, amenity and recreational opportunities) (Lawson et al., 2014).

The Newcastle LAA focussed on social learning and the building of trust. By coming together and collaborating as equals, stakeholders learned from one another about novel aspects of BGI, how other stakeholders and institutions have implemented BGI, and the opportunities available in Newcastle. Social learning increased the capacity of individuals and organisations to; manage differences in perspectives around flood risk management and the role of BGI, learn about the drivers that motivate each other's particular courses of action, reframe knowledge, and make collective decisions based on negotiation and conflict resolution (O'Donnell et al., 2018). This facilitated a change in working practices by bringing together diverse viewpoints and partner objectives to negotiate solutions that generate multiple benefits (*ibid.*).

Elements of capacity building such as *human resources* and *structures* were further embedded into the LAA from the beginning, primarily as part of the visioning process. The overarching goal of the Newcastle LAA was to promote a vision; for Newcastle to become a city that follows the principles of a blue-green city by maximising the opportunities to achieve multiple benefits through blue-green approaches to surface water management, and to realise it by recognising, and utilising, windows of opportunity for potentially influencing the strategies of decision makers (O'Donnell et al., 2018). Observations from researchers at LAA meetings identified social learning at multiple levels, e.g. on short-to-medium time scales through collaboration between members (particularly those not typically included in urban flood risk management discussions, such as health professionals and estate managers), when negotiating a blue-green vision (*ibid.*). *Material resources* proved essential in helping the LAA illustrate the dynamics and opportunities around BGI implementation. As an example, LAA activities that contributed to the development of the vision include a systematic process of stock-taking of existing BGI in Newcastle, which led to the identification of 28 key locations of interest that were included in an interactive map (Fig. 4). BGI initiatives in Newcastle were classified into delivered projects (from which lessons could be learned), opportunities to influence (projects that are in the early planning stage or have just received funding) and visionary projects (ideas of potential BGI that may benefit the city of Newcastle but with no specific funding/plans in place at present). Subsequent LAA activities identified a hypothetical blue-green urban core, which was later used in flood inundation simulations as part of the Blue-Green Cities research project (Fig. 4).

The Newcastle LAA has raised awareness of the multiple co-benefits of BGI among local Government stakeholders and policy makers, which has the potential to increase political support and advocacy for BGI projects (O'Donnell et al., 2018). For example, the development of the 'Newcastle Declaration on Blue and Green Infrastructure' commits signatory organisations to prioritising the use of BGI to tackle flood and water management challenges through collaborative working. The declaration, originally signed in 2016, represents an example of the *processes* and *enabling mechanisms* elements of capacity building. It forms the backbone of new flood and water management projects within Newcastle City Council, for instance directly influencing the Newcastle Local Flood Risk Management Plan (March 2016) and its support for BGI schemes. In the foreword, it is stated that 'we [Newcastle City Council] have recently signed up to the Blue Green pledge which commits the City to managing flooding in a more natural way whilst still obtaining the benefits from using green infrastructure for the benefit of the environment, our residents and visitors and the economy' (Newcastle City Council, 2016).

Greater awareness around the importance of BGI in their work has created greater *human resources* capacity among practitioners and decision makers with regards to managing the 'wicked' problem of flood risk. However, we cannot say that impacts such as longer term change in governance and cultural norms have yet been achieved by the Newcastle LAA. Traditional approaches to urban flood risk management governance are still evident despite progress made in social learning and translation into action that prioritises BGI approaches. This highlights the importance of the functional aspects of capacity building, but it also stresses that long timeframes and persistence are needed to enable all potential impacts to be achieved.

5. Conclusions

This paper explores the different scales at which social learning operates, both within a community of practice, and within the organisations and aspects of society with which members of that community engage. The mechanisms through which social learning is translated into the building of capacity differ, both in their likely form and effectiveness at those different scales.

Increasingly, responsibility for flood risk management in the UK and elsewhere is being devolved, downwards and outwards, bringing a wider range of stakeholders to the table than ever before. This places greater importance on mechanisms such as Learning and Action Alliances (LAAs) to provide arenas in which social learning is nurtured, encouraged, and strategically focussed on building capacities within stakeholders that enable them to more effectively manage flood risk. LAAs aim to build those capacities on at least three scales; from the individuals engaged in the LAA itself, to the organisations of which they are part (and with which they engage), and to the wider environments in which they are embedded. This paper explores the concept of capacity building in LAAs, identifying some of the technical and functional elements that can contribute towards achieving change. It illustrates, through two UK case studies, different ways in which these elements have been combined, identifying examples of where capacity building has led to desired outcomes, and also where a lack of attention to certain elements, such as enabling mechanisms, had lessened impact at wider scales.

The Newcastle and Tewkesbury LAAs highlight some of the opportunities and challenges associated with capacity building in flood risk management, particularly those aimed at facilitating long-term societal changes. Exploring these case studies allows us to better appreciate the multi-dimensional nature of capacity building and how different communities of practice (Wenger, 1998) might manage it to their greatest benefit. They also illustrate the need for several capacity building elements to be present, in combination, to achieve objectives and bring about desired changes. These objectives and changes, and hence the combination of elements required to achieve them, differs greatly depending on the context in which they are situated. Without careful planning and consideration, the natural presumption that building capacity within a community will enhance the capacity for that community to change, may not be realised. If one wishes to drive those changes in a particular direction, or to influence the speed at which they occur, then discussions about these elements should be present during the

Fig. 4. Material resources elements of capacity building from the Newcastle LAA. From top left, clockwise: stakeholder mapping of BGI initiatives in Newcastle and the NE; hypothetical master planning for a Blue-Green urban core; GIS shapefile illustrating BGI in part of the urban core (research output for the Blue-Green Cities project); and an interactive map classifying BGI initiatives as existing (yellow), planned (pink), opportunity to influence (purple) or visionary (green).

earliest planning stages to ascertain which, when and how capacities will be built.

Attending to capacity building can maximise the lifespan of any impacts. While taking advantage of the shorter-term 'windows of opportunity' approach (as in the Newcastle LAA), it provides a framework to understand some of the more nuanced requirements for longer-term change. For example, while it is relatively manageble to change the mindset of LAA members, translating this into changes outside the LAA requires many other elements of capacity building to be present (decision-making, coordination, delivery). While we are not suggesting that all five elements of capacity building are required for capacity building to be successful, or that we have identified all the elements that might be required, we argue those designing LAAs need to be mindful that different elements of capacity building exist, and are likely to bring about different changes at different durations and scales.

CRediT authorship contribution statement

Shaun Maskrey: Conceptualization, Writing - original draft, Methodology, Writing - review & editing. **Tudorel Vilcan:** Conceptualization, Writing - original draft, Methodology, Writing - review & editing. **Emily O'Donnell:** Writing - review & editing. **Jessica Lamond:** Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

undertaken by the Urban Flood Resilience Research consortium (www.urbanfloodresilience.ac.uk). This work was supported by the Engineering and Physical Sciences Research Council (grant numbers EP/P004180/1, EP/P004210/1 and EP/P004237/1).

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2020.02.012.

References

Argyris, C., Schön, D.A., 1978. Organizational Learning. Addison-Wesley, Reading, MA.

Ashley, R., Blanskby, J., Newman, R., Gersonius, B., Poole, A., Lindley, G., Smith, S., Ogden, S., Nowell, R., 2012. Learning and action Alliances to build capacity for flood resilience. J. Flood Risk Manage. 5, 14–22.

Bandura, A., 1977. Social Learning Theory. Prentice Hall, Englewood Cliffs, NJ.

Batchelor, C., Butterworth, J., 2008. Learning Alliance Briefing Note 9: Visioning (draft). SWITCH FP6 Programme. accessed 23.09.16. http://www.switchurbanwater.eu/outputs/pdfs/WP6-2_BRN_9_Visioning_draft.pdf.

Bos, J.J., Brown, R.R., Farrelly, M.A., 2013. A design framework for creating social learning situations. Global Environ. Change 23, 398–412. https://doi.org/10.1016/j.gloenvcha.2012.12.003.

Brinkerhoff, D., 2010. Developing capacity in fragile states. Public Adm. Dev. 30, 66–78.

Bryson, J., Crosby, B., Stone, M., 2015. Designing and implementing cross-sector collaborations: needed and challenging. Public Adm. Rev. 75 (5), 647–663.

Butler, C., Pidgeon, N., 2011. From `flood defence' to `flood risk management': exploring governance, responsibility, and blame. Environ. Plann. C Gov. Policy 29, 533–547.

CADRI, 2011. Basics of Capacity Development for Disaster Risk Reduction, The Capacity for Disaster Reduction Initiative. online, available at https://www.unisdr.org/we/inform/publications/18061, last accessed 28/03/19.. .

Dudley, E., Ashley, R., Manojlovic, N., van Herk, S., Blanksby, J., 2013. Learning and action alliances for innovation and active learning in a European context. In: 8Th International Conference. Planning and Technologies for Sustainable Urban Water Management. Lyon, France.

Few, R., Scott, Z., Wooster, K., Flores Avila, M., Tarazona, M., 2016. Strengthening capacities for disaster risk management II: lessons for effective support. Int. J. Disaster Risk Reduct (available online 16 February 2016).

Gourgoura, P., Blätgen, T., Lykou, A., Birkmann, J., Makropoulos, C., 2015. Learning and action alliances: a tool for flood risk governance in coastal areas. The case of rethymno, crete. In: 14th International Conference on Environmental Science and Technology (CEST 2015). Rhodes, Greece. pp. 3–5.

Hagelsteen, M., Becker, P., 2013. Challenging disparities in capacity development for disaster risk reduction. Int. J. Disaster Risk Reduct. 3, 4–13.

Hurlbert, M., Gupta, J., 2017. The adaptive capacity of institutions in Canada, Argentina, and Chile to droughts and floods. Reg. Environ. Change 17, 865–877.

Koontz, T.M., 2014. Social learning in collaborative watershed planning: the importance

of process control and efficacy. J. Environ. Plann. Manage. 57, 1572–1593. https://doi.org/10.1080/09640568.2013.820658.

Laing, M., Wallis, P.J., 2016. Scientists versus policy-makers: building capacity for productive interactions across boundaries in the urban water sector. Environ. Sci. Policy 66, 23–30.

Lamond, J., McEwen, L., Twigger-Ross, C., Rose, C., Joseph, R., Wragg, A., Papadopolou, L., White, O., Proverbs, D., 2017. Supporting the Uptake of Low Cost Resilience: Final Report (FD2682). Project Report. Defra, UK. available at http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=19221.

Lawson, E., Thorne, C., Ahilan, S., Allen, D., Arthur, S., Everett, G., Fenner, R., Glenis, V., Guan, D., Hoang, L., Kilsby, C., Lamond, J., Mant, J., Maskrey, S., Mount, N., Sleigh, A., Smith, L., Wright, N., 2014. Delivering and evaluating the multiple flood risk benefits in Blue-Green cities: an interdisciplinary approach. In: Proverbs, D., Brebbia, C.A. (Eds.), Flood Recovery, Innovation and Response IV. WIT Press, pp. 113–124. https://doi.org/10.2495/FRIAR140101.

Lucas, B., 2013. Current Thinking on Capacity Development, Research Report no. 960, GSDRC. University of Birmingham Helpdesk .. www.gsdrc.org/docs/open/HDQ960.pdf.

Newcastle City Council, 2013. Summer 2012 Flooding in Newcastle Upon Tyne. accessed 19.02.19.. https://www.newcastle.gov.uk/sites/default/files/wwwfileroot/environment/environment/microsoft_word_-_summer_2012_flooding_report_-_final_-_july_2013.pdf.

Newcastle City Council, 2016. Local Flood Risk Management Plan. . accessed 19.02.19.. https://www.newcastle.gov.uk/sites/default/files/wwwfileroot/environment-and-waste/flood-management-newcastle/2016.03.31_complete_and_final_rpt_-_lfrmp_march_2016_1.pdf.

Newman, R., Ashley, R., Molyneux-Hodgson, S., Cashman, A., 2011. Managing water as a socio technical system: the shift from 'experts' to 'alliances'. Proc. ICE-Eng. Sustainability. 164, 95–102.

O'Donnell, E., Lamond, J., Thorne, C., 2018. Learning and Action Alliance framework to facilitate stakeholder collaboration and social learning in urban flood risk management. Environ. Sci. Policy 80, 1–8.

Pahl-Wostl, C., 2019. The role of governance modes and meta-governance in the transformation towards sustainable water governance. Environ. Sci. Policy 91 (October 2018), 6–16.

Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., Taillieu, T., 2007. Social learning and water resources management. Ecol. Soc. 12 (2).

Pahl-Wostl, C., Mostert, E., Tàbara, D., 2008. The growing importance of social learning in water resources management and sustainability science. Ecol. Soc. 13 (24).

Porter, J., Birdi, J., 2018. 22 reasons why collaborations fail: lessons from water innovation research. Environ. Sci. Policy 89, 100–108.

van der Molen, F., 2018. How knowledge enables governance: the coproduction of environmental governance capacity. Environ. Sci. Policy 87 (November 2017), 18–25. https://doi.org/10.1016/j.envsci.2018.05.016.

van Herk, S., Zevenbergen, C., Ashley, R., Rijke, J., 2011. Learning and Action Alliances for the integration of flood risk management into urban planning: a new framework from empirical evidence from the Netherlands. Environ. Sci. Policy 14, 543–554.

Wenger, E., 1998. Communities of practice: learning as a social system. Syst. Thinker 9, 2–3.