Learning and Action Alliances for the integration of flood risk management into urban planning: a new framework from empirical evidence from the Netherlands.

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ABSTRACT
Urban development and regeneration present windows of opportunity to reduce flood vulnerability that are often not taken advantage of. Collaborative planning is needed to integrate planning and flood risk management and can be achieved by a social learning framework: Learning & Action Alliance (LAA). This paper presents a new framework on how to organise a LAA to support collaborative planning. The framework is verified based on empirical evidence from 2 case studies in the Netherlands where LAAs supported the adoption of an integrated approach to flood risk management and urban development. More than 60 interviewees reported that the LAA helped develop and applied relevant knowledge in 3 types of joint activities: system analysis; collaborative design; and governance. These supported demonstration projects through 3 threads by: establishing facts; creating images; and setting ambitions. This was done via 3 streams by: addressing problems; developing solutions; and influencing politics. The new framework has been demonstrated to provide an effective guide to the organisation of a LAA and provides a new analytical tool to assess the impact of LAAs. Other success factors for LAAs and the better integration of flood risk management into the planning process are considered.

Key words:
complex decision-making, Learning & Action Alliance, flood risk management, urban planning and development, transition, social learning, Netherlands.

Vitea
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1. Introduction

Urban floods are increasing worldwide and are likely to become even more damaging in future due to climate change (Munich Re, 2009). Increasingly it is recognised that the use of large infrastructure alone to combat this has the risk for technological lock-in and is likely to be less effective than integrated approaches to manage flood risk (Evans et al., 2004). Therefore a shift to an approach that comprises both structural and non-structural responses is going to be needed that also maximises multifunctional opportunities for land use. Amongst the non-structural responses, land use planning is considered as one of the more crucial components in managing flood risks (Wheater & Evans, 2009; White, 2010). An integrated approach to flood risk management set within urban planning processes is now seen as an effective way of minimising risk, although this has not always been recognised in practice and empirical guidance on its implementation is still lacking (e.g. DCLG, 2009; Carter et al., 2005). In certain countries, such as England, planning incorporating flood risk has become a mandatory requirement (since 2001) and takes a regional as well as a local perspective (DCLG, 2009). In

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the Netherlands the Dutch spatial planning procedure 'Room for the River' explicitly aims to increase flood safety combined with increased spatial quality of landscape, nature and culture (Ministry of Transport, Public Works and Water Management, 2000; Schut et al., 2010). In addition to planning for new developments, the large stock of existing buildings provides significant opportunities for retrofitting as part of normal redevelopments. Thus it may be possible to incrementally reduce flood vulnerability in European cities by taking advantage of current redevelopment opportunities. For this to happen, flood risk management needs to be integrated better into planning and urban retrofitting and development processes (ECTP, 2005).

However, there are many barriers to integrate flood risk in planning. Urban planning sets out to integrate different needs and requirements at a range of spatial and temporal scales. In this, flood risk management is not normally considered to be the most important of the various utility and service needs and opportunities. 'External integration' of wider priorities is part of a general ambition to make planning processes more inclusive in many developed countries (Spit & Zoete, 2006). Flood risk management is a long term goal compared with many other planning considerations. To address this Hajer et al. (2006) suggest a transition to 'horizontally, interactive' planning, as opposed to 'vertically institutional' in order to foster flexible and dynamic planning regimes. These should be flexible and dynamic enough to address contemporary, complex challenges - such as flood risk - combining spatial quality with democratic legitimacy. The multi-objective decision making used in urban planning is complex and needs decision makers who are capable of planning urban areas that can accommodate uncertain futures. Actions are needed in the short term with short term benefits to bring about the required changes to deliver the longer term plans to make urban areas flood resilient (Geldof, 2007; Hamin & Gurran, 2009; White, 2010). Despite this, the complexity of planning processes means that no single stakeholder group has final or absolute control over urban or spatial developments (Sellers, 2002). This multi-actor setting further complicates the way in which flood risk can be adequately addressed in planning processes (OECD, 2010). Another set of barriers includes the increasing uncertainty about changing flood risk (Milly et al., 2008) and a lack of understanding or shared perception of the effectiveness of non-standard response measures (Adger et al., 2005). This lack of understanding also contributes to a technical lock-in to structural solutions, such as defence measures (Walker 2000). The barriers point towards 'wicked-problems'; being "problems that have multiple and conflicting criteria for defining solutions, solutions that create problems for others, and no rules for determining when problems can be said to be solved" (Rittel and Webber, 1973) or persistent problems that are ill-structured, involve many stakeholders, are surrounded by structural uncertainties, and are hard to manage (Rotmans, 2005).

Integrated, collaborative planning should overcome these barriers and involves facilitating complex, decision making. Governance and network theories (Hanf and Scharpf 1978; Kickert et al.,1997; Marsh and Rhodes, 1992; Rhodes 1997; Scharpf 1997) indicate that stakeholders are becoming more actively involved in decision making to develop a joint definition of the problems and potential responses and for the sharing of interests, aims, and ambitions; and also to learn together. Interactive decision making is expected to result in richer policy proposals that can be implemented more efficiently and thus raise the democratic legitimacy of the decisions (Edelenbos & Klijn, 2005; Farrelly et al. 2009). More persistent barriers, such as: institutional structures, cultures and approaches in planning and flood risk management, require a transition or regime change (e.g. Pahl-Wostl, 2007; van der Brugge and Rotmans, 2007; Wong and Brown, 2009). Also these transitions require increased and wide stakeholder involvement to help reach consensual decisions (Rhodes, 1997; Pahl-Wostl et al., 2007; Ashley et al., 2009). The need for integration of flood risk management into the way in which cities are planned, requires new skills and competencies in all of the stakeholders concerned and they need to be better supported (Evans et al, 2004). Pahl-Wostl et al. (2007) recommend "social learning" processes as a means of developing and sustaining the capacity of different authorities, experts, interest groups, and the general public to manage their water systems effectively. Social learning includes both the capacity building of individuals and organisations, as well as the creation of relational qualities and social capital (Pahl-Wostl et al., 2007; Bouwen and Tallieu, 2004). Social learning also helps to build on experience to cope with uncertainty and change, which is especially relevant for integrated flood risk management and urban planning (Folke, 2006). In short, social learning is considered an alternative, complementary policy instrument in water governance (Blackmore et al. (2007) and is gaining recognition as a

potential governance or coordination mechanism (Ison & Watson, 2007). Hence many authors stress the need for multi-party collaboration and propose some sort of social learning framework (White, 2008; Boelens, 2006; Pahl-Wostl et al., 2007; Farrelly et al., 2009, etc.).

The question arises as to how best to organise a social learning framework to support collaborative planning. Few authors provide guidance on how to organise a social learning framework and these are not focussed on supporting collaborative planning or flood risk management. Lipnack and Stamps (1997) propose key principles of networked organisations: unifying purpose; independent members; voluntary links; multiple leaders and integrated levels. Others (Franke, 1999; Miles and Snow, 1986), propose the duties of the net-broker or coordinator of such networks: initiation and preparation of the network; maintaining and improving the network collaboration; promoting the partnership concept; monitoring and continuously improving network performance; responding to opportunities. Senge (1990) presents learning objectives: building a shared vision; personal mastery; surfacing and testing mental models; team learning and systems thinking. Finally, Daniell et al. (2010) provides recommendations on the 'co-engineering' and negotiation process to set up the organisation to support a participatory water management process, but not on the eventual design of the organisation itself.

This paper describes and evaluates a new framework to organise social learning to support collaborative planning, drawing on theories on social learning, development planning (Van Buuren, 2006) and decision making (Teisman, 2000; Kingdon 1984). There are a number of potentially relevant case studies in which stakeholders and experts have been part of a new process of co-production and evolution aimed at the development and implementation of a shared, integrated and adaptive approach to manage flooding within the planning and development process. However, these have so far been poorly monitored and not effectively evaluated and documented (Pahl-Wostl, 2007). This paper evaluates two case studies. These case studies demonstrate how flood risk management has been supported by a social learning framework so as to be better incorporated into urban development planning.

2. Learning & Action Alliance and knowledge

Social learning mechanisms or the frameworks of multi-party collaboration necessary to deliver social learning have been variously named: communities of practice (Wenger, 2000); learning alliance (Verhagen et al., 2008; Batchelor & Butterworth, 2008); learning & action alliance (Ashley et al., 2009; Newman et al, 2011); socially-embedded institutions (Cleaver, 2002); learning platforms or arenas (Farrelly et al., 2009); learning networks for sustainable development (De Kraker et al., 2010; Von Malmborg, 2007; Manring et al., 2003); learning organisation (Senge 1990) and networked organisations (Lipnack and Stamps, 1997). Often without providing an explicit or unambiguous definition. These frameworks all have in common a multi-stakeholder and learning aspect. The differences are found mostly in their operational aims or in the transition stage they contribute to. Daniell et al. (2010) distinguish between a management-driven participatory process with instrumental goals and research-driven processes focusing more heavily on social learning. Both aims are important to integrate flood risk management and urban planning and thus in this paper we will use the term Learning & Action Alliance (LAA) of Newman et al. (2011). They use the definition of a Learning Alliance by Batchelor & Butterworth (2008): ¨a group of individuals or organisations with a shared interest in innovation and the scaling-up of innovation, in a topic of mutual interest¨, and add the word *Action* to highlight both its learning and also its delivery aspects. In the context of this research *Action* refers to the integration of flood risk management in urban development planning projects. Nonetheless an LAA can be used for different innovations in different sectors. Van Herk et al. (2010) pose the hypothesis that different social learning frameworks are necessary at different stages of a transition and that collaborative research is appropriate during the early stages of transition. The integration of flood risk management and urban planning is in a early phase of its transition from 'fighting against water' to 'living with water' (Rijke et al, 2008; Newman et al, 2011) and needs innovative demonstration projects and the creation of networks to influence policy processes and change the regime (Van Herk et al., 2010). However, also in later transition phases, continuous social learning is still necessary to cope with uncertainty and change (Folke, 2006), whilst participatory planning will always be needed for urban planning

and flood risk management as policies are not set at a certain moment by a certain actor (Healey, 1998; De Bruijn & Ten Heuvelhof, 1999). A LAA can serve all stages of this transition.

The main output of LAAs is knowledge (Wenger, 2000). It is when this emergent, contextualised knowledge is coupled to carefully designed social interactions, that bring people into new relationships with each other and the resources at stake, that it is possible to envisage practice-driven policy processes, informed by a process of multi-stakeholder knowledge generation (Jiggins et al., 2007, p533). Knowledge has many forms, as described by Bläckler (1995): ¨knowledge is multi-faceted and complex, being both situated and abstract, implicit and explicit, distributed and individual, physical and mental, developing and static, verbal and encoded.¨ According to Van Buuren (2006) there are three categories of knowledge: (i) explicit, factual and impersonal; (ii) socially construed, normatively loaded reality definitions and images (Schön & Rein, 1994, Fischer, 1990); and (iii) experience-based competencies and skills (Schön, 1983; Cook & Brown, 1999). Tacit knowledge especially, covering the second and third categories, can contribute to the innovation (Nonaka & Taceuchi, 1995) that is necessary for demonstration projects and the transition towards integrated flood risk management. The knowledge development in LAAs comprises all these types of knowledge. By means of co-generating knowledge and stimulating its application, a LAA can reach its aims to support integrated, collaborative planning, facilitate social learning and thus support a wider transition to effectively include flood risk management in development planning processes. Complex decision making – as integrated planning- requires applicable knowledge (Lindblom & Cohen, 1979). Knowledge needs to feed into planning and land-use decisions and is the basis of any flood resilient city (White, 2008). Thus, the organisation of a LAA should enable the development, exchange and application of knowledge.

3. Organising an LAA to support collaborative planning

Van Buuren & Nooteboom (2009) present 3 ways in which knowledge development can contribute to the quality of decision making in flood risk management and urban development planning. Knowledge development focussed on: (1) the quality of the ultimate policy choice (usefulness, applicability); (2) the procedural quality of the planning process (transparency, timeliness) and (3) the quality of stakeholder participation in the planning process (openness, equity, dialogue). These 3 *logics*, as they call them, can be complementary, seem often sequential and can be deliberately chosen, but often are not. Along similar lines Van Buuren (2006) studied in earlier work the role of knowledge in decision-making for spatial development processes and presented 3 interrelated *threads*:

1. to *establish facts*. This thread generates knowledge that: is coherent and not contradictory, has a proven quality and serves to reduce uncertainty and has been established without unacceptable influence from the wishes and opinions of the parties involved;
2. to *create images*. This thread supports *frame reflection* in which parties identify their view of reality and discuss it, look for images or meanings that they share, and create renewed and more creative images as a result of the interaction;
3. to *set ambitions*. This thread supports the negotiations on aspirations of the parties towards implementation.

Thus, a LAA is to be organised to support collaborative planning via these three threads. A LAA should support the *fact* (1) thread by generating and exchanging factual knowledge, and the *image* (2) and *ambitions* (3) threads by bringing stakeholders together voluntarily and in a way that they can freely discuss interests and views. In this way a LAA can thus support interactive decision making. A LAA also supports different types of (social) learning: *single-loop* learning or capacity building through the fact thread; *double-loop learning* to change beliefs, norms and objectives through the image and ambition thread; and *deutero-learning*, learning the ability to learn simply by engaging in the learning process (based on: Tuinstra et al., 2008). In the case studies presented in this paper, the contribution of the LAAs to decision making via each *thread* has been analysed. The contribution of the LAAs to the various types of learning was not explicitly considered in this study.

How do these facts, images, ambitions actually end up in planning decisions? We have described how threads support decision making, but not how the knowledge is actually applied

and captured in policy and business proposals. To stimulate the actual uptake of knowledge from a LAA requires an understanding of decision making processes in urban development planning. Ratcliffe et al. (2004) stress the importance of understanding the dynamics of the procedural milestones and political and corporate decision making processes in urban planning. Decision making processes in urban development seem unstructured as policies are not set at a certain moment by a certain actor (Healey, 1998; De Bruijn & Ten Heuvelhof, 1999). Kingdon (1984) presented the *stream model* to help understand such complex decision making processes. He defines decision making as the connection between three concurrent streams of problems, policies / solutions and politics or participants (Teisman, 2000). These streams are independent, each with their own dynamics. Linkages between the 3 streams occur if there is favourable momentum; a so-called 'policy window' (Kingdon, 1984). Following the stream model, an LAA is to be organised to:

(i) Analyse and address problems;
(ii) Develop and propose solutions; and
(iii) Influence politics by seeking political commitment or bringing participants together.

Thus, an LAA can push and pull the 'streams' of problems, solutions and politics to take advantage of, or even provoke, a policy window for decision making. Pahl Wostl et al. (2007) posed similar hypotheses related to problems; claiming that the processes of framing and reframing 'a problem domain' are essential elements of the social dynamics of the group during processes of negotiation of meaning. Farrelly and Brown (2011) highlight the importance of multi-actor collaboration and the role of scientific partners to develop new solutions to be applied experiments or demonstration projects in urban water management. Bringing participants together is an inherent characteristic of an LAA. The case studies here seek empirical evidence of the contribution of LAAs on the *streams* in the decision making process.

4. Framework for organising an LAA

In short, an LAA is to be organised to generate and apply knowledge to contribute to collaborative planning via the three threads: establish facts; create images and set ambitions, and the three streams in the decision-making process: address problems; propose solutions; and bring participants together. Additionally in this paper we propose a framework to organise a LAA around 3 groups of activities aiming to contribute to the threads and streams: 1. system analysis; 2. collaborative design; 3. governance. Professionals involved in collaborative planning or related social learning processes might implicitly work already according to these notions. For example, based on three existing approaches in the Netherlands, Van der Ven et al. (2006) recommend a mix of optimization, design and negotiation activities for urban water management planning. The framework we present here, however, logically structures LAA activities, their interfaces and relates them to objectives to support collaborative planning via threads and streams. Fig. 1 illustrates the 3 LAA activities. The 3 activities (which actually comprise matrices) are presented in a loop and are interconnected by arrows as the activities are mutually supportive and run in parallel. Each activity is represented as a matrix that shows how the activity delivers in regard to the threads and streams (Sections 3) in 5 cells.

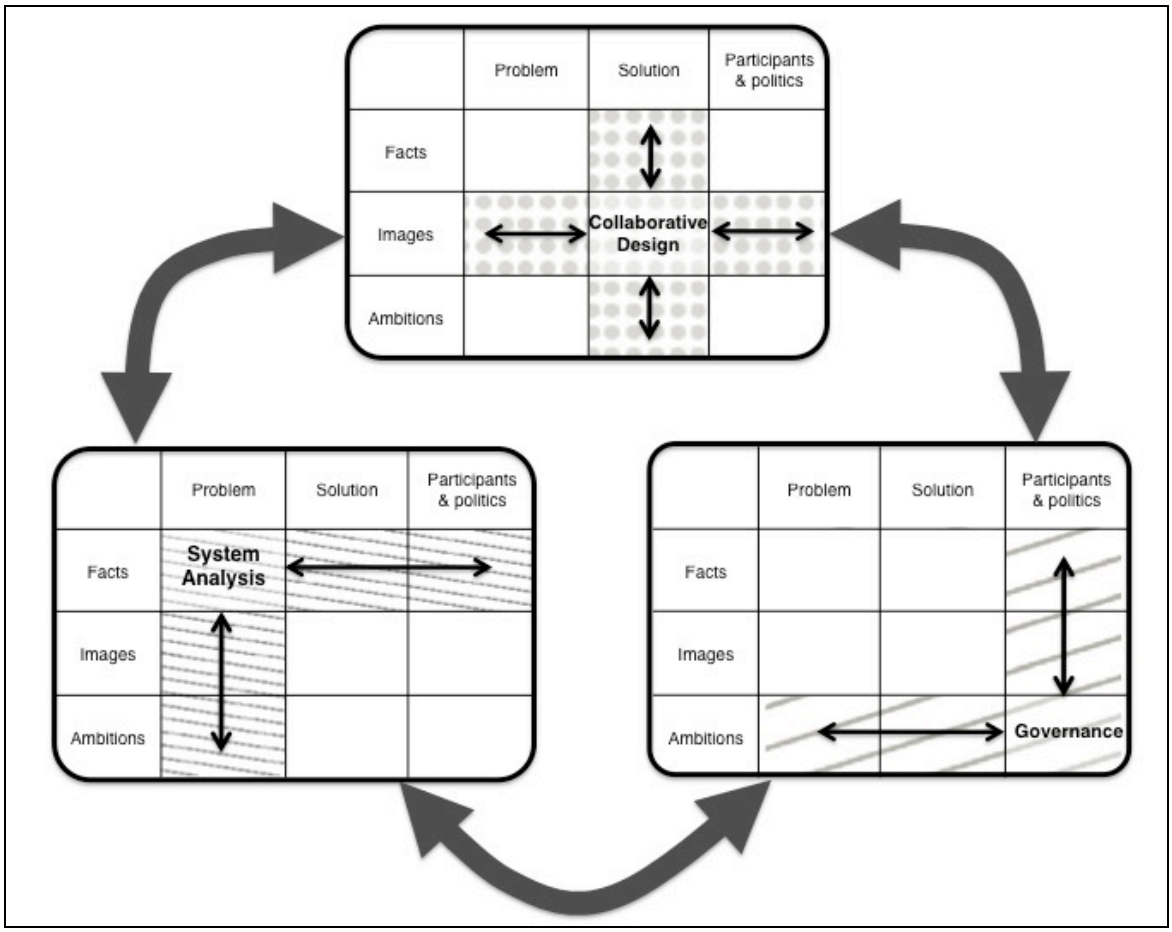

Fig. 1: 3 interactive LAA activities contributing to collaborative planning via 3 threads (facts, images, ambitions) and 3 streams (problem, solution, participants & politics).

The 3 activities can comprise different work tasks that need to be run in parallel supporting each other. The interactions can be deduced from Fig.1 by overlaying the matrices of each activity, with overlaps occurring for four cells in each activity. System analysis influences design objectives and the range of design variables as stakeholders discuss the underlying objectives and problems. System analysis both involves participants in establishing facts and problems can be discussed. These can be prioritised and addressed amongst decision makers based on results from system analysis. Similarly, collaborative design involves participants in developing solutions that, in turn, feed into discussions on ambitions. The interests and ambitions of participants should guide design work, and solutions should be discussed. Successful interface management between collaborative design and governance can be assessed from *actor contentment* and *enrichment* (Edelenbos & Klijn, 2005); i.e. the degree to which the outcome of interactive processes is regarded as positive by actors, and the variety of ideas and the influence of these ideas on the outcomes such as decisions and plans. In this section the activities and their contribution to collaborative planning via threads and streams are described in more detailed.

4.1 System Analysis

System analysis mainly aims to ***establish facts*** and to analyse, define or reframe and address ***problems***. The relevant facts or information requirements for flood risk management include for example: definition of the areas at risk from flooding, green infrastructure mapping, ground composition, flow paths, nature and vulnerability of urban fabric, critical infrastructure (White, 2008). System analysis should also study the various layers of a spatial system: substratum, infrastructure networks and occupation patterns (Priemus, 2007) at various scales such as catchment, urban area and building level (Zevenbergen et al., 2008). It should involve participants in establishing facts jointly as all stakeholders possess knowledge, including factual knowledge from previous studies, relevant to frame problems and solutions, and to provide

knowledge to decision making (Renn, 1995; Ehrmann & Stinson 1999; Petts & Brooks 2006). Moreover, decision makers have to balance multiple objectives or problems: e.g. flood safety has to be combined, or can compete with housing and many other objectives. All these objectives engage many and diverse stakeholders; each with their own interests. LAAs aim to create and exploit the freedom to consider a broad range of problems, stakeholder interests and solutions. The LAA members should share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems (Wenger, 2000). As a consequence there is more room for creativity and innovation because the participants are less likely to start to negotiate from entrenched positions (Pahl-Wostl et al., 2007).

4.2 Collaborative Design

Collaborative design mainly aims to ***create images*** and to develop, analyse, discuss and propose ***solutions*** and strategies. Collaborative design typically results in urban masterplan designs that can be developed in workshops with multiple stakeholders considering multiple objectives. In urban design, objectives can compete or may need to be combined. Therefore design is an activity recommended for frame reflection and to exchange perspectives (create images). Design work is a task oriented action with relational qualities of reciprocity and reflexivity recommended for social learning (Bouwen & Tallieu, 2004). Collaborative design includes the development of different alternatives instead of one single preferred design. Alternatives can show a larger variety of solutions to address multiple problems and allow participants to discuss these freely. Rapid prototyping can help to stimulate progress and help with the interaction with the parallel activities of system analysis and governance. LAAs are expected to be more useful when demonstration projects are in an early development stage when there is more flexibility in the design. In the evolving process the options available for decision makers will gradually decrease, whilst early design decisions generally constrain later change and have a high impact on the overall project investment cost (Van Herk et al., 2006). Flood risk is most effectively addressed in the early stages of urban development and in an integrated way (Carter et al., 2005, White, 2008).

4.3 Governance

The governance activity involves ***participants*** in discussing and defining their ***ambitions*** to create socially construed knowledge and highlight the ambitions and roles of the stakeholders regarding the development project and policy in general. The problems and solutions as defined in the system analysis and collaborative design are here discussed by the stakeholders. Complex decision making involves stakeholders with different views, stakes and values interpreting and valuing information differently; mobilizing different knowledge to underline viewpoints (Koppenjan & Klijn, 2004). The process of generating knowledge collectively in an LAA and discussing it in this activity can help address differences and avoid conflict and also preserve scientific validity (Lindblom & Cohen, 1979; De Bruijn & Ten Heuvelhof, 1999). 'Governance' also provides the vehicle to consider the existing institutional and policy framework and the roles and tasks of each stakeholder. If deemed appropriate, policy processes can be initiated and supported from the LAA for a broader transition in spatial planning or water management beyond the development project (Van Herk et al., 2009). Such social learning can support a change in the governance structure that may be required for general environmental improvement (Pahl-Wostl et al., 2007).

5. Methodology

The investigation used two case studies in the Netherlands to study the dynamics of the Learning & Action Alliances that were established in each. This was to develop a common understanding of the function and value of the LAA in ensuring that flood risk management was effectively included in the development planning processes. The case studies were selected to encompass different types of development and alternative sources of flood risk and for which the dynamics of the LAA in each could be expected to be similar: (1) De Stadswerven, an urban redevelopment project in Dordrecht, which has increasing fluvial flood risk from surrounding rivers; and (2) Westflank, an urban development project in Haarlemmermeer, with a need for increased freshwater storage and with increasing pluvial flood risk from the urban drainage

system. The two projects were supported by LAAs funded by the Dutch research programme Living with Water (LMW, 2010), Urban Flood Management Dordrecht (UFM, 2008) and Building with Water (BMW, 2008) respectively. The studies of the collaborative planning processes and LAAs followed the 'roadmap' of Eisenhardt (1989) and used recommendations of Flyvbjerg (2006), as theory development took place in parallel with the case study analysis (section 5). The theory on the contribution of the LAAs to collaborative planning (section 3) was verified based on the first De Stadswerven case study. Then the relation was made with LAA organisation (section 4) and validated with the Westflank case study. The case study analysis involved a triangulation of multiple methods, following the principles of Yin (2003). The data comprised for each case study: a) 2 workshops with stakeholders that participated in the urban planning process and Learning & Action Alliance (n=36); b) semi-structured individual and group interviews (n=24). a) and b) focussed on the activities and results of the LAAs and the LAA contribution to collaborative planning and decision making. Questionnaires were filled in, then the researchers classified the answers in activities, threads and streams (section 4), after which the results were discussed individually and plenary. c) Observation as the researchers were also participants in the planning process and LAA and thus engaged in delivery as well as observation (action research: Checkland & Holwell, 1998; Flood 1998). d) Documentation content analysis of relevant policy, Stadswerven and Westflank project documentation, minutes of LAA meetings, media and scientific literature. e) A validation test was organised through a large workshop with external experts (n=52) and stakeholders from the LAAs studied and planning processes (n=35) to draw out contradictory and/or alternative explanations of the development and uptake of knowledge out of the LAA in the planning process. During this workshop also the relevance of the theory and case experiences were discussed.

6. CASE STUDIES

6.1 Flood resilient waterfront development at risk from the river

The De Stadswerven case study was a redevelopment project in a former shipyard area, located on the edge of the historical city centre of Dordrecht. It was proposed to develop 1600 residential buildings with an associated range of commercial, cultural and public facilities. The 30 hectare development area was located in the outer flood plain which is not protected by the main ring dike for the City, being adjacent to the river confluence for three rivers: the Beneden-Merwede; Noord and Oude Maas; one of the most intensively used waterway areas in the world. Fluvial flood risk was initially not considered in the plans, but at the outset the requirement was stipulated to raise the ground level of all new developments in the area in accordance with the Dutch Water Act (2009) to ensure flood safety. Under influence of a LAA, the approach radically altered from one of 'flood prevention' to that of 'flood risk management' in common with initiatives elsewhere.

The development process started in 2001 when the municipality acquired land and developed an urban masterplan for De Stadswerven that was eventually approved by the city council in April 2005. Following the concept of flood defence, the ground level was to be raised up to 4m above mean sea level to meet regulations. In the following period the delivery of the De Stadswerven redevelopment was delayed and the approved masterplan was subject to further review due to a perceived lack of ambition and estimated cost overruns. This created tension between the private development consortium and the municipality and also political tension between the city council and government. Two local governors were questioned by the local parliament and the municipality faced a lawsuit against the private developers. The city government decided to suspend work on the project in September 2007. During the suspension of work on the project, there was a change of ownership in the private development consortium, now led by a new private developer. Meanwhile, the research project Urban Flood Management (UFM) Dordrecht (2005-2008) was created with a LAA comprising public, private and research partners. The De Stadswerven redevelopment was used as a case study for knowledge development for the LAA UFM, without initially directly engaging in the project; i.e. only as external observers. Nevertheless, after the project planning was temporarily suspended in 2007, the UFM LAA then had to directly support the delivery of the project. The UFM LAA challenged the requirement to raise the ground level of the entire area based on flood risk analysis suggesting a low vulnerability. Upon resumption, the masterplan was redefined which provided an opportunity, a 'policy window', to use an integrated flood risk management approach proposed by the UFM LAA. Flood risk was used as a design variable for the new masterplan. It included lower lying, attractive water-rich, yet flood proof areas as well as raised areas and

infrastructure that can serve as safe havens and escape routes for evacuation. As a first step towards its implementation in practice, the UFM LAA proposed and actively participated in a feasibility study for a pilot FRM project to provide 100 flood proof dwellings in the De Stadswerven redevelopment.

6.2 *LAA Urban Flood Management's (UFM) contribution to collaborative planning*

The contribution of the LAA UFM to the decision making process for De Stadswerven is described in Table 1 using the framework as presented in section 4. For each activity type the impact is presented via threads (van Buuren, 2006) and streams (Kingdon, 1984). The activities are described in more detail on the UFM website (UFM, 2008) and by Gersonius et al. (2007).

Activities: system analysis; collaborative design; governance.	Contribution on **threads**: facts; images; ambitions.	Contribution on **streams**: problems; solutions; participants / politics.
System Analysis consisting of: flood mapping (water levels & flow velocity); ground level analysis, vulnerability analysis of buildings, infrastructure; public space and critical assets; climate change scenario analysis. Moreover risk perceptions of inhabitants were studied, as well as the insurability of assets in De Stadswerven against flood risk.	The obtained **facts** on flood risk, showed that the redevelopment area was not particularly vulnerable to flooding compared with the rest of the city as it was situated on higher ground. This information was effectively communicated via visualizations in public presentations and publicatons that promoted public debate on flood safety in areas outside the main dikes, that were previously thought of as unsafe as they are unprotected by dikes. (**images & ambitions**)	The **problem** was reframed in discussion with stakeholders (**participants**) as was found that: flood risk is limited, it could be insurable and communication to inhabitants requires attention. These insights stimulated an investigation via the LAA for alternative design **solutions** that did not rely on elevating ground levels.
Collaborative design work on appealing designs of masterplans with attractive, water rich areas with marketable developments. Options for robust and adaptable spatial strategies for future uncertainties were investigated. Also a communication strategy was devised. Finally, design work for the assets in a pilot project of 100 flood proof dwellings.	Stakeholders got new views of reality (**images**) as the UFM LAA showed with her designs that flood risk is manageable through urban planning, flood proofing design and emergency response. The areas outside the dikes were presented as *safe havens*, not high risk areas. Furthermore, the design concepts provided options that potentially increased the spatial quality of the redevelopment whilst also reducing flood risk and addressing the project constraints (**ambitions**). The urban planners in Dordrecht believed that these measures not only addressed flood risk, but created a more attractive living environment as the relation with the water becomes more apparent and the area has a variety of different ground levels.	The proposed measures were integrated **solutions** that simultaneously addressed the interests of multiple stakeholders. The designs were considered inspiring, yet were not considered threatening to their own plans by the overall De Stadswerven project management team as long as they lacked detail. The new masterplan for the redevelopment was made by the same urban planners (**participants**) that participated in the LAA and ultimately incorporated several flood risk reducing measures designed in the UFM project. It included 'flood free routes' and water-rich areas where the tidal influence can be lived with by inhabitants and thus account appropriately for climate change.
Governance. The LAA discussed the results from system analysis and collaborative design. UFM brought together a broader consortium of stakeholders than had originally been used for project delivery of De Stadswerven. This group launched the idea for a pilot project with 100 flood proof dwellings. An inventory was made of existing policies related to FRM and urban development in areas outside the dikes. Responsibilities and liabilities of different stakeholders were discussed and policy recommendations were drafted.	The pilot project with 100 flood proof dwellings made discussions on **ambitions** explicit as the concepts were brought to practice. The project was presented and seen externally (**images**) as an example of innovative planned building, which is both attractive and cost-effective in areas outside protective dikes. The LAA explicitly mobilised external political and financial support for implementation of the solutions proposed by UFM, providing opportunities for the De Stadswerven project managers (**ambitions**). E.g. the LAA UFM lobbied for financial and procedural support from the national DeltaTechnology Committee as the new masterplan might require additional investment and increase process and legal complexity.	Decision makers, including the city alderman and regional and national governments representatives formed a steering committee of the LAA that could support project delivery (**participants / politics**). The LAA UFM initiated and supported national and regional policy change for governance of developments in areas outside the dikes and, in general, for integrated flood risk management. E.g. the new policy of the Province of South Holland used UFM pilot as an exemplar. The integrated flood risk management approach attracted interest and support from the communication media and thence attention at Dutch Government level. Prior to this, the project had received mainly negative media attention due to the political tensions and project delays. Later, the UFM findings were adopted by the national Delta Commission and the Dutch Crown Prince visited Dordrecht.

Table 1: LAA UFM activities and contribution to collaborative planning of De Stadswerven via 3 threads and 3 streams.

6.3 Water storage in high density urban areas in the Netherlands

The second case illustrates the initiation and design phases of a development in the Westflank Haarlemmermeer area of the Netherlands. The area is situated in the Randstad and metropolis region of Amsterdam and is expected to provide some 20,000 new dwellings between 2010 and 2030. The planned development is to take into account a number of spatial constraints: spatial and environmental policies for Amsterdam Schiphol airport; spatial policy for the Greenport Bollenstreek area and water policy to increase local water detention and storage. The development comprises 3036 hectares, with 10,000 new dwellings; 1M m^3 peak flood retention capacity; 2M m^3 seasonal flood water storage and some 900 hectares of recreational green space. The LAA provided a new approach to effectively deliver on the water storage objectives that is now setting an example for profitable, attractive developments. This, in turn, is changing policy in The Netherlands in relation to such developments.

From 2004 a spatial plan was developed for Haarlemmermeer Bollenstreek, adopted by regional parliaments and presented to the national ministry of Housing, Spatial planning and the Environment in May 2006. Within a year of the start of the spatial planning process for the proposed development, a broad consortium of public, private and research partners created an LAA as part of the research project 'Building with Water' (BwW). BwW (2004-2008) aimed to learn about flood resilient and climate proof urban development in polder areas - behind the dike rings - and had the explicit ambition from the outset to contribute to the overall planning of the Westflank development. The LAA BwW identified the Westflank as a possible location for water storage and housing, for which a spatial exploration was executed with support from BwW. This included conceptual designs of high density urban areas with water storage, supported by a technical feasibility study, a market study and a cost benefit analysis. In November 2007, after lobbying of the LAA BwW, the project was included in the national policy programme Urgency Programme Randstad, thus providing access to additional financial legal and political support. In the following 2 years a development strategy was defined with water areas and multi-functional use of space as guiding design principles. As a first step towards its implementation in practice, BwW stakeholders agreed on the intention to deliver a pilot project 'waterliving' of 500 dwellings.

6.4 LAA Building with Water's (BwW) contribution to collaborative planning

The contribution of the LAA BwW to the decision making process for Westflank is described in Table 2 using the framework as presented in section 4. For each activity type the impact is presented via threads (van Buuren, 2006) and streams (Kingdon, 1984). The activities are described in more detail on the BwW website (BMW, 2008).

Activities: system analysis; collaborative design; governance.	Contribution on **threads**: facts; images; ambitions.	Contribution on **streams**: problems; solutions; participants / politics.
System Analysis consisting of: an analysis of the (ground) water-soil system (incl salt water intrusion) to verify the need and possibilities for water storage: flood mapping, inventory of civil works and infrastructure, landscape. LAA BwW conducted a real estate market study for 'water living' on potential buyers, needs, products, and prices; and a cost benefit analysis for the exploitation of water living.	The aggregated spatial aspirations from all of the original objectives exceeded the available space as illustrated by the BwW project, with a map showing the spatial demands. (**facts**). Based on that BwW redefined the required water storage objectives from a plan-based, footprint approach in hectares, to a volumetric storage approach in cubic meters; thus opening the way for a consideration of locations for water storage with different water depths. (**image / ambitions**) The market study found that new building typologies in the area were also competitive in terms of cost and market demands (**facts**).	LAA BwW showed the need and possibilities for water storage **(problems)** which stimulated the designers to investigate the possibilities of combining functions. (**solutions**). The **problem** definition was broadened with insight on pluvial flood risk as well as salt water intrusion. The marketability and cost-effectiveness of 'water living' raised the interest of private developers and contractors (**participants / politics**).
Collaborative design. LAA BwW developed conceptual and detailed designs for high(er) density urban environments with water storage applicable in various areas. LAA BwW developed a housing-water-index to show the possible housing density when combined with water storage that was used as input for design work.	The LAA BwW showed the potential of multi-functional use of space (**image**), particularly of high density urban development combined with water storage. The developed designs by BwW were considered appealing and functional by Westflank Haarlemmermeer stakeholders (**image, ambitions**).	BwW provided **solutions** showing the potential of multi-functional use of space with a newly developed housing-water-index. Based on that concept the LAA supported the zoning and location search for water storage. The Westflank was proposed as an area where high density urban development and thus with high expected revenues could be combined with water storage designed for fluctuating water levels. The latest masterplan designs incorporate many examples; e.g. sub-areas with a variety of urban 'amphibious' structures such as flood resilient homes, infrastructure and public green spaces. (**solution**)
Governance. LAA BwW brought together a broad consortium of stakeholders, especially enriched by private stakeholders. The LAA BwW provided the means to lobby widely for broad public, political and financial support. E.g. LAA BwW connected with senior national policy makers and politicians and successfully lobbied for inclusion of Westflank in Urgency Programme Randstad. The LAA BwW proposed and supported a feasibility study for 'waterliving' pilot of 500 dwellings.	The LAA BwW considered a broad range of sectoral and stakeholder **ambitions**; especially interest of land owners, developers and contractors were brought into a public driven process. Urgency Programme Randstad gave a boost to the project and paved the way for an intention agreement for a pilot project 'water living' in November 2007 signed by all major stakeholders. (**ambitions**).	The LAA introduced new stakeholders and interests to the process (**participants/politics**). This supported **problem** reframing, e.g. including private interests. Support for new **solutions** was forged towards implementation through 'waterliving' pilot project and further backed by the Urgency Programme Randstad, providing access to additional financial, legal and political support for the urban development (**politics**).

Table 2: LAA BwW activities and contribution to collaborative planning of Westflank via 3 threads and 3 streams.

7. Discussion and Analysis

This research has revealed that LAAs can support collaborative planning. The case studies in Stadswerven and Westflank provided relevant empirical evidence of social frameworks that supported the integration of flood risk management into urban planning processes. The two LAAs have had a decisive influence on the urban masterplans and related policy proposals that have been adopted. The LAA UFM proposed design concepts with varying ground levels and a new flood proof building typology. BwW proposed the combination of housing and green areas with water storage to exploit fluctuating water levels. The design concepts embraced multifunctional use of space through which flood risk management was connected with other objectives and interests. For both case studies, respondents highlighted a shift in perspective where flood risk management was seen as a solution instead of a problem.
The LAA brought together a broad range of stakeholders each with their interest and expertise that steered and enabled the reframing of the problem and the development of these innovative solutions. Participants confirmed that the prospect of a learning experience attracted them and more participants were motivated to engage in a more open dialogue on ambitions than in the traditional urban development processes. In interviews with the stakeholders, spatial design was seen to stimulate fruitful discussion as all objectives needed to be merged into a single holistic urban design. One respondent insightfully called the proposed designs ¨lucky dips¨ in which all stakeholders could highlight how their interests were addressed.

The elements of the new framework proved to be collectively exhaustive. The contributions of LAAs to collaborative planning processes that were described by 60 respondents could all be classified according to the framework without exception. The mobilisation of financial, political, legal or procedural support proved an important element of the 'governance' activity. That lobbying and dissemination work was important for the implementation of new solutions and policies, especially as the LAA had no mandate or formal position to impose conditions on to the development process. Respondents indicated that this independence was a success factor in contributing to collaborative planning as the LAAs had the freedom to address new and politically sensitive problems and explore innovative solutions, unconstrained by formal political positions with participation of different stakeholders and expertise and had access to broader and new political, research, media and public networks. LAAs in which actors are more willing to leave entrenched positions are perceived to be crucial for the adaptive governance of social-ecological systems (Folke et al. 2005). Gunderson (1999) stresses that these informal, shadow networks can be incubators for new approaches to govern social ecological systems. Van Herk et al. (2010) suggested that the connection can be made through people working together. In particular the pilot projects 'flood proof building' of 100 dwellings in Stadshavens and 'water living' of 500 dwellings in Westflank became important connectors between the LAA and the formal decision making process towards implementation.

Also, the framework proved useful, both descriptively as an analytical tool and prescriptively to guide LAA work, although the activities, threads and streams are not necessarily mutually exclusive. The overlap between activities is logical as they are mutually dependent; e.g. respondents highlighted that ¨many design ideas popped up whilst discussing results of (system) analysis.¨ The difference between the threads 'images' and 'ambitions' was not always clear either. When partners discussed their view of reality (*images*), they also discussed their shared or conflicting *ambitions* towards implementation. Finally, the researchers found that new images (thread) often led to, or were created by new solutions (stream) and that negotiating ambitions (thread) involves participants and influences politics (stream). These overlaps make a strict classification difficult. However, during the validation workshop, participants stressed the practical and analytical value of the framework. After case study presentations, 87 participants were asked questions such as: compare the importance of the LAAs in: analysing problems versus developing a solution, or establishing facts compared with creating images and setting ambitions. The subsequent discussion proved insightful. Few participants stressed both possible answers, whilst roughly half of the participants mentioned one pathway (thread or stream) of a LAA to support collaborative planning, and the other half mentioned the alternative. After group discussion, participants confirmed the usefulness of all activities, all threads and all streams, and the relation between them. The framework provides a tool to LAA members to organise their joint work to contribute on all threads and streams and to recognise the importance of each activity in contributing to these. It is possible to conclude that the value of

the framework is in recognising the broadness and added value of all activities and aims, not in strictly separating them.

8. CONCLUSIONS

Urban development, regeneration and retrofitting present windows of opportunity to reduce flood vulnerability that are often not taken advantage of. Collaborative planning is needed to integrate urban retrofitting and development processes and flood risk management. This can be achieved by a social learning framework: Learning & Action Alliance (LAA). A new framework has been developed and validated to guide the organisation of LAAs and to analyse their performance in support of collaborative planning. A LAA should be organised in terms of a number of activities: system analysis; collaborative design and governance in order to: establish facts; create images and set ambitions (*threads*) and to: address problems; develop solutions and involve participants and influence politics (*streams*). The two case studies in the Netherlands show the value of LAAs that had a decisive influence on the flood proof, urban development masterplans and related policy proposals that have been adopted. LAAs can be a governance or coordination mechanism or policy instrument (Blackmore et al., 2007; Ison & Watson, 2007) to create flood resilient urban areas by taking advantage of current redevelopment and retrofitting opportunities.

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