This is a repository copy of *22 reasons why collaborations fail: Lessons from water innovation research*.

White Rose Research Online URL for this paper:
http://eprints.whiterose.ac.uk/134105/

Version: Published Version

Article:
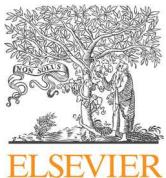
22 reasons why collaborations fail: Lessons from water innovation research

James J. Porter[a,*], Kamal Birdi[b]

[a] *Department of Geography, King's College London, Strand Campus, London, WC2R 2LS, United Kingdom*
[b] *Institute of Work Psychology, Sheffield University Management School, Conduit Road, Sheffield, S10 1FL, United Kingdom*

A B S T R A C T

Bold and inventive solutions are urgently needed to safeguard the future use of water. In response, collaborative-innovation is increasingly championed. If stakeholders including water utilities, supply-chain companies, research institutions and local communities work together, share their experiences and pool ideas, meaningful change could happen, it's argued. But effective collaboration is far from easy. For every incentive that drives collaboration forward, another barrier blocks its path. Whilst the literature offers many possible factors that influence the success (or failure) of collaborative-innovations, it remains unclear which factors are most important, where the highest agreement and disagreement exists, and if accommodating one factor creates problems for another. This is important because its not always practical, nor necessary, to apply everything from the academic literature. In this paper, we report findings from an international systematic literature review that brings together a range of studies that cross the water collaboration and water innovation divide. We identify 22 broad themes that are spread (unevenly) across the entire collaborative-innovation process; highlight how the level of attention given to each theme varies greatly; and where disagreement exists. Our research provides practical insights on how to create more effective collaborative-innovations in water and where future research should be directed.

1. Introduction

As environmental problems become more complex, contentious and challenging to solve calls have grown for the involvement of more stakeholders in environmental decision-making. In water management, collaboration is often heralded as a solution. It can help stakeholders with different needs, capacities, and experiences work together to improve the decision-making *process* and its *outcomes* (Margerum and Robinson, 2015). Collaborations can encourage a more inclusive and participatory ethos where different perspectives are valued, efforts are better aligned to reduce duplication and increase efficiencies, as well as offering the opportunity to resolve longstanding conflicts (Margerum, 2011).

Yet critical scholars raise questions over the extent to which collaborations work (Bodin, 2017), and in turn, if a darker side of collaborations exists (Kallis et al., 2009). For instance, the framing of collaborative efforts can be used by those with greater access and expertise to exclude certain voices or knowledge types. Such practices speak to not only the crucial role played by power but also the deeply political nature of water itself, how its managed, for whom, and to do what

(Harrington, 2017; Margerum, 2002). Who gets involved, has a say, benefits or pays, all tell us a great deal about the transparency, accountability and legitimacy of collaborative processes as a democratic deficit opens up, not closes (Kallis et al., 2009; Margerum and Robinson, 2016). Inconsistencies in how we define and use collaboration[1] add further complications (Emerson et al., 2011; Margerum and Robinson, 2015). Even when these concerns are considered other practical challenges remain.

Findings from collaborative water studies are often criticised for being too locally focused or lacking generalizability. As Leach and Pelkey (2001) explain, this means the literature risks comparing apples with oranges, relying on empirical research from only one or two case studies, each with different methods, policy contexts, regions, and sectors (cf. Emerson et al., 2011; Robinson et al., 2011). Indeed, Sabatier et al. (2005) lambast the field for failing to develop an empirically grounded theoretical framework. This makes it difficult for researchers and practitioners alike to discern what are the dos and don'ts of water collaboration. If the literature disagrees on these dos and don'ts it is even harder to know where to start. Where water collaboration theories have been applied, such as institutional rational

---

choice (Ostrom, 1990), the political contracting (Benson et al., 2013), and the advocacy coalition frameworks (Sabatier et al., 2005), the focus tends to be on the self-maximising interests of actors that make them want to work with others as opposed to how the collaborative process should be run. Whereas the collaborative model developed by Ansell and Gash (2007) explains how to create a more harmonious, and fair, process it says little about whether the factors involved are transferrable from one context to another.

For water management, a pressing concern is how to secure access to clean water under increasing pressure from growing populations, climate change, pollution, and aging water infrastructures pushed to their limits (Kiparsky et al., 2013; Speight, 2015). To stop water becoming too expensive, dirty and scarce, innovation is urgently needed. If existing water sources can be better used, new sources better exploited, consumers make better use of water, and governments better support research and development, it's argued that many water problems could be tackled (Moore et al., 2014; Thomas and Ford, 2005). But the water sector is, understandably, conservative. It is responsible for supplying safe, reliable, and affordable water. The sheer size, complexity and longevity of water infrastructures make repair and renewal preferable to change (Dobbie et al., 2016); safe treatment of water makes tried-and-tested technologies preferable to experimental ones (Speight, 2015); skill shortages or silo-thinking make it hard for managers to embrace new ideas (Kiparsky et al., 2013); and regulatory environments where price rises are discouraged can make large-scale investments challenging (Thomas and Ford, 2005). This institutional culture, coupled with the organisational norms and the staff behaviour it shapes, can stifle innovation. As a result, water providers are increasingly looking to collaborate with others, including research institutions, supply-chain companies, and communities, to help them innovate.

In this critical review, we aim to understand the main factors that influence the success or failure of collaborative-innovation in water. We update and go beyond the previous Leach and Pelkey (2001) review of watershed partnerships by covering a more contemporary period of literature, having a more inclusive geographical scope and focusing particularly on collaborative innovation in the water sector. To do this, we conducted a systematic literature review of peer-reviewed publications, over a twenty-year period: 1996–2016. In what follows, we explain our data and methods, before highlighting the broad range of themes identified, which themes are best supported by the literature, and whether there is agreement over which themes are most important. We map the data onto five interrelated questions about the collaborative-innovation process: what is needed to initiate the process, who should be involved, how work together, how to design the process, and importantly how the process should be run. To close, we argue that whilst there is strong agreement about key factors that influence the success of collaborative-innovations, researchers and practitioners alike should be wary of applying these factors uncritically.

2. Data and methods

To understand what are the main factors that influence the success of collaborative-innovation in water, we conducted a systematic literature review of empirical papers. In water research, systematic literature reviews have gained a reputation as a robust method for identifying, analysing, and synthesising large bodies of literature (Stefanelli et al., 2017). Whereas traditional literature reviews seldom justify what search or selection criteria they used, systematic literature reviews make this explicit to improve the transparency, accountability and reproducibility of the results – so that other researchers have a baseline from which to check and build upon in future studies (Porter et al., 2014). In turn, systematic reviews also allow for a more critical and consistent engagement with studies by prioritising empirical evidence over preconceived knowledge, which is crucial when tracing how understanding has changed over time.

We used ISI Web of Science, the largest and most comprehensive research publication database, to perform a keyword search for journal articles published between 1st January 1996 and 1st October 2016. Articles published before 1996 were excluded, as Leach and Pelkey's (2001) review on watershed partnerships already covered this period. As 'collaboration', 'innovation' and even 'water' are understood differently across disciplines, fields, and scholarly traditions; we used different keyword combinations for each so that the fullness of the topic was covered. The same is true for how 'success' or 'failure' are conceptualised.

In total, 843 keyword searches were conducted, from water*, collaborat*, innovate*, to driver* and barrier* (see Supplementary Materials for a full list of keyword searches). 2944 papers were returned. Once these papers were imported into Endnote software, we applied an inclusion and exclusion criterion. Only empirical, peer-reviewed publications (not books), written in English, which evaluated the process of collaborative efforts in water innovation, were included. For instance, studies that focused on the development of innovations rather than on the teamwork that brought them about, such as trials of microbes that change colour in polluted water, were excluded.

48 papers were retained for further analysis. To prioritise the highest-quality, and most empirically-robust, studies we ranked these papers using a scoring system from one to five. Five star papers were clearly executed, used reliable research methods, and were critically analysed. Large-scale surveys of discrete groupings, using appropriate statistical techniques, or multi-method approaches using in-depths interviews and surveys, met this criterion (see Supplementary materials for full details). To ensure consistency, the scores were double-blind checked by both co-authors, independently, to identify any papers that fell between two rankings. 26 papers (0.88% of the initial search) met the inclusion criteria, scoring three stars or above. As shown in Table 1, these papers include different research methodologies, geographical regions, and collaborative contexts (e.g. watershed partnerships, urban water governance, and water supply, treatment and conflicts).

To analyse the data, we developed a qualitative scorecard to record each paper's characteristics – authorship, research overview, methods used, key findings. A central question put to the studies was: what influences the success of collaboration in water innovation? We performed a content analysis to convert the qualitative findings from disparate papers into a meaningful set of general underlying themes to allow comparative discussion of the literature (Haslam and McGarty, 2014). After reading each paper, the conclusions were summarised whilst remaining faithful to the original meaning and language, also known as *condensation* (cf. Erlingsson and Brysiewicz, 2017). 238 distinct conclusions (an average of 9 per study) were identified (see Supplementary materials). Each conclusion was given a *code* that closely described, in a few words, its condensed meaning (e.g. risk aversion, risk-taking, too uncertain). We then grouped the codes into *categories* that described different aspects, both similarities and differences, of the text that belonged together. Lastly, to capture the underlying meaning of each category we defined 22 higher-level *themes*, as shown in Table 2. Of the 238 conclusions, 208 fitted well within the 22 themes, whilst the remaining 30 (none of which were identified by more than 2 studies) were not categorised.

3. Results: what factors influence the success (or failure) of collaboration in water innovation?

Close inspection of all 22 broad themes reveals several patterns. First, themes are spread (unevenly) across the collaborative-innovation process, from how to initiate the process, 'who' should be involved, and how to get everyone to work together, to how to design and run that process. Second, the level of attention given to each theme in the empirical studies reviewed varies from the central focus of the analysis to a side-note. Although the frequency with which a theme is cited should not be confused with its importance, recurrence may indicate that it

Table 1

Publications systematically reviewed. Research approach key: A = unassisted interpretation; B = rely on respondents' views; C = compared findings against theory, D = Compare cases against each other.

#	Publications	Cases	Location	Context	Interviews	Survey responses	Documents analysed	Research approach	Ranking
1	Dobbie et al. (2016)	5	Perth, Adelaide, Melbourne, Sydney and Brisbane, Australia	Urban water management and governance	–	620	–	C&D	4*
2	Howarth and Monasterolo (2016)	5	United Kingdom	Energy-food-water nexus	78	–	–	C&D	3*
3	Alegre et al. (2015)	9	Portugal	Water innovation	162	–	–	A	3*
4	Burns et al. (2015)	1	Melbourne, Australia	Water drainage management	9	–	–	B	3*
5	Desportes et al. (2015)	1	Cape Town, South Africa	Flood risk governance	90	–	–	C&D	3*
6	Erickson (2015)	4	United States	Watershed management	–	–	2000	C&D	3*
7	Madzingamiri et al. (2015)	1	Harare, Zimbabwe	Water sanitation management	NA	–	NA	C&D	3*
8	Medema et al. (2015)	1	Quebec, Canada	Sustainable water governance	41	–	–	C	4*
9	Scholten et al. 2015	2	Netherlands & United Kingdom	Water resources management	17	–	–	C&D	3*
10	van Burren et al., 2015	3	Netherlands	Water resource management	NA	–	NA	C&D	3*
11	Biddle and Koontz (2014)	26	United States	Water partnerships, pollution reduction	–	72	26	C&D	4*
12	Berado (2014)	1	Florida, United States	Watershed management	–	97	–	C&D	4*
13	Bremer and Bhuiyan (2014)	2	Cairo, Egypt	Water supply	24	–	–	C&D	3*
14	Koontz and Newig (2014)	2	Lower Saxony, Germany and Ohio, United States	Watershed management	41	–	–	C&D	5*
15	Bettini et al. (2013)	1	Perth, Australia	Drought, water scarcity, governance	31	–	–	C&D	4*
16	Ravnborg et al. (2012)	5	Bolivia, Mali, Nicaragua, Vietnam, Zambia	Water conflicts	45	–	–	B	3*
17	Hoverman et al. (2011)	1	Kongulai, Solomon Islands	Integrated water resource management	35	–	–	C&D	4*
18	Mandarano and Paulsen (2011)	6	Philadelphia, United States	Watershed management	–	–	135	C&D	3*
19	Wolfe and Hendriks (2011)	2	Alberta & Ontario, Canada	Water efficiency and the built-form	89	–	–	B	3*
20	Bohnet (2010)	2	Great Barrier Reef region, Australia	Water quality improvement planning	75	–	–	C&D	5*
21	Huntjens et al. (2010)	4	Hungary, Portugal, Netherlands, and Ukraine	Water resource management	42	–	–	D	3*
22	Kallis et al. (2009)	1	California, United States	Water governance	NA	–	–	C&D	3*
23	Ferreyra et al. (2008)	1	Ontario, Canada	Water quality improvement planning	11	–	60	C	4*
24	Butcher & Jeffery (2005)	1	International peer-reviewed publications	Use of membrane in water treatment	–	–	1678	C	5*
25	Byron and Curtis, (2002)	2	Victoria, Australia	Watershed initiatives	–	458	–	C	5*
26	Konisky & Belerie (2001)	4	United States	Watershed management	NA	–	–	C	3*

Table 2

22 themes that can influence the success (or failure) of collaborative-innovations in water. Each study reviewed was assigned a key identifier # in Table 1, which is used below to denote which themes were discussed by which studies.

Theme	Definition	Publications
Stakeholders have the capacity to enact change	Those involved have the skills, resources and time needed to be actively involved in deliberations and any future actions, or at least have the opportunity to learn and develop these capacities.	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
Clear roles and responsibilities	The roles and responsibilities of the institutions and individuals involved are clear (not fragmented).	1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 21, 22
Acceptance of different social values, norms and cultures	Efforts are made to ensure different group values, norms and cultures are treated equally alongside more Westernised or scientific approaches.	1, 2, 4, 5, 8, 10, 12, 13, 14, 15, 16, 17, 20, 22, 26
A strong or clear vision	Everyone involved agrees on the purpose of the collaboration, the priorities and long-term goals, their role and responsibilities within it, and what is needed to resolve the problem at hand.	1, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 16, 19, 20, 22, 23, 25, 26
Participation is open to all stakeholders	Every effort is made to ensure as many stakeholders affected are included in the process, or at least had the opportunity to participate.	1, 2, 4, 5, 7, 8, 9, 10, 12, 14, 15, 18, 20, 21, 22, 25, 26
Funding	Sufficient money is set aside to run the collaborative-innovation process and implement the actions selected.	3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 18, 21, 22, 24, 25
Trust	A firm belief that all stakeholders are acting in good faith, sharing relevant experiences and materials, and not pushing their own agenda or one that disadvantages others.	1, 2, 3, 4, 5, 7, 10, 12, 13, 16, 17, 18 19, 22
An effective coordinator or bridging organisation	Where a neutral person or organisation is appointed to facilitate conversations and coordinate actions between different, often disparate, stakeholders to ensure a fair, impactful, outcome.	3, 4, 5, 6, 8, 9, 12, 16, 17, 18, 19, 22
Strong leadership	Either from a personal or organisational level, strong leadership can involve setting agendas, keeping the process moving, or ensuring the best solution is reached.	2, 4, 5, 8, 9, 12, 14, 19, 21, 23, 25, 26
Low risk or high willingness to experiment	There is a willingness to take risks, accept failure as normal practice, so that experimentation is welcomed and encouraged.	1, 3, 4, 5, 7, 10, 13, 15, 19, 21, 22
Sensitivity to power imbalances	An appreciation that different stakeholders have more or less power to effect change and their willingness to engage in the process may be impeded by perceptions of being subjected by other more powerful actors.	1, 2, 5, 7, 8, 13, 14, 17, 21, 22
Introduction of new Government legislation, regulation or policies	Where Governments, agencies or departments introduce new legislation, regulations or policies to support of new working practices.	1, 5, 8, 10, 12, 13, 15, 19, 20, 21, 24, 25
Activities are bounded by a small geographical area	All stakeholders, and actions under consideration, concern a well-defined geographical area with clear local commitments at stake.	1, 4, 8, 12, 13, 14, 16, 21, 23, 25
Sustained participation	Importance of encouraging and supporting stakeholders to stay involved throughout the collaborative-innovation process.	8, 11, 12, 14, 18, 20, 25
Clear methods for evaluating and measuring outcomes	Necessity of implementing comparable and long-term methods to quantitatively assess the extent to which actions have been successful and identify what has changed.	1, 3, 4, 5, 10, 11, 12, 18, 24, 25
Adequate time to plan and execute actions	No one part of the collaborative-innovation process is prioritised at the expense of the others so that there is time to discuss, formulate, and execute actions without rushing.	2, 3, 4, 9, 10, 13, 14, 18, 19
Effective communication, data sharing	All stakeholders have access to the data or evidence used to make decisions by the group and efforts are made to ensure that everything is communicated clearly and effectively to everyone.	1, 2, 3, 5, 7, 11, 12, 18, 21, 24
Clear and accessible scientific information	Availability of scientific information used to inform decisions is circulated to all stakeholders involved and presented in a non-technical, or exclusionary way.	2, 8, 13, 14, 17, 24, 26
Low costs or investment required	Little money, time or resources are needed from stakeholders to enable the process to proceed.	3, 8, 10, 12, 13, 19, 20, 24
Low or medium levels of conflict	All the stakeholders refrain from creating new, or exacerbating old, lines of conflict so that everyone works together harmoniously.	5, 14, 16, 17,
All actors are fully committed	Not only do all stakeholders participate in discussions, pooling ideas, and sharing experiences, but they are also committed to achieving meaningful change.	3, 5, 6, 8, 10, 14, 15, 26
Clear decision and process rules	The procedures for consulting, prioritising, and deciding upon different courses of action are fair and explicit from the outset.	1, 2, 5, 12, 14, 18,

plays a key role. Lastly, the level of agreement in the themes over the extent to which collaborations will succeed also varies. Where some themes are highly contested, others are accepted with little or no disagreement. Below these patterns are explained with the themes highlighted in bold.

3.1. Which themes were identified by the empirical studies reviewed?

3.1.1. How to initiate collaborative-innovations?

Every theme identified emerged in response to problems repeatedly flagged up during the collaborative-innovation process. Efforts to initiate collaborative ventures can falter if stakeholders do not feel the need to involve others to innovate, if little incentive exists to challenge the status-quo, if the appetite for risk-taking is low, or if there is a lack of financial support. The **introduction of new government legislation, policies or regulation** may shake-up stakeholder behaviour

(Desportes et al., 2015; Koontz and Newig, 2014; Medema et al., 2015). Setting new, stricter, water quality standards or performance metrics can help stakeholders recognise the advantage of working together, especially when deadlines for compliance are tight. Related to this, if a culture of **risk-taking is encouraged** stakeholders may feel more comfortable experimenting without fear of the political ramifications if a new technology/service failed (Dobbie et al., 2016; Desportes et al., 2015; Bettini et al., 2013).

Providing ring-fenced **funding** for stakeholders to support the development of prototypes, field-testing, and implementation of new ideas, or simply covering the costs involved in hosting meetings, can also help **lower entry costs** so that participation does not become the exclusive preserve of an elite (Alegre et al., 2015; Bohnet, 2010). Grant schemes and prize money targeted at specific problems can breed competition between stakeholders to get involved (Butcher and Jeffrey, 2005). Finding a fair way of spreading the costs of involvement

amongst all stakeholders, with no single stakeholder carrying all the risk (Erickson, 2015), or too large an amount of money expected up-front (Alegre et al., 2015), can also make collaboration more appealing.

3.1.2. Who should be involved?

Concerns were raised that collaborative efforts involve only the usual suspects, partly due to the technical nature of some innovations. This can discourage those with different skill-sets, experiences, and knowledge from taking part or limit their contribution and commitment. **Participation should be open to all** (Bremer and Bhuiyan, 2014; Madzingamiri et al., 2015; Medema et al., 2015). Every effort should be made to accommodate as many stakeholders as possible, or at least give them the opportunity to participate, to avoid damaging the legitimacy of the process. That said, **stakeholders must also have the capacity to act** (Dobbie et al., 2016; Howarth and Monasterolo, 2016; Alegre et al., 2015). It's essential that the skills, experience, resources, time, energy and liberty exist to take part fully. Building in time for learning, removing jargon, and an emphasis on reflexivity, can all help.

Those who do become involved, however, must be **fully committed**. That is, offering ideas, sharing experiences, and actively taking part in discussions, to achieve positive change (Madzingamiri et al., 2015; Ravnborg et al., 2012; Mandarano and Paulsen, 2011). Without a strong commitment, momentum can be lost. Formal agreements, or contracts, can help prioritise efforts, ensure sufficient resources are allocated to complete the process, and get buy-in from senior management (Scholten et al., 2015; Koontz and Newig, 2014).

3.1.3. How to get everyone to work together effectively?

Another set of challenges relate to getting stakeholders working together effectively. If antagonism exists between group members, if some push an agenda to the detriment of others, if one or more actors' influence over proceedings is disproportionate to others, or if the values and traditions of smaller groups are not respected, then it can be difficult to build a cohesive and constructive working relationship.

Efforts are needed to identify tensions beforehand and find ways to resolve disputes so that only **low or medium levels of conflict** exist (Desportes et al., 2015; Ravnborg et al., 2012). This can help build or repair **trust**. It's crucial that a strong belief exists that all stakeholders are acting in good faith, sharing relevant experiences/materials, and refrain from anything that might disadvantage others (Dobbie et al., 2016; Madzingamiri et al., 2015). As trust develops over time, regular face-to-face interactions are encouraged (Desportes et al., 2015). Alongside this, a **sensitivity to power imbalances** either in the form of preventing dominant actors from drowning out the voice of others or awareness that some stakeholders have more or less power to exert change, can help to create a shared vision and lower dropout rates (Howarth and Monasterolo, 2016; Kallis et al., 2009). Strong leadership or the addition of a neutral facilitator can be helpful here (Byron and Curtis, 2002; Burns et al., 2015).

The full **acceptance of different values, norms and cultures** is also essential (Bohnet, 2010; Hoverman et al., 2011; Ravnborg et al., 2012). If western ideas about what should inform decision-making, in this case scientific methods, exclude local knowledge this can devalue the contributions of communities and residents who often are intimately connected to the problem (Bohnet, 2010). Similarly, culture clashes can impede participation. As Hoverman et al. (2011) explains, despite women in Solomon Island households being primarily responsible for sourcing and using water, they are not able to attend formal meetings with elders where these issues are discussed. But by changing the venue, from village halls to kitchens, both groups were able to sit together without offending cultural sensitivities. Likewise, the necessity of bribes, whilst frowned upon, may be the only way to gain access to resources in some cultures (Bremer and Bhuivan, 2014); or the political unwillingness to accept water supplies running dry even in times of drought (Dobbie et al., 2016). Understanding and respecting these social values can prove invaluable to identifying the path of least resistance.

3.1.4. How to design the process?

Concerns about how a collaborative-innovation process should be designed drew the most attention from the literature. Poor planning in terms of the time needed, or scope of activities; a lack of accountability and transparency in how things are decided; and practices that, unintentionally, limit the full contribution of participants; were all cited as problems (Konisky and Beierle, 2001; Huntjens et al., 2010). It's important, therefore, that there is **adequate time to plan and execute actions**. No single activity, whether that be discussing, formulating or implementing ideas, should be done at the expense of the others. If not, people may dropout, delays may occur or projects may be left unfinished. Detailed yet flexible short-term (6 months to 18 months) plans can receive higher buy-in and retention (Alegre et al., 2015). **Activities should also be locally focused**, within well-defined geographical areas where stakeholders have a direct stake in the problem, as this tackles the challenge of travel and time involved in face-to-face meetings (Desportes et al., 2015; Ferreyra et al., 2008).

To address the lack accountability, transparency, and legitimacy in collaborative-innovation processes, it is recommended that the procedures for consulting, prioritising and deciding upon different courses of action are seen to be fair by all involved and made explicit from the outset (Medema et al., 2015; Koontz and Newig, 2014). In other words, establish **clear decision and process rules**. Everyone also needs to be **clear about his or her role and responsibilities** within the process to avoid overlaps and fragmentation over who does what, or what is expected, as this can erode ownership of the problem (Dobbie et al., 2016; Erickson, 2015; Bettini et al., 2013). **Clear methods for evaluating and measuring outcomes** are also important to assess the extent to which actions undertaken have been successful and therefore what has changed (Biddle and Koontz, 2014; Mandarano and Paulsen, 2011). The inability to quantify whether actions have been successful can discourage participation from those accustomed to justifying their time and effort via costs-benefits (Dobbie et al., 2016). Setting clear, measurable, objectives can also help with retention and secure future investments.

Clear and accessible scientific information is also needed (Biddle and Koontz, 2014; Medema et al., 2015). If people do not understand the information used to make decisions their ability to participate is reduced, as is their ability to contribute new ideas. This underlines the need for **effective communication and data sharing** (Hoverman et al., 2011). If data are withheld or communicated unequally, trust can be eroded.

3.1.5. How to keep the process on track?

Several concerns were raised about how to keep collaborative-innovations on track. **A clear and strong vision** is needed (Alegre et al., 2015; Erickson, 2015; Bohnet, 2010). If everyone pulls in different directions, and it's unclear what the end goal is, momentum may wane. Time is needed to listen and prepare an agreed vision on the purpose of the collaboration, its priorities, long-term goals, and what is needed to resolve the problem. **Strong leadership** goes hand-in-hand here in setting agendas, keeping the process moving, ensuring the best solution is reached for all involved, so that the vision is achieved (Byron and Curtis, 2002; Madzingamiri et al., 2015). A**n effective coordinator or bridging organisation** can also help facilitate conversations between stakeholders and coordinate actions to ensure a coherent outcome. This requires a neutral actor that has the respect of peers, often university researchers (Burns et al., 2015; Berado, 2014; Koontz and Biddle, 2014).

Yet all of this can be undone if participation is not **sustained**. If key actors drop out, the process can halt whilst they are replaced or efforts are made to continue without them (Mandarano and Paulsen, 2011; Biddle and Koontz, 2014). The introduction of formal agreements, contracts, and projects with shorter timescales are suggested in these

Table 3
Rank order of water collaborative-innovation themes.

Theme	Coverage	Mean	Level of Agreement
Stakeholders have the capacity to enact change	25	11.94%	96% (A/24, D/1)
Clear roles and responsibilities	18	9.35%	100% (A/18, D/0)
Acceptance of different social values, norms and cultures	15	8.48%	100% (A/15, D/0)
A strong or clear vision	18	7.26%	94.4% (A/17, D, 1)
Participation is open to all stakeholders	17	6.13%	64.7% (A/11, D/6)
Funding	15	6.06%	78.6% (A/11, D/4)
Trust	14	5.62%	85.7% (A/12, D/2)
An effective coordinator or bridging organisation	12	4.29%	83.3% (A/10, D/2)
Strong leadership	12	3.98%	100% (A/12, D/0)
Low risk or high willingness to experiment	7	3.87%	85.7% (A/6, D/1)
Sensitivity to power imbalances	10	3.36%	100% (A/10, D/0)
Introduction of new Government legislation, regulation or policies	12	3.29%	91.7% (A11, D/1)
Activities are bounded by a small geographical area	10	3.21%	90% (A/9, D/1)
Sustained participation	10	2.82%	60% (A/6, D/4)
Clear methods for evaluating and measuring outcomes	10	2.81%	90% (A/9, D/1)
Adequate time to plan and execute actions	19	2.61%	100% (A/10, D/0)
Effective communication, data sharing	12	2.51%	100% (A/12, D/0)
Clear and accessible scientific information	9	2.49%	77.8% (A/7, D/2)
Low costs or investment required	8	1.86%	100% (A/8, D/0)
Low or medium levels of conflict	5	1.70%	80% (A/4, D/1)
All actors are fully committed	8	1.55%	100% (A/8, D/0)
Clear decision and process rules	7	0.94%	100% (A/7, D/0)

studies as ways to resolve this.

3.2. Which themes are best supported by the empirical studies reviewed?

Despite identifying a broad range of themes that can influence the success (or failure) of water collaborative-innovations, and explained what role each of them plays, it remains unclear how to differentiate between which themes are seen to be crucial and those that are less so? This is important as its not always practical, nor necessary, to accommodate all 22 themes.

To answer that question, we counted up the total number of conclusions made by each paper. We then counted how many of those conclusions corresponded to every theme. For instance, Dobbie et al. (2016) made 34 conclusions of which 11 focused primarily on trust (32.35%). Some papers focused on one or two themes at the expense of others, and therefore, more conclusions are recorded for those themes. To account for this, we added the percentages for the total number of conclusions made by each paper for each theme and divided them by the number of papers we reviewed to give a mean score. The highest mean scores indicate where the highest concentration of discussion has been directed in the empirical studies reviewed. As shown in Table 3, by ranking the mean scores, we can identify which themes are discussed the most. Several patterns emerge here.

First, none of the themes were discussed by all of empirical studies. The majority (57.7%) of papers discussed the top 5 themes. However, even the highest ranked theme (stakeholders have the capacity to act) did not feature in all 26 papers reviewed, only 25. At the bottom, nearly a fifth (19.2%) of papers discussed at least one of the themes. This suggests that the attention given to each theme not only varies across the empirical studies reviewed but also that some themes are seen to be more important than others. To what extent this reflects which stakeholders are involved, the kind of problem to be solved, or the context at hand, is unclear.

Second, the top 5 themes hold little surprise in emphasising an inclusive, equitable, collaborative-innovation process where people have the capacity, responsibilities, and vision to effect meaningful change. Yet themes dedicated to ensuring procedural legitimacy, trust, accountability and transparency are all found towards the middle to bottom of the rankings. This may speak to a subtle distinction between the principles needed to initiate collaborative-innovations and what is needed to achieve those principles thereafter.

Third, a few themes were lower in the rankings than may have been

expected. All actors being fully committed is ranked second from bottom. If some stakeholders are perceived to be less committed than others, then collaborations can easily breakdown as contributions (intellectual and practical) fluctuate and dropout rates increase. Why commitment is ranked so low is not immediately obvious. It could be that full commitment is taken-for-granted in the studies reviewed, with concerns about sustained participation and contribution rarely featuring. It could also be commitment is understood implicitly in relation to other themes such as the acceptance of different social values, norms and cultures or sustained participation, and therein, is not stated explicitly. Or it could be that commitment is genuinely seen to be of less importance compared to other themes.

Of interest here is that funding and trust are close but do not make it into the top 5 themes. When Leach and Pelkey (2001) performed a similar study relating to watershed partnerships in 2000, a different picture emerged. The top 5 factors, in 2000, were: (1) funding, (2) an effective coordinator; (3) inclusive group membership; (4) limited scope of activities; and (5) trust. The differences between 2000 and 2016 could be due to a shift away from how to get people or organisations to work together in the first place - as the collaborative ethos was still relatively novel at the time – to now emphasising how best to run that process. Adding innovation into the collaborative mix may have also influenced which themes are highlighted.

3.3. Does agreement exist over which themes are most important in the empirical studies reviewed?

Although the level of attention received by different themes in the literature varies, with some themes seen to be potentially more important than others, this does not mean that all the papers agreed. Where the role played by some themes was accepted with little or no disagreement, others were highly contested. This is important because some themes may share dual qualities in that the way they are interpreted can both help and hinder the success of collaborative-innovations. So which themes secured the highest level of (dis)agreement? And do any of the themes contradict the others?

Four of the top five themes: stakeholders must have the capacity to act (n = 24 papers agreed/1 paper disagreed, 96%), clear roles and responsibilities (n = 18/0, 100%), a clear or strong vision (n = 18/1, 94.4%), and the acceptance of different values, norms and cultures (n = 15/0, 100%); all recorded very little to no disagreement. The lack of contention here, coupled with the high level of attention given to

these themes, suggests that they can be key contributors to the success of collaborative-innovations. Whereas for the other theme in the top 5, participation should be open to all (n = 17/6, 64.7%), over a third of the studies felt it could also cause collaborative-innovations to fail. If too few people are involved this can, of course, limit the diversity of voices and the increase the risk of group-think (Alegre et al., 2015; Burns et al., 2015; Wolfe and Hendriks, 2011) but if too many people are involved this brings its own problems (Burns et al., 2015; Dobbie et al., 2016; Kallis et al., 2009). For instance, when there is no upper limit on the size of group, how do you ensure that everyone's views and opinions are heard and respected in a timely and fair way? How is consensus reached? Or how do you ensure that those pushing their own agenda do not strategically fill as many places as possible? Applying the themes uncritically is discouraged.

Sustained participation (n = 10/4, 60%), where the same stakeholders remain part of the collaborative-innovation process from start to finish, attracted an even higher level of disagreement. Participants can be left feeling burnt out if the frequency of meetings or level of activities is too high (Medema et al., 2015; Bohnet, 2010; Byron and Curtis, 2002), if the goals are unclear or the time taken to complete them is too long (Byron and Curtis, 2002), or if mechanisms for monitoring progress are too vague (Bohnet, 2010; Dobbie et al., 2016). This can leave participants not only emotionally exhausted but also with a diminished sense of achievement, which can impair their willingness to work together in future (Byron and Curtis, 2002). If participation is to be sustained, the right balance needs to be struck over how long these collaborative-innovations should last; whether everyone is needed throughout; and what procedures are in place to give people a break or replace them.

Funding (n = 15/4, 73.3%) proved another divisive theme. Rather than the lack of funding spelling the end of a collaborative-innovation several papers insisted that this can stimulate stakeholders to work together. If the problem is big and urgent enough funding should not be a stumbling block as a strong impetus to solve it will take over (van Burren et al., 2015; Bremer and Bhuiyan, 2014). Over recent decades, universities have forged closer relationships with industry partners in response to changing funding patterns and to demonstrate research impact (Butcher and Jeffrey, 2005). Although funding certainly helps cover the costs of running collaborative-innovations (e.g. travel, venue, meetings etc.) its absence can mean stakeholders seek out new partnerships or work more creatively with what they have.

Putting to one side the extent to which the literature agrees/disagrees, a closer inspection suggests that not all the themes complement one another. Accommodating one theme could create problems for another. Participation should be open to all and stakeholders must have the capacity to act is a prime example. Where the former emphases inclusiveness, the latter adds the condition of excluding the 'wrong' people. For Kallis et al. (2009) whilst the necessity of stakeholder capacity is often raised with regard to technically challenging innovations, a darker side of collaboration is revealed here. Not having the right skills, knowledge or experience can be used to deny entry and keep alive the status-quo of the 'elites' and 'everyone else' (Harrington, 2017; Margerum, 2002). How to reconcile the ideals for inclusion with the practicalities of stakeholder capacity is unclear. Another challenge relates to the role of trust and efforts to minimise conflict. Face-to-face interactions are often helpful for building trust between stakeholders, and therein encourage sharing and commitment. But if a prehistory of antagonism exists conflicts may intensify and trust erodes.

4. Discussion and conclusion: why do collaborative-innovations fail?

Collaborative-innovations fail for numerous reasons. If there is a lack of funding, commitment, clarity over who does what, or vision, collaborative-innovations can fail. In total, we identified 22 influential themes from empirical water studies. Yet drawing firm conclusions is

difficult because the level of attention given to each theme varies across the studies and the extent to which the literature agrees varies too. Several practical and theoretical implications did emerge, however.

First, high level of attention and agreement within the top 4 themes: stakeholders must have the capacity to act, clear roles and responsibilities, acceptance of different values, norms and cultures, and a clear and strong vision; suggest they all play a key role in the success of collaborative-innovations. Lower levels of attention given to the need for clear decision and process rules, low to medium levels of conflict, and low entry costs, indicate they may play a more supportive role. Why commitment is not higher up may reflect how it was discussed within the empirical studies reviewed. In turn, since the last review of the literature conducted by Leach and Pelkey (2001)[2] funding, trust and an effective coordinator have all dropped down the list. This may reflect a shift away from how to get people to work together to how to run collaborative-innovations. Nearly a third of the themes focused on 'how to design the process' compared to less than a fifth that discussed 'how to initiate a collaborative-innovation'. Or it could be methodological in origin, as Leach and Pelkey's (2001) review concentrated on the US, Canada and Australia, where our research took an international dimension.

It is also important when setting up collaborative-innovations to avoid applying these themes uncritically. On the one hand, it's not always practical, or desirable, to accommodate all 22 themes, especially in contextually sensitive matters, and on the other, not all themes complement each other. We found high levels of disagreement within the literature for several themes – participation should be open to all, funding, and sustained participation. Whereas ensuring participation is open to all whilst also ensuring that those involved have the capacity to contribute fully provides a potential source of tension. Of concern here is an awareness of the darker side of these themes could be used by more powerful actors as a way to justify the exclusion of particular stakeholders and knowledge types, or simply skew what each is able to contribute to the process (cf. Harrington, 2017; Kallis et al., 2009). Scholars, as a result, need to be more reflexive in acknowledging that the solutions they propose to environmental collaboration problems rarely, if ever, exist in isolation. Rather these solutions work in cooperation and competition with the other themes identified in this review, and therefore, are deeply political in bringing into being particular ways for managing water.

Second, a bigger picture of what influences *why* stakeholders become involved and stay engaged in collaborative-innovations emerges from this review. Collaboration theories, including institutional rational choice (Ostrom, 1990), the political contracting framework (Benson et al., 2013), and advocacy coalitions (Sabatier et al., 2005), rightly appeal to the self-maximising instincts of stakeholders in getting them to work together and the necessity of building trust and setting formal agreements yet can miss other key factors. The need for regulatory interventions (e.g. new legislation), and the need for a more risk-taking culture, all suggest rational behaviour alone may not be enough. These same self-maximising instincts that make collaborative-innovations attractive may also need to be tempered to avoid discussions being steered strategically by one set of participants. The provision of clear decision rules, neutral coordinators, and effective communication and data sharing, may serve to introduce procedural legitimacy through greater transparency and accountability.

Of interest here is that our review also adds some nuance to Ansell and Gash's (2007) understanding of the collaborative process. Themes such as the introduction of new government legislation, acceptance of different values, norms and cultures, and focus on local issues, all

---

[2] Leach and Pelkey (2001) ranked each theme by coverage. That is, how many of the papers they reviewed discussed that theme. A potential limitation here is that measurement does not account for how much a theme was discussed. Our study has attempted to address this.

suggest that collaborative-innovations need to be aware of, and responsive to, different contexts. That is, what works in one place and time may not translate to another. In addition, our review identifies 10 new themes not cited in Ansell and Gash's (2007) collaborative model (see Supplementary materials).

Lastly, it's important that the limitations of this, or any, literature review are fully acknowledged. Time period, search method, and inclusion/exclusion criteria selected, as well as the focus on empirical peer-reviewed publications (not books), all influenced the findings. However, we believe that the transparency, accountability and reproducibility of our review embody the academic rigour needed to tackle this complex subject. Our research reveals much we still do not know. That is, does the type of innovation itself effect how the collaborative process is primed, or who should be involved? Does the emphasis given to individual themes change depending on which stakeholders are involved? And does the context in which collaborative innovation takes place (e.g. public, private, one country or across national borders) influence who becomes involved and which themes are prioritised?

Scholars, from Bodin (2017); Emerson et al. (2011); Harrington (2017), and Lubell (2004), to Margerum and Robinson (2015), are already questioning the extent to which collaboration works, under what conditions, and the politics at play, to inform a more critical and reflexive research agenda. But if we are to break away from the conventional approaches, technologies, infrastructures, and governance arrangements for managing water (Bettini et al., 2013; Dobbie et al., 2016; Huntjens et al., 2010), our review shows that we need a much deeper empirical understanding of: (i) how we can support and enhance stakeholder capacity/learning; (ii) how the design of collaborative processes affects its outcomes; and (iii) which themes should, or at the very least can be, prioritised to effectively collaborate. These are the challenges we urgently need answers to and where future studies should start.

Acknowledgement

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.2018.07.004.

References

Alegre, H., Coelho, S., Feliciano, J., Matos, R., 2015. Boosting innovation in the water sector – the role and lessons learned from collaborative projects. Water Sci. Technol. 72 (9), 1516–1523.

Ansell, C., Gash, A., 2007. Collaborative governance in theory and practice. J. Public Adm. Res. Theory 18 (4), 543–571.

Benson, D., Jordan, A., Smith, L., 2013. Is environmental management really more collaborative? A comparative analysis of putative 'paradigm shifts' in Europe, Australia and the USA. Environ. Plan. A 45 (7), 1695–1712.

Berado, R., 2014. Bridging and bonding capital in two-mode collaboration networks. Policy Stud. J. 42 (2), 197–225.

Bettini, Y., Brown, R., de Hann, F., 2013. Water scarcity and institutional change: lessons in adaptive governance from the drought experience of Perth, Australia. Water Sci. Technol. 67 (10), 2160–2168.

Biddle, J., Koontz, T., 2014. Goal specificity: a proxy measure for improvements in environmental outcomes in collaborative governance. J. Environ. Manage. 145, 268–276.

Bodin, O., 2017. Collaborative environmental governance: achieving collective action in socio-ecological systems. Science 357, 659.

Bohnet, I., 2010. Integrating social and ecological knowledge for planning sustainable land and sea-scapes: experiences from the Great Barrier Reef Region, Australia. Landsc. Ecol. 25, 1201–1218.

Bremer, J., Bhuiyan, S., 2014. Community-led infrastructure development in informal areas in urban Egypt: a case study. Habitat Int. 44, 258–267.

Burns, M., Wallis, E., Matic, V., 2015. Building capacity in low-impact drainage management through research collaboration. Freshw. Sci. 34 (3), 1176–1185.

Butcher, J., Jeffrey, P., 2005. The use of bibliometric indicators to explore industry-academia collaboration trends over time in the field of membrane use of water treatment. Technovation 25, 1273–1280.

Byron, I., Curtis, A., 2002. Maintaining volunteer commitment to local watershed initiatives. Environ. Manage. 30 (1), 59–67.

Desportes, I., Waddell, J., Hordijk, M., 2015. Improving flood risk governance through multi-stakeholder collaboration: A case study of Sweet Home informal settlement, Cape Town. South Afr. Geogr. J. 98 (1), 61–83.

Dobbie, M., Brown, R., Farrelly, M., 2016. Risk governance in the water sensitive city: practitioner perspectives on ownership, management and trust. Environ. Sci. Policy 55, 218–227.

Emerson, K., Nabatchi, T., Balogh, S., 2011. An integrative framework for collaborative governance. J. Public Adm. Res. Theory 22, 1–29.

Erlingsson, C., Brysiewicz, P., 2017. A hands-on guide to doing content analysis. Afr. J. Emerg. Med. 7 (3), 93–99.

Erickson, A., 2015. Efficient and governance of socio-ecological systems. AMBIO 44, 343–352.

Ferreyra, C., de Loe, R., Kreutzwiser, R., 2008. Imagined communities, contested watersheds: Challenges to integrated water resources management in agricultural areas. J. Rural Stud. 24, 304–321.

Harrington, C., 2017. The political ontology of collaborative water governance. Water Int. 42 (3), 254–270.

Haslam, A., McGarty, C., 2014. Research Methods and Statistics in Psychology. SAGE, London.

Hoverman, S., Ross, H., Chan, T., Powell, B., 2011. Social learning through participatory integrated catchment risk assessment in the Solomon Islands. Ecol. Soc. 16 (2).

Howarth, C., Monasterolo, I., 2016. Understanding barriers to decision making in the UK energy-food-water nexus: the added value of interdisciplinary approaches. Environ. Sci. Policy 61, 53–60.

Huntjens, P., Pahl-Wostl, C., Grin, J., 2010. Climate change adaptation in European river basins. Reg. Environ. Change 10, 263–284.

Kallis, G., Kiparsky, M., Norgaard, R., 2009. Collaborative governance and adaptive management: lessons from California's CALFED water program. Environ. Sci. Policy 12, 631–643.

Kiparsky, M., Sedlak, D., Thompson, B., Truffer, B., 2013. The innovation deficit in urban water: the need for an integrated perspective on institutions, organizations, and technology. Environ. Eng. Sci. 30 (8), 395–408.

Konisky, D., Beierle, T., 2001. Innovations in public participation and environmental decision making: examples from the Great Lakes region. Soc. Nat. Resour. 14 (9), 815–826.

Koontz, T., Newig, J., 2014. From planning to implementation: top-down and bottom-up approaches for collaborative watershed management. Policy Stud. J. 42 (3), 416–442.

Leach, W., Pelkey, N., 2001. Making watershed partnerships work: a review of the empirical literature. J. Water Resour. Plan. Manag. 127 (6), 378–385.

Lubell, M., 2004. Collaborative environmental institutions: all talk and no action? J. Policy Anal. Manag. 23 (3), 549–573.

Madzingamiri, D., Schouten, M., Blokland, M., 2015. Water, sanitation, hygiene partners collaborating to combat severe cholera outbreaks during the State of Emergency in Zimbabwe. Water Policy 17, 288–370.

Mandarano, L., Paulsen, K., 2011. Governance capacity in collaborative watershed partnerships: experience from the Philadelphia region. J. Environ. Plan. Manag. 54 (10), 1293–1313.

Margerum, R., 2002. Collaborative planning: building consensus and building a distinct model of practice. J. Plan. Educ. Res. 21, 237–253.

Margerum, R., 2011. Beyond Consensus: Improving Collaborative Planning and Management. MIT Press, Cambridge, USA.

Margerum, R., Robinson, C., 2015. Collaborative partnerships and the challenges for sustainable water management. Curr. Opin. Environ. Sustain. 12, 53–58.

Margerum, R., Robinson, C., 2016. Introduction: the challenges of collaboration in environmental governance. In: Margerum, R., Robinson, C. (Eds.), The Challenges of Collaboration in Environmental Governance: Barriers and Responses. Edward Elgar Publishing Ltd, UK, pp. 1–26.

Medema, W., Adamoski, J., Orr, C., Arjen Wals, O., Milot, N., 2015. Towards sustainable water governance: Examining water governance in Quebec through the lens of multi-loop social learning. Can. Water Resour. J. 40 (4), 373–391.

Moore, M., von der Portern, S., Plummer, R., Brandes, O., Baird, J., 2014. Water policy reform and innovation: a systematic review. Environ. Sci. Policy 38, 263–271.

Ostrom, E., 1990. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge University Press, Cambridge.

Porter, J.J., Dessai, S., Tompkins, E., 2014. What do we know about UK household adaptation to climate change? A systematic review. Clim. Change 127 (2), 371–379.

Ravnborg, H., Bustamante, R., Cissé, A., Cold-Ravnkilde, S., Cossio, V., Djiré, M., Funder, M., Gómez, L., Le, P., Mweemba, C., Nyambe, I., Paz, T., Pham, H., Rivas, R., Skielboe Yen, N., 2012. Challenges of water governance: the extent, nature, and intensity of water-related conflicts and cooperation. Water Policy 14, 336–357.

Robinson, C., Margerum, R., Koontz, T., Moseley, C., Lurie, S., 2011. Policy-level collaboratives for environmental management at the regional scale: lessons and challenges from Australia and the United States. Soc. Nat. Resour. 24 (8), 849–859.

Sabatier, P., Leach, W., Lubell, M., Pelkey, N., 2005. Theoretical frameworks explaining partnership success. In: Sabatier, P., Focht, W., Lubell, M., Trachtenberg, Z., Vedlitz, A., Matlock, M. (Eds.), Swimming Upstream: Collaborative Approaches to Watershed Management. MIT Press, Cambridge, MA, pp. 173–199.

Scholten, P., Keskitalo, E., Meijerink, S., 2015. Bottom-up initiatives towards climate

change adaptation in the Netherlands and the UK: a complexity leadership perspective. Environ. Plann. C 33, 1024–1038.

Speight, V., 2015. Innovation in the water industry: barriers and opportunities for US and UK utilities. Wiley Interdiscip. Rev. Water 2 (4), 301–313.

Stefanelli, R., Castleden, H., Harper, S., Martin, D., Cunsolo, A., Hart, C., 2017. Experiences with integrative Indigenous and Western knowledge in water research and management: A systematic realist review of literature from Canada, Australia, New Zeland and the United States. Environ. Rev. 25 (3), 323–333.

Thomas, D., Ford, R., 2005. The Crisis of Innovation in Water and Wastewater. Edward Elgar Publishing House, Cheltenham.

van Burren, A., Eshuis, J., Bressers, N., 2015. The governance of innovation in Dutch regional water management: organizing fit between organizational values and innovative concepts. Public Manag. Rev. 17 (5), 679–697.

Wolfe, S., Hendriks, E., 2011. Building towards water efficiency: the influence of capacity and capability on innovation adoption in the Canadian home-building and resale industries. Built Environ. 26 (1), 47–72.