Incorporating Risk Communication into Flood Resilience Planning: Challenges and Solutions in Belfast

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Abstract
Risk communication, the flow of information between decision-makers, risk experts and the public, can be a valuable tool in societal resilience building. Risk communication can be used both to inform the resilience planning process as well as to directly build resilience at all societal scales. The city of Belfast is currently developing a resilience strategy that addresses flooding in the city as well as other environmental, social and economic risks. Using complexity theory as an analytical tool, the thesis uses a scoping study to identify occurring and recommended types of risk communication in other urban, developed contexts and the challenges to implementing risk communication. These findings are then applied to the Belfast case and based on a document analysis, the risk communication occurring in Belfast and likely challenges are analysed. The findings of the thesis include the fact that both the scoping study findings and the Belfast documents recommend high engagement of the public in risk communication. Despite this, the majority of risk communication in Belfast involves the public in a contributing or feedback-giving role rather than as a leader in the process. Many, if not all, of the challenges to risk communication identified in the scoping study could be expected to arise in Belfast and most are already addressed in some way in the planning process. The thesis also explores the relevance of the specific context in which the risk communication takes place and concludes that although learnings from other cities should be recognised, the challenges posed by Belfast's history make it a particularly challenging context for risk communication.

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Acronyms

100RC	100 Resilient Cities
CAS	Complex Adaptive System
LDP	Local Development Plan
NGO	Non-Governmental Organisation
POP	Preferred Options Paper
SCI	Statement of Community Involvement

1 Introduction

1.1 Background and context

Climate change is changing the risk profiles of cities, which is leading to a call for a more participatory approach to disaster risk management and climate change adaptation, involving different stakeholders throughout society (Few, Brown, & Tompkins, 2007). One way to do this is through risk communication, which creates a flow of information about risks between the public, risk managers and decision-makers (Leiss, 1996, p. 86). Risk communication has been found to increase the legitimacy of the risk management process as well as leading to improved processes through the incorporation of more views and analysis (Chilvers, 2008).

This thesis will examine how risk communication can be used to develop societal resilience and the challenges to this, focusing on flooding in the city of Belfast, the capital of Northern Ireland. In Belfast, tidal flood risk is of most concern, but pluvial and fluvial flooding are also putting residents and properties at risk. Flood alleviation schemes across the city are already investing in temporary and permanent flood defences (Department for Infrastructure, 2019a). Risk communication can be used both as a tool for planning resilience building projects and as a tool to actually build resilience and this thesis examines how the structural solutions can be complemented and supplemented with risk communication. Belfast is currently in the process of developing a resilience strategy, which should address flooding amongst other risks to the city. The strategy is expected to be published around October/November 2019 (personal correspondence).

Belfast is currently home to around 340,000 people, with one of the youngest populations in Europe. The city's economy is growing, and Belfast is a regional hub for knowledge and education. An ambitious urban regeneration programme has seen investments in infrastructure, cultural facilities and housing, amongst others (Belfast City Council, 2016a). Despite the recent investments and improvements, the city is still recovering from the impacts of a period of conflict known as the Troubles (Belfast City Council, 2016a). Recently, extremism has been on the decline (Lowry, 2019) but remnants of the conflict are still visible in the damage to the city's infrastructure and in the remaining divisions in the population (Belfast City Council, 2016a). Neighbourhoods in the city are divided by peace walls and interface sites intended to discourage violence between conflicting groups (McClements, 2019). The conflict is intertwined with some of the city's persistent problems with health, education and economic inequalities, with some groups having benefited from the city's economic growth and some have been left behind (Belfast City Council, 2016a). Many of the flood prone areas are also those most socially and economically disadvantaged (Sayers and Partners, 2017). Risk communication could be a particularly useful tool in Belfast, which is still experiencing conflict and disagreement, as it has been found that collaborative processes are more likely to identify shared community values and build relationships, even in cases where participants have conflicting opinions (Beierle & Konisky, 2000).

The thesis examines resilience holistically and uses complexity theory to analyse the ways in which resilience at different scales and in different sectors of society contribute to overall societal flood resilience and how risk communication can contribute to this process. The data

in this thesis is collected through a scoping study and through identifying documents from Belfast City Council that focus on the resilience building process.

Figure 1 Flood map of Belfast city centre showing coastal (green), surface water (pink), and river (blue) floodplains currently (left) as well as projected floodplains in 2030 (right) (Department for Infrastructure, 2019b).

1.2 Research question and objectives

The overall research question is "*how can risk communication contribute to increased societal flood resilience in Belfast*". In order to answer this, the thesis has two objectives;

1) Identify recommendations and challenges for using risk communication to build societal resilience based on literature and on real cases of risk communication for flood or multi-hazard resilience;
2) Investigate how risk communication can be used to strengthen urban flood resilience building efforts in Belfast and using the knowledge of recommendations and challenges examine what challenges are likely to arise and whether and how the city is attempting to overcome them.

1.3 Thesis outline

Chapter 2 describes the theoretical framework of the thesis based on the literature on risk communication and resilience as well as connections between the two.

Chapter 3 presents the methodology and data collection and analysis methods.

Chapter 4 presents the main findings of the thesis for the way in which Belfast approaches resilience as well as the ways in which risk communication can be used to build resilience and what the challenges to this are.

Chapter 5 discusses the results of the thesis and presents an analysis through complexity theory.

Chapter 6 concludes the thesis with a summary of the findings and interpretations.

2 Literature review

2.1 Risk communication

This chapter will examine literature on risk communication and resilience on which the theoretical framework of this thesis is based on. This section will describe the development of the risk communication concept from one-way risk communication towards recommendations for a more participatory form of risk communication. This is in order to analyse how risk communication could best be used to develop societal resilience. Risk experts have a strong normative imperative to use risk communication to inform the public of the risks that they may be posed to as well as to involve them in the process of developing resilience building measures that concern them (Wardman, 2008). When conducting risk communication, it is important to define the aims of the message for the specific context and use the aims to design an effective communication campaign. On a larger scale, however, the communication often has a longer-term aim, such as creating change in social norms and values (Moser, 2010). Therefore, risk communication should be expected to also aim to contribute towards the long-term societal change towards resilience.

Fischhoff (1995) and Leiss (1996) map out the development of the risk communication concept and practice since the 1970s until the mid-1990s. They describe the development of risk communication from its origins as one-way communication, where the risk assessment experts simply communicated the exact figures of their assessments to the public and other stakeholders (Fischhoff, 1995; Leiss, 1996). One-way risk communication proved to not reach its aim of convincing the public to accept the assessments or change their behaviours. The reasons for this include that one-way risk communication messages were not trusted by their recipients, as they were seen as insincere and manipulative (Leiss, 1996). A common criticism of this type of risk communication is that it attempts to 'brain-wash' people into accepting a certain risk mitigation measure rather than engage the public in discussing its benefits and alternatives (Wardman, 2008). The recommendation now is for two-way or dialogic forms of risk communication, where the public is invited to contribute to the creation and selection of risk mitigation measures rather than just accepting ones presented to them (Fischhoff, 1995). Both the public and the risk managers take part in a learning process and the aim is to develop trust between experts and the public (Aven & Renn, 2010) and create meaningful interaction (Leiss, 1996).

If we accept the consensus that partnerships and two-way, dialogic forms of risk communication are best as the literature suggests, then it is worth examining how this can be done effectively and what type of partnerships between decision-makers and the public produce the most effective participation. Although more recent typologies exist[1], Arnstein's (1969) Ladder of Participation, based on the degree of involvement the public has in the process, is still a good typology of participation and risk communication.

[1] A list has been complied by, for instance, Reed (2008).

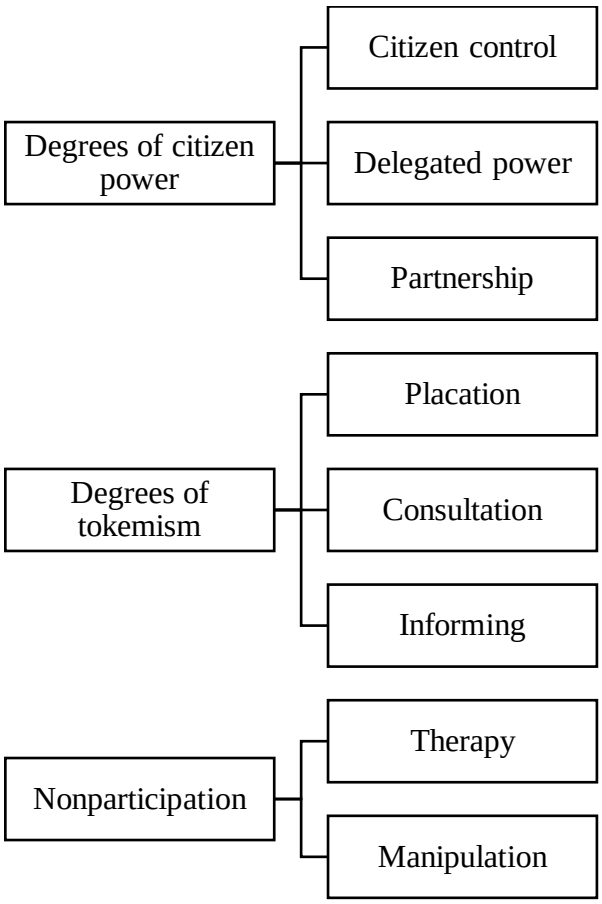

Figure 2 Ladder of Citizen Participation according to Arnstein (1969).

Arnstein's ladder aims to differentiate between meaningful forms of participation near the top and non-participation and tokenism near the bottom, where participation is only done for the sake of the power-holders, who wish to appear like the process is participatory (Arnstein, 1969). Risk communication needs to be a true partnership, where the public really feel like they have the power to influence decisions (Beierle & Konisky, 2000; Fischhoff, 1995; Arnstein, 1969). Although risk assessments will be done by experts based on facts and figures, the priorities deducted from them may not match those of the public. To really give the public the power to impact decision-making and ensure their views and priorities are truly considered, the public needs to be involved as early as possible in the problem framing stage and throughout the planning, implementation and monitoring process (Reed, 2008; Chilvers, 2008). Participatory processes should be "*representative of all those interested and affected by a decision or action and remove unnecessary barriers to participation*" (Chilvers, 2008, p. 425). Meaningful risk communication requires broad and relatively intense participation.

2.2 Risk communication for resilience

Belfast has expressed its aim as increasing the city's resilience. Therefore, it is important to analyse how resilience building is operationalised in literature and how risk communication can contribute to this process. Risk communication can be used both as a tool for planning resilience building projects and as a tool to actually build resilience.

This thesis looks at resilience through complexity theory. A complex system is one that has emergent properties, which cannot be reduced to the properties of its parts (Heylighen, Cilliers, & Gershenson, 2007). Resilience is often seen as arising from the interactions between the agents and is therefore an emergent property of a complex adaptive system (CAS) (Bergström & Dekker, 2014). In a CAS, the resilience of "smaller systems", in this case individuals or households, can influence the resilience of the "larger system", in this case city, both positively and negatively (Pendall, Foster, & Cowell, 2010). Therefore, risk communication can help to understand the factors that influence the resilience of smaller systems and therefore can help increase overall societal resilience. On a larger scale, understanding the priorities of these groups in resilience building projects, and how their resilience is influenced by larger scale projects, can help make these projects more equitable.

Complex systems are open and influence and are influenced by agents outside of the system. In order to operationalise resilience in an open system, it is necessary to choose some boundaries (Heylighen, Cilliers, & Gershenson, 2007). It is not possible to consider all interdependencies and objects in a system and therefore some omissions must be made. Looking at the same system from different scales and using multiple descriptions gives the most holistic picture of the system (Becker, 2014).

Some of these attempts to operationalise the different indicators of societal resilience are presented below in Table 1. Although many categorisations and indicators exist in literature, these were selected as they show an interesting selection of how operationalising resilience can be approached.

Table 1 Indicators of societal resilience

Author	Indicators of societal resilience
Becker, 2014	Society's ability to - anticipate risks; - recognise risks; - adapt to risks and; - learn from risks.
Tyler & Moench, 2012	- Agents (individuals) with the resources and capacities to react and learn from hazards; - institutions that provide agents opportunities fair and equal opportunities to access resources and information and applies new knowledge and agent input into decisions, and; - robust and flexible systems (such as infrastructure, food delivery systems or trade patterns) (Tyler & Moench, 2012).
Cutter, Burton, & Emrich, 2010	- Social resilience, example indicator: educational equity; - economic resilience, example indicator: percentage employed; - institutional resilience, example indicator: percentage population covered by flood mitigation schemes; - infrastructure resilience, example indicator: number of hospital beds, and; - community capital, example indicator: number of civic organisations.

Attempts to operationalise resilience include Becker's (2014) reference to societal functions. He sees the overall purpose of a society to be the ability to continue on a desired development path despite stresses and disturbances. The way it is able to do this is by successfully anticipating, recognising, adapting to, and learning from risks. These functions support each other, and resilience is an emergent property that arises from these functions (Becker, 2014). Tyler & Moench (2012) divide society into scales, which is reflected in Bergström & Dekker (2014), who talk about micro, meso and macro level societal resilience. Many of the same actions that Becker describes as societal functions are present in Tyler & Moench as the actions of individual agents[2]. Looking at Tyler & Moench (2012) and Becker (2014), risk communication itself can increase resilience. According to the list by Tyler & Moench this can happen through, for instance, ensuring that decision-making processes are transparent and representative, which is a factor that directly contributes to resilience. If we look at resilience through Becker's (2014) societal functions, risk communication can strengthen the success of these functions at household level, by increasing knowledge of risks and therefore enhancing

[2] Resilient individual agents, according to Tyler & Moench (2012) have the capacity to organize and reorganize; identify, anticipate, plan, and prepare for a hazard; mobilise assets; and learn from part experiences (p. 316).

the ability to anticipate and recognise risks, for example. Further at societal level, this can occur through ensuring more information and analysis is available, making sure the functions are based on as much data and contributions as possible.

Unlike Tyler & Moench and Bergström & Dekker, Cutter et al. (2010) do not look at resilience through societal scales but rather through different sectors of society. They use these characteristics to measure resilience by assigning quantitative indicators to each characteristic. Although they focus on measuring rather than increasing resilience, the implications from their research are that improving any of the aspects listed will improve overall resilience. Applying it to the categorisation by Cutter et al. (2010), risk communication can function as a tool to share information between the public and the decision-makers when planning a resilience project, for instance sharing information about demographics and their needs or the resources available in an area.

Ultimately, whichever indicators of resilience are chosen, risk communication can be used to strengthen the resilience building process. All of these resilience frameworks and attempts to operationalise it are of course simplifications. Resilience is always context-specific, complex and multi-faceted and therefore difficult to measure or fit into a framework. What these simplifications do offer is a way to analyse a complex topic and provide opportunities to make theory-based experiments and evaluations.

2.3 Challenges and assumptions

Challenges to using risk communication for resilience building can also be found in literature. Literature seems to insist that risk communication occur at all stages of resilience building, from the problem framing, to the development and assessment of choices, to the evaluation of the project. The more intense the participation in risk communication, the better, lest it falls into simple tokenism or nonparticipation. Defining the goals of urban resilience building, however, is often dominated by those in powerful decision-making roles based on their own perspectives (Meerow & Newell, 2016). Risk communication can help with this if done in a truly dialogic manner, however it is impossible to have representatives of all different groups around the table and given the same space and weight. To ensure relative breadth of participation, often representatives of different interest groups are involved in intensive, collaborative processes (Arvai, Gregory, & McDaniels, 2001).

The complexity of society means that it is impossible for most people, in particular those lacking the knowledge and experience of societal change processes, to understand the implications of resilience building decisions. The public is often perceived to lack the knowledge and understanding of the scientific aspects of risk, which is sometimes used as a reason to not involve them in resilience building (Chilvers, 2008). People have a difficulty understanding all the trade-offs involved in a risk decision and often end up selecting an option that does not address all their concerns and values (Arvai, Gregory, & McDaniels, 2001). To solve this issue, the public need to be given enough resources, for instance information or time, to make an informed contribution (Chilvers, 2008; Arvai, Gregory, & McDaniels, 2001). To create equality of views and opinions, participants lacking the scientific knowledge or the time to analyse all available information will be given information that has been “translated” or

summarised from the more extensive, scientific jargon. This can mean that information diverging from the dominant can be omitted for the sake of clarity or manageability (Chilvers, 2008). A potential solution for this could be starting at a lower rung of the participation ladder. By first educating the public through using less intensive methods, could increase their understanding. This could also prove a less time-consuming method for the public, who often lack the incentives or interest to take part in participatory processes (Chilvers, 2008; Few, Brown, & Tompkins, 2007). However, a worry with this solution is that the aim would again be "correcting" the people's views, rather than giving them the tools to interpret, analyse and contribute. Another challenge is that although the aim of two-way risk communication is to create trust, trust is fragile, created slowly but destroyed fast (Slovic, 1993).

Figure 3 This thesis sees resilience as desirable, however some interpretations of the term may be less appealing to some. The description of the mural below it, located in Belfast, declares that social and political change only comes from thorough consultation with the community (author's own photograph).

3 Methodology

3.1 Data collection

This data in this thesis was collected using a scoping study and a document analysis and complemented with existing literature. The aim of using existing literature in this thesis is to understand what is already known about the area of research (Bryman, 2012), in this case, risk communication and resilience and their relationship. In order to understand the theories behind the selected theoretical framework, a desk-based study of academic literature on topics around

risk communication, *resilience*, and *complexity* was conducted. This began with a search using Google Scholar and LUBsearch to search for articles using these keywords as well as Boolean combinations of the search terms. As the aim of the research is to relate findings from risk communication literature with resilience and complexity theory literature, influential works from all fields were selected for the review, even if they were not directly related to the other themes. Once relevant literature had been selected, the reference lists of these studies were examined to identify further literature and documents.

Other sources of literature and data were collected through a scoping study and a document analysis, which are described in detail below. The findings from the scoping study and the document analysis were complemented and contrasted with the findings from other literature.

3.1.1 Scoping study

The aim of a scoping study is to do a rapid, broad analysis of existing literature (Arksey & O'Malley, 2005). In this thesis, it is used to examine the connection between risk communication and resilience in literature.

Not much literature exists on the connection between risk communication and resilience, which is why scoping study was seen as a good way of exploring the topic. A scoping study is a rigorous and transparent method of literature review that identifies all relevant literature. Unlike a literature review, a scoping study does not assess the quality of influence of the selected articles (Arksey & O'Malley, 2005), therefore, conducting both a broad scoping study and an review of influential literature was seen as providing different texts and approaches to the research question. After reviewing all scoping study articles, patterns began to emerge. As a result of the scoping study, it was discovered that most articles discuss real cases of risk communication and it was decided that a focus on the ways this is done provides an interesting counterpart to the more theoretical findings of the literature review.

According to Arksey & O'Malley (2005), a scoping study consists of five stages:

1. Identifying the research question;
2. Identifying relevant studies;
3. Study selection;
4. Charting the data;
5. Collating, summarizing and reporting the results.

Step 1. Identifying the research question

Here, a scoping study is seen as an effective method of scoping out all the literature that exists on the connection between risk communication and societal resilience. The aim was to create a research question that creates adequate breadth of coverage (Arksey & O'Malley, 2005) while at the same time ensuring that the amount of literature is manageable and relevant to the context of Belfast. Therefore, the question that guides the scoping study is "*What is known in literature about using risk communication to increase societal flood resilience in developed urban contexts?".* Alternative and broader questions were considered and tested, e.g. "*What is known*

in literature about using risk communication to increase societal resilience?", but it was decided that such a wide question provided many articles that were not relevant and narrowing down the question provided more manageable and more relevant hits. The breadth of the literature was maintained practicable by including the reference to "*developed, urban contexts*", which also ensured the applicability to Belfast. It is however acknowledged that this means relevant articles may have been missed. As the scoping study is not the only method of discovering and examining literature in this thesis, the research question was phrased in a way as to identify articles that are relevant to the context rather than more general.

Prior to a systematic search, scan searches were conducted to become familiar with terminology and develop a broader understanding of the material (Beerens & Tehler, 2016).

Step 2. Identifying relevant studies

The database selected for this thesis is Scopus, owned by Elsevier, as it contains a wide selection of multi-disciplinary articles from a variety of publishers (Beerens & Tehler, 2016). Both academic literature and grey literature were considered to ensure theories, examples and case studies from both peer-reviewed literature as well as conference papers and reports were included.

Five keywords were identified from the research question; 1) risk communication; 2) resilience; 3) urban; 4) developed; 5) flooding. Development and flooding were not included as search terms in the Boolean search, as they were identified to misleadingly limit articles that did not explicitly mention developed contexts or flooding in the search terms, even if they were addressed in the article. Instead, articles' titles and abstracts were examined to identify whether they addressed developed or developing contexts and whether they focused on a specific hazard. Only articles discussing developed contexts and either flooding or multi-hazard resilience were selected.

The scan searches revealed synonyms for the keywords, which were included in the search to ensure other appropriate literature was also identified. The keyword search included the following keywords:

Table 2 Scoping study keywords

Keyword 1: risk communication **Synonyms:** public education; participation; engagement; consultation.
Keyword 2: resilience **Synonyms:** preparedness; vulnerability; complexity.
Keyword 3: urban **Synonyms:** city; cities.
Excluding keywords: diabetes; HIV; cancer; cardio; bacteria; caries.

Although this thesis looks explicitly at resilience, the scan searches identified that many articles refer to preparedness, when discussing a similar issue. Vulnerability is often seen as the

opposite of resilience, which is why it was also included. Complexity, while a different topic entirely, was also added, as it was considered interesting and important to see how risk communication could address complexity related to resilience. Some excluding keywords were also included, as these terms provided many irrelevant medical hits. Risk communication brought up many health risk related articles, and therefore some health conditions not caused or connected to climate change were excluded.

This search gave 293 hits. Filtering by language (English) removed 13 articles, leaving 280. No exclusions were done based on publishing date.

Step 3. Study selection

A read through the remaining 280 articles' titles helped remove those that were clearly irrelevant (e.g. *Health of the homeless street women in South Africa*). At this stage, articles which focused on hazards other than flooding or multi-hazard resilience were removed. Articles that focused on a developing context were also discarded.

Inclusion criteria:

1) Article's geographic focus is on the developed world[3];
2) Article addresses flooding or is multi-hazard focused;
3) Article deals with real cases of using risk communication for increasing resilience or the theoretical connection between the fields.

In borderline cases or cases where it where there was uncertainty, the articles were kept. This title analysis removed 224 articles, leaving 56. The abstracts of the remaining articles were read and filtered based on the inclusion criteria, after which 20 remained. Of these 20, the researcher did not have access to 6 and therefore 14 articles that address the topic of the thesis were identified and analysed. As the number of included articles is low, it was considered whether some of the inclusion criteria could be loosened to be more inclusive. However, it was decided that more restrictive criteria would ensure that all articles describe a similar context to Belfast, as the results of the literature review emphasise the importance of contextual understanding.

Step 4 of the scoping study method, charting the data, can be found in Appendix 1. Step 5, the results of the scoping study, are presented in Chapter 4.

[3] Based on the list in the UN World Economic Situation and Prospects (United Nations, 2019)

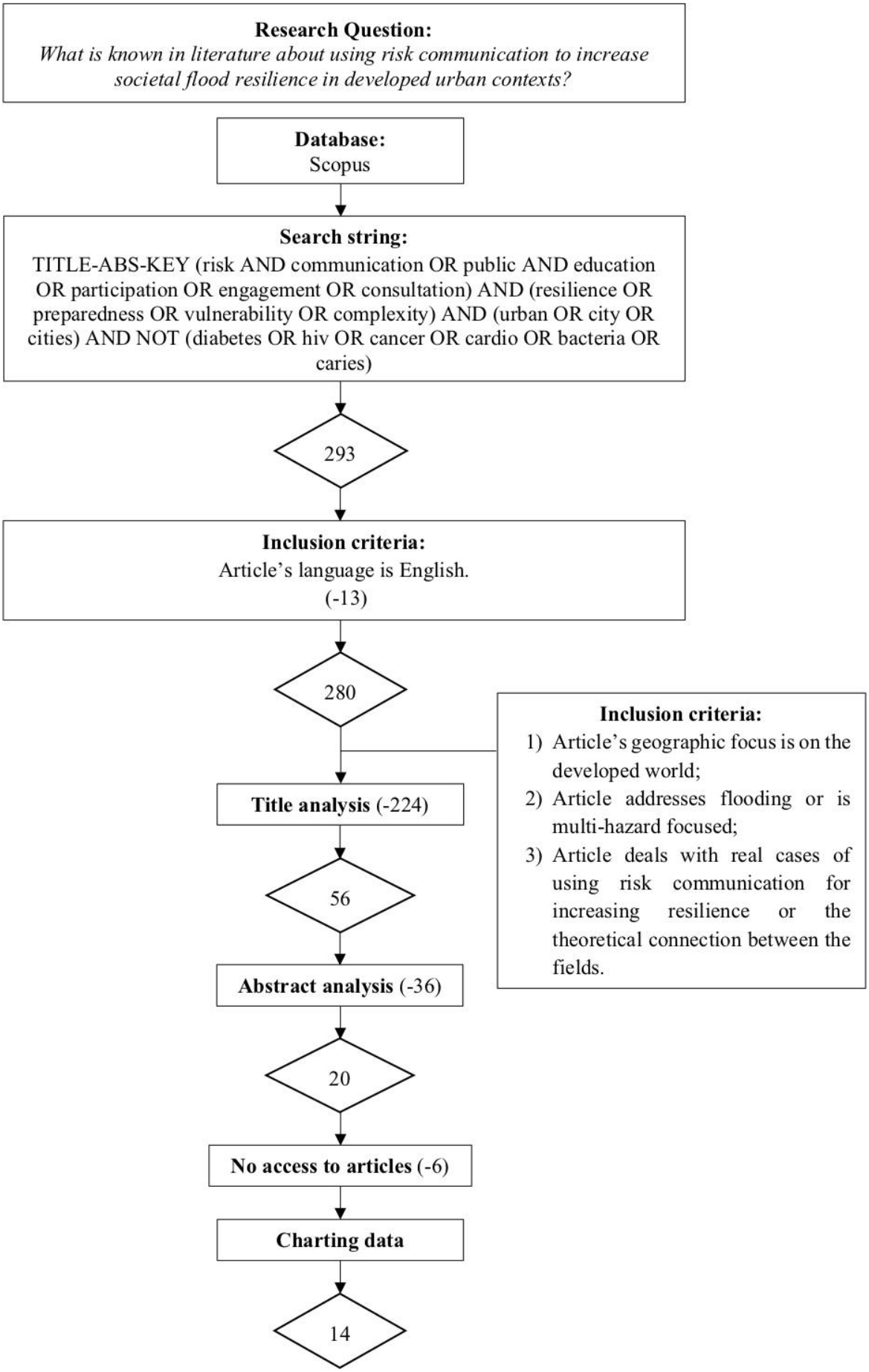

Figure 4 Overview of study selection and charting data

3.1.2 Document analysis

Document analysis is a method often used in qualitative research with other data collection methods to triangulate data. It combines elements of content analysis, where information from documents is grouped into categories, and thematic analysis, where themes in the texts are identified (Bowen, 2009). Document analysis was selected as the final data collection method as it allows the analysis of empirical data related to Belfast specifically and how it correlates with theoretical findings and case study findings from the scoping study.

The aim of the document analysis in this thesis is to identify how Belfast approaches the topic of resilience and risk communication and compare this with the findings from theory and similar case studies found in the scoping study.

The texts reviewed are;

1) The Belfast Agenda (2015), a community plan created in partnership with local stakeholders, community organisations, and residents, and led by Belfast City Council. The Agenda outlines outcomes and ambitions to support economic and social planning in the city until 2035. It also sets the immediate priorities for 2017-2021;
2) The draft Local Development Plan (LDP) (2018) is aligned with the Belfast Agenda and created to support its implementation. The LDP guides investment and development decisions to enable sustainable spatial growth up to 2035;
3) The Statement of Community Involvement (SCI) (2016b), which was created to outline Belfast City Council's policy on community involvement in the creation of the LDP and the consideration of planning applications. It outlines who, when, and how the community will be invited to participate in the production of the LDP;
4) 100 Resilient Cities Agenda Setting Workshop Report (100RC report) (2016a) was created when Belfast was selected as one of the Rockefeller Foundation's 100 Resilient Cities. The Report summarises the findings from the agenda setting workshop aiming it prioritise the risks and factors influencing Belfast's resilience.

All texts apart from the SCI were found on the Belfast City Council website under the page Resilient Belfast. These documents were selected for analysis as they were identified by the Belfast City Council as being relevant to the city's resilience planning. It was decided that in order to avoid any bias on behalf of the researcher, it was most transparent to select all documents listed by the Council as resilience relevant, rather than select ones that the researcher felt were most pertinent. The SCI was identified after reading the section of the LDP describing its creation process. The SCI was included in the document analysis as it outlines the way risk communication was incorporated into the local development planning process. All documents are available to download from the Belfast City Council website, meaning they are also available to the public.

In a document analysis, documents should be viewed as being linked to other documents, also called inter-textuality (Flowerdew & Martin, 2013). The selected documents are clearly

connected, as they are mainly written by same organisation[4] and all make reference to each other. Therefore, despite being individual documents, they are analysed in the thesis as representing a complementing whole. Occasionally the Belfast City Council website was also consulted to confirm or supplement some information in the documents.

3.2 Data analysis

During the scoping study, rather than beginning reading with ready-made categories and finding examples of them in the literature, NVivo was used to code all references to risk communication that seemed relevant to the research question. The texts were initially skimmed to get an understanding of the texts. On the first real reading, the articles identified in the scoping study were coded in Nvivo to make note of all sections where risk communication practice, challenges to it, its aims, and results or success factors were mentioned. After reading all articles and examining the nodes, it was decided that the focus should be on risk communication practice and challenges. All texts were then read again to ensure all mentions were coded. The nodes were then grouped together to create hierarchical nodes (Flowerdew & Martin, 2013). The node groupings for risk communication practice and challenges are presented in the Results chapter. Although only mentions of risk communication were analysed, it was also considered whether the way resilience is approached in these texts should be noded and presented. However, it was decided to only focus on risk communication as many texts did not specify how they view resilience and it was not seen as particularly relevant.

The document analysis was also conducted in Nvivo in much the same way. The documents were analysed by initially skimming them. During an in-depth reading, all mentions of risk communication practice and challenges were coded. As the documents do not explicitly discuss many challenges to risk communication, it was decided to examine whether the documents mention any of the challenges identified during the scoping study in relation to other issues, for instance, do the documents make any mention of power relations in any context. The Nvivo search function was also used to search for keywords identified in the previous data collection phases to ensure all relevant sections had been identified and coded.

[4] The 100RC document was not written by the Belfast City Council like the other documents, but the Council played a large role in facilitating the resilience setting workshop.

Table 3 Document analysis keyword searches

Keyword	Justification
Flood	Research question
Communication / communicate	Scoping study keyword
Participation / participate	Scoping study keyword
Engage(ment)	Scoping study keyword
Consult(ation)	Scoping study keyword
Resilience / resilient	Scoping study keyword
Vulnerability / vulnerable	Scoping study keyword
Prepared(ness)	Scoping study keyword
Power	Literature review & scoping study results
Fair(ness)	Literature review & scoping study results
Commitment / committed	Literature review & scoping study results
Trust	Literature review & scoping study results
Understand(ing)	Literature review & scoping study results

Finally, the highlighted sections were returned to in order to interpret how they relate to the research question and whether they align with the findings from the scoping study and literature review. This 3-step approach is recommended by Bowen (2009).

Figure 5 3-step approach to document analysis

3.3 Limitations

The approach to resilience and risk communication in this thesis is rather normative. The justification for seeing resilience as "good" is based on the aims expressed in the texts examined for the purposes of this research. In the case of Belfast, where a resilience strategy has not yet been published, problems reflected on in this research are based on the issues in the documents selected for analysis. However, even with the attempt to be transparent about why certain things are seen as problems and some as successes, it is likely these notions are also influenced by the values of the researcher.

During the literature review stage, preference was given to more recent research, as it was assumed these works would have the most up-to-date examples and make use of recent research as references. However, with risk communication, it was identified that most influential

literature was written in the 1980s and 1990s. This leads to the problem that these papers do not consider more recent innovations and technology used in risk communication. The urban context has also changed and become more complex and interdependent, making older studies less relevant. Many of these studies focus on psychological factors, which are not susceptible to much change, so they were deemed appropriate.

Limitations associated with the scoping study also include the fact that the documents were written for different purposes and focus on different aspects of risk communication and resilience. Therefore, the words they use differ, for instance the word consultation could be used for a variety of different types of engagement. Although the aim of a scoping study is to be transparent, some aspects will be left up to the interpretation of the researcher. In this case, the words were understood to have multiple meanings and therefore their meanings were gauged from the surrounding text rather than simply coding "consultation" as always being the same level of risk communication.

The scoping study results may also not represent reality, as it may be that despite certain forms of risk communication are written about frequently, they may not occur in reality in the same way or in the same extent as literature implies. In the same way, frequently occurring forms of risk communication may not be present in literature in the same proportion as could be expected. In this thesis, it was decided that a scoping study was the best way to achieve a broad selection of articles, which will give as true a representation of reality as possible, however it must be kept in mind that this representation is not exact. Also, the small number of articles included in the scoping study means the generalisations that can be made from the findings are limited.

Limitations associated with the document review include that the analysis focuses on official documents and therefore they may have another aim apart from outlining resilience processes. Documents should be reviewed in terms of both the context in which they were produced and their expected readership. The documents might not record issues the writers may not want the readership to know (Flowerdew & Martin, 2013), in the case of Belfast, it could be expected that the documents will want to paint a picture of a thriving city, which provides great opportunities for investment. Although the emphasis in this thesis is on the contents of the document, the context in which they were created should not be forgotten. Analysing the documents found in the scoping study and the document analysis also requires some interpretation and therefore had the documents been selected or coded by someone else, they may have interpreted differently and prioritised different aspects of the texts.

4 Results and analysis

4.1 Scoping study results: Risk communication

As seen in the literature review, the extent of public participation or the "quality" of risk communication can be looked at from a variety of angles. It seems that at what point in the process the public is involved is relevant (Reed, 2008; Chilvers, 2008), as is the extent of their involvement and how much influence they have over the process (Beierle & Konisky, 2000; Fischhoff, 1995; Arnstein, 1969). It could even be analysed whether the entire public is actually

represented or how committed all parties are (Chilvers, 2008). This thesis has chosen to focus on the intensity of the involvement and how much influence the public has over the resilience building process. This choice was made due to the fact that based on the literature review, this seemed like one of the most relevant characteristics of risk communication. It was also a factor that could be identified in many of the articles identified in the scoping study.

The scoping study texts were reviewed for mentions of actual examples of occurring risk communication as well as recommendations for it. The differences in risk communication that were identified in the scoping study texts were mainly about intensity, timing and the level of power the public have over the process. The following five categories, which are shown below along with how frequently they appeared in Figure 6, were identified in the scoping study texts. Where an article discussed a type of risk communication as a real case as well as recommended it, this was coded as "actual".

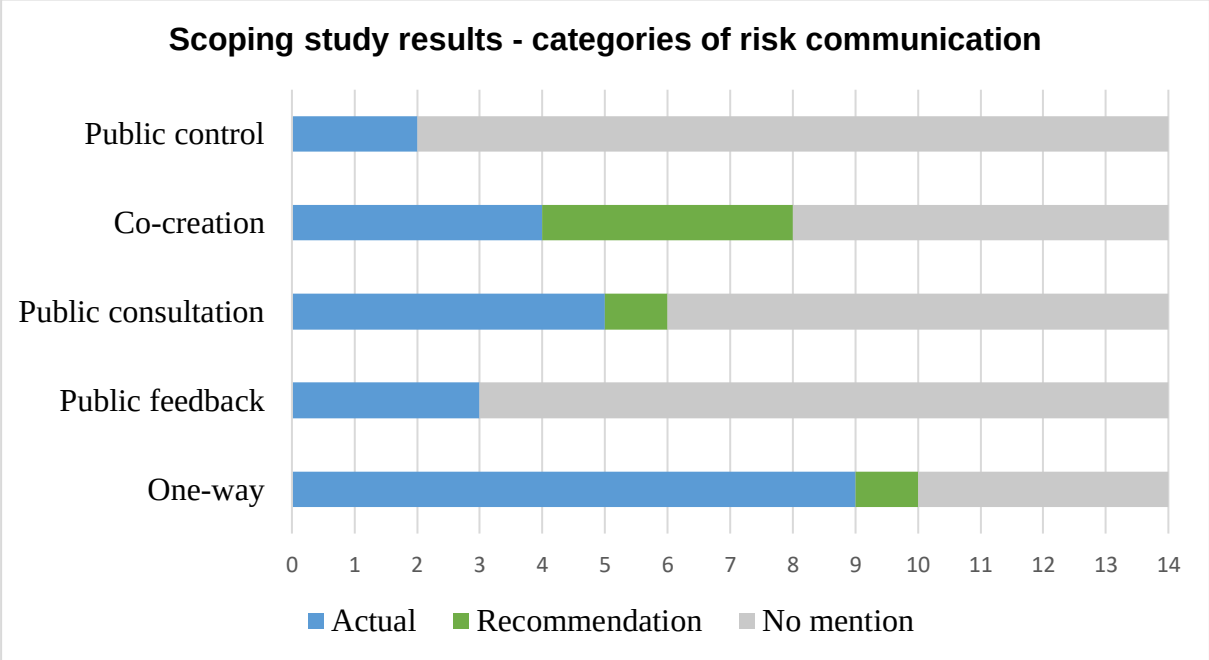

Figure 6 Scoping study results – categories of risk communication

The results show that the majority of cases show examples of *one-way* risk communication. Most articles where recommendations for risk communication were made recommended public/decision-maker co-creation.

4.1.1 Public control

Public control refers to government or NGO supported but citizen created and led projects that help the community. This does not include actions individuals take to reduce their own vulnerability. Examples of this were rarely found in the scoping study texts, however one example is *Ibasho*, or community led and created spaces in Japan, where the elderly are encouraged to design and implement spaces and programmes that increase community cohesion

and resilience (Aldrich & Kyota, 2017). Based on the low numbers of cases found in the scoping study, *public control* does not appear to be a particularly common or recommended form of risk communication.

4.1.2 Co-creation

Co-creation refers to cases where experts and the public have roughly equal input into project planning and implementation. In the scoping study, examples of cases where this was occurring include Dordrecht in the Netherlands, where there was a need for a water storage facility. Although experts provided the technical knowledge and requirements, it was up to the local residents to design the kind of storage they would be happy with (Fratini, Geldof, Kluck, & Mikkelsen, 2012). Although *co-created* projects were slightly more frequent than *public controlled* ones in the scoping study texts, they still did not occur as frequently as other, lower intensity forms of risk communication. However, recommendations were the highest for this type of risk communication. This is the most recommended but not a particularly commonly done form of risk communication. This indicates that it has the potential to increase resilience at least in theory but in reality, it perhaps requires too many resources or planning to be done as frequently as some other forms of risk communication.

4.1.3 Public consultation

The code *public consultation* was used when the public has the opportunity to contribute information or analysis, but it is up to the experts to decide whether this information is used. The difference between *co-creation* and *consultation* is often due to the way risk communication is planned, with *consultation* projects often incorporating an extra step, where the information received from the public is evaluated by experts rather than implemented directly into projects. On one occasion, consultation arose because the public was not willing to take part in a full *co-creation* process: "*the residents were rather passive during these events, letting the local authorities and the industrial actors decide for them and following their decisions*" (Kudo & Granier, 2016, p. 245). However, in this case, it could be that if the public had been eager to participate, their views might still have been overruled. It is interesting to note that the responsibility for effective participation also relies on the public. It is the role of the decision-makers to create circumstances where the public has the ability and the incentives to take part but, as will be seen below, this can prove challenging. Although the term *consultation* is often used in literature to indicate a similar process to the *public feedback* category described below, it was felt that the term consultation indicates more of an active role throughout the process, whereas *feedback* is here only used to indicate risk communication that takes part when a plan is already in place. Unlike the forms of risk communication described above, *public consultation* still maintains that the authorities should have more power than the public. This perhaps makes it less risky and as a consequence more common. Recommendations for this type of risk communication are lower, indicating that it may not be seen as effective.

4.1.4 Public feedback

Initially, only four categories were identified in the scoping study using the level of power as a decider. However, it was also identified that it is important when this power is available to the public. Whether the public's input is requested before, during or after the plan development and implementation determines how open-ended the public's recommendations can be. Therefore, a fifth category, *public feedback*, was added and differentiated from *public consultation*.

Whereas *consultation* uses information gathered from the public either during the problem framing or project planning and implementation stages, *feedback* is only in reference to information that is requested after a draft plan has already been created. In effect, the public has the choice to either accept or reject the plan or possibly suggest alterations, which may or may not be taken into consideration. A good example of this type of risk communication can be found in Cavan & Kingston (2012), who describe the pedestrianisation of streets in New York City. After the project had been initiated, the public and local businesses were interviewed during the monitoring stage of the project to get their views on whether the area had improved as a result of the project. Had the public been part of deciding where and whether the pedestrianisation takes place, this would be coded as either *consultation* or *co-creation*. Public feedback is not particularly commonly done and not recommended and therefore the scoping study indicates it is less likely to be effective in theory and in reality.

4.1.5 One-way

One-way risk communication refers to examples such as leaflets or presentations, aiming to inform the public of risks or mitigation measures. A clear example of this includes a UK campaign called Preparing for Emergencies, which saw leaflets describing risks sent to households (Preston, Avery, Chakrabarty, & Edmonds, 2011). *One-way risk communication* is a cost-effective way of reaching a large number of people, which is perhaps why it is done so frequently. The lack of recommendations however indicate that it may not be the best way to create real change despite its other benefits.

Figure 7 A mural at an interface site in west Belfast recognises the unequal impacts of climate change (author's own photograph).

4.2 Scoping study results: Challenges

The challenges to risk communication for resilience mentioned in the 14 articles included in the scoping study were grouped into four different categories. The challenges appear to align with the findings of the literature review, which shows that much of the literature is also relevant to resilience building in urban, developed contexts similar to Belfast. It could therefore be assumed that these challenges are likely to arise in the case of Belfast and should be expected and prepared for. Mentions of the challenges identified in the scoping study were examined in the Belfast documents.

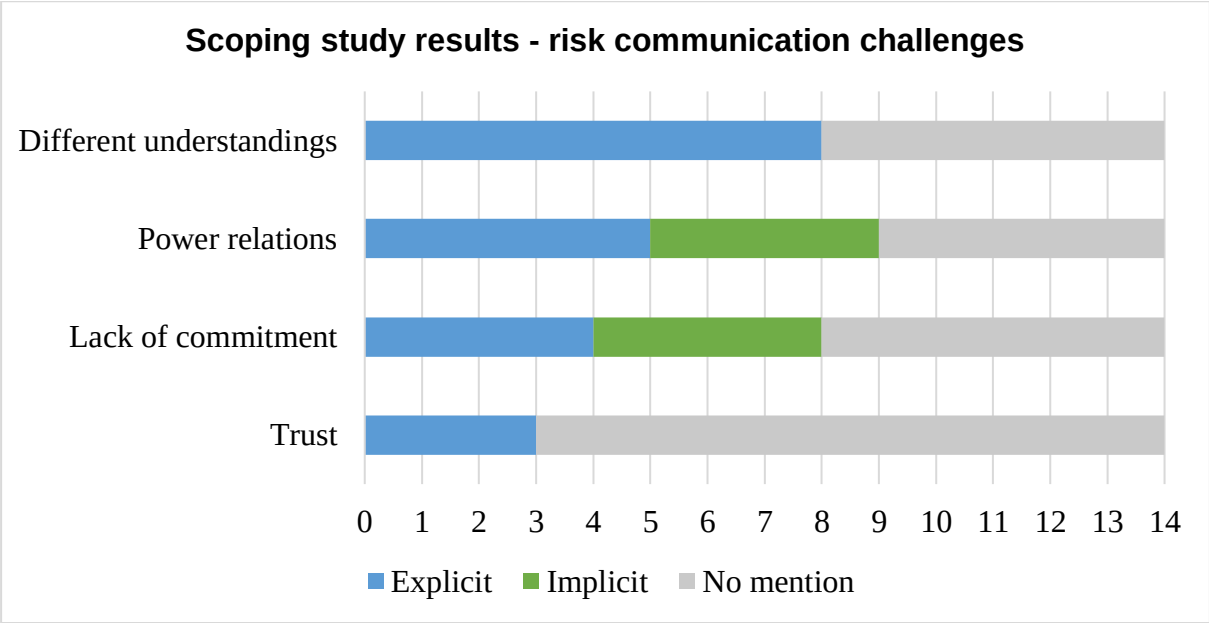

Figure 8 Scoping study results – risk communication challenges

4.2.1 Different understandings of risk and key concepts

Although one of the main aims of two-way risk communication is to increase understanding of the priorities and aims between the public and decision-makers, in order for this to happen, all participants need to have a certain level of existing knowledge and a shared understanding of what the conversation is about. The scoping study identified that the public and decision-makers prioritised risks differently, had different understandings of what resilience means and had different levels of scientific knowledge, leading to the public having a lower understanding of scientific concepts (e.g. Mees, Driessen, & Runhaar, 2014). This was also a finding in the literature review, which emphasised the need to ensure the public has the right resources, both in terms of information and time, to be properly acquainted with relevant facts. Although in this thesis, the focus is on developing a shared understanding, rather than changing the public's perception. However, in the scoping study, the shared understanding often came across specifically in terms of technical understanding, which the public was perceived to lack. "*Some threats which both the media and the political discourse consider to be highly significant for Australian cities and for large cities in developed countries in general are not among the top concerns for our respondents.*" (Boschetti, Gaffier, Moglia, Walke, & Price, 2017, p. 354).

This challenge is mentioned explicitly in 8 out of the 14 articles examined, showing that it is the most likely to arise in contexts that are similar to Belfast and therefore also likely to arise in Belfast.

4.2.2 Power relations and targeting of messages

The scoping study identified challenges in ensuring all risk communication recipients received similar attention. This was the case both when participating in dialogue and when receiving risk communication messages. This was due to some participants being more used to expressing

their opinions in group discussions. An example of this was Japanese women, who identify as housewives and have a negative perception of formal leadership roles. For this reason, their experiences and perceptions made their communication styles different to their male counterparts, who were more accustomed to taking on leadership roles and expressing their views publicly (Aldrich & Kyota, 2017). Often the opinions of people who were perceived to have more power also had more weight in the discussions (e.g. Mees, Driessen, & Runhaar, 2014). The messages were often created by the people with power with people similar to them in mind. This resulted in people with fewer resources or people who generally felt they were not in the majority group in not being able to equally participate in communication. The scoping study texts found that this led to some groups of people being alienated by the way participation was conducted. Some did not have access to the required technology, and some felt that the messages they received were irrelevant to their group or even antagonised them. An example of this was leaflets sent by the British government outlining possible risks, including crime and terrorism. Black and minority ethnic recipients of this message felt pathologised in terms of identification with terrorism; "*In our focus groups, the respondents, in the main, did not consider that [the Preparing for Emergencies leaflet] was 'for them'*" (Preston, Avery, Chakrabarty, & Edmonds, 2011, p. 755).

This challenge was mentioned in explicitly 5 times and explicitly 4 times, making it most frequently mentioned challenge. However, the fact that many mentions are implicit, indicates that perhaps it is not a challenge that is acknowledged as frequently as *different understandings*, described above. This could mean that although it arises frequently, it is not explicitly recognised and prepared for.

4.2.3 Lack of commitment

The scoping study texts identified a lack of commitment in the risk communication process. This was both from the decision-makers, whose approach was tokenistic or aiming to change behaviour and views rather than incorporate them into planning, as well as from the public, who had little interest in participating or learning; "*Interviews with local governments and private sector stakeholders revealed that each Smart Community focuses on changing participants' behaviours rather than on promoting their participation as citizens*" (Kudo & Granier, 2016, p. 241).

A lack of commitment was acknowledged explicitly in 4 articles and implicitly in another 4.

4.2.4 Issues related to trust

Issues related to trust were identified in the scoping study as hindering the risk communication process. Interestingly, this was the case when there was too little trust as well as when they public trusted the authorities too much. When not enough trust was present, the public found it difficult to believe the information they received and did not want to participate in any participatory processes, as they were deemed pointless; "*Low levels of institutional trust […] indicates an overall negative disposition towards authorities. This may have important implications on communication of risk or information provided from the authorities towards*

citizens, as documented in previous works." (Diakakis, Priskos, & Skordoulis, 2018, p. 410). The reverse was also found: the public do not feel they need to participate as they trust the decision-makers will make the best decisions on their behalf; "*The citizen participation looks weak in both areas, not because residents are not interested in their cities, but because they have strong trust in established institutions and let them decide on their behalf*." (Kudo & Granier, 2016, p. 245).

This challenge was mentioned in only 3 out of 14 cases, making it the last common. This implies that it is perhaps not as likely to arise in cities that are similar to Belfast but depending on the context, may still need to be prepared for.

4.3 Document analysis results: Resilience in Belfast

The findings for resilience in this chapter are based on the document review. In order to analyse how risk communication contributes or could contribute to Belfast's resilience, it is important to understand how the city approaches the concept of resilience and what the aims of resilience building are. Flooding is ranked in the top 5 priority risks in the 100RC Report. The document also attempts to highlight the connections between the different risks. Flooding is connected to physical and energy infrastructure as well as climate change. It is highlighted that flooding can disrupt energy security and have an impact on already aging infrastructure.

The same approach to resilience is not visible in the other texts, which do not define resilience and do not discuss its complexities. Resilience is mentioned in reference to;

- the mental and physical health of residents,
  "*People experience good mental health and are emotionally strong and resilient*" (Belfast City Council, 2017, p. 53);
- the economy,
  "*We will work with the city's anchor institutions - those larger organisations with an historic investment in the city's long-term success - to better leverage their economic power as employers, suppliers and contractors to build a resilient mutually supportive city economy*." (Belfast City Council, 2017, p. 43);
- environmental and climate change, which includes mentions of flooding,
- "*A city that is resilient to environmental and climate change.*" (Belfast City Council, 2017, p. 54);
- social cohesion and community resilience,
  "[…] *build community cohesion and resilience through collaborative effort to ensure inclusive growth for all*." (Belfast City Council, 2018, p. 3);
- infrastructure, which also includes mentions of flooding,
  "[…] *identify and implement opportunities to build resilience into the built and natural environment and to develop and implement sustainable strategies to explore, address and manage significant flood risk.*" (Belfast City Council, 2018, p. 223).

In all reports, flooding is discussed as an infrastructure or environmental issue and the suggested mitigation measures are mainly physical. Solutions include improved land use planning and avoiding development in areas of potential flood risk; promoting appropriate agricultural and

forestry practices; and more sustainable water and sewage services. The LDP also briefly mentions flood warnings and "*informing the public about flood risk and what to do in the event*" (Belfast City Council, 2018, p. 233) as a flood risk mitigation measure.

As identified in the literature review, resilience can be looked at in terms of different societal scales or sectors (Tyler & Moench, 2012; Bergström & Dekker, 2014). Although some connections are made, the interdependencies and connections between risks or resilience efforts and scales are not discussed in detail in the documents;

- *Risk interdependencies*: The connections between different risks are briefly outlined but not in much detail. The impact of flooding on aging infrastructure is highlighted in the 100RC report, but it could be imagined that damaged infrastructure could also impact flood risk. However, this is not identified in the documents and neither are other connections between other risks. Risk mitigation options are also very specific and very few multi-hazard options are outlined;
- *Resilience scales*: The resilience at different scales is not addressed in terms of flooding, which is seen as a societal level risk. Flood resilience at household or organisational scales is not mentioned;
- *Sector resilience*: Flooding is seen as strictly infrastructural and environmental problem. Although, as discussed above, issues such as community cohesion have been found to reduce the consequences of flooding, these connections are not made explicit in the texts. Reducing the city's greenhouse gas emissions is mentioned as a way of influencing climate change, which has an impact on flooding, but apart from this, flooding solutions are seen as a separate issue from other social, health, political or economic interventions.

Flooding is mentioned in all documents as an important risk for the city and is mentioned in terms of environmental or infrastructural resilience. It can be seen that emphasis is placed on other aspects of resilience, which could also play a role in reducing the consequences of flooding, although this does not seem to be the main aim and is not explicitly stated.

Figure 9 The river Lagan has recently seen investment in flood defences and is important in resilience building (author's own photograph).

4.4 Document analysis results: Risk communication in Belfast

Based on the findings from the scoping study, the previously identified documents relating to Belfast were analysed to find examples of the five categories of risk communication. This is in order to see whether the use of risk communication in Belfast corresponds with the findings in other, similar contexts and whether the city is preparing for the challenges that are likely to arise.

4.4.1 Public control

Similarly to the scoping study, in the Belfast documents, very few mentions are made to *public controlled* projects. The texts do mention that citizen controlled projects exist, however very little detail is given; "*Partners across the city are investing in important community assets, while communities themselves are bringing forward and executing investment projects*" (Belfast City Council, 2017, p. 31). When keeping in mind that the documents aim to describe the objectives and outcomes of projects led by the Council, it may not be surprising that projects where the Council is not in charge or possibly not involved at all, are not described. However, the Council could still play a role in supporting or encouraging citizen led projects, which could well be outlined in these documents.

4.4.2 Co-creation

Co-creation does not occur in Belfast, but its merits are recognised: "*We want to find better ways of working at the local level, particularly in exploring how we can work with residents and partners, to co-design and deliver more effective solutions that can be adopted at scale across the city*" (Belfast City Council, 2017, p. 33). Although public opinions are encouraged and incorporated into planning, as will be seen below, the documents themselves acknowledge that more can be done to make the process truly *co-created*, where the public and decision-makers have equal say and input.

4.4.3 Public consultation

Belfast's 100RC report is a summary of a workshop where 80 key stakeholders in the city's resilience project came together. The report does not say who the participants were, so it is not possible to identify how many of the participants represented residents or community groups. The report does include a list of organisations that "*have a role to play in creating a resilient Belfast*" (Belfast City Council, 2016a, p. 23). The list consists mainly of governmental departments and public services and organisations. The only stakeholders on the list that would likely be invited to represent private residents are "local community groups" and possibly "schools" and "non-governmental organisations". Although all stakeholders listed could claim they represent the public, most will also drive other interests. For instance, the Belfast Health and Social Care Trust could be assumed to push for improved health care for residents and must have gained extensive knowledge of what the public wants from health care, however the public should work with them throughout the process to ensure the changes really reflect their needs and wants. Therefore, the risk communication here seems to be at the *consultation* level, as although some citizen representation groups are involved, they are could easily be overturned by other interest groups in case there is disagreement.

The Belfast Agenda, which is essentially the problem framing document, as it outlines the problems and desired outcomes, was created based on information and views gathered from the public through the "Belfast Conversation": "*A key element of the development of the Belfast Agenda was a series of citywide facilitated public workshops, online questionnaires and social media interaction. This was known as the Belfast Conversation and helped to create the vision, aspirations, and outcomes in the Belfast Agenda*" (Belfast City Council, 2017, p. 44) According to a document available on the Belfast City Council website, views were gathered using;

- Surveys;
- Facilitated public workshops;
- Social media (Belfast City Council, 2015).

Therefore, the public's views are incorporated in the problem framing stage, which is an important part of the planning process.

4.4.4 Public feedback

In the Belfast documents, *public feedback* is used a method to evaluate both the Belfast Agenda and the LDP. After the Belfast Agenda was created based on the Belfast Conversation described above, the public was invited to give feedback using the same methods as the data was gathered to test whether "*we had captured accurately what people across the city had told us they wanted for the future through the Belfast Conversation*" (Belfast City Council, 2017, p. 44). After the problem was framed and priorities set in the Agenda, experts created Preferred Options Papers (POPs), which outline the potential city planning options that could be selected for the LDP based on the information gathered in the previous step. Although the public was not directly involved in creating these, they are encouraged the review the POPs and submit their representations and views;

- At public meetings and exhibitions;

- In writing, by post or email;
- On the website using a contact form[5].

The draft LDP is then based on the POPs and the feedback from experts. After its publication, representations from the public are invited. The representations are then published and counter-representations are encouraged Although the public representations are processed concurrently to the preparation of the LDP, it is difficult to tell how much of the feedback is used during the plan development stage; "*Any representations or views received as a consequence of its publication will be considered whilst formulating the draft Plan Strategy*" (Belfast City Council, 2016b, p. 11). The representations are then independently examined. Therefore, it appears that they are not used during the plan development stage but rather after a draft has already been created and therefore would be classed as *feedback* rather than *consultation.*

4.4.5 One-way

As discussed above, *one-way* risk communication with the public is mentioned in the LDP as a way to reduce the risk of flooding. This is done through warnings and informing the public; "*Flood warning; flood emergency planning; informing the public about flood risk and what to do in the event of a flood to their property; adapting existing property to the risk of flooding"* (Belfast City Council, 2018, p. 233). Unlike the examples of risk communication discussed previously, which refer to how the public was engaged during the creation of the plans and identification of problems, *one-way* risk communication is suggested in the plans as a partial solution to the risks. This is interesting, as the documents state the Council's emphasis on risk communication, however the only form of risk communication suggested as a tool to directly build resilience is *one-way*.

4.5 Document analysis results: Challenges in Belfast

The texts included in the document analysis were analysed for mentions of the challenges identified in the scoping study.

4.5.1 Different understandings

As has been identified, the public has been relatively well engaged in the process of developing the Belfast Agenda. Some example questions asked in the Belfast Conversation are available on the Belfast City Council website;

- What do you like about Belfast?;
- How can we make our city better?;
- What's your vision for Belfast in 2030? (Belfast City Council, n.d.a).

[5] Representations are still available to view on the Belfast City Council website (Belfast City Council, 2019). Other ways of giving feedback may have been available, however the ones listed are ones that were either mentioned in the documents analysed or could be inferred from viewing the submitted representations.

These questions are very open ended and do not require much knowledge about the issues or concepts. As the aim is to gauge preferences and priorities, lack of knowledge on the part of the public should not pose a challenge. This information is used to inform the LDP process and therefore the risks and priorities discussed in the plan should be relatively well informed of the public's perceptions of risks and visions. The 100RC report also ranks risks to the city. The workshop included sessions on understanding the resilience and risk concepts to ensure all participants were on the same page.

The LDP is a more technical and practical guidance document and therefore contributing to it requires an understanding of the issues and ways to solve them. This may be why participation to this part of the resilience building project is more limited. Even though contributions are only requested at the *feedback* level, the draft LDP itself is a 300-page document. The expectation that a substantial proportion of impacted residents reads, understands and provides feedback on it is unrealistic. One way the Council has attempted to make it more approachable and to provide the resources the public needs to participate is through the presentations and videos at public meetings and exhibitions, which will only present parts of the plan the presenters feel is understandable and relevant to the public. This will inevitably lead to omissions and "translations" that make assumptions about the public's levels of understanding and interest. Although this absolutely makes the information more succinct, the majority of the public cannot be expected to have the knowledge and time to become intensely involved in the planning process.

4.5.2 Power relations

The difference in the way materials are understood by different groups with different perceived power and influence could well be expected to be an issue in Belfast. The documents outline attempts to ensure sufficient participation from all groups. At both the *feedback* and *consultation* levels, the public has many different ways of contributing, ideally meaning that everyone has access and resources to give their input. Special efforts were made to reach "under represented" groups[6], which were contacted prior to the development of LDP to "*identify any particular issues or needs which they feel the plan should address*" (Belfast City Council, 2016b). Efforts were also made to receive representations from young people through the Belfast Youth Forum.

The 100RC report makes a note of the participants' "*power of persuasion*" in the conversations. The participants were open to changing their minds during the group's discussion, which is seen as a good thing, since it shows the "*open and understanding nature of the people*" (Belfast City Council, 2016a, p. 17). Considering the majority of participants at the workshop were representatives of government or other organisations, and therefore could be assumed to be in positions to relative power to have their voices heard, this may well be an accurate interpretation

[6] These under represented groups are identified by the Equality Commission for Northern Ireland and include a variety of interest groups, including religious and political organisations, representatives of minority groups, NGOs and others. A full list can be found in Appendix 3 of Equality Scheme for Northern Ireland Assembly Commission (2011).

of why people were willing to change their minds. It should however be also acknowledged that changing the minds of participants or achieving consensus should not be the aim of risk communication. Rather, the aim should be to incorporate consensus and divergence and recognise differing viewpoints and uncertainties in order to explore different options (Chilvers, 2008).

4.5.3 Lack of commitment

Whether there is a lack of commitment in Belfast is difficult to assess based solely on the documents. The fact that risk communication is occurring at many identified levels shows that dialogue is a priority and the Council states it is committed to participation; "*the council is fully committed to engaging with local communities and stakeholders to encourage inclusive discussions on the LDP draft Plan Strategy key planning policies that will guide future development to deliver the tangible social, economic and environmental benefits for the city*" (Belfast City Council, 2018, pp. 3-4). The documents themselves however acknowledge that more needs to be done to reach the *co-creation* and *citizen control* levels of resilience planning, which is encouraging, as it shows the Council is aware of its shortcomings and hopefully attempting to address them.

The commitment to dialogue from the people is also difficult to evaluate, but one way to assess this is to look at the responses from the public to the risk communication process. The Belfast Conversation, which was used to inform the Belfast Agenda development, consulted directly "*over 700 people and received over 240 written responses. Over 90 responses were received from children and young people*" (Belfast City Council, 2017, p. 45). According to the Belfast City Council website, 120 representations were received as input for the LDP. Out of these 120, 19 can be confirmed to be from 18 individuals and a further 4 representations wished to remain completely anonymous and could therefore be individuals or organisations. Many of the remaining representations are from businesses, such as housing development companies, as well as governmental organisations and community interest groups (Belfast City Council, 2019). Although it is unrealistic to assume that all residents impacted by the LDP would submit individual representations and many of the community interest groups represent groups of people affected, the number of representations is low. The Belfast Agenda consultations fare only somewhat better. Although this could be seen as lack of commitment or interest on the part of the public, combining this information with the analysis above of how and when the public is invited to participate, it is fair to make the assessment that the city is more committed to ensuring the public is engaged in the problem framing stage of the process. During the plan development, assessment and monitoring, the public is invited to take part but this is not done with the same intensity or commitment as the problem framing, or in other words, the development of the Belfast Agenda.

4.5.4 Trust

Trust is only explicitly mentioned once in the selected analysis documents. This is in reference to the spatial segregation and peace walls and although it is not explicit, it would appear refers

both to trust between different communities and trust in the authorities: "*The contested spaces provide opportunities for developing shared meanwhile community projects that would help build trust and confidence to improve social cohesion*" (Belfast City Council, 2018, p. 51). This lack of trust could absolutely be expected to pose a challenge in Belfast due to the city's history. Trust is one of the main aims or two-way communication and this could be expected to be one of the reasons the City Council has chosen to make communication such a large part of the community planning processes.

5 Discussion

5.1 Findings: Risk communication recommendations and challenges

The first objective of the thesis was to *"Identify recommendations and challenges for using risk communication to build resilience based on literature and on real cases of risk communication for flood or multi-hazard resilience".* In order to identify recommendations and challenges for using risk communication to increase societal resilience, Chapter 2 presents a summary of the literature considered in the thesis. It was found that according to literature risk communication should be;

- Dialogic or two-way in nature;
- A true partnership, where the public has power over the decisions made;
- Representative of those who are affected by the decision.

Challenges for using risk communication for resilience building were also identified;

- Those setting the goals and leading the resilience building process are often those with power who set the problem and the options to solve it from their point of view;
- Identifying and ensuring all relevant stakeholders are present can be difficult. It can be challenging to incentivise the public to take part;
- The public often lack the technical knowledge and understanding to contribute to resilience building in a manner that would be required in true two-way risk communication;
- The public needs to trust the authorities in order to want to participate.

The scoping study identified five categories of risk communication based on the level of power the public has in the decision-making; *public control*, *co-creation*, *consultation*, *feedback*, and *one-way*. Many of the findings of the scoping study align with the more general findings of the literature review. The results of the scoping study can be aligned with Arnstein's (1969) ladder of participation, where *one-way* refers to "nonparticipation" according to Arnstein. *Public feedback* and *consultation* correspond to "tokenism", where the information and views residents provide are considered but they can still be outvoted by the more powerful seats at the table. Where the seats are equally shared between experts and other powerholders and the public, and the views they express are given similar value, *co-creation* and *public control* are examples of "citizen power" (Arnstein, 1969). Although the two categorisations align, the 5-level method was created in favour of using Arnstein's original ladder due to the difficulty of differentiating between the different rungs of the ladder when limited information was available. For example, if a text mentions using public meetings as a form of participation with little additional

information, it is difficult to decipher whether the public's opinions were asked and if so, whether they were asked in a meaningful way or asked only from a select few, which could be the difference between the informing, consultation and placation rungs.

Although the findings broadly align with the findings from literature, some differences were identified;

- Only two articles included in the scoping study implemented the most involved method and none recommended it, although literature emphasises the need for the public to hold the power;
- The highest number of recommendations was for *co-creation* where the authorities and the public have equal input into the process. This contradicts the literature review, which recommends more power be given to the public;
- *One-way* was the most common form of risk communication, although this is not particularly surprising, as it is the easiest way to reach a large number of recipients and reach at least tokenistic participation, it does go against the recommendations from both the literature review and the scoping study;
- Although the public's high level of power over the process was decided to be the most important characteristic in risk communication, the timing of the communication was also identified as important. Only requesting information *after* a plan was put in place means it cannot be used as effectively as it could before or during planning.

In terms of the challenges identified in the scoping study, they too align with the findings from literature, however, again, some differences were found;

- Power was identified not only as a challenge in terms of dominating problem framing and discussion but also in planning how risk communication takes place. Messages are framed and distributed in ways that could alienate some recipients;
- As well as a focus on the public's *lack* of knowledge and understanding, the scoping study identified a need for a *shared* understanding. As well as requiring the information and resources to make informed contributions, the public also needs to be included in deciding what the conversation is about, the type of resilience that is pursued, and what is prioritised and valued;
- Not only is lack of trust a potential challenge, too much trust will also hinder engagement in risk communication.

5.1.1 Risk communication and complexity

As has been discovered, risk communication for resilience in practice does not always follow theoretical recommendations. The Belfast case illustrates how risk communication can be used as a planning tool, but it is interesting to look at how, according to complexity theory, the different categorisations of risk communication could most effectively be used to increase resilience.

Looking at resilience through complexity theory, resilience is an emergent property, which arises from the local interactions between the agents in the system and cannot be controlled (Bergström & Dekker, 2014). Applying this framework to the risk communication categories

identified in this thesis, in order to directly increase resilience, risk communication should aim to create or at least contribute to emergence and encourage interactions between agents that lead to increased resilience. Following this logic, the higher intensity levels of risk communication provide more opportunities for interaction and exchanges of views and therefore would be more likely to lead to emergence. It would appear that *public controlled* programmes are themselves examples of emergence, where interactions between agents have led to the creation of the risk communication campaigns without any management or control from above. These campaigns arising from the public could be excellent tools for encouraging further emergent properties in the form of resilience, as they create local interactions and micro-behaviours.

Co-creation on the other hand could be seen to create emergence through the interactions between the public and experts, all of whom have a similar influence over the resilience building process. The lack of a power imbalance means that although the process of bringing the parties together is the result of processes at the meso or macro scale, during the actual co-creation phase, no party is in control of the process. This reflects the conditions required to create emergence, as the co-creation is not controlled and leads to interactions at the micro scale between agents. Agents in a CAS are unable to predict the consequences of their actions to the entire system, however, *co-creation* increases the knowledge and understanding of all participants and therefore leads to agents having more information on which to base their actions. A similar process occurs at the *public consultation* level, where much of the Belfast risk communication occurs, however with more control from the experts and decision-makers, which works under the illusion that resilience building is a process which can be centrally controlled.

At the *feedback* level, there is a similar level of control as well as a much more limited range of available interactions at the micro scale. While at the *consultation* level and above, the public can contribute information, analysis, opinions, and suggestions, at the *feedback* level the only available interactions are to either accept or reject a proposal. Even lower intensity, *one-way risk* communication would ideally lead to conversations between the recipients of the communication, but no direct interactions between the senders and the recipients are incorporated into the communication. The attempt is to influence the micro level through an injection of information, but without accompanying it with opportunities for interactions and actions between agents, it is unlikely to lead to emergence.

5.2 Findings: Risk communication aims and practices in Belfast

The second objective in this thesis was to *"Investigate how risk communication can be used to strengthen urban flood resilience building efforts in Belfast and using the knowledge of recommendations and challenges examine what challenges are likely to arise and whether and how the city is attempting to overcome them."* The summary of findings here is divided into findings regarding Belfast's approach to resilience more generally and findings regarding risk communication for resilience.

5.2.1 Resilience in Belfast

The way in which Belfast approaches resilience was first discussed in order to understand what the aim of risk communication in Belfast is. Belfast aims to increase the resilience of all sectors, all scales and all individuals. The usage of the term resilience in the document analysis texts is not particularly consistent and the interdependencies and complexities of its different mentions are not discussed. The different scales of resilience, micro, meso and macro (Bergström & Dekker, 2014) or agents, institutions and systems (Tyler & Moench, 2012), are identifiable in the descriptions of resilience in the texts. Cutter et al.'s (2010) categorisation of resilience can also be found in the documents. The first three columns in Table 4 below show a rough categorisation of Belfast's resilience:

Table 4 Categorisation of Belfast's resilience

Belfast resilience	Resilience scale (Bergström & Dekker, 2014; Tyler & Moench, 2012)	Resilience category (Cutter, Burton, & Emrich, 2010)	Potential for risk communication
The mental and physical health of residents	Micro; agent	Social resilience	Work with public to understand issues affecting health and access to health care. Provide resources and information to address issues. Co-create projects encouraging health maintenance and increased access to health care.
The economy	Meso; institutions[7]	Economic resilience	Understand issues affecting employment and entrepreneurship, provide support for public to start businesses and provide education and resources for unemployed and budding entrepreneurs.
Environmental and climate change	Macro; systems	Institutional resilience	Work with public to understand vulnerabilities and gaps in household resilience, co-create projects that address risks and mitigation measures at all scales, co-monitor projects and request feedback.
Social cohesion and community resilience	Meso; institutions	Community capital	Understand existing issues and exacerbating factors, encourage public controlled projects addressing cohesion, provide public tools, resources and information for projects.
Infrastructure	Macro; systems	Infrastructure resilience	Understand public's needs and wishes for infrastructure and land use, co-create plans that support public's needs, monitor projects in partnership.

[7] The economy could also be seen as macro level resilience, however, the texts' emphasis is on increasing the power of businesses and other organisations (institutions) to be able to offer employment opportunities and therefore economic resilience. Therefore, the resilience building efforts are seen more as focusing on the meso level.

Although less clear, references to Becker's (2014) societal functions can also be found. However, it appears that the way resilience is viewed is done more through sectors than functions.

Literature on societal complexity and resilience emphasise the need to be hazard- and target-specific when planning resilience as well as potentially focusing on some sectors over others;

- *Target-focus*: The documents approach resilience for all individuals and sectors and the outcomes are "*intended to improve the lives of everyone in Belfast*" (Belfast City Council, 2017, p. 19). Although special focus is placed on those that might need extra support due to, for instance, health conditions or unemployment, the aim is for improved outcomes for all.
- *Risk-focus*: The 100RC report does list a variety of hazards to build resilience to but it is not necessarily specified how each risk is countered. This is reflected in the other documents, which do not include such a clear list and analysis of risk, but which discuss a variety of problems and solutions, which are not directly linked.
- *Sector-focus*: All societal sectors are seemingly covered in resilience planning. Although flooding is only discussed as an environmental or infrastructural problem, it is worth noting that all the different aspects of resilience discussed in the documents could feed into flood resilience. Poor health and low incomes have a negative impact on individual and household resilience (Sayers and Partners, 2017) and social capital and cohesion will increase community and societal resilience against flooding (Wickes, Zahnow, Taylor, & Piquero, 2015). Therefore, although not explicitly highlighted in the texts, all mentions of attempted sector resilience building could also conceivably be used to increase flood resilience. However, without explicitly addressing the resilience of these sectors in reference to flooding, the efforts could inadvertently reduce flood resilience, as was found in the literature review. Therefore, although societal resilience is looked at through different sectors and scales, flood resilience is not.

Some possible explanations for this wide focus in the Belfast documents include; the need to omit detail – perhaps more specificity and prioritisation exists but is not expressed in these documents; the fact that a city-wide development plan is truly city-wide and addresses all risks and populations, perhaps other schemes exist that focus more on the most vulnerable individuals and sectors; or perhaps a broad focus and a range of no-regret, multi-hazard solutions was deemed most appropriate for the city.

5.2.2 Risk communication for resilience in Belfast

The findings from the scoping study were applied to the Belfast documents used in the document analysis. Mentions of all five types of risk communication were identified, however *public control* was only mentioned as something that is occurring outside of the Council's work. As *public control* is not commonly done or recommended form of risk communication based on the scoping study, it is not surprising it is not common in Belfast. It is also therefore perhaps not the most effective way of contributing to resilience.

Co-creation was not currently occurring, but the Council acknowledged the need to become more involved in this type of risk communication. *Co-creation* is the most commonly recommended risk communication category based on the scoping study. This implies that Belfast is right to work to find ways of incorporating more of it into its resilience building efforts and ideally would already have done so in the development of the resilience strategy, agenda and LDP.

The majority of the risk communication in Belfast takes place at the *consultation* and *feedback* levels, implying that risk communication for resilience is not looked at through complexity theory. At these levels, the emphasis is on increasing the knowledge and understanding of decision-makers, who attempt use this information to create policies or projects that directly create resilience at the macro scale, for instance through land use planning. The scoping study found *public consultation* the second most common risk communication category, aligning with the fact that it is commonly used in Belfast. It was also recommended in one article. Both factors indicate that it is a realistic form of risk communication but also due to the recommendation for it, has the potential to contribute to resilience.

Public feedback is not recommended in the articles included in the scoping study, and although it is done in some examples, the evidence in support of this type of risk communication is not particularly high. Therefore, although Belfast's extensive feedback work does support the city's other efforts, it is not recommended by the other findings.

One-way risk communication was also relatively rare, only occurring in cases of flood warnings. *One-way* risk communication is the most commonly done form of risk communication based on the scoping study, however recommendations for it are low. Therefore, it appears to be a relatively simple intervention but not very likely to really lead to resilience. However, as it is commonly done, cities clearly see some benefit in it, even if that benefit is only tokenistic participation.

The last column in Table 4 lists some possibilities for increasing the resilience of the sectors identified in Belfast using risk communication based on the findings of this thesis. Rather than an exhaustive description of risk communication opportunities, it aims to highlight the ways in which the public can be involved in resilience building even in sectors where expert knowledge is vital, such as infrastructure. It also indicates options for both directly increasing resilience as well as for using risk communication as a tool in resilience planning. Some of this may already be occurring in Belfast, however this is not mentioned in the documents. This table indicates that although *public controlled* projects have been described as the goal for risk communication, in many sectors *co-creation* may be a more viable option, where a partnership between experts and the public combines technical knowledge and an understanding of the context. This was also a finding in the scoping study, where most articles recommended *co-creation* over *public contro*l, which was also more commonly done in real cases. This implies that Belfast should perhaps focus on *co-created* projects over *publicly controlled* ones. Most ideas expressed in Table 4 are at the co-creation level, which was identified as the level where Belfast could focus more of its risk communication efforts. The city acknowledges that co-creation is a viable option for Belfast and due to the nature of the intervention, and based on the scoping study results, could realistically be an effective way of contributing to resilience building efforts.

Risk communication in the Belfast documents is almost solely seen as a tool to plan resilience and not to directly increase it. Most of the risk communication identified occurs at the problem framing and plan development stages. Very little can be seen during the project implementation or monitoring phases. This implies that the impacts of resilience building are expected to be linear. Risk communication is not needed during the implementation and monitoring stages, as long as all relevant knowledge has been successfully gained before the beginning of the project. Resilience building takes into consideration the wishes of the public but the actual project takes place at a scale above the expertise or experience of the citizens – not many have the ability to contribute to land use planning projects.

Despite the fact that this approach to risk communication may not create emergence, it may still produce many of the benefits of risk communication discussed in Chapter 2;

- Including the public in resilience planning will increase the legitimacy of those plans;
- The fact that the risk communication done in Belfast can be classed as two-way or dialogic, means that it can play a role in building trust;
- It will also incorporate information about the resilience of the households, or smaller systems, in the CAS to the resilience planning at the macro scale. This hopefully means that planning is more equitable and benefits from more information;
- Vice versa, the participating residents will gain an increased understanding of resilience and risk that they can use to inform their household resilience building or to become more involved in societal resilience building and accompanying risk communication;
- The Council can fulfil its normative imperative of informing the public – this is a rather tokenistic way of viewing risk communication but nevertheless can be important for a city to show they are engaging the public.

5.2.3 Challenges and the Belfast context

As discussed above, both resilience building and risk communication are very context-dependent. In Belfast, many of the challenges identified in the scoping study could be imagined to be influenced or even exacerbated by the specific conditions caused by the city's history. The articles selected for the scoping study examine areas similar to Belfast, in that they are urban areas in developed countries. However, the challenges identified in this thesis are shaped by their specific cultures, histories and experiences of the cities;

- *Different understandings of key concepts*: This challenge was the most commonly mentioned explicitly in the scoping study. Therefore, considering this along with the specific context of Belfast and the way risk communication is planned, it is likely to become an issue in the city.

Past examples from Belfast have shown that different priorities can lead to challenges. The site of Girdwood, an abandoned barracks in north Belfast, was planned to be a cross-community space. Despite extensive consultations with and feedback from stakeholders across the community divide starting around 2001, it was very difficult to reach a consensus between conflicting parties. It was viewed by some that a "zero sum" deadlock and delay was preferable to a solution that might benefit the other group more (Planning for Spatial Reconciliation Research Group, 2016)[8];

- *Power relations*: The scoping study identified power relations as the most common challenge and mentions of it were both explicit and implicit. Risk communication in the city also can in some ways exacerbate this, as was shown in Section 4.3.3. Inequality in Belfast is growing (Capener, 2017). This, coupled with historic discrimination (O'Hagan, 2018), would make it likely that some groups both have fewer resources to contribute as well as a pre-existing perception that their voices will not be heard. This creates the type of conditions that this thesis, as well as research on different contexts (e.g. Beebeejaun, 2006), has found to discourage engagement in community planning. The documents analysed do not specify which groups were more likely to participate, therefore it is not possible to confirm whether this was the case. Therefore, although some efforts are made to reach under-represented groups, power relations are like to pose a challenge in Belfast;
- *Lack of commitment*: Based on the scoping study, evidence shows that a lack of commitment is a common challenge in urban, developed contexts. Considering the nature of Belfast and its history, it could be imagined that the authorities' commitment to community engagement and risk communication is high. At its best, risk communication can create trust and reduce conflict (Beierle & Konisky, 2000), which could help with the other challenges discussed here. The commitment from the public is difficult to assess, but despite the declining tribalism, sectarianism still exists, and the numbers of participants in the Council's risk communication remain rather low, indicating that if not commitment, something is limiting the number of residents engaging with risk communication
- *Trust:* The scoping study findings showed that although risk can pose a challenge, this is not particularly common. However, combining this evidence with an analysis of the Belfast context, it is very likely to make both risk communication and resilience building more difficult. Although one of the main aims of two-way risk communication is to create trust, the Girdwood case shows a lack of trust both in the public as well as decision-makers. The interface sites across the city are divided by walls and gates, showing the deep mistrust some sectors of society still hold.

Therefore, all of the challenges to successful risk communication identified in the scoping study are likely to arise in Belfast. Some of them are already addressed in the texts;

- Questions asked of the public are easy to understand in order to avoid them being interpreted differently by individuals with different levels of knowledge and experience;

[8] Girdwood has now been developed into a community hub consisting of meeting spaces, health facilities and classes, amongst other things, but this process took over 15 years (Belfast City Council, n.d.c).

- Similarly, information is presented through different media to make it more accessible;
- Efforts are being made to engage under-represented groups to bridge the possible power imbalance;
- The public has a variety of ways in which to contribute, ideally increasing their commitment to the process and increasing representativeness.

It is interesting to note that the Council is already making efforts to counter the challenges identified in the scoping study, possibly showing that the challenges they expect are similar to those found in this thesis. Much can be learned from the ways in which other cities have addressed these issues but simply looking at 'best practice' or recommendations may lead to overly ambitious planning, which does not take into consideration the realities and challenges of the situation

Figure 10 Past and present social and political problems in Belfast are also represented in the many murals around the city (author's own photograph).

5.3 What's next?

Belfast City Council is currently developing its resilience strategy based on the 100RC Report as well as further consultations with relevant stakeholders. Although the city was selected in 2016 to become one of the Rockefeller Center's 100 Resilient Cities, which kickstarted the process of developing the resilience strategy, the Center announced in April 2019 that it will phase out funding for cities outside of the United States starting July 2019 (Berkowitz, 2019). As well as an end to the funding, this also means that Belfast will no longer have access to the knowledge sharing opportunities offered by the scheme. The Belfast Agenda and the LDP, although connected to the resilience process, are not directly supported by the 100RC programme. Therefore, as the funding ends and the Council will be expected to fund resilience building in another way, this might lead to the work done on the 100RC process being increasingly incorporated into other city development. The Council has previously indicated its interest in learning from the resilience building done in Glasgow and Bristol (Belfast City

Council, n.d.b), both also British cities, so the knowledge sharing between these cities will most likely continue even after the 100RC programme formally comes to an end.

The development of the LDP is not expected to be affected by these changes. According to a timetable last revised in November 2018, the draft plan is currently under soundness-based independent examination. The plan strategy is expected to be adopted in 2020 (Belfast Planning Service, 2018). The Belfast Agenda is currently implementing its immediate priorities until 2021, after which it will presumably move on to fulfilling the vision set out for 2035. There is little information about whether the Belfast Conversation is still ongoing and what the future plans for risk communication are. However, as was identified in the results section, the bulk of risk communication focuses on problem framing rather than implementation and monitoring of progress. Therefore, it could be assumed that after all plans are in place, the public will not play a large role in fulfilling them.

5.4 Limitations and recommendations for future research

As well as the limitations associated with the methodology described in Chapter 3, some other limitations regarding the findings of this research apply. This thesis has not analysed the ways the documents included in the scoping study view resilience, as not many documents described how resilience was understood by the authors or the authorities implementing the resilience planning projects. However, had the resilience been described in the documents and analysed, this may have revealed that some ways of risk communication or challenges may be more applicable to specific resilience building efforts.

Although using complexity theory has allowed this thesis to analyse resilience building and societal change through a theoretical framework, it has not always aligned with the way resilience is viewed in the other documents. As has been discussed earlier, it is not made explicit how resilience is operationalised in Belfast but based on the analysis it would appear that resilience is not seen in terms of complexity. This means that some of the risk communication findings may not align with the way resilience is approached in Belfast. This creates some challenges, as the way resilience is perceived could have played a role in the planning of the accompanying risk communication. The aims of risk communication in Belfast have also not been made explicit in the documents, which means that the analysis may have misunderstood their purpose and therefore misanalysed them.

This thesis was intended to provide a brief overview or indication of how risk communication is and could be used to increase societal resilience. More research into successful and unsuccessful case studies, where the aims and processes of risk communication are clearly aimed at increasing resilience, could help assess and evaluate some of the ideas suggested in this thesis. This thesis has also analysed some of the challenges associated with using risk communication for resilience but not suggested solutions. More research on how these challenges could be overcome is needed.

There is also potential for more research into whether starting at lower rungs of the risk communication ladder can be used to build trust, knowledge and shared understanding as basis

for moving further up the ladder in the future or whether intensive processes work as well in contexts that lack the preconditions as in contexts where some basis exists.

6 Conclusion

This thesis set out to explore how risk communication can contribute to increased societal resilience. The thesis has identified risk communication recommendations and challenges from literature. The Belfast context was analysed to see if the recommendations are followed and the challenges identified and addressed and whether the findings from literature can be applied to the Belfast case.

The first objective of the thesis was to examine risk communication for resilience in existing literature. The main findings of this are as follows;

- The degree of power the public has over the process of resilience planning and implementation was seen as a vital characteristic defining the quality of the risk communication process. These forms of risk communication however demand more from participants and therefore they may not be achievable as the first stage in the risk communication process and may need to be built up to through first incorporating some *one-way* or *feedback* level risk communication;
- More interactive and less controlled forms of risk communication are more likely to create resilience through emergence as well as through providing participants with more access to information and analysis. The type of risk communication selected should however be planned to complement the way resilience is viewed. Some forms of risk communication are more appropriate for resilience planning while others can be used in resilience building. Therefore, the aims and operationalisations of resilience need to be made explicit in order to decide how risk communication can best contribute. The aim of risk communication should be considered before jumping to high involvement risk communication;
- The majority of real cases of risk communication give the public considerably less power that the higher levels of participation. In cases similar to Belfast, risk communication occurs mainly at the lowest level
- The main challenges cities are likely to face are different understandings between the authorities and the public and within different sectors of the public. This is related to the other major challenge of power imbalances. Other likely challenges are a lack of commitment and a lack of or too much trust.

When looking at the second objective of the thesis focusing on the city of Belfast and its approach to risk communication for resilience, the following conclusions can be made:

- Belfast's risk communication for resilience occurs mainly at the *consultation* and *feedback* levels identified in this thesis. Based on evidence from the scoping study, these are both viable and realistic ways of conducting risk communication but are not recommended as frequently as others;
- Based on the evidence from the scoping study, *co-creation* is the most recommended type of risk communication, however, it is not currently occurring in Belfast. Therefore,

placing more emphasis on co-created resilience projects could strengthen Belfast's risk communication and resilience process;

- The challenges identified in literature and in real cases are very similar and many of the challenges are already either identified explicitly or addressed implicitly in the Belfast documents. Despite this, the way these challenges arise and should be addressed are very context-dependent. Therefore, learning from other contexts is extremely valuable but no 'one size fits all' solutions exist.

Although all cities have their challenges, the history of ingrained conflict and divisions in Belfast mean that issues such as a lack of trust and a power imbalance may be more prevalent in most other developed urban areas. Although the specific context of the city needs to be considered, Belfast provides an interesting example of how risk communication can work even in difficult conditions and many of the lessons learned in Belfast could also conceivably work in cities with fewer of these historic challenges.

This thesis has aimed to contribute to existing knowledge of risk communication by comparing and contrasting findings from literature and practical projects. Overall, the thesis has fulfilled the two objectives it set out to examine risk communication for resilience both generally as well as in urban, developed contexts and Belfast specifically.

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Appendix 1 Charting scoping study data

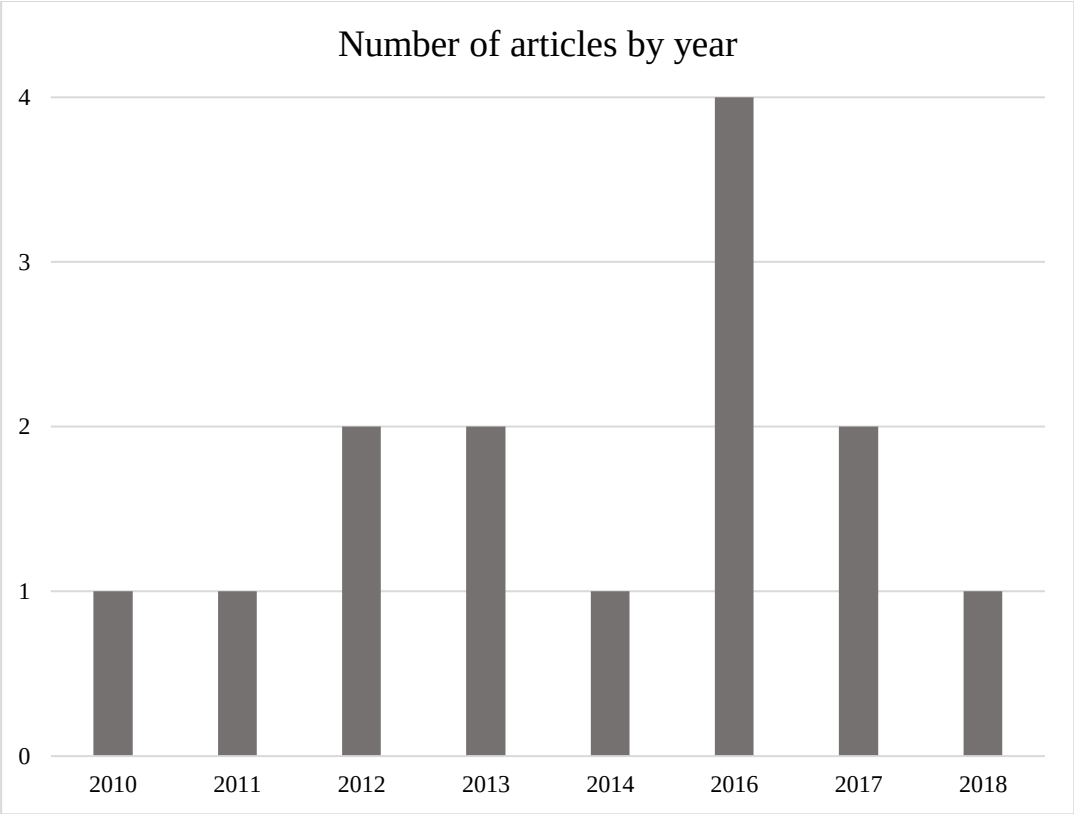

Figure 11 Number of articles by year

Table 5 Subject areas of articles

Subject area	Number of articles (n=14)
Social sciences	4 (29%)
Environmental science	4 (29%)
Engineering	3 (21%)
Medicine	1 (7%)
Earth and planetary sciences	1 (7%)
Computer science	1 (7%)

Subject areas were defined based on the stated subject areas on Scopus. An article could be included in more than one category, possibly indicating a multi-disciplinary approach. When this was the case, one of the indicated categories was selected.

Table 6 Regions and regional focus of articles

Region	Region of publication (n=14)	Regional focus (n=14)
Northern America	2 (14%)	2 (14%)
Eastern Asia	1 (7%)	2 (14%)
Northern Europe	1 (7%)	-
Southern Europe	1 (7%)	2 (14%)
Western Europe	6 (43%)	3 (21%)
Australia	3 (21%)	1 (7%)
Europe	-	3 (21%)
Global	-	1 (7%)

The region of the publishing institution was identified based on the stated affiliation of the first author of the article. The regional focus was identified based on an analysis of the title, abstract[7]. Global refers to articles with no specific regional focus. Some articles focus on the whole of Europe, where a specific region cannot be found in the article.

[7] Regions were defined according to the United Nations Statistics Division Geoscheme (United Nations Statistics Division, n.d.)

Appendix 2 Scoping Study Articles – Examples of risk communication

The table below lists the articles identified in the scoping study and the examples of risk communication they discuss (3 = real case study examples; 2 = recommendations for this type of communication; 1 = no mention).

Article	Public control	Co-created	Public consultation	Public feedback	1-way
Diakakis et al. (2018). Public perception of Flood Risk in Flash Flood Prone Areas of Eastern Mediterranean: The case of Attica Region in Greece.	1	1	2	1	3
Boschetti et al. (2017). Citizens' Perception of the Resilience of Australian cities.	1	2	1	1	1
Aldrich & Kyota (2017). Creating Community Resilience Through Elder-Led Physical and Social Infrastructure.	3	3	1	1	1
Kudo & Granier (2016). Citizen Co-designed and Co-produced Smart City: Japanese Smart City Projects for "Quality of Life" and "Resilience".	1	2	1	3	3
Batica & Gourbesville (2016). Resilience in Flood Risk Management - A New Communication Tool.	1	2	1	1	2
Burnside-Lawry & Carvalho (2016). A Stakeholder Approach to Building Community Resilience: Awareness to Implementation.	1	1	3	1	3
Hutter (2016). Collaborative Governance and Rare Floods in Urban Regions - Dealing with Uncertainty and Surprise.	1	1	1	1	1
Mees et al. (2014). Legitimate Adaptive Flood Risk Governance Beyond the Dikes: The Cases of Hamburg, Helsinki and Rotterdam.	1	2	3	1	3

Article	Public control	Co-created	Public consultation	Public feedback	1-way
Radywyl & Bigg (2013). Reclaiming the Commons for Urban Transformation.	3	3	1	3	3
Nirupama & Maula (2013). Engaging Public for Building Resilient Communities to Reduce Disaster Impact.	1	1	3	1	1
Fratini et al. (2012). Three Points Approach (3PA) for Urban Flood Risk Management: A Tool to Support Climate Change Adaptation through Transdisciplinarity and Multifunctionality.	1	3	3	1	3
Cavan & Kingston (2012). Development of a Climate Change Risk and Vulnerability Assessment Tool for Urban Areas.	1	3	1	3	3
Preston et al. (2011). Emergency Preparedness as Public Pedagogy: The Absent-presence of Race in 'Preparing for Emergencies'.	1	1	1	1	3
Peel & Lloyd (2010). Strategic Regeneration: A Policy Coupling Approach to Managing a Coastal Resort in South Wales.	1	1	3	1	3

Appendix 3 Scoping Study Articles – Examples of challenges

The table below lists the articles identified in the scoping study and the challenges risk communication they discuss (3 = explicit mention; 2 = implicit mention; 1 = no mention).

Article	Different understandings	Lack of commitment	Power relations	Trust
Diakakis et al. (2018). Public perception of Flood Risk in Flash Flood Prone Areas of Eastern Mediterranean: The case of Attica Region in Greece.	3	2	2	3
Boschetti et al. (2017). Citizens' Perception of the Resilience of Australian cities.	3	1	3	1
Aldrich & Kyota (2017). Creating Community Resilience Through Elder-Led Physical and Social Infrastructure.	1	1	2	1
Kudo & Granier (2016). Citizen Co-designed and Co-produced Smart City: Japanese Smart City Projects for "Quality of Life" and "Resilience".	1	3	3	3
Batica & Gourbesville (2016). Resilience in Flood Risk Management - A New Communication Tool.	3	1	1	1
Burnside-Lawry & Carvalho (2016). A Stakeholder Approach to Building Community Resilience: Awareness to Implementation.	3	1	1	1
Hutter (2016). Collaborative Governance and Rare Floods in Urban Regions - Dealing with Uncertainty and Surprise.	3	3	2	1
Mees et al. (2014). Legitimate Adaptive Flood Risk Governance Beyond the Dikes: The Cases of Hamburg, Helsinki and Rotterdam.	3	3	3	1

Article	Different understandings	Lack of commitment	Power relations	Trust
Radywyl & Bigg (2013). Reclaiming the Commons for Urban Transformation.	1	2	3	1
Nirupama & Maula (2013). Engaging Public for Building Resilient Communities to Reduce Disaster Impact	1	2	1	1
Fratini et al. (2012). Three Points Approach (3PA) for Urban Flood Risk Management: A Tool to Support Climate Change Adaptation through Transdisciplinarity and Multifunctionality.	3	2	2	1
Cavan & Kingston (2012). Development of a Climate Change Risk and Vulnerability Assessment Tool for Urban Areas	1	1	1	1
Preston et al. (2011). Emergency Preparedness as Public Pedagogy: The Absent-presence of Race in 'Preparing for Emergencies'	3	3	3	3
Peel & Lloyd (2010). Strategic Regeneration: A Policy Coupling Approach to Managing a Coastal Resort in South Wales.	1	1	1	1